THE FENLAND

PAST AND PRESENT

BY

SAMUEL H. MILLER, F.R.A.S., F.M.S.,

GOLD MEDALIST AND FOREIGN MEMBER OF THE SOCIETY OF ARTS AND SCIENCES OF UTRECHT;

AND

SYDNEY B. J. SKERTCHLY, F.G.S.,

HER MAJESTY'S GEOLOGICAL SURVEY.

ILLUSTRATED WITH ENGRAVINGS, MAPS AND DIAGRAMS.

Guthlac's Cross.

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TO

ALEXANDER PECKOVER, F.L.S., F.R.G.S.,

This Volume

IS DEDICATED

IN TOKEN OF MUCH KINDNESS.

PREFACE.

Many historical books have been written on different localities in the Fens—some of them having special reference to the great drainage-works carried out during the two past centuries, others touching the growth and decay of the religious houses, while a few have recorded the annals of towns.

Romance, too, has found a fertile source of themes in Fen legends, adventures, and exploits. But as no treatise, bearing the complexion of modern science and conveying the results of recent investigations, in relation to the whole Fenland, has hitherto appeared, this volume is put forth as an attempt to supply that want in the literature of our country.

Much of the information embodied in this book is entirely new and is the outgrowth of many years' research made by the authors, and their friends.

An extensive series of meteorological observations carried on by one of us for a long period in and around Wisbech forms the basis of the section on Meteorology.

The other has travelled, hammer and note book in hand, over nearly every acre of the broad Fenland, a task which occupied him several years, and which has probably never before fallen to the lot of one man.

Knowing this district intimately, and each having had occasion, in his professional capacity, to seek whatever was to be found of treasured lore, it appeared to the authors that by combining the results of their own researches with those of their predecessors, an instructive and valuable book might be produced.

The co-operation of those interested in the scientific history of the Fens was sought and the appeal was heartily responded to; the names of those gentlemen are appended to this preface, and they also appear at the commencement of their respective articles.

Some of the topics treated of are new, and the opinions are not seldom at variance with those of older authorities. Notably this is the case with respect to some portions of history and to certain branches of meteorology, geology and the methods of draining. These opinions are the sturdy growth of years of continued labour, and our readers must judge on which side lies the truth.

That each may be responsible for his own work, our respective initials are appended to our individual sections.

We have striven so to impart our knowledge that while the man of science shall find that accuracy has never been sacrificed, the general reader may be able to follow out *ab initio ad finem* every step of the trains of thought.

It is impossible to produce such a book free from error, and none could feel more deeply than ourselves how far this work falls short of our own ideal. We shall esteem it a great kindness if our Fenland friends will impart to us any facts, herein unnoticed, that may be of interest. With the exception of the engraving of the illustrations, the work has been entirely produced in the Fens, and our best thanks are due to Mr. J. LEACH for the admirable manner in which the letterpress and tables have been executed.

It is necessary to add that the Geology is herein treated in quite a distinct manner from that adopted in the government memoir on '*The Geology of the Fens.*' The present work deals more with general principles and results than was advisable in a technical work like the latter. Each supplements the other. One is a storehouse of facts, the other of deductions.

The cost of engraving several of our plates has been presented; the names of the donors will be found appended to the 'description of the illustrations.' One thing calls for special mention. The beautiful chromo-lithograph is from a picture generously painted for and presented to one of us, for this work, by Mr. Edwin Ellis, and the costly reproduction has been no less munificently given by Mr. Jonathan Peckover.

The following gentlemen have assisted in the literary work of this book, and to them we tender our hearty thanks—

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[S. H. M.]
[S. B. J. S.]

April, 1878.

CORRECTIONS.

It is earnestly requested that these corrections be made with pen and ink.

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THE FENLAND.

CHAPTER I.

GEOGRAPHICAL SKETCH OF THE FENLAND.

THE mid-east coast of England is indented by a large bay which receives the waters of many rivers that flow through an extensive tract of level country; this inlet is known as *The Wash*, anciently the *Æstuarium metaris* of PTOLEMY; but *metaris* was properly the bay, *æstuarium* the land liable to be overflowed; and the latter formed the seabord part of what we call *The Fenland.*

This great level tract—the largest plain of Britain—is interesting by reason of its magnitude, its almost unbroken flatness, and its fertility; because, within its bounds important historical and political events have transpired, far-famed institutions of a by-gone age have flourished and decayed; and, because, through many ages it has demanded the most strenuous energies of the sturdy men of yore, and, in these later times has taxed all the powers and genius of experienced engineers to secure it from the inroads of the watery element.

In these days it may be difficult to realize what aspect was presented by this

"level Fen, a prospect wild and wide."

A gloomy prospect, indeed, it may have been to some, to those at least who aver that

> "Here a grave Flora scarcely deigned to bloom."

But circumstances did, no doubt, rule impressions. To the old chroniclers it had its charms—to WILLIAM OF MALMSBURY, who perchance made visit in spring-time when the waters had retired—when the green sward was putting forth its vernal freshness—to him it appeared "a very Paradise." The expansiveness of a wide plain is, in itself, beauty, to some "a beauty as of the sea, of boundless expanse and freedom." (*Kingsley.*) But old Fen scenes, here and there, would present to the eye vast stretches of tall reeds, luxuriant, bending their brown flowerets to every gale and their rustling was like the murmur of a summer's sea, and

> The bright mere gleamed like a mirror
> In the mid-day sun.

Impressions like these were felt by the old monks of Ramsey, so it is clear that the Fens in those times were not always dark and dank and gloomy, "a dismal swamp" o'erhung with fog. But here, as elsewhere, there were seasons of gloom, of difficulty, and of hardship.

Nor would those fenmen of the transition period, when banks and sea-walls were raised against the intrusive waters, and when meres were first kept within bounds, and deep fens were gradually yielding to man's determined will— have been the hardy and thrifty race they were, had the Fenland, like some tracts in eastern climes, been periodically fertilized by inundations: those fenmen did more than sow and reap, they wrung their harvests from an unwilling soil.

By the aid of the pictorial illustrations in this book, some notion will be preserved of true old Fen scenery, whose appearance can be realized at present on a few spots

[illegible]

only. The aid of history may here be sought to enable the reader to take a retrospect—to picture to his imagination the habits and the surroundings of the ancient people of the Fens, who built their huts on the islands, and gained their livelihood, in part, by roving in their canoes over the broad waters, fishing for pike and eels, or snaring or shooting wild fowl—people who ofttimes baffled their enemies by taking refuge among the tall reeds in the shallow waters, or who, in the severe winters of the past, skated for miles over a sea of ice, which covered a district now become one of the most fertile regions in the British Isles.

Labour, skill, resolution, capital—these have made the GREAT FEN what it ~~is to-day~~, the GOLDEN PLAIN OF ENGLAND.

was before Free Trade ruined agriculture

I. *The Boundary.*

[*North.*] Let us suppose ourselves at Lincoln, about to make a circuit of the Fenland; we set out in an easterly direction along the valley of the Witham, which river, for a few miles, runs by the northern boundary of the Fen country. After proceeding four or five miles in this course, we see Fiskerton on the north and Washingborough on the south of the river; a few miles farther on we take a south-easterly direction; leaving Bardney we then pass on by Stixwold and Kirkstead and proceed southward near Coningsby; here the river Bane for two or three miles forms the north-west boundary, and we pass eastward to Mareham-le-Fen, Revesby, Toynton St. Peter's, Firsby, to Burgh-le-Marsh, where the flanking Marsh-land of the the Lincolnshire coast forms a continuation of the Fenland.

[*East.*] Crossing the Wash in a south-easterly direction we approach the north-west coast of Norfolk. A long strip of low land skirts the coast of the Wash by Heacham, Ingoldisthorpe, Dersingham, Sandringham Warren and

North Wootton to Lynn. Hence the boundary runs nearly due south along the course of the Ouse by St. German's, Watlington and Downham Market, with a large inflexion along the Nar valley. Our course then bends to the eastward towards Fordham and Roxham Fen, and passes north-east near Wereham; thence south-east by Stoke Ferry, Methwold, Hockwold-cum-Wilton to Brandon. The Fens are here continued into the valley of the Little Ouse. Passing from Brandon westward, a distance of 3 miles, we come to Brandon Fen, to the south of which is Wangford Fen, and pass thence to Lakenheath and southward to Mildenhall. Here a small portion of the Fen projects eastward into the valley of the Lark towards Worlington, and so, to Isleham.

[*South.*] From Isleham we sweep round Soham (Cambridgeshire). Thence the line trends by Wicken to Burwell, Swaffham Priory, Swaffham Bulbeck and Quy-cum-Stow, (the most southern point of our district), then north-west to Waterbeach, north of Landbeach, round by Cottenham, Rampton, Balsar's Hill, Willingham to Over. Here a small portion of Fen dips southward by Swavesey; thence the boundary continues by Fenny Drayton, Fenny Stanton, to the east of St. Ives and Holywell for a mile to the west of the Ouse to Earith; then it turns northward to Chatteris Fen, by Somersham, High North Fen, Pidley, Warboys, north to Ramsey, then westward to the north of Upwood Fields, and again southward to Wood Walton.

[*West.*] From this point our route takes a somewhat tortuous course by Sawtry St. Andrew, Conington and Holme, whence it swings round by the west to Yaxley, then north-east to Farcet, King's Dyke, westward to Peterborough, and by the Car Dyke to Eye. Then it takes the course of the Car Dyke to Peakirk, Deeping St. James, Market Deeping to Barholm, north to Thurlby, Bourn, Morton, Rippingale, Billingborough, Horbling, Heckington, Howell, Anwick Fen, Billinghay; thence the boundary line trends to the north-north-west by Walcott Fen and the Car Dyke, Timberland, Nocton Wood, Branston Wood to Washingborough again. The extreme length between Lincoln and Quy is about 73 miles, and the extreme breadth between Peterborough and Brandon is about 36 miles, the area being 1306 square miles.

II. *Topographical Description.*

General Features. As in describing the boundary, we commenced with the northern extremity of the Fenland, so in taking a glance at its general characteristics, we shall start from the same point, though we cannot observe the same uniform course. Along the valley of the Witham lies a narrow tongue of Fen about 4 miles in its greatest width, between Washingborough and Kirkstead; the north-east of this tract is skirted by the higher grounds which lead up to the Lincolnshire Wolds; its western side by the South Heath hills, which lie between Lincoln and Grantham. And on this tongue of Fen, fourteen miles in length, there is no village; drains and droves intersect it transversely. Billinghay stands in its western extremity, and Tattershall on the eastern. By the western side of the tract runs the Car Dyke, which is traceable from the Witham near Lincoln to Billinghay, Heckington Fen, southward to Bourn, and to the river Glen at a point 4 miles north-west of Market Deeping; it is said to have extended originally by Peterborough to Cambridge.

[*Rivers.*] The WITHAM, emerging from the tongue of land already described, runs south-east and receives its tributary, the *Bane*, near Tattershall, it then flows through the Fens to Boston Haven, in its lower course passing between Wildmore and Holland Fens.

The southern slope of the Wolds is drained by the river STEEPING, which enters the Fens at a place of the same name, and running eastward discharges its waters into Wainfleet Harbour and the Wash. The Steeping at one time drained East Fen.

A vast network of Drains surrounds Boston and its neighbourhood.

The WELLAND rises in Northamptonshire, and after flowing past Stamford enters the Fenland on the west near Tallington; it then flows onward by Market Deeping and Crowland, taking a northerly direction by Cowbit to Spalding. Along this course, from two miles south-west of Crowland towards Spalding, are wash-lands which receive the waters of the river when it overflows; the exterior banks of these wash-lands are higher than the river banks. From Spalding the Welland runs north-east to a point within three miles of Fossdyke Bridge, where it receives the *Glen*. Fossdyke Bridge is near the Welland Outfall, that is, Fossdyke Wash.

The GLEN rises near Somerby, about 3 miles east-south-east of Grantham, flows southward to a point three miles north-east of Stamford, then swings round and runs into the fens near Greatford, thence north-east through Deeping Fen, by Pinchbeck, Surfleet, to its point of confluence by "the Reservoir."

The NENE rises at Catesby in Northamptonshire, enters the Fenland at Peterborough, where it branches off through Standground Sluice into the Middle Level system of rivers and drains. (The former course of the Nene and its branches will be found fully described in the Chapter on Rivers.) Five miles below Peterborough, on the north side, is Thorney river, which receives the waters of the Nene through a sluice at Dog-in-a-Doublet, and from that point to Guyhirn lies a wash between Morton's Leam and the Nene. The main channel, called the "Great River," runs to Wisbech, thence by Sutton Bridge into the Wash; in this lower course it receives the waters from several large drains. The whole of the actual present course from Peterborough to the sea is an artificial cutting.

"*The old Nene*," from New Dyke north of Ugg Mere, west of Ramsey Mere and thence having a course north-east to March and Upwell, forms part of the river system of the Middle Level drainage.

The Great Ouse rises near Brackley and Towcester in Northamptonshire, passes through the north of Buckinghamshire, and by the towns of Bedford, St. Neots, and Huntingdon; it enters the Fens at St. Ives, flows on to Earith, where it falls into the Hundred Feet River, which has an almost straight course to Denver Sluice.

The old course was in what is now called the old West River; this runs from Earith eastward by Willingham, Haddingham, Stretham common, and turning northward is joined by the *Cam* at Harrimeer in the parish of Stretham, a little south of Thetford-in-the-Isle. These united streams flow past Ely and receive the *Lark* at Littleport Bridge, thence northward for three miles, where the *Little Ouse* or *Brandon River* joins the main stream. A few miles further on, the *Wissey* or *Stoke River* runs into the Ouse, and a mile below this Denver Sluice prevents the tidal waters from flowing up the stream formed by the West River and its tributaries, and turns the water up the Hundred Feet River. Below Denver Sluice the river has a free flow by the port of Lynn into the Wash. At Lynn the Ouse receives the waters of the *Nar*, a stream which rises at Litcham, runs past Castle-Acre to Narborough, whence it has a westerly course and flows through an arm of the Fenland.

In the neighbourhood of Denver Sluice is a remarkable junction of rivers and drains—for besides those named, there is the *Old Bedford River* with its sluice, and the *Well*

Creek with Salter's Lode sluice—four discharges within a few hundred yards.

The Witham, the Welland, the Nene, and the Great Ouse, flowing into the Wash, drain 5850 square miles. (For area of basins and length of streams, *see Chapter on Rivers.*)

[*The Banks.*] The banks in the Fens form a very remarkable and characteristic feature. In most parts of our country the rivers have their sloping shores and ronds, but here every river has its artificial banks—in many cases inner and outer banks, with *wash-lands* between—the outer embankments being the higher.

The banks may be divided into three classes; *first*, the ancient; *second*, the sea-banks or "sea walls" as they are sometimes termed; and *third*, the river and drain banks.

Of the first class, we find examples in the old seadykes—like those along the coast of East Holland in Lincolnshire, and those to the south of the Wash, by Holbeach and Gedney marshes, Long Sutton, Tydd, Wisbech, Walton, Walpole, and thence towards the Ouse—fine old banks, (now in part become roads) attributed to the Romans. Another is Crooked Bank, south of Wisbech, having its continuation formerly by the Sand Bank, which runs by Parson Drove and northward into Lincolnshire. The present channel of the Nene was cut through this bank at Cold Harbour Corner. With this ancient class may be placed the bank of Devil's Dyke, to the south of the Fens.

In the second class we place the modern sea-banks, which are constructed for the reclamation of land from the Wash, not simply as a barrier against the *encroachments* of the sea. Fine specimens of these banks may be seen in Wingland between the Outfalls of the Nene and Ouse. Some of these, constructed previous to the last enclosures, are now used as roads.

The third class are very numerous, being, as already stated, essential to every river and drain. In many parts the river banks form the highways between town and villages. There was economy in this. The river must be embanked, and a road considerably raised above the surrounding country was equally necessary, in order to maintain the means of communication in wet seasons. Where the roads were made by the course of a natural river, they are very winding. In some places the old river has disappeared, or only some traces of it crop up here and there, as the traveller proceeds by the tortuous highway—such as the Well Road, near Wisbech. a so called

In the following verses, by ~~the~~ Poet [redacted], there are striking allusions to the Road by the River in the Fenland:—

"And moving thro' a mirror clear
That hangs before her all the year
Shadows of the world appear,
There she sees the highway near
    Winding down to Camelot;*
There the river eddy whirls,
And there the surly village churls
And the red cloaks of market girls
    Pass onward from Shalott.

Sometimes a troop of damsels glad
An abbot on an ambling pad,
Sometimes a curly shepherd-lad,
Or long-hair'd page in crimson clad
    Goes by to tower'd Camelot;
And sometimes thro' the mirror blue
The knights come riding two and two;
She hath no loyal knight and true
    The Lady of Shalott."

* *Cam* was a British ~~word for~~ winding. The tortuous character of the natural streams is strikingly observable in the Fens. The word *Cam*, crooked, we find in the Cam in Gloucester and Cambridgeshire, the Camil in Cornwall, the Camlad in Shropshire, the Cambeck in Cumberland, the Camlin in Longford, and the Camon in Tyrone. Morcambe Bay is the crooked sea bay, and Camden is the crooked vale. We have also the rivers Kamp and Champ in Germany, and the Kam in Switzerland. DIEFENBACH, Celtica, I. p. 110. This word was adopted into English, though it is now obsolete. So SICINIUS VELUTUS says of the crooked reasoning of MENENIUS AGRIPPA, "This is clean kam"; to which BRUTUS replies, "Merely awry." *Coriolanus Act III, Scene 1.* The root appears in the phrase, arms in kembo, or a-kimbo. To Cam, in the Manchester dialect, is to cross or contradict a person, or to bend anything awry. KENNETT,

No one ever saw a boat like that on the Fens

Fig. 1. *Among the Fen Reeds, near Ely.*

"Of all the Marshland Isles, I Ely am the Queene,
For winter each where sad, in me looks fresh and green."

(Polyolbion, 21st Song.)

[*The Islands.*] There are islands in the Fenland. Not artificial ones, such as may be formed by drains and ditches, but natural islands, having an elevation of a few feet above the surrounding Fens; it is, however, only in the southern part of the district that these are situated, with two exceptions north of Boston,—Sibsey and Stickney.

Then there are islets within an island, for some of them lie within the boundary assigned to what is called the Isle of Ely, which extends from Tydd St. Giles in the north,

Parochial Antiquities, Glossary, s. v. Camera; Whitaker, Hist. Manchester, vol. II. p. 274; Davies, in Philolog. Proc. vol. VI. p. 129; Halliwell, Archaic Glossary, s. v.; Gluck, Kelt. Namen, p. 34. [Taylor, Words and Places, 2nd ed. p. 217.]

to Upware on the south, *i.e.*, 28 miles in length; and from the Nene near Peterborough on the west, to Abbot's Delf near Soham on the east, *i.e.*, about 25 miles.*

But the Isle of Ely proper is an elevated tract, including Chetisham, Downham, Coveney, Witcham, Mepal, Sutton, Haddenham, Wilburton, Stretham, Thetford, and the city of Ely on its east side; this island is about 7 miles long and 4 miles broad.

Within the larger area there are other slight elevations, which were in former times dry ground while the Fens were flooded; they were *islands*, as the terminations of their names imply; such were those in *ea* or *ey*: Ramsey, Whittlesea, Thorney, (all in the same meridian); and east of the gravel ridge, stretching from Chatteris to March, are Manea and Stonea; and east of Whittlesea is Eastrea, (east island; *æsteræ*, DAN.) and around Ely,—Coveney, Stuntney, Quaney, &c.

Derivation of the names.

We are told that *Ely* was *Elig* in the Saxon tongue and *Elge* in the Latin of BEDE. "Elge is situated in the province (or kingdom) of the East-Angles, being a district of about 600 families, in the form of an island, surrounded either with fens, or waters, whence, and from the abundance of Eels, that are taken in the said Fens, it had its name."†

* It is divided into 4 hundreds—

		ACRES.			ACRES.
1	Ely hundred—		3	North Witchford—	
	Ely city - - - - -	17,480		Chatteris - -	
	Downham - - -	26,940		March - - -	78,760
	Littleport - - -			Whittlesea, &c.	
2	Wisbech hundred—		4	South Witchford—	
	Wisbech St. Peter's -	6,450		Haddenham - -	48,660
	Other parishes - - -	64,340		Sutton, &c. - -	

Total area - - 242,630 acres.

† BEDE, quoted by BENTHAM, p. 47.

Now what are the probabilities that *Ely* means *eel-island?* The Saxon for eel was æl; the Sax. for island was ig. (*Seen in* ANCARIG, *Thorney*.)* æ corresponds to the same Gothic letter as â, but comes into English with the sound of *ee*,† and the E in Ely is long. [Besides there are many examples, as *Ethel*, noble, which is more correctly Æthel, as in Ætheldreda; other names will appear in this form hereafter.] "Dicimus autem Ely, Anglice id est, a copia anguillarum quæ in eisdem capiuntur paludibus, nomen sumpsit." "Y sive Ey, Anglis Insula est .... iisdem etiam anguilla dicitur Ael, Anglis Eel." (*Historia Eliensis, Lib. prim.*)

ig; the g in Anglo Saxon had a sound similar to the terminal *g* in modern German; *g* came into English in three forms, one being *y*; it was the final for i, as in hii = hig, (they.)

ea interchanged or displaced the Anglo-Saxon *e* or *i*; *ea* would be an older form and preferable to *ey*, as island, thus Whittlesea rather than Whittlesey—but this name should not be divided, Whittle-sea. In Doomsday book it was Witesie, now Whittles-ea. We infer that *ea* and *ey* (island) have come from Saxon *ig* by the influence of phonetic changes, as *eâ* was Saxon for *river*. This last word, in its original form, was often applied to a river or drain. DUGDALE mentions *ea* near Wainfleet;‡ the Old *Ea* and Catts-water.|| What is now called Popham's *Eau* is called *Ea* in DUGDALE.§ The Fen-men still speak of Bourn Ee, Risegate Ee, Popham's Ee, &c. The present spelling, Eau, (French) is misleading as to the derivation.

* "The place is called Thorney on account of the very dense thickness of the bramble bushes there." WILLIAM OF MALMSBURY.

There was an island in the Thames of the same name—the Abbey was built on it. "The ancient name of Westminster came into disuse because of Thorney in Cambridgeshire." (BOSWELL's Anglo-Saxon Dictionary.)

† See DR. MARCHS's Grammar of Ang. Sax. Lang. p. 13.

‡ 2nd edition, pp. 161, 162. || Ibid. 380. § Ibid. 393.

But it was also written *Ee* as "the river of Welle, called Well Ee" (DUGDALE); and again it became *ey* as the termination of the names of places on rivers, such as Welney and Tilney.

The derivation of the term *Holland*, as applied to South Lincolnshire, will be discussed elsewhere. The MERES that *were*, and are not, will be noticed in the history of Drainage. [S. H. M.]

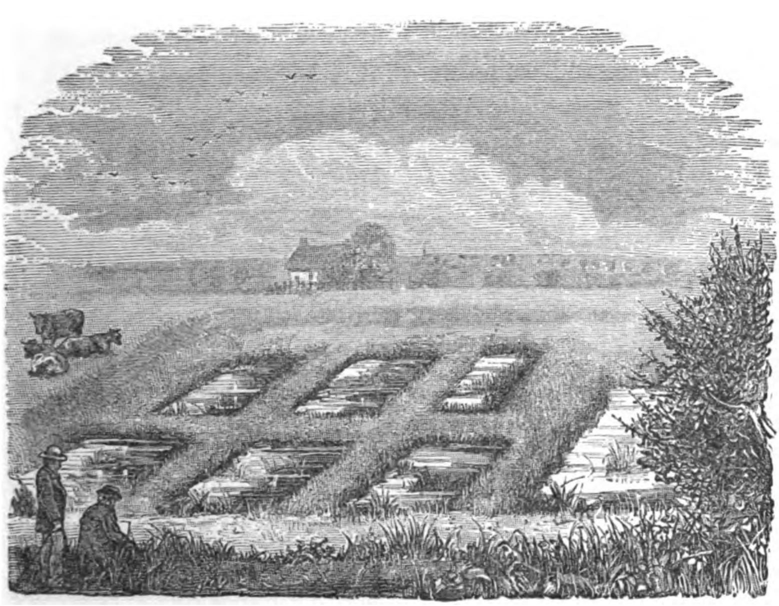


FIG. 2. *Ancient Salt Pans, at Bicker-haven, in Lincolnshire.*

CHAPTER II.

THE PRE-HISTORIC INHABITANTS OF BRITAIN.

REGARDING the origin and first estate of man, science is altogether silent, or reveals but few glimpses of a vague and unconnected character. What appear to us the traces of his most remote existence, prove that he was a barbarous savage living chiefly by the chase, and accoutred only with tools and weapons of stone, bone, wood and such-like readily accessible materials. His condition was lower than that of the least cultured savage of whom we have any experience, for he knew not the art of grinding his tools, and this cannot be said of any savage within the historic period. Nevertheless, we have solid grounds for the belief that, even then, he was an ancient denizen of the earth, and his earliest remains must be sought in the tropical regions of the Old World, rather than in Central Asia, whence his more cultured descendants seem to have come.

Subsequent to the rude condition above indicated, the human race made steady progress, and apparent retrogressions were due only to local circumstances and did not affect mankind at large. It used to be confidently asserted that man had fallen from a state of high civilization, traces of which were positively stated to be discernible in all races at all times. Nevertheless DR. E. B. TYLOR, F.R.S., perhaps the highest living authority on these matters, writing upon this subject, says, "Where such arguments have had no aid from direct history, but have gone on mere inspection of the arts of the lower races, all that I can call to mind, seem open to grave exception." He goes on to say, "To judge from experience, it would seem that the world, when it has once got a firm grasp of new knowledge or a new art, is very loth to lose it altogether, especially when it relates to matters important to man in general, for the conduct of his daily life, and the satisfaction of his daily wants, things that come home to men's 'business and bosoms.' An inspection of the geographical distribution of art and knowledge among mankind, seems to give some grounds for the belief that the history of the lower races, as of the higher, is not the history of a course of degeneration, or even of equal oscillations to and fro, but of a movement which, in spite of frequent stops and relapses, has on the whole been forward; that there has been from age to age a growth in man's power over nature, which no degrading influences have been able permanently to check."* Decline may arise from war, or expulsion into less favourable situations, but it would be difficult to cite a single instance of a race going back from a newer to an older art, such as abandoning the use of pottery for wicker-work, of metals for stone, of flint and steel (or their substitutes) for the fire-drill, of the spindle for hand-twisted fibre, or of weaving for the "wattling in" of strands.

As might have been expected, the remains of man are confined to the newer strata, and generally to the newest of these. The rude people of whom we have spoken, as not knowing the art of grinding are, however, recognised almost solely by their remains; but very few bones belonging to their skeletons are known, or can be referred to them positively. The tools are mostly of chipped flint, some very rude, others shewing considerable skill and some

* TYLOR, Early Hist. Mankind, pp. 190, 191, 1865.

appreciation of symmetry. The crudest specimens require some experience for their detection, and their artificial nature is often doubted by such as do not possess that knowledge. Indeed, it is not unusual to hear statements such as "Oh! they could be matched in any gravel heap." To this I would reply, firstly, that for many years I, and many others, have been almost daily studying gravels, and could not readily be deceived in the matter; and, secondly, that if anyone will impartially set himself to examine the stones in any gravel pit, he will, after handling some thousands, be compelled to alter his views; and if any doubts still linger in his mind they will be as to whether the flints in question ever were obtained from such deposits; and, further, if he be fortunate enough to find a stone of the required shape he will assuredly treasure it, at least as a curiosity, even if he still doubt its being fashioned by human handiwork.

These remains are found in the gravels of certain river-valleys, and in caves; and their geological relations will be shewn in the sequel, where it will also be proved, beyond much doubt, that the people who used them lived during the earlier part of the glacial epoch. They were certainly contemporary with an extinct fauna which included the reindeer, mammoth, and woolly rhinoceros among arctic animals; the lion, hyæna, and hippopotamus among tropical and the grizzly bear, bison, and wild boar among the temperate mammals; thus showing that during his occupation great changes of climate occurred; which, together with the character of the fauna itself, afford some idea of the duration of his occupancy and the distance of his separation from us in time. Man's co-existence with these extinct animals has been, furthermore, proved in a most remarkable manner by the discovery in the caves of Périgord, of drawings of the mammoth, reindeer, bison, and a peculiar variety of horse, engraved with great spirit (the two former on their own tusks and bones) showing a true appreciation of the æsthetic principles of art.* The existence of art culture with a low state civilization can be paralleled among modern savages; the Red Indians, for example, especially excel in this direction, and striking examples of their productions may be seen in the CHRISTY collection and elsewhere.

In this place we are chiefly concerned with the races that have inhabited our land, and the Fens in particular. The old Stone Folk we have been dealing with, have left their remains only at one place within the Fens, at Shrub Hill, near Feltwell, Norfolk,† but the vicinities of Brandon, Lakenheath, and Mildenhall, are peculiarly rich in them. The people were a race of hunters and fishers, and there is no evidence to shew they had domesticated any animal, even the dog being absent from their homes. In endeavouring to correlate them with existing races, we can seek analogies only among implements, and these data are not lacking. The tools have a facies distinct from any others, and they are only matched by those in use by the Eskimos. From this strange people have been collected implements of stone and bone, which in form could scarcely be distinguished from those of the old Stone Folk. They too are hunters and fishers, they too are partial to the reindeer, and they too excel in the depiction of hunting scenes upon their bone tools. Moreover, they have the same habit of collecting heaps of refuse around their dwellings, the same habit of splitting bones for the marrow, and they dress hides in the same manner and sew them with similar

* Cavernes du Périgord, Revu. Arch., 1064; and Reliquiæ Aquitainicæ, 1865-75. For Drawings in English works see the latter, LUBBOCK'S Pre-historic Times, 1869, and DAWKIN'S Cave Hunting, 1874.

† For the very simple reason that the excavation of the Fen-basin is subsequent to their period of occupancy, and moreover that most of the Fenland was then sea.

implements. These coincidences were first pointed out by my friend and late colleague, PROF. BOYD DAWKINS, F.R.S.* and he justly remarks that "To the objection that savage tribes living under similar conditions use similar instruments, and that therefore the correspondence of those of the Eskimos with those of the reindeer folk does not prove that they belong to the same race, the answer may be made that there are no two savage tribes now living which use the same *set* of implements, without being connected by blood."† He therefore concludes that the Eskimos are lineal descendants of the old Stone Folk. The Eskimos are a *Mongoloid* (*Turanian*) people, and this race seems to have come, in later times, at any rate, from Central Asia.

Long as was man's sojourn in our land during the old stone age it came to an end, owing to a return of Arctic conditions, and the submersion of a great part of Britain. This submersion does not seem to have affected the Fenland or the district to the south to a greater extent than 20 feet, but in Lancashire and Scotland it attained a maximum of over 2000 feet: this question is treated more fully in the sequel.

When man re-appeared on the scene, the glacial period was near its close, glaciers may still have lingered in the mountain districts, but the climate was growing milder, and from that time forward Britain has never been without human occupants. The interval between the immigration of the race in question, and the emigration of the Old Stone Folk, may be, to some extent, realised from the fact that the old southern fauna, including 19 species, had for ever passed away, five of its members indeed dying out completely. The physical evidence is even more striking, and will be described afterwards. The fauna of the new

* Eskimos in the south of Gaul, Sat. Rev., Dec. 1868. Cave Hunting, p. 359, 1874.

† Ib. p. 358.

epoch consisted almost entirely of species known to have inhabited our land within historic times.

The new race of men, like the old one, was unacquainted with the use of metal, but the stone and other implements show a great upward stride. The stone tools are very often polished and nearly always more symmetrical than of yore, and the degree of culture can be paralleled by many existing savage races, as the Red Indians, the Australians, the Polynesians, etc. From the principal materials in use, and the excellence of manufacture, these people may be spoken of as the Newer Stone Folk. Their skeletons are found in numbers. The chief peculiarities of the race may be thus summarised. They were a 'long-headed' people of short stature, averaging about 5ft. 5in. in height, with oval faces and regular features, of dark complexion, with black hair and dark eyes. They lived in caves and elsewhere, and buried their dead, generally in a contracted posture, in barrows which are often of the kind known as 'long.' They were partly hunters, but possessed a few domestic animals, such as the Keltic short-horned ox,* the goat, the horse and dog. They manufactured pottery, but it was hand-made and ill-burnt.

The skeletons, implements, and habits of these Newer Stone Folk are sufficiently well known to enable us to pronounce with certainty upon their race. They belong to the great smooth-haired class of *Leiotrichi*, which are divided into four classes, viz:—

1. The *Australoids*, comprising the Australians, the hill tribes of the Deccan, the ancient Egyptians, etc.

2. The *Mongoloids*, who range from Lapland to Siam,

* This animal, the *Bos longifrons*, was indigenous to Britain, and is called Keltic because at the Roman invasion it was the only domesticated ox possessed by the Keltic races. It survives in the dark mountain breed of small cattle in Wales and Scotland. The ordinary British cattle are descended from a larger species, *Bos urus*, introduced about A.D. 449.

and include the Malays, Polynesians, Maoris, Eskimos, and American races.

3. The *Melanochroi*, or "dark whites," inhabiting the Mediterranean area, Western Asia, Persia, etc.

These three races are all characterised, among other features, by the possession of dark, but not black, complexions, long black hair and dark eyes.

4. The *Xanthocroi*, or "fair whites," including the fair Keltic nations, the Slavonians, Scandinavians, Teutons, etc.

With the *Melanochroi* the Newer Stone Folk agree in all respects. They constituted a great race which spread from Asia southward and westward, over Europe and northern Africa, as far as Ireland and the Canaries on the west and south. They are known to us by the various tribal designations, such as the Guanches of the Canaries, the Berbers and Kabyles of northern Africa, the Ligurians who extended from the Po to Marseilles, and the Basques who occupied great part of Spain and south-western France, extending in that country as far as the Loire (*Ligur*). From their settlement in force over the Iberian peninsula the Basque races have been termed Iberians, and this term has come to be applied to the whole of these Melanochroic people. The term "black Kelts" is also used for the Basques, to distinguish them from the fair Kelts or Xanthochroic people. We shall use the term Iberian in its widest signification.

The Iberians were Turanian people who spread over most of Europe and north Africa in the newer Stone Age, and have left their traces in great plenty in the long barrows of Britain and Ireland. The old blood is still traceable in the short, black-haired, dark-eyed, oval-faced people of Wales, especially in Denbighshire; and in Ireland, west of the Shannon. The very name of Britain has been supposed to be of Iberian stock, the termination *tan* being common among the ancient names of Spain.*

PROF. HUXLEY, to whom the above classification of the human race is due,† has suggested with a strong degree of probability that the Iberians are a mixture of Australoids and Xanthochroi, and if so, they are indirect blood relations of the ancient Egyptians. The Old Stone Folk, on the other hand, belong to Mongoloid class of Leiotrichi, of whom the Lapps and Eskimos are modern examples; hence we see that even in the Old Stone Age there were no signs of the fusion of the crisp-haired *Ulotrichi* and smooth-haired *Leiotrichi*, and it is from such striking facts that we are justified in ascribing to mankind an antiquity far greater than that of the earliest relics at present known. As every fact points to an Asiatic origin of the Iberians, it follows that the fusion of Australoids and Xanthochroi took place in very early times, and while the former have pushed chiefly southwards and eastwards to India and Australia, the latter have migrated to the westward. It is just possible, however, that Australoids and Xanthochroi have sprung from the Iberic stock, in which event they are newer than the Iberians.

The presence of the Iberians in the Fenland is plentifully attested by the discovery of their highly wrought stone implements, which have been found in great numbers as is shewn in the sequel. One of the most interesting discoveries of this race, is that of the skull of a bull in Burwell Fen with the frontal bone crashed in with a ground celt, which was found in the skull itself.‡ (This interesting relic is shewn in the left-hand figure; *see Illustration to Natural History Chapter.*) It affords us a vivid picture of the habits of these swarthy little men, who durst attack

* See Art. Brit. Ins. in SMITH's Dict. Rom. and Greek Geog.

† Critiques and Addresses, pp. 134, *et seq.* And Pre-historic Congress, Norwich vol. pp. 92, *et seq.* Also Jour. Eth. Soc. vol. II, pp. 382, 404, &c.

‡ BABBINGTON. Camb. Antiq. Soc. vol. ii. p. 285.

the active wild bull with a stone tool mounted in a wooden handle.

Towards the close of the Stone period the Iberic race was invaded by a tall, broad-headed, fair race of Kelts, a branch of the Xanthocroi, who had likewise come from the far east, and brought with them a knowledge of bronze, iron being still unknown. We have seen that the Iberians met with no human opposition in settling in Britain, and indeed they appear to have been a peaceable race, who everywhere succumbed to the tall, fierce, better-accoutred, fair Kelts. Such was the case in Britain and Ireland, and the Iberians fell back before them into the mountain fastnesses, just as the Kelts afterwards succumbed to the Belgæ in the south, the Britons before the Romans, and the Brit-Welsh before the English. But the conquest was one of absorption and not of extermination, for the fusion of the two is abundantly proved by the skeletons which have been found in so many places in the United Kingdom,* and the same fact is attested on the continent; indeed we have historic evidence of the fusion in Spain, when the mixed race were called Keltiberi. CÆSAR found and TACITUS described the dark and light races of Britain living side by side, both speaking an Aryan language. The old tongue of the Iberians thus seems to have been early lost, as is often the case with conquered peoples, but it is still preserved in the Pyrenean district.

The chief characteristics of the Keltic invaders were their tall stature, broad skulls, fair hair and blue eyes, uncouth features and small hands. They generally burned their dead, and buried the ashes in urns with implements and ornaments in round barrows. To them are due many of the stone-circles, such as Stone-Henge. They made orna-

* DAWKIN'S—Cave Hunting, p. 197. See also the works of BUSK, HUXLEY, LAING, THURNAM, &c.

ments of jet, amber, and fossils, and were acquainted with the use of gold, with which they adorned some of the jet beads most exquisitely. Silver and iron were unknown. They do not seem to have introduced any domestic animals, for the Keltic short-horn, goat, sheep, and dog, were already subservient to the Iberians, and no new animals are associated with Keltic finds. It is probable, however, that they greatly improved agriculture, bringing with them grain and other vegetables. They were also acquainted with the potter's wheel.

It has been suggested that they must have come over in ships, to build which metal tools would be required, as monoxylic canoes could not have conveyed large numbers of men, and England, unlike what it was when the old Stone Folk came, was separated from the continent.* This argument seems to me void of all truth. England was separated from the continent when the Iberians came over, and the same reasoning should apply to them, yet we know they were entirely ignorant of the use of metals and no one has ever suggested that they had ships. Again, modern savages go longer voyages in monoxylic vessels than was necessary to traverse the narrow channel, then narrower, over which Englishmen can swim. And moreover we know that the Danish and Norse Vikings descended upon the English coasts in open boats.

The Keltic remains in the Fenland are numerous, as the finds of bronze celts at Kyme, and elsewhere, attest.

It is, however, extremely probable that there were many invasions by Keltic tribes, just as there were several incursions of northmen, each better equipped than their predecessors, and some of these may have introduced the knowledge of iron, which is probably not of European origin. At any rate we are certain that the Keltic races

* WHITNEY. Language and the study of Language, 1867.

rapidly became dominant in Britain, that commerce flourished, and that when the Romans arrived iron was the common metal of the land. It seems then that the Iberians were ignorant of the use of metal till they learned it from their Keltic conquerers, and that here, as elsewhere, iron was preceded by bronze. That the manufacture of iron in latter times was a well-known art, is proved by the numerous small heaps of slag, which are still to be found in Northamptonshire and Lincolnshire, in places where iron-stone and wood abounded. Of these I have found very many, and the one nearest the Fens is at Little Bytham, near Bourn in Lincolnshire.

We have now brought down the history of Britain to close upon the historic period, and in the next chapter we shall see, what Mr. Evans has also shewn, that the Britons when Cæsar landed, were much more highly civilised than has been supposed.

The European languages belong to two great classes, the Turanian and Aryan. The former term is derived from *Turan*, the Persic name for the countries lying to the north of Persia or Iran; but it may have an older etymology referring to the nomadic habits of many of its people, thus Max Muller derives it from *Tura*, which implies the swiftness of the horseman.* The Turanian languages are far older than the Aryan, and the Iberians were Turanian; so too are the Lapps and Eskimos and, by inference, the Old Stone Folk also.

From the Aryan languages arose the Indo-European tongues of the present day. The term is allied to the Sanscrit *arya*, excellent, meaning the best, or more probably, as Max Muller has shown, from *arya* signifying "one who ploughs or tills," hence the Latin *aro*, *arare*, to plough.† The study of Aryan root-words has thrown considerable

* Science of Language 3rd ed. p. 242. † Ib. p. 242.

light upon ethnology, and when the Turanian roots have received like attention, much interesting matter will be revealed. It is possible that some of the curious words used by the Brandon flint-knappers, are relics of the language of the newer Stone Age, nor should this be deemed improbable when we remember that the peculiarities of those ancient people are still preserved at Brandon, as shewn in the description of flint-knapping.

[S. B. J. S.]

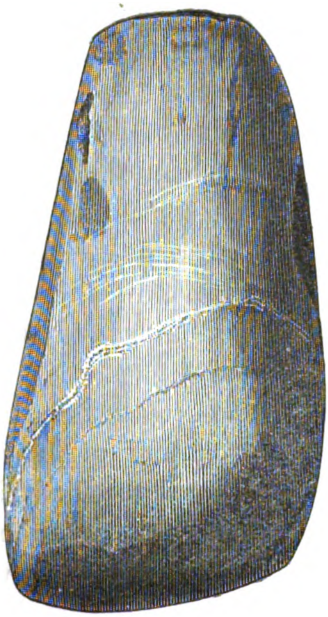


FIG. 3. *Polished Celt, from Edenham, near Bourn, Lincolnshire.*

CHAPTER III.

HISTORICAL SKETCH.

SECTION I.—*The Ancient Britons.*

THE earliest inhabitants in the historic period of this country have been called 'BRITONS' but if this word was really of Iberic origin, it points to a probable ethnological relationship anterior to the Aryan migrations. The Phœnicians made known this name to the Greeks, and in CÆSAR's time it had become a Gallic word. The Iberian, however, was one of the oldest languages of Europe—a language spoken when the population of all western Europe was homogeneous, and the great classic nations had not yet been allured by the mineral wealth of the Isles of the West*; a remnant of this language is now found among the Basques in the Pyrenees.

The Aryans came from near the river Oxus, on the western slopes of Belur-tag, one of the highest mountains in Central Asia, and displaced the Turanians (or Iberians). We call those who reached western Europe—Kelts; but the Greeks, Latins, Teutons, and others, were of the same stock,—the Hindoos and Persians were Aryans also, but later emigrants than the Kelts.†

* See LATHAM's Nat. His. of the varieties of Man, p. 551.

† The sacred book of the Hindoos, the Sanskrit Vedas, was compiled about 1500 B.C. (see DR. MARCH's comp. Gram. of Anglo. Sax. 1875.) Thus some notion of the antiquity of the Keltic immigration to Britain may be realized; since we know that the Greeks, Latins, and Teutons were intermediate emigrants, and that the Hindoos were settled in India before the Vedas was compiled.

The Kelts appear to have come mainly in two swarms, the Gadhelic and Cymric; the former probably came first; the latter may have been more civilized, and it is of these we are about to speak. We shall henceforth call them Kelts; there is no evidence that they called themselves *Britons*—the real Britons were pre-Keltic.

British Kelts occupied the Fenland. Of this there are evidences in such remains as the tumuli, stone implements, bronze and iron swords, spear-heads, etc.

STUKELEY says the tumuli or barrows are British not Roman*

"We may be well assured that the whole country was well inhabited by the *Antient Britons*, and that, as far as the sea coasts, especially the islets and higher parts, more free from ordinary inundations of the rivers, or though not embanked above the reach of the spring tides. For the nature of this place perfectly answered their gusto, both as affording abundant pasturage and in being so very secure from incursions and depredations of war and troublesome neighbours, by the *different fens* upon the edge of the high country."†

This writer states that he observed the abundance of old Welsh words left in this part of the country, and he was persuaded that the name *Holland*‡ is derived from that language, though now terminated by a later word, as is frequent enough.

* Itinerarium Curiosum, London 1724. † Ibid.

‡ But the word Holland does not appear to have been derived from the Welsh, *Hal* or *Hallt* (Salty), but from the Germ. *hohl* (hollow), low Germ. *holig*—it was, then, not introduced by the Dutch settlers, but it comes from the language of the common stock of the Teutonic race. STUKELEY was in error too in assuming that it was terminated by a *later* word. The Teutonic *land* and the Welsh *llan* are Aryan words, *i.e.*, they belong to the primitive Indo-European race. The Welsh word is properly *lann* and the final *n* represents a primitive *d*; as *dinn* (a fort) represents a more ancient *dind*, which is yet in existence. That this etymology is important will appear presently.

Our Illustration facing page 32 of this chapter gives a view of South Holland. It was taken from the top of the tower of Crowland Abbey—looking eastward towards the Wash,—this landscape may be useful in enabling the reader to judge of the appearance of the country,—as far as the eye can reach are presented dry ground, and fertile fields—fairly sprinkled with trees.

It signifies *salt* or *marshland*, such as is gained from the sea, and to this day such are called "salt marshes." hence, too, Salter's lode, Saltneney gate.

The tribes which occupied the Fenland, according to PTOLEMY, were, in Lincolnshire and part of Northamptonshire, the CORITAVI—and in Norfolk, Suffolk, Cambridgeshire and Huntingdonshire, the ICENI; more strictly, perhaps, the Cenomanni or Cenimagni, a sub-tribe of the Iceni, held part of Suffolk and Cambridgeshire.

But it must not be assumed that these were of the Keltic stock, pure and simple. MR. KEMBLE observes—"There cannot be the least doubt than an active communication was maintained throughout by the Keltic nations on different sides of the channel; and similarly, as German tribes gradually advanced along the lines of the Elbe, the Weser, the Maes, and the Rhine, occupying the countries which lie upon the banks of those rivers, and between them and the sea, it is reasonable to suppose that some offsets of their great migrations reached the opposite shores of England."* "The Coritavi who occupied the present counties of Lincoln, Leicester, Rutland, Northampton, Nottingham and Derby, were German, according to Welsh tradition itself,† and the next following name Κατυευχλανοὶ,‡ though not certainly German, bears a strong resemblance to many German formations."

* The Saxons in England, p. 8.
CÆSAR notes the migrations, Bell. Gall. v. 12. "Britanniæ pars interior ab iis incolitur, quos natos in insula ipsa memoria proditum dicunt; maritima pars ab iis qui prædæ ac belli inferendi causa ex Belgis transierunt." [The interior part of Britain is inhabited by those who, they say, according to tradition, were born in the island itself; the sea coasts, by those, who, in order to plunder and make war, crossed over from the Belgæ.] Some writers suppose that the Belgæ of CÆSAR were located in Kent and Sussex. These may have come from Belgic Gaul, and at the same time belonged principally to the Keltic stock. (See LATHAM's Ethnology of the British Islands, p. 63.) But the direct historical conclusion from the ancient authorities as to the Belgæ, is this; they were a Keltic people, some of whom in CÆSAR's time were mixed with Germans, without having lost their national characteristics. (SMITH's Greek and Roman Dic. p. 387.)

† According to the Triads, these Coritavi had migrated from a Teutonic Marshland.

‡ The Catyeuchlani occupied part of Northampton, Buckingham, Bedford, Hertford and Huntingdon.

The early inhabitants of this district, although denominated Britons (British Kelts) may, then, have been a mixed race, probably two or three centuries before CÆSAR's invasion.

As to the extent to which it was peopled, we have no certain data for estimation.

ELSTOBB* informs us that MR. ATKINS, a gentleman much employed in surveys and examinations of the condition of the Fens in his time, and who had taken pains to make inquiry into their ancient state, says, "the Fens that are now, were formerly in the nature of meadow-land, fruitful, healthful, and very profitable to the inhabitants, and yielded much relief to the people of the high countries in the time of drought;" hence, says he, "we find LELAND and other writers, very lavish in their praises of this once fruitful country."

"From which accounts it sufficiently appears that the most considerable part of the Great Level was antiently sound dry land by nature, well furnished with timber trees and woods: a great part of which was originally in the nature of forest, and the habitation and shelter of deer, etc., as appears by the horns of these animals having been dug up in the making of drains in several places. That this was the state of the Great Level, when the Romans entered the island, is highly probable."

THOMPSON in his history of Boston, says, "It does not appear probable that the district of Lincolnshire, now called Holland, was at the time of the Roman invasion thickly populated . . . . . that the country adjacent to Boston was inhabited prior to the Roman conquest, scarcely admits of a doubt."

The river Witham was sacred to the Druids, and its banks were most likely populated to a considerable extent for that period.†

* Historical account of the Great Level, p. 7.

† See OLIVER's Religious Houses on the Witham, pp. 30-31.

Before Roman times the British Kelts advanced northward to the Isle of Ely, and seized upon the islets of high ground, fortified by rivers and Fens, and there erected petty sovereignties on a soil at once rich and secure.* The remains of remote antiquity were found at Chatteris in 1757.† Chatteris had its name, Chartreuse, from a nunnery founded there in 980 A.D. by ÆLFWENA, mother of Earl ÆTHELWINE, Alderman of all England: founder of the Abbey of Ramsey.

On the site of this monastery was probably the palace of the monarch, among the old British Kelts, whose tomb was dug up.

CÆSAR (perhaps to exaggerate the power of the people he could not conquer) represented the inhabitants of Britain as countless, and their buildings numerous—but says, "The Britons call it a town (Caer) when they have defended their woods with a rampart and trench, whither they congregate in order to avoid an incursion of their enemies."‡ (Oppidum autem Britanni vocant, cum silvas impeditas vallo atque fossa munierunt, quo incursionis hostium vitandæ causa convenire consuerunt).

But it must be remembered that he saw only one corner of Britain, and therefore wrote mostly from hearsay, though this account was given after his second invasion. The oppida, upon or near the sites of which the principal Romans stations were subsequently fixed, were not visited by CÆSAR, as he does not mention the name of any single town (Caer). Certainly, considerable advances in civilization were made in the time of CYNOBELIN, *i.e.*, before the real

* The finds of British Coins at March and other places indicate the extent to which this district was occupied. (*See Antiquities.*)

† See "Selection of Curious Articles from Gent. Mag.," vol. I. p. 248.

‡ "If we may implicitly trust the report of CÆSAR, a British City in his time differed widely from what we understand by that term." KEMBLE'S Sax. in Eng., vol. II. p. 263.

conquest of Britain commenced. In the same chapter from which the above description of the oppidum is quoted (Com. de Bello Gallico, lib. V. c. 21) we learn that CÆSAR, having ascertained the whereabouts of CASSIVELLAUNUS, advances with his legions and finds the place (Urolanium?) admirably fortified by nature and art—(locum reperit egregie natura atque opere munitum); most likely this fortification consisted of a ditch, stockade and rampart. Thus the engineering of the Britons received the commendation of CÆSAR. He found it necessary to make his attack in *two* directions (tamen hunc duabus ex partibus oppugnare contendit)—hence the strength of the fort. It may be here noted that CASSIVELLAUNUS was most probably chief of the Catyeuchlani. And STRABO asserts, "The forests of the Britons are their cities. For when they have enclosed a very large circuit with well felled trees, they build within it houses for themselves, and hovels for their cattle. These buildings are very slight, and not designed for long durations." The habitations (except in the oppida) were no doubt simple cabins constructed with wood, or in this part most likely of reeds which would be plentiful, and also of clay, which would be found near the surface. On the seaward portion, the ancient Fenlanders were, like the other inhabitants of south-eastern Britain, in advance of the natives of the more inland and northern parts—practised, too, in a rude method of agriculture, in the construction of implements, spears, axe-heads, etc., also in basket work—(why should not the osier, so plentiful now, have grown then?)—in the manufacture of a coarse cloth; these things belonged to the then civilization of the parts adjacent to the continent. The prevalent custom of staining the skin would obtain in this district. Perhaps the woad (*Isatis tinctoria*) now so largely cultivated in the Fens, as we shall show, was also grown then.

"This tract abounds likewise with turf and sedge for firing, reeds for thatching, alders and other aquatic trees, especially willows, which the soil particularly suits, and which are planted as a fence against floods, and being often lopt are of singular service by their numerous shoots, or as PLINY calls them, offspring. Of these, both here and in other places, are made baskets, of which I suppose MARTIAL, if I understand him right, speaks in his Apophoreta:—

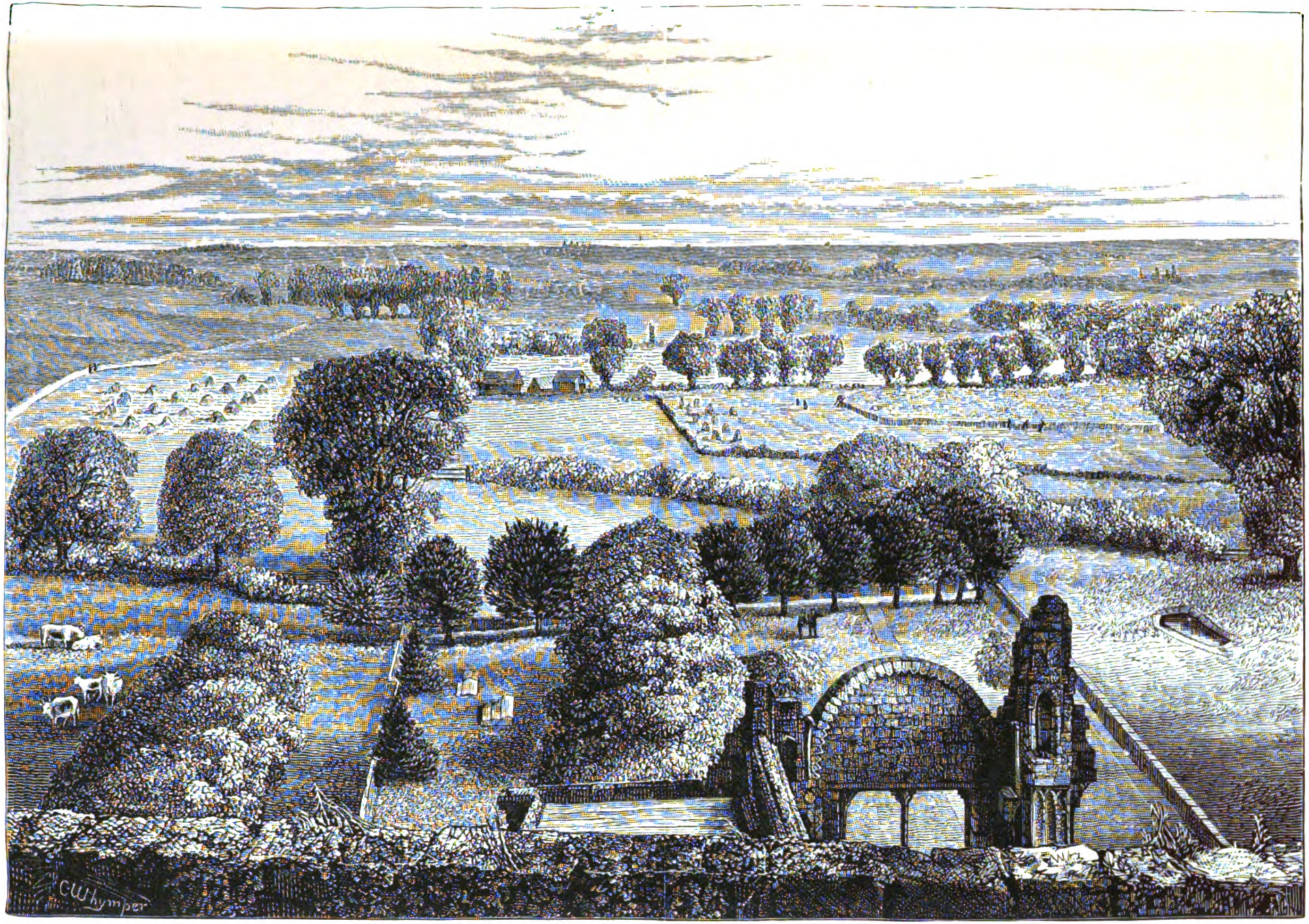
> '*Barbara de pictis veni Bascanda Britannis,*
> *Sed me jam mavult dicere Roma suam.*
>
> From painted Britain I a basket come,
> Imported and adopted here at Rome.† ' "

It is no stretch of the imagination to suppose that coracles made of osier twigs, covered with the deer skins, floated over the waters of the Fens,—the materials for such were at hand,—and that inter-communication was kept up by rivers. Trackways would be formed where silt or gravel lay at or near the surface, or formed natural highways, and these would mark out the direction of some of the roads and embankments afterwards improved or extended by the Romans.

THOMPSON, quoting from BADESLADE, says, "The banks which the Romans caused to be raised, to guard the low lands of Lincolnshire from the inroads of the ocean, are said to have been the work of a colony of foreigners, brought over probably from Belgium, a country of a similar description, the natives of which, from their knowledge and habits, would be eminently fitted for such employment."

But the Coritavi, who inhabited Lincolnshire, are said to have been immigrants from a Teutonic Marshland, and if so they may have kept up some communication with their kindred on the continent, as did the Kelts—and therefore would also have some knowledge of embanking and draining;

† GOUGH'S Camden, vol. II. p. 214.



South Holland, from Crowland Abbey.

beside, they may have settled in the Holland of the Fens, because they were accustomed to land of that nature.

Hence we may infer that the Romans found a rude system of embanking, when they invaded this part of the country, and as the land was fertile they would be induced to carry it still further, and in that case would employ more labour on the work by bringing over men from the lowlands of the continent.

THOMPSON says that the ancient Britons were ignorant of the art of catching fish—and quotes DIO NICEUS in support of his opinion, and therefore would lead us to conclude that the fish with which the Fens abounded would not be utilized. But it was rather the northern Britons who did not fish—and the southern inhabitants who abstained from hares and poultry.*

It is not our purpose to dilate in particular on the manners and customs of the Kelts, that being the province of a more general history; British remains will be described under the head of "*Fenland Antiquities*."

We find a connecting link between the periods of the Cæsarian invasions and the real Roman conquest, in the history of CYNOBELIN or CUNOBELINUS. He was the son of THEOMANTIUS,† nephew of CASSIVELLAUNUS. This prince, to make his estate more respected, caused his *own image* to be stamped on his coins, after the manner of the Romans, having previously made his payments in rings of iron and plates of brass of a certain weight which usually passed current amongst the people of Britain.

"His own peculiar territory was that of the Trinobantes, and probably the Catyeuchlani, and part, at all events, of

* Pictorial His. of Eng. vol. I. p. 126. See LUBBOCK's Pre-historic Times, p. 190.

† SPEED, book V. p. 189. Where this ruler is called "the happie prince Cunobeline." The name TASCIOVANUS is given as the name of his father in "The Coins of the Ancient Britons," by J. EVANS, F.R.S., p. 220 *et seq*. T A S C. F is found on Coin No. 5 on the plate in this book.

the Boduni, and it is principally within the limits of these tribes that his coins have been found in each of the counties of Norfolk, Suffolk, Cambridge, Nottingham, Essex, Herts., Beds., Bucks., Oxon., Middlesex, and Kent; but Essex, as might have been expected, seems to be the most prolific of them."* *(See Illustrations in Chapter on Antiquities.)*

The reign of CYNOBELIN is thought to have extended over many years, and to have terminated between A.D. 40 and 43.

SECTION 2.—*Romano-British Period.*

IN the reign of the emperor CLAUDIUS, A.D. 43—just 97 years after CÆSAR'S final invasion—the real reduction of Britain by the Romans commenced. At this time AULUS PLAUTIUS landed with four legions, and it would seem that during their early campaigns, many of the auxiliaries were lost in the deep bogs and swamps. Soon after, CLAUDIUS himself came to Britain with reinforcements, and was present with the army at the taking of Camalodunum, the capital of the Trinobantes, a neighbouring tribe of the Iceni. The emperor returned to Rome after six months' absence, leaving the Fenland still intact.

PLAUTIUS, and VESPASIAN who was second in command, reduced little more of the country than that which lay to the south of the Thames.

OSTORIUS SCAPULA arrived with fresh troops about A.D. 47, and by a series of battles regained the district which the Britons had recovered after the departure of PLAUTIUS; and we learn from TACITUS that OSTORIUS erected a line of forts from the Severn (*Sabrina*) to the Nene (*Antona*.)†

The Brigantes and the Iceni were compelled to become the allies of the conquerors, but further subjugation was

* EVANS'S "Coins of the Ancient Britons," p. 288.

† Or *Aufona*. See SMITH'S Gk. and Rom. Geo. vol. I. p. 337.

not attempted until the appointment of SUETONIUS PAULINUS as commander of Britain in the reign of NERO A.D. 59.

Having had a peaceful administration for two years, this general proceeded to reduce the west of the country when the Iceni and Trinobantes formed an alliance under the leadership of Boadicea. This great queen of the Iceni was smarting for revenge on account of the wrongs inflicted upon her and her family by the Romans. Her husband, PRASUTAGUS, the wealthy king of the Iceni, with a view to conciliate the Romans and to secure to his daughters a portion of their lawful rights, had made CÆSAR joint heir with his children. The will, however, was violated and the entire kingdom claimed by the Romans; and this indignity was aggravated by the cruel dishonor of BOADICEA and her daughters. The intrepid queen assumed the command of the forces and displayed such astute generalship and personal valor that she has been placed in the foremost rank of heroines. TACITUS describes her person with evident admiration; and SPEED as worshipfully thus translates his remarks: "The *Confederates* in this businesse were not to seek their Leader: their Queenes dishonours so apparantly knowne, (and for matter of *gouernment* they made no difference of Sexe) her birth extracted from their *Roiall blood*, her hearts affection approued to her *Countrie*, her indignities receiued of the proud *oppressors*, and her haughtie spirit threatening reuenge, assured them of her vttermost *endeauours*: which accordingly she effected to her dying day, and to her neuer dying fame." Then BOADICEA reviews her troops. "Boduo in her Chariot doing the parts of a most noble *Generall* droue from troope to troope to see and commend their *forwardnesse;* and dismounting attended with her two daughters, and *two hundred and thirty thousand* resolute *Britaines*, gat her to a seat made of marish turfes, after the manner of the *Romans*, apparelled in a loose gowne of changeable colours, wearing a *Kirtle* thereunder very thick *pleited*, the tresses of her yellow haire hanging downe to the *skirts*. About her necke shee had a chaine of gold, and in her hand held a light *speare*, being of personage tall, and of a comely cheerful *countenance*, and so a while she stood pawsing, in viewing her *Armie*, and being regarded with *reuerend silence*, at length she spake unto them." Then follows a long oration. (TACIT Annal. l. 11.)

The confederates under Boadicea surprised the Romans and the colony at Camalodunum was captured. PETILIUS CEREALIS, lieutenant of the ninth legion, proceeded to the rescue, but was completely cut up, losing most of his foot-soldiers, himself with a troop of horse escaped with difficulty.* Verulamium (St. Albans)—and afterwards Londinum, were attacked by the British, and many thousands were slain before the revolt was quelled.

In the next year, A.D. 62, SUETONIUS gained a decisive battle, in which the revolters suffered severely, and the queen, finding further resistance hopeless, ended her life by poison.

Although the Roman supremacy was now restored, the rebellion had been sufficiently formidable to make the conquerors feel that they had only barely escaped a total overthrow.

The Iceni and their allies henceforth yielded to the Roman sway—and, doubtless, in time, acquired Roman habits and customs; a higher degree of civilization *ought* to have been the issue. But has not the British civilization of the first century A.D. been underated?—though most likely great progress was made between the invasion of CÆSAR and the reign of CLAUDIUS.

MR. KEMBLE† thinks it is scarcely possible that CÆSAR

* See SPEED's His. of Rom. and Brit. 1629. This 9th legion, after being decimated in BOADICEA's revolt, was recruited under NERO, but was again unfortunate in AGRICOLA's campaigns against the Caledonians. † Sax. in Eng. vol. II. p, 265.

and STRABO were strictly accurate in their reports, or that there were from the first only such towns in Britain as these authors describe,* that it is not consonant with experience that a thickly peopled and peaceful country should long be without cities; CÆSAR himself tells us that the buildings of the Britons were very numerous and bore a resemblance to those of the Gauls;† that a race so conversant with the management of horses as to use armed chariots for artillery, are not likely to have been without an extensive system of roads, and where there are roads, towns will not long be wanting; and, further, when less than 80 years after the return of the Romans to Britain, and scarcely 40 years after the complete subjugation of the island by AGRICOLA, PTOLEMY tells us of at least 56 cities in existence—then we may reasonably conclude that these things were not all due to the efforts of Roman civilization.

[*The Towns.*] The British oppida in the Fenland may have determined the sites of the following Roman stations:—

(*a*) In the district of the Coritavi—
Lindum (Lincoln), Vainona (Wainfleet), ——— (Spalding), Causennis (Ancaster), Durobrivas (Castor-on-the-Nene.)

(*b*) In the district of the Catyeuchlani—
Durolipons (Godmanchester or Ramsey.)

(*c*) In the district of the Iceni—
Camboritum (Cambridge), ——— (Lynn), ——— (Wisbech), Icano (Icklingham.)

All the above-named districts were included in the province of FLAVIA CÆSARIENSIS. In THOMPSON'S history of Boston there is a list of other but less important Roman stations in Lincolnshire.

* See Supra p. 31.

† "Creberrima ædificia, fere Gallicis consimilia." Bell. Gall. v. 12.

Did the sites of the Roman Municipia and Colonia coincide with those of the British oppida? "It is safe to assume that they did so coincide generally. The municipality as a general rule pre-supposes a British oppidum."*

But there exists some doubt as to the modern towns occupying the exact situation of the Roman ones. "Place for place the old towns and the new were near each other, rather than on absolutely identical spots." The physical conditions which determined the position of the Fen towns is, however, a subject of considerable interest.

Referring to the above-named Roman stations, we may state that Lincoln is the most easily identified.† There are several reasons for preferring Ancastor to Boston‡ as the equivalent of Causennis. The position of Durobrivas has been variously discussed, but we prefer the locality above-named.||

The site of the Roman camp at Wisbech was in the fork between the Nene and the Ouse in their ancient course, but the first historical mention of Wisbech is in the charter of a grant made in the middle of the 7th century, by WULFERE king of Mercia.§

The probabilities of Lynn being a Roman station are discussed in RICHARD's History of Lynn, (vol. I. p. 215.)

In addition to those permanent stations, the Romans erected many encampments, such as Earith Bulwark (*see Illustration in Chapter on Antiquities*) in Hunts.; this construction may have been adapted to a subsequent mode of defence. A village called Colne (*Colonia*) lies two miles west of the Bulwark; the latter commanded the river. At Stamford, Horncastle, North Kyme, and Burgh, in Lincolnshire,

* SMITH's Dic. of Greek and Roman Geo., art., Brit. Insula.

† Vainona is equally certain. (See His. of Wainfleet.)

‡ See article on the Witham, postea.

|| For a full discussion on this point, see SMITH's Dic. of Gk. and Rom. Geo., art. Durobrivæ, p. 192.

§ KEMBLE—Codex Diplom., vol. V. p. 4.

were other camps. Several lay to the west of the Fenland, in Lincolnshire; such stations were designed to guard the valleys and roads, or in some cases the rivers, like that at Earith by the Ouse, and at Washingburgh by the Witham.

[*The Roads.*] From what has already been said respecting the Roman stations being preceded by British towns, it may be inferred that we are disposed to give the British Kelts credit for having had the skill to construct roads. Now the ground for this assumption must be briefly stated. It is acknowledged that CÆSAR marched his forces some distance into the interior of Britain, and he could scarcely have done so if there had been no roads, for he had not time to construct them. Again, if the Britons had towns, nothing is more natural than that they should have had some means of travelling, rude perhaps, but yet artificial, by which the different families of the tribes could keep up a communication, or by which the different tribes could carry on such traffic as belonged to those primitive times.

"The old tradition is, that the southern part of the island was, in the British times, crossed in various directions by four great highways, still in great part to be traced, and known by the names of the Fosse, Watling Street, Ermine Street, and the Ichnield."*

"It has been rashly inferred that the primitive Britons had no roads. Modern antiquaries say that eight highways, older than the Roman occupation, can be traced, one of them running round the entire coast.† If this were so, it is probable that the Roman engineers turned the works of the conquered people to some account, and, when it was possible, made the British road a Roman street." (*W. F. Collier, LLD.*)

* Pic. His. of England, vol. I. p. 109.

"The Watling, and the Icnild or Ikening Street, are supposed to have been originally constructed by the Britons, prior to the Roman invasion. (THOMPSON'S His. of Bos., p. 12.)

† See also THOMPSON'S His. of Boston for traces of this road, p. 13.

Ancient Roads connected with the Fens—

(*a*) Ermine Street. This road extended from London, passed some distance to the west of Cambridge, by Godmanchester (Hunts.), Castor (N'hampton), Ancaster to Lincoln—a branch of this road struck off to Stamford thence to Bourn and onward to Lincoln where it joined the main road.

(*b*) The Salt-way branched off from the Ermine street, passed by Saltby and onward to Leicestershire.

(*c*) The Foss-way, which led from Bath N.E. to Newark, ran to the west of the Fens and on to Lincoln.

(*d*) Another road running from Doncaster to the north of Lincoln, S.E. by Horncastle and Little Steeping to Wainfleet.

(*e*) The Via Devana crossed Ermine street near Huntingdon and led to Cambridge.

(*f*) Akeman Street led from Cambridge to Ely and Littleport, and crossed the Little Ouse near Brandon, thence by Southrey, Downham, to near Lynn.

(*g*) Icknield Way ran just to the south-east of the Fenland—it formed the boundary between Cambridgeshire and Suffolk—along a line from Kentford and Newmarket—thence in a southward line it crossed Devil's Ditch. This was a British road.

(*h*) Bullock Road, extending from Verulamium to Chesterton on the Nene, and having a branch to Godmanchester, is given as a British Road on a map in Professor Babington's *Ancient Cambridgeshire*.

(*i*) Fen Road commenced on the east of Norfolk, thence to Swaffham, crossed the Peddar Way, ran on to Denver, and north of March by Whittlesea towards Peterborough.

Several other Roads, (*a*) "Probably Roman," and (*b*) "Ancient Ways of uncertain date" are marked on Prof. Babington's map.

SECTION III.—*Decline of the Roman Power.*

WE have glanced at the principal events connected with the subjugation of the most powerful tribes of the British Kelts, viz: the Trinobantes and the Iceni, but the records are too meagre for a continuous history of the whole period of the Roman occupation; indeed, if we omit the 40 years' conflict maintained on the northern frontiers, the remark would fairly apply to the rest of Britain.

After the death of SEVERUS, at York, A.D. 211, Britain has no place in history for nearly three quarters of a century—except that in the reign of PROBUS, (A.D. 276-283), who made a strenuous effort to restore the exhausted frontiers of the empire, by the bestowment of land on barbarian captives—we find it recorded that Vandals were transported into Britain and probably into Cambridgeshire.* "ZOSIMUS tells us that PROBUS sent into Britain the Burgundians and Vandals whom he had conquered, who settling here proved of great service to the Romans whenever any disturbance happened. Where they were settled, I know not, unless it was in Cambridgeshire. For GERVASE of Tilbury mentions an antient camp in that county called Vandalsburg."†

We are thus brought to a time when Saxon pirates swept the northern seas; to the reign of the Roman emperors DIOCLETIAN and MAXIMIAN, whose disasters in the west

* See GIBBON'S Decline and Fall of the Roman Empire, vol. I. p. 198. London, 1839.

† GOUGH'S Camden, Intro. p. cxxxix. 2nd ed., 1806.

"Near to Cambridge, to the S.E. are high hills, called by the students "Gog magog hills"; by Henry of Huntingdon, the pleasant hills of Balsham, from the hills below, where, as he says, the Danes left nothing on which they had not exercised their horrid cruelties. On the top of these hills I saw a large fortification triple trenched, and at that time certainly impregnable, (in the opinion of those who understand the art of war) but for the want of water. Some think it was a summer station of the Romans or Danes. GERVASE of Tilbury seems to call it Vandlebury. 'Below Cambridge,' says he, 'was a place called Vandlebury, from the Vandals who made a camp here, when they ravaged part of Britain and cruelly massacred the Christians. The plain where they pitched their tents on the top of the little hill is trenched round, having only one entrance.'" Ibid. vol. II. p. 218.

culminated in the defection of CARAUSIUS. The power of Rome had now passed the meridian of its glory and the tide of rebellion was setting in on every side.

CARAUSIUS,* as emperor of Britain, maintained his authority with vigor for seven years, keeping the Caledonians in check on the northern border, and escaping the revenge of MAXIMIAN.

The dismemberment of Britain was a serious blow to the Roman empire. The Romans lamented the loss of a country so desirable on account "of the fertility of its soil, alike adapted for the production of corn or of vines, the rich pastures covered with innumerable flocks, and its woods free from wild beasts or venomous serpents. Above all, they regretted the large amount of the *revenue* of Britain."†

CARAUSIUS was assassinated by ALLECTUS in A.D. 293, and Britain again became a Roman province under CONSTANTIUS. This emperor died at York in A.D. 306; his son CONSTANTINE assumed the imperial purple, after which the country enjoyed repose through the first half of the fourth century.

In the reign of HONORIUS the forces of Britain revolted, and elected another emperor, named MARCUS (A.D. 407), who soon shared the fate of many such an aspirant—and internal insurrections ensued—other usurpers arose—Rome made a few spasmodic efforts to retain Britain, but HONORIUS was compelled to acknowledge the independence of this island, and it was lost to Rome for ever in the middle of the first half of the fifth century.

* CARAUSIUS was a Menapian; but in the 3rd century the inhabitants of the Menapian territory (Belgium) were certainly Teutonic (KEMBLE's Sax. p. 12).

AURELIUS VICTOR calls the allies of CARAUSIUS, Germans; EUTROPIUS gives them the name of Saxons, (GIBBON, chap. XIII.)

† GIBBON, vol. I. p. 213.

SECTION IV.—*British Civilization.*

WE have briefly reviewed the events of a period of nearly four centuries of Roman occupation; no small period that, in the history of any country. Dating back from the present time, the same number of years would carry our retrospect to the reign of the first sovereign of the House of York. What a contrast we see in the influences and conditions of the two periods! But it would be a mistake to suppose that everything 'British' was barbarous—and everthing Roman, refined. A purely military occupation of a country, like that of the Roman in Britain, could never develop the higher principles of civilization. The people as a nation were physically degenerated; stalwart British youths were drafted off to the armies of the continent—even to Illyricum and Egypt—to spill their blood in the distant provinces of the empire, while those who remained at home were reduced to the condition of serfs, unused to any kind of military discipline. Some few of noble birth were pampered with the sweets of the conquerors' luxuries and habits, and even donned the Roman toga.

The people of Britain, however, became to a certain extent a mixed race—as we have already intimated—by intermarriage with the conquerors, who were not necessarily of the purely Roman stock.

DR. LATHAM has shewn that the Roman roads are the best data for ascertaining the parts of our island, where the mixture of Roman and foreign blood was greatest. The least accessible districts, such as Lincolnshire, were the most Keltic; and amongst the pre-eminently Roman tracts he places Norfolk and Suffolk. Further, he remarks, "The Roman blood, then, in Britain, seems to have been inconsiderable, even when we class as Roman everything which was other than British. That the language, however, was chiefly Latin more or less modified, is what we infer from the analogies of Gaul and Spain. *The history, too, of four centuries of civilization and corruption is Roman also.* (The italics are ours.) That there was a bodily evacuation of Britain by the Romans, a concealment of treasures, and a migration to Gaul, rests upon no authority earlier than that of the Anglo-Saxon writers, some five centuries later. The country was rather a theatre for usurpers and rebels; none of whom can be shewn to have left the island, or to have been exterminated by the Anglo-Saxon invasion—an invasion to which an earlier date and a more gradual operation than is usually assigned will be attributed."*

That the Britons, after the withdrawal of the Romans, were reduced to such a helpless state as GILDAS depicts, is scarcely credible.† If they were, they wofully degenerated in five centuries, and presented a painful illustration of the hideous nature of imperial tyranny and misgovernment. Let us revert to the condition of the Britons in the first century, and see what sources there are by which we may measure their civilization. For the Iceni, we claim a high position among the pre-Roman inhabitants. They had for their neighbours and allies those who had made some progress in civilization. The revolt of BOADICEA takes a prominent place in history. It shews that the British Kelts were capable of being organized to resist a common foe; *and that they were amenable to the leadership of a woman*—this to our mind argues an *advanced* civilization—not to say refinement. We know of no parallel in the history of a *barbarous* people. Women like SEMIRAMIS, NITOCRIS, CLEOPATRA, and DIDO, had ruled before, and they were the rulers of civilized nations. Besides, savage nations are not wont to concede to women an honorable

* Ethnology of the British Islands, p. 103.

† GILDAS gives us the letter of the Britons to ÆTIUS. "The groans of the Britons, etc." The epistolæ Gildæ is referred by DR. LATHAM to about the year A.D. 550.

position—evidences are not wanting to shew that the British Kelts did respect their women,* and it is very questionable whether even the Romans were their peers in this respect—notwithstanding what CÆSAR has said of the social life of the Kelts.†

When we claim for the Britons a considerable degree of civilization, it is not to be supposed that we are making any comparison between the 1st and 19th centuries. We do not assume that they approximated to modern social refinement. Enough of cruelty there was no doubt, as there has been in every nation since—and we cannot claim for Druidism, more than for any other system of priestcraft, that it had a tendency to assuage the evil passions or to modify the tyranny of mankind. But that the Kelts were—in CÆSAR's time—far removed from mere barbarism, is easily shewn. They were subject to law. The Druids, their magistrates, were held in great honor; and, as CÆSAR tells us, decided all disputes, both public and private. The office of the Druids, too, was not merely magisterial and sacerdotal, but educational also; for they instructed others than those who designed to enter the priesthood. The Druids reasoned with the youth, and imparted to them their reflections on many things—respecting the stars and their motions—the magnitude of the universe and of the earth, the nature of things and the immortal gods.‡

CÆSAR speaks more particularly of the Druids of Gaul, yet that this applies to those of Britain will appear presently.

Again, the Britons' preparations for warfare, shew a considerable remove from mere savagery. It is true that savage nations may be very skilful in war, and even in the management of horses, but the position is different when horses are employed to draw chariots. In this case the

* Pic. His. p. 130. † See p. 11.

‡ Bel. Gal. lib. VI. c. 14.

horses must be strongly equipped, or they would be worse than useless—but the invader has described the agility and rapidity of his enemy in the use of their chariots—therefore there must have been manufactures, unless the chariots and their harness were imported, and this implies a rather extensive commerce and the possession of valuable material for exchange; agricultural produce over and above what was necessary for home consumption; or money which was the representative of capital of some kind. If the chariots and equipments were produced in Britain there was skilled labour of no ordinary kind, and if they were imported, there was a kind of wealth which belongs to a civilized condition. But the war implements were on a large scale, for CÆSAR tells us CASSIVELLAUNUS declined a regular engagement (in this he shewed good generalship, for he spared his men and adopted such tactics as harasssed CÆSAR)—he sent away the greater part of his forces and left about *4000 charioteers* to watch the Romans on their march.*

From this we may infer that the number of chariots in Britain was very large. In addition to this there were cavalry—for CÆSAR records that the cavalry and charioteers of the enemy fought bravely with his own cavalry on the march (Equites hostium essedariique acriter prætio cum equitatu nostro in intinere conflixerunt.) Thus it appears that the Britons had chariots, used as artillery; cavalry for making sudden attacks on a marching force; and foot-soldiers for ordinary defence—and their defences required regular siege operations before they could be reduced.

Another point of great importance in our enquiry, is the nature and extent of the British earth-works. The first Roman invader admitted that the oppidum which he attacked, was admirable both for situation and construction.

* CASSIVELLAUNUS . . . . . dimissis amplioribus copiis, millibus circeter quatuor essedariorum relictis, intinera nostra servabat. (Bel. Gal. v. 19.)

Many barrows or tumuli are found in the Fenland, and it is not reasonable to assume that these and the military defences were the only works of which the British Kelts were capable. In the south of Cambridgeshire there are four extensive banks, ridges or dykes, named Devil's Ditch, Balsham Dyke, Brent Dyke, and Haydon Ditch; "they are it is believed, the strongest boundary ditches to be found in the kingdom."* They appear to be of anterior construction to the ancient roads, for gaps were made for these to pass through the dykes. "Some persons have supposed that they were made by the followers of BOADICEA, others that they were the work of the invaders . . . . . It seems nearly if not quite impossible to lay down the course of the *Icknield Way*, and the Roman Road which undoubtedly succeeded it, so as to avoid crossing one or more of these ditches."†

After the ancient Fenlanders learnt that the country was subject to invasion, they would naturally occupy such parts as were calculated to afford them subsistence and an easy shelter. And what part of Britain was better adapted than this for those who needed to defend themselves against the incursions of their enemies? But the islets alone may not have been sufficient for this purpose, and therefore the level would be occupied and probably embanked. If those Britons could throw up fortifications, dykes, and barrows, they could also make banks to prevent the encroachment of the water upon their settlements. That they did do so, is in the highest degree probable, since we find at this day many British mounds‡ in close proximity to the banks attributed to the Romans. That the Romans executed great drainage and embanking works in this district is certain, though not by the employment of their soldiers alone, but by the labour

* BABINGTON's Ancient Cambridgeshire, p. 58. † Ibid. p. 59.

‡ For list of Fenland mounds, see Appendix.

of the inhabitants and of people whom they brought over from the low countries of the continent. If, however, the Car-dyke was of Roman instruction, it is curious that that a Keltic name was applied to it.* So much has been said about *Roman* works, that is often forgotten that the Britons might have obtained the knowledge of such from older sources, since it appears that the Greeks and others embanked rivers and valleys (Thessaly is thus said to have been wrested from the waters)† before the foundation of Rome. That the Greeks brought a knowledge of engineering into western Europe and communicated it to the Belgic Gauls, is quite possible, for the Ionians, who colonized Gaul and who were remarkable for their adventures and enterprises, visited our shores.

We have shewn then that the Roman oppida were generally preceded by British towns; the Roman roads had their origin in those of the British Kelts, and that Roman banks and perhaps seawalls had their foundation in British earthworks.

May we not claim, too, for those early Fenmen a mode of living not much, if any, ruder than that of the ancient inhabitants of Kent, who resembled the Gauls? It is admitted by PLINY that the latter had a considerable knowledge of agriculture and manured the land. Surely the Fenlanders were not included among the inhabitants of the interior, who, according to CÆSAR, did not sow corn (frumenta non sement). The Fens were also rich in pasturage, as might have been inferred from the number of horses required for the Icenian chariots.

Another element in the civil life of the Fenlanders, was their advance upon the primitive system of barter, since

* "SALMON, in 'The Survey of England,' says that *Cardyke* signifies no more than *fendyke*. The Fens of Ankholme Level are called cars." THOMPSON'S His. of Boston, p. 9. See also list of Dialectic words in this work. STUKELY admits that *car* and *fen* are nearly synonymous.

† DUGDALE, 2nd ed. p. 8.

for a hundred years before the first invasion they had used gold and silver coins.* Cæsar said they used brass or pieces of iron whose weight was fixed.† Not only has this passage been shewn to be corrupt, but also that Cæsar mentions elsewhere a currency of gold coin in Britain.‡ "Long before the days of Julius there had been a native coinage in Gaul; and long, too, before that time had the commerce between Britain and the more civilized parts of the world been conducted through that country." (*Evans.*)

But what influences operated in the development of ancient British civilization?

Dr. Latham says, "Roman civilization took deep root rapidly in Britain, though in a bad form. The early existence of lawyers and money lenders shews this. During the reign of Domitian the advocates of Britain were known to the Satirists of Rome; and as early as that of Nero, the calling in of a loan by the philosopher Seneca helped to create the great revolt under Boadicea."‖ But except in respect to the use of the Roman language, it is doubtful whether the culture was much different from that which had developed itself under Cynobelin—a civilization which though being due in a great degree, to Gaul, was also more or less indirectly Roman as well; but, nevertheless, a civilization which was unattended with any loss of nationality."§

Cæsar and other writers have stated that the Gauls, though inferior to the Greeks and the Romans in civilization, were in advance of the Germans. The Gauls were closely

* See Engravings and description of Ancient British Coins in *Chapter on Antiquities.*

† "Utuntur aut ære, aut taleis ferreis, ad certum pondus examinatis, pro nummo." (Bel. Gal. v. 12.)

‡ See Evan's Ancient British Coins, p. 18.

‖ As this was within 20 years of their first real contact with the Romans, they must have had some property more than is commonly known, to give as security. This loan by Seneca amounted to 10,000,000 sesterces, or £81,000. (Nall's Dialect of East Anglia.)

§ Ethnology of the British Islands.

connected with the Britons, who would, therefore, probably be also in advance of the Germans.

But the question here arises whether that early Gaulish civilization was not due to *Grecian* influences before the Roman conquest.

What evidences are there, then, that the early British civilization is attributable to the Greeks? In order to make our position clear in this matter, it is necessary to speak of the Grecian colonies in Gaul.

It was by the settlement of certain Greeks in the south of Gaul, that the light of civilization is thought to have first dawned upon the peoples of western Europe.

The Ionic Phokæans founded a colony at Massilia (now called Marseilles) in 597 B.C.* It grew rapidly in wealth and power. The territory on the main-land was limited, but rich in wine and oil. Seventeen colonies on the shores of Gaul and Spain were established by the Massilians. Massilia became a considerable maritime power, holding its own against the power of Carthage. In 218 B.C. it formed an alliance with the Romans, but maintained its freedom intact. In the war between POMPEY and CÆSAR it espoused the cause of the former, but was subdued by the latter, yet it retrieved its position under the first emperor, and became so celebrated for its literature and philosophy, that the most illustrious Roman youths resorted thither to pursue their studies. Such was the great emporium of Gaul, and the centre from which civilization spread towards the west. "But the commerce between the Greek colony of Massilia and Britain also commenced at an early period, and, it seems probable, dates back some centuries B.C. . . . . It seems possible that at first this intercourse of the Greeks was direct by sea, and conducted in the same manner as that of the Phœnicians or Cartha-

* GROTE's His. of Greece, vol. III. p. 537.

ginians, as PYTHEAS of Massilia appears to have navigated as far as Britain. But it is certain that eventually it was carried on overland through Gaul."*

MR. EVANS has shewn that the early silver coins of Massilia were imitated by the surrounding country—that about 356 B.C., PHILIP II. of Macedon acquired extensive gold mines, and that gold coins became very general.

"In Gaul this was especially the case, and the whole of the gold coinage of that country may be said to consist of imitations, more or less rude and degenerate of the Macedonian Philippus." The gold coins of PHILIP were imitated in Gaul about 300 B.C., and the earliest known British coins date between 150 to 200 B.C. The Iceni had gold and silver coins, types of which, and of those of CYNOBELIN found in or near the Fenland, are given in our illustration under the head of *Antiquities*. But the conclusion drawn from historical facts, is that the *native* coinage of the Iceni ceased about A.D. 50.

The following quotation from MR. EVANS' book, p. 42, will assist our argument. "The use of money at so early a period in this country, will no doubt appear almost incredible to those who have been accustomed to regard the Ancient Britons as the merest barbarians; but I think that such persons will find that their impressions as to the character of the Britons, have been derived from the descriptions of the tribes of the interior, rather than of those along the sea-board . . . . . That the Britons were accomplished workers in metal is beyond all doubt; but that they should have understood the art, not only of coining, but of counterfeiting coins, may appear surprising, as the art of forging is usually regarded as one of the accompaniments of a high degree of civilization."

* The Coins of the Anc. Britains, p. 22.

Another question of interest is—what was the origin of the British war chariot?

The probabilities are highly in favour of the idea being obtained from the Greeks. HOMER has described the ancient custom of heroes and princes fighting in battle on their chariots; in fact no chief was without one. The chariot was used at the onset to put the enemy to flight, and in battle the warrior leaped from the biga and fought on foot* Such was the practice in Britain as described by CÆSAR, who was an eye-witness of these manœuvres.

The gold coin of PHILIP—the prototype of the earliest Gaulish coins—had on the obverse a charioteer in a biga drawn by two horses. Thus—

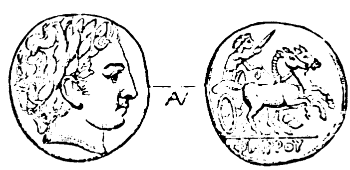


FIG. 4.—*The Macedonian Philippus.*

These chariots might have been introduced three or four centuries before JULIUS invaded the country—during which time the inhabitants would have attained considerable proficiency in using them.

* Compare HOMER's Iliad, XI. 709—11.

μετὰ δέ σφι Μολίονε Θωρήσσοντο
παῖδ' ἔτ' ἐόντ', οὔ πω μαλα εἰδότε θούριδος ἀλκῆς.

Also Iliad, XI. 753—57.

ἔνθα Ζεὺς Πυλίοισι μέγα κράτος ἐγγυάλιξεν·
τόφρα γὰρ οὖν ἑπόμεσθα διὰ σπιδέος πεδίοιο,
κτείνοντές τ' αὔτους ἀνά τ' ἔντεα καλὰ λέγοντες,
ὄφρ' ἐπὶ Βουπρασίου πολυπύρου βήσαμεν ἵππους
πέτρης τ' Ὠλενίης.

As here intimated, the chariots were used on a plain, or level ground. They could not have travelled in Britain any considerable distance unless there had been roads.

The ancient British shield here figured,* bears certain resemblances to Greek shields of the simpler types. It has an umbo and is ornamented with concentric rings of studs, thus preserving the appearance of the laminated shields made of leather or leather and wood.

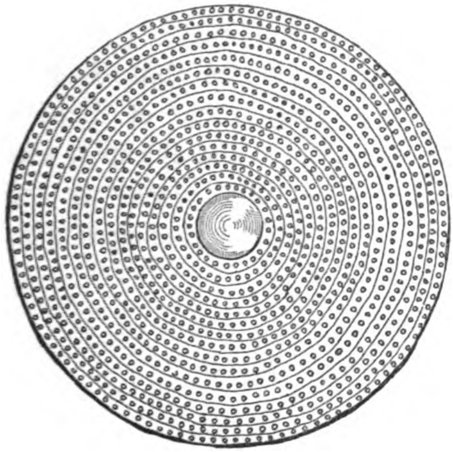


FIG. 5.—*Circular British Shield.*

A further illustration of Grecian influence is found in CÆSAR's description of the Druids. Those who desired exemption from military service, resorted to the schools of the Druids and were under training for 20 years. The doctrines taught by the Druids were not committed to writing, but in all public and private affairs they employed the *Greek characters.* (cum in reliquis fere rebus, publicis privatisque rationibus, Græcis utantur literis. Lib. VI. c. 14.) JULIUS is here speaking more particularly of the Gallic Druids, but he shews in the preceding chapter that in Britain the great school of the Druids existed. That the institution was devised in Britain and conveyed to Gaul, and that in his day those who wished to understand the system accurately went from Gaul to Britain to learn it. (Disciplina in Britannia reperta atque inde in Galliam translata esse

* This shield belongs to a period anterior to the Roman invasion. It was found in Aberystwith; for a description see "The Archælogia," vol. 23rd, p. 96. In KNIGHTS' "Pictorial History of England," it is erroneously stated to have been found in the bed of the river Witham. This error is also repeated in WALKER and CRADDOCK's His. of Wisbech, p. 35. (A description of the one found in that river, will be given in the *Chapter on Antiquities* in this book.)

existimatur: et nunc, qui diligentius eam rem cognoscere volunt, plerumque illo discendi causa proficiscuntur. Lib. VI. c. 14.) Therefore before the Roman invasion the Greek language to some extent was used in Britain.*

These, then, are some of the evidences that Grecian culture was an element in the early stage of British civilization; and further, the use of coins and chariots, and the existence of many mounds, the high places of the Druids, prove that the ancient Fenlanders participated in this civilization.

SECTION 5.—*The Saxon Period.*

OBSCURITY—dark obscurity, overhangs the traditions which have been handed down to us respecting the period following the retirement of the Roman forces, and the events which led to the conquest of Britain by the tribes of Germany. Yet no uncertainty attaches to this record, viz: that in the middle of the fifth century the power of Rome, once so gigantic, was fast fading away, and that of the Germanic race was rolling in like a mighty wave upon a defenceless shore.

Those Teutonic tribes, adventurous and restless, urged too by the increase of their numbers and the necessities incident to an inhospitable climate, sought to improve their condition by daring enterprises. The state of Gaul and Britain favored their prospect of success.

"The expeditions known to tradition as those of HENGIST, ÆLLI, CISSA, CERDIC, and PORT, may therefore have some foundation in fact; and around this meagre nucleus of truth, were grouped the legends which afterwards served to conceal the poverty and eke out the scanty stock of early

* Ogham characters were used in Britain, and Latin inscriptions written in Ogham, have been found, though not in the Fenland, so far as we know,—neither are we aware of the existence of Greek inscriptions.

history. But I do not think it at all probable that this was the earliest period at which the Germans formed settlements in England."*

In A.D. 306, CONSTANTIUS died at York, and his son CONSTANTINE, on assuming the purple, is said to have been assisted by EROC king of the Alemanni. EROC was an ally—therefore there were Germans in Yorkshire.†

On the withdrawal of the Roman rule, a number of petty commonwealths, was, no doubt, formed; some for instance would be composed of seditious Romans left in the country and of men of mixed descent; these ranged themselves under AURELIUS AMBROSIUS,‡ while another faction followed the leadership of VORTIGERN (GWRTHEVYRN). While such hostile parties were contending for the mastery, the south was threatened by another enemy advancing from the north—the Picts and Scots.

KEMBLE argues, that if in the middle of the fifth century the Saxons had regular settlements at Bayeux; and if even before that time the country about Grannona (Port-en-Bessin, in Normandy) bore the name of Littus Saxonicum,‖ we may easily believe that at a much earlier period Saxons had found their way over the ocean, which was less dangerous than their marching through the country of hostile neighbours. "A north-east wind would, almost without effort of their own, have carried their ships from Hêlgoland and the islands of the Elbe, or from Silt and Romsey, to the WASH and the coast of NORFOLK. There seems then every probability that bodies more or less numerous, of coast-Germans, perhaps actually of Saxons and Angles, had colonized the eastern shores of England long before the time generally assumed for their advent."

* KEMBLE'S Saxons in Eng., p. 7. † LATHAM'S Ethnology of British Islands, p. 97.

‡ AMBROSIUS is said to have retaken Lincoln from Saxons in A.D. 494. (Lincoln Date book.)

‖ The shore from Sussex to the Wash also bore this name, or from the present site of Portsmouth to Wells in Norfolk. (KEMBLE.)

"HENGIST defeated the Picts and Scots at Stamford in Lincolnshire, not far from the *Nene*, the *Witham*, and the *Welland*, upon whose banks it is nearly certain that there were German settlements.*

WIDUKIND'S story of an embassy from the Britons to the Saxons, to entreat aid, is thus rendered not altogether improbable: but then it must be understood of Saxons already established in England, and on the very line of march of the Northern invaders, whom they thus took most effectually in flank."†

After this defeat of the northmen, HENGIST is said to have obtained from VORTIGERN a grant of land in Lincolnshire, and on this he built a castle, at a place now called Thong-Caistor (the British *Caer Egarry*). The story goes, that an ox-hide was cut into strips or thongs which formed the circumference of a large plot of ground.

This myth has been in vogue in many nations, since the tale was current of DIDO'S thus obtaining a site for the citadel of Carthage.

> "Mercatique solum, facti de nomine Byrsam,
> Taurino quantum possent circumdare tergo."
> (Æneid, bk. I. 368-8.)

* The Batavians fought for the Romans in Britain in A.D. 69, and may in part have shared the land. (TACITUS, His. IV. 12.)

The Friscians when pressed by the Roman power, conveyed their youth to the banks of the Rhine and were then severely threatened unless they returned to their ancient territories; these may have emigrated to Britain. See TACITUS, Ann. xiii. 54.

Have these left the names of Friskney and Freiston in Lincolnshire?

"Tradition here and there throws light upon the causes by which bodies of men were impelled to leave their ancient habitations, and seek new seats in more fruitful or peaceful districts. The emigration of HENGIST has been attributed to a famine at home, and even the grave authority of history has countenanced the belief that his keels were driven into exile." (Sax. in Eng. p. 69.)

Another historian—FREEMAN—takes the following view: "We cannot seriously doubt that, in the course of the 5th and 6th centuries, a succession of tribes of kindred origin, all of them of the same Low-Dutch stock, and speaking essentially the same Low-Dutch language, landed at various points of the British coasts, that they gradually forced their way inland, and founded permanent Teutonic kingdoms." [NOTE. "It should always be borne in mind that our affinity in blood and language is in the first degree with the Low-Dutch, in the second degree with the Danish. With the High-Dutch, the German of modern literature, we have no direct connection at all."] (Norman Conquest, vol. I. 14.)

† Sax. in Eng., p. 11.

It is curious that the Hindoos attribute a similar stratagem to the English, as a means of obtaining Calcutta. WILLIAM PENN is said to have secured land on the banks of the Delaware by like means. We may safely reject all these as mythical fancies. Were we told that the original possessors of the land were in some cases treated to the thong, we might regard the tradition in a more serious light. HENGIST may *thus* have expelled the natives from the land which he possessed in Lincolnshire.

However, *Thong castle* was a stronghold for HENGIST, and it was here that he entertained VORTIGERN at a feast. The poetic fable of ROWENA's conquering charms we shall not repeat. Artists have done their part in pourtraying a drama which most likely originated two centuries after its real characters lived, but we do not deplore that imagination and poesy have thrown a few bright gleams into the vista of those bygone ages. The *wassail bowl* had its beginning in Britain at some time, and in some place,—and Lincolnshire may have the honor.

VORTIGERN is said to have been deposed, and his son VORTIMER to have received the sovereign power over the Britons; the latter then gained three victories over HENGIST who was driven from Britain. VORTIMER died in 475 and was buried at Lincoln. VORTIGERN again ruled and recalled HENGIST.

It is not our purpose to repeat a long list of traditional stories respecting the Saxon conquest, for they are full of inconsistencies.

The story of the three ships of HENGIST and HORS, coming to Kent, has its counterpart in the migration of the Astrogoths, Visigoths, and Gepidæ, migrating in three ships to the Vistula. The murder of the British chiefs by HENGIST accords with what is related of the old Saxons in

Thuringia.* OFFA is said to have been a progenitor of the Mercian kings—and the same tale is told of a Danish prince of the same name.†

MR. KEMBLE says, "I look upon the genuine details of the German conquests in England as irrevocably lost to us."

Few tasks could be more difficult than to cull from the mass of tradition handed to us, anything like veritable history, as to the exact time and mode of procedure of the Saxon conquerors of this country.

"LAPPENBURG has devoted several pages of his elaborate history to an investigation of the Kentish legends, with a view to demonstrate their traditional, that is, unhistorical character. He has shewn that the best authorities are inconsistent with one another, and with themselves, in assigning the period of HENGIST's arrival in England."‡

That the contest was at first piratical and afterwards became a more regular and protracted warfare, there can be no doubt. As to the fate of the cities, we are left to conjecture. Regular siege operations do not appear to have been carried on. The old inhabitants were not exterminated, though great numbers must have perished in skirmishes for the mastery—many yielded to the victors and were eventually blended with them; several British words are retained still as household terms. Some of the British Kelts long held their own in the Fenland.||

* Sax. in Eng. p. 16.

DR. LATHAM in his "Ethnology of the British Isles," discusses at considerable length the term *Saxon* and says, "The story about 'Nimed cowre Seaxas = take your daggers,' and the deduction from it, that *Saxons* meant dagger-men, is of no great weight; with the present writer at least. Still, as far as it goes, it is something."

† HENRY of HUNTINGDON tells us, "In the fourth year of his (OFFA's) reign, BERTRIC took to wife EADBURGA, daughter of OFFA, king of Mercia. . . . . . In those days the Danes landed in Britain, from three ships, to plunder the country."

‡ Saxons in England, p. 32.

|| "Some of the passages collected by SIR F. PALGRAVE (Eng. Commonwealth, I. 462) would seem to shew that parties of independent Welshmen held out in the Fen country till a very late date." (Norman Con., vol. I. 24.)

The Mark.

We now come to speak of that which is not so doubtful—*i.e.*, the SAXON MARK in the Fenland. We find in the names of places, traces of Saxon associations and settlements*

MR. KEMBLE has shewn that there were two principles which lay at the foundation of Teutonic settlements—*first*, the possession of land; *second*, the distinction of rank.

Among the Anglo-Saxons the *Mark* was the land held in common by a number of men or families. The term *Mark* had a legal as well as a territorial signification, and the Marksmen "had commonable rights."

First, then, the Mark was a boundary or division of land.

Second, a voluntary association of free-men settled upon that land and having rights in common.

These divisions and communities varied in extent.

"Many hypotheses may be formed to account for these aggregations, especially on the continent of Europe. Perhaps not the least plausible is that of a single family, itself claiming descent, through some hero, from the gods, and gathering other scattered families around itself; thus retaining the administration of the family rites of religion, and giving its own name to all the rest of the community."†

The Harlings (A.S. *Herelingas*) are found at Harling in Norfolk, and at Harlington (*Herelingatún*) Bedfordshire. The Wælsings (*Old Norse Völsungar*) whose family hero was SIEGFRIED or SIGURDR, reappear at Walsingham, Norfolk.

Billing was the progenitor of the royal race of Saxony,

* Sax. in Eng., p. 58.

† The conquest of Britain differed in several respects from the Teutonic conquests in other parts of the Roman Empire. Except in Britain, these invaders adopted the religion and language of the invaded. "Everywhere but in Britain the local divisions and local nomenclature survived the conquest. And as the English in Britain retained their religion, so they also retained their language, and retained it more firmly." (Ibid. 15-16.)

and is represented in various localities, as, Billingford, Norfolk; Billinghay and Billingborough in Lincolnshire.

The appended list, drawn from Appendix A of KEMBLE'S 'Saxons in England,' will shew the extent to which the Saxon Mark applies to the Fenland.*

SAXON MARKS, AND THEIR LOCAL NAMES, IN AND NEAR THE FENLAND.

(Arranged Alphabetically.)

SAXON MARKS.	LOCAL NAMES.	COUNTY.
Æcingas,	Oakington,	Cambridgeshire.
Billingas,	Billinghay, etc.,	Lincolnshire.
Bolingas,	Bolingbroke,	,,
Copingas,	Coping Syke,	,,
Cwædringas,	Quadring,	,,
Deorsingas,	Dersingham,	Norfolk.
Dodingas,	Doddington,	Cambridgeshire and Lincolnshire.
Doningas,	Donington,	Lincolnshire.
Dorringas,	Dorrington,	,,
Forkingas,	Folkingham,	,,
Hædingas,	Haddington,	,,
Hæcingas,	Heckington,	,,
Hillingas,	Hillington,	Norfolk.
Honingas,	Honington,	Cambridgeshire.
Horblingas,	Horbling,	,,
Horningas,	Horningsea,	Cambridgeshire
Impingas,	Impington,	,,
Islingas,	Islington,	Norfolk.
Læferingas,	Leverington,	Cambridgeshire.
Metheringas,	Metheringham,	Lincolnshire.
Risingas,	Risings,	Norfolk.
Ripingas,	Rippingale,	,,
Ruscingas,	Ruskington,	Lincolnshire.
Sandringas,	Sandringham,	Norfolk.
Screadingas,	Scredington,	Lincolnshire.

* In this list the termination *ing* is found generally in the names. Now it is necessary to state that this *ing* was not in Anglo-Saxon a participial termination, but was used to form patronymics. MAX MULLER (see Science of Language, 2nd series, p. 16, where he quotes from KEMBLE'S Saxons in Eng.) says, "In the plural these patronymics frequently became the names of families, clans, villages, towns, and nations, *e.g.*, *Thyringas*, the Thuringians," etc.

SAXON MARKS, AND THEIR LOCAL NAMES, ETC., *continued.*

SAXON NAMES.	LOCAL NAMES.	COUNTY.
Sempringas	Sempringham,	Lincolnshire.
Spaldingas,	Spalding,	,,
Steápingas,	Steeping,	,,
Teorringas,	Terrington,	Norfolk.
Drecgingas.	Threckingham,	Lincolnshire.
Tælingas,	Tallington,	,,
Trumpingas,	Trumpington,	Cambridgeshire.
Waelingas,	Walsingham,	Norfolk.
Wætlingas,	Watlington,	,,
Weotingas,	Weeting,	,,
Wæsingas,	Washingborough,	Lincolnshire.

But the Marks did not continue long as independent divisions or aggregations. In different parts several became united and formed what has been denominated the Gá* or Scír, and there is a probability that some of our modern counties are identical with the ancient Gás.

The word Scír was not used in the Saxon chronicles till after the time of ALFRED.

Lindisware and Lindisse became Lincolnshire. Eastengle was afterwards divided into Norfolk and Suffolk.

BEDA mentions the Regio Gyrwiorum (in which Peterborough was situated), and also the Australes Gyrwii, that is, the South Gyrwians.†

The amalgamation of the Marks into Gás and subsequently into counties, did not interfere with their original character, and there may have been divisions intermediate between the Gás and the comparatively modern shires.

KEMBLE has given a list of certain divisions noted in SIR H. SPELMAN'S glossary under the head of Hida—we quote those which belonged to or are nearly connected with

* *Gau* is German for province or district.

† "The inhabitants of this and the rest of the low country were called by the natives Gyrvii, 'Gyr' in English, signifying the same as 'Palus,' deep fen, in Latin." (DUGDALE, 2nd ed. p. 178.)

our own district—and from these, some estimate may be formed of their respective areas :—

	HYDAS.		HYDAS.
Lindesfarona	7000	Spalda	600
Súð Gyrwa............	600	East Engle	30000
Norð Gyrwa	600	Myrcna................	30000

"Lindisfaran are the people of Lindisse, a portion of Lincolnshire; North and South Gyrwas were probably in the Mark between Eastanglia and Mercia; as Peterborough was in North Gyrwa land, this must have comprised a part of Northamptonshire; and Æðelðrýð derived her right to Ely from her first husband, a prince of the South Gyrwians;* this district is therefore supposed to have extended over a part of Cambridgeshire and the Isle of Ely. Spalda may be the tract stretching to the north-east of these, upon the river Welland, in which still lies Spalding."† The same writer suggests that previous to Alfred's reign the area of Mercia must have been greater than that stated above, and that Eastanglia was not so large till the settlement of Guthrom's Danes.

It must be remembered that the franchise of our Saxon forefathers depended upon the possession of land, and that to a very late period of our history a man had no rank unless he was a landed proprietor—in fact, a man without land was compelled to enrol himself under a *freeman's* patronage.

What was a Hide of land? The quantity is not definitely ascertained. Some think it was as much as could be tilled with one plough. But this must have been variable, according to the nature of the land.

* Tonbert, to whom she was married in 652. The Isle of Ely was settled on her in dower, and on the death of Tonbert in 655, she gained full possession of the Isle. Hence the Isle enjoyed peculiar privileges which were retained after the establishment of the Bishopric of Ely—it was, in fact, a principality. (Bentham's Ely, p. 46.)

† Sax. in Eng., vol. I. p. 83.

Others, as much as would be sufficient for the support of one family.*

"From the mode of distribution it is probable that each share was originally called Hlyt. The ordinary A.S. was Higid (contracted to Híd)."† Híd has an etymological relation to *Higam*, *Hiwan*, the family. The Hide was, then, the household estate and comprised arable land only. The Saxon acre may have been very nearly equal to our own of the present day, but the Hide varied. 64½ acres

Beda stated the Isle of Wight contained 1200 hides (that is a quantity equal to the North and South Gyrwas); the island contains 86,810 acres,‡ or 72⅓ acres per hide, but as only 75,000 acres are under cultivation the hide is only 62½ acres.

Now according to the parliamentary return of 1841, the acreage of the Isle of Ely was as follows:—||

	AREA.		AREA.
Hundred of Ely	26940	South Witchford	48660
,, Wisbech	70790	Cambridge borough...	3470
North Witchford	78760	Ely city	17480

That is, 246,100 acres in all.§

* This supposition places us in the same predicament.

† Kemble, vol. I. 92.

Hyd among the A.S. was the same as *Tectum* among the Latins; and *Hyde-lands* were lands annexed or appertaining, ad *hydam* seu tectum. (Spelman.)

‡ Mr. Skertchly thinks that 1000 acres must be added to the area of the Isle of Wight, owing to the subsequent loss by incursions of the sea and by land slips.

|| "The boundaries of the Isle of Ely are thus described in Sprott's Chronicle, published by Hearne. 'At *Erhithbrigge* begins one entrance into the Island, which extends as far as *Sotton Grove*, and so at *Mephale*, and so at *Wychombrigge*, and so at *Ely Dounhom*, and so at *Littleport*, and so at the Town of *Ely*, and so at Haveryngmere, and so at *Stratham Lode*, and so at Audlong Wesche, on the south side of the island, and so at Alderhethebrigge, and so at Erhithbrigge. These are the entrances into the island, one at *Littleport*, another at *Stonteneyebrigge*, the third at Alderhethebrigge, the fourth at Erhithbrigge.'" (Stevenson's Supp. to Bentham's Ely, p. 45.)

§ The whole Isle of Ely, as a County, Principality, or Earldom, contained 600 Hides of land; the government and jurisdiction whereof, had been settled by St. Ætheldreda on her monastery, but how much land the church was in possession of within that district, does not appear. (Bentham's Ely, p. 69.)

Now taking the proportion of the arable to the meadow, waste, &c., as 5 : 11 we have—

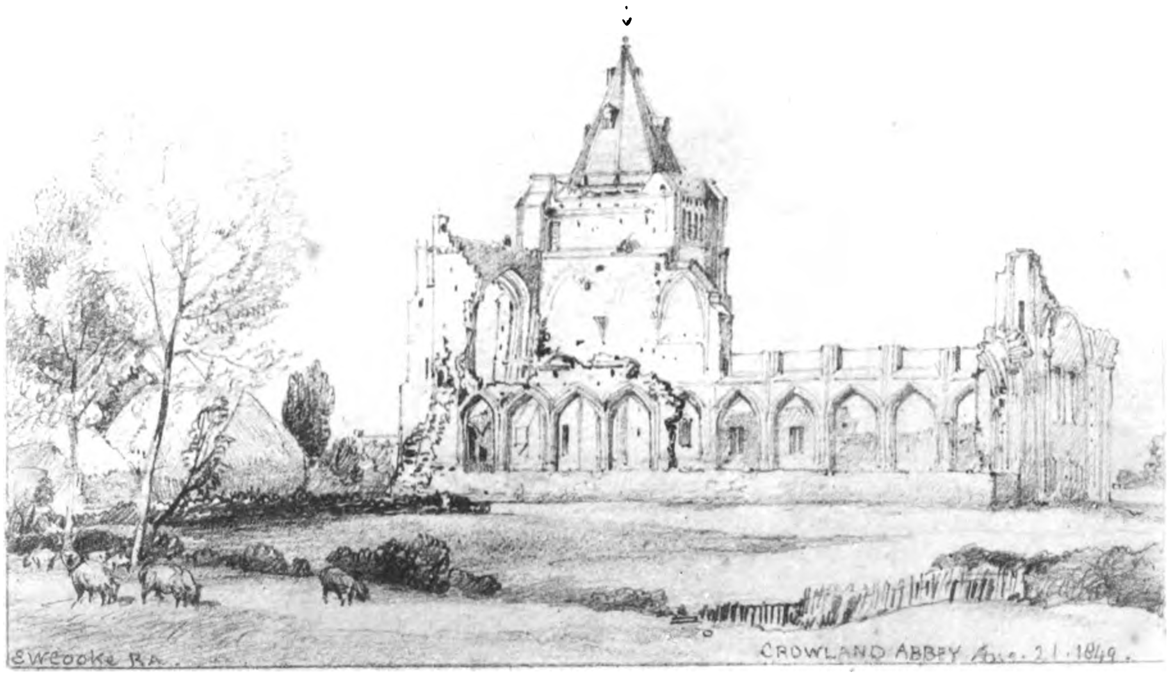
Arable...........................	76906	Acres
Meadow, waste, water, &c...	169194	„

And assuming that the Gyrwii occupied an area equal to the Isle of Ely, and that the land capable of tillage was about or nearly half that occupied by meadow, water, and waste, then there were 64½ acres to the Hide.

Eastanglia is said to have contained 30,000 hides. Now supposing Norfolk and Suffolk to be the counties it included, then in 30,000 hides we have in Norfolk 1,295,360 statute acres, and in Suffolk 969,600, making a total of 2,264,960 acres or 75·4 acres per hide; but not much more than 2,000,000 of acres are said to be under cultivation, if so, we have 66½ acres to the hide. For a full discussion of the value of the hide, we must refer to "KEMBLE's Saxons in England," vol. I. From this we gather that the hide contained only about half the amount calculated above.

The total Hidage of England was 243,000; now if a hide contained 32 or 33 acres, then at the time of the Conquest one-third of England must have been under cultivation; if 40 acres, then nearly one-half, which is hardly probable. Thirty acres to the Hide seems the most reasonable calculation.* Taking this lowest calculation, (30 acres to the Hide) we have for the Gyrwas and Spalda alone, a total of 54,000 acres of arable land, or nearly one quarter of the entire acreage of the Isle of Ely. From this we might make some estimate of the population in the plain between Eastanglia and Mercia. How many hides of Eastanglia and Lindesfarona may be assigned to the Fenland, it is difficult to say.

* "A hide of land is defined by MR. H. P. WYNDHAM, in his translation of *Wilescire* from Domesday book, to be an uncertain portion of land worth annually 20s. of Norman money, and therefore varying in extent according to the quality." (STEVENSON'S Supp. to BENTHAM'S Ely, p. 41.)


E W Cooke R.A.
CROWLAND ABBEY Aug. 21. 1849.

Modern writers have shewn that this country was not a precise heptarchy or octarchy in early Saxon times, but that it was divided among a host of petty chieftains, whose possessions, in time, became consolidated into seven or eight not very well defined dominions, the rulers of which possessed different degrees of power. To the chief of these rulers the title of Bretwalda has been given.* This title is said to have been a mere assumption, and that it conferred upon the possessor no power over other states. The Bretwalda was not a *war-king*, but one whose sway was widely extended.

The FENLAND belonged to two of the great Saxon confederations.

1. Eastanglia, which occupied the eastern part, "stretching to the N. and W. up to the Wash and the marshes of Lincoln and Cambridgeshire, and comprehending, together with its marches, Norfolk and Suffolk, and part at least of Cambridge, Huntingdon, Bedfordshire, and Hertfordshire."

2. Mercia, which extended to the west and included Lincolnshire.

The Eastangles became subject to one ruler—OFFA, whose reign commenced in 571. This was one of the most purely Teutonic realms in Britain.† REDWALD, king of Eastanglia, (600—617 A.D.) is called the fourth Bretwalda. This ruler came into conflict with ÆTHELFRITH, king of Northumbria, and defeated him on the banks of the Idle in Nottinghamshire.

Eastanglia fell somewhat into obscurity. It is recorded as having had 15 kings, the last of whom was EADMUND (870 A.D.)‡

* MR. KEMBLE has endeavoured to prove that this title has been misunderstood, and he has taken exception to SHARON TURNER's theory—see chap. on "Growth of the kingly power," Sax. in Eng., vol. II. MR. FREEMAN has fully discussed this question in his work on "Norman Conquest," see Appendix, Note B. p. 542, vol. I.

† Norman Conquest, I. 24.

‡ He was subdued by the Danes in the 16th year of his reign, and died a martyr's

Mercia became a powerful state at the end of the 6th century—an amalgamation of a number of small states without any distinct founder; CRIDA is mentioned as being king, though he was not the first king, in 586. "In Mercia a crowd of wholly independent principalities seems to have been gradually united under one common rule—a type of the fate which the whole island was destined to undergo, though not at the hands of Mercia."*

PENDA, a grandson of CRIDA, reigned in Mercia from 627—655.

Christianity had been introduced into England, and a fierce struggle between the partisans of Paganism and the pioneers of the Christian faith, now ensued. PEADA waged war against the adherents of the new faith, gained some temporary successes and made vigorous efforts to subdue all Britain, but met his overthrow at the hands of OSWY in a battle fought at Winwidfield, near Leeds. Mercia soon after became nominally Christian.

PENDA (656) was succeeded by his son PEADA; this prince was the founder of the Abbey of Medeshamstead (Peterborough) but did not live to see the building completed. His brother WOLPHERUS (659 A.D.) had the honor of carrying it to completion and of endowing the same.† He was buried in the monastery. On the death of WOLPHERUS, his wife ERMENHELD became a nun of Ely. The other kings of Mercia were—

ÆTHELRED (675.)	ECGFRITH (796.)	LUDECAN (824.)
KENRED (704.)‡	KENWOLFE (796.)	WITHLAFE (826.)
CHELDRED (709.)	KENELM (798.)	BERTHULFE (839.)
ÆTHELBALD (716.)	CEOLWULF (820.)	BURDRED (852.)
OFFA (757.)	BERNULFE (821.)	The last Mercian king.

death; having been shot by the arrows of the Northmen; he was buried at Saint Edmundsbury, Suffolk.

* Norman Conquest, I. 26—27.

† See DUGDALE, 2nd ed. p. 367, where the charter, on the authority of ROBERT DE SWAFFHAM, is quoted; the town of "Wisbeche" is therein mentioned.

‡ He died at Rome.

The Monasteries.

[PETERBOROUGH.] ÆTHELRED is said to have obtained from Pope AGATHO, extraordinary privileges for the Abbey of Medeshamstead in 680. "The Abbey was in fact by these privileges raised to the dignity of a vice-Papal See: for not only was its abbot rendered superior to all others north of the Thames, and allowed to take precedence in all conventions and ecclesiastical assemblies; 'but if any Briton, or any persons of the neighbouring islands, had a desire to visit Rome, and could not by reason of its distance, they might repair to St. Peter's in this Monastery, there to offer up their vows, be absolved from their sins, and receive the apostolical benedictions.' Appendix to Gunton."*

[ELY.] This Abbey was founded (in 673 A.D.) by ÆTHELDREDA (to whom reference has been already made on p. 62); she was the aunt of ERMENHELD, the wife of WOLPHERUS. We need not repeat what has been recorded of the austerites of ÆTHELDREDA, or of those who were her companions in her imaginary sanctities. Chronicles tell us that her sister, SEXBURGA, queen of Kent and mother of the Mercian queen, also the daughter of ERMENHELD, Princess WERBURGA, were associated with the foundress, and succeeded her in the government of the nunnery.

WILFRID, bishop of York—a famous founder of monasteries, eminent, too, for his skill in architecture, is said to have devoted a considerable time in arranging the affairs of the convent, and in forming plans for the erection of the monastery and church.†

ÆTHELDREDA obtained from Pope BENEDICT great immunities and privileges for the new establishment.‡

* See BRITTON's His. of Peterboro' Cath., p. 7.

† See BENTHAM's Ely, p. 24. ‡ WATSON's His. of Wis., p. 96.

[*Abbesses.*] ÆTHELDREDA, first abbess of Ely, died 679 A.D. The translation of her remains from the first burial

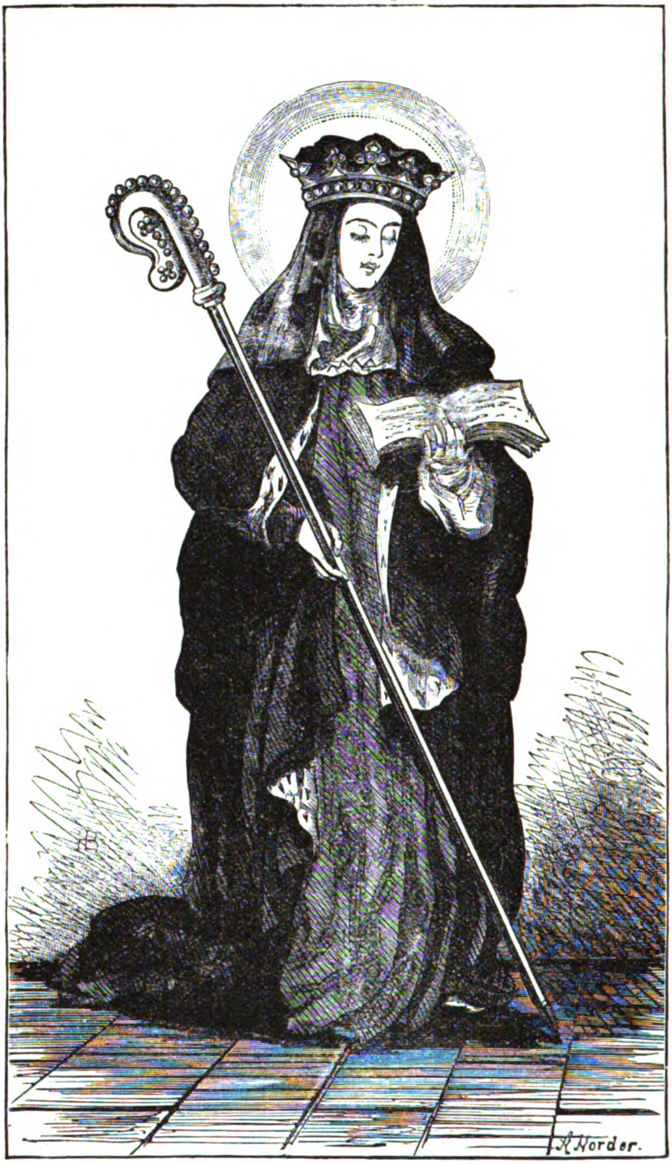


FIG. 6.—*Queen Ætheldreda.*

From "*The Costume of English Women*," by WALTER THORNBURY, in ART JOURNAL, p. 17, Jan. 1873. By permission of Messrs. VIRTUE, London.

place into the church of Ely, took place on 17th October, 695.

SEXBURGA, the second abbess, died 6th July, 699.

ERMENHELD, third abbess, date of death unknown.

WERBURGA, fourth abbess, was the last whose name has been handed down, although the monastery continued under a succession of abbesses for 197 years, remaining intact till destroyed by the Danes in 870 A.D.*

To the DANISH PERIOD we must refer for further details in the history of these monasteries.

"The Fabrick of the present Cathedral Church of Ely, was begun by Simeon the 9th Abbot, between the years 1082 and 1094; how far the building was carried on by him, is not easy to say: only we find, that this Abbot meeting with much trouble, towards the end of Wm. the Conqueror's reign, and under King Wm. II. the work was frequently interrupted, and went on but slowly. However, it was resumed, and carried on with more vigour, by Richard, the 10th and last Abbot, who succeeded in the year 1100; and finished the east end, the adjoining cross, with a tower on the intersection, and made some progress in building the nave or body of the church: he also fitted up the Choir, and having removed the bodies of the four principal Saints, *Etheldreda*, *Sexburga*, *Ermenilda*, and *Withburga*, from the old conventual church, and deposited them in their several shrines, at the east end of this new church; Divine Service was performed the first time in it, on the 17th Oct., 1106; and the next year this Abbot died.

In the year 1109, this Abbey was converted into a Bishoprick, and Hervey Bishop of Bangor, translated to this new-erected See: he procured of King Hen. I. a Charter for dividing the Abbey lands and possessions,

* The Bissexcentenary Festival of ST. ÆTHELDREDA was celebrated in 1873. It commenced on the 17th and ended on 21st Oct. A summary of the proceedings was edited by DR. MERIVALE, Dean of Ely.

between the Bishop and the Prior and Convent: the maintaining the Fabrick was vested in the Prior and Convent." (STEVENSON'S *Supp. to* BENTHAM'S *Ely.*)

[CROWLAND.] We must now retrace our steps for a little, to introduce the early history of Crowland Abbey.* We would fain divest this narrative of its mysticism, and record only simple and unquestionable facts—if such were possible. But cull as we may, the resources at our command will not yield us a simple unvarnished tale. Besides, if monastic story were stripped of the marvellous, it would be robbed of its greatest *glory*. Antiquity itself has thrown a halo of splendor around the deeds of those early ascetics, who, in virtue of the faith that was in them, esteemed it the highest merit to seclude themselves from the world,—to win confidence, and ofttimes stores of worldly goods, from the sanguine and the conscience-striken—to bestow piecemeal upon the needy, the alms that had been gained from the generous giver—to erect some ecclesiastical pile to the honor of God, with the last of the temporal possession of a dying penitent.

We will not pass a sweeping condemnation upon the old monks, like those of Crowland—for certainly they were a light to some degree, though a very dim one, in a dark age. But to be good by stealth is an easier task, notwithstanding vaunted privations, than to come out into the world and do battle with its difficulties, to resist its temptations, to be generous with self-earned riches or to aid in moulding the public mind, in giving it the impress of large heartedness and loving sympathy. Although monasticism has always appeared in the garb of an assumed sanctity and

* "The trustworthy history of Crowland, out of which the narrative of the false INGULF seems to have grown, is given by ORDERIC, 537 *et seq.* The true form of the name is *Cruland*, *Croland*, *Crowland*. *Croyland* is a form still unknown on the spot, and it is not found in ancient English writers. In Domesday, however, we have *Croiland* and Cruiland. Was this form owing to a devout pun, *quasi Croixland?*" (FREEMAN'S Norman Conquest, vol. IV. p. 597, note 2.)

induced in the popular mind the belief that it possessed some inexplicably mysterious influence—phases of character displeasing to our mind, and unsuited, as we think, to the present age, yet we must admit that for centuries the monasteries afforded the only asylum for the poor and afflicted, and perhaps, not in a few instances enabled the captive and the slave to purchase their freedom.

Crowland has a history of remote antiquity. To St. Guthlac, the confessor, is given the honor of its origin. He was the son of Perwald, a Mercian Noble, who having served in the army retired and became a monk, in his 24th year, in the monastery of Repton, Derbyshire.*

"By divine guidance he came in a boat to one of the solitary desert islands, called *Crulande*, on St. Bartholomew's day, and in a hollow on the side of a heap of turf, built himself a hut in the days of Conrad (Kenred?) king of Mercia; when the Britons gave their inveterate enemies, the Saxons, all the trouble they could."†

One Tatwine is said to have accompanied Guthlac to the islet, and the hollow of a tumulus was chosen for the Saint's abode. The Britons, who to some extent still held their own in the Fenland, appear to have given Guthlac considerable annoyance.‡

A deplorable state of the Fens is depicted by some who wrote of that period. Dugdale, quoting from the life of St. Guthlac (in Bib. Cotton), shews that the fresh waters were of wide extent and deep, being held up by the obstructions of the outfalls. "For by the inundations and

* Where king Æthelbald was buried. (Ingulphus.)

† Gough's His. and Antiq. of Crowland.

Croyland, means *crude* and muddy land. (Riley's Ingulph, p. 8.)

‡ An apocryphal story is told of St. Guthlac, of Crowland, to prove the existence of Britons in the Fenland, at a period long posterior to their conquest by the Angles. The Saint being disturbed one night by a horrid howling, was seriously alarmed, thinking that the howlers might be *Britons*: upon looking out, however, he discovered that they were only devils,—whereby he was comforted; the Britons being the worse of the two." (Nall's Dialects of East Anglia, p. 427.)

overflowing of the rivers, the waters standing upon the level ground, maketh a deep lake, and so rendereth it uninhabitable, excepting in some places, which God of purpose raised (as may be thought) to be habitations for his servants, who chose to dwell there: for in such places, within the fen, do they (viz. the monks of Ramsey, Thorney, Crouland) and many other beside, to which there is no access but by navigable vessels, except unto Ramsey, by a causey, raised with much labor on the one side thereof." Then we have the description of a "hideous fen of a huge bigness which, beginning at the banks of the river Gronte, extends itself from the south to the north, even to the sea," and the horrors of Crulande itself, "for no countryman, before that devout servant of Christ, St. Guthlac, could endure to dwell in it, by reason that such apparitions of devils were so frequently seen there."

Of course, such a state of things must greatly exaggerate the goodness of the man who would choose that spot for self-exile, or for a retreat whence he might make his missionary exploits.

The "Crulande devils" of monstrous shapes are, we think, resolvable into hallucinations caused by periodical fever attendant upon fen ague. In such a condition he imagined himself tormented by fenmen or devils, who dragged him from his cell, bound him, "cast him head and ears into the dirty fen," and otherwise maltreated him, "drawing him among brambles and briers, for the tearing of his limbs." But the recluse reached the islet on St. Bartholomew's day,* so that Saint came to the rescue, with a whip, a scourge—(not such a scourge as was wielded some centuries after, in a continental country, and associated with the name St. Bartholomew;—surely neither the 'Crulande' nor any other '*devils*' could ever have been so

* Crowland Fair is still held on St. Bartholomew's day.

terrible, yet the deed was a *Christian act*)—and with this he effectually chastised his assailants. The whip is figured on the Crowland half-penny, also on a shield on KENULPH's cross,* which still stands on the road between Thorney and Crowland.

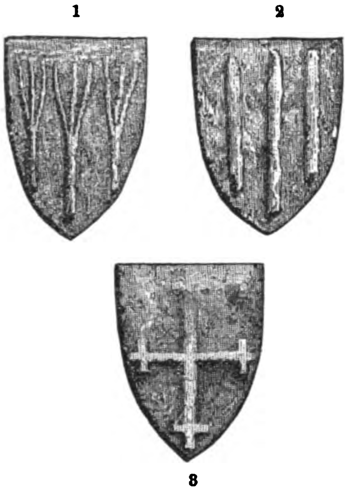


FIG. 7.—*Shields on Kenulph's Cross.*

1. The whips of St. Guthlac
2. His knives.
3. His cross.

GUTHLAC soon gained some fame for his sanctity, and drew around him a number of disciples.

KENRED, king of Mercia, died in 704 and was succeeded by CHELDRED, son of ÆTHELRED. ÆTHELBALD, great nephew of PENDA, was kept in exile by CHELDRED; he often repaired to GUTHLAC for advice and consolation. After 15 years of solitude, GUTHLAC died; FELIX tells the story of the last scene. ÆTHELBALD gained the sovereignty of Mercia in 716, and in remembrance of his confessor or in fulfilment of his promise, founded the monastery of Crowland. KENULPH, a monk of Evesham, was the first abbot, and if the king's charter, as given by INGULPH, may be depended upon, the grant of land included a large tract, comprehending "the whole island of Croyland, the same to be set apart for the site of an abbey and severally to be held; being surrounded by four rivers *Shepishee* on the east; the *Nene* on the west; *Southee* on the south; and *Asendyk* on the north, where runs the common drain between Spalding and the said island; four leagues in length and three in breadth;

* See SIR JONAS MOORE's Map of the Bedford Level—on which "ST. GUTHLAKE'S CROSS," is marked, in Porsand. The Shield shews GUTHLAC's Cross.

together with the Marsh land adjoining," *i.e.*, on both sides of the Welland, one part, called Goggisland, on the north, is two leagues in length, extending from the bridge of Crowland to Aspath, and one league broad from the river Welland to Aspenhalt, and another part of the Marsh south of the Welland, two leagues in length, from Crowland

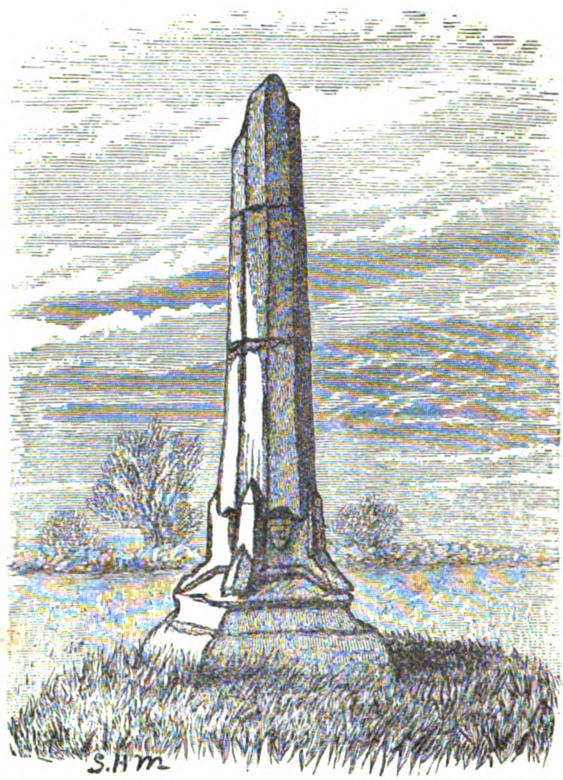


FIG. 8.—*Kenulph's Cross.*

bridge to Southlake, and two leagues in breadth from the Welland to Fynset near the Nene, with piscary in the rivers Nene and Welland. The king granted towards the building 300 pounds in silver and 100 pounds for the ensuing ten years. The monks were authorised to build a town with a right of common for themselves and servants. The charter is dated 716 A.D.

One great error has been perpetuated in reference to the foundations of the abbey. INGULPH says, "The king ordered huge piles of oak and beach in countless numbers to be driven into the ground, and solid earth to be brought by water in boats, a distance of 9 miles," before the edifice was built. But the recent Geological survey has proved that Crowland stands upon a mound of gravel, and that a ridge of gravel lies between that spot and Peakirk. The peat lies to the north-west and south-east of this ridge, and to the north-east of the abbey, at less than a mile distant, begins the silt which stretches to the Wash.

See p. 140

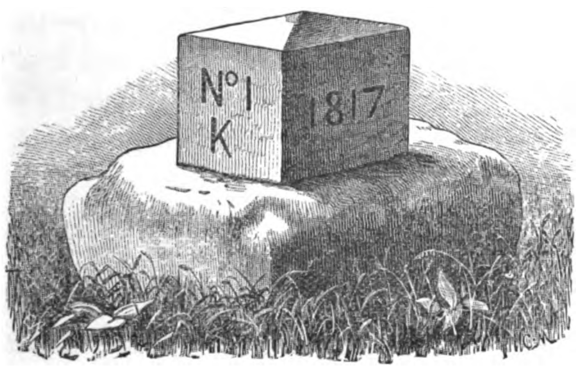


FIG. 9.—*Kenulph's Stone*—
An old boundary mark, standing in Welland Wash, 2 miles S.W. of Crowland, surmounted by a modern one, dated 1817.

Here it may be stated incidentally, that Peakirk takes its name from PEGA, the sister of GUTHLAC, who founded a cell on that spot. She greatly lamented the death of her brother; left in the hands of KENULPH the scourge of ST. BARTHOLOMEW, and other relics; returned to her cell for two years; then went on a pilgrimage to Rome, where she died.

Leaving the intermediate and doubtful history, we come to another marvellous event, in the restoration of Crowland abbey by TURKETEL, the chancellor of king EADRED (946).

On the accession of this sovereign, a disturbance broke out in Northumbria, where one HIRCIUS was a nominal king. WULFSTAN, the archbishop of York, aided the revolters. TURKETEL, who had done signal service to the state during four reigns, was commissioned to proceed to the north to effect a pacification, and on his way thither stopped at Crowland, and witnessed what devastation had been done by the Danes—the monks were reduced to a "holy trinity of three brethren." These poor men entertained the chancellor to the best of their ability, and besought him to give his aid in the restoration of the once famous monastery.

FIG. 10.—*St. Guthlac's Cross, at Brotherhouse, near Crowland.*

The inscription reads thus—

Aio hanc petram Guthlacus habet sibi metam.

I say this stone GUTHLAC has for himself (as) a boundary. Or, freely,

GUTHLAC has placed this stone for his boundary mark.

Touched by the importunity of "the three," he resolved, after having accomplished the purpose of his mission to the north, to devote himself to this object.

Having, not without some difficulty, gained EADRED's consent to his withdrawal from public life, he proceeded to Crowland, and became abbot of that monastery. Then followed a charter from the king—a restoration of the lands and the return of the monks (948). ["Crosses were erected for various purposes: to determine the boundaries of property, especially of religious houses, such as the cross of St. Guthlac, near Brotherhouse, between Spalding and Croyland, erected, Mr. Lethienllier says, about A.D. 730, but Mr. Gough informs us, it was one of the restored stones set up by Thurketyl, who died A.D. 975, in his 68th year. This has given rise to much curious and learned controversy." (Stevenson's *Supplement to* Bentham's *Ely*.)

The invention of Bells. "According to Spelman, *Paulinus* bishop of Nola, in Campania, was the inventor of Bells now used in churches, about A.D. 400. Hence the Lt. word *Campana*.* Pope Stephanus III. built a tower to St. Peter's church, and placed three bells in it, to call the people to divine service, A.D. 770. Beda also mentions the use of large bells in England, as early as A.D. 680. Egelrick, abbot of Croyland, during Eadgar's reign, cast six bells; and Turketul, who died 975, is said to have 'led the way in that fancy.'" (Stevenson's *Supplement to* Bentham's *Ely*.)] There was of yore an adage, "Sweet as Crowland bells."

Subsequently, in the reign of the Confessor, Crowland became subject to the rule of the abbot of Peterborough. Leofric, nephew of Leofric the Great, earl of Mercia, had been a monk of Peterborough, and on the resignation of Arnwig in Jan. 1053,† was raised to the dignity of abbot by the recommendation of the latter. This abbot Leofric enriched Peterborough, which gained the title of "the Golden Borough." He was so highly esteemed by king Eadward, that his spiritual control was extended over five monasteries, viz: Peterborough, Thorney, Crowland, Coventry, and Burton.

But in 1062, this great abbot appointed Ulfcytel, one of his own monks, to the abbacy of Crowland. He built a

* Hence Campanology.

† Freeman's Norman Conquest, vol. II. p. 348.

church for the monastery, as TURKETUL'S church had become delapidated, in which work he was aided by WALTHEOF, the earl of Huntingdon and Northampton, who endowed the monastery with the lordship of Barnack, in Northamptonshire.

[*Barnack Rag.* MR. SKERTCHLY has given me the following notes respecting Barnack. The gift of Barnack to Crowland abbey was a most important one, and exercised a powerful influence over the architecture of ecclesiastical edifices. At Barnack a peculiar hard limestone, known as Barnack Rag, was dug. It is almost entirely composed of drifted fragments of shells, with a few oolitic grains, and is frequently false-bedded. Geologically it is inferior oolite limestone. This Barnack Rag is, without doubt, the most durable freestone in the kingdom, and so long as the stone lasted was eagerly and persistently sought for. If this valuable property had not come into the hands of the church, it is probable that very much of the magnificent Gothic architecture which renders South Lincolnshire and North Northamptonshire unparalleled in the richness of their churches would never have been produced; but when the quarries became monastic property the stone was made available for church purposes upon terms much more moderate than would otherwise have been the case.

MR. (now PROF.) J. W. JUDD, with whom I surveyed this area for the Government, in his "Memoir on the Geology of Rutland, &c.," makes the following pertinent remarks: 'In mediæval times the well-known 'Barnack Rag' was, very extensively worked, and was carried by water to all parts of Lincolnshire and the fen country for the erection of many noble Gothic structures. . . . The working of this stone appears to have been almost entirely abandoned before the beginning of the fifteenth century. At the village of Barnack, a statue of evident Roman workmanship has been found, carved out of the easily recognised 'rag'; in the beautiful parish church, the Saxon, Norman, Early English, and Decorated portions are built of the same material, but in the fine mortuary chapel, which is of the Perpendicular age, stone from another locality has been employed." (p. 141.) PROF. JUDD further remarks that "In the neighbourhood of Barnack the very extensive 'hills and holes' show what enormous quantities of the celebrated 'Barnack rag' were quarried in former times. Indeed, almost all the beautiful ecclesiastical edifices of the Norman, Transition, Early English, Geometric, and Decorated periods, in North Northamptonshire and South Lincolnshire, and especially those of the adjoining Fenland, appear to have been constructed of stone derived from these extensive quarries, around which a very considerable population of quarrymen appears in early times to have been established. Far earlier—even in Roman times—the value of this building material seems to have been recognised; but before the Perpendicular period (15th century) the use of the stone appears to have been abandoned, probably from the exhaustion of the quarries. . . . It is only necessary to study some of the beautiful Gothic edifices constructed of this stone to see how freely it was capable of working under the chisel, how suitable it was for buildings with elaborate mouldings and florid decorations, and how its durability so well adapted it for preserving the triumphs of mediæval workmanship, even when exposed in the open air to a rigorous climate." (p. 172.)

In the year 1839 a report was issued as the "Result of an Inquiry . . with reference to the selection of stone for building the new Houses of Parliament," in which the following passage occurs: "The churches of Stamford, Ketton, Collyweston, Kettering, and other places in that part of the country, attest the durability of the shelly oolite termed Barnack Rag." Indeed, I have often noticed the Norman and Transition portions of churches, as, for instance, in the west front of Ely Cathedral, less worn by time than the Perpendicular, as in the hood-mouldings of the clerestory windows. A list of the edifices in the Fenland in which Barnack Rag was used would include nearly every church over three hundred years old, but I may especially mention the cathedrals of Peterborough, Ely, and Lincoln; the abbeys of Ramsey, Thorney, and Crowland; and the fine churches of Wisbech, Moulton, Holbech, Spalding, and Boston.

In fine, it is scarcely possible to exaggerate the munificence of Waltheof, earl of Huntingdon and Northampton, in making over to Crowland the rich lordship of Barnack.]

The new church built by Ulfcytel was damaged by fire in 1091, through, it is said, the negligence of a plumber while mending the roof; it was then restored by Ingulph, who had been made abbot on the deposition of Ulfcytel in 1085.* Ingulph was succeeded by Geoffrey in 1109. During this abbot's rule the monastery was again repaired; he is believed to have obtained the means of carrying on this work by sending out mendicant monks to solicit alms, and by obtaining from archbishops and bishops the remission of certain penances. Then followed Waltheof, a man of noble blood, one who bore the name of the beforementioned earl, but who must not be confounded with him. This abbot Waltheof introduced Orderic,† of St. Evroul, a Norman monastery, a monk and historian, to write an epitaph for the tomb of the Earl Waltheof; to this story we shall return when we come to speak of the great actors in the drama of the Norman conquest.

* Mr. Freeman points out that the false Ingulph gives the date of Ulfcytel (Wulketul) as 1075, whereas his deposition did not take place till the Gloucester Assembly in 1085. He was deposed to make room for an Englishman in Norman favour, and not by any accusation of Ivo Taillebois.

† See his history in Norman Conq., vol. IV., p. 497.

From the reign of KENWOLFE the greatness of Mercia had waned. The power of Wessex was in the ascendant; WITHLAFE or WIGLAF was vanquished by ECGBERHT, and being taken from a cell of Crowland, was allowed to reign as a tributary prince.

It was during the reign of OFFA, that the Danes or Northmen made marauding incursions into England, and 793 A.D. is the date assigned by some writers as the time of the Danes' landing in Northumbria, which they conquered about 867 A.D.*

SECTION VI.—*Danish Invasions.*

THE conquest of Northumbria opened up the way to the invasion of Mercia, in 868, when the Northmen reached Nottingham, whence they were temporarily dislodged by BURDRED (king of Mercia, 852—874 A.D.) He was finally overcome by the invaders, and with his wife, ÆTHELSWITH, fled to Rome, and soon after died there.

Thus did EADMUND, the last king of Eastanglia, and BURDRED, the last of the Mercians, succumb to the fury of the Northern foemen.

It was, then, during the conflicts which just preceded the permanent Danish settlement that Eastanglia and Mercia ceased to be kingdoms. The tide of conquest rolled from north to south. Twenty thousand Northmen, who had intended to land on that eastern projection of country on which piratical bands had landed before—on a sandy tract extending for some miles along the coast of Norfolk, and which still retains the name *Denes*, were driven northward by adverse winds, and so landed in Scotland, made their way across the Tweed and, as in the

* MR. FREEMAN shews that the Danish invasions of this country are resolvable into three periods. 1. Simple plunder. 2. Period of settlement. 3. Political conquest.—His. Norman Conq., vol. I., 12, 43, and seq.

case of many an army since, left the marks of devastation in their track, and thus was reinforced that remnant of an army which BURDRED had driven from Nottingham towards York in the winter of 869. The Danish ships meanwhile passed southward along the coast. The reinforced army was formed into two divisions. One took to their ships, and, entering Eastanglia, overthrew EADMUND as already stated; the other, under HUBBA, marched southward and entered Kesteven, a part of Lincolnshire, in the autumn of 870.*

According to INGULPH, the Fenmen now made some attempt at resistance. ALGAR,† Earl of Holland; TOLI, a layman of Crowland; MORCARD, Lord of Brunne; and OSGOT, governor of Lincoln, collected forces and did battle with an advanced party of the Danes, and, it is said, made some effort to withstand the approach of the main forces, but were soon overcome.

The Danes attacked Crowland Abbey, stripped it of its treasures, murdered the monks, destroyed the *holy* relics, collected the bones of the *saints* and set fire to them and the church (26th September, 870.) The Pagans then marched towards Medeshamstead (Peterborough), plundered the monastery there, and slew the abbot and eighty other persons. Leaving the church in flames, they pressed on to Huntingdon and Cambridge, intending to unite with the other division of their forces which had gone to Eastanglia.

The Isle of Ely was now exposed to the Danish incursions. It was even at that early period a place of refuge.‡ Marauding parties, detached from the fleet, passed up the rivers in quest of booty, and finding their way up the estuary of the Ouse, which then flowed past Wisbech, they

* BENTHAM, p. 66.
The name is still preserved in the Fens at Hubba's bridge, in Kesteven.

† Algarkirk, where the earls were buried, takes its name from them; and not far from Bourn exists Morkary wood. ‡ BENTHAM, p. 68.

approached the monastery of ÆTHELDREDA; "for such was the depth of the waters, which, compassing this isle, extended to the sea, that they had an easy access unto it by shipping.*

"The islanders," says BENTHAM, "wanted not courage and resolution to defend themselves: on the first notice of their danger they collected their forces, and joining with their countrymen who had fled thither, as to a place of refuge, (among whom were several *English* noblemen and principal persons of the adjoining counties,) they marched towards the enemy, and vigorously repulsed them, forcing them to retire to their ships, and to quit the place."

The Danes soon returned to the attack with greater forces and determination, led, it is said, by one of their kings, probably HUBBA. A bloody fight ensued, for the defenders of the Isle of Ely fought with great spirit, but the Danes were the conquerors. The monastery of ST. ÆTHELDREDA was broken into, the monks and nuns were put to the sword, the house stripped of its valuables, the town plundered, the church and many buildings burnt. The invaders departed laden with spoil, for many who had taken alarm on the approach of the Danes had carried their effects and riches to Ely as a place of security. The church and buildings belonging thereto remained in ruins for several years. A few of "the secular clergy" made an attempt, some years after, to effect a partial restoration. These seculars gained some favour from ÆLFRED, and benefactions from time to time, among which was a grant from EADRED in 955, but they were ejected on the restoration of the monastery in the reign of EADGAR the peaceful, who became king of all England in 958 A.D.

The charter of endowment was granted by that king in 970. BRITHNOTH was the first abbot of Ely.

* DUGDALE, 2nd ed., p. 181.

It may be interesting to note that when the conventual church was restored, DUNSTAN, Archbishop of Canterbury, whose name is popularly associated alone with ridiculous legends, was invited and did perform the rites of dedication of this restored church of Ely.

Abbot BRITHNOTH governed the abbey about eleven years, and met a martyr's death (981) at the instigation of ÆLFTHRYTH (or ELFRIDA), to whom is attributed, also, the death of her step-son EADWARD the Martyr (979).

It is fitting here to refer to the renewal of the Danish invasions in 988 A.D., because in connection with the history of Ely, we have the name of another BRITHNOTH, a brave East-Saxon Ealdorman.*

The Danes had plundered Ipswich, and were proceeding into Essex. BRITHNOTH met them at Maldon, and fought them on the banks of the Blackwater. The Northmen were victorious, and the Ealdorman was slain; the body was rescued after a severe struggle on the part of the enemy to possess it, and was *buried at Ely* (991 A.D.)†

The restored abbey of Ely became richly endowed. King EADGAR bestowed the manor of Hatfield, Herts., consisting of 40 hides of land,‡ and East Dereham, in Norfolk.‖ Abbot BRITHNOTH procured or purchased 60 hides within

* MR. FREEMAN (I., p. 261,) remarks that after the death of EADGAR, there was a reaction against the monastic party, but says, "The monks found powerful supporters in the eastern part of the kingdom, where their cause was strongly supported, it would seem even in arms, by two remarkable men, who then held the governments of East Anglia and Essex. ÆTHELWINE of East Anglia, one of the founders of Ramsey Abbey, is chiefly known for his bounty to monastic foundations, to whose gratitude he probably owed his singular surname of the Friend of God (*Amicus Dei*). With him was associated his maternal uncle BRITHNOTH, Ealdorman of the East Saxons, whose lavish gifts to Ely, Ramsey, and other monasteries, won him well-nigh the reputation of a saint, and whom we shall soon find dying a hero's death in the defence of his country against heathen invaders."

† Ibid, I., p. 273. (In BENTHAM'S Ely he is called Duke BRITHNOTH. Perhaps the Latin *Dux* and the Danish *jarl* were beginning to alternate as titles.)

‡ By a survey, subsequently made, it is said to have contained 2260 acres, *i.e.*, about 56½ acres per hide.—BENTHAM, p. 74.

‖ We find ST. WITHBURGA'S name associated with this place, and also with Holkham. She is said to have been nursed at Holkham and buried at Dereham. The body was stealthily taken to Ely.

the Isle. Other large endowments were added from time to time, in the adjacent counties. The Ealdorman BRITHNOTH left a widow, who shewed her devotion to the abbey of Ely by adding to the munificent gifts bestowed by her husband in his life-time; she offered, too, a bracelet of gold, "she adorned the minster with one gift, which, if it survived, would rank among the most precious monuments of the history and art of any age. Ely once could rival Bayeux; the industry and the conjugal love of the widow of the East Saxon Ealdorman were no less famous than those of the wife of the Norman king. Among the choicest treasures of Ely under her first bishop, a hundred and twenty years later, was the elaborate tapestry on which the devotion of ÆTHELFLÆD had wrought the glorious deeds of the hero of Maldon."‡ Such a tribute was worthy of the man who staked his life rather than yield to the Danish offer to withdraw on the receipt of money, to which, indeed, ÆTHELRED yielded in the same year that the hero of Maldon was slain. The Unready was swayed by timid advisers: the Northmen returned five times with the same demand, and the delusive purchase was five times augmented.

The first payment made to the Danes, then, was in the year 991 A.D. The price of peace was raised successively from ten thousand to fifty thousand pounds weight of silver; hence the tax called Dane-geld, which, like a tax of modern times, imposed for warlike purposes, was not repealed when the original object for which it had been raised had long ceased.

This eastern part of our country was, for a few years, free from the attacks of the Northmen, who committed their ravages on the southern coasts, especially the Kentish and Wessex.

We are not wishful to enter into the details of the

‡ His. of Nor. Conq., I., p. 274.

massacre of ST. BRICE'S day, which has been greatly exaggerated, for if the massacre had been general the Fenland would have been rid of its Danish settlers,* which is not at all probable. The next important phase of Danish invasion appears in the attacks of SWEGEN on Eastanglia, and the resistance of ULFCYTEL, earl of the Eastangles. In the account of this invasion we have the history of the affrays at Norwich and Thetford. The battle at the latter town was really a drawn game, and the Danes went home to Denmark.

In 1010 the Northmen again attacked Eastanglia, landing near Ipswich. ULFCYTEL was not surprised on this occasion, but was betrayed by THURCYTEL, a thane of Danish descent, who took to flight, and most of the army followed him, except the men of Cambridgeshire.† The enemy gained the advantage, and burnt Thetford and Cambridge.

English resistance collapsed. SWEGEN made a final attack in July, 1013: sailed up the Humber and then up the Trent. The north was severed from the south. The Northumbrians gave him their allegiance; then followed the men of Lindsey (on the northern border of the Fenland), and lastly came the submission of the five burghs—Lincoln, Leicester, Derby, Nottingham, and Stamford.

Taking hostages from these districts, and leaving them with CNUT, commander of the fleet, SWEGEN went southwest through Mercia, committing great devastation on his way to Oxford. But the details of his conquest and his elevation to the kingship belong to general history.

In the northern part of the Fenland the Danish element largely prevailed, and Danish settlements became more permanent than in many other parts of England. We

* We refer our readers to Appendix GG., vol. I. of FREEMAN'S Nor. Conq.

† Ibid. p. 344.

learn that after CNUT was elected king, he obtained material help from the men of Lindsey, for which they were afterwards punished by ÆTHELRED on his regaining the sovereignty.

We cannot trace with any degree of completeness the career of CNUT in his remorseless plundering, but there are one or two events in his life which demand some notice here. To this Danish pirate, after he became sole ruler of England, are attributed deeds of piety; yet we find it difficult to understand how the lion became transformed into the lamb; how one who never scrupled

"To wade through slaughter to a throne,"

should become the beneficent ruler of the nation he had mutilated. But we are told "CANUTE himself was distinguished by his liberality to the church. As though he wished to make compensation for the destruction of Croyland abbey by the Danish soldiery, he gave the splendid golden chalice which stood on the high altar of the restored church there. Under CANUTE, Christianity was almost completely established in the Danelag itself. MR. WORSAAE is disposed to consider Croyland as the chief point from whence Christianity and civilization were diffused through the Danish population in England. There were many Danish abbots of Croyland between the ninth and twelfth centuries."* Although CNUT is said to have gradually changed into a prince, English in all but birth,† and although his better nature could be touched by the merry (the sweet) chanting of the monks of Ely as he, the king, was rowed up the river, yet he could maintain his power by the banishment or the death of those who fell under the bane of mere suspicion.

King's Delph, a causeway between Peterborough, Whittle-

* THOMPSON'S His. of Boston, p. 29. † Nor. Conq., vol. I., p. 429.

sea, and Ramsey, is attributed to CNUT. An account of this is found in CAMDEN's Britannia. But EADGAR, in his charter to Peterborough abbey, is said to have made this the boundary of his donation.

MR. FREEMAN says that CNUT's personal tastes seem to have led him to the great religious houses of the Fen country, where the dead of Maldon and Assandun reposed in the choirs of Ely and Ramsey. Nowhere was his memory more fondly cherished than in the great minster which boasted of the tomb of BRITHNOTH. There he was not so much a formal benefactor as a personal friend. But he was held in no less honor at Ramsey, the resting-place of ÆTHELWEARD. There he built a second church, and contemplated the foundation of a society of nuns, which he did not bring to perfection.*

[ÆTHELWEARD, a son of ÆTHELWINE, the founder of Ramsey abbey, was slain in the battle of Assandun (Ashington, Essex,) 1016 A.D.]

Seeing that Lincolnshire figures so prominently in the story of the Danish invasion, we shall be prepared to find, at this day, the remains of the Danish element in that county, especially in the names of places and in dialectic words. The names of the towns in Lincolnshire indicate this prevalence of the Danish element, for 292 are found to be of Scandinavian origin. Of these 292 towns, 212 have the termination *by*, 63 have *thorpe*, 1 has *with*, 4 have *toft*, 8 have *beck*, 1 has *ness*, and 3 have *dale*.*

The Danish occupancy in other parts of the Fenland has not left such permanent marks. We have not failed to seek for information as to the prevalence of words having the complexion even of a Scandinavian origin, but with

* Nor. Conq., vol. I., p. 487.

† THOMPSON's His. of Boston, p. 80.

little result; for the Secretary of the English Dialect Society could render no assistance in the matter.

Some one has mentioned the existence of the Danish word *bro* (a bridge), used in Hunts. for a small bridge with a hand-rail, thrown over a stream.

In Cambridgeshire we find the words—

cloof, the hoof, (DAN. *kloo*.)
flick, a flitch, (D. *flycke*.)
flit, to remove to another residence, (D. *flytte*.)
frowy, stale, as applied to bread.
garled, spotted, as applied to butter, (D. *gaare*.)
gob, a mouth, (D. *gab*.)
pammy, fat, (SWE. *pamp*.)
roky, misty, (D. *røgg*, smoke.)
rag, to tease, (D. *rog*.)
sliving, idle, (D. *slæver*.)
spretched, cracked, applied to eggs at the time of hatching (D. *spranken*.)
stroming, taking long strides. (D. *ström*.)

These are provincialisms in frequent use. But taking 304 names of towns or villages in Cambridgeshire, we find none of the Danish terminations like those in Lincolnshire,* except one, *Begdale*, a part of Elm, near Wisbech. *Toft* is the name of a small village south-west of Cambridge.

The following table will enable us to compare the occurrence of the Danish terminations in the names of places in the counties more or less connected with the Fenland :—

COUNTY.	Total Places in Directory.	TERMINATIONS.						
		-by.	-thorpe.	-with.	-toft.	-beck.	-ness.	-dale.
Lincolnshire - - -	1055	212	63	1	4	8	1	8
Northamptonshire -	490 †	17	26	—	3	1	—	—
Huntingdonshire - -	148	—	—	—	—	—	—	—
Bedfordshire - -	230	—	—	—	—	—	—	—
Cambridgeshire - -	304	—	—	—	(1)	—	—	1
Norfolk - - - - -	916	18	32	—	3	—	—	—
Suffolk - - - - - -	652	4	8	—	2	1	—	2

* Directory of Cambridge, &c., edited by E. R. KELLY, M.A., F.S.S. in 1875.
† Directory, edited by E. R. KELLY, M.A.

+ Camb. -

fleet - Shallow.

Of those places having a Danish termination to their names, the nearest to Hunts. is Kingsthorpe, a hamlet of Polebrook, on the south-east of the Nene; but taking a line north-east from this place, and crossing the Nene, we come to Deene and Deenethorpe, a name wholly Danish.

We give these facts and remarks as bearing upon what we are about to quote from the pen of Dr. Latham. (See article *Durobrivæ* in Smith's Dic. of Gk. and Rom. Geo., vol. I. p. 793.) In order to be brief, we may take Castor as the *Durobrivæ* of the *Itinerary* of Atoninus.

Although there is no part of this island where Saxon forms are excluded, there are vast tracts where there is nothing Danish.

The districts where the Saxon forms prevail, the metamorphosis of the Roman term *castra* is chester or cester (Godmanchester, Chesterton, Cirencester); whereas, where the Danish forms prevail, it is *caster* (Tadcaster, Ancaster, Casterton). There is no exception to this rule of distribution. Now, what takes place in the very spot under consideration? Even this—that whilst *Lincolnshire* (on the borders of which *Castor* stands) is the most Danish of all the counties of England,—whilst *Northamptonshire* (to which it belongs) is largely Danish,—whilst *Caster*ton, An*caster*, &c., are the northern transformations of *castra*,—whilst every other Danish shibboleth (*sk*, *carl*, and *by*, &c.,) is rife and common as we advance towards *York*,—the moment we cross the *Nene*, and get into *Huntingdonshire*, *Bedfordshire*, and *Cambridgeshire*, the forms are *chester*, in respect to the particular term *castra*, and exclusively Saxon in all others. No trace of Danish occupancy can be found in *Huntingdonshire*, so truly does the *Nene* seem to have been a boundary, and so abrupt was the transition from the Danes, who said *castor*, to the Saxons, who spoke of the *chester* (*ceastre*). More than this, at some time between the evacuation of the isle by the Romans, and the Norman conquest, the northern and southern defences—for such the *castra* of *Chester*-ton and *Castor* (in Northamptonshire) were—may have constituted the opposed and hostile parts of a bilingual town; and the analogue between the present German-Danish frontier in Sleswick-Holstein may thus have been exhibited in England.

Taken in connection with the list of Dialectic words,* what we have now advanced may suffice to shew the extent and influence of the Danish occupancy in the Fenland; and here we briefly revert to CNUT's reign, in order to connect the thread of our story. This Dane married EMMA, the widow of ÆTHELRED, and by her had a son HARTHACNUT. He had sons also by a former wife. At CNUT's death the kingdom of England was divided. HAROLD, son of the first wife, advanced his claim, and by aid of partizans commanded the north—EMMA held a kind of regency in the south for her own son, who was in Denmark. But EMMA had two sons by ÆTHELRED—ÆLFRED and EADWARD, who had long resided in Normandy, and taking advantage of the unsettled state of affairs in England, they made independent attempts to obtain their inheritance.

There are conflicting stories as to the fate of ÆLFRED. The most generally received account is, that he was seized by GODWINE, earl of the West Saxons, sent to London, (where his eyes were cruelly put out), thence in a state of nudity to Ely, where he died and was buried.†

At HARTHACNUT's death, the Anglo-Danish dynasty ended, and the above-named EADWARD reappeared, (he is popularly known as the Confessor), but he was in fact only a nominal king, while almost all the real power was in the hands of

* See Chapter IV.

† MR. FREEMAN has gone into considerable details on the death of this ÆTHELING, (see vol. I. note SSS.) GODWINE's implication in the brutal usage of this prince is doubted.

Godwine. This earl had six sons, the second of whom, Harold, was earl of Eastanglia and Essex, and the rest of the country south of a line drawn from the Wash to the Severn, was under the sway of the other sons. If Godwine was aggressive, he appears also to have been patriotic and to have kept in check the Norman predilections of the Confessor. But Leofric, earl of Mercia, and Siward, earl of Northumbria, were formidable opponents of the great earl and aided in effecting his banishment, which was not of long duration (Oct. 1051—Sept. 1052.)

While Godwine was banished in Flanders, and Harold in Ireland, Norman influence had its sway, and the young duke William of Normandy, visited his cousin Eadward the Confessor.

By the combined action of fleets, fitted out by Godwine in the harbours of Flanders, and by Harold in Ireland, the father and son were enabled to re-enter England. Godwine was restored to power by the Witenagamot, held outside the walls of London. Archbishop Robert, the bishop of Dorchester, and many other Normans, fled the country. The earl survived his restoration only a short time.

During Harold's banishment, Ælfgar, son of Leofric of Mercia, received the earldom of Eastanglia, but was dispossesed on Harold's restoration. When the latter was raised to the earldom of Wessex, at the death of Godwine, 1053, Ælfgar returned to his rule of Eastanglia; but his career was turbulent and his power fitful. On the death of his father Leofric in 1057, he succeeded to the earldom of Mercia, and Gurth, a younger brother of Harold, ruled in Eastanglia.

But we find that Huntingdonshire and Cambridgeshire were separated from Mercia in 1051,* and united to the earldom of Eastanglia under Harold. Northamptonshire,

* Norm. Conq. vol. II. app. G.

too, was detached from Mercia and included in Northumbria. SIWARD died in 1055, and TOSTIG, the brother of HAROLD, became earl of Northumbria, when Northamptonshire and Huntingdonshire were united to that earldom. Thus the sway of the house of GODWINE extended beyond the Humber. Ten years after TOSTIG's elevation, the Northumbrians revolted against his stern rule—deposed him and elected MORKERE (or MORCAR), a younger son of ÆLFGAR of Mercia. The elder son, EADWINE, having succeeded to the earldom of Mercia at the death of ÆLFGAR, which probably took place in 1062.

The western part of the Fenland now became subject to some rough usuage. A combination of Northumbrians, Mercians and Welsh, attacked the counties of Northampton and Huntingdon, killed many of the people, burnt their houses and committed other serious depredations—the effects of which were felt for years afterwards.

The social condition of the people during this period, seems not to have engaged the attention of the chroniclers—at least it was not thought by them to be of sufficient importance to be noted. The mass of the people were in serfdom, but Anglo-Saxon law permitted even a serf to become a thane, if circumstances favored his deliverance from slavery and his possession of land; landed property gave a passport to political power and influence, which noble birth alone could not secure.

SHARON TURNER, speaking of the laws which provided for a thane's advancement to the dignity of an earl, says, "But the most curious passage on this subject is that which attests, that without the possession of a certain quantity of landed property, the dignity of sitting in the witena-gamot could not be enjoyed, not even though the person was noble already. An abbot of Ely had a brother who was courting the daughter of a great man, but the lady refused him, because, although noble, he had not the lordship of forty hides, and therefore could not be numbered among the proceres or witena. To enable him to gratify his love and her ambition, the abbot conveyed to him certain lands belonging to his monastery. The nuptials took place and the fraud was for some time undiscovered.*

For a few years in the early part of HAROLD's power, the country was in a state of quietude, when ecclesiastical affairs received much attention. HAROLD himself rebuilt the church at Waltham, and founded a college of secular canons and a lectureship; and in reference to this MR. FREEMAN says—"That, stout English patriot as HAROLD was, he was never hindered by any narrow insular prejudices, from seeking merit wherever he could find it. HAROLD had seen something of the world; he had visited both France and Italy; but it was not from any land of altogether foreign speech, that he sought for coadjutors in his great work, ... HAROLD brought over ADELHARD, a native of Lüttich, who had studied at Utrecht . . . . He became a canon and lecturer at Waltham."†

It may be noted here, that HAROLD's church at Waltham was consecrated in 1060 by the Archbishop of York, who died the same year and was buried at Peterborough.

If quietude could have been maintained, the people would have made considerable social improvements under HAROLD, but the frequent interchange of earldoms and the feuds of earls were inevitable barriers to progress.

SHARON TURNER remarks, "But weak reigns are always characterised by one perturbing mischief—the factions of powerful nobles; and EADWARD's life was marked by this stamp.‡

* His. of Anglo-Saxon, vol. II. p. 22.

† Norm. Conq. vol. II. p. 443.

‡ His. of the Anglo-Saxons, vol. I. p. 450.

SECTION VII.—*The Norman Conquest.*

WE have seen that HAROLD, GURTH, TOSTIG, EADWINE, and MORKERE—men who were to take so prominent a part in the coming conflict, were more or less associated in the government of the Fenland.

At the banishment of TOSTIG in 1065, Northamptonshire and Huntingdonshire were again separated from Northumbria, and erected into an earldom under WALTHEOF, a son of SIWARD; but more of him hereafter.

On the 5th Jan., 1066, EADWARD, the crowned monk and one of the weakest of monarchs, passed away, leaving behind him no one who could claim a right to his crown by descent. But, hitherto, the English crown had been almost solely elective; the balance of evidence is in favor of EADWARD'S having named HAROLD, rather than WILLIAM of Normandy, as his successor; but however this may have been, the decision really rested with the Witenagemot, and HAROLD was elected king.

Here it is essential to introduce a few facts which appear to belong rather to general history—essential, as links in a chain, to lead us to that notable juncture in the Norman conquest, the attack on the Isle of Ely.

The new king's first assailant was the banished TOSTIG, who collected forces in Flanders and Normandy—(with duke WILLIAM'S assent no doubt), and plundered the coasts of England, especially those of Lindesey, where he burnt towns and slew the inhabitants. He was driven thence by EADWINE and MORKERE and proceeded to Norway, where he gained the alliance of the king HAROLD HARDRADA.

The English HAROLD had been watching the south, expecting the invasion from Normandy—the north was left under the guardianship of the earls, EADWINE and MORKERE. TOSTIG and HARDRADA, after various plunderings, united their forces, sailed up the Yorkshire Ouse, and landed their army at Riccall near York. The two earls marched against the invaders but were defeated, and York was surrendered.

The Saxon king made a skilful march to the north, and took the invaders by surprise in the neighbourhood of York. Here was fought the notable battle of Stamford Bridge, in which TOSTIG and his ally were slain (25th Sept., 1066.) Three days afterwards, duke WILLIAM landed in Sussex unopposed; HAROLD again marched southward; the Northumbrian and Mercian earls refused assistance, but the men of Northampton and Huntingdon and those to the east and south were loyal to HAROLD.* LEOFRIC, the abbot of Peterborough, joined the king's army. It was on Saturday, 14th Oct., 1066, that the great battle of HASTINGS was fought—or the battle of SENLAC, for it was on the hill Senlac that the English army was posted, but whoever would understand the greatness of that fight, must consult the historian of the "Norman conquest."

The first fruits of WILLIAM's victory was the possession of only a small portion of this country—the south-east corner; the CONQUEROR acted with some apparent moderation, and held out fair promises, in order to win the confidence of chieftains. To EADWINE he promised one of his daughters in marriage, but this was never fulfilled; and, as a seeming mark of favour, he took with him on his visit to Normandy the three earls, EADWINE, MORKERE, and WALTHEOF.

Soon after this, another step was taken in the subjugation of England, and a favorable opportunity offering, the two former of these earls revolted and united their forces in the north. WILLIAM entered on a third campaign, and among other towns took Lincoln and caused a castle to be built there (1068). This city, yielding tamely to the Conqueror,

* See Norman Conquest, vol. III. p. 424.

Site of Hereward's Castle at Bourn.

was leniently treated. WILLIAM had pushed as far north as York, and on his return journey, after leaving Lincoln, stayed at Huntingdon and Cambridge; at the latter town another castle was built; but neither place was dealt with so favorably as Lincoln.

EADWINE and MORKERE again submitted to WILLIAM, were received into his favor and nominally restored to their estates (1068.)

But in south Lincolnshire, the Conqueror met with considerable resistance from the HOLLANDS, the WELLES, and the lords of KYME—who resisted him, too, till an arrangement was made in their favor, one which indicates that an overture came from the Conqueror that they should keep possession of their lands.

"These estates . . . . . were probably held by what was then known as *allodial* tenure, which signified an hereditary and perpetual estate, free, and in the power of the possessor to dispose of by gift or sale, but subject to the common and constant tax of *hidage* . . . . . The families of HOLLAND and KYME were for a long time closely connected with this neighbourhood."*

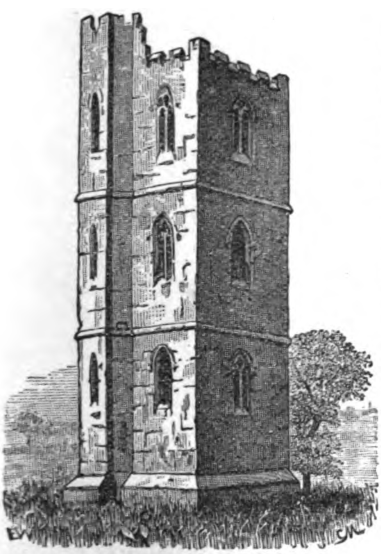


FIG. 11.—*South Kyme Tower.*

Large tracts of land, however, came under the complete control of WILLIAM and were parcelled out among his barons or followers. Not a little craft was exercised by some who gained possessions—if we may

* See THOMPSON'S His. of Boston, p. 34.

For Genealogy of the KYMES, as deduced from OLDFIELD'S His. of Wainfleet, see App.

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credit what is told of EUDES of Champaign, who, when a son was born to him, is said to have represented to the king that the land he already possessed (and which had formerly belonged to DREUX BRUERE the outlawed Fleming), was not fertile and produced only oats. He therefore sought the grant of land proper to bear wheat that he might obtain wheaten bread for his infant son, whose mother was half-sister to the Conqueror. The king, touched by this appeal, granted some lands in Lincolnshire.

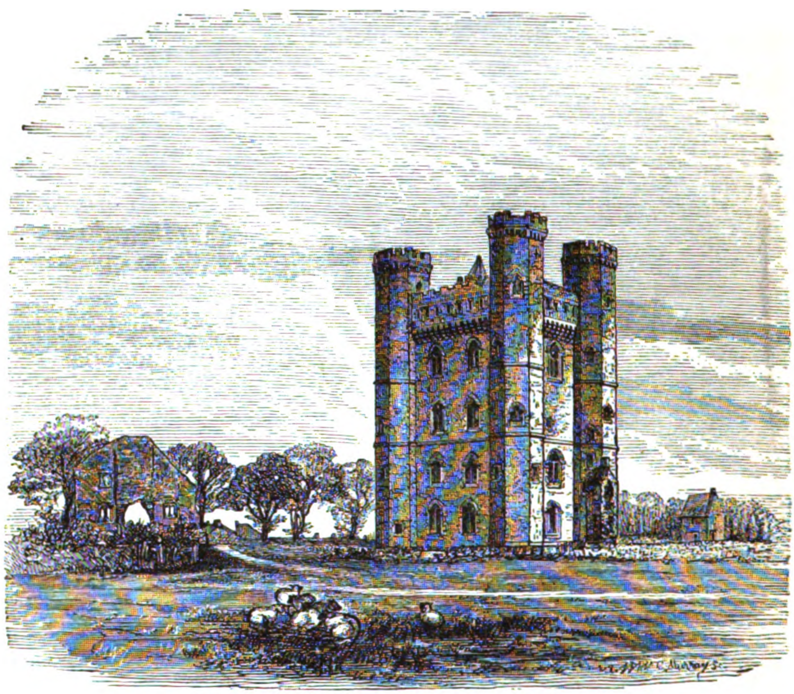


FIG. 12.—*Tattershall Castle.*
As it appeared in August, 1873. For description see Appendix.

Whether or not there is any truth in this tale, it serves to shew that Lincolnshire was then a fertile corn-bearing district.

A local annalist tells us that EUDO, son of SPIREWIC, was the founder of the Tattershall family. He came over with the Conqueror, and as a reward for his services, obtained, amongst other lands, the lordship of Tattershall. Eventually the barony became the right of female branches of the family—JOAN was married to SIR ROBERT DRIBY—their heiress married SIR WILLIAM BERNAKE, but failing a male issue, the right fell to a granddaughter MAUD, wife of RALPH DE CROMWELL, who was summoned to Parliament in the right of his wife in the reigns of EDWARD III. and RICHARD II. The grandson of MAUD and RALPH DE CROMWELL, also called RALPH, became constable of Nottingham Castle in 1445; he was made treasurer by HENRY VI. This RALPH built Tattershall Castle about 1440 A.D.*

Another Danish Invasion. For two years past, English suppliants had appeared at the court of Denmark, urging another invasion. SWEND prepared a fleet of 240 ships, which set sail under OSBEORN, his brother. This fleet was manned with a motley company of continental adventurers, who attacked the coasts of Kent and Eastanglia, and sailed up the Yare and Wensum; they were driven back, however, and tried their fortune in the Humber. Amongst others who aided this invasion, was Earl WALTHEOF, whose career had hitherto been obscure. The armament having arrived in the Humber, the men of Northumbria joined it and an attack was made upon York. And now the time arrived that WALTHEOF was to enter the rank of heroes.

MR. FREEMAN, speaking of that attack (on 21st Sept., 1069), says—

"And now it was that for the moment WALTHEOF, the son of SIWARD and ÆTHELFLÆD, stood forth as the hero of deeds which handed down his name in the warlike songs of the tongues of both his parents . . . . . . how he stood by the gate as the enemy pressed forth, and how, as each Norman drew nigh, a head rolled on the earth beneath the

* See OLDFIELD'S Wainfleet, p. 127—9.

unerring sweep of the Danish battle-axe. Three thousand of the strangers (Normans) died that day. A hundred of the chiefest in rank were said to have fallen among the flames by the hand of WALTHEOF himself, and the Scalds of the North sang how the son of SIWARD gave the corpses of the Frenchmen as a choice banquet for the wolves of Northumberland." Only a few, among whom were the governor of York and his family, were spared that day. The news of the catastrophe was carried to WILLIAM while he was at his favorite sport in the forest of Dean. He swore vengeance and went to the north, and then followed the slaughterings and burnings and desolations, of which historians have said so much.

But WALTHEOF, with others, made submission to the Conqueror and was restored to his earldom (Huntingdon and Northampton), and received in marriage JUDITH, a niece of king WILLIAM'S. In 1072, he was created earl of Northumberland,* on the deposition of COSPATRICK; but being, at a wedding feast held at Exning in Cambridgeshire, unwittingly mixed up in a conspiracy with RALPH, earl of Eastanglia and ROGER of Hereford, among whom the country was to be partitioned; he lost all favor with the king, and although he appears to have explained his real position to WILLIAM, he was arrested on the king's return to England and imprisoned at Winchester. His wife, JUDITH, seems to have betrayed him. WALTHEOF was beheaded on 31st May, 1076; the body was buried at Winchester, but afterwards translated to Crowland and interred there 15th June, 1076, (to which reference has already been made.)†

WILLIAM'S vindictiveness does not appear to have extended to the treatment of the dead bodies of his victims,

* Norman Conquest, vol. IV. p. 268.

† See supra, p. 80.

for he allowed HAROLD as well as WALTHEOF an honorable burial.

INGULPH laments the death of the earl as a calamity, and speaks of JUDITH as "that most wicked Jezebel."* She afterwards shewed extreme penitence, and is said to have founded a nunnery at Elstow, Beds.†

It seems proper to mention here, that MATILDA, the daughter of the unfortunate WALTHEOF, was married to SIMON of Senlis, to whom she conveyed the earldoms of her father. They had offspring—SIMON, WALTHEOF, and MATILDA. SIMON, the elder, died and his widow, MATILDA, was married to DAVID of Scotland, who reigned from 1124 to 1153. The son of DAVID and MATILDA was HENRY, earl of Huntingdon, who took his grandfather WALTHEOF's title. "Through this marriage came the long connexion between the earldom of Huntingdon and the Royal house of Scotland, and through it too the blood of WALTHEOF . . . . . . passed into the veins of the later kings of England."‡ It may not be impossible to trace the descent from the offspring of DAVID and MATILDA to its connexion with the house of Stuart, and from the house of Stuart to that of Hanover.

Resistance in the Fenland. While the Conqueror was in the north carrying out his great revenge, insurrections were rife in his rear; these were partially suppressed by WILLIAM's lieutenants, but the west required all his own personal prowess to bring it into subjection; and the Northumbrian tragedy was repeated on the banks of the Dee and the Mersey.

The one corner of England which had not submitted to WILLIAM, was the Fenland. The last Danish invasion, under OSBEORN, found favor in the eyes of the Fenmen, who, as we have seen, were now so largely Danish. But these invaders were honest neither towards their kindred

* RILEY's translation, p 146. † Norm. Conq. vol. IV. p. 604. ‡ Ibid. p. 605.

nor the Conqueror. The latter, being so busy putting down revolts, patched up a peace with Osbeorn and allowed him to plunder the coast of the disaffected. We learn that this Dane and his companions ascended the river to Ely in May, 1070.*

It may thus have been William's policy to attack what had been hitherto regarded as the *holy land* of the English—a land containing the most renowned of the ecclesiastical establishments (and at the present time noted for the magnitude and beauty of its village churches); there were Ely, Ramsey, Crowland, Thorney, and Peterborough, with their succursal cells—the last-named abbey was, perhaps the most easily assailable, especially on the west, where there was not so perfect a network of water courses—swamps and meres—as around the Isle of Ely.

Some of these Danes allied themselves with one who will ever be regarded as the great hero of the Fens—Hereward—a mytho-historical personage, whose name, ~~now for~~ the first time was identified with real history.

Who was Hereward? By some writers, this "England's darling" has been unhesitatingly called the son of Leofric, the lord of Bourn, by others, it is said that there is no historic proof of this, and that his parentage is unknown; and while in Domesday book, he does not appear to have held anything in chief (did the commissioners purposely omit his name?); some one of the same name, if not himself, held lands of a count in Warwickshire. Hereward did hold lands in Lincolnshire, if not at Bourn;* some which

* Mr. Freeman quotes the Peterborough Chronicler on this point, thus—Þa comen into Elig Christien þa Densce bisceop and Osbearn eorl, and þa Densce huscarles mid heom, and þa Englisce folc of eall þa feonlandes comen to heom, and wendon þat hi sceoldon winnon eall þæt land." Vol. IV. p. 454. It appears that Christian, a bishop, was a boon companion of Osbeorn's. Was his office spiritual?

* Our illustration of the site of Hereward's Castle, is a view near Bourn; there are the mounds shewing the contour of extensive foundations—there is the "well

were afterwards in the hands of ULFCYTEL, abbot of Crowland, appointed in 1062 (see supra. p. 77.)* HEREWARD fled his country, for what cause no one knows, and it was subsequent to 1062, no doubt. But he returned, after much wonder-working, and taking as allies some of the Danes, already referred to, as well as certain outlaws, he attacked the monastery of Peterborough, (June, 1070.) But it was not mere lawlessness which induced this sacrilege; the circumstances which led to it were briefly these: LEOFRIC, the abbot of Peterborough (before mentioned), while fighting for HAROLD, was wounded on the field of Senlac, and returning to Peterborough died of his wounds (Nov., 1066.) BRAND, a provost of Peterborough, was chosen by the monks as their abbot, and EADGAR ÆTHELING confirmed the election. This abbot held his office about three years. He died while WILLIAM was quelling disturbances in the north; but the Conqueror made the next appointment in the person of TUROLD; he was more of a soldier than a monk. At this, some of the Saxon monks revolted and sought the aid of HEREWARD.

INGULPH tells us that HEREWARD was the nephew of BRAND, and that he was vexed to see a foreigner rule over his kinsmen.

Something more than the association of a dead uncle, led to this bit of of warfare in the plundering and burning of Peterborough; the Saxon hero was doubtless valiant in the

head," with its bubbling springs. [Compare *Brunnen*, Ger. a well; *Born*. O.G. for well (nearly obsolete); and *Brune*, Sax. for brook.] HEREWARD most probably dwelt here after his great exploits.

* We refer our readers to a report of *The Associated Architectural Societies* Meetings held at Bourn in June, 1861. This report contains a paper by the REV. E. TROLLOPE, M.A., F.S.A., on *Hereward the Saxon Patriot;* to which is appended the PEDIGREE of the WAKE Family descended from HEREWARD. There are six beautifully illustrated charts of this pedigree, and we may add that the HEREWALD WAKE there named succeeded to the baronetcy in April, 1865, on the death of his father SIR WILLIAM WAKE. SIR HEREWALD, then, is the living representative of our Great Fen Hero.

We have placed a copy of the above Report and Pedigree in the Wisbech Museum for the convenience of any who may wish to refer to them.

cause of his Saxon kindred, and the opportunity now offered to shew some resistance to WILLIAM; and the taking of the stolen treasures to Ely indicates that HEREWARD had fixed upon that spot as his retreat—*his camp of Refuge.*

The Isle of Ely was then an island really.

HEREWARD was soon joined by other patriots who swelled the ranks of the "revolters" in the Isle. ÆTHELWINE, bishop of Durham, who had previously taken refuge in Scotland, came hither. EADWINE and MORKERE revolted in April, 1071, the former strove to reach Scotland, but was slain; the latter came to the camp. SIWARD, a Northumbrian thane, also joined HEREWARD; but of the presence of STIGAND and FRITHRIC of St. Alban's, there is no historical proof, notwithstanding that some general (not only local) histories have asserted it as a fact.

We are told that men from Berkshire repaired to the "Camp of Refuge" and that everything bade fair for a long defence."*

Here we may introduce a passage which will shew what we have before intimated, that the Britons held their own, to some extent, in this district, till the time of the Norman Conquest.

"The Fenland was, of all parts of Britain, one of the best suited for the last remnants, either of a vanquished nation, or of a vanquished political party, to hold out against their enemy till the last. There is reason to believe that some isolated spots in this wild region had been held by remnants of the old Keltic inhabitants for ages after Eastanglia and Mercia had become English ground. It is even possible that, here and there, an outlying British settlement may have lingered on to the days of WILLIAM, and that HEREWARD, as well as EADRIC on the other side of England, may have found allies among the descendants of

* Norm. Conq. vol. IV. pp. 468-69.

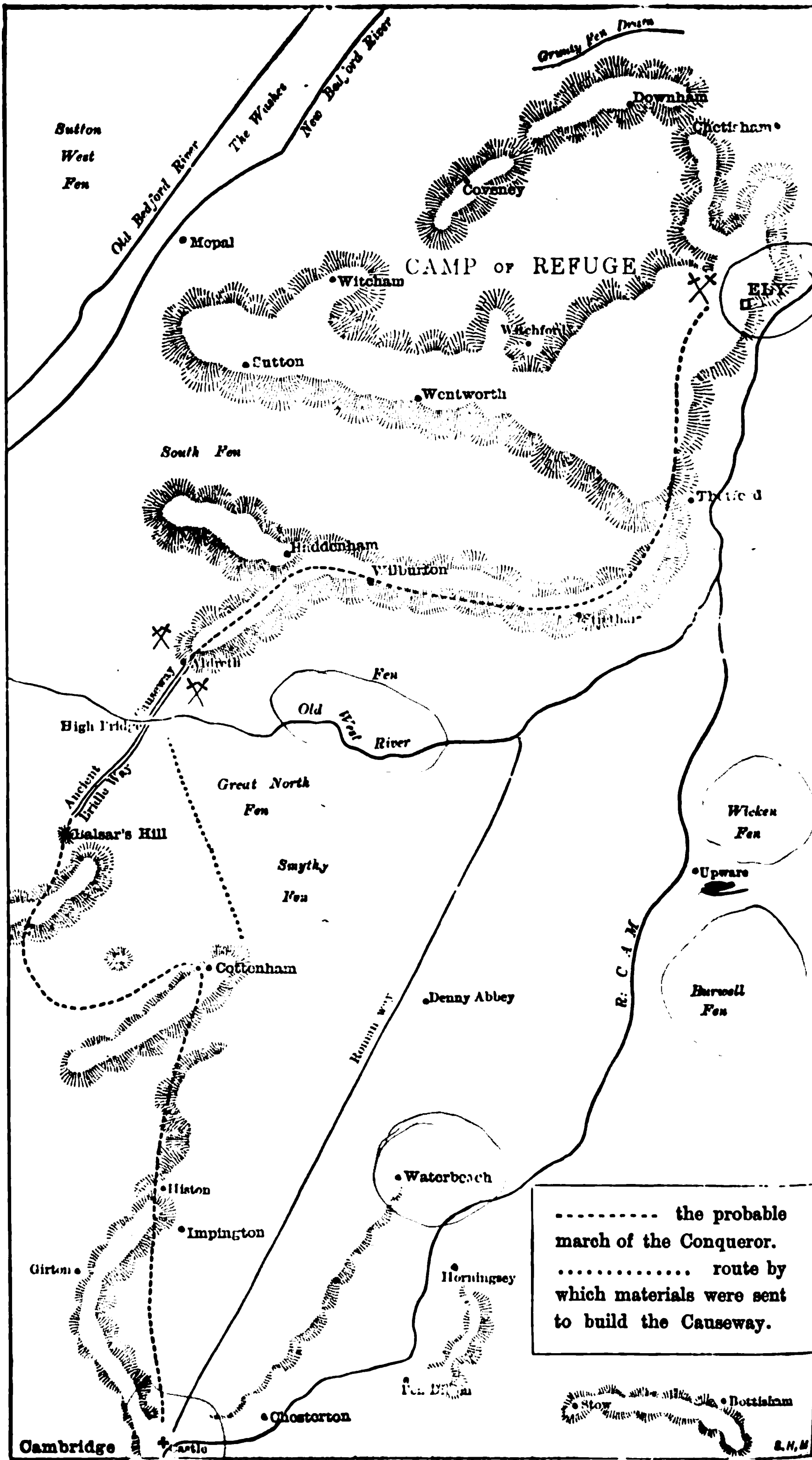
those whom his fathers had displaced. In after days the land which had thus sheltered the last relics alike of British and English independence, sheltered the last relics of the party which had fought for the freedom of England by the side of SIMON of Montfort."*

WILLIAM fixed his head quarters at the castle which he had built at Cambridge, and laid his plans for a regular blockade of the Isle. His ships were collected in the Wash to guard every inlet of the Fens, and the soldiery were posted at every approachable roadway from Brandon round to the south-west of Ely.

Attacks were made in the Isle from different points, sometimes by water from the direction of Brandon, at another time from the neighbourhood of Reach (just on the south border of the fen country), whence there was a water communication with the Ouse. At present this point is indicated by the Reach Lode and Burwell Lode, which unite with the Cam near Upware, about three and a half miles South of the confluence of the Cam and Ouse.

Details of the attacks by water are very meagre, but it is evident the Normans were repulsed on the watercourses, for WILLIAM was compelled to make his regular siege operations in another direction. For some reason or other he could not approach Ely by what was presumably the regular road —the Roman Way, from the castle—through Stretham and to the west of Thetford; but he took a course north, by Histon, or thereabouts, to Cottenham, which is situated on a high ridge just bordering on that part now called Smythy Fen. Here materials were collected for the construction of a causeway at Aldreth to the north of that branch of the Ouse known at present as the Old West River. From Cottenham those materials—viz., stone, trees and hides, &c.,

* MR. FREEMAN cites a passage from the His. of Ramsey, p. 86, in proof of the existence of Britons in the Fenland in the reign of CNUT. (See Norm. Conq., vol. IV. p. 470, note 1.



Map shewing the Conqueror's approach to Ely and the high ground of the Isle of Ely proper.

were conveyed by water.* But west of Cottenham were Belsar's Hill and Willingham Points, probably occupied by WILLIAM's soldiers. "The camp that was occupied by the Conqueror's army when he besieged the Isle of Ely is still visible at the south end of Aldrey Causey,† within the manor of Wivelingham, and is corruptly called Belsar's Hills." (BENTHAM, p. 104.) MR. CAMDEN did not know what was meant by that name. A MS., said to be in the Brit. Mus., states that it takes its name from "BELASYUS, Generall of the King's army."

The Saxons in the Isle, seeing that the Normans were now so closely approaching the Camp of Refuge, made desperate efforts to interrupt the operations of the work. Here, then, was the spot on which the greatest of HEREWARD's exploits were made. If legendary history may be credited, his attacks on the Conqueror's workmen and soldiers were sudden, mysterious, and murderous.

On the banks of the Ouse mighty struggles between Saxon and Norman took place, and the latter were offtimes driven back and their causeway demolished. It is not our purpose to dwell upon (but simply to mention) those legendary tales about HEREWARD's assuming the vocation of a potter—of his visit to Brandon, while the king had his head-quarters there—of his conflicts with the king's menials and his miraculous escape to the isle. They may or may not be veritable history. But, no doubt, a pretended sorceress was employed. HEREWARD, perhaps, assumed the garb of a fisherman, and at night set fire to the partially-

* But the main approach was not by either of these great roads (Akeman Street and *via* Devana,) but at a point called Ædreth, a corruption of the name of the patron saint ÆTHELTHRYTH." FREEMAN, vol. IV. p. 464. (The *th* may have glided into *d* by Danish and Norman influence. A sound nearly like our *th* is written by the Danes *d* as *fader*, father.)

† "In the Gesta Herewardi (57) the place is called 'Abrehede . . . . . . ubi minus aquis et palude prœcingitur [insula].' In the Ely History, (Liber secundus) 229, it is 'Alrehethe, ubi aquæ insula minus latæ sunt.' The bridge, when I was there, looked very much as if it had been broken down by HEREWARD and not mended since." FREEMAN, Norm. Conq., vol. IV. p. 465.

constructed causeway. And it is probable that the setting fire to the dry reeds may have been adopted to arrest the progress of the Conqueror, but whether this occurred precisely when the witch was making *her third spell* is a matter of no moment.

DUGDALE associates the conspiracy at the wedding of RALPH, Earl of the East Angles, with this period, whereas, WILLIAM's attack on the Isle of Ely took place in 1071, and RALPH's marriage in 1076.* The reduction of the Isle of Ely was the toughest piece of business which WILLIAM had to do in England, for the stoutest hearts of the Saxon race had mustered there, and the waters of the fens were their bulwark. And, after all, it was not the wavering of those stout hearts, but the treachery of the monks, whose hearts were touched by the loss of the lands on the borders of the Isle, that led to the betrayal and dispersion of the last of the old Saxon heroes.

The camp had been regularly blockaded for some months, and WILLIAM fondly hoped that famine would do what the force of arms could not accomplish. Privation, or threatened want, is said to have determined the monks in making their secret overtures to WILLIAM. Some hope they may have had that by thus yielding, they would be allowed to retain their office or regain their lands.

The Conqueror's soldiers were guided by a route known to the monks, and suddenly the Camp of Refuge was forced. HEREWARD found himself assailed by overpowering numbers, against whom it was fruitless to contend. Some historians tell us that many of the brave defenders of the Isle were put to the sword; yet we think this is true of those only who fought in the storming of the line of defence. Such as gave themselves up as prisoners were mutilated or imprisoned. MORKERE threw himself upon the mercy of the

* See Supra, p. 100.

king—and the mercy he obtained was imprisonment for life in Normandy, and SIWARD, the thane, met a similar fate. HEREWARD did not submit, but valorously made his escape from the Isle, and reached some ships which were kept in readiness, and took to the open sea on the coast of Norfolk. We learn that he, eventually, fixed his abode on his own lands in Lincolnshire, where he was joined by his partisans, and from whence he carried on a guerilla warfare that greatly harassed the Normans; but, seeing that the struggle was hopeless, he at last made peace with the king, took the oath of allegiance, and henceforth was allowed to enjoy his ancestral estates.

Mighty deeds are told of this hero of the Fens; legendary history, here as elsewhere, has been a fertile source of speculation; marvellous feats and contests requiring superhuman strength and endurance are attributed to the lord of Brunne. Valiant he was, no doubt, and Norman as well as Saxon were wont to say that HEREWARD, and three more such as he, would have frustrated the designs of the Conqueror of Senlac. Long was the memory of this last of the Saxons fondly cherished by our countrymen—and proudly is that memory cherished by the fenmen even of to-day.

Abbot THURSTON, and some of his monks, have the credit for giving WILLIAM the cue which led to the reduction of the Isle; they are said to have gone to Warwick to make submission. Soon after the victory, the king paid his devotions at the altar of ST. ÆTHELDREDA. This religious act made so deep an impression upon him that he condescended to take 700 marks, which were really augmented to 1000, on the pretence that he was displeased with the conduct of the monks. THURSTON, too, had to make the most abject obedience in order to assuage the king's wrath for something "which is not mentioned." On the death of this abbot, WILLIAM purloined the plate and other valuables of the Abbey, and it is gratifying to believe that THEODWIN, the appointed successor of Thurston—Norman monk though he was—did not accept the office till the king returned the spoil. The estates of the church, given to the Normans while the Isle was under siege, were in the power of the foreigners for some time. After a great struggle, the king was prevailed upon to allow a council of inquiry to be held respecting the illegality of holding these lands; the assembly, eventually, met at Kentford, in Suffolk, and the issue was "the church of Ely was put in possession of all the Rights, Customs, and Privileges it enjoyed at the time of King EDWARD's death" (BENTHAM.)

Another trial which the church had to bear was that imposed upon it by the tenure of Knight's service. When the great survey had been made, the king commanded the attendance of all the great Churchmen, as well as of the Barons, to meet him at Salisbury (Aug. 1086.) Here, they, with their complement of men, had to attend and swear fealty.*

The king fixed for Ely Abbey 40 Knights' fees, and refused to take a money consideration in lieu thereof. This was the number of soldiers which the monastery had to maintain; but WILLIAM RUFUS demanded double this number to aid him in suppressing the insurrection which favoured ROBERT.

Ely became a bishoprick in the reign of HENRY I., and HENRY, formerly bishop of Bangor, who had been so energetic in effecting this change, was the first bishop.

* At this convention, at Salisbury, all the sub-tenants, as well as the *Tenants in capiti*, had to take the oath of fealty to the king as lord paramount of all. This was more oppressive than the feudalism of the Continent, where the vassal took the oath of fealty to his own immediate *lord* only.

According to MATTH. PARIS, 1070 was the date when Knight-service was imposed on the church.

The Conqueror, in order to keep a check upon the north of the Isle, and probably to hold command of the river, built a castle at Wisbech, and placed a garrison of soldiers there, and appointed a constable over them. Local historians tell us it was at first an erection of *turf*. "By Domesday book it does not appear that any castle at that time existed at Wisbech. But WILLIAM the Conqueror, in the last year of his reign, erected a castle of stone . . . . At that time the waters of the Ouse, passing by Well, emptied themselves into the north sea beyond Wisbech, running a very short distance from the castle walls, and the exact spot of the building has been by CAMDEN, and other authors, shown to be where the late castle (taken down in 1816) stood. . . . . in the centre of that part of the town called the Crescent."* As a fortress it was dismantled in the reign of HENRY II.

SECTION VIII.—*Effects of the Conquest and events of the 12th and 13th Centuries.*

THE effects of the Norman Conquest were most severely felt by the citizens and burgesses, upon whom the burden of "dues and customs" were laid. In place of the old Saxon borough-reeve, the Bailiff (Fr. *bailler*, to farm out) had jurisdiction; of course, the highest bidder became the local ruler. Wisbech, Lynn, Boston, and other Fen towns were, no doubt, brought under this common bondage. Lincoln had formerly its port-reeve.

In time the Normans found that they could obtain larger revenues from the burgesses themselves than through the Bailiffs, and therefore the towns regained their ancient liberties to elect their own chief officer by paying a fixed rental to the king or feudal lord; but the old Saxon title

* WATSON'S Hist. of Wisbech, p. 123.

was, in the main, lost, and Mayor (Fr. *Maieur*) took its place. Of the few towns which obtained that privilege, early in the 13th century, Lynn was one of the first, for king John made it a free borough, and granted a charter of incorporation. There seems, however, to have been, between the bishop of Norwich and the Mayor of Lynn, some struggle for supremacy in municipal affairs; appeal was made to Henry VI., who is said to have favored the corporation, and "to have ordered the sword to be carried before the mayor."*

Yet Lynn was not the only privileged town, for in the 5th year of John's reign the men of Boston obtained a charter, by virtue of which they had power to appoint their own bailiff.† This town was then in a flourishing condition as a port. In 1205 it paid £780 as a tax, amounting to the fifteenth of the merchants' goods, while London paid only £836. The lords of Kyme and their confederates, by their sturdy resistance during the conquest, most likely secured the means of prosperity; they retained their estates though they could not hold them in chief.

In the reign of Stephen, the Isle of Ely had again become the arena of military strife. Nigel, the bishop of Ely, and Alexander, bishop of Lincoln, took the side of Matilda. The former, we are told, built a stone rampart amongst the bogs and fens—somewhere on the same spot that Hereward had had his camp. Stephen, following the method employed by the Conqueror defeated Nigel, who fled to Matilda at Gloucester, and assisted to rekindle the flames of insurrection in the West. Stephen went thither, and then the bishop of Lincoln mustered the scattered forces of

* Richards' Hist. of Lynn, vol. I., p. 387. Boston did not obtain a charter of incorporation till Henry VIII's reign. Nicholas Robinson was first Mayor in 1545. Wisbech, after the guilds ceased to be, received a charter of incorporation in the reign of Edward VI. Ten men were nominated in 1550. The first Town Bailiff, Richard Best, was elected in 1564—the first Mayor, Henry Leach, in 1835.

† Thompson's Hist., p. 771.

Ely, and gained the alliance of the earls of Lincoln and Chester. STEPHEN returned again to the Fen country, and proceeded to besiege Lincoln castle, which was in the hands of the above-named allies. While the king was thus engaged, the Earl of Gloucester crossed the Trent early in February, 1141, and appeared before Lincoln. STEPHEN gave battle, but was vanquished. Lincoln suffered considerable damage.*

Most of the stirring events of the last days of the unhappy king JOHN, occurred in the Fenland. The Isle of Ely was again a camp of refuge, to which many fled for the protection of their life and property. For some time JOHN had his head quarters at Lincoln; this post becoming untenable by reason of the growing power and military force of the barons, he marched southward toward Peterborough, then struck eastward by Crowland, plundering as he went toward Lynn, which was his military depôt. Having recruited there, he seems to have determined to fight one final battle with his foes, and then turning westward he proceeded by Wisbech, which may have been attached to his cause,† and then came that fatal crossing of the estuary of the Ouse—the conflict with the boisterous tide—not a battle with the barons—the issue is known, confusion, dismay, and soon after the monarch's death at Newark.

During the reign of HENRY III. the Isle of Ely again became the resort of the disaffected. After the battle of Evesham, (Aug. 1265) severe measures against the family and partisans of the late earl of LEICESTER were adopted by the advice of the parliament at Winchester. SIMON, the eldest surviving son of that earl, sought to defend himself

* The battle was fought without Newport-gate, upon the Lincoln Plain, February, 23rd, 1141. *The Lincoln Date Book.*

† See WALKER and CRADDOCK's His. of Wisbech, p. 210.

in the Isle of Axholm, and other disaffected barons, his partisans, obtained possession of the Isle of Ely, whence they made incursions against the king, while he was besieging the castle of Kenilworth.

The king and prince EDWARD besieged the Isle of Ely on all sides.* The earl of GLOUCESTER took up arms against the king, and the citizens of London made common cause with him. The Pope offered some wise counsel and a parliament was held at Marlborough, in Nov., 1267. Here the "Provisions of Oxford" were accepted as the ground of pacification, and the patriots of the Isle of Ely hearing this, gave up further resistance.†

Thus was the Isle the last to submit in the struggle for constitutional rights, nor did it yield till there was assurance that those liberties were secured, which were in all future ages to prove in no mean degree the foundation of England's greatness.

After the reign of HENRY III. there are few historical events which specially demand our attention here. The records become less and less distinctive, and gradually merge into the general history of the country. We shall in the next Chapter bring under our review the development of the English Language; then will follow a chapter on the dismemberment of the Monastic establishments; but the events connected with civil wars in the time of the Stuart dynasty, having been so fully dealt with elsewhere, need no comment from us.

Our readers, therefore, will regard the history of the Drainage of the Fens, taken in connexion with the geography of the Rivers-system, as the essential continuation of our narrative down to the present time.

[S. H. M.]

* SPEED, p, 550.

† "SIMON DE MONTFORT was the first statesman who perceived and fully appreciated the growing importance of the commercial middle classes in England . . . . . DE MONTFORT soon perished in the vicissitudes of civil war; but his reform measures perished not with him." (CREASY, on the Rise and Progress of the English Constitution, p. 193.)

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CHAPTER IV.

STANDARD ENGLISH—THE LANGUAGE OF THE FENLAND.

"Written English, 'Standard English' in the phrase of MR. OLIPHANT, is certainly neither the Northumbrian of York, nor the Saxon of Winchester. It is the intermediate Anglian speech of Eastern Mercia. It is the speech of a district, the exact bounds of which I will not take on me to define, but within which, one riding of Lincolnshire and part of another is certainly taken in. We might not be going very far wrong if we ruled that modern English is the language of the Gyrwas . . . . It was a Lincolnshire man, a Bourne man, who gave the English language its present shape." (FREEMAN *on Lindum Colonia.*)*

THE passage quoted above will convey to the reader the idea that the folks of the fens—especially of the area assigned to the Gyrwas, have no dialect; it is our purpose to demonstrate this. But more than this, we can assert that the genuine educated Fenman of South-west Lincoln and the Isle of Ely has few, if any, provincialisms, even of accent. It is not so with the natives of North Lincolnshire, or of Northumbria, for they have only to utter the word *more* or *man* to mark the 'shire' in which they dwell. In the main, the people of the fens have a very fair regard to orthoepy; we are speaking now of those called the 'common people,' and the aspirate is not much abused; in this respect they compare favourably with their western neighbours in Northamptonshire and thereabouts. MR. OLIPHANT remarks, "I visited Stamford in 1872, and found that the letter *h* was sadly misused in her streets."

* See a paper, read before the Lincoln Architectural Society at Grantham June 16th, 1875, and printed in MACMILLAN'S Mag., 1875.

But there are immigrants in the Fen district as well as elsewhere, and the speech of passers-by may be as bad representatives of the vernacular as some visages, taken at random, are of true English beauty. It is a fact, however, that in the eastern part of the Fenland there is often heard an interchange of *i* and *oi*, and a contraction of *his own* and *her own* into *hisn* and *hern;* yet we think these are not so grating as the *tew* (two) and *dew* (do) heard in Norfolk.*

In this county there is a neglect of ordinary grammatical forms—thus we hear, 'he have,' 'he do,' in general talk. [No doubt, as education advances, the grosser expressions like *yow* (you), *bor* (allied to *boor*, and Ger. *bauer*, a peasant, will be eradicated.] But we have to show that the Fenland was the cradle of modern classic English; that here was the fusion of those elements of speech into a dialect which was to grow into a model language, the vehicle of thought for a great nation—a language more widely used at the present day than any other on the globe.

And then the enquiry arises—What were the circumstances that favoured the development and spread of this East Midland Dialect? Can we find a solution of this question in the fact that certain institutions fostered this dialect? or that some individual genius employed it in his literary works? In both.

"It may seem strange that England's now standard speech should have sprung up, not in Edward the First's Court, but in cloisters on the Nene and the Welland. We must bear in mind that the English Muse, as in the tale of the Norfolk bondman (farmer), always leaned towards the common folk; it was the French Muse that was the aristocratic lady."†

* The writer does not claim descent from the Gyrvii, and therefore feels at liberty to make a few criticisms which may apply even to his own county.

† "The Sources of Standard English, by T. L. Kington Oliphant, M.A., Macmillan and Co., 1873. Mr. Oliphant has worked out this matter so thoroughly that we cannot do better than refer to his book to illustrate our remarks as we proceed.

In no part of England, perhaps, was there such a cluster of monastic institutions, within the same limits, as in the Fens (there were four mitred abbots)—none that could enjoy such seclusion. Here men had the leisure and opportunity to think and write. The Saxon monasteries, ~~too~~, were the chief, or, perhaps, the only schools for education, and they very early obtained certain privileges on that very account. But this was not all, by the banks of these fen rivers, and in the neighbourhood of these monasteries, there was a fusion of races—a Dano-Anglian amalgamation; and, in all probability, this union was more resistant to the inroad of French influences than was the Saxon race of Wessex, though it could not repress them altogether.

To make Norman-French the dominant language was part of the Conqueror's programme; many French words did take root, and they remain to the present day. But the time came when Norman despotism waned, and the feudal sway declined, and then this Dano-Anglian speech gained strength, and in the 14th century became the language of the Court. (In 1362 English was made the language of the law courts.)

But we cannot attempt a connective history of this language; we can do little more than direct the reader's attention to the subject, and make a few references to the work already quoted, by way of illustration.

Mr. Oliphant tells us that "of all cities, none has better earned the homage of the English patriot, the English scholar, and the English architect, than Peterborough . . . Without the Peterborough Chronicle we should be groping in the dark for many years, striving to understand the history of our tongue." This writer traces the development of the East Midland Dialect—shows how Norse forms cropped up—how such expressions as *was it noht lang* was used long before the middle of the 12th century—a form not known to London even till two centuries after; "Peterborough, it is plain, has had more influence upon our speech than London."

The New speech made its way southward, and Cambridge has some share in the glory of a conquest won so noiselessly. But to be enduring, this speech must have gained acceptance in the grand centres of civilization—London, Oxford, and Cambridge. The latter lay within the boundary of this Midland Speech, and her students, who came from all parts of England, helped, no doubt, to spread the dialect.

We learn that a young man from Bourn came to Cambridge about 1300, or a little earlier, and saw there Robert Bruce, afterwards king of Scotland, as he tells us in a poem."* This young man was ROBERT MANNING, or ROBERT of Brunne, a poet, and the patriarch of the New English.†

In respect, then, to our classic English, the Fenland may claim that to her belongs the POET OF THE PAST.

DR. LATHAM used to tell us, in his "English Language," that, broadly, the *Old* English began with Henry the Third's reign and ended with that of Edward the Third—(and he included the poems of ROBERT of Brunne in the *old* English)—that Middle English followed, and that the era of New English began in the reign of ELIZABETH.

But we have now to date back the beginning of New English to the early part of the 14th century. It was the time (in 1303 A.D.) when "DANTE had been at work upon

* See extract from p. 202 of "Standard English."

"Now of kyng Robin salle I ȝit speke more,
& his broþer Tomlyn, Thomas als it wore,

. . . .

Of arte he had þe maistrie, he mad a corven kyng,
In Cantebrige to þe clergie, or his broþer were kyng.
[NORTH LINCOLNSHIRE.]

† MANNING was a Gilbertine canon in the monastery at Bourn.

the loftiest part of his Divina Commedia; at the precise time that MANNING was completing his Handlyng Synne,—the first thoroughly formed pattern of the New English."

"Almost every one of the Teutonic changes in idiom, distinguishing the New English from the Old, the speech of Queen VICTORIA from the speech of HENGIST, is to be found in MANNING'S work. We have had but few Teutonic changes since his day, a fact which marks the influence he has had upon our tongue."

But the language with which MANNING started was the Dano-Anglian dialect.

We shall quote a specimen of ROBERT MANNING'S poetry from the Handlyng Synne of which MR. OLIPHANT remarks, "Had the Handlyng Synne been a German work, marking an era in the national literature, it would long ago have been given to the world in a cheap form." *May we express a hope that such will soon follow this notice of our Fen Poet—the first great writer in our modern classic English.*

[We select a portion of the poem descriptive of a remarkable bishop of Lincoln, ROBERT GROSTHEAD—(MANNING used the French form GROSTEST)—in allusion to the bishop's large head. ROBERT GROSTEST, properly ROBERT COPLEY, a native of Suffolk, was tenth bishop of Lincoln and a man of great learning and ability; from his refusing to obey certain dictates of the Pope, he has been called 'a Protestant in Popish times.' He died in 1253.]

The following appears on the title page of a copy of this book now in the British Museum.

ROBERT OF BRUNNE'S

HANDLYNG SYNNE,

(Written A.D. 1303)

With the French Treatise on which it is founded,

. .

'Le Manuel des Pechiez,' by WILLIAM OF WADINGTON, now first printed from MSS. in the British Museum and Bodleian Libraries,
Edited by F. J. FURNIVALL, ESQ., M.A.
Printed for the Roxburgh Club, London,
J. B. NICHOLS AND SONS, 1862—(4to.)

MANNING says—

"For lewdë* men y vndyrtoke
On englyssh tunge to make þys boke,"

[* *lewyde*, unlearned or ignorant; from A.S. *læwede*, laical. See line 43 of prologue and French line 113—Par la laie gent ert fet (ert, c'est escrit.)]

This *Handbook of sins* treated of the seven deadly sins, as illustrated by legendary tales.* But the verses we have selected are *not* translated from the French—they are ROBERT'S own composition—and others may be found in "*The Sources of Standard English.*"

VERSES ON THE BISHOP OF LINCOLN.†

"Y shall you ʒow telle as y have herde
Of þe bysshope Seynt Roberde,
Hys toname‡ ys Grostest surname
Of Lynkolne, so seyþ þe gest.|| So saith the Story
He lovede moche to here þe harpe;
For mannys wyt hyt makyþ sharpe;
Next hys chaumbre, besyde hys stody,
Hys harpers chaumbre was fast þerby.
Many tymes be nyʒtys and dayys,
He had solace of notes and layys.
One askede hym onys,§ resun why
He hadde delyte yn mynstralsy:
He answerede hym on þys manere,
Why he held þe harper so dere:
'Þe vertu of þe harpe, þurghe skylle and ryʒt,
Wyl destroye þe fendes myʒt,

* The seven were, pride, anger, envy, sloth, covetousness, glut, lechery.

† The Saxon Letters—
Ð, ð = the flat sound of our *th* in *thine*.
Þ, þ = the sharp sound of our *th* in *thin*.
ʒ = the *g* = the initial *y*, and = *gh* medial, as ʒe = ye, and ryʒt = ryght.

‡ surname. || story. § once.

And to þe croys by gode skylle
Ys þe harpe lykenede weyle.*
Anoþer poynt cumforteþ me,
Þat God haþ sent unto a tre
So moche joye to here wyþ eere;
Moche þan more joye ys þere
Wyþ God hym selfe þere he wonys,†
Þe harpe þerof me ofte mones,—‡
Of þe joye and of þe blys
Where Gode hym self wonys and ys.
Þare for, gode men, ȝe shul lere,||
Whan ȝe any glemen here,
To wurschep Gode at ȝoure powere,
As Davyde seyþ yn þe sautere,
Yn harpe, yn thabour, and symphan gle,
Wurschepe Gode, yn troumpes and sautre,
Yn cordys, an organes, and bells ryngyng,
Yn al þese, wurschepe ȝe hevene kyng.'"

MANNING tells the tale of two good women who never had a word with their husbands for 20 years. (They were Fenland women, no doubt, and we hope there are many such now-a-days). He comments thus—

"A godë womman ys mannys blys
Þere here love ryȝt and stedfast ys;
Þere ys no solas vnder heuene
Of allë þat a man may neuene
Þat shulde a man so mochë glew
As a gode womman þat loueþ trew.
No derer ys none yn Goddys hurde
Þan a chaste womman wyþ louely word."

Perhaps the reader would like this bit of *The Handlyng Synne* in modern dress:—here it is—

"A good woman is man's bliss,
Where her love right and stedfast is,
There is no solace under heaven,
Of all that a man may neven, *(know)*
That shall a man so much glew, *(please)*
As a good woman that loveth true.
No dearer is none in God's herd
Than a chaste woman with lovely word."

* well. † dwells. ‡ reminds. || learn.

It is notable that in *The Handlyng Synne* may be found many of the adverbial and other phrases in common use at the present day—as

> "One of þys dayys shul ȝe deye."
> "And sette at noȝt þat he hadde told."
> "And to þe ded was as trew as steyl."

We shall now take a leap over some five centuries or more—for the student of *English* needs not our help to trace out for himself even a sketch of the various modifications, clippings, or foreign additions in our speech, and we find ourselves in company with a county-man of Robert Manning's, the author of "*The Northern Farmer*"—a poet who "has done much for the revival of pure English."* This poem contains some of the old forms—as we shall see by comparing a few passages—forms which have disappeared from modern *refined* speech.

From "*The Handlyng Synne*"—

> "He ys wurþy to be shent *(disgraced)*
> For *a*† doþ aȝens þys comaundment."

From "*The Northern Farmer*"—

> "But Parson *a* comes an' *a* goes, an' a says it eäsy an' freeä."

From "*The Handlyng Synne*"—

> "Men askede hym why he þedyr ȝede,
> *Syn*‡ he was an holy man yn dede" *(indeed.)*

From "*The Northern Farmer*"—

> "I've 'ed my point o' aäle ivry noight *sin*' I beän 'ere."

Leaving further comparisons of this kind to those who are curious to make them, we pass on to take a peep at a few passages in the writings of the Poet ~~Laureate,~~ whose

* "The Sources of Standard English," p. 319.
† *a* is contracted from *ha* which was formerly *he*.
‡ This was clipped from the Sax. Siððan, since.

style bears the impress of Fen scenery and colouring; and without in any degree attempting a biographical sketch, we may say that in respect to modern classic English, the Fenland lays some claim to THE POET OF THE PRESENT.

Born at a village by the south of the Wolds—not far from the spot where the *Steeping* enters the Fens, he received his early impressions of scenery from the objects in the neighbourhood; there were the dark Wolds to the north; the wide-spreading Fens to the south—and the "brook" that drained the gentle slope on which the home of his childhood stood. From the allusions made to the "brook," we gather that the young poet often wandered on the banks of "a rivulet, then a river." A little below Somersby it is dammed to form a mill stream, and it may be that at Stockworth Mill, "*The Miller's Daughter*" was conceived.

> "How dear to me in youth, my love,
> Was everything about the mill,
> The black and silent pool above,
> The pool beneath that ne'er stood still.
>
> . . . .
>
> I loved from off the bridge to hear
> The rushing sound the waters made,
> And see the fish that everywhere
> In the back-current glanced and played."

Other allusions to this early home are found in the "*Ode to Memory*," and in "*In Memoriam*," the gently winding course of the *Steeping* is sketched by a line or two which shew that it swerves:—

> "To left and right thro' meadowy curves,
> That feed the mothers of the flock."

In the "*Ode to Memory*" the poet describes the sea-coast of Lincolnshire—a coast from which the waters ebb afar

> "Stretched wide and wild the waste enormous marsh."

And in the "*Palace of Art*" we see

> "A still salt pool locked in with bars of sand,
> Left on the shore, that hears all night
> The plunging seas draw backward from the land
> Their moon-led waters white."

Again, in

> "Locksley Hall that in the distance overlooks the sandy flats,
> And the hollow ocean ridges roaring into cataracts."

Then a pleasant sea-view in "*The Lotus Eaters*"—

> "How sweet it were . . . .
> To watch the crisping ripples on the beach,
> And tender curving lines of creamy spray."

Have we not the imagery and tinting of this district, portrayed in, "one willow over the river wept," "the soughing reeds," "the tangled water courses," "the barges trail'd," "the marish green," "the clustered marish mosses crept," (marish, *fenny* or *marshy*), and "the bulrush in the pool?"

But we select a few other verses, from MR. TENNYSON'S poems, which will shew, we think, some Fen scenes drawn with his own peculiar delicacy.

Here's one from "*Mariana*"—

> "From the dark fen the oxen's low
> Came to her; without hope of change
> In sleep she seem'd to walk forlorn,
> Till cold winds woke the grey-eyed morn
> About the lonely moated grange."

From "*New Year's Eve*"—

> "The building rook 'ill caw from the windy tall elm tree,
> And the tufted plover pipe along the fallow lea.
>
> . . . .
>
> When the flowers come again, mother, beneath the waning light,
> You'll never see me more in the long gray fields at night;
> When from the dry dark wold the summer air blows cool
> On the oat-grass and the sword-grass and the bulrush in the pool."

From "*The Dying Swan*"—

"Some blue peaks in the distance rose,
And white against the cold-white sky,
Shone out their crowning prows,
One willow over the river wept,
And shook the wave as the wind did sigh;
Above in the wind was the swallow,
Chasing itself at its own wild will
And far thro' the marish green and still
The tangled water-courses slept,
Shot over with purple, and green, and yellow.

. . . .

And the creeping mosses and clambering weeds,
And the willow-branches hoar and dank
And the wavy swell of the soughing reeds,
And the wave-worn horns of the echoing bank,
And the silvery marish-flowers that throng
The desolate creeks and pools among,
Were flooded over with eddying song.

From "*The Lady of Shalott*."

"On either side the river lie
Long fields of barley and of rye,
That clothe the wold and meet the sky
And thro' the field the road runs by
To many-tower'd Camelot;

And up and down the people go,
Gazing where the lilies blow
Round our island there below,
The island of Shalott.

Willows whiten, aspens quiver,
Little breezes dusk and shiver
Thro' the wave that runs for ~~ever~~ ever!
By the island in the river
Flowing down to Camelot.

Four gray walls, and four gray towers,
Overlook a space of flowers,
And the silent isle imbowers
The Lady of Shalott.

By the margin, willow-veil'd
Slide the heavy barges trail'd
By slow horses; and unhail'd
The shallop flitteth silken-sail'd
Skimming down to Camelot:

But who hath seen her wave her hand?
Or at the casement seen her stand?
Or is she known in all the land,
The Lady of Shalott?"

[S. H. M.]

DIALECTIC OR PROVINCIAL WORDS, OF SCANDINAVIAN ORIGIN,

Used in Norfolk and Lincolnshire.

[Communicated by the REV. JOHN DAVIES, M.A. (Cantab),
(sometime) Rector of Walsoken.]

AUTHORITIES FOR DIALECTIC WORDS.

Dictionary of Provincial and Archaic Words, by J. O. HALLIWELL.
Vocabulary of East Anglia, by the REV. R. FORBY.
Lincolnshire Provincial Words, by J. E. BROGDEN.
English Dictionary, by N. BAILEY, ed. 1724.

SCANDINAVIAN AUTHORITIES.

Icelandic (Old Norse) Lexicon, by HALDORSON.
Swedish Dictionary, by DAHNERT.
Swedish Provincial Dictionary, by J. E. RIETZ (1867.)
Danish Dictionary, by WOLFF.
Danish Provincial ditto, by MOLBECH.
Glossarium Sui-Gothicum, by IHRE.
Glossarium der Friesischen Sprache, by OUTZEN.
Idiotikon Frisicum, by DE HAAN HETTEMA.

Abbreviations:—N. Norfolk. L. Lincolnshire. O. N. Old Norse or Icelandic. Sw. Swedish. Dan. Danish. Norw. Norwegian.

Barren—the vagina of a cow, (L.) Prov. Sw. *bärane;* Prov. Dan. *bærend*, id.

Bask—to beat severely, (N.) Norw. *baska;* Prov. Sw. *basa*, to beat, to strike heavily.

Big—a kind of barley, (N.) O.N. *bygg*; Dan. *byg*, barley.

Bob—a bunch, (L.) O.N. *bobbi*, a knot, a round lump.

Boof—stupid, (L.) O. N. *bofi*, Sw. *bof*, a low fellow.

Bramish—to assume affected airs, to brag, (N.) Prov. Sw. *brama*, to be consequential or ostentatious; O. Sw. *bram*, pomp, pride; Dan. *bramme*, to boast, to brag.

Brangle—to dispute (L.) O.N. *branga*, tumult, disturbance; Prov. Sw. *brang*, a turbulent dispute or quarrel.

Brattle—to lop off branches of trees, (N.) Prov. Dan. *bratta;* O. N. *briota*, to break off.

Breck—a piece of unenclosed arable land, a sheep walk, (N.) O. N. *brecka*, the slope of a hill.

Brump—to lop trees in the night clandestinely, (N.) Prov. Sw. *brumm*, leaves and small branches of trees.

Brunt—unceremonious, (L.) Sw. *brant*, rough, rude.

Caddy—hale, hearty, (L.) O. N. *katr*, lively, merry.

Car—fen land, a marsh; also a gutter, (N.) Sw.-Goth. *kærr;* O. N. *ker*, a marsh.

Catch, a small trading vessel, used in inland navigation, (N.) O. N. *kaggi*, a keg, a small vessel or cask; *kuggi*, a little ship; Sw. *kag;* Dan. *kog*, id.

Cauf—a bulge in a bank or wall, (L.) O. N. *kulpa*, to swell out. Hence O. N. *kalfi;* Prov. Sw. *kalv*, calf (of the leg) from its form.

Charmed—eaten by rats or mice (L.), "The mice *charmed* the harden poke and let out the chisels." O. N. *karma*, to divide, to separate.

Checkory—lumpy coal, (L.) O. N. *keckr*, a lump, a clod.

Clink—smart; "*clink* and clean," smartly or entirely performed, (L.) Prov. Sw. *klank*, clean, pure.

Clecks—chaff left in dressed corn, (L.) O. N. *klacki;* Dan. *klik*, a fault, a blot or blur.

Coggles—small round stones used for paving, (L.) O. N. *köggul*; Prov. Sw. *kägla*, to make small heaps; Dan. *kugel*, a ball, a globe; Prov. Dan. *kugel*, round.

Crease—a split or rent, (N.) O. N. *krassa*, to tear; Sw. *krossa;* Prov. Sw. *krasa*, to tear asunder.

Creepers—grapnel hooks, (N.) O. N. *kryppe*, a curve or a curved thing; Prov. Sw. *kryppog*, crooked.

Culpit—a large lump of anything, (N.) Prov. Sw. *kullp*, a clumsy heavy man, a short thick female.

Cump—a ball, (L.) Norw. *kump*, a round lump; Prov. Sw. *kamp*, round stones; *kumpa*, to cut off a round piece.

Dag—a *day* of rain, a slight misty rain; (N.) O. N. *dögg*, fine rain, dew; Sw. *dagg*, dew.

Dills—the paps or teats of a sow, (N.) Prov. Sw. *del*, the teat of an animal; [O. H. G. *tila*, mamma.]

Ding—to beat, to knock, (N.) O. N. *dengia*, to thump, to bruise.

Dollop—a shapeless lump, (N.) O. N. *dolpr*, a large fat animal.

Droll—to put off with excuses, (N.) O. N. *drolla*. to delay, to put off.

Dunk, Dunky—a pig of a short, thick-set breed, (L.) Sw. *tung*, heavy, thick, gravid; O. N. *thungr*, heavy; Prov. Dan. *tuun*, thick, fat.

Feague—to be perplexed, to be restless, (L.) O. N. *fika*, to move about in a restless manner; Prov. Sw. *fika;* Prov. Dan. *fige*, to move hastily.

Feit—a field, (L.)

Fete—a large puddle, (L.)

Fitty—marsh land by the sea, (L.) O. N. and Su.-Goth. *fit*, a marshy plain, marsh land near the sea; Prov. Dan. *fied*, a large open plain.

Flit—to remove from from one house to another, (N. and L.) Dan. *flytte*, to remove, to change one's abode.

Frack—to abound, swarm or throng, (N.) O. N. *frekia*, abundance; *freckr*, abundant; Prov. Dan. *frakket*, plump, full-grown.

Freat—a recipe, (L.) O. N. *frædi*, knowledge, instruction.

Frowy—stale, not sweet, (N.) O. N. *frugga*, to become unsound or mouldy; *frugg*, musty hay.

Gag—a hoax, (L.) "That's all *gag*," that is all nonsense or humbug, O. N. *gaga*, to mock; *gagr;* Prov. Sw. *gager*, wild, insolent.

Gant—a village fair or wake, (N.) O. N. *gant*, sport, merriment.

Garle—to spoil butter by handling it with hot hands, (N.)

Garled—streaked, spotted, (N.) Prov. Dan. *gaare*, a streak, a vein.

Gimber, Gimmer—a female sheep that has not been shorn, (L.) Prov. Sw. *gimbur*, a young sheep, that has not had a lamb; Dan. *gimmer*-lam, an ewe-lamb.

Gimble—to grin or smile, (N.)

Gimlin—a smiling or grinning face E. (H.) Prov. Sw. *gimla*, to twist the mouth about, to grin.

Goaf—a rick of corn laid up in a barn, (N.)

Goave—to lay up corn in a barn, (N.) Ex. "Do you mean to *stack* this corn or to *goave* it?" Prov. Dan. *gulve*, to lay up corn or hay in a barn; *gulv*, a partition in a corn-store or barn.

Gob—a mouth, (L.) Dan. *gab*, the mouth; O. N. *gopi*, a cavity.

Granein—the fork of a tree, (L.) O. N. *grein;* Sw. *gren*, the fork of a tree, a bough or branch.

Gulp—the young of an animal; a short squabby person, (N.) Prov. Sw. *kullp*, a short thick person; O. N. *kulpa*, to swell out.

Hame—the steam from boiling water, (L.) Prov. Sw. *äma*, a breath of wind; O. N. *eimr*, *eymr*, breath, vapour. [N. Fries. *ome*, *ame*, breath; Goth. (ULPHILAS) *ahma*, breath, soul.]

Harr—a sea mist, (L.) Prov. Dan. *har*, the thick mist that sometimes rises in hot weather.

Haze—to dry by exposing to the air, (N.) Prov. Sw. *äsa*, to hang up in order to dry.

Hawm—to loll, to lounge, (L.) O. N. *hyma*, to waver as one who is sleepy.

Hike—to go away, (N.) O. N. *hika*, to go, go away, to retreat.

Hile—to oppose, to hinder, (L.) Prov. Sw. *hila*, to bind, to skackle.

Hobby—a roadster, a hack, (L.) Dan. *hoppe*, a mare.

Hoist—a cough, to cough, (N.) O. N. *hosta*; Dan. *hoste*, to cough; [A. S. *hwostan*, to cough.]

Huskin—a clod-hopper, (L.) O. N. *huski*, a rustic.

Izles—smuts, floating particles of soot, (L.) (primarily, sparks from glowing embers), Prov. Sw. *ysla*, glowing embers; O. N. *usli*, fire.

Keb—to pant for breath, to sob, (L.) O. N. *keypa*, to puff or blow, as a seal.

{**Kett**—carrion, (N.)
{**Ketty**—nasty, stinking, (N.) O. N. *kött*, *ket*, flesh; Dan. *kiod*, id.

Kevir—to blubber, to cry, (L.) O. N. *keypar*, a howling or bellowing.

{**Kick**—novelty, fashion, (N.)
{**Kickey**—showy, (N.) Dan. *skik*, manner, fashion.

Kink—to strain or injure a tool, (L.) O. N. *kinkia*, to turn, to twist.

Lall—a petted, spoiled child, (N.) O. N. *lalla*; Dan. *lalle*, to babble as a young child.

Lam—to beat severely, (N.) O. N. *lemia*, to beat, to strike; *lama*, to break, to bruise.

Lire—to plait a shirt, (L.) Prov. Sw. *lira*, to twist, to fold.

Lite—to depend, to rely on, (L.) O. N. *lita*, to look, to look at.

Logger—to shake and jolt, as a wheel which is not perpendicular to its axis, (N.) Dan. *logre*, to move up and down, to wag (the tail.)

Lop-start—the stoat, (N.) O. N. *lopi*, a lump, a swelling; *stertr*, Dan. *stjert*, a tail.

Louk—coarse grass on sea banks or fen lands, (L.) O. N. *laukr*, any succulent herb.

Lubbard, Lubber—a dolt, a big cowardly boy, (L.) O. N. *lubbi*, a heavy, lazy hind.

Lunt—short or surely, (N.) O. N. *lunti*, rustic, rough, surly.

Meg—to peer about, (L.) Prov. Dan. *mige*, to look or aim.

Mog—to move, to go forward, (L.) O. N. *moka*, to move.

Moke—a mist, thick foggy weather, (L.) O. N. *mugga*, a mist of rain or snow.

Moozles—a slow person, a stupid sloven, (L.) Prov. Dan. *mosle*, to be dull or lazy at work.

Mugging—a beating, (L.) Prov. Sw. *muka*, to dig; prim. to strike, to pierce; O. N. *moka*, to strike, to hew.

Netting—urine, (L.) Prov. Dan. *nette*, urine.

Pammy—thick, fat, (L.) Prov. Sw. *pamp*, a large man; *pampa*, to walk heavily; *pampen*, swollen; Prov. Dan. *pamper*, a thick, fat man.

Pingle—to eat delicately or in small quantities, to trifle with work, (N.) Prov. Sw. *pyngla*, to be busy about small matters, to work lazily.

Pounce—a blow, (N.) Prov. Sw. *punnsa*, to strike, to dash.

Raffle—to stir the blazing faggots in an oven; to move or fidget about, (L.) O. N. *hrafla*, to sweep, to scrape; *rafa*, to wander up and down; Prov. Sw. *raffla*, to strike, to rake out.

Rag—to tease; also, to revile, (L.) O. N. *raga*, to abuse, to revile; *ragna*, to curse; Prov. Dan. *rag*, dispute, quarrel.

Rile—to disturb, to vex, (N.) O. N. *hrella*, to grieve, to afflict; *ridla*, to disturb.

Roak, Roke—thick mist, (L.) Dan. *rögg*, vapour, smoke; Sw. *rök*, smoke. [N. Fries. *raag*, a thick mist; Germ. *rauch*, smoke, steam; A. S. *reac*.]

Ruck—to go about, to gossip, (L.) O. N. *hröcka*, to go to and fro; Sw. *raka*, to go, to meet.

Ruck—to squat or crouch down, (N.) O. N. *hruka*, to wrinkle, or contract in folds.

Ruggle—to reel, to stagger, (L.) Sw. *ragla*, to waver, to totter; O. N. *rugga*, to rock; *rugla*, to confuse, to disturb.

Scarped—dried up and parched, as the skin in fever, (L.) O. N. *skarpr*, hard, dry.

Scoot—an irregular angular projection in a field, (N.) Sw.-Goth. *skot*, an angle; O. N. *skot*, a dark angle or corner.

Scrogged—twisted, stunted, (N.) Prov. Sw. *skrokk*, what is wrinkled or crumpled; O. N. *skrucka*, a wrinkled old woman.

Seeves—rushes, (L.) Dan. *siv*; O. N. *sef*, a rush, a bulrush.

Shot, Shoat—a half-grown pig, (N.) O. N. *sköd*, a little pig.

Sipe—to dribble out or over, to ooze out, (L.) Prov. Sw. *sipa*, to flow gently, to trickle; *sip*, the place where a small stream flows out; N. Fries. *sipen*, to ooze.

Skelp--to kick with violence, (N.); to strike, to upset, (L.); O. N. *skelfa*, to strike, shake, terrify.

Skime—to look at a person askance, to "cock the eye" in looking at a person, (L.) O. N. *skima*, to cast the eyes round, to give a quick shy glance.

Skoppolot, Skoppoloit—romping, rude, indelicate play, (N.) O. N. *skoppa*, to run to and fro; *lot*, an effort, exertion.

Slot—a hollow tuck in a cap or dress, (L.) O. N. *slöddr*, a hollow.

Slur—thin washy mud, (N.) O. N. *slor*, sordes of fish.

Smoot—a narrow passage, (L.) Prov. Sw. *smutt*, a narrow passage between two houses; Prov. Dan. *smutte*, an opening, a small passage.

Snape, Sneep—foolish, silly, (L.) O. N. *snape*, a fool.

Snare—to lop boughs from a tree, (L.) O. N. *snara*, to cast off, to twist.

Spretched—cracked, applied chiefly to eggs, (L.) Dan. *spraken*, cracked; *spreke*, to crack, to split.

Stag—a colt, a cockerell, (L.); a cock turkey, (N.); O. N. *steggr*, a male wolf, the male of any animal.

Stoiting—the jumping of fish above the water, (N.) O. N. *steyta*, to push, thrust, thrust up.

Stope, Stoup—a post, (L.) Prov. Sw. *stopa*, a post; O. N. *stolpi*; Dan. *stolpe*, id.; [A. S. *stofn*.]

Stroop—the gullet or wind-pipe, (N.) Sw. *strupe*; Dan. *strube*, the throat or gullet.

Strull—well, excellently, (N.) O. N. *striall*, rare, uncommon.

Tad—dung, (N.) O. N. *tad*, dung, manure.

Tangs—"You are in pretty *tangs*," (N.) O. N. *tangr*, a rag, a clout.

Teds, socks, (L.) Prov. Sw. *tata*, a slipper.

Tipe—to toss with the hand, (L.) O. N. *tifa*, to move the hands to and fro.

Tot—a small drinking vessel, anything small, (N.) O. N. *toddi*, a piece, a fragment.

Tyd—a delicate morsel, (L.) O. N. *tita*, a small delicate thing. [Common Eng. a *tid-bit*.]

Wath—a ford, (L.) O. N. *vad*, ford; Lat. *vadum*; [A. S. *wathu*, a way.]

Wyme—to sneak to coax, (L.) (apparently to linger about a person for the purpose of obtaining something, as a child with its mother,) O. N. *vima*, to linger about stupidly.

[J. D.]

CHAPTER V.

THE DISSOLUTION OF MONASTERIES.

IN a former chapter we have briefly noted some facts connected with the rise of the great religious houses, and some of the remarkable events in their subsequent history. We have seen that PETERBOROUGH, for nearly 1,000 years, had no mean place in the annals of the church, for, as early as 680 A.D., it obtained extraordinary privileges from Pope AGATHO, ~~and~~ was afterwards raised to the dignity of a vice-papal See; and, when ~~the monas~~teries were dissolved, its yearly revenue was amongst the largest in the country.

We find that certain abbots were summoned to Parliament in 1538,* and among them were those of Ramsey, Peterborough, Crowland, and Thorney—one-fifth of the whole number present.† In the following year came the final dissolution of the great abbeys. The last abbot of PETERBOROUGH, JOHN CHAMBERS, was conscrated bishop of the new see in 1541 or 1542. ELY, however, had been erected into a bishopric in 1108-9 (HENRY the First's reign); this was the first innovation upon the early Saxon distribution of Sees. The church of the monastery became the cathe-

* See Bishop BURNET's Hist. Reformation of Ch. of Eng., vol. I. 513.

† At the time of dissolution there were altogether twenty-eight mitred abbots with a seat in the Upper House.

dral, and HERVEY was the first bishop, but the government of the monks devolved on the prior, while the bishop, though their nominal superior, could not violate any of their ancient privileges. VINCENTIUS was the first prior. His successors received the title *Dominus*, were mitred priors, and in some reigns were summoned to parliament.

In 1261 the number of the monks was 70, this was about the maximum; and seven years before the dissolution there were 36 monks and the prior in this monastery. STEVENSON'S Supplement to BENTHAM'S Ely, on pp. 55-56, contains "a copy of the surrender of Ely Monastery, by the Prior and Convent," dated Nov. 18, 31st of HEN. VIII., signed by ROBERTUM STEWARD, Priorem, and 23 others."

CROWLAND. The last abbot of this monastery was JOHN WELLES (alias BRIDGES); he, as a member of convocation, signed the "Articles agreed on about Religion" in 1536.* He was present at the Parliament of 1539 (as were also the abbots of Ramsey, Peterborough, and Thorney), and at the surrender was rewarded by a pension of £120 a-year for life.

THORNEY. The abbot, ROBERT BLYTHE (also bishop of Down) signed the above-named articles, and generally appears to have acted with the other abbots of the district. The abbey suffered mutilation at the time of the dissolution; part of it, however, was made parochial.

RAMSEY. It is noteworthy that several monasteries founded in EADGAR'S reign, though exempted from certain taxes and exactions, were not free from all episcopal control, but EDWARD the Confessor exempted *Ramsey* from episcopal jurisdiction.† The founding of this abbey is attributed to

* For an abstract of these Articles see BURNET'S Hist. of Ref., vol. I., p. 432.

† Ibid, p. 377.

Æthelwine, Ealdorman of Eastanglia, in 969. It was a rich monastery, as the subjoined table shows; Camden computed the value at £7,000 of money of his time. The last abbot was John Wardeboys.

SPALDING PRIORY. Thorold de Bukenhall, brother to Godiva, countess of Leicester, took six monks from Wulgate, abbot of Crowland, and founded Spalding Priory as a cell to Crowland. The ground plat of the monastery is given in the *Monasticon*, of 1718, showing its position on the west of the Welland and south of the market-place.

PEAKIRK. In 1048, by the judgment of king Hardicnut, Wulgate, abbot of Peakirk, lost his abbey, with all the manors belonging to the same, to Kenulf and Kinsin, abbots of Peterborough, who claimed them.

Of the smaller religious houses we can say but little, except that we shall give the reader a somewhat detailed account of Marmound Priory, because the land formerly belonging thereto has retained some of its ancient privileges, being *tithe-free* at the present day.

[The Act for the suppression of the lesser monasteries was passed in the session of parliament held in 1536. "By another Act, all these houses, their churches, lands, and all their goods, were given to the king and his heirs and successors . . . . . and for the gathering the revenues that belonged to them a new court was erected, called the *Court of the Augmentation of the King's revenues* . . . . . . Thus fell the lesser abbeys to the number of 367."—Burnet.]

Marmound Priory, situated in Well, about five miles S. of Wisbech, is said to have been founded by Richard I., "who gave 300 acres of fine pasture land in Upwell and Outwell to have the prayers of three priests in the said House." (Watson.) It was a cell to the Priory of Sempringham (just to the west of the Fen boundary) in Lincolnshire, which fact gave rise to an error in Dugdale's

Monasticon Anglicanum of 1661, where Marmound was stated to be in Lincolnshire,* which error was corrected in the edition of 1830 (vol. VI. p. 2,, p. 979.) In this edition is the following,—"It was founded in the reign of King RICHARD I, or King JOHN, by RALPH DE HANVILLE, as a cell to the Priory of Sempringham."†

There was a charter of confirmation in the fifth year of JOHN's reign, which shows that the foundation was really in his brother's reign.

Pope INNOCENT III. granted a bull confirming to the order of ST. GILBERT of Sempringham, all their possessions—amongst others those held in "Welle," and forbidding all *to require or extort tithes.* A copy of the surrender,‡ dated 14th October, 1538, shows that the original bore the signatures of ROGER, the Prior," and "WILLIAM CRISTALL."

In *Valor Ecclesiasticus*, 26th HEN. VIII., edition 1817, p. 379, the annual value of Marmound is shewn to have been £10/7/7. During the reign of EDWARD VI., the house, site, lands, etc., were granted and farmed to one THOMAS NEALE for a term of 21 years, for a rent of £33/4, with certain reservations. Queen ELIZABETH granted the same to PERCIVAL BOWES, and JOHN MOSYER, in 1567.

The present estate contains 141 acres, free from all tithes; it had its own embankment, and was drained by a windmill till 1850, when the Middle Level Commissioners erected a sluice, now called Marmound Priory Sluice. The estate has a tunnel to the west of this sluice, by which water may

* In WATSON'S Hist. of Wisbech—also in WALKER and CRADDOCK'S—Sempringham is erroneously placed in Norfolk; and in the *Monasticon*, published in 1718, Marmound was placed in the Norfolk list.

† "The Master and Canons of Sempringham declared by their deed that they and theirs in the Place called Mirmaude, the Gift of RALPH DE HANVILLE, were subject to the Bishop of Ely, notwithstanding all other Privileges."—*Monasticon* of 1718, p. 268.

‡ This and several other valuable documents relating to the Priory have been placed in our hands by MR. HENRY WEST, the present proprietor of the Marmound estate. He bought it in 1868.

be supplied to the land, and to the east another tunnel by which water is drained off at a low level. No other land drains through the estate. In 1869, during some alterations on the farm premises, large pieces of stone, the remains of church windows were dug up; also several human skeletons in a good state of preservation; these were re-buried on the spot.

CHATTERIS NUNNERY, founded about 980, was annexed to Ely in the reign of HENRY I.; it had previously declined, but under the protection of Ely continued in a flourishing state till the dissolution.

[Chatteris Nunnery was, with the church, destroyed by fire in the days of ROBERT OXFORD, bishop of Ely, in 1302.] —*Monasticon.*

MULLICOURT PRIORY, established before the time of the Conqueror, was situated in Outwell; the exact position is not known, but a place is assigned to it on the Ordnance Map. This priory was annexed to Ely.

In *Notitia Monastica*, by bishop TANNER, it is stated that the Benedictine Monks of Mullicourt Priory obtained licence to alienate their lands to the Monastery of Ely in 24 HEN. VI., and in *De Rebus Britannicus*, vol. I., by LELAND, we read—

> Mullicourt Priory—
> Appropriat: eccl: Elien: per Henry
> Spynney Priorat: S. Mar & S. Crucis
> appropriatus per Henr: regem monaster:
> de Ely.

A copy of the deed is given in the *Monasticon*, pub. 1846, p. 490. (Ex. Miscellan. G. p. 241, in Collegio Corp. Christi, Cantabrig.)

A LIST of the Principal RELIGIOUS HOUSES in the FEN DISTRICT, and the Value of those suppressed by Henry VIII.

M, monastery. P, priory. N, nunnery. F, friars. C, college.

Place.	Style.	Dedication.	Order.	Annual Value. £.	s.	d.
Cambridgeshire.						
Ely...............	M	St. Ætheldreda	Black Monks...	1302	8	2
Chatteris	N	St. Mary	Black Nuns ...	112	3	6
Mullicourt......	P	— — —	Benedictine ...			
Fordham	P	— — —	Gilbertine	46	3	0
Swaffham Bulbeck......	N	— — —	Black Nuns ...	46	10	8
Marmound ...	P	— — —		10	7	7
Thorney	M	St. Mary	Benedictine ...	500	2	5
Hunts.						
Ramsey.........	M	St. Mary and St. Benedict	Black Monks...	1983	15	0
Saltrey (Sawtrey) ...	M	St. Mary	Cistercian	199	11	8
Lincolnshire.						
Lincoln	M	St. Mary	Sec. Canons ...	1533	0	0
Boston	F	St. Mary	Carmelite Fr.			
(3 Colleges) ...	C	St Mary, St Peter Corpus Christi	— — —	66	13	4
Bourne	P	— — —	Canons Gilbert.	16	0	6
Crowland	M	St. Guthlac ...	Benedictine ...	1217	5	11
Kyme...........	M	— — —	Black Canons	188	4	9
Sempringham	M	St. Gilbert...	White Canons and Nuns ...	359	12	7
Spalding	M	SS. Mary and Nicholas	Andeganensis	878	18	3
Tattershall ...	C	— — —	— — —	348	5	11
Norfolk.						
Lynn	F	St. Mary	Carmelite Fr.	1	15	8
(Hospital)	H	St. John	— — —	7	6	11
Northampton.						
Peterborough	M	St. Peter	Benedictine ...	1972	7	0

This list is drawn from SPEED's Catalogue, based on the authority of LELAND. For other small houses see THOMPSON's *History of Boston, pp. 736—747.*

The total value of all the monasteries in the kingdom is put down by Bishop BURNET at £131,607 6s. 4d., as rents were then rated, but the true value of which, he says, was at least ten times as much; then, estimating the income of the Fen monasteries at the same rate, we find their annual value equal to about £94,000, without Lincoln.

Before closing this chapter we ought to remark that King HENRY VIII. was not devoid of all conscience—perhaps it was policy—for he designed to convert £18,000 into a revenue for eighteen bishoprics; he erected six of them, Peterborough being one,* and he sold some of the appropriated lands at a low price, or gave some away, making the condition that certain ancient *hospitalities* to travellers should be upheld; then, in 1545, he commissioned three bishops and the chancellor of the *Court of Augmentation*, to grant some moneys for the poor, and for the mending of the highways. Peterborough and Ely had each £20 a year for the poor and a like sum for the highways.

The following lines were formerly intended to characterise the Monasteries of Peterborough and others in the neighbourhood:—

> "RAMSEY, the rich of gold and of fee,
> "THORNEY, the flower of many fair tree;
> "CROWLAND, the courteous, of their meat and their drink,
> "SPALDING, the gluttons, as all men do think:
> "Peterborough, the Proud,
> "Sawtrey, by the way—that old Abbay
> "Gave more alms in one day—than all they."

(JOHN BRITTON'S *Hist. and Ant. of Peterborough.*)

[S. H. M.]

* CATHERINE of ARRAGON, first wife of HENRY VIII. was buried in the north aisle of the Abbey Church, in Jan. 1536. Lord HERBERT ascribed the preservation of the Abbey and its conversion into a Cathedral to this fact. The church remained as a monument to the queen—an inscription marks the spot of interment.

MARY, Queen of Scots, was buried in the south aisle, 1st Aug., 1587. For details of the funeral see AGNES STRICKLAND'S *Lives of the Queens of Scotland*, vol. VII. pp. 502-6.) The remains of this queen reposed here for 25 years, and were then removed, by JAMES I., to the south aisle of HENRY VII's Chapel, Westminster. her Soul is in Hell —

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CHAPTER VI.

DRAINAGE OF THE FENS.

IN describing the drainage system of the Fens, it is necessary to proceed historically, if we would rightly appreciate the changes which have taken place from time to time.

It must be clearly understood that within historic times the country has never been clothed with trees, as has been supposed in consequence of old records describing part of the Fenland as belonging to the forest of Kesteven. The presence of the remains of large forests imbedded in the peat, and a misapprehension of the term forest itself, have led different historians into this and other errors. In the chapters on geology it will be shown that the peat and buried forests are far older than the commencement of the historic era, and contemporary history shows that the forest in question was not woodland. Thus, in INGULPH'S "History of Croyland," we are informed that the forest was deafforested by kings HENRY I., STEPHEN, HENRY II., and RICHARD; and that the latter granted to the inhabitants of the neighbouring towns "permission to build upon the said marshes,"* thus describing the nature of the ground. DUGDALE quotes records of proceedings against the inhabitants of Ramsey, Thorney, and Whittlesea for that they "had

* INGULPH'S Hist. of Croyland, BOHN'S ed., p. 282.

wasted all the fen of Kyngesdelfe, of the alders, hassacks, and rushes . . . . . so that the king's deer could not harbour there."* Here, again, we have clear proof that the forest was not woodland; and, moreover, from the same records it appears that the woods did not extend to the fens from the highlands. The word forest literally means "out of doors," or the outlying country (Lat. *forestum*, allied to *foris*, out of doors), hence the old term merely signified land in a state of nature. It is necessary to understand this, because, unless we can form a correct idea of the aspect of the country in the earliest historic times, we shall be at a loss to appreciate the character of the drainage works. Sundry authors have made great capital out of this forest, which they took as proof that formerly the country was perfectly drained by nature.

Others, again, have proceeded upon exactly opposite assumptions, asserting that the Fenland was little better than one vast bog. The earliest records, however, shew that a considerable portion of the fen itself formed pasturage even in winter. This we may glean from the Winchester Roll, from Doomsday, and from the so-called Saxon charters of Crowland. Doubts have been thrown upon the genuineness of these charters by Hicks and Palgrave, who shew that a feudal tone, foreign to Saxon times, pervades them, and I have brought forward other proofs from geological data. As an example of the untrustworthiness of the old monkish histories, where it was inexpedient to tell the truth (for even they did not lie for nothing), we may cite Ingulph's account of the building of Crowland Abbey, of which he states that "Croyland consisting of fenny lands . . . . it was not able to support a foundation of stone; wherefore the king (Ethelbald, A.D. 716,) ordered huge piles of oak and beech in countless numbers to be

* Dugdale's Hist. of Embank., p. 366.

driven into the ground," etc.* Not one word of this is true, for the abbey is not built upon "fenny land," but upon solid gravel, and there never were any piles driven into the ground to form a foundation; if there had been they would have been found since the greater part of the old site has been dug over and over again without yielding a trace of such work. Neither was there any occasion for such a structure. This pleasant and vivid fiction was necessary in order to show that Crowland was in possession of authentic records of that date, besides the charter. There is little doubt that these charters were made by Prior Upton, in the year 1415, to support the claims of his monastery. Still, the charters have their value, because even Prior Upton† was, to a certain degree, trammelled with truth; for it is clear that it would have been bad policy to describe the country in question falsely, since such assertions would have been at once refuted. Hence, when we read of turbaries, marshes, pastures, and salt-pits, we may be sure they had an actual existence. The charters, then, may be appealed to for a description of the state of the country at the time of their manufacture; and from them we cull the fact that the Fenland was far from being a vast morass. Indeed, all history tends to show that the worst state of the fens (Marshland, perhaps, excepted) was that immediately preceding the great drainage in the sixteenth century.

We may, with great probability, look upon the undrained fen as a vast open plain, covered, for the most part, with deep sedge, dotted with thickets of alder and willow, abounding in shallow lakes, temporary and permanent, and overflowed in its lowest parts, nearly, if not every winter. The fishing

* Ingulph, p. 9.

† Ingulph himself was a bold historian, and could shew an exalted disregard for truth upon occasion. Thus he abstracts the records from Doomsday respecting Crowland Abbey, extolls himself for the pains and care he took to be accurate, recommends posterity to trust to him—and his account is a garbled travesty of the original!

and fowling were valuable in the extreme, and the drier portions afforded a luxuriant pasture land.

Such was the state in which it remained for long ages. The silty lands towards the Wash formed the richest section, but the tide rolled in daily over a vast extent of salt marsh.

In treating of the history of the drainage in my official memoir on the Geology of the Fenland, I have divided the subject into four empirical sections, and the same plan will be followed here. The sections are as follow:—

1. *The Roman Period.*

2. *The Early English Period;* from A.D. 409 to 1189, or, from the departure of the Romans to the death of HENRY II.

3. *The Mediæval Period;* from A.D. 1189 to 1603, or, from the death of HENRY II. to that of ELIZABETH.

4. *The Recent Period;* from 1603 to the present time.

It is necessary to premise that in early times the courses of the rivers were different, as will be shown in a future chapter. The *Witham* flowed out to sea by Wainfleet in Roman times. The *Nene* and *Great Ouse* passed by Wisbech, and the *Little Ouse* alone made its way to sea through Lynn.

1. *The Roman Period.* MR. MILLER has already discussed the interesting question of the great sea-walls known as the Roman Banks. They extend for about a hundred and fifty miles along the old sea-bord of the Fenland, and I have estimated that at least eleven millions of tons of material must have been used in their construction. A glance at the geological map will show that since the erection of these banks large areas of marsh have silted up and been enclosed. This new land is about 64,000 acres in extent, and lies chiefly between the mouths of the rivers

Witham and *Ouse*, the maximum breadth being about five miles. Along the sides of the Wash the accretion has been much less. On the Norfolk coast the maximum accretion has been 0·75 mile, the minimum 0·213 mile; and on the East Holland coast of Lincolnshire we have a maximum of about a mile and a minimum of 0·25 mile. The question of the rates of accretion will be dealt with in the geological section of this book.

Other banks in the interior have been attributed to the Romans. The Raven (or Roman) bank extending from the *Welland*, near Cowbit, in an easterly direction to the Delph bank, which joins the sea-wall. It is difficult to see the object of this bank unless a suggestion of my own be the true one. The Romans were in possession of the country for four hundred years. If we suppose they turned their attention to this district, valuable as it was as a camp of refuge and for its fertility, at an early date, nothing is more probable than that they should throw up a bank like the one in question to protect such land as was only occasionally overflowed by the tide. At a later date the so-called Roman bank might be erected to include not only the newly-accreted land, but some of the salt marsh, and if this latter were one of the latest works executed in the plenitude of their power it gives us about four hundred years as the interval between the erection of the two banks. Some colour of truth is given to this hypothesis by the fact that while at Whaplode Drove, Gedney Hill, and Sutton St. Edmund's fortified Roman castella were erected inside the Raven bank, no Roman station was formed between that bank and the sea-wall, where the important towns of Holbech and Long Sutton are now situated. The area between the two banks may have been debateable ground, only occasionally overflowed by the tide, in which case the Roman bank was erected to protect the solid ground, and the outer bank was the first attempt at reclamation from the sea. It is, however, open to anyone to call the Raven bank the Roman bank, and attribute the outer bank to post-Roman-British work; and I merely throw this out as a suggestion, although it is very improbable that the cowed and enervated Britons would have undertaken such a great national work after the departure of their conquerors. Surely, when a similar scheme has been abandoned by the present generation, the downtrodden Britons would not have accomplished such a work.

From the scanty materials that remain, it would seem that the Romans not only protected the fens from incursions of the sea, but provided a sound, though inadequate, system of interior drainage. They recognised the fact that these low lands suffered from fresh-water in two ways—from the floods coming from the high land adjacent, and from the native rainfall. They consequently separated the two sources of evil, which the great drainers have failed to do, by surrounding the highland border with a catch-water drain to collect the extraneous water. This drain is still in existence, and is known as the Car Dyke, though it has been suffered to fall into decay until it has become a mere ditch. That it was deemed an important work by the Romans is evident from the fact that they erected forts at seven places along its course, namely, at Northborough, Braceborough, Billingborough, Garrick, Walcot, Linwood, and Washingborough. It certainly extended from Ramsey to Lincoln, and Stukely thinks it started at Cambridge, and it is not unlikely. It was used for the purposes of navigation as well as drainage; but its chief object was to collect the waters of the highlands and prevent them over-riding the fens.

The Romans proceeded upon sound principles in their interior drainage works. They accepted the natural rivers as the arterial drains, and led the subsidiary ones into them. This is what the great drainers did not do. They made the natural subservient to the artificial drainage, and hence the disasters which have arisen. At the beginning of this century RENNIE reverted to the Roman system in draining the East and West Fens, whose reclamation had beforetime been declared impossible, and the success of his operations is proof alike of his own genius and that of the Romans, whom it is beginning to be the fashion to decry.

The Roman drains have been almost obliterated, but the old West Lode and Hammond Beck are, in all probability, due to their enterprising zeal.

2. *The Early English Period.* The records of drainage during this period are meagre in the extreme. Mention is made of the Asendyke and Powdyke, and some few minor drains, but the only real attempt at reclamation was that of Deeping Fen, by RICHARD DE RULOS, in the time of HENRY I. This work, considering the times, was a success, for, although many lakes and sykes remained, the general surface was sufficiently drained to ensure a pretty certain crop to the husbandman, which was by no means the case before.

It is from the records of this era that we obtain the best accounts of the early state of the Fens. The genuine Saxon charters and annals, the works of INGULPH, FELIX, WILLIAM of MALMESBURY, WILLIAM of CROWLAND, and others afford us valuable hints respecting the Fens, but, as they have already been cited, it is unnecessary to do more than allude to them here.

3. *The Mediæval Period.* During this period the state of the drainage became of paramount importance. The population was increasing, and its wants growing daily more extensive; and hence, as the land was improving in value great pains were taken to render the drainage as secure as possible. At the same time, the natural drainage was

deteriorating in consequence of the outfalls becoming obstructed by deposits of silt.

Notwithstanding the imperative nature of the work, however, land-owners and occupiers seem to have been sadly remiss in allowing banks, both of drains and sea-walls, to decay. There being no central body with power to enforce repairs, each person did as little as he could, and during storms and heavy rains the land was continually being flooded. The establishment of the Court of Sewers did something towards remedying the evil, by appointing Commissioners to view and repair drains and banks, but in spite of this the work was carried on in a very desultory manner.

In Lincolnshire we find that much of Kesteven and Holland were drowned in the years 1248 and 1250, owing to the neglect of the sea-walls, and similar woes befell in the years 1257, 1286, 1292, 1322, 1357-8. Marshland was drowned from the same cause in the years 1287-89-92-94-95-97, 1334 to 1339-78, 1422, 1520 and 1569. Severe measures were taken against defaulters in this respect, and in some cases the culprit had his sins brought home to him in a striking manner—he was placed in the breach and built in. History affords no instance of this punishment being inflicted twice upon the same person—an effectual method of making a man stop his own gap! The accounts left to us of the floods are terse but vivid in the extreme. As an example we may take the disaster of the year 1337, when the people of Wigenhall dolefully reported "That on the morrow after the Epiphany . . . . a certain bank on the west part of the said river, by means of the raging of the sea, broke; so that the tide entered and overflowed a thousand acres of land, sowed with corn, to the great damage of the said town. And that on the west part of the said river, by reason of the like tempests, happening upon the eve of S. Hillarie next before, the before-specified bank was broken and torn, so that the tides entered, bore down a house, and overflowed CC. acres of land sowed with corn. And that, on the eve of S. Andrew, in the eighth year of the said king [Ed. III] the said bank was by the like mishap, broken again for the space of three furlongs in a certain place called Burty's hithe, insomuch as the tides flowing in thereat overwhelmed a thousand acres of land sowed with corn; and that on the morrow after the feast of S. Hillarie then last past, there was by the like means a breach made on the east part of the same river, whereby eight score acres of land, sowed with corn, were overflowed." (*Dugdale.*)

Similarly, the inhabitants suffered from fresh-water floods, no less than twenty-eight such disasters being recorded during this period, and many more must have taken place without their memory surviving. Several causes conduced to this state of things; *firstly*, the outfalls of the rivers were silting up and daily becoming less capable of discharging their waters; *secondly*, the banks and drains were often neglected, and *lastly*, the banks were not unfrequently cut wilfully either by proprietors who expected to rid their own land of water in this way, or by the disaffected half-savage fishers and fowlers who were opposed to any reclamation.

4. *The Recent Period.* James I. revived a scheme proposed at the close of the reign of Elizabeth, to drain "Deping, Spalding and Pinchebec Fens, Thurleby Fen, Borne South Fen, and Crouland Fen, (alias Gogisland Fen)," and it was agreed that Thomas Lovell should undertake the work and receive a third part of the land which he drained and made "summer and winter ground."

As an illustration of the manner in which alone the work could be performed, it may be mentioned that about

340 acres were to be left as "lakes and sikes" in the lowest ground, since the boldest adventurer did not seem to think such parts could be reclaimed. The work never seems to have been carried out.

In the year 1638, Sir William and Sir Antony Ayloff with others "undertook" these Fens. They cleaned out the Welland and deepened its outfall, cleared drains, erected sluices, and made partition dykes "By which works the water was so well taken off, that in summer this whole Fen yielded great store of grass and hay; and had been made winter ground in a short time; but that the country people, taking advantage of the confusion throughout the whole kingdom, which ensued soon after the convention of the late long parliament (as is very well known) possessed themselves thereof; so that the banks and sewers, being neglected by the adventurers, it became again overflowed, and so remaineth at this time." (1652—*Dugdale*.)

In the year 1720 the North Forty-foot Drain was constructed to drain the land north of Kyme Eau. The drain withdrew a quantity of water which used to enter the river Witham at Langrick, and poured it into the river at Boston. It did not effect its proposed object, but seriously damaged the river by withdrawing the water from the upper reaches. This is the first instance we have had to mention of the alteration of the natural drainage system in favour of an artificial one, but it will be seen that such is the principle upon which most of the drainage has been effected. Nevertheless it needs but a slight knowledge of fen rivers, to be sure that the only effectual way of preserving them, is to pour as much water as possible into them, and to keep the outfalls as free from silt and sand as possible.

In the year 1761, a scheme was devised by Mr. Langley Edwards for draining the lands adjacent to the Witham, and restoring and maintaining the navigation from Boston to

Lincoln. An Act was obtained for the purpose of carrying out the scheme, and by it the Witham Commission was established, having control over the land on each side of the river from Lincoln to Boston, and as far east as the higher ground from Freiston to Wrangle and westward to the Cardyke. To this the East Fen was added in the year 1801.

The level was divided into six districts, and the following works executed. The river was altered from Boston to Chapel Hill, and cleaned, widened and deepened from that place to Stamp End near Lincoln; weirs and other obstructions were removed, the river was banked and the tributary drains cleansed and deepened. Between Boston and Chapel Hill the river was to have been straight, but two great angles were made in it for the convenience of the owners of the land adjacent, so that private interest was allowed to take the place of public benefit in this, as in so many other cases in the Fens. The Grand Sluice was erected, and opened with great ceremony in the year 1764, and a new sluice was made at Auton's Gowt for the discharge of the waters from West and Wildmore Fens.

The lands adjacent to the Witham at once benefitted by the change, but the East and West Fens remained drowned. The evil effects of damming a silt-laden, tidal stream, soon became apparent, as will be shewn in the article on the river Witham.

East, West and Wildmore Fens received no benefit from the above works, but remained in a state of nature. What that state was, may be judged from the description given by GOUGH in his edition of CAMDEN'S Britannia. East Fen he says, "exhibits a specimen of what the country was before the introduction of draining. It is a vast tract of morass, intermixed with numbers of lakes, from half-a-mile to two or three miles in circuit, communicating with each other by narrow reedy straits. They are very shallow, none above four or five feet deep, but abound with pike, perch, ruffs, bream, tench, dace, eels, etc."*

In the year 1630, Sir Antony Thomas undertook to clean and deepen the cuts leading to the natural outfall at Wainfleet, and to the artificial ones near Boston. This was accomplished, and four years afterwards Sir Antony and his colleagues received their award of land, the Fens being so satisfactorily drained that "not more than sixteen hundred seventy and three acres" remained under water!

In this half-drowned state, these Fens remained until they were finally drained by Mr. Rennie under Acts obtained in 1801, 1803 and 1818. It was suggested, amongst other opinions, that the waters of East Fen should be conveyed by a new cut to Wainfleet Haven. This is undoubtedly the direction of the ancient natural drainage, but so great have been the physical changes in the district, that the scheme was abandoned in favour of a new cut discharging into the Witham at Hobhole. The West and Wildmore Fen waters discharged into the river by Anton's Gowt and Maudfoster sluice. Rennie's plan was a revival of the Roman method

* Dugdale gives a list and map of these lakes, and as they entirely disappeared their curious names may be here recorded.

1. Stock water.	22. Wash Ballock.	43. The Skires.
2. Groope.	23. Harts Booze.	44. Cow mouth.
3. Kealcote sikes.	24. Gibhurne nuke.	45. Robb water.
4. Stickford sikes.	25. Gowple.	46. Middle water.
5. Rogger.	26. Dwitmouth.	47. Dobbin.
6. Popple poole.	27. Salter gate.	48. North lade.
7. Keale Haven.	28. Gasp water.	49. Jack water.
8. Mose water.	29. Burnt meere.	50. King's fishing.
9. Steven water.	30. Burnt meere lodes.	51. Smith nuke.
10. Fisher bind hole.	31. Ell lade.	52. South lade.
11. Little park croft.	32. Faire Fishes, S.	53. Bill water.
12. Great park croft.	33. Faire Fishes, N.	54. Bill water Clotton.
13. Muggill.	34. Emholme.	55. Madghill water.
14. Great Goodin.	35. Torow fare.	56. Goodin draughts.
15. Girdle gate.	36. Keale dikes, W.	57. Beane sike.
16. Cherry hurn.	37. Keale dikes, E.	58. Leake meere.
17. Long water.	38. Swinham lade.	58. Starr gate.
18. Brightey.	39. Domine.	60. Kyme pitts.
19. Bamb weare.	40. Matlade.	61. Small pits, not considerable.
20. Silver pitt.	41. Matlade flottons.	
21. Coot mouth hole.	42. Jewel water.	

of separating the highland from the Fen waters by a catchwater drain, and collecting the latter by successively larger drains until finally they fell into the main arterial cut.

The plan was eminently successful, and soon afterwards when great floods overrode much of the low land in England (1814) it was strongly tested. MR. BOWER reported that "the East, West and Wildmore Fens and low lands adjoining, is perfectly free, and as ready for all agricultural purposes as the high country lands."

Nevertheless physical causes, then unrecognised, were at work which gradually, but surely, reduced these Fens to their pristine condition. Much of the land drained is peat, and this began to shrink with the abstraction of water, and has now reached the amount of two feet, thus reducing the fall of water by that quantity. Moreover, the silt so accumulated at Hobhole sluice, that the water stood on an average five feet higher than formerly, and in times of flood as much as eight feet. Now the level of the land in question, averages only eleven feet above Hobhole cill, and the water formerly stood two feet on the cill. If, therefore, from the nine feet fall thus obtained we subtract seven feet (two for the shrinkage of peat and five for the deposition of silt) we have left a fall of only two feet in average seasons, and practically none whatever in times of flood when a rapid discharge is most needed.

No wonder, then, that during the heavy rainfall of 1866 the East Fen was for weeks under water, and looked from the neighbouring hills like a great lake. It was accordingly determined that as a natural drainage could not be maintained, the water must be lifted by pumps. An Act was thereupon obtained (1867) and under its provisions two of APPOLD's centrifugal pumps were erected at Lade Bank, each of which, working independently, is capable of lifting the water six feet above the drainage level. Up to the present time these fine engines have answered admirably.

We must now turn our attention to that portion of the Fens which lies south of the river Nene. It was known as the Great Level, but by an Act dated 1663, the title was altered to the Bedford Level, by which it is still known, and by which we shall hereafter distinguish it. The term Great Level is often given to the whole Fenland, but it has never correctly been applied. This mistake has been made, for example, by SMILES in his "Lives of Great Engineers," and strange to say even on the Rivers Commission map, published in the year 1874!

Several minor schemes for draining parts of the level, were carried out in the reign of JAMES I., and an elaborate survey was made in the year 1695 by RICHARD ATKINS, which is remarkable as being perhaps the earliest geological survey on record. Some of his observations are more graphic than polite, as when he describes one part as "all vile moor, by the whole tract." In this year HAYWARD made his celebrated survey of the level.

In the year 1630, the sixth of the reign of CHARLES I., a contract was entered into for the complete drainage of the level. A Dutch engineer, SIR CORNELIUS VERMUYDEN, undertook the work and was to receive 95,000 acres of the reclaimed lands on completion of the work. This is the first appearance of this celebrated man in the history of our district, but he was practically conversant with draining operations both in Holland and England. The national prejudice of Fenmen, however, proved too strong for him at this time, and the contract was annulled. VERMUYDEN, however, seems to have been as determined to undertake the work and become possessed of a fine slice of fair English land, as the natives were that no foreigner should hold possession therein. He seems to have been a man of considerable eminence in his profession, and of indomitable perseverance in the prosecution of his ideas. FRANCIS, earl of Bedford, undertook the scheme on the failure of VERMUYDEN'S plan, and under a contract, styled the Lynn Law, was to receive 95,000 acres on the successful completion of the drainage, of which 40,000 acres were to be devoted to the maintenance of the works in an effective condition; 12,000 were to be alloted to the crown, and the remaining 43,000 were to fall to the share of the earl. In what manner VERMUYDEN accomplished his purpose, cannot now be determined, but it is certain that his influence with the earl was very great, in as much as notwithstanding the determined local opposition, which had by no means cooled in the few months that had elapsed since the rejection of VERMUYDEN'S proffer, the earl not only adopted his plan but made him the engineer of the work. Thirteen gentlemen joined with the earl to carry out the drainage, which was carried on rapidly.* The Old Bedford River, Sam's Cut from Feltwell to the river Ouse, Sandy's Cut near Ely, Bevill's Leam, Peakirk Drain, and Hill's Cut were the chief drains made, and others were cleansed and enlarged, such as Morton's Leam, and the New South Eau.

The object of these works was to make the level summer land, the possibility of rendering it winter land also does not seem to have been as yet recognised. The inadvisability of abstracting large quantities of water from the natural rivers, will be discussed presently.

* The names of the Original Adventurers are given in the "*Indenture of fourteen parts*," 7 CAR. I., 1831.

EARL OF BEDFORD (two shares.) OLIVER, EARL OF BULLINGBROOKE (one.)
EDWARD, LORD GORGES (one.) SIR ROBERT HEATH (one.)
SIR MILES SANDYS (two.) SIR WILLIAM RUSSEL (two.)
SIR ROBERT BEVILL (one.) SIR THOMAS TYRINGHAM (two.)
SIR PHILIBERT VERNATT (one.) DOCTER SAMES (one.)
ANTHONY HAMOND (two.) SAMUEL SPALDING (one.)
ANDREWS BURRELL (one.) SIR ROBERT LOVATT (one.)

There were 20 shares in all, the holder of one is unknown.

In the year 1637, at a session of Sewers, held at St. Ives, the level was declared drained "according to the true tenor and true intent of the said Act or law of Sewers made King's Lynn." We now enter upon one of the most singular stages in the history of the Fens. The adjudication of the 95,000 acres was made at the above session, the king's surveyor-general assisting therein; but the 12,000 acres were not awarded to the crown, an act which seems utterly inexplicable. Moreover, the works did not fulfil their intended object, notwithstanding the report of the session, so that the whole affair was complete jobbery. The inhabitants of the level soon found the works ineffective and bitterly complained that much of their land had been taken away without the remainder being improved, nor were their feelings soothed by the knowledge that they had been outwitted by VERMUYDEN. To crown this extraordinary piece of business, the earl and his participants were called upon to pay an exorbitant royal tax upon the whole 95,000 acres, which amounted to no less than 142,500*l.* per annum, the cost of the drainage works having been 131,170*l.*

The adventurers seem to have made all haste to be rid of so unprofitable an estate, and we find a new survey was made by HAYWARD, in which the area was returned at 310,757 acres, and the king declared himself undertaker, and operations were commenced. Little was done, however, save banking MORTON'S Leam, erecting sluices at Standground and Tyd, and making a new cut for the river Nene between the Horseshoe at Wisbech and the sea. The civil war breaking out shortly afterwards the work was stopped, and in the year 1649 the king was beheaded.

WILLIAM, earl of Bedford, son and successor of FRANCIS, then undertook the drainage of the level by permission of what the cavalier DUGDALE characteristically styles "that Convention then at Westminster, and then called by the name of a Parliament," under the St. Ives' law. SIR CORNELIUS VERMUYDEN in the mean time claimed a great portion of the 95,000 acres, as payment for work executed for the former earl. It is not advisable to follow the new company through their difficulties with the obstinate and wily Dutchman; suffice it to say that on every point he beat them, and his scheme was adopted and carried out by himself. The plan was like that so successfully adopted in Holland—the making of large straight arterial drains into which successively smaller cuts discharged themselves, the junctions being guarded by sluice doors. It was pointed out at the time, and has been iterated and re-iterated ever since, that the conditions of the Fens of Holland and England are radically different. The former lie below the ordinary sea level and possess no adequate natural drainage system, whereas the latter are entirely above mean tide level and possess good natural drains in the rivers. The obvious method of draining our Fens is to embank and clean the rivers, to improve the outfalls, and to make the the interior drainage entirely subservient to that of nature. By thus leading the waters into the rivers, they would be more able to keep themselves clear than at present. A careful study of Fen rivers for some years, has convinced me that it is practically impossible to pour too much water into them. Their outfalls are still silting up, and to the end of time must continue to do so; and the energies of Fen-men must always be directed to keeping the channels as clear as possible. Now it is essential that the laws which govern the flow of water, be understood by all interested in drainage matters. MR. A. TYLOR, F.G.S., has by careful experiment determined the following important laws:—

1. In navigable rivers the water flows steadily at one rate, not overtaking the water before it: that is, it possesses uniform motion.

2. The velocity of such rivers increases as the cube root of the quantity of water, the slopes remaining the same. Thus if the amount of water be increased twenty-seven times, the velocity will be trebled.

3. The velocity increases as the cube of the increase of slope, the quantity remaining the same.

4. The erosive power of a river increases as the fourth power of the velocity. That is to say, if the velocity be doubled the erosive power will be sixteen times as great.

Now I have not the slighest hestitation in saying, that had these laws of Mr. Tylor's been understood and acted upon at the time of the drainage of the Bedford Level, millions of pounds would have been saved in the past, and unknown wealth spared in the future. The great difficulty in fen draining is to obtain an adequate discharge of the water, the natural fall being slight and the outfalls being gradually choked by material brought up from the sea. In dealing with nature, it is essential, firstly, that we recognise as fully as possible the laws by which she is governed, and secondly, which of those laws can and which can not be made subservient to our ends. In fen drainage two points are immutable—the natural slope of the ground, which cannot be increased, and indeed has steadily diminished since the great drainage, by the settling down of the peat—and the silting up of the river estuaries, which must go on as long as England is an island. If we could increase the velocity of the rivers they would be able to fight much more successfully with the incoming silt, and so clear their channels. Now though we can never attain increased velocity with the same quantity of water on the same slope, yet we can practically attain the same object by pouring as much water as possible into the river as high up as possible, for by laws 2 and 3 Mr. Tylor has shewn that doubling the quantity of water has the same effect as doubling the slope. Furthermore, by law 4 this would enable the river to remove just sixteen times as much silt from its estuary as before. This is no mere theory, but sound deduction based upon the careful experiments of a practical engineer. It bring before us more vividly, perhaps, than has ever been attempted before, the importance of sending every available drop of water into the rivers, and the suicidal effect of abstracting that water and damming tidal streams

Vermuyden's scheme was diametrically opposed to this principle, which, of course, was only dimly appreciated at the time; yet pressure was put upon him to make the rivers the main drains, but, alas! ineffectually, and the artificial system of largely ignoring the rivers was, unfortunately, adopted, and can never be remedied. The evil which the wily Dutchman did lives after him, and he would have gone down unhonoured to posterity had not Mr. Smiles beamed upon him for no other reason than that he was a magnificent example of "Self Help."

Vermuyden began badly, progressed ignorantly, and finished disastrously.† These are strong words, but they are the honest outcome of long and practical acquaintance with the subject. If there was one fact more prominent than the rest, it was that the interests of the whole Level were one and inseparable; but he put asunder that which Nature had joined, and divided the Bedford Level into three portions—

North, Middle, and South,

whose common interests were thus made to clash to a

† If it had not been for Vermuyden, there w[illegible] [illegible] or [illegible] in the [illegible]. Had he succeeded, he w[illegible] conferred a [illegible] on mankind, [illegible] agriculture. [illegible]

degree which none but the hereditary occupiers can adequately estimate.

The North Level lies between the Welland and the Nene.

The Middle Level is bounded by the Nene and the Old Bedford River, which had been made a few years previously and found wanting.

The South Level extends from that river to the highland.

How can it be shown that these districts on the same level, with interweaving watercourses and co-equal desiderata, were so distinct that they should be set at variance with one another like a trio of mongrels over a meat biscuit? Yet such has been the disastrous result.

In the North Level the works consisted in the embanking of the Welland and the improvement of existing drains, the main sewer being the Shire Drain, a natural stream embouching at Tyd Gote.

In the Middle Level the Nene was embanked from Peterborough to Guyhirn, and the Ouse from Over to Earith. The New Bedford River was made from Earith to Denver, parallel to the old river of the same name, its object being to convey the waters of the highland more directly to the outfall. Banks were made on the north side of the old and on the south side of the New River, enclosing a space called a Wash "for the waters to bed in" in time of flood. Here I must pause to say a word in favour of VERMUYDEN, who has been sadly traduced for not confining the waters so that they should, by their enhanced velocity, expel themselves from the land. This, doubtless, was the more scientific plan, but we must remember that the law of the increase of velocity with augmented quantity was then unknown. VERMUYDEN saw the outfalls choking, considered the action inevitable (as it is), and accepted it as irremediable, as did all the engineers of the time; hence, he argued that it was better for the flood waters to waste themselves by spreading impotently over the wash, than to damage the surrounding lands by fretting breaches in the banks when they could not void themselves into the sea by reason of the accumulated silt. His deduction was legitimate, his premises were in fault. He was a great but mistaken man. We shall discuss the effect of the Bedford Rivers in the sequel.

The Forty Foot Drain, from Welche's Dam on the Bedford River to the Nene, near Ramsey Mere, Hammond's Eau near Somersham, Stoney Drain, and the Twenty Foot River in the parish of March, the Sixteen Foot River from the Forty Foot to POPHAM's Eau, Conquest Lode leading to Whittlesey Mere, TONG's Drain and Denver Sluice, to be hereafter anathematized, were at this time constructed.

In the South Level little was done beyond embanking the rivers, the chief exception being a pretentious abortion, which was to have been named St. JOHN's Eau, after the then premier, who prophetically eschewed the honour, and it is now spoken of as Downham Eau.

I must delay further discussion of the effects of these works to the chapter on rivers, where I hope to indulge to satiety in that strong language which is an Englishman's prerogative, and would here merely remark that the main object VERMUYDEN had in view was to show how much better he could drain land than Nature could, by doing all in his power to abstract the wealth of water from *her* works and pour it into his own.

In the year 1653 these great works were declared to be finished, and those who are interested in such matters may glean instruction or amusement, according to their various bias, by the touches of party spirit which enliven contemporary and other historians, DUGDALE, Knight, Surveyor-general and Garter king-at-arms, almost ignores the existence of so insignificant a personage as one OLIVER CROMWELL (not unknown to students), and WELLS, whose day-star is named RUSSELL, could see no turpitude in robbing CHARLES I. of 12,000 acres to give to his idol BEDFORD, but burns with holy ire when 3,000 acres were demanded by the Commonwealth for the good of the State! The State was then republican, hence the indignation; but the same writer sees no extortion in the grant of 10,000 acres to *the Crown* on the restoration of the STUARTS! How profound was DICKENS when he wrote (human) "Nature is a rumun, she is!" The 95,000 acres were awarded to the Earl of BEDFORD, less 10,000 acres for the crown. VERMUYDEN vanishes from the history of the Fenland and of the world, and rumour states that he died in poverty—alas, poor Dutchman!

Twenty-three years afterwards, A.D. 1678, these expensively made drains were found to be inadequate to their task, and we learn that "for the speedier cleansing and scouring of draynes, the four surveyors of the Level do forthwith buy each of them a mill, made for that purpose." From the time the desiccation of the fens commenced, the drainage began to deteriorate in consequence primarily of the shrinkage of the peat, which reduced the slope of the ground; and, secondarily, of the silting up of the outfalls of the rivers, a process going on more rapidly than before in consequence of the abstraction of so much water from the upper reaches of the Fen rivers. The drains became so lowered as to be incapable of discharging into the arterial cuts, and mills had to be erected to lift the water into them. At first horse-mills were used, but the want was not so generally felt as to meet with unanimous support, and many opposed the innovation. But the necessity increased with time, and in the year 1727 windmills became general. These were ordinary undershot wheels with float-boards in

the direction of the radii. Presently these were found incapable of discharging the water, and the system of double-lifts was introduced at the beginning of this century. The historian of the Bedford Level describes the system thus: "one large mill is erected near the main river, and then a smaller one at some distance behind; the one mill, by first raising the water from the mill drain, and in certain quantities, lessens what is called the head of water to be thrown by the first mill, and, finally, facilitates its operations."

Water mills became so general as to impart a peculiar feature to the landscape. The intermittent action of the wind as a motive force, and the steadily increasing necessity for a more certain and speedy delivery of the water has of late years led to the introduction of steam pumping mills. At first these were nothing but lifting wheels, driven by steam power, but about the middle of this century the centrifugal pump was introduced, and windmills are becoming rare and will soon vanish. They are almost gone from the fens of Lincolnshire, but still linger in the Middle and South Levels. The beautiful drawing of Wicken Fen represents one of the old windmills. It was sketched by my friend MR. E. WHEELER.

Since the great drainage the principal new works have been applied to improving the river—a subject that will be treated of hereafter. The district of Postland, containing 7,451 acres, was incorporated with the North Level by an Act passed in the year 1754. A splendid new cut, called the North Level Drain, has been made from Clow's Cross to Tyd Gote: the Meres of Whittlesea, Ramsey, etc., have been drained, and partly in connection therewith the Great Middle Level Drain has been constructed.

We will defer any general remarks upon the system of drainage until the rivers have been described, but a few words may be said upon the drainage of the Meres.

Of the shallow sheets of water called Meres, that of Whittlesea was by far the largest, and we will confine our description thereto. It was situated in the Middle Level, about 4½ miles S.S.W. from Peterborongh, and two miles E. from Yaxley. Its greatest length was 2½ miles, its maximum breadth 1¾ miles, and its area varied from 1,000 to 1,600 acres, according to the season. Its aspect is shown in the annexed cut, copied from the Ordnance

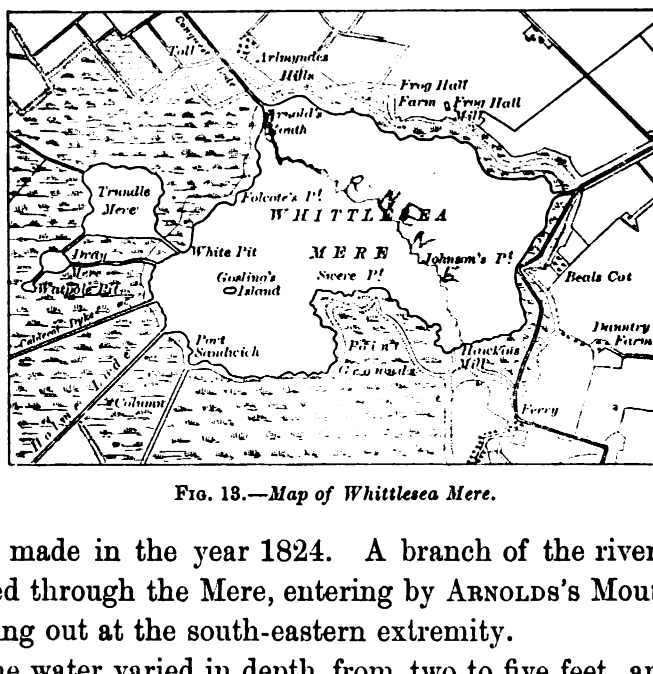


Fig. 13.—*Map of Whittlesea Mere.*

Map made in the year 1824. A branch of the river Nene flowed through the Mere, entering by Arnolds's Mouth and passing out at the south-eastern extremity.

The water varied in depth from two to five feet, and was surrounded by a reed-shoal, which formed a beautiful and valuable fringe. The reeds extended over an area of 200 acres, and yielded annually about a thousand bundles, valued at a pound apiece. The land around the mere was a dank and deep peat bog: and over this and the reed shoal hovered myriads of insects, including the majestic Swallow Tail *(Papilio Machaon)* and the brilliant Large Copper *(Polyommatus dispar)*, both of which have long since vanished from the scene, the latter, indeed, having become extinct.

The Mere was a grand place for water sports, as may readily be believed. In summer, sailing and other boats skimmed over its surface laden with fishing or pleasure parties, while round its margins naturalists delighted to roam and revel among a fauna and flora almost unparalleled for richness in the country. The boating trips, too, were rendered none the less enjoyable from the spice of danger which often beset them in the sudden storms which ruffled its surface into fierce little waves—waves which nearly made a prey of King CANUTE, of tide-compelling memories, and did, if tradition be true, engulph two of his sons when he resided at Bodsey, the "moated grange" hard by. Brilliant as its surface was in the summer time, the mere never showed to such advantage as when its shallow depths were converted into hard black ice—then gentle and simple thronged its bosom upon skates, still called by fen-men *pattens*, after the old Norman French. Sleighs and ice-boats glided over the smooth surface, and great was the enthusiasm which prevailed when a skating race took place, and the sturdy natives competed for supremacy. Here some of the fastest "running" in the world might be seen, and old men still delight to tell how TURKEY SMART, skated or "ran" his mile in two minutes two seconds; and how GITTAN (fine old British name!) of Nordelph ran a mile in two minutes twenty-nine seconds.

All this is changed! and where the coot and moor-hen swam, rich fields of corn + wave over the landscape. The drainage of the mere was commenced in the year 1851, and MR. W. WELLS, M.P., of Holme, has given a graphic and valuable description of the operations in a paper published in the Journal of the Royal Agricultural Society. Without entering into technical descriptions of levels, which may be found in MR. WELLS's paper and my official "Geology of the

+ which hardly pay for the seed —

Fenland," it is sufficient to state that when the cut was made through the bank, the water flowed freely for several days into the exterior river. The first rush of water subsided on the second day, and at the end of three weeks, under the influence of a favourable wind, only a very sluggish stream passed outwards. It was soon found that a perfectly natural drainage could not be maintained, for the winter level of the water outside rose above the bed of the river. One of Messrs. EASTON and AMOS's newly-invented Appold pumps was erected, capable of discharging 16,000 gallons per minute with a 6-foot lift, and worked by a 25-horse power engine.

Throughout the summer of 1852 much progress was made in bringing the bed into a fit state for agricultural purposes, in laying out roads and dykes, and in planning out farms. But in the autumn heavy rains swelled the rivers and the pressure upon the banks was so great that on the second of November the banks burst, and "in a few hours Whittlesea Mere was itself again," about a thousand acres being covered with two feet and a half of water. The new pump now put forth its energies, and, after three weeks' incessant pumping, the water was got under, and since then the mere has been as dry as any portion of the fens.

The banks were then strengthened and the main dyke completed. It passed directly through the mere, starting near Holme station, and into it the small drains run. The surrounding bog was tapped by a small drain, and the land rapidly began to sink, owing to the abstraction of the water. One consequence of this was that the drains became shallower, and the engine emptied the water in a few hours and then had a short respite until the water flowed in again. To overcome this uneconomical way of using steam power, the main dyke was enlarged at its lower end so as to form a reservoir, and it answered admirably. The question of the shrinkage of peat will be dealt with in the chapter on Geology when we treat of that substance, as will also other matters of scientific interest connected with the meres.

Coleseed and Italian rye-grass were the crops taken the first year, and then oats and wheat were successfully planted, and since then the mere has grown valuable produce. The mean annual value of the mere before drainage was £1,160, and after £12,350, thus showing a large profit. This pleasant prospect is, however, seriously marred by a drainage tax of 12/6 per acre, imposed under the Middle Level Acts of 1844 and 1851. This tax is payable upon 3,000 acres, comprising the mere and adjacent bog, and as the Acts were for the improvement of natural drainage it seems rather hard that this district, which does not admit of being so drained, should be saddled therewith.

The natural drainage of the Mere was by the river Nene, a branch of which, in fact, flowed through it; but, as usual in such works, nature has been violated, and the waters of the mere are poured into the Ouse, the Nene suffering loss in this case as it has done in so many others. It is said the drainers met with "moral difficulties" respecting the natural discharge by the Nene, but that adjective seems to be just two letters short of the truth.

[S. B. J. S.]

THE NORTH LEVEL SLUICES.

(Communicated by MR. J. T. MARSHALL, Tydd St. Mary.)

[MR. TELFORD was the engineer of the first North Level Sluice, which was constructed in the year 1830, at an expense of about £18,000. It was a great improvement on an old sluice, known as "GUNTHORPE'S," which was situated at the end of the Shire Drain, so called, although it did not divide the shires at all parts as the original one did:—where "Wingland House," the residence of Mr. W. Spikings, now stands. The sill of the new sluice was laid eight feet below the old one (level with Zero on the Free Bridge gauge at Lynn), and 20 feet below the 1830 sluice was afterwards adopted as the Nene Valley datum, and 100ft. below it the North Level datum. (The datum of the Ordnance Survey—" $\frac{8}{10}$ths of an inch above the mean tide level at Liverpool,"—is 5ft. 10in. above the sill of 1830.)

The late Robert Stephenson was considered "chief" of the profession, and in 1847 was consulted by the Wisbech Corporation, the North Level and other Commissioners on the Nene. About this time his cousin—the present George Robert Stephenson—who may be said to have succeeded Mr. Borthwick (under Mr. Robert Stephenson) as North Level engineer, with Mr. B. P. Stockman to assist him, had the present Sea-sluice and neck, constructed by Messrs. Smith and Knight, the contractors, at a cost of about £20,000; the contract having been about £17,000. Its sill is 5ft. 4in. below that of 1830.

After the disaster in the Middle Level, caused by the destruction of the Sea-sluice at Wiggenhall St. Germans, Lynn, in 1862, and the Marshland Sluices near the same place, public attention was naturally turned to the *North* Level, where ordinary observers of the Sluice noticed an unusual quantity of water boiling up on the drain side whenever there was a high tide in the river. Mr. Stockman was thereupon employed (under Mr. G. R. Stephenson) to examine it; and, by Mr. Stephenson's direction, certain repairs were executed.

In 1865 Mr. G. R. Stephenson resigned his appointment under the North Level Commissioners; and, upon his recommendation, Mr. Stockman was elected as his successor. He enjoyed the confidence of the late Mr. Edward Jackson, who for over 40 years was the clerk to the Commissioners, and took a warm interest in all the works.

In 1866 the wing-walls on the river-side of the sluice were observed to bulge, whereupon MR. STOCKMAN had them partly pulled down and rebuilt, and the present handsome cast-iron strutting bridge put between them; which work has stood remarkably well.

In February 1868, some high tides, one of them 27ft. 8in. on the sill (122ft. 4in. above the North Level datum; 42ft. 4in. above the Nene Valley datum; or, 16ft. 6in. above the Ordnance survey datum) having caused subsidences at the backs of the wings on the river side, MR. STOCKMAN had them filled with clay and Whittlesea sand, but, as a precaution, the committee directed him to make a pile-dam about a quarter of a mile up the drain. This being completed, the Committee then determined to erect a "Protection Sluice," so that if the outer one gave way the "Protection" would prevent such drowning as the South Holland district suffered when its sluice fell in 1851, and the Middle Level one in 1862. This, MR. STOCKMAN planned and undertook to have put in *without stopping the drainage*, an engineering feat never before attempted.

His scheme consisted of 34 rectangular caissons of boiler-plate iron, each about 9ft. by 3ft. 6in. and 23ft. long (like the case of a lucifer match box) which were to be sunk until their tops were 2½ft. below the bed of the drain (the sill of 1859) in two rows quite across it, and one under each pier. These were to be filled with concrete, then the intervening spaces excavated and filled in like manner. The piers were of cast iron, also filled with concrete, and the abutments of brick-work. The girders, road plates, and joists were of boiler-plates. The whole was to stand on what might be called a rock of concrete, 120 feet by 60 feet, and 23 feet deep,* thus contrasting most favourably with the usual foundations of wood piles driven into the sand, which are generally smashed to atoms before more than half down, and their tops very much shortened by the free, but necessary, use of cross cutting saws. The contract was taken for £10,800 by the Thames Iron Works Company, under Mr. Hussey, the manager of their girder department. It was expected that the caissons would go down rapidly, as excavated, and especially when laden with from 50 to 70 tons of iron kentledge, as they frequently were; but it would appear immaterial whether wood or iron, piles or caissons are used, or whether excavations or no excavations are made, the sand of this neighbourhood holds them so firmly that they go down very slowly, though with iron caissons no cross-cutting saws are available, and the work must be completed as undertaken. At first various pumps were tried and the ordinary methods of excavating, so common in sinking wells, but these were soon found impracticable, seeing that as much sand frequently rose in a few hours as occupied several days to take out. Then "bags and spoons" were tried but found to be too tedious, and the ingenuity of various gentlemen of the contracting company was racked until one of their draftsmen (a Mr. Hodgson) improved a "digger" (of American invention) which may be described as an iron box about 5ft. by 3ft. with a pair of excavators, or delving jaws, inside, working similarly to the grabber of a pile engine. Two of these diggers, of which four were ultimately used at one time, were worked in two caissons at the same time by a portable steam engine which lowered them down, closed their jaws so as nearly to fill their boxes, and then raised them and emptied their contents on to a platform, whence it was wheeled away. The quantity each digger brought up at once was usually about two

* About 50 feet below the level of the land.

barrow-loads, and the system, though slow, was quite successful, inasmuch as it took out the sand and left water in its place.

In Feb. 1872, the work was considered sufficiently near completion to be tested by letting in a high tide, when the water was found to leak, or sipe, round the wings on both sides; and ultimately they (the wings) had to be wholly re-excavated, and some loose stones removed which had been thrown in temporarily at the bases of the approach banks, and which the contractors refused to take out. This incident led to a dispute between the engineer and the contractors, and the ending of a chancery suit has proved the engineer was right. Instead of stopping the works (as many who possessed only a superficial knowledge of the affair thought he ought to have done), which would have led to a long law-suit (with the works unfinished, and probably under water) the engineer preferred keeping the reins in his own hands, and not using the whip too freely. The result is, the Commissioners have obtained an excellent sluice at a moderate cost, say £15,000, which is far superior to anything of the kind attempted before, and our friends who live in the *lowest* fens of the North Level may sleep in safety; for, if the outer sluice should give way, the "protection" one will prevent their lands being flooded about 14 feet deep, as some of them might be.]

CHAPTER VII.

THE RIVERS OF THE FENLAND.

RIVERS are among the most important agents in the economy of the world, and in the Fenland they are of paramount importance. Nevertheless, it is a remarkable fact that, notwithstanding the wealth that has been lavished upon them, their physiology is, perhaps, less known than that of less directly important agents, such as volcanoes. Engineers have made exhaustive reports upon special rivers —for instance, HUMPHREYS and ABBOT upon the Mississippi, Sir C. HARTLEY on the Mouths of the Danube, REVY on the La Plata, and BELGRAND on the Seine, but an exhaustive treatise on the general phenomena of rivers has never yet been written. To one person, MR. A. TYLOR, F.G.S., an engineer and geologist, we are indebted for much valuable knowledge on these interesting questions; and his work, unfortunately, has not attracted the attention it so eminently deserves. The privilege of that gentleman's friendship enables me to bear strong testimony to the enlightened perseverance with which he has amassed an immense store of facts, from personal research and travel, respecting the mechanics of rivers.

Rivers are fed directly, or indirectly, by the precipitated moisture of the atmosphere—directly by the immediate return of that moisture to the rivers; indirectly by springs which are the bubbling out of water which has soaked into the ground. They are natural drains—yet, nearly all works upon physical geography speak of lands being *watered* by rivers, which is as absurd as speaking of the roof of a house being watered by the water-spouts—rivers only water lands when they are used for irrigation. Rivers flow down slopes by the action of gravity, and by the weight and velocity of their water cut away or *erode* the rocks over which they travel, and in this way are formed the valleys in which they run. Standing on the hills overlooking a river valley the eye of a geologist invariably recognises the fact that the river has at some previous time flowed at a higher level than at present, and it becomes a question of great interest to determine how much of the slope is hillside and how much river-valley. To Mr. Tylor we are indebted for the solution of this problem, and, strange as it may sound, he is the only one who has enabled us to discriminate between hill and vale. He has shown that the hill slopes, determined by atmospheric agencies, are convex, and that the valley sides formed by running water are concave. These two curves insensibly merge into one another, so that the whole contour is a flowing line, called by mathematicians a binomial curve. Fig. 14 will illustrate this. The curved portion B, A, B, is convex, and is the hill; while B, V, B, V,

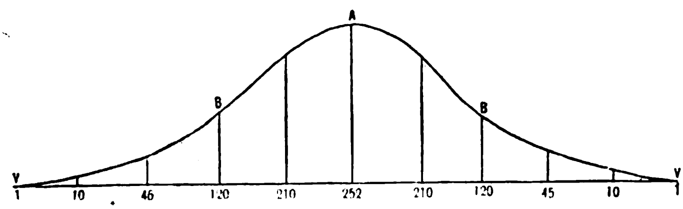


Fig. 14.—Binomial Curve.

are concave, and represent the valley slopes. This curve possesses the property that, if equal distances are taken along the base line, and perpendiculars be erected increasing in height in a certain ratio, these perpendiculars will terminate in the curve. It follows from this that the slope of the water in a river is not a straight line, but a curve, and the same observer has shown that in the navigable portions of a river this curve so closely approximates to a parabola, that if the heights of two points of a river and their distance asunder be known, the height of any intermediate point can be determined. The value of this discovery to engineers can scarcely be over-estimated, but its wide applicability seems to render many doubtful of its accuracy, yet it has been tried by MR. TYLOR, and others, and never been found wanting.

Its value to our enquiry is of another kind, for it enables us mathematically to demonstrate in a few minutes a truth which it took me five years to determine geologically; namely, the fact that the fens are in no sense the delta deposits of the rivers which flow through them. If the Fenland be a delta it must partake of the parabolic slope, but it does not: and very careful research has convinced me that no delta deposits exist therein, notwithstanding the general opinion to the contrary. The Fenland is a silted-up bay, just as its extension, the Wash, is a silting-up one; and the Wash is no more the estuary of the fen rivers than the German ocean is of the Humber.

Another important fact bearing upon the origin of rivers is—that they do not necessarily shew the general slope of the country, but often cut through ranges of hills. Of this we have a fine example in the Witham, which after flowing roughly parallel with the Trent, suddenly leaves the low land, and, bending almost at right angles, cuts right through the hills at Lincoln, 240 feet in height. The Old Nene, again, has sawn through the highland of March; and, the Ouse at Ely, in like manner, deliberately pierces the hills, instead of running clear of them, as the Bedford Rivers were made to do. The interpretation of this peculiarity we owe to Prof. A. C. RAMSAY, F.R.S., and we shall allude to it in our chapters on Geology. It is here only necessary to notice that when the rivers began to saw into what are now the hill tops, they must have flowed at or above that level, and an immense amount of material must have been since worn away. In this manner we arrive at some idea of the great antiquity of our rivers.

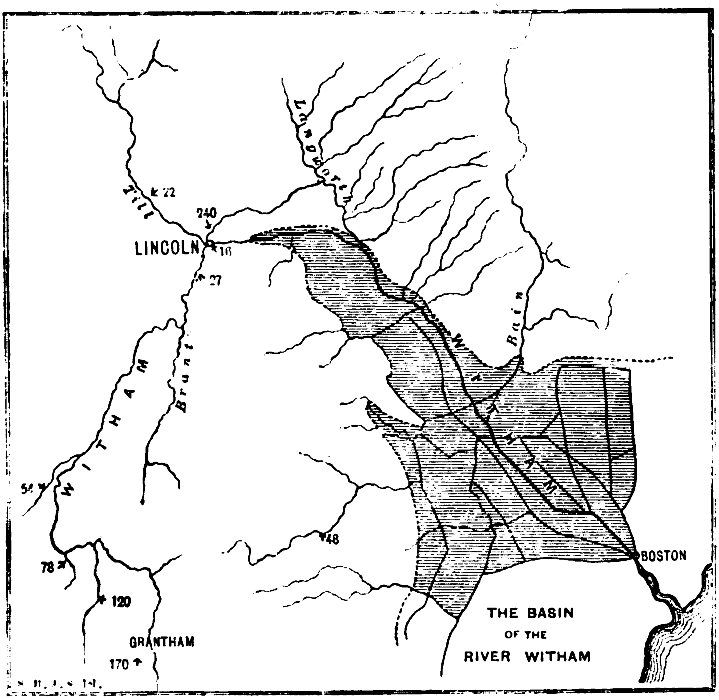


FIG. 15.—*The Basin of the R. Witham. Heights in feet shewn by figures.*

If we trace the course of a river and its tributaries, the most important general feature which strikes us is that the angle at which the tributaries at first enter the main river are acute, and grow larger as they approach its mouth. Such great rivers as the Amazon bring this out clearly, but even our small fen rivers shew it very well. Take the Witham as an example—its tributaries the Brant, Till, and

Langworth enter it at much more acute angles than the Bane, as shewn in the annexed cut, and this law is invariable; and it is equally clear that no tributary can enter at a greater inclination than a right angle, for the pressure of the water in the main river would prevent the efflux of the tributary water. This latter law we shall presently find throws great light upon the nature of the Well Creek.

We have before propounded Mr. Tylor's first law, that the movement of rivers is uniform motion, or that in an ideal river the water flows at the same rate from source to mouth; the diminished quantity of water in the upper reaches compensating for the greater slope—the presence of a harder or softer rock than usual modifies this law to some extent. When a river receives a tributary; the slope of the river diminishes and prevents the velocity increasing from the enhanced quantity—a tributary with one-tenth of the volume of water flowing down a slope ten times as much as the main river would enter it at the same speed.

Moreover, the tributary deflects the main stream, so as to cause it to flow in the line known in mechanics as the resultant of the two forces. Thus, if two rivers of equal volume, and having the same slopes, joined at right angles, say, one from the north and the other from the east, the united stream would continue at an angle of 45°, or directly S.W.: a tributary $\frac{1}{45}$th of the volume of the main stream entering at an angle of 45° would deflect the stream one degree. This is one of the causes of the serpentine character of natural streams.

Let us suppose an ideal case of a river whose basin was upon a perfectly homogeneous rock, and that it received no tributaries and lost nothing by percolation or evaporation. It would form a straight channel of uniform width and depth, and its transverse section would be a parabolic curve. Now, suppose two equal tributaries, with equal slopes, to enter the river high up its course at the same acute angles, exactly opposite each other, their deflecting powers would be neutralised by one another, and the river would continue to flow in a straight line. Its cross section and slope would be so altered from the point of junction downwards as to ensure uniform motion, and the curve of the transverse section would remain parabolic as before.

Supposing a series of such similar pairs of tributaries to enter the river in the same manner, like modifications of cross section and slope would ensue, and the transverse section would still be parabolic, only the curve would grow flatter below each confluence, and the river would maintain its straight course. The motion in such a river would be uniform, and it would discharge almost any quantity of water that might enter it by its tributaries without disastrous flooding, for the velocity would increase as the cube root of the quantity (law 2, p. 156). The modification of the section and slope with the incoming of the tributaries is due to the increase of erosive power, which, by law 4 (p. 156) is as the fourth power of the velocity. Thus, if the tributaries supplied 1,000 times the quantity of water in the inital stream, the velocity would be 10 times, and the erosive power 10,000 times, as much as before.

The clear idea we have now formed of the physiology of rivers will be of great use to us in endeavouring to establish the scientific method by which, it appears to me, fens and marshes should be drained. It has shewn us that in making an artificial cut for drainage by the natural flow of water the bed must be a parabolic curve, whose character will depend upon the slope of the ground. If in one part the bed be too deep the energy of the river will be used in filling up the hollow; if the curvature be too little, as in the case of a straight line, that energy will be expended in cutting away the protuberant mass, and it must be clearly understood that a river cannot dig holes below its mean bed (excepting under waterfalls and against obstructions).

Of course we can never find such an ideal river as we depicted, but the undrained fen was as near an approach to it as could be expected in nature; and in the antagonism to the principles here laid down is to be found the explanation of all the difficulties which have been and are still being experienced. It is too late now ever to hope to see the fens drained upon these principles; but we may yet expect to see a large portion of the Wash reclaimed, and drained upon a true scientific system.

Inasmuch as the slope of the fens, from the highland to to the sea, is very small, the curve of the parabola is very flat, but the drainage of the district has been carried out too much as if there were no compensating force attainable, whereas, the whole volume of the highland water entering the fens by the rivers helps to enhance the velocity; for instance, the quantity of highland water which comes down the Witham is double that which the fen itself supplies; and every drop of this is equivalent to an increase of slope. If then, the fen rivers had been straightened as much as possible, and the waters of the district been led into straight cuts, entering the rivers at right angles, opposite each other, as high up as possible, there would have been attained the maximum velocity, and, hence, the best drainage—the maximum of erosive power, and, hence, the clearest outfall—the rivers would have maintained their course with the minimum of training (for the deflecting power of the tributary drains would have been neutralised) and we should have been spared the pitiable sight of fine drains such as the North Forty Foot, the South Forty Foot and the Witham, for example, running parallel and close together for miles. This means vast outlay expended to produce the minimum result. We cannot altogether blame the old drainers for their obtuseness, for these principles now are not generally known even among engineers; indeed, I am not aware that they have ever been brought forward in this form.

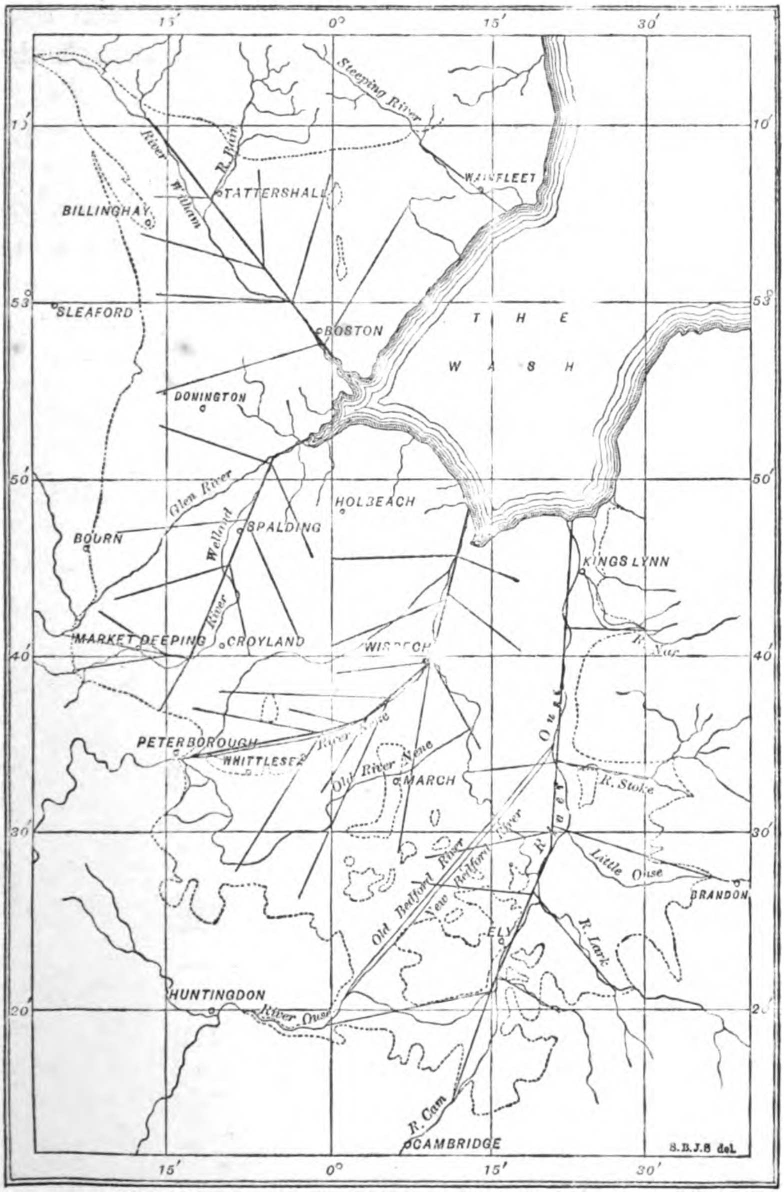


Fig. 16.—*Ideal Drainage of the Fenland.*

As a matter of curiosity, and possible use, I have ventured to insert the accompanying *Map* showing the Fens drained upon the principles here set forth.

We must now direct our attention to the particular rivers in the district, and trace the history of the changes they have undergone as briefly as possible.

The River Basins, &c.

The lengths of these rivers and their tributaries, with the areas of the basins they drain, are thus given by the Rivers Commission, 1874 :—

NAME.	LENGTH.	AREA OF BASIN.
STEEPING	18	
Tributaries	—	
Other small streams	—	
	——	101
WITHAM	40	
Till	14	
Bane	24	
Brant	13	
Langworth	9	
Other small streams	—	
	——	1079
WELLAND	42	
Gwash	19	
Glen	31	
Chater	15	
Other tributaries....	—	
Other small streams	—	
	——	760
NENE	100	
Old Nene	42	
Ise	22	
Other tributaries....	—	
Other small streams	—	
	——	1007

Ouse	143	
Little Ouse	37	
Lark	28	
Cam	30	
Brook	10	
Rhee	15	
Ivel	18	
Ousel	19	
Tove	21	
Other tributary streams	—	
	——	2607
Nar	35	
Tributaries	—	
Other small streams	—	
	——	131
Wissey	28	
Tributaries	—	
Other small streams	—	
	——	243

The area drained by these rivers collectively is very nearly 6,000 square miles, or between an eighth and a ninth of the whole of England. The area of the Fenland is 1306 square miles; hence the drainage basin is more than $4\frac{1}{2}$ times as large as the Fens. This roughly represents about 6 times as much water as is derived from the Fens themselves, and the extra velocity so obtained is about twice that derivable from the Fen waters alone, which is nearly equal to increasing the natural slope from four to five inches per mile, and the erosive force is very nearly increased sixteen-fold, supposing it to be concentrated in one channel. Nearly every particle of this existing power is wasted by the present system of drainage. The rivers, robbed and weakened at nearly every point, require vast outlay to maintain them in an efficient condition for the purposes of drainage and navigation, and the drains themselves involve continued expense—much of which might have been saved.

Space compels us to omit any particular account of the small rivers Steeping, Glen, Cam, Lark, Little Ouse, Wissey and Nar, interesting though some of them are. We shall, therefore, consider in their geographical order the Witham, Welland, Nene and Ouse.

[WITHAM.] The river Witham rises close by the village of South Witham near Grantham, and flows by that town and Lincoln to Boston and the sea. Its course is roughly horse-shoe shaped, its mouth being nearer to its source than to its central part.

Lincoln was an important military and civil station of the Romans, and the river was undoubtedly an important water-way. If we look at a map of the Fens, it will be seen that an important town stands at the entrance of each river into the Fens and another at its mouth. Thus we have on the

Witham	the towns of	Lincoln and Boston.
Welland	,,	Deeping and Spalding.
Nene	,,	Peterborough and Wisbech.
Ouse	,,	St. Ives and Lynn.

Of these places, Boston is the only one which was not in existence during the Roman occupation, and as *Lindum* (Lincoln) was the most important station in the district, it seems singular that the entrance to the river on which it stands, should be left unprotected, especially when so insignificant a stream as the Steeping had the very large port of *Vainona*, now Wainfleet, at its mouth. The consideration of this peculiarity led me to look with favour upon a suggestion by STUKELEY that in ancient times the Witham flowed from Lincoln to Dogdyke and from that point across the East and West Fens to Wainfleet, receiving the Steeping as a tributary near that town, and this opinion was further strengthened by finding the course of the river so depicted on RICHARD of CIRENCESTER's map. I accordingly sought for remains of the old channel, and found unmistakeable traces of it from Dogdyke some miles eastwards. The course was marked by a silted up channel in the gravel, but where this deposit dipped under the silt the course could be no longer traced in consequence of the identity of the beds. This matter being determined, the importance of *Vainona* is explained, for it was the port and fortress on the water-way to Lincoln.

It is not improbable that the present course of the river at this time was in existence as an inconsiderable creek, which enlarged as the ancient channel decayed, until eventually it became the main, and finally the only open course of the river.

From the year 1240 to 1415, we find occasional notices of the Witham respecting the maintenance of banks, &c., and from the fact that the HANS or STEELYARD Merchants, established themselves in Boston in the year 1474, we may infer that the river was not in a defective state at that date.

The tide flowed as far as Lincoln, raising the water at Swanpool two feet, but in the year 1500 MAYHAVE HAKE, an engineer of Gravelines, was directed to place a sluice across the river to stop the tidal flow and prevent the salt water from flooding the adjacent ground, for we are told that at Dogdyke "the salt and fresh water strove soe together, that the water ran soe over the banks on both sides of the haven, that it drowned all the common Fen, soe that men might have come with boats from Garwick to Boston towne; and likewise from Boston to Kirkby land side."* Another sluice was erected at Langrick in the year 1543.

* THOMPSON'S Hist. of Boston, p. 357.

Had the river been protected by proper banks instead of being checked by sluices, the drowning of the land would have been prevented and the river greatly improved. It need scarcely be said that from the time of the erection of the sluices the river began to decay, as has been, and must always be, the case when tidal streams are checked; yet engineers never seem to have learned the lesson, although many of them now see the evil, and would have them removed at any cost. With the deterioration of the river came decline of commerce, which rendered matters still worse, by checking the efforts to keep the channel clear. The dissolution of the monasteries, of which there were twelve between Lincoln and Bardney, was another misfortune to the river, for the monks did their best to protect their lands by good banks. The silt and sand banks caused the tide to be retarded, until at last it overcame all obstacles and rushed up the tortuous channel to Boston as a bore or hygre, and in the year 1697 great damage to quays and banks is recorded from this cause.

In the year 1720 the North Forty Foot was made by Earl FITZWILLIAM for the drainage of the land north of Kyme Eau. By this means a quantity of water which formerly discharged into the river at Langrick was carried direct to Boston, thus weakening the current of the river, without, as it soon appeared, improving the drainage of the land it was intended to benefit.

Matters continued to grow worse, until in the year 1751 vessels of 40 tons, drawing six feet of water, could only reach the town at spring tides, although 30 years previously craft measuring 250 tons came up the river daily. So serious did the state of affairs become at last, that in the year 1761 an Act was obtained for draining the fens adjacent to, and improving and maintaining the navigation of, the river, and the powers held by the Court of Sewers passed into the hands of a body known as the Witham Commission. The river was to be improved by a straight cut from Boston to Chapel Hill, a very wise determination, but as usual "moral" difficulties arose, and, to *oblige* one landed proprietor, the channel was turned at ANTON'S Gowt, and to *accommodate* another it was bent at a sharp angle towards Langrick. After what has been said it would be tedious to keep pointing out the evils of these and other courses, and we must content ourselves with merely recording the curiosities of unscientific engineering in the sequel. As if to reduce any possible benefit to a minimum, the Grand Sluice was erected at Boston to stem the tide and hold up the water. Nothing so effective could have been designed had the avowed object been to choke up the outfall as speedily as possible.

By the year 1811 RENNIE was called in to scour and deepen the river above the Sluice, for, of course, there was no efficient outlet for the sediment brought down by the river. In the year 1846 the navigation of the Witham above Boston lost its importance by the construction of the Great Northern Railway, to which the rights and responsibilities of the navigation were entrusted. From this time the river became chiefly of importance for drainage purposes, but even then the river could not clear itself, and it had to be scoured and deepened in the years 1865 and 1870. At the former period the bed was made on a dead level from Boston to Horsley Deeps (six miles), another unnatural work, which entailed upon a river incapable of discharging its sediment the additional task of cutting its channel into a parabolic curve.

After the erection of the Grand Sluice attention began to be directed to the improvement of the river towards its outfall. A straight cut was made from the sluice to the iron bridge at Boston in 1825, which improved the river at the town, but did not benefit the navigation owing to the defective state of the channel below Maud Foster Sluice. Between the years 1828-33 a new cut, 800 yards in length, was made across Burton's Marsh, cutting off the great bend known as Wyberton Roads. The river was further straightened in the year 1841 as far as Skirbeck, and, since then, further improvements in straightening the channel and training it with fascines have been accomplished.

We must now briefly glance at the effects which the Grand Sluice has had upon the condition of the river. My friend MR. W. H. WHEELER, C.E., is just as strongly opposed to the principle of damming tidal streams as I am, and his intimate official knowledge of the Witham renders his opinion very valuable. In his "Report on Boston Harbour and Outfall," his "Outfall of the River Witham," and his pleasant little book on the "Fens of South Lincolnshire," he expresses his conviction that until the Grand Sluice is removed it is hopeless to expect permanent benefit to Boston haven, no matter what expense is gone to for new works. He shews that before the erection of the Sluice the tidal waters ran from ten to twenty miles above Boston; the mean quantity of water which passed the site of the Sluice during an average spring tide was 31,680,000 cubic feet, and of this mass, with its powers of erosion, augmented by the flow of the fresh-water, the river is twice robbed daily. ELSTOBB, RENNIE, CHAPMAN, TELFORD, STEPHENSON, and HAWKSHAW have written against the Sluice; but there it stands as firmly, but let us hope not so permanently, as Boston Stump.*

The tidal water, laden with silt, sweeps up the river, and being suddenly checked by the Sluice, deposits its burden against the doors and along the channel, and there is no

* MR. WHEELER has quite recently been acrimoniously attacked by a brother engineer for advocating these simple natural laws. It is passing strange that ignorance should glory in itself.

back scour at the Sluice, and only a sadly diminished one below it to remove the deposit. RENNIE, in the year 1802, found ten feet of silt accumulated on the cill, and the communication between the river above and below quite stopped. In the year 1806 the cill of Hobhole Sluice was laid two feet below low-water spring tides, and ten years afterwards fifteen inches of silt was standing on the cill; now there is about four feet. In the year 1864 the silt stood about eleven feet above the cill, which was three feet higher than the level of the water above the Sluice, and a similar state of things existed at other sluices.

MR. WHEELER has further shewn that the course of the water below Hobhole is obtructed by shifting sands and a tortuous course, and that, in spite of all the work expended on the river above that place, the channel does not, and cannot improve, for the whole force of the river, even in times of flood, is expended in turning over the sands. He proposes to straighten this course and train it by fascines, so as to avoid the troubles alluded to. This is sound philosophy, as is also his mournful declaration that, until the Sluice be removed, no permanent benefit can be expected.

[WELLAND.] The river Welland rises near Sibbertoft, and forms the boundary between the counties of Leicester, Rutland, and Lincoln. It is the only river of the fens which has preserved its ancient course with anything like integrity, and the Roman banks near Spalding attest the similarity in size between those times and the present.

Until the drainage of the fens in the 17th century the river branched at Crowland—one portion flowing through Spalding, as at present, the other (known as the South Ea, the South Holland, or Shire Drain) joined a branch of the Nene at Noman's-land-hirne, and entered the sea by Cross Keys Wash. DUGDALE, writing in the year 1660, tells us that this was the main channel, and describes the other as flowing "in a most slow course to Spalding and Surfleet." At present the branch as far as Noman's-land-hirne is a mere ditch, and the main course a fine stream.

The Spalding channel became defective in the 13th century, and in 1337 we are told that the surrounding lands were often under water. In the reign of ELIZABETH the state of the river was very bad, but was improved when Deeping Fen was drained by the AYLOFFS, as related in chapter VI. VERMUYDEN, on draining the Bedford Level, embanked the east side of the river to protect the North Level from floods. In the year 1794 a new cut was made from the Reservoir to Foss Dyke, but the river continued to silt up owing to its defective outfall, and in 1815 the neap tides did not reach Spalding. This state of things continued until, in the year 1835, the water was only a few inches deep. MR. JAS. WALKER, C.E., thereupon devised, and MR. BEASLEY carried out the most admirable plan for improving the river by fascine training. MR. WHEELER, writing on the subject, says that it "was found to be so simple and inexpensive as compared with other methods, and at the same time so effective, that it has since been used in all similar works in the estuary. It consists of barrier walls, or banks made of thorn faggots about six feet long and three feet girt, which are laid in the water in courses varying in width in proportion to the depth; and, as each course, which is weighted with clay, sinks, others are laid on till the bank is raised to about half-tide level. The branches of the thorns interlaced one with another, and the silt brought up by the tides rapidly deposits amongst and at the back of this fascine work, and thus a solid embankment is formed, of sufficient strength and tenacity to withstand the strongest tidal current." The river was scoured out, straightened, and trained, and this training has now been carried about $2\frac{1}{2}$ miles below Fosdyke Bridge.

In this river we see the beneficial effect of letting the tides have full sway, and of straigthening the outfall channel. The river now gives little trouble, and so strengthened is the current (notwithstanding that a large quantity of water from the Black Sluice District has been withdrawn from it and poured into the Witham) that impinging upon the stream of the larger river Witham at an angle it has driven it from its direct course into Lynn Deeps, and compelled it to turn northwards along Boston Deeps.

[NENE.] The river Nene rises near Daventry, in Northamptonshire, and enters the fens at Peterborough. It is the most interesting of the fen rivers geographically, historically, and geologically. Geographically it is important from its central position and once pre-eminent greatness: historically, from the changes which have taken place in it through the influence of man: and, geologically, by reason of the light which its silted-up estuary throws upon the history of the Fenland. It is singular, too, that so much misapprehension has arisen concerning this river, considering its importance, but it is, nevertheless, true, that even the actual changes in its branches have been misunderstood.

Unfortunately, we have but the most meagre notices of the Nene before the reign of HENRY VII., but such as they are, especially when read by the aid of subsequent records, they enable us to construct a tolerably complete account of the river.

At present the main river passes from Peterborough through Guyhirn to the sea, the channel between the two former places being along an artificial cut called the New Leam, roughly parallel with which is an older cut known as

MORTON'S Leam, from the name of its projector, Bishop MORTON, by whom it was constructed sometime between the years 1478-90. This was the chief waterway before the New Leam was made, and it has been tacitly understood that prior to its formation there was no direct river between Peterborough and Wisbech; Sir J. COODE, C.E., for instance, in his admirable report on the Nene (1875) quotes MR. PAGE to the effect that MORTON'S Leam "was the first direct channel between Peterborough and Wisbech." We shall now see into what a dilemma this supposition leads us.

Everyone admits that at Peterborough the Nene divided, one portion going north to Noman's land, where it received a branch of the Welland and then passed as the South Ea to Tid Gote, and another part flowed south through Whittlesea Mere, by Benwick to Outwell *and thence along the Well Creek to the Ouse at Salter's Lode.* As to these facts there can be no doubt, for they are many times mentioned, sometimes in great detail, in contemporary records. But if one branch flowed out at Tid Gote and the other ran into the Ouse, what water passed through Wisbech if there was no communication between Peterborough and that town? We know that at one time the Ouse flowed by Wisbech; but, as we shall presently see, this was not the case when the Nene passed down Well Creek, indeed, it had long previously ceased so to flow.

Turning now to the northern branch we meet with a similar difficulty, for the South Ea branches at Clow's Cross one part going northwards to Tid Gote, the other southwards to Guyhirn. There must, therefore, have been a channel from Guyhirn to the sea, and this it was which passed through Wisbech. Accordingly, we find mention made in the year 1437 (before MORTON'S Leam was made) of the "river of Wisbeche" which flowed from Guyhirn to the sea, and again in 1438 we read of the same stream.

Hence we may take it as proved that between Guyhirn and the sea there has always been a natural stream.

The same record furthermore distinctly states "that one part of the water of the Nene descended from the bridge at Peterborough unto Thorney barre aforesaid; thence to Noman's land in Croyland . . . . . And they said that the other part of Nene which passeth from Peterborough bridge aforesaid unto Wodeshed in Wytlesey, thence to Whittlesey brigge, thence by Whittlesey to Wardiscote, in Whittlsey, and thence unto the great river of Wisbeche." This, again, is proof conclusive that there was a natural stream between Peterborough and Guyhirn, so that MORTON'S Leam is only a straightend natural water-course, and not an entirely new course as was believed. On this view of the matter there could have been little or no water flowing between the Well Creek and Walsoken.

Turning now to the Well Creek, we notice first that its irregularities prove it to be a natural stream, and secondly that it enters the Nene at an acute angle of 45°. From what has been said about the entering angles of tributaries, it is clear that the Creek was a tributary of the Wisbech river at the time when the Great Ouse flowed that way from Welney. Yet we have seen that in the 15th century it became the main course of the southern branch of the Old Nene, and in all probability this was in consequence of the channel to the north silting up, when the Great Ouse was diverted towards Lynn. That the channel was decaying as early as the year 1340, is abundantly shewn by various presentments from that date until 1437, when it was reported "the river of Wysebeche had been for many years past been . . . . . filled up with silt and sand brought in by the sea-tides."

Before taking up the history of the Nene from this point we may notice that besides the branches known as the

Wride and Knarlake (now superseded by the New and MORTON'S Leams), we read of "the river of Elm," which seems to have run from March by Friday Bridge to Elm, pretty much along the course of the Wisbech Lower Road. The last mention of this river is in the year 1580, and it probably was allowed to decay on the great drainage of the Bedford Level in the 17th century.

When the Wisbech outfall had decayed, as mentioned above, the enterprising bishop MORTON cut the Leam which bears his name. It is very remarkable that the date of this important work cannot be accurately ascertained. ARMSTRONG, indeed, tells us that it was made in 1490, but he gives no proof of his assertion, and he probably fixes the date too late, for MORTON was bishop of Ely from 1470—86, and it is improbable that the work was undertaken after his connection with the diocese was ended, for we know that he then entered with zest into the political affairs of the time. The original sectional area of the Leam, according to DUGDALE, was 40 × 4 feet, and it afterwards became apparent that it was too small to accomplish its task. In the year 1570, we accordingly find that it was enlarged so that its sectional area was 20 feet greater.

The channel of the Nene was again neglected, and the outfall became so choked with silt and sand, that in the year 1538 the water backed up the old course of the Ouse from Outwell by Welney to Littleport, and so flowed by Denver to King's Lynn, so that what was once the main channel of the Ouse became a minor branch of the Nene. The river seems to have been cleaned out about this time and again left to shift for itself, with the inevitable result that it decayed to such an extent, that in the year 1631 we find DUGDALE speaking of MORTON'S Leam being "new made," as if all the work had to be done over again.

It was not until the year 1721 that any effectual steps were taken to improve the outfall. KINDERLEY at that date proposed and partially carried out a scheme for straightening the channel as far as three miles beyond the then river's end. The river at that time ended about four miles below Wisbech, instead of twelve miles as at present; and from its termination flowed in a very tortuous course, which continually shifted, through salt marshes varying in width from half-a-mile to three miles. These marshes were flooded each tide, and were by a curious misapprehension deemed to be beneficial to the river in virtue of the large amount of water they poured into it during the ebb, the loss sustained by the water spreading over them during flood tide, which would otherwise have run up the river, being entirely ignored. The channel was full of dangerous shifting sands; KINDERLEY tells how "the channel changed a full mile, by degrees from west to east, in two years' time from June 1721." Messrs. WALKER and CRADDOCK, the historians of Wisbech, further inform us that "It was, therefore, always necessary to engage pilots up to Wisbech, even by vessels in the habit of trading thither; for there was no part of the North Sea more dangerous in rough weather than these sands and uncertain channels, which were the cause of frequent wrecks to the small barges that ventured along them at certain seasons." KINDERLEY proposed to avoid this dangerous course by cutting a new one from the river's end near the South Holland Drain Sluice through the land, and the work was entered upon by the North Level Commissioners with the approval of the Corporation of Wisbech. When the work was nearly completed, the latter body withdrew its support, vehemently opposed the scheme, and finally went so far as to destroy the work already done. In this state the river remained until the year 1773, when the plan was successfully carried out without opposition and with immediate benefit, for the first "fresh" that came down the river scoured it out from seven or eight to fifteen or sixteen feet, and the water at Wisbech was lowered four or five feet. The cut, however, was not carried out beyond the river's end, and the river began to decay once more, and Mr. WELLS, the historian of the Bedford Level, tells us how in the year 1804 "The state of the River Nene . . . . . . had long been a subject of general complaint; so much so, that a respectable alderman of Lynn facetiously observed, that he regularly attended the river Nene meetings, until he saw on his way thither persons making hay in the bed of the river, after which he thought such attendance perfectly unnecessary."

During the time in which KINDERLEY'S Cut was in abeyance, SMITH'S, or the NEW, Leam was made to supersede the old MORTON'S Leam, which was found to be so defective that it was deemed less expensive to make an entirely new cut, than to render it an efficient drain.

Messrs. RENNIE and TELFORD, at the beginning of this century, devised a scheme for straightening the river from the end of KINDERLEY'S Cut to Crab Hole, and the work was carried out by Messrs. JOLIFFE and BANKS at a cost of £200,716. The new cut, called the Nene Outfall Cut, was opened in June 1830, Sutton Bridge being made before the waters were turned into the new course. The contractors estimated that the tidal scour would deepen the channel four or five feet, and they were disagreeably surprised to find that instead of such a beneficial result ensuing, the channel slightly silted up. It was soon apparent that the mischief lay in the great bay or inflexion which marked the natural estuary of the river. A dam was consequently erected across the old channel, and the tide thereby directed into the new cut, speedily scoured it out, not merely to a depth of four feet but as much as ten. Indeed, the erosion was so great that fears were entertained respecting the safety of the bridge, and quantities of stone were thrown into the river to stem the tide. Commenting upon this practice, the authors of the History of Wisbech say, that it has "continued ever since, to the prejudice both of drainage and navigation, as there is a fall of from two to three feet occasioned by this ridge of stones; besides, the water precipitated over it at the ebbing and flowing of the tide, has scooped out holes on each side of the bridge from 28 to 30 feet at low water. The effect of these holes is to create a series of eddies, especially on the flowing of the tide, so as to render a vessel almost unmanageable."*

A new sluice was erected for the purpose of warping up the old channel above the embankment; but so great was the scour of the tides that the water-level in the new cut was lowered to such an extent that the cill was almost always high and dry, and the sluice, consequently, utterly useless.

The banks of the new channel were at this time protected with stones, 100,000 tons, costing £32,000, being used for the purpose.

The effect of this great work was immediately beneficial, as may be gathered from the fact that, whereas at the time of their undertaking spring tides at Wisbech rose only four feet—they now reach, and often exceed, fifteen feet.

In the year 1832 another cut, called Pauper's Cut, because distressed agricultural labourers were employed upon it, was opened. It cut off a detour below KINDERLEY's Cut, and thus rendered the channel still straighter. Considerable difficulties were experienced in constructing the dam across tho old channel, but they were afterwards overcome and the work brought to a successful issue. The new channel was

* WALKER and CRADDOCK's Hist. of Wisbech, pp. 453-4.

opened on May 7th, 1832, and the proceedings have been graphically described by MR. N. WALKER.*

Since this time no great work has been undertaken, excepting the construction of a new iron swing-bridge at Sutton Bridge, the deepening of the river between Baxter's and Guyhirn, and the embanking of new marshes, and the piling and facing of the river banks at Wisbech.

Sir JOHN COODE, the eminent engineer, in the year 1875, presented to His Grace the Duke of BEDFORD a most exhaustive report upon the present state of the Nene, which is of more than passing interest. By a series of simultaneous observations he carefully determined the mean depth, sectional area, and some of the tidal peculiarities of the river Nene between Peterborough and the Stone Ends. The following table shews the depth of the river at low water spring-tide on September 26th, 1874, when from the dryness of the season the freshwater was reduced to a minimum.

DEPTH OF RIVER NENE IN 1874.

BETWEEN	MAXIMUM.		MINIMUM.		MEAN.	
	ft.	in.	ft.	in.	ft.	in.
Peterborough and Cross Guns	2	9	0	8	—	
Cross Guns and Wisbech ...	12	8	2	6	6	0
Wisbech and Sutton Bridge...	14	0	2	0	5	9

The results of the tidal observations were very remarkable, and may be thus stated. In normal tidal rivers the whole of the water is supposed to flow up the river during flood tide and then to flow back again, so that at any one time the water in every tidal portion of the river is flowing in one direction. In the Nene, however, the ebb commences in the lower reaches while the flood is still in progress

* Hist. Wisbech, p. 461-2.

higher up the river. Thus, on September 26th, 1874, "whilst the tide *ran down* or ebbed at Stone Ends to the extent of 6ft. 11in. for the two hours between 6.30 and 8.30 a.m., it *ran up* or flowed at Cross Guns in the same period to the extent of 6ft." There must, as Sir JOHN remarks, be two strong opposite currents during this interval with a zone of slack water between them. The cause of this anomaly is stated to be, in the opinion of the same engineer, the insufficiency of the duration of the flood tide, caused by the shoals and tortuous channels at the outfall through which the flood has to fight its way, "so that by the time the flood reaches Stone Ends, which point must be regarded as the mouth of the river proper, a considerable period has elapsed, necessitating a great velocity in order to fill the upper districts in the limited time before high water, so rapidly does the flood rise that the insufficient sectional area of the river at Wisbech—considerably reduced by shipping lying alongside the wharves and in mid-stream —is quite unequal to the filling of the channel above Wisbech bridge at the same rate as the tide rises below that point, hence the declivity of, say, two inches per mile below Wisbech, and of 15½ inches per mile above it, but the upward tidal wave has acquired a certain momentum, and although throttled and impeded in passing through Wisbech it retains sufficient velocity to carry it, eventually, as far as Dog-in-a-Doublet, or when there is but little fresh water in the river, even between it and Northey Gravel, although it arrives there later than it should have done and rises to a less height; meanwhile one tide has not only risen to its full at Stone Ends, but has already been ebbing there for no less than 3 hours 15 minutes; 45 minutes thereafter the tide turns at Dog-in-a-Doublet also, and it is then ebbing throughout the whole length of the river. At 12.45 p.m., on 26th September, it was practically low-water at Stone

Ends, but the ebb lingered on until the flood came in at 3.15 p.m., or 2½ hours thereafter; had the river been in proper train this period of tidal inactivity would have been added to the duration of the floods, and the time of ebb and flow would then have been more nearly equalised than at present.

The sectional areas were found to be as follows:—

Sectional Areas of the River Nene in 1874.

POSITION.	Distance from the Towers in miles.	Sectional Area at High-water in square feet.	High-water compared with area at Towers.	Sectional area at Low-water in square feet.	Approximate Area at Low-water compared with area at the Towers.
The Towers	—	8,660	1,770	*say* 1·0	*say* 1·0
Walton Dam......	8	3,980	740	,, ·5	,, 0·5
Waldersea Sluice	13¼	1,550	210	,, ·2	,, 0·125
Guyhirn Bridge	16½	1,080	170	,, ·125	,, 0·100

"Although, as I have stated, it was practically low-water at Stone Ends at 12.45 p.m. (spring tide of 26th September), further up the river the ebb was not so forward, for in consequence of the obstruction caused by Walton Dam, and the insufficient depth at Pauper's Cut, its progress seawards was retarded; in fact, the channel is never thoroughly drained of the water which, if the river course were properly regulated, ought to run out at each spring tide, Walton Dam penning it back in one case, and the outfall, to a most serious extent, in the other, this will be evident from . . . the table relating to low-water, which gives the inclination immediately inside the Outfall as 1·9 inch per mile, and at the back, or upper side of Walton Dam as 1·8 inch per mile, whereas the incline between Horseshoe Bend and North Level Sluice at the same time was no less than 14¼ inch per mile, or eight times as great in one case as in the other."

The same Report brings out another remarkable fact, namely, that the level of high-water at Peterborough during the spring-tide of September 26th was seven feet *below* high water at Stone Ends.

It seems to me probable that the pulse-like propagation of the flood (if it may be so termed) is but a modified remnant of the bore or *hygre*, which, of yore, was so common a phenomenon in this river.

In investigating the nature of the tides of the Fenland rivers for my forthcoming Memoir on the Geology of the Fenland, I came across the following curious passage respecting the river Witham in Prof. L. D. B. GORDON'S Report to the Commissioners of the Admiralty on the Lincolnshire Estuary Bill (11 and 12 Vict. c. 129), 1851. "It is evident (from the tidal diagrams in the report) that the height of low water on Hobhole cill does not vary much with the tides, *but is usually lower during neaps than during springs*, both there and at the Grand Sluice." The italics are in the original.

This was new to me, though Captain BEECHEY cites an analagous phenomenon in the Severn above Lidney, attributing as the cause, that "at spring tides there is more water thrown into the river than can escape before the return of the following tide."* I examined all the published records of the tides to satisfy myself of this strange fact, but found that the height of low water was seldom recorded, and never with sufficient regularity to afford safe data for the investigation. Thereupon I wrote to my friend, MR. W. H. WHEELER, C.E., of Boston, whose intimate acquaintance with the Witham would, I thought, enable

* Remarks upon the Tidal Phenomenon of the River Severn, p. 3, by Capt. T. W. BEECHEY, R.N., F.R.S. London, 1851.

him to settle the question so far as that river was concerned. He replied, "If the low water at Hobhole is lower at neaps than springs, it is a fact unknown to me. At Clayhole, three miles lower down, there is a very great difference, spring tides being considerably the lowest; the average low water at springs being 90·14 feet above datum, and at neaps only 101·29 feet, giving a difference of 11·15 feet.*

I then wrote to the editor of *The Fenland Meteorological Circular and Weather Report*, who kindly made for me copies of the traces of the self-registering tide-gauge at Wisbech for April and July in 1875, and the subjoined table. I chose these months because the former was very dry, the river Nene consequently low, and the effects of the tides, therefore, comparatively uninfluenced by the fresh water; while the latter month was very wet, and the tidal influence greatly modified by the strong freshets. The results of my examination are as follows.

For the purposes of this investigation we may divide all tides into springs and neaps; but this division can be made in two ways, viz.—(1) by finding the mean range of high water, and taking the tide which most nearly corresponds with this as the division, or (2), by equally dividing the number of tides from spring to neap, remembering that the highest springs along this coast generally occur four transits after new and full moons.† The latter plan has been adopted because the former was found to be fruitful in error.

If, however, we take the *highest* and *lowest* spring and neap ebbs, there seems to be no doubt that the ebb of springs is often less than that of neaps. The following table, shewing these measurements from January to August,

* Datum 100 feet below Ordnance Datum.

† Admiralty Tide Tables, p. 5, 1874. Actually the highest April tides occurred on the 5th and 2nd transits, and the July tides after the 2nd and 6th transits.

brings this out very forcibly. The heights are above Nene Valley datum.*

LOWEST SPRING TIDES.	FT.	IN.	LOWEST NEAP EBBS.	FT.	IN.
Jan. 22nd.	25	0	Jan. 12th.	24	6
Feb. 7th.	24	4	,, 31st.	24	6
,, 22nd.	24	6	Feb. 14th.	23	9
Mar. 8th.	24	8	,, 26th.	24	6
,, 21st.	24	0	Mar. 18th.	24	6
April 6th.	23	2	,, 31st.	23	0
,, 21st.	24	0	April 13th.	24	6
May 5th.	23	9	.. 27th.	24	8
,, 20th.	23	3	May 12-13	23	0
June 4th.	24	0	,, 26th.	23	6
,, 20th.	23	9	June 11th.	23	1
July 4th.	24	6	,, 26th.	23	6
,, 20th.	24	9	July 10th.	24	0
Aug. 4th.	25	9	,, 26th.	23	6
,, 18th.	24	9	Aug. 10th.	24	1
,, 31st.	24	6	,, 23rd.	24	5
MEAN	24	2	MEAN	24	3

Here we see that, though the spring ebbs are sometimes a foot above the neap ebbs, the mean heights of low water are nearly equal. But on the 26th July the neap ebb was exceptionally great, owing to the heavy rains, and if we eliminate this, the means are for springs 24ft. 2in., and for neaps 23ft. 11in., shewing a difference in favour of springs of 3in. This result is, however, unsatisfactory from the limited data at command. We will, therefore, examine the April and July tides in detail.

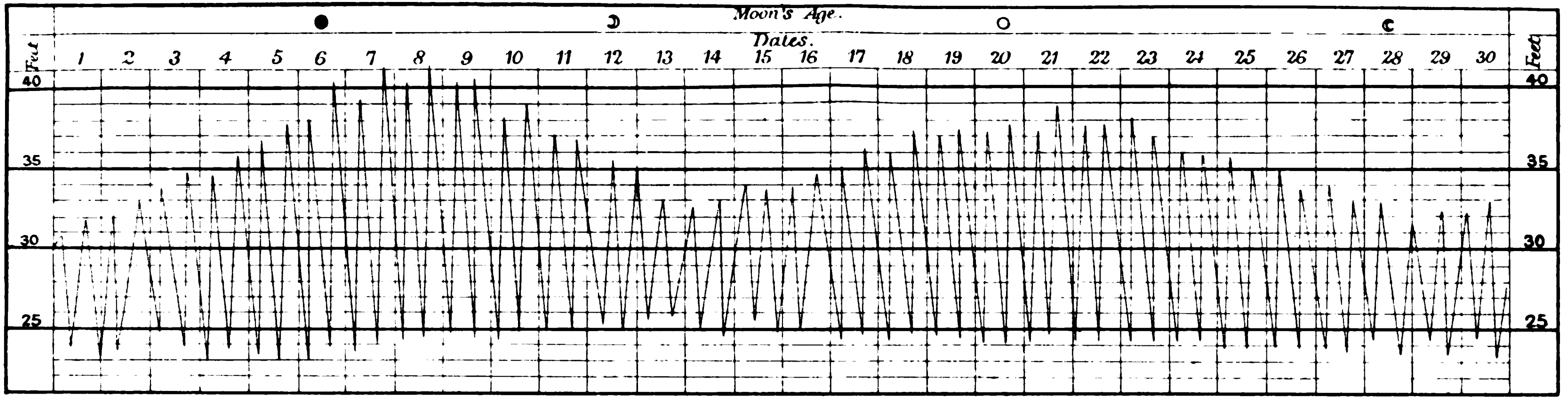
* 74·34 below Ordnance Datum.

April Tides.—During the month 57 high tides were registered at Wisbech. The mean height of the high water was 35·8ft., and of low water 24·1ft., giving a mean difference of 11·7ft. The mean height of low water *springs* was 23·9ft. and of *neaps* 23·8ft., the slight excess being in favour of the former, but the numbers are practically equal. The lowest spring ebb was 23·1ft., the lowest neap ebb 23·0ft. The highest spring ebb was 24·8ft., the highest neap ebb 24·7ft., the greatest excess of spring ebb over neap ebb 1·8ft., and the greatest excess of neap over spring ebb 1·6. These figures are very close, and as April was exceptionally dry, the maximum tidal influence was obtained. Hence we are justified in making the following statement. *The heights of low water in the river Nene at Wisbech at spring and neap tides are practically the same, and the spring ebb is sometimes as much higher than the neap ebb as that is normally above the spring ebb.*

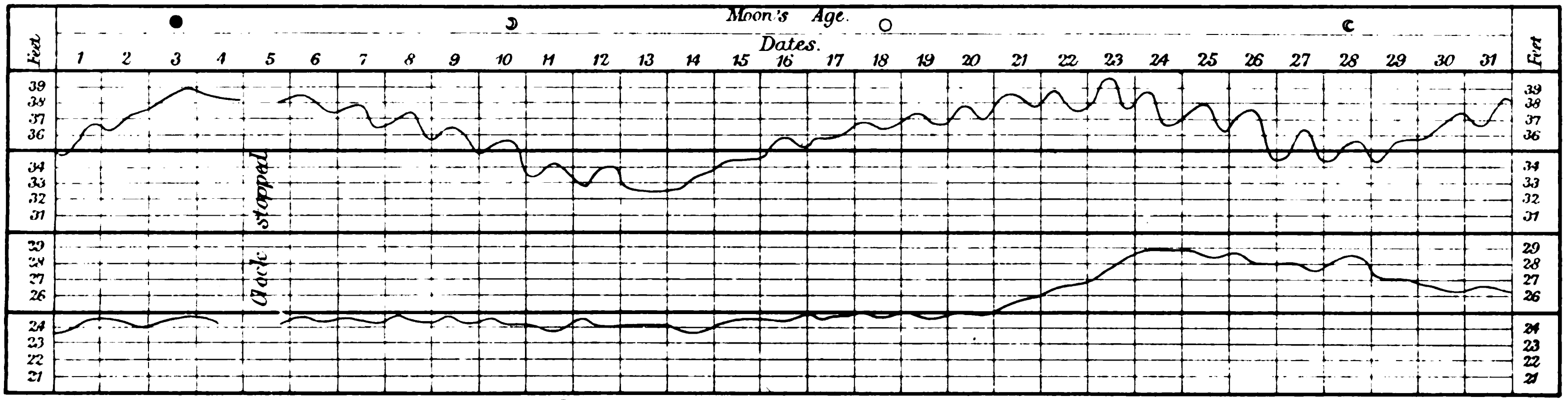
On the 8th, 9th, 10th, and 11th, the wind blew from the N.N.E. and N.E., and its influence in keeping up the water might seem to account for the heights of the spring ebbs at those dates; but equally high ebbs occurred with the wind S.E., S.S.E., N.W.N., and S.W. later on in the month during the full moon springs.

It is clear, then, that the water cannot ebb as fast as it flows, and the cause of this is evidently the defective state of the channel to seaward of the Stone Ends.

July Tides.—The tides of July show admirably the effect of a great rainfall. On page 139 of the *Circular* before referred to, the dates and quantities of rain are recorded, 7·14in. being registered at Wisbech. The chief rains occurred from the 15th to the 25th, and *the height of low water rose steadily from 24·6ft, on the former to 28·9ft. on the latter date*; nor, by the end of the month, was the excess of water completely voided, low water on the 31st being 26·5ft. above datum.



TIDES IN THE NENE AT WISBECH, APRIL, 1875.



TIDES IN THE NENE AT WISBECH, JULY, 1875.

The mean height of the new moon springs was 24·4ft., of the succeeding neaps 24·2ft., shewing a slight excess in favour of the former—these were normal tides. Then came the rains, which continued through the full moon springs and half the succeeding neaps. The average height of low water of these springs was 25·4ft., and of the neaps 27·3, or taking those only of the rainy days 28·8ft. From these data we see that, although the low water springs for the month had a mean of 24·9ft., and that of the neaps 25·7ft., this result was entirely owing to the great freshets in the river which came down quicker than the water could get away.

The diagrams in Sir JOHN COODE's Report, I find, confirm this singular fact, and moreover prove, so far as observations upon two tides can, *that the anomaly is only true in that part of the river lying above Walton Dam*. Thus, the differences between low water of spring and neap tides at Sutton Bridge and Wisbech are shewn to be—

At Sutton Bridge	22 feet.
At Wisbech	0 ,,

Moreover, from Walton Dam to Dog-in-a-Doublet the low water of the neap tide of September 21st, 1874, was lower than that of the spring-tide six days afterwards, the greatest difference, about two feet, being near Guyhirn Bridge.

It is patent that these peculiarities of the Nene tides are deleterious both to drainage and navigation, and it is equally clear that to remove them the sectional area and depth of the river must be altered in conformity with those laws of river action which have been so strongly insisted upon; in other words, the obstructions at the Outfall, at Walton Dam, and Wisbech must be removed, and the river properly deepened.

In conclusion, I may be allowed to express an opinion, which is, indeed, a conviction, of the inadvisability of erecting docks at Wisbech. There are two incontestible scientific objections to the scheme, which I believe have never yet been brought forward. *Firstly*, the river would require to be so deepened as to secure a minimum depth of at least 17 feet. Unless the river bed as far as Peterborough were proportionally lowered, and the whole incline from thence to Stone Ends were reduced to the proper parabolic curve, the whole tendency of the river would be to fill up the deepened channel until it acquired a slope commensurate with that of its upper reaches. This difficulty is, however, not beyond the reach of engineering skill. *Secondly*, a far more serious objection, and one which must eventually destroy the utility of docks at Wisbech, and that, too, in spite of the application of the highest engineering genius, lies in the geological peculiarity of this particular area. The tidal streams which enter the Wash and the fen rivers flow from the north; and, fretting away the shores of Yorkshire, bear with them a huge and ceaseless burden of sand and silt, which has formed, and is still forming the sand banks and salt marshes of the Fenland shores. Indeed, it is this deposit which has formed the rich silt-land of the Fenland itself, and every Fenlander knows how the marshes are encroaching on the sea, and how it is only a question of time as to when the broad surface of the Wash itself shall become a great and fertile plain. Every year the mouth of the Nene gets further and further from Wisbech, to which it was once adjacent. In other words, *the river is growing longer*, and so long as the tides flow from the north such must always be the case. Now, as the amount of water discharged by the river remains practically the same, and so far as Wisbech is concerned, remains absolutely the same, it follows that the river must grow shallower in the course of years. The silt *will* come down with the tides, it *will* enter the river with the flood, it *will* be deposited at slack water, and, as the tides at Wisbech must grow weaker and weaker, so will the depth of water diminish, and the docks grow less and less useful. Much as (for the sake of Wisbech) we may regret it, nevertheless, it requires no prophetic inspiration to predict that it is by nature doomed to lose its position as a sea-port, and to become an inland town. The present generation has witnessed the springing up of an important town between Wisbech and the sea—on solid ground over which they and their fathers had often sailed, and their descendants will assuredly witness still further changes in the same direction. It is wiser to bow to this irrevocable decree of nature than to lavish wealth in what, at best, must be but a temporary expedient to stave off impending doom.*

[THE GREAT OUSE.] The Great Ouse rises near Brackley and Towcester, on the borders of Northamptonshire and Oxfordshire, and runs through Buckingham, Olney, Bedford, St. Neots, Huntingdon, and St. Ives, and enters the Fens at Earith, where it formerly branched, sending one

* Since the above was written, the Report of Mr. J. ABERNETHY, C.E., has been presented to the Corporation of Wisbech, upon the Dock scheme. This gentleman is highly in favour of the plan of erecting Docks. He proposes to prevent the salt water from damaging the fresh water supply of the Thorney lordship "by proportioning the sectional area of the new channel [through Wisbech] so as to admit into the river above the Horseshoe Bend precisely the same volume of tidal water which at present passes into its upper reaches." Now this, it seems to me, would be only removing one obstruction and substituting a lesser one. Given a river of known volume and slope, the velocity and sectional area can be calculated, for it is self-evident that under the conditions stated a certain amount of water must pass any given point in a certain time, and if the channel be narrowed or otherwise interfered with, with the intention of reducing the sectional area, the water will rise or heap up in that narrowed portion so as to attain the proper sectional area. The effect of this would obviously be to reproduce on a smaller scale the deleterious effects to the river at present experienced through the obstructions at Walton Dam and in the Wisbech bend. Neither of the points I alluded to above is touched upon in this report, and I would once more ask attention to this simple statement of the laws which regulate the flow of water in rivers. The length of the river is increasing: the slope of its bed is consequently growing less: its velocity is therefore diminishing, and its erosive power growing feebler. I have pointed out how vastly the obstructions at Wisbech modify the tides; and I will only add that the idea of getting rid of the great bend through the town is so good and essential to the well-being of the river, that one might even sanction the experiment of a Dock for the sake of ensuring it.

branch in a north-easterly direction to the Nene at Benwick, and another in a curvilinear direction southwards, round the highlands of Ely to Littleport, thence it turned northwards along what is now called the Old Croft and Old Welney River to Upwell, where it received the united waters of the Nene and the northern branch, or West Water, and thence it passed by Wisbech to the sea. From Earith to the junction of the leam it was called the West Water.

The present course from Earith is quite different, for most of the water is conveyed direct to Denver, the northern branch has been allowed to decay since the great drainage, and the West River is little more than a good-sized ditch until the Cam adds its necessary quota to the stream. The Old Croft River is practically obsolete, and from Littleport the waters flow along the ancient, but, nevertheless, artificial cut known as Brandon Creek, and formerly as Heming's Lode; and so, by what was once the channel of the Little Ouse, past Denver, Downham Market, and Lynn to the sea.

At Harrimeer the Ouse receives the Cam; between Ely and Littleport it is joined by the Lark; the Little Ouse enters it at Brandon Creek, the Wissey near Hilgay, and the Nar at Lynn.

The Benwick branch, or West Water, seems never to have been particularly important, but the river between Littleport and Wisbech, once the main channel of the Ouse, holds an important place in Fen history—if history that can be called of which scarce any documentary evidence exists.

The geological evidence that the passage by Littleport and Welney (which we will call the Welney River) was a very important one is perfectly clear, and the ancient estuary is shewn upon the Geological Map in the sequel. Its decay dates from the cutting of the channel between

Littleport and Brandon Creek, formerly known as Littleport Chaire and Rebech or Priest's Houses. The date of this undertaking, which turned the waters of the Great Ouse into the channel of the Little Ouse is unknown, but that it is artificial is proved by the geological evidence; by its straightness (a sure sign of artificial work in all fens and marshes: see TYLOR, Geol. Mag., vol. ii., 1875), and by traditional belief. The last reason is, with many, the most important, and the whole case was so perfectly set forth in the year 1617 by Sir HENRY HOBART, Lord Chief Justice of the Common Pleas, that the entire passage, as given by DUGDALE (pp. 394-6) is here quoted.

"So long as the outfall of Wisbeche had its perfect being, the whole river of Ouse had there its perfect outfall, from whence the town seemeth to have taken its denomination, *viz.*, Ouse or Wisbeche. Thither then came the first branch of Ouse, from Erith, by the course now called the West Water, to Benwick; where meeting with a part of Nene (which then was very small, the greatest passage being, in those days, by Crouland, South Ea, Wride stream, and other courses about Thorney) fell together by Great crosse, or Plant-water, to the north seas at Wisbeche. The other part of Ouse, being the second branch, fell down from Eryth to Harrymere, and there meeting with the River Grant from Cambridge, passed so united to Ely: thence to Littleport Chaire, and so by Welney and Welle to the said north seas at Wisbeche, where it met with a former branch from Benwick.

"Then, as it seemeth, there was no river between Littleport Chair and Rebech, which is a place by Priests houses, where Ouse parva, or Brandon water, falleth in; but divers lodes, lakes, and dikes, as S. Edmund's lode, Gnat lode, and Dockey lode, which took their natural fall into a great meer by Welle, called the Wide; and from the Wide, by divers tracts, Webwinch lake, Aldy lode, Old Smal lode, Cheselbeche, Warbeche lode, Smal lode, and so into the river at Upwell, and thence, with the same branch from Littleport, to the north seas at Wisbeche.

"But Wisbeche outfall decaying, and the passage of Nene by Crouland likewise failing, through the decay of Spalding River and other hindrances; the West water, or first branch of Ouse, with Nene united, waxed weak in the passage, and so fell down by Marche to Welle; and not finding passage by Welle at Shrewes nest point, the most part thereof turned back again to Litleport, by the old forsaken second branch of Ouse, and holdeth that course to this day.

"This second branch of Ouse, with Grant united, lying thereby debarred of passage by Wisbeche, means were made to let it fall from Litleport Chair to Rebech, by a lode, which at the first seemed to be called Hemming's Ea, and so in Ouse parva's chanel, passed to Salter's lode, and thence to Lynne; whose chanel, not long before that time, was not above six poles wide, being then by true presentment said at that time to be both sufficient for the haven and vessels thither resorting by the inlet of the salt water; and large enough to pass away the fresh, as by the proceedings of a fair commission thereof, in an. 1378, may appear.

"Then began the waters from above Welle, and all thereabouts, to seek their passage by that tract to Lynne, Wisbeche chanel, and so as low as the Cross Keys, which was over the face of the marshes betwixt Welle and Wisbeche, and so downwards towards Tirington, utterly thereby decaying, as to this day may yet be seen. But the people of Marshland, finding themselves over-charged by these waters, upon complaint made to King Edward the First, obtained a commission, an. 21 Edw. I.,* to have the waters

* A.D. 1294.

of Welle (which anciently had their outfall by Wisbeche) to be brought and carried *in debitum & antiquum cursum*, &c. Then were there three stops made, *viz.*, the first at Fendike, about Upwell town's end (near where Popham lode sluice now standeth) 2. at Small lode bridge; and, 3. at Outwell bridge, and order taken for opening of the river from Welle to Elme floodgates, upon the confines of both countries, at the costs of the people of the Isle, and of Marshland indifferently."*

The same authority then proceeds to prove his case in detail, as follows:—

"To show that the river of Ouse had its outfall at Wisbeche, besides what is before expressed.

1. The sea banks from Welle to Wisbeche.

2. Wisbeche Castle, founded "super flumen illud famo-"sum, quod Welle streme appellatur." (Regist. de Petroburg.)

3. "Situm est prædictum castrum, quod à pluribus paludibus et fontibus principium habet, et per longos meatus in mare magnum juxta Wisbbeche derivare liquidé comprobatur." (Regist. de Thorney, parte 3ª, p. 34.)

4. The people of King JOHN perished in the water of Welle.

That there was some time no river between Littleport Chaire and Rebbech.

1. A record vouched by MR. HEXHAM, surveyor to PHILIP Earl of Arundel; the tract of the river being of a clean contrary nature, *viz.*, more straight than any of the Ouse in all the Fens from Ely to Wisbeche.

2. The imposing of the name of Heming's Lode in the description of Rack Fen, in the words of the record, *viz.*, "à le Chaire per Heming's Lode, usque Gnat's Lode End."

That the waters of the Isle should not, nor of old did,

* DUGDALE, p. 394.

fall down from Welle upon Marshland eastward, nor into Welle Fens in Norff.

1. See the commission de anno 21 E. I.*

2. See the Leet Rolls de anno 29 E. I. pro Wadingstow, fracto, in hiis verbis: "Reginaldus de Burgo fregit obstu-"pationem de Wadingstow, fractam per Breve Domini "Regis, et reversit aquam extra rectum cursum suum ad "magnum dampnum et nocumentum totius patriæ; ideo in "misericordia iij. s." See there some others amerced for the like; and in the next Leet how their pledges were amerced, and the offenders commanded to be attached.

3. See the Rolls of Upwell Lees, 12 E. II. *in fine*, divers amerced for breaking or hurting the banks of the Fen called the Fendike, between Welle and Wellenhee; and many presentments to prove that there were banks from Upwell to Wellenhee; and that they should not be broke nor cut, nor the water turned into the Fens near Marshland.

4. See the stopping of the waters of Welle from falling upon Marshland, upon the complaint of Marshland men to the King, by whose commission they were stopped at Outwell Brigge, at Small Lode Brigg, and at Fendike Lake in Upwell, and at a place near the sluice at Upwell Town's End, on Popham Lode Head, sometimes called Wadingstow.

5. And upon the breach of the dam at Small Lode Bridge (by means of a complaint of Marshland men); see a commission sent down in 25 E. I. to inquire of the malefactors, and to punish them expressly, for breaking Small Lode Dam, and a writ of attendance directed to the sheriff to that purpose.

6. And that Small Lode Dam was, according to this commission, made and fortified again, appeareth plainly by

* This Commission sat at Upwell, to take "into consideration what ought to be done for restoring those waters of Utwell (for so that great river of Ouse, which had formerly passed that way, was then called) to their due and antient course."

divers presentments and punishments set forth in the Leet Rolls of Upwell after those days: only one of 12 E. II. shall suffice, *viz.*:—"Et dicunt, quod Walterus Jolyff con-"suetus est trahere batellam suam ultra estupationem "factam per Breve Domini Regis, apud le Little Lode, per "quod dicta estupatis deterioratur; ideo in misericordia "ij. s." See there four or five more amerced for the like. And that there were banks from Upwell to Welney aboard the great river kept, that the water should not fall into the Fens on Norfolk side, may be proved by very many present-ments, almost in every king's time since Edward I. to King James, *viz.*, in 1, 2, 22, 23, 24, 25, E. I.; and 12, 15, 14, 18 E. II.; 3, 4 E. III., &c.; 2 R. II., &c.

I will only add one more old record to prove that the waters of the Isle should not fall into the Fens on Norfolk side, anno 24 E. I.

"—— Juratores dicunt, quod Adam Noach cidit com-"munem dravam per medium, juxta Hold Wellen-Hee, per "quod cursus magnæ ripariæ, et Hold Wellen-hee trans-"versus est ex recto cursu versus mariscum, ad grave "nocumentum totius communitatis: ideo dictus Adam in "misericordia, xij. d." And in the Leet following his pledge was amerced and pained to have it amended; and he him-self distrained to answer to it.

So that where it is here said (and in many other places also) that the stream of the great river of Wellen-hee was turned out of his right course by cutting the fen dikes or droves, in this presentment and some others it is said that the water was turned into the Fen, so as to go out of the right course into the Fen, proveth plainly that there was no watercourse through the Fen for the water to pass by.

And in anno 1 Mariæ it was thus presented:—" —— Et "quod nulla persona abscindet Calcetum in aliquâ parte "ejusdem, sive aliquorum aliorum Calcatorum, etc., sub "pena foris facturæ pro quolibet tempore sic factum, vi. "s. viij.d."

And in the convocation for Cowstowe . . . the jury say thus :—

"—— Dicunt etiam, quo antiquo tempore, antequam "aquæ Marisci descendebant versus Wigenhale, sed post- "quam aquæ Marisci descendebant versus Wigenhale "nunquam fuit dictum fossutum aliqua salvatio, etc."

Whereby it appeareth, that antiently the waters of Upwell did not fall down towards Wigenhall, and so by Lynne.

That there was a mere in Welle called the Wide.

Robert de Swaffham, in his History of the Foundation of Peterborough, under the title, "De gestis incliti militis "Herewardi," saith that Hereward fleeing William the Con- "queror, "cum navibus suis, quas habebat benè armis "munitas, etc., in quoddam mare Wide vocatum, juxta "Welle secessit, magnum et spaciosum lateribus aquarum, "et liberos exitus habens." The name and tract of which meer yet remaineth in the Fens of Upwell, Wide Lode being ordained to be cleaned by the same law that Small Lode was.

That the waters had their course from Gnat Lode towards Welle.

The tract to this day sheweth it; for the presentment by which Small Lode is so much urged saith, that Gnat Lode "incipit apud Hawkyns Bright, et durat usque Fowe Lodes "End." The Crosse end of Gnat Lode was Docky Lode; and in the same presentment it is said, that Wide Lode was in length a mile and an half and xv. furlongs, and that old Small Lode "incipit à Wide Lode," and continued towards Welle, to a place of late called Crosse-water against Nurses viij. acres end, by the space of half a mile and half a furlong, and there fell into Cheselbeche Lode, alias Small

Lode, and from Seman's Goole came into the river a little below Upwell church.

Other branches there were, all tending their course towards Welle, and so to the north seas, at Wisbeche, as Webwinche Lake, Well Meere, Audley Lode, Wabeche Lode, Chesbeche Lode, Twane Lode, Saltham Lake, &c., as may seem by the tracts of many of them in the Fens of Welle."—(DUGDALE, pp. 395-6.)

We have no data at present by which to fix the time of the alteration of the course of the Great Ouse. That HEMMING'S Lode is very ancient, is shewn by the facts that although Marshland suffered intensely from the change, no attempt was ever made to restore the Ouse to its old course; there are indeed slight evidences which tend to shew that it was before the Norman conquest.

The withdrawal of so large a body of water from the Nene river, naturally exercised a disastrous influence upon the outfall which began to decay, and seems to have become at last so choked that only a puny brook dribbled through Wisbech. The waters of the Nene, coming by way of Benwick and March, were too feeble to force their way through the silt in the estuary, and they entered the Well Creek at Outwell, reversed its current and flowed by Nordelph to the Ouse near Denver, and thence by Lynn to the sea. This singular state of affairs was highly disastrous to the trade of Wisbech, and by interfering with the drainage of Marshland gave rise to a series of terrible floods. In the year 1294 the Marshlanders presented a 'grievous complaint' to the king, praying that the waters of the Nene might be turned through Wisbech, and not allowed to 'mix with the waters running through Mershland.' What the result was is unknown, but we are certain that no effectual means were taken to improve the river, for in the year 1315 the river still flowed down Well Creek, and the same seems to have been the case in the year 1329.

During all this time serious alterations were taking place at Lynn. The Little Ouse drained an area of about 200 square miles, and this small district alone poured its waters into Lynn Haven. The Great Ouse on the other hand has a basin of 2,700 square miles, or thirteen-and-a-half times as large, and Lynn Haven became the outlet of this great area also. Moreover, as we have just seen, much of the Nene water itself began to pour into the Lynn river; and if we only allow half the Nene drainage to have entered the Ouse, we have still sixteen times as much water passing through Lynn as was originally the case, and the direct results would be that the velocity would be more than doubled, and the erosive power would be nearly forty times as great as that of the Little Ouse alone. Consequently the river wore away its banks with alarming rapidity, and hence we find no traces of the Roman banks of the Lynn estuary. In the year 1362, the unfortunate Marshlanders in a 'doleful petition' shew that the Lynn River, which formerly was only 12 perches broad, was then 'a full mile in breadth.' This was, of course, an exceptional flooding of the channel, but in the years 1378, 1565, and 1618, we find notices shewing that the river was growing wider. The church of Old Lynn was washed away, and Tilney and Wiggenhall lost many houses and much land.

This loss of land was inevitable, but if the river had been properly trained it could have been confined within reasonable limits, the current would have kept the channel clear and Lynn Haven would have become a valuable and permanent port. Instead of this, the river was allowed to wander to and fro across the marshy land, to widen its channel as it liked, until finally the broad, shallow, horse-shoe bend south-west of Lynn was formed, and a wide estuary north of the town. Rivers have a tendency to widen their channels quicker than they deepen them, as anyone who has watched the meanderings of a brook through its meadows can see for himself, but this widening is at the expense of the velocity of the stream. The Ouse was thus allowed to spend its force in useless widening, its current grew feebler, and, finally, the resistless tides, which never spend their power in vain, acquired supremacy and the river bed began to silt up. As early as the year 1350 the warning note of this disaster was sounded; but, although nothing but good could have resulted, the river was never trained until the present century. The work, which would have cost but little years ago, was then accomplished at a vast expense, and so difficult is it to overcome prejudice that over £12,000 were spent in defending the Act which permitted the Eau Brink Cut to be made.

We now come to a very important event in the history of the Ouse—the formation of the Bedford Rivers—with which we are here only concerned so far as they affect the Ouse. The object of the Bedford Rivers was to convey the highland waters from Earith more directly to the sea, and their length from Earith to Denver Sluice is ten miles shorter than that of the Ouse between those places. The great sluice at the Hermitage turns the waters into the Bedford River, and the Ouse from thence to its junction with the Cam at Harrimeer has dwindled to the size of a big ditch. The construction of the Bedford Rivers necessitated the erection of a sluice across the Ouse at Denver, for the bed of the new river being eight feet higher than that of the old, the flood waters would have turned up the Ouse instead of flowing seaward. Denver Sluice, however, served also to divert the tides from the Ouse into the Bedford River; and it also, by checking the silt brought up by the tides, and the mud brought down by the river, caused a deterioration in the channel. This was speedily apparent below the sluice, for, although the quantity of water in that part of the river was the same as before, its effects were much diminished. This is clear when we remember the laws which regulate the flow of water. The water now parted at the Hermitage, would, if united there, flow down the old course with enhanced speed and increased scouring power; and, moreover, the full swing of the tides would help to keep the channel clear. It is not too much to say that everything that was done up till the time in question was such as to ensure the worst possible river—the waters were divided, as we have seen; part of these only flowed intermittently, when the sluice was opened, and the river was permitted to spend the remnants of its enfeebled vigour in uselessly fretting for itself a wide and shallow estuary.

As if the Bedford Rivers could not, even indirectly, benefit the land without bringing a compensating evil in its train, it was found that its waters over-rode those of the Middle Level which flowed down Well Creek, forced them back, and drowned wide areas of land. To remedy this evil Tong's Drain was cut from Nordelph to Stow Bridge. This certainly attained its object so far as the Middle Level was concerned, but it helped to hurry on the climax of misfortune in the Ouse, because the abstraction of so much water from the channel at Denver had the effect of causing the bed to silt up faster than it otherwise would have done.

For the relief of the South Level a similar cut, now known as Downham Eau, was made from the south side of the sluice to Stow Bridge. Of course, this cut assisted to make the main channel worse than ever, and very soon nearly ten feet of silt were deposited, and the outlet of Downham Eau was "lost and abandoned." This cut did direct harm to the level, and the land became habitually drowned. It never seems to have been noticed that as the distance between Denver Sluice and Stow by the Eau was longer than by the river, the waters could not possibly flow so rapidly as by the river, and, in consequence, as a relief drain for the South Level it was, of necessity, useless.

We thus see that the formation of the Bedford Rivers necessitated the sluicing of the Ouse, the Old Bedford River, and Well Creek; and that Tong's Drain and Downham Eau were made for the relief of the Middle and South Levels respectively; in other words, these two drains were necessary to perform the very work that was to be so well accomplished by the new drainage scheme.

Complaints were made year by year of the bad state of the South Level, and it was ineffectually proposed to remove the Hermitage and Denver Sluices. In the year 1695 it was shewn that the river above the Sluice was so deteriorated that "where boats and barges usually passed in the old adjacent river beyond Ely, grass and fodder is now cut.*

In the year 1713 the sluice "blew up," in consequence of a high tide meeting a heavy flood, and the Ouse once more became tidal. Respecting the consequences of this destruction, I cannot do better than quote the observations I have made thereon in my official work.

"In the year 1713, during a very high tide, which met with heavy floods coming down the river, Denver Sluice blew up, and the tide, after an absence of 60 years, once more flowed up the Ouse. The South Level occupiers now had hopes of reclaiming their land, and the navigators were triumphant. But the Hermitage Sluice still diverted the waters of the Ouse into the Bedford River, and hence there was not sufficient water in the old river to scour out the channel. The tides flowed for two hours up the Cam, and though in their reflux they scoured the river, to some degree, below Denver, the channel above that point began

* Hist. Nav. K. Lynn, p. 83, &c.

to silt up for want of water, and the South Level waters, not being able to get away, drowned the lands. Moreover, the Bedford River waters turned up the Ouse, as the erectors of the sluice had anticipated, and in the year 1720 they ran up for twenty-one days without cessation,* and the unfortunate South Level was thus further burdened with the waters of the Middle Level. BADESDALE, whose strong opposition to the Bedford River, and Denver Sluice its adjunct, has called forth the remonstrances of the authors of the History of Wisbech,† describes the state of the Level as being drowned "to such a depth that the sun can-"not exhale the waters, nor dry them up; and from "Haddenham Hills, in our view of the Fens, we observed "they were all to the south and east bright, excepting "here and there a reed or sallow-bush, and some small "tracts of grounds which appeared above the water."‡ Denver dam, in which the sluice was placed eight feet above the bed of the river, also restricted the current, and the river silted up to a depth of from eight to ten feet, thus making matters even worse—and the state of the South Level was worse than it ever had been.

The people of the level, therefore, advised the re-erection of the sluice when the evils appeared to be growing worse. WELLS remarks upon this, "yet, strange as it may appear, "we shall find both parties lamenting the consequences of "this demolition; and the authors of the History of Wisbech wax quite gleeful over the same fact. Nevertheless, a careful and impartial study of this question firmly convinces me that BADESDALE was, in this respect, right; all these troubles are the direct consequence of the formation of the Bedford river, and the present effective state of drainage has been brought about *in spite*, and not in *consequence*, of

* Hist. Nav. Lynn, p. 87.

† WALKER & CRADDOCK's Hist. Wisbech, pp. 161-2, &c.

‡ Hist. Nav. Lynn, p. 87.

the principle of deserting natural for artificial rivers. Where BADESDALE and his party were wrong was in supposing that the resuming of the old channel was alone sufficient to maintain the drainage and the river in an effective state. The outfall was deteriorating owing to the widening of the estuary and neglect of training, and the construction of the Bedford River and its collateral works greatly facilitated the growing evil. It is my firm belief that had the Bedford River never been made, and had early attention been paid to the outfall, the original river would have amply sufficed for drainage and navigation, and a vast outlay would have been spared.

BADESDALE and his party have been taunted with demanding the re-erection of the sluice, as though they thereby admitted their case to have been upheld on false grounds. This is unfair, for if the river had been restored to its former volume, by allowing the downfall waters to flow into it as of yore, and the dam at Denver been removed, the evils they complained of would have been materially diminished. But this was not done, and they had no alternative but to solicit the re-erection of the sluice as the only means left to them of getting rid of waters of the Middle Level, &c., now that their own river was robbed of its strength.

There is no doubt that the blowing up of Denver Sluice (the Bedford River being in existence) was a disaster, for it reduced the South Level, which was so well drained by nature that the adventurers found it unnecessary to devote much attention to it,* to a condition unparalleled for drowning in the history of the fens.

For thirty-seven years matters remained in this condition, but the sluice was eventually rebuilt by LABELYE, a Swiss engineer, and opened in the year 1750, from which time it has remained comparatively intact.

* Hist. Bed. Level, p. 744.

The Ouse, however, was in a worse condition than ever, and though the South Level was relieved of the Middle Level waters, it could not void its own, and remained constantly liable to surrounding. At the same time the channel of the river continued to silt up below the sluice and the Middle Level waters were discharged with increasing difficulty, until it, too, was drowned, and the historian of the Bedford Level says that "in the year 1777, both the Middle "and South Levels were in a most deplorable condition, "and the debt of the corporation, as well as the state of "the arrear roll, most alarming."*"

KINDERLEY, in the year 1720, suggested the straightening of the river by a cut from Eau Brink to Lynn. The scheme, which was an admirable one, was not adopted until the year 1795, and even then met with strenuous opposition; for the Lynn people looked upon the wide, shallow, horse-shoe-shaped bight as a safeguard against the silting up of the estuary. Remove this, they argued, and the river is robbed of a great quantity of water, is prevented from entering the river, and its back scour is lost. Better principles happily prevailed in the end, and the cut was completed in the year 1821, but not before five separate Acts of Parliament had been obtained. The authors of the History of Wisbech, commenting upon this cut, well remark—"It shortened the course of the old river two miles and a half, and the low-water mark at its upper end shortly after fell between four and five feet, and subsequently two feet more, in consequence of an improvement in the work. The low-water mark continued subsequently to fall until it reached its maximum of seven feet. The drainage cills of Denver Sluice were laid six feet lower, and a corresponding improvement was felt in all the low lands of the Middle and South Levels.

* WELLS, Hist. Bed. Level, p. 748.

"Thus its effects, though less than was anticipated by those who expected a deluge rather than a river, have made a manifest change in the South Level. The tide, which hardly lifted itself into the Bedford, now penetrates almost to the end of it;* that river has deepened considerably; and the channel of the Ouse, formerly so silted below Denver, was speedily cleansed by the increased spread and body of the tide that flowed through it. Had the cut been carried into deep water beyond Lynn harbour, its effects would have been much more effective.*

In the year 1827 the circuitous course of the river Ouse from Ely to Littleport Bridge, round Padnall Fen, was abandoned, and a straight cut made in its place. Since this time a fresh channel, called the New Cut, has been made from Lynn into the Wash at Vinegar Middle. The former wide estuary has silted up, and the beneficial effects of improving the outfalls of the Fenland rivers have been abundantly manifested.

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* WALKER and CRADDOCK'S Hist. Wisbech, p. 165.

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CHAPTER VIII.

THE WASH.

> . . . . . . As the crest of some slow-dashing wave
> Heard in dead night along that table shore
> Drops flat, and after the great waters break
> Whitening for half a league, and thin themselves,
> Far over sands marbled with moon and cloud,
> From less and less to nothing.
>
> TENNYSON.

THE Wash is the largest bay on the east coast of England, and it is the receptacle for the waters of the Fenland. The Romans called it *Metaris Æstuarium*, but it is not an estuary at all, but a bay. An estuary is the wide tidal mouth of a river, a bay is an indentation of the coast quite irrespective of river action. That the fen rivers have helped to make the Wash, is certain, as will be hereafter made clear, but we have no more right to call it an estuary, than we have to apply that term to the Straits of Dover because the Thames flows thereinto. MR. MILLER (Chap. I.) has suggested that the Roman name was a compound one, referring both to the bay *(metaris)*, and to the salt-marshes *(æstuarium)*; and if this suggestion be true (and it seems not improbable) it shows that the Romans had very clear ideas of Physical Geography. It is certain, however, that no such accurate views are entertained by the present race, for the Wash is invariably alluded to as an estuary.

From Gibraltar Point to Hunstanton Light, the width of the Wash is 12 miles; the length from the centre of the line joining the above points is 14·8 miles; the greatest length, from Hunstanton Light to Fossdyke Bridge is 23 miles; and the area is 250 square miles.

The physical features of the Wash are peculiar. The bay is surrounded by great banks of sand, and salt-marshes; the former of which are constantly altering their shape and extent, and gradually encroaching upon the deeper water. Between these banks are narrow overfalls and sled-ways, through which even the experienced fisherman will not venture after a week's absence without sounding. The tidal currents are vigorous and tortuous, and are complicated by the streams of the rivers Witham, Welland, Nene, and Ouse. The centre of the Wash is occupied by a deep basin known as the Well, in which deeper water is found than occurs all across the North Sea to the opposite coast.

Fisheries of mackerel, herring, soles, plaice, skate, turbot, and whiting, serve to dot the waters with small smacks, whose peculiar sliding-gunter gear, and long-nosed boats called prans, give quite a foreign aspect to the scene. Mussels, cockles, oysters, shrimps, and small prawns, are taken in abundance. Clams, the local name for *Scrobicularia piperata*, are also collected for food, and the razor-fish (*Solen*) affords a delicious dish to the knowing ones in sea-lore, while the sea-urchin provides by no means a despicable delicacy to those who know where to find them in abundance. Sea birds enliven the scene with their graceful flight, and the little guillemots may be found plentifully in certain spots. Here, too, may be observed the habits of seals, which are plentiful enough in one part; and which I would gladly see protected like the sea-lions of Vancouver Island.

The fishermen reared on these waters are a hardy, skilful race, whose seamanship is often beyond all praise, and whose knowledge of the intricate tides and currents is simply astonishing. Looking at the falling water on a bank the smack-master will say, "I think, Sir, we can just run the tail of the 'Thief,' if the little'un steers. We'll have to rush for'ard as she grazes and cant her over, but we are just in time to save a mile or two." And so you run, the sea hissing and seething as the tight boat dips; then comes a slight shock: all run forward, the pluckiest right out to the bowsprit end: she dips her nose and rises with a shake. "There, Sir, I knew she'd do it," is the quiet remark, and three minutes afterwards the spot shows dark above the foam.

The sands at low-water springs rise from one to fifteen feet above the water, and are composed of fine sand and gravel, which grows finer as you approach the shores, until it merges into the rich silt that forms the marshes, and half of the Fenland itself. The material is brought by the tidal currents flowing from the north, which are wearing away the coasts of Yorkshire with unrelenting persistence. Part of this is rolled along the bottom, but more is suspended in the water, and falls when the current is checked, the finest material travelling furthest, and forming the fertile silt or warp.

I have carefully estimated the rates at which the marsh is forming along different parts of the Wash coast, and find that from the time of the erection of the Roman sea-walls, which I assumed to be actually of Roman origin (Mr. Miller not having advanced his cogent reasons for ascribing them to the British at the time I made the calculations) to the present time the mean annual rates of accretion were for the

East Holland Coast of Lincolnshire - -	1·83 feet.
Base of the Wash (between the Welland and Ouse - - - - - - - - - - - -	10·73 ,,
Norfolk Coast- - - - - - - - - - - -	0·66 ,,

Further details are given in my official memoir. Assuming that the Roman banks were erected in the 2nd century, there have been 70,000 acres of land reclaimed from the sea during the past 1700 years. This growth of marsh takes place in almost equal quantities on each side of a line drawn from about Lynn Knock to Whaplode Church, as was pointed out by Captain VETCH, R.N., in his Report on the Norfolk Estuary Scheme in the year 1849.

The mode of growth of these marshes is as follows. The fine florulent silt, brought in by the tides, is carried by the water by virtue of the velocity, and when this is checked at the slack of high water, the silt falls to the bottom, and thus a bank is gradually formed against the shore. So soon as this rises to 8·6 feet above Ordnance Datum, or mean tide level, the glasswort (*Saliscornia herbacea*) here known as Samphire, begins to grow. In this state the marsh is technically known as Green Marsh, and it is only dry towards high water. The stems of the samphire assist largely in the further development of the marsh by checking the flow of the water, and thus allowing a longer time for the silt to fall, and also by preventing so much being carried off by the ebb. As the marsh increases in height, other plants of less aquatic habits make their appearance, and by the time it has reached the height 11·0 feet above Ordnance Datum, it is covered with sweet verdure, is then called Green Marsh, and is in a fit state for embanking. I am indebted to MR. W. H. WHEELER, C.E., so often quoted, for the levels of these marshes. Referred to low-water spring tides the heights of Samphire and Green Marsh are respectively 18·54 feet and 19·86 feet.

The Samphire is largely gathered for food. It is either boiled and eaten as a vegetable, in which state it is more curious than appetising; or pickled, in which condition it merits considerable praise.

That the Wash is gradually filling up there can be no question, and it is only a matter of time as to when the bay will be converted into dry land. The bay was once co-extensive with the Fenland itself, and 1300 square miles have become dry ground within recent geological times, and the process is still going on.

It is a matter of general history, as to how some twenty years ago it was proposed to reclaim most of this wide area, and it is equally well known how the grand scheme fell through owing to local opposition. Of the practicability of the undertaking I am perfectly convinced; and I feel pretty confident that had it been carried out as originally intended, a handsome dividend would now be comforting the shareholders.

The tide which fills the Wash runs southwards through the German Ocean, and, spreading across the mouth of the Wash, pours its water into the bay sideways, the flood tide running in a S.S.W. direction on the west coast, and W.S.W. on the east side. The ebb tides run in nearly opposite directions, or N.N.E. and E.S.E. Off the Knock and the Hook of Long Sand it is high water on full and change at 6h.; springs run 5 miles an hour, ebbs 2½; springs rise 23 feet, ebbs 14 feet. When the flood overflows Long Sand the tide runs strong from the E. Near the Woolpack and Sunk Sand the flood runs W.S.W., and the ebb E.S.E. The tide thus flows down the Wash coasts so that it is high water at Boston and Lynn at about the same time, and about half-an-hour before high water at Wisbech.

In the Well, on the other hand, the tide is always flowing and there is no ebb. In the course of twelve hours the tide completely boxes compass, the tidal stream flowing continually at the rate of from 2½ to 3 knots per hour. It is owing to this singular fact that the deep basin of the Well has its existence, for the tides act as a kind of great centre-bit, slowly turning and grinding out the bottom.

Recently, 1874, a new Chart of the Wash was issued, and the comparison of this fine work with the previous one, is one of the most instructive means of acquiring a knowledge of the alteration in the sand-banks.

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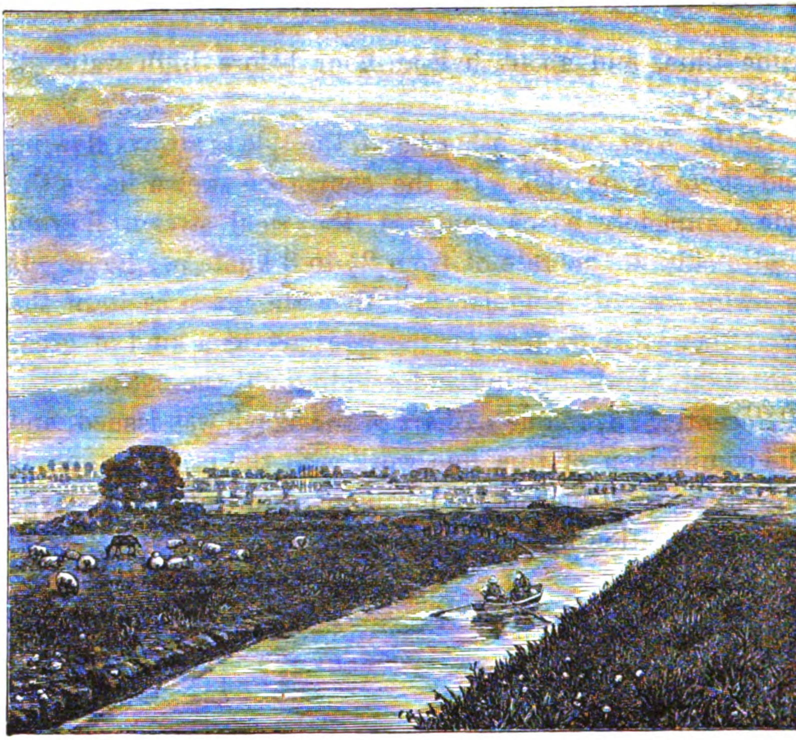


A Mirage in the Fens. See p 284.

CHAPTER IX.

THE CLIMATE OF THE FENLAND.

IT is just two hundred years since "The Theatre of the Empire of Great Britain" was given to the world.* From no other source can we obtain, regarding this district, any description of the climate of the remote past.

Of course the ingenious author spoke only in general terms, not being able to give the results from precise observation; still, his statements are worth something. But before quoting SPEED, we may refer to a remark made in one of the PASTON letters, written two centuries previous to his time, and from which we may gather that the winters four

* By JOHN SPEED. This "exact Geography of England," &c., was published in 1676. It was dedicated to King JAMES I.

centuries ago began, in *this latitude*, much earlier than now.

On Sunday, 27th October, 1465, MARGARET PASTON writes to her husband, JOHN PASTON, to complain that the Duke of SUFFOLK'S men had done great damage to the PASTON estate at Heylesdon, near Norwich, and had ransacked the church and houses, &c., and says:—"I would some men of worship might be sent from the King to see how it is both there and at the Lodge, ere than any snows come, that they may make report of the truth, else it shall not mowe be seen so plainly as it may now; and at the reverence of God speed your matters now."*

Thus it appears that early in November heavy falls of snow were expected, and such as would cover the buildings and prevent, for some time, the possibility of making a correct estimate of the damage done. The land was early sealed by the winter's snow.

In DRAYTON'S "Polyolbion," published in 1612, we have in the 25th song, KESTEVEN'S Oration, in which she boasts of her climatal superiority over her southern neighbour—Holland.

. . . . . "quoth shee, O how I hate
Thus of her foggy Fennes, to heare rude Holland prate,
That with her Fish and Fowle, here keepeth such a coyle,
As her unwholesome ayre, and more unwholesome soyle."

At that period, then, South Lincolnshire had the unenviable character of being insalubrious. From "The Theatre of the Empire of Great Britain" we obtain the following notes on "the Air" of each county connected with the Fenland.

LINCOLNSHIRE. "The Air upon the East and South part is both thick and foggy by reason of the Fens and unsolute grounds, but therewithal very moderate and pleasing. Her graduation being removed from the equator to the degree of 53, and the winds that are sent off her still working seas do disperse those vapours from all power of hurt."

* Letter LVIII., vol. iv. p. 227., pub. by Sir J. FENN, 1787.

NORTHAMPTONSHIRE. "The air is good, temperate, and healthful."

HUNTINGDON. Little is said about the climate of this county, whose condition is disposed of in one phrase—"of positure temperate;" then we have this remark, "the vale, contiguous to the Fens, best for pasture, in which to no part of England it giveth place."

CAMBRIDGESHIRE. "This Province is not large, nor for air greatly to be liked, having the Fenns so spread upon her North, that they infect the air far into the rest."

SUFFOLK. "The Air is good, sweet, and delectable, and in some parts, of some of our best Physitians, held to be the best in the Land."

NORFOLK. "The Air is sharp and piercing, especially in the Champion,* and near the Sea; therefore it delayeth the Spring and Harvest, the situation of the country inclining thereto."

By what we glean from old writers we may conclude that before the Fens were drained, fogs were very prevalent, and the question naturally arises—Why should the Fen district have been more foggy than a sea shore or a lake region is at the present day? No doubt these latter are more subject to fogs than elevated inland districts, but they have not the character, generally, of being malarious, as the Fens are reported to have been.

It is not our purpose in this book to dilate largely upon the *principles* of climatology, but it is fitting to make some remarks upon the probable causes of the Fen fogs.

We shall premise that by actual observation we have proved that evaporation is greater from a surface of fresh than from that of sea water in this latitude; and probably it is so everywhere, as the salts appear to affect the molecular condition of the water and to retard evaporation.

* The open country: corrupted from Fr. *Campagne*.

Now, formerly, there were large collections of fresh water in this Fen country—the lands were frequently flooded—the ground lay sodden for a long period—great tracts were covered with decomposing vegetable and animal matter, so that the air was not only charged with the watery vapours, but by gaseous exhalations also; and these would be the cause of malaria.

Again, this plain is low, and sheltered, except on the north, and the light breezes that would clear the mists and fogs from the higher lands of Norfolk or Lincolnshire, would have little or no effect on the humid air in the fens. Another cause of fogs may have been sudden indraughts of cold air from the north-east, across the Wash, and thence over this plain, overhung by a still but damp atmosphere.

An observer,* who commenced making meteorological observations in Cambridgeshire, nearly half a century ago; and to whose book we shall frequently refer, says—"If during the prevalence of a thick fog and a northerly or easterly wind, the wind change to the south or south-west, the fog will speedily disappear below, though the sky may remain clouded overhead." This change would arise from the warm under-current rarefying the vapour.

It is generally thought that the air must be saturated with moisture when fogs obtain; but it is not always so, exactly, for sometimes during a fog the air temperature and dew point temperature are not precisely, though nearly, alike; and *complete* saturation is sometimes experienced when there is neither fog, mist, nor rain, but a quiescent damp atmosphere. A day's fog is a rarity now.

The author just referred to, says—(p. 365)—"Cambridgeshire has the character of being damp, and so it undoubtedly is, compared with many other counties in England,

* Rev. L. Jenyns, M.A., Obs. on Met., pub. 1858.

notwithstanding the small quantity of rain which falls upon it. But it is in the fens chiefly, or those places which, like Swaffham Bulbeck, are in the immediate neighbourhood of the fens, that the atmosphere, at certain periods of the year more particularly, is in that humid state which renders it unhealthy for some constitutions."

This writer states what he observed some thirty or forty years ago. Such does not hold good at present, for the Fens now are not more foggy than any other part of the country—perhaps not so much as some. We are informed that thirty or forty years ago the summer mornings were almost always foggy, but they are seldom so now, nor have they been for several years past.

Recently we have known visitors, who had come from different parts of England, remark how beautifully clear and transparent the air is in the Fens, and how surprising the visibility.

Often on a Spring or Summer's evening we have specially observed this visibility in Marshland; where the eye had an unobstructed view for several miles, the most distant objects in the landscape appeared defined with remarkable clearness. This visibility does not arise from humidity merely, nor is it followed by rain, but from a clearness attendant upon comparative purity.

It is not necessary here to go minutely into all the evident alterations of climate effected by the drainage of the Fens. The effects of climatic changes are noted in different sections of this book, and the influence of climate on health will be treated of in the chapter on "the Sanitary Condition."

Precise information regarding the Meteorologic condition of the Fens, as compared with other parts of England, will be found in the discussion of the annexed tables.

One great cause of the improvement of the climate of the Fenland in recent times is attributable to the general drainage and cultivation of the land, and the consequent higher temperature of the soil through solar influence, and the percolation of warm rain. The evaporation which produces coldness, is, probably, less than formerly.

We believe that the inhabitants of the Fens—at the present day—enjoy as sunny skies, as beautiful star-lit nights, and as magnificent cloudscapes as any people in England. Just at the period of penning these lines we have witnessed the most beautifully azure sky—as fine, we think, as the azure of Italy—and recently, too, sunsets of surpassing grandeur.

We now pass on to consider the results of Meteorological observations made at Wisbech during fifteen years.*

GENERAL METEOROLOGICAL RESULTS.

As it may be agreeable to the general reader to see at a glance the principal deductions made from the study of the Meteorology of the Fenland, we have here brought together under one view the main facts gathered from the details given in the tables which will follow. This plan will facilitate a reference on special points.

THE BAROMETER. The *highest* observed reading of the barometer (1861—1875) occurred at 3 p.m. on 6th March,

* *The Instruments used at Wisbech.*—The Barometer is a FORTIN'S made by NEGRETTI and ZAMBRA—tested by Mr. GLAISHER. The dry and wet bulb hygrometer, the maximum and minimum thermometers (in the shade), the blackened-bulb thermometers for solar radiation, and the minimum thermometers for the terrestrial radiation, by the same makers, are all tested instruments. The rain-gauges (of the GLAISHER pattern) are 8 inches in diameter, have been tested by Mr. G. J. SYMONS for the British Association Reports.

Mr. CASSELLA has recently supplied instruments as duplicates or for experimental purposes; these and some of the older instruments have recently been verified at Kew.

An OSLER'S anemometer, by NEGRETTI and ZAMBRA, has been used for registering the direction and force of the wind, and the rain-gauge attached to it, for registering amount and duration of the rainfall at an elevation of 45 feet above ground. A ROBINSON'S anemometer, by NEGRETTI and ZAMBRA, is 40 feet above ground.

The stand for the thermometers is a modified form of STEVENSON'S, with louvre-boards, a top double-boarded, a raised cap to shut out sunshine and rain, but to allow a free current of air to pass.

1874, it was 30·800 inches. The *lowest* reading at 9 a.m. on 24th Jan., 1872, it was 28·362 inches—thus shewing an *amplitude* of 2·438 inches.

The least monthly range of the barometer was noted in April, 1865—it was equal to 0·444 (the rainfall that month was 0·558 in.)

THE RAIN. The *greatest fall in one day* occurred on 2nd April, 1872,—it was 2·270 inches. The *greatest fall in one month*,—5·933 inches, in July, 1872.

The least monthly fall was 0·369 in., in Sept., 1865.

The *average yearly rainfall*, 24¼ inches (nearly.)

The *greatest* number of rainy days in one year was 208, in 1872; the *least* number in one month was 2, in Sept., 1865.*

THE TEMPERATURE. The *highest* recorded temperature in the shade was 92°·4 F., on 21st July, 1868, (150°·3 in sun's rays.)

The *highest monthly* mean was 66°·9 F. in July, 1868.

The *lowest* reading in the shade, 8°·5 F., on Jan. 1st, 1871, (6°·5 on the grass.)

The *lowest monthly* mean was 31°·5 in Dec., 1874, (for six days in this month the temperature never rose to 32°·)

[For other details see *Table shewing the range of the monthly mean temperature.*]

The *amplitude* of the monthly mean was 24°·1 in 15 years.

The mean daily temperature of the year is 49°·

THE WIND. On an average, the wind blows from N.E. or E. on 71 days; S.E. or S. on 75 days; S.W. or W. on 140 days; N.W. or N. on 79 days of the year.

* It is noteworthy that the Oct., 1875, shewed a rainfall of 5½ inches, on 19 days.

THE CLOUDS.

. . . . . . " With one virtuous touch
Th' arch-chemic sun, so far from us remote
Produces, with terrestrial humour mixed,
Here in the dark so many precious things,
Of colour glorious and effect so rare."

MILTON.

" Overhead the arch of Heaven spread more ample than elsewhere, as over the open sea; and that vastness gave, and still gives such cloud-lands, such sunrises, such sunsets, as can be seen nowhere else within these isles."—KINGSLEY'S *Hereward the Wake.*

" I think it should be borne in mind that a flat country is not without its advantages, even in respect of beautiful objects upon which the eye can rest with pleasure, and by which the artist's eye can be educated. The effects of sunrise and sunset and indeed all beauties depending upon the atmosphere, are seen nowhere better than in a district like this; everyone must have been struck occasionally with the grand cloud pictures which may be seen in a country having a wide horizon; eccentric forms, Alpine snowy ranges, weasels and whales, and every variety of hue."—*High Art in Low Countries.**

The beauty of the Fen sky is becoming proverbial, and the writers above quoted have done not a little to inculcate an appreciation of its charms. The breadth of view here presented to the spectator—embracing as it does the concavity of an almost perfect hemisphere, enables him to see the whole cloud formation, and to watch uninterruptedly all the changing variety of its form, colour, or motion.

The summer morning sky often dappled with cirro-cumulus tinted with an exquisitely delicate grey, presents the appearance of immense loftiness—and in the evening the plain seems bounded by mountain heights, blended with the horizon by a warm grey hue—the rounded tops of the small cumuli or the cumulo-stratus presenting the aspect of snow-peaks, or the elevations of an aerial city, glittering with gold and silver, " which the eye is disposed to contemplate as the architecture and home of giant spirits;" and towards the setting sun the streaks of cloud

* An Inaugural Address given at the opening of the Wisbech Industrial and Fine Art Exhibition, 7th May, 1866, by the Very Rev. H. GOODWIN, D.D., Dean of Ely (now Bishop of Carlisle).

exhibit the most gorgeous colours, in all the various shades of purple, gold and ruby. And as the summer wanes and harvest-tide approaches, a beautiful phenomenon is presented on this wide-spread plain, by the *full* moon rising in the east, while the sun still lingers in the west—both orbs above the horizon, confronted. The following lines by ~~the~~ Poet ~~Laureate~~ record this sight:—

> "The charmèd sunset lingered low adown
> In the red west;
> They sat them down upon the yellow sand,
> Between the sun and moon, upon the shore."

The Monthly Mean amount of Cloud as deduced from observations during 15 years 1861-1875. (A cloudless sky being 0, and completely overcast 10.)

	Jan.	Feb.	Mar.	Ap.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Mean......	6·7	7·3	6·6	5·8	6·0	6·5	5·9	5·9	5·7	6·3	6·4	7·1

The Mean amount of cloud = 6·3, that is, on an average, *more than half the sky is obscured by cloud.*

Thus it appears that on the average, September has the least amount of cloud; in the years 1865 and 1868 the cloud in September was very small in amount, but in 1866 it was unusually great. April is next, being slightly more cloudy than September. June shews an amount above the average, and this is accompanied by an increase of the relative humidity as compared with May. December, January, and February exceed the average in cloudiness, and those also are the months of greatest humidity.

Looking to the mean amount of cloud for each year, we find the following results:—

		Diff. from average.
In 1861 the mean was	5·5	— 0·8
,, 1868 ,, ,, ...	5·8	— 0·5
,, 1870 ,, ,, ...	6·0	— 0·3
,, 1865, 1871, and 1874	6·2	— 0·1
,, 1872 ,, ,, ...	6·3	0·0
,, 1869 ,, ,, ...	6·4	+ 0·1

			Diff. from average.
In 1863, 1864, 1866 ,,	....	6·5	+ 0·2
,, 1875 ,, ,,	....	6·7	+ 0·4
,, 1862 ,, ,,	....	6·9	+ 0·6

It is remarkakle that 1872 shews an average amount of cloud, while it was the year of heaviest rainfall in the period under review; this is explained by the fact that in March, April, June, and July, the mean was only 5·5; May, August, and October were slightly above the mean; and in February, November, and December the amount was 7·1.

The greatest monthly obscuration of the sky recorded was 8·8 in February, 1873.

The least monthly obscuration was 3·7 in May, 1868.

TABLE I.

PREVALENCE OF FOG.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Tot.
1861	4	3	0	2	0	2	0	0	0	2	2	2	17
1862	1	1	1	0	0	0	0	2	0	0	4	1	10
1863	1	2	0	0	0	0	0	0	0	7	0	0	10
1864	5	2	1	0	1	0	0	0	1	3	2	4	19
1865	3	4	2	4	0	0	1	3	4	5	0	2	28
1866	0	0	0	0	0	3	1	1	3	5	2	2	17
1867	2	2	0	0	1	2	0	0	2	2	4	2	17
1868	1	1	0	2	0	0	0	0	1	3	2	1	11
1869	4	0	0	0	0	0	1	0	1	4	1	3	14
1870	0	1	0	0	0	0	0	2	5	0	8	3	19
1871	3	1	0	0	0	1	0	0	0	3	2	2	12
1872	2	1	2	0	0	0	0	0	0	0	1	2	8
1873	0	3	3	0	0	0	1	0	1	2	0	2	12
1874	1	1	2	0	1	0	1	0	0	3	6	4	19
1875	2	0	0	0	0	0	0	0	2	2	0	0	6
Mean	2·0	1·4	0·7	0·5	0·2	0·5	0·3	0·5	1·3	2·7	2·3	2·0	14·6

We find that the greatest number of fogs occurred in 1865, and the least in 1872 and 1875, the latter being the years of greatest rainfall.

The fogs which occurred from March to August inclusive were mostly those of the morning, and were followed by fine days; those of the winter were often day fogs.

THE RAINFALL.

For the purpose of gaining some general notion of the distribution of RAIN over England and Wales, it is convenient to divide the country into *four regions*.*

First Region. From the Cheviot hills, by the east, the Pennine range to the southern part of Lancashire, within which boundary the annual average rainfall ranges between 50 and 170 inches.

Second Region. This includes most of Wales, and Devon, and Cornwall, where the annual average lies between 40 and 50 inches.

Third Region. The centre of England, from Lancashire, part of Yorkshire, and thence west of the Eastern counties to Sussex (inclusive), having a rainfall averaging from 30 to 40 inches.

Fourth Region. The east of England, from the Tweed to Kent, the average rainfall being from 20 to 30 inches.

The Fenland belongs to the *fourth region*, and we shall now consider what proportion its rainfall bears to that of the whole region.

For the purpose of comparison we must select such stations, in the *fourth region*, as will shew an average, from a long series of observations.

* In determining upon this method we have been greatly assisted by referring to the statistics in "British Rainfall," and other publications, by MR. G. J. SYMONS, Sec. of Meteorological Society.

[But, like most rules, the above have their exceptions, for Dartmoor with a yearly fall of above 80 inches should be included in the *first region*, and Lancaster with an average several inches less than Bolton would properly belong to the *second region*.]

	inches.
Bywell, Northumberland average of 13 years (1856-1868)	28·19*
York, average (1860-9)	24·48
Spalding, Lincolnshire (1860-9)	25·34
Honington, Norfolk (1860-9)	23·98
London—Camden Square—(1860-9)	25·68†
Stamfordham, Northumberland, average of 13 years (1856-1868)	28·65
Darlington, Durham, average of 10 years (1859-1868)...	29·92
Average of the 7 stations	26·60

Now, selecting a few stations situated just ontside the Fen district, we find the following results.

	Average of decade ending 1870.	Average of 15 years ending 1875.
Holkham, Norfolk	22·44	23·39
Fakenham „	25·00	—
Bury St. Edmunds	22·30	24·09
Royston, Herts	22·24	22·32
Bedford	21·00	21·57
Northampton	23·50	24·32
Wellingborough	22·80	23·66
Grantham	21·90	22·18
Lincoln	19·75	21·36
Average	22·33	22·86

Now, the average rainfall at Wisbech during the decade (1861-70) was 22·768, or rather less than half an inch above the average of the above-named stations; and the average of the 15 years was 24·233 inches, or about equal to that at Bury St. Edmunds and Northampton, or 1·47 inches above the average of the surrounding district.

* These three averages are obtained from the METEOROLOGICAL REPORT for 1868. (From Nat. Hist. Trans. of Northumberland and Durham) by Revd. R. F. WHEELER, M.A.

† BRITISH RAINFALL, 1875.

At Boston the average rainfall of the 20 years (1854-73) was 22·38 inches, this being nearly identical with the rainfall of the district.

Now the average rainfall at Pode Hole, a little west of Spalding, is given in *Symons's British Rainfall*, for 1875, as follows:

	(1850-9)	(1860-9)	(1860-5)	Depth 1875.
Average	23·38	25·34	25·11	32·25

But looking back to an earlier date, and to a record kept at the southern part of the *Fenland* we get the following (Rainfall at Swaffham Bulbeck, 1833-49).*

TABLE II.

Year.	Rain in inches.	Year.	Rain in inches.
1833	18·750	1842	21·598
— 4	14·980	— 3	27·758
— 5	23·310	— 4	22·231
— 6	23·920	— 5	22·652
— 7	19·670	— 6	22·946
— 8	17·390	— 7	20·719
— 9	26·345	— 8	27·711
1840	17·412	— 9	23·657
— 1	31·220		

The mean as deduced from these was 22·486 inches, which is remarkably near the above-named averages.

* Obs. on Meteorology, by Rev. L. Jenyns, M.A., Vicar of Swaffham Bulbeck, 1858. Voorst.

TABLE III.

YEARLY RAINFALL AT WISBECH.

Year.	Total Rain in gauge 6 inches above ground.*	Total Rain in gauge 8 feet above ground.*	Total Rain in gauge 85 feet above ground.	Heaviest monthly Rainfall during each year.	The month.	Days on which 0·01 inch or more fell.
	Inches. (a)	Inches. (b)	Inches. (c)	Inches. (d)		
1861	21·264	—	—	3·650	Nov.	177
1862	21·303	—	—	3·018	March.	192
1863	19·357	—	16·90	3·088	June.	162
1864	15·995	15·41	12·93	2·828	March.	125
1865	27·439	26·52	22·92	5·500	Oct.	142
1866	26·394	25·33	20·75	3·419	Aug.	172
1867	26·080	25·05	20·11	3·514	May.	155
1868	22·844	21·68	19·07	5·188	Dec.	123
1869	26·523	25·49	21·89	4·207	Dec.	146
1870	20·487	19·50	16·28	3·391	Dec.	134
1871	24·822	23·90	19·87	4·107	June.	151
1872	38·458	36·87	29·14	5·933	July.	208
1873	23·392	22·67	19·38	4·023	Aug.	161
1874	19·446	18·83	16·06	2·776	Sept.	153
1875	29·689	28·80	23·91	7·145	July.	169
Mean	24·233	—	—	—	—	158

* Measured in a GLAISHER'S 8 inch gauge.

In column (*d*) Jan., Feb., and April are the only months unrepresented; March appears *twice;* May, *once;* June, *twice;* July, *twice;* Aug., *twice;* Sept., *once;* Oct., *once;* Nov., *once;* Dec., *thrice.* Although the heaviest rain in 24 hours, recorded in the 15 years, was on 2nd April, 1872, yet the total of that month was 4·025 inches only.

Taking the twelve years' complete observations (1864—1875) of (*a*), (*b*), and (*c*), we find, if (*a*) = 100, then (*b*) = 96, and (*c*) = 80.

TABLE IV.

Shewing the Average Monthly Rainfall in 15 years; also the Average Number of Days on which 0·01 inch or more fell.

	Jan.	Feb.	Mar.	April.	May.	June.
Depth in inches.	1·746	1·435	1·565	1·500	1·751	2.186
Days.	14·8	12·9	14·8	11·0	11·2	12.3
	July.	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
Depth in inches.	2·751	2·431	2·328	2·253	2·128	2·156
Days.	12·5	11·6	13·1	15·2	14·2	13·8

The *greatest* number of rainy days, then, occur in *October*. The *least* number in *April*. In October rain falls about every other day. In April about every third day.

The *greatest fall*, on the average, is in July, Aug., and Sept., and this is largely due to thunderstorms. The *least fall* occurs in Feb., March, and April.

Generally it may be stated that the rain is not of long duration—it falls in heavy showers; drizzling rains are not frequent, except in the later months of the year.

TABLE V.

ANALYSIS OF TABLE NO. VI.

Number of heavy rains (during 15 years) in		Per cent of total.	½-inch and less than ¾-inch.	¾-inch and less than 1 inch.	1 inch and less than 2 inches.	Above 2 inches.
January	5	4·0	3	2	..	..
February	5	4·0	4	..	1	..
March	7	5·6	5	1	1	..
April	3	2·4	2	..	..	1
May	7	5·6	5	1	1	..
June	15	11·9	7	5	3	..
July	18	14·2	6	3	9	..
August	20	15·8	11	4	4	1
September	15	11·9	11	1	3	..
October	10	7·9	6	3	1	..
November	8	6·4	5	2	1	..
December	13	10·3	11	1	1	..
Total	126	..	76	23	25	2
Average heavy rains per year	8·4					

This analysis seems to require very little comment. That so few heavy rains occur, shews a remarkable adaptability of natures operations to the conditions of the country. Only twice in the 15 years has the rainfall, in 24 hours, exceeded *two inches*—and only twenty-five times has it been between one inch and two inches. It will be noted that during June, July, and August, most of the heavy rains fall, that is at a season when evaporation is most active, and the land is least likely to be flooded. The number of heavy rains in December is augmented by those (*i.e.* 8) in 1868-69-70. (See Table No. VI.)

TABLE VI.—THE HEAVIEST DIURNAL RAINS AT

(Rainfall of ½ an inch and upwards, in

	1861.		1862.		1863.		1864.		1865.		1866.		1867.	
Month.	Date	Depth. Inch.	Date	Depth. Inch.	Date	Depth. Inch.	Date	Depth. Inch.	Date	Depth. Inch.	Date	Depth. Inch.	Date	Depth. Inch.
Jan.	..	..	..	..	..	..	..	..	6	0·50	..	..	..	..
,,	..	..	..	..	6	0·51	..	..	27	0·80	..	..	30	0·86
Feb.	..	..	..	..	..	..	..	..	17	0·61	..	..	..	..
March.	..	..	24	0·68	..	..	6	0·53	..	..	..	..	..	..
,,	..	..	..	..	..	..	10	0·60	..	..	..	..	..	..
April.	..	..	..	..	..	..	..	..	..	..	..	..	20	0·58
May.	12	0·74	..	..	..	..	7	0·58	..	..	..	..	10	1·62
,,	..	..	..	..	..	..	..	..	..	..	..	..	12	0·84
June.	10	0·76	..	..	6	0·54	..	..	2	0·94	4	0·74	..	..
,,	22	0·74	..	..	17	0·58	..	..	..	..	..	..	..	..
,,	..	..	..	..	20	0·50	..	..	..	..	..	..	..	..
July.	21	0·54	..	..	..	..	..	..	7	1·65	29	1·12	26	1·15
,,	26	1·21	..	..	..	..	..	..	18	0·65	..	..	..	..
,,	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Aug.	..	..	17	0·66	3	0·58	..	..	24	0·93	12	0·53	6	0·59
,,	..	..	..	..	..	..	..	..	25	0·90	..	..	..	..
,,	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sept.	..	..	29	0·66	..	..	16	0·72	..	..	..	..	3	1·00
,,	..	..	30	0·54	..	..	..	..	..	..	..	..	9	0·62
Oct.	..	..	..	..	..	..	..	..	10	1·37	..	..	15	0·51
,,	..	..	..	..	..	..	..	..	17	0·89	..	..	..	..
,,	..	..	..	..	..	..	..	..	19	0·83	..	..	..	..
,,	..	..	..	..	..	..	..	..	27	0·50	..	..	..	..
Nov.	14	1·77	..	..	9	0·54	24	0·68	..	..	..	..	..	..
,,	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dec.	5	0·54	..	..	..	..	..	..	..	..	..	..	1	0·67
,,	7	0·67	..	..	..	..	..	..	..	..	..	..	..	..
,,	..	..	..	..	..	..	..	..	..	..	..	..	..	..
No. of heavy rains each year.		8	..	4	..	6	..	5	..	12	..	3	..	10

WISBECH, DURING 15 YEARS (1861—1875.)

24 hours previous to 9 a.m. each day.)

1868.		1869.		1870.		1871,		1872.		1873.		1874.		1875.	
Date	Depth. Inch.	Date	Depth. Inch.	Date	Depth. Inch.	Date	Depth. Inch.	Date	Depth. Inch.	Date	Depth. Inch.	Date	Depth. Inch.	Date	Depth Inch.
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	23	0·61	..	..	..	..	..	..
..	..	12	1·01	6	0·69	10	0·59	..	..	2	0·64	..	..	..	..
7	0·60	19	1·05	..	..	15	0·56	21	0·78	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	28	0·77	2	2·27	..	..	..	..	..	..
..	..	3	0·54	..	..	..	..	..	..	26	0·54	..	..	..	..
..	..	8	0·72	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	16	1·31	15	0·66	19	0·55	29	0·86	..	..	29	1·43
..	..	..	..	..	..	17	1·04	..	..	..	..	..	..	30	0·62
..	..	..	..	..	..	22	0·64	..	..	..	..	..	..	..	..
..	..	..	..	5	0·51	21	0·65	6	1·16	12	0·55	..	..	14	0·86
..	..	..	..	..	..	..	..	14	0·92	13	1·06	..	..	15	0·56
..	..	..	..	..	..	..	..	24	1·36	..	..	..	..	19	1·40
..	..	..	..	..	..	..	..	..	..	..	..	..	..	20	1·71
..	..	..	..	..	..	..	..	..	..	..	..	..	..	21	0·86
6	0·81	5	0·52	27	0·64	17	1·14	5	1·06	18	0·64	..	..	12	0·85
18	0·64	7	0·65	..	..	..	..	7	1·12	24	2·00	..	..	28	0·52
22	0·50	..	..	..	..	..	..	30	1·11	..	..	..	..	..	..
29	0·53	9	0·57	5	1·19	23	0·52	25	0·67	..	..	3	0·50	21	0·77
30	0·55	10	0·57	..	..	29	1·44	..	..	..	..	..	..	..	..
3	0·87	..	..	..	..	..	..	20	0·73	21	0·51	..	..	20	0·73
6	0·63	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	14	0·60	..	..	2	0·66	28	0·82	5	0·58
..	..	..	..	..	..	..	..	..	..	..	..	..	..	13	0·89
7	0·51	16	0·50	13	0·62	..	..	16	0·78	..	..	..	..	2	0·57
22	0·67	17	0·66	19	1·04	..	..	..	..	..	..	..	..	..	..
29	0·52	21	0·52	..	..	..	..	..	..	..	..	..	..	..	..
29	11	..	11	..	7	..	11	..	13	..	9	..	2	..	14

THUNDERSTORMS.

In the following tabular notice of Thunderstorms no attempt is made to give details of their comparative severity, or of the consequences attending them; the principal object being to shew, for each year, the frequency of their occurrence. When the *date alone* is given a thunderstorm, T. S. with its usual attendants of rain, and sometimes hail, is indicated—when only thunder was heard T is inserted—when only lightning was seen L is added; (H) means hail fell during the storm.

1861.—May 20th T; 23rd. June 5th T; 20th; 23rd T; 26th; 29th. July 7th; 8th; 16th T; 20th; 26th T; 27th (H); 28th T; 31st T. September 25th T; October 8th. Total, T. S. 9; T. 8 = 17.

1862.—May 3rd; 6th; 7th; 9th; 21st T (H). June 11th; 27th (H). July 12th; 15th; 16th; 22nd T. August 15th T. Total, T. S. 9; T. 3 = 12.

1863.—January 20th (H). April 10th L. June 7th; 8th (H); 10th; 11th T. August 2nd; 25th; 31st. September 9th L; 10th T; 22nd (H). November 1st L. Total, T. S. 8; T. 2; L. 3 = 13.

1864.—May 19th; 20th. June 13th; 23rd. August 21st. September 3rd L; 16th; 17th (H). Total, T. S. 7; L. 1 = 8.

1865.—February 28th L. May 5th T; 9th; 22nd; 23rd. July 6th, 7th, 8th, 9th, 10th, 11th T; 16th L; 17th. August 24th T. October 9 L; 11th T; 17th T (H). Total, T. S. 9; T 5; L. 3 = 17.

1866.—January 4th. February 4th. April 2nd L; May 4th; 27th. June 4th; 30th. July 1st; 5th; 29th T. August 10th; 16th. September 2nd L (H); 6th T; 15th. November 13th L, 14th L. Total, T. S. 11; T. 2; L. 4 = 17.

1867.—May 10th, 11th. June 14th T. July 15th T. August 20th. September 3rd. Total, T. S. 4; T. 2 = 6.

1868.—April 27th. May 9th T; 19th L; 29th L. July 15th L; 26th L. August 6th; 11th. September 20th; 27th. October 21st L. December 26th L. Total, T. S. 5; T. 1; L. 6 = 12.

1869.—April 14th. May 7th T; 10th T; 17th; 19th. July 17th. August 5th. September 5th; 8th, 9th, 10th; 30th. Total, T. S. 10; T. 2 = 12.

1870.—June 16th. July 1st; 16th. August 1st T; 18th L. Total, T. S. 3; T. 1; L 1 = 5.

1871.—February 28th. March 25; 16th T; April 17th. May 27th T. June 15th; 20th. July 5th; 9th; 26th. August 17th; 19th T. October 8th L. Total, T. S. 8; T. 4; L 1 = 13.

1872.—February 23rd. April 24th. May 22nd. June 2nd; 17th; 18th; 19th; 24th; 25th; 26th. July 6th; 12th; 23rd; 24th. Aug. 2nd T; 5th; 7th; 8th T; 31st. September 4th; 20th L; 29th. Total, T. S. 19; T. 2; L. 1 = 22.

1873.—January 3rd L. March 11th. April 6th T; 15th L, 16th. May 3rd T; 23rd T. July 12th; 15th; 23rd; 27th T. August 9th T; 24th; 25th L; 26th T. September 1st L; 3rd; October 13th L; 26th L. Total, T. S. 7; T. 6; L. 6 = 19.

1874.—May 7th; 25th. June 22nd; 26th. July 21st 23rd; 24th T; 29th. August 8th; 29th. September 9th. Total, T. S. 10; T. 1 = 11.

1875.—January 24th L. May 7th; 18th T, 19th. June 4th T; 17th L. July 11th; 17th; 19th. September 8th L; 25th. October 11th T; 12th L; 23rd. Total, T. S. 7; T. 3rd; L. 4 = 14.

SUMMARY.

	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
T.S.	9	9	8	7	9	11	4	5	10	3	8	19	7	10	7
T.	8	3	2	0	5	2	2	1	2	1	4	2	6	1	3
L.	0	0	3	1	3	4	0	6	0	1	1	1	6	0	4

Hence we learn that 1872 was the year of most frequent electrical phenomena, and 1870 the least. There were 126 thunderstorms in the 15 years, giving an average of *eight per year*. Thunder alone was heard on 42 occasions, and lightning seen on 30; therefore, electrical phenomena was witnessed about 13 times per year.

MEAN TEMPERATURE OF THE SEASONS AT WISBECH FOR FIFTEEN YEARS—(1861-1875).

(*a*) The Spring = March, April, May.
(*b*) The Summer = June, July, August.
(*c*) The Autumn = September. October, November.
(*d*) The Winter = December, January, February.

The *Spring* of 1868 was the warmest, being 2·°8 above the average, and that of 1873 the coldest, being 2·°1 below.

The *Summer* of 1868 was the warmest, being 3·°8 above the average, that of 1862, the coldest, being 3·°2 below the average.

The *Autumn* of 1865 was the warmest, being 3·°6 above the average, that of 1871, the coldest, being 2.°2 below the average.

The *Winter* of 1868 was the warmest, being 4·°1 above the average, that of 1870, the coldest, being 3·°4 below the average.

[The Mean is obtained from the readings of the dry bulb at 9 a.m. and 3 p.m. (corrected for diurnal range) and those of the Max. and Min. Thermometers.]

TABLE VII.

	(*a*) SPRING.	(*b*) SUMMER.	(*c*) AUTUMN.	(*d*) WINTER.	
	°	°	°	°	
1861	47·4	60·3	50·4	39·7	(1861-2)
1862	48·3	57·1	49·0	41·7	(1862-3)
1863	48·1	59·8	49·9	38·0	(1863-4)
1864	47·9	59,5	50·3	36.4	(1864-5)
1865	48·3	61·0	53·3	41·4	(1865-6)
1866	46·6	59·6	50·3	40·5	(1866-7)
1867	46.7	59·7	49·5	39·3	(1867-8)
1868	50·4	64·1	49·7	43·1	(1868.9)
1869	45·9	59·6	50·1	36·8	(1869-70)
1870	47·8	61·4	49·4	35·6	(1870-71)
1871	48·2	59·6	47·5	40·3	(1871-72)
1872	48·2	61·1	49·5	38·5	(1872-73)
1873	45·5	61·4	48·1	39·9	(1873-74)
1874	48·0	60·4	49·8	36·1	(1874-75)
1875	47·4	60·5	49·8	38·4	(1875-76)
Means	47·6	60·3	49·7	39·0	

Mean Temperature of Year = 49°·1

Or from Max. and Min. only = 49·8

TABLE VIII.

MAXIMA AND MINIMA TEMPERATURES.

Month.	1861. Max	1861. Min	1862. Max	1862. Min	1863. Max	1863. Min	1864. Max	1864. Min	1865. Max	1865. Min	1866. Max	1866. Min	1867. Max	1867. Min	1868. Max	1868. Min
Jan. ..	48·8	9·0	54·3	22·2	53·0	27·1	53·3	15·1	50·2	15·7	53·6	24·9	56·0	12·3	53·4	24·4
Feb. ..	54·7	23·5	56·8	26·0	54·4	27·4	55·8	18·1	55·7	21·3	55·3	26·0	58·1	28·2	61·5	26·7
Mar. ..	60·8	27·7	60·9	21·5	63·4	26·6	60·7	26·0	55·0	24·9	63·5	21·1	59·6	24·0	62·2	29·0
April ..	65·3	30·7	72·6	28·0	66·0	29·0	75·8	33·2	74·5	31·2	77·4	32·0	67·5	29·2	68·5	31·0
May ..	76·9	29·4	81·1	37·3	76·4	30·3	85·7	34·3	82·7	31·3	73·4	30·3	84·0	32·3	86·0	35·5
June ..	83·4	45·0	74·4	40·8	79·7	41·6	81·2	39·0	85·9	38·4	84·0	39·5	79·0	40·7	87·0	41·5
July ..	72·8	47·3	80·1	43·5	84·4	38·5	85·0	45·5	83·8	44·0	89·4	43·7	79·0	42·0	92·4	46·5
Aug. ..	82·2	44·5	75·1	47·0	81·5	42·9	86·0	37·1	76·2	40·7	77·1	44·0	88·6	42·8	89·8	43·4
Sept. ..	78·6	38·1	70·7	40·0	71·3	36·4	76·0	36·8	84·0	42·0	71·6	39·0	77·2	35·1	87·7	42·7
Oct. ..	75·1	39·2	70·3	28·2	65·0	33·0	68·0	38·1	73·0	32·0	68·0	30·8	66·6	30·8	64·4	28·2
Nov. ..	56·3	20·7	56·8	22·5	58·5	29·3	55·1	28·5	56·2	30·2	59·2	28·0	58·2	24·0	60·0	27·8
Dec. ..	52·6	25·0	54·5	32·1	54·2	26·6	53·6	17·8	52·0	30·7	56·2	27·7	56·8	20·1	56·7	31·2

Month.	1869. Max	1869. Min	1870. Max	1870. Min	1871. Max	1871. Min	1872. Max	1872. Min	1873. Max	1873. Min	1874. Max	1874. Min	1875. Max	1875. Min
Jan. ..	58·0	25·0	50·8	22·0	44·2	8·5	53·6	28·0	55·0	22·0	54·2	27·2	54·1	11·8
Feb. ..	58·0	30·5	56·3	21·0	57·0	24·3	56–0	31·1	50·0	25·0	54·8	20·5	52·0	24·5
Mar. ..	52·4	26·4	57·4	23·4	71·2	29·8	62·0	26·8	65·0	26·5	68·0	19·4	59·0	27·0
April ..	77·0	32·0	80·4	26·3	66·0	28·0	72·8	30·2	74·4	31·0	77·0	31·8	73·5	30·0
May ..	69·1	34·0	81·0	31·0	77·5	34·1	73·1	32·2	68·0	33·0	73·1	31·4	81·4	39·3
June ..	86·2	37·2	85·5	43·0	75·2	39·3	84·0	38·1	85·0	41·6	83·0	35·9	85·0	42·0
July ..	88·3	45·2	83·6	46·0	79·0	46·3	87·3	44·7	88·4	44·6	90·8	44·3	78·0	41·0
Aug. ..	87·5	39·7	79·8	40·7	86·2	46·0	79·3	43·0	82·7	46·0	83·4	43·0	83·7	48·2
Sept. ..	76·2	40·8	74·0	36·0	76·5	35·0	77·0	34·0	72·8	36·1	74·6	40·8	81·0	43·0
Oct. ..	73·0	27·5	72·0	32·8	66·2	32·0	64·4	32·0	71·1	25·7	66·4	32·0	67·7	32·0
Nov. ..	58·5	26·5	56·2	28·0	52·5	22·0	61·2	31·0	55·1	29·3	58·2	22·8	60·4	30·0
Dec. ..	55·5	16·5	56·5	9·0	49·2	12·5	51·2	29·0	56·3	23·5	50·7	14·0	54·5	26·0

From this Table the extreme Range of Temperature may readily be obtained for any given period within the 15 years.

TABLE IX.

Shewing the RANGE of the Monthly Mean Temperature.

	Highest Monthly Means.	Month.	Lowest Monthly Mean.	Month.	Range.
	°		°		°
1861	62·2	August.	33·4	January.	28·8
1862	58·7	,,	38·3	,,	20·4
1863	61·5	,,	40·6	,,	20·9
1864	61·3	July.	35·8	,,	25·5
1865	64·1	September.	35·4	,,	28·7
1866	60·4	June.	40·5	February.	19·9
1867	62·7	August.	34·7	January.	28·0
1868	66·9	July.	37·7	,,	29·2
1869	64·1	,,	36·9	December.	27·2
1870	64·2	,,	33·1	,,	31·1
1871	64·3	August.	31·8	January.	32·5
1872	64·8	July.	39·8	,,	25·0
1873	63·7	,,	34·5	February.	29·2
1874	64·8	,,	31·5	December.	33·3
1875	62·5	August.	35·3	February.	27·2

From this Table we see that—

(*a*) The highest means occurred *once* in June; *seven times* in July; *six times* in August; and *once* in September, and that the highest of all was in July, 1868.

(*b*) The lowest means, *nine times* in January; *thrice* in February; *thrice* in December, and the lowest of all in December, 1874.

TABLE X.

HYGROMETRICAL ELEMENTS.*

	Mean temp. of Dew-point.	Mean depression of Dew-point below air temp.	Mean elastic force of vapour.	Mean weight of vapour in a cubic foot of air.	Mean weight of a cubic foot of air.	Mean degree of Humidity Saturation being equal to 100.
	°	°	in.	grains.	grains.	℔ cent.
January	35·6	2·3	0·209	2·4	554	90
February	36·8	3·2	0·222	2·5	554	89
March	37·7	3·8	0·226	2·6	551	85
April	42·8	5·5	0·275	3·1	546	79
May	46·6	6·5	0·319	3·6	538	76
June	52·0	6·0	0·391	4·3	536	79
July	55·6	6·4	0·445	4·8	529	77
August	54·8	6·1	0·430	4·7	530	78
September	53·0	4·3	0·410	4·4	534	84
October	47·0	3·1	0·318	3·6	540	87
November	39·0	2·9	0·240	2·7	550	89
December	36·9	2·1	0·223	2·5	554	91
Means	44·8	4·3	0·309	3·4	543	83

* It may not be irrelevant to note that this Table is deduced from above 33,000 distinct observations and records—each element being calculated from these by the aid of Glaisher's Hygrometrical Tables.

A few general principles may be here enunciated, in order to render intelligible the results to be deduced from the above Table.

(*a*) The atmospheric air always contains, in solution, some vapour of water, the quantity of which varies with the temperature of the air; and the higher this temperature is, the greater is the amount of *invisible* vapour ;* while vapour is in a gaseous state it is, like other gases, *dry*. But this vapour has a tendency to condense by a lowering of the temperature of the air containing it, and is then made sensible; the *dew point* is that temperature indicated by the thermometer when dew begins to be deposited, and the air is saturated "with the quantity of vapour it actually contains."

(*b*) The *elastic force*, or *tension of vapour* (given in the table), is an expression of the statical force which vapour exerts on a column of mercury. As an illustration, suppose the barometer reading to be 29·9 inches and the *tension of vapour* at the time of observation 0·4 inch, then if all the vapour were withdrawn from a column of air extending throughout the atmosphere, the barometer would read 29·5 inches, and would thus represent the weight of a column of *dry* air. The *elastic force* is a measure of the *absolute* amount of vapour in the air.†

(*c*) The degree of *humidity* in the table expresses the *relative*, not the *absolute* humidity; complete *saturation* is

* At the temp. of 30°, a cubic foot of air is saturated with water by the weight of two grains; at 41° by three grains; at 49° by four grains; at 56° by five grains, and so forth.

"At 212° the air is capable of absorbing a quantity of vapour of water equal to its own volume; the tension of the water becomes equal to that of the air; it boils; and the pressure of the vapour is equal to one atmosphere."—"The Atmosphere," edited by J. GLAISHER.

† For details see GLAISHER's Hygrometrical Tables. *See* also GANOT's Physics, for methods of experiment. "Vapours—Measurement of their tension."

represented by 100, and absolute dryness is 0; so that 90 represents that the moisture in the air is 10 per cent. short of saturation.

The Table shews the *annual march* of the Dew-point temperature, the Vapour tension, Humidity, &c.

The dew-point, the air temperature (found by adding the first and second columns), the elastic force, and the weight of vapour in a cubic foot of air appear to make a very uniform progression towards the maximum epoch in July; when the weight of a cubic foot of air is at a minimum, and the relative degree of humidity nearly a maximum, the return of the former to the minimum epoch in January, is more gradual between July and October than in the later months; and the degree of humidity has its maximum in December.

It will be noted that the humidity oscillates twice between April and August, having its actual minimum in May. June is very generally more humid than the two preceding and succeeding months.*

In the next tables some elements of COMPARATIVE METEOROLOGY are given; the geographical distribution of the stations is the best the writer could determine upon, as it was necessary to use the observations of those where records had been made for, at least, the same period as at Wisbech. The details have been drawn from MR. GLAISHER'S Meteorology of England, published in the Quarterly Journal of the Meteorological Society.

Further on will be found a table shewing the *mean* temperature, at these stations, as deduced from the mean of the maximum and minimum temperatures alone.

* See diagram.

TABLE XI.

Of Monthly *Mean* Temperature of the Air at

	WISBECH.	GREENWICH.	NORWICH.	YORK.	LIVERPOOL.	LLANDUDNO.	OXFORD.	OSBORNE.
	°	°	°	°	°	°	°	°
Jan. ..	37·9	38·8	38·1	37·3	39·7	42·0	39·2	40·4
Feb. ..	40·0	40·2	39·4	39·5	40·7	42·3	40·5	41·3
March .	41·5	41·5	41·1	40·0	41·4	43·3	41·9	42·5
April ..	48·3	48·3	47·1	46·5	47·5	48·9	48·5	48·4
May ..	53·1	52·8	51·8	50·6	51·3	52·0	52·8	53·0
June ..	58·0	58·1	56·8	56·4	56·5	57·1	58·3	58·1
July ...	62·0	62·4	61·5	60·2	60·1	60·0	61·9	62·3
Aug. ..	60·9	61·4	61·5	58·8	59·6	60·0	60·5	61·4
Sept. ..	57·3	57·7	57·1	54·7	56·0	57·1	56·9	58·2
Oct. ...	50·1	50·1	50·0	48·4	49·9	51·4	50·1	51·9
Nov....	41·9	42·4	42·3	40·8	43·1	45·0	42·3	44·3
Dec....	39·0	40·0	39·6	39·1	41·7	43·1	40·0	41·4
Mean	49·1	49·4	48·8	47·7	48·9	50·2	49·4	50·2

TABLE XII.

Of Monthly Means of *Daily Range* of Temperature of Air.

	°	°	°	°	°	°	°	°
Jan. ..	9.6	9·5	9·3	8·8	8·1	9·0	8·8	11·2
Feb. ..	10·5	11·0	10·3	9·2	8·1	9·1	9·6	11·5
March .	14.4	14·5	13·0	11·1	9·9	11·0	12·8	14·3
April ..	18·7	19·2	16·5	14·4	12·4	11·6	17·0	17·8
May ..	20·7	20·5	17·0	15·2	12·8	15·1	18·6	19·1
June ..	20·5	20·9	18·0	15·2	12·8	15·2	18·7	19·4
July ..	20·4	21·6	17·3	15·7	12.7	15·7	19·4	19·7
Aug. ..	19·5	20·3	16·6	14·3	12·1	14·6	17·8	18·1
Sept. ..	17·5	18·4	14·9	12·8	10·7	12·8	15·7	16·0
Oct. ...	13·8	15·1	12·7	11·8	9·7	11·5	13·0	13·5
Nov....	11·0	11·7	10·2	10·6	8·4	9·2	11·0	12·2
Dec....	9·1	9·4	8·8	8·8	7·8	8·4	9·2	10·7
Mean ..	15·4	16·0	13·7	12·3	10·4	11·9	14·3	15·3

TABLE XIII.

Shewing Monthly *Mean* Temperature of the Dew-point at

	Wisbech.	Greenwich.	Norwich.	York.	Liverpool.	Llandudno.	Oxford.	Osborne.
	°	°	°	°	°	°	°	°
Jan....	35·6	34·9	35·3	34·9	35·4	37·5	36·2	38·4
Feb. ..	36·8	35·8	36·4	37·2	36·3	37·9	37·0	39·3
March ·	37·7	36·5	37·5	36·7	36·9	37·6	36·8	38·9
April ..	42·8	41·8	40·5	42·3	40·5	41·8	41·7	44·3
May...	46·6	45·3	45·8	45·2	43·5	44·4	45·2	48·6
June ..	52·0	50·4	50·6	50·8	49·6	49·6	50·7	52·8
July...	55·6	53·8	51·6	53·9	52·0	53·0	53·5	56·5
Aug....	54·8	53·3	53 3	54·1	51·4	52·8	53·0	56·4
Sept. ..	53·0	51·2	51·8	51·5	49·9	50·0	50·9	54·7
Oct....	47·0	46·0	46·6	44·8	45·0	44·9	45·8	48·4
Nov....	39·0	38·6	39·1	38·1	38·2	39·6	38·4	40·9
Dec....	36·9	36·5	37·1	36·9	36·9	37·9	36·3	39.1
Mean ..	44·8	43·6	44·1	43·8	42·9	43·8	43·8	46 5

TABLE XIV.

Of Monthly Mean Degree of Humidity at Saturation = 100.

Jan. ..	90	86	90	91	84	84	88	92
Feb. ..	89	84	89	91	84	84	86	92
March .	85	82	87	88	82	81	82	87
April ..	79	78	79	83	77	77	78	86
May ..	76	76	80	82	74	75	75	85
June ..	79	74	78	82	77	75	76	84
July ..	77	73	77	80	75	78	74	81
Aug. ..	78	75	76	84	76	76	76	82
Sept. ..	84	79	82	88	80	77	80	87
Oct. ..	87	86	88	87	83	79	85	88
Nov. ..	89	86	88	90	83	81	87	88
Dec. ..	91	87	90	90	85	82	87	91
Mean ..	83	80	83	86	80	79	81	86

REMARKS.

(1) From Table XI we see that the *mean temperature* of Greenwich and Oxford are identical—the same with Norwich and Liverpool—that the mean of Wisbech is rather higher than Norwich, and less than Greenwich; also, that at Llandudno and Osborne it is equal, but that the temperature at Llandudno is more equable than at Osborne; York shews the lowest mean of all the stations.

(2) The mean *daily range* is greatest at Greenwich, and becomes less as we proceed towards the north-west—being least at Liverpool—at Llandudno 1½ deg. more than at Liverpool—at Wisbech and Osborne the mean comes out the same degree, but the variations are less.

(3) The mean temperature of the *Dew-point* is highest at Osborne and lowest at Liverpool; it is the same at York, Llandudno, and Oxford—at Greenwich nearly the same as at these three stations. Wisbech ranks next to Osborne, then Norwich.

(4) The mean degree of relative *Humidity* is highest at York and Osborne, being 86 per cent.; Wisbech and Norwich stations rank next, and are 83 per cent.; then Oxford 81 per cent; Greenwich and Liverpool 80 per cent., and Llandudno 79.

And from this we deduce that the mean degree of Humidity at Wisbech is 4 per cent. above the least humid, but only ½ per cent. above the average of all the stations.

The Tables XI, XII, XXIII, XIV, have been calculated from MR. GLAISHER'S returns given in the reports of the Registrar-General of Births, Deaths, and Marriages, on a Mean of 15 years (1861 to 1875 inclusive); these means—in Table XI—have, consequently, been deduced from the *dry bulb*, corrected for *diurnal range* according to MR. GLAISHER'S tables, and from the mean of the Maxima and Minima, also corrected.

The Table XII, *Daily Range*, is calculated from differences of the mean of the Maxima and Minima temperatures for each month.

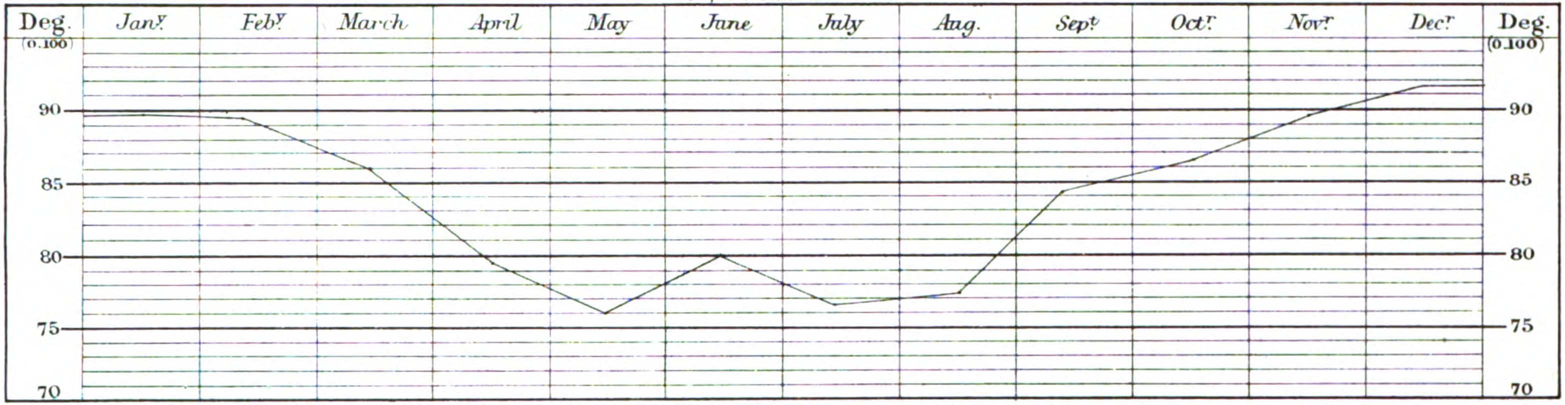
The Tables XIII and XIV, shewing the mean *Dew-point* temperature and the *Humidity*, are calculated from the means of the *dry* and *wet bulbs*, corrected for Daily Range by the same tables.

[The writer has adopted this as the most ready method of comparing the climate (so far as it goes) with the districts around. If Stamford be taken as a centre instead of Wisbech, the stations selected will be found to lie just on the boundary of a circle.]

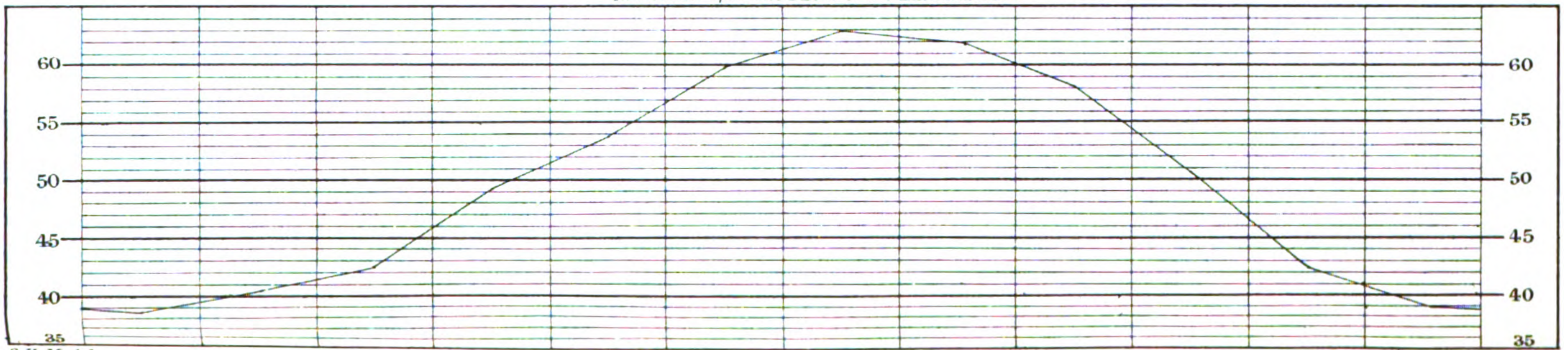
The method of obtaining the mean temperature, by correcting the readings of the Dry-bulb Thermometer, has recently met with many opponents—and certainly the present writer is not prepared to defend it—but if that plan be discarded, there is simply nothing left from which to deduce the *mean temperature* but the arithmetical means of the daily Maxima and Minima.

[The attention of the Meteorological Society of London, has recently been directed to this subject. It is suggested that tables of *diurnal range*—calculated from observations made upon a uniform system, at stations fairly representing different districts and elevations throughout this country—should be constructed for the purpose of reducing single readings to the mean of the day.]

CURVE SHOWING THE MEAN DEGREE OF RELATIVE HUMIDITY AT WISBECH, FOR EACH MONTH, ON AN AVERAGE OF 15 YEARS, (1861 - 1875)
Complete Saturation = 100.



CURVE SHOWING THE MEAN TEMPERATURE OF THE AIR FOR EACH MONTH, ON THE AVERAGE OF 15 YEARS (1861-1875) AT WISBECH.
Calculated upon the Mean of the Max. and Min.



S. H. M. del.

The following Table has been compiled from Mr. Buchan's Paper on "*The Temperature of the British Isles*," published in the Journal of the Scottish Met. Soc., March, 1871.

TABLE XV.

Shewing Mean Monthly and Annual Temperature as deduced from the Arithmetical Means of the Daily Maxima and Minima.

Station.	Height above sea-level.	No. of years observation.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly mean.
Wisbech (*Cambs.*) ..	14	7	37·9	40·6	42·2	48·6	53·9	60·1	62·7	61·8	58·1	51·2	42·7	39·9	50·0 (*a*)
Greenwich (*Kent*) ..	159	13	38·3	40·8	42·4	49·1	54·6	61·0	63·8	62·0	59·2	51·9	42·6	40·7	50·6 (*b*)
Norwich (*Norfolk*) ..	50	13	37·4	40·1	41·8	48·0	53·9	59·2	62·5	61·7	58·2	51·5	43·0	40·1	49 8 (*c*)
York (*Yorks.*)......	50	13	36·6	38·9	40·4	46·6	51·9	58·2	60·2	59·8	55·5	49·4	41·7	39·0	48·2 (*d*)
Liverpool (*Lancs.*) ..	37	13	40·5	42·1	42·6	48·6	54·0	59·3	62·4	61·6	57·9	52·2	44·2	42·6	51·0 (*e*)
Llandudno (*Carnar.*)	100	7	41·2	42·4	42·7	47·7	52·8	58·3	61·6	60·5	57·8	51·9	45·0	42·7	50·5 (*f*)
Oxford (*Oxfordsh.*) ..	210	13	38·4	40·6	41·9	48·2	53·6	59·5	62·1	61·1	57·3	50·9	42·2	40·6	49·7 (*g*)
Osborne (*Hants.*) ..	172	12	40·2	41·4	42·7	49·0	54·2	60·1	63·2	62·5	59·5	53·5	45·0	42·6	51·2 (*h*)

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)	(*h*)
(*A*) Yearly means in Table XI. ..	49·1	49·4	48·8	47·7	48·9	50·2	49·4	50·2
(*B*) Yearly means Table XV. ..	50·0	50·6	49·8	48·2	51·0	50·5	49·7	51·2
Difference between (*A*) & (*B*) ..	−0·9	−1·2	−1·0	−0·3	−2·1	−0·5	−0·3	−1·0

But it is seen that the number of years in Tables XI. and XV. do not coincide, therefore we take the monthly means, calculated from the arithmetical means of the Maxima and Minima; for the same 15 years (1861-1875) and find the following results for Wisbech.

	Jan.	Feb.	Mar.	April	May	June	July
Means from Table XI	37·9	40·0	41·5	48·3	53·1	58·0	62·0
Means from Max. & Min. only ..	38·2	40·4	42·4	49·2	53·9	59·6	62·9
	+0·3	+0·4	+0·9	+0·9	+0·8	+1·6	+0·9

	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly.
Means from Table XI	60·9	57·3	50·1	41·9	39·0	49·1
Means from Max. and Min. only	61·9	58·0	50·6	42·3	39·1	49·8
	+1·0	+0·7	+0·5	+0·4	+0·1	+0·7

Therefore by calculating the mean temperature from the simple arithmetical mean of the Max. and Min., we obtain a yearly mean three-quarters of a degree higher than by the hypothetical method before referred to.

The following Table (XVI.) gives the results of the observations made at Wisbech, with a terrestrial radiation thermometer, that is a self registering minimum, by NEGRETTI and ZAMBRA; this instrument was used throughout the 15 years. It was placed on props, the bulb touching the grass which was invariably kept short. The table gives the lowest reading during each month for the period (1861-1875) and also the mean for each month. No attempt has been to take averages and the design of the table is to enable the reader to note for himself the periods of greatest cold, as shown by a thermometer exposed to the open sky. Sometimes the simple readings have been taken as indicative of the *temperature of vegetation*, that is of grass or short plants. By refering to Table VIII., the lowest temperature in the shade will be found for any month, and subtracting the lowest on the grass from the lowest in the shade, we have the amount of terrestrial radiation thus, take December, 1875, by Table VIII., lowest in shade 26·°0, by Table XVI., lowest on grass 20·°0, radiation = 6·°0.

TABLE XVI.—MININIMUM TEMPERATURE ON GRASS (TERRESTRIAL RADIATION.)

MONTH.	1861.		1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.
January	Min.	14·0	20·0	24·3	11·8	12·1	19·5	9·4	19·6	21·0	11·3	*6·5*	22·3	21·5	21·7	12·0
	Mean	27·4	32·1	34·0	27·8	28·2	33·7	26·5	31·7	32·2	29·3	25·7	32·3	33·4	30·8	32·7
February	Min.	23·0	23·5	22·6	13·0	17·7	20·0	22·0	23·6	24·7	16·0	23·3	24·1	18·5	16·5	17·7
	Mean	35·6	35·8	32·4	28·9	29·9	31·3	35·8	34·9	36·6	28·2	25·1	24·7	28·8	29·2	28·3
March	Min.	28·2	16·5	22·3	21·4	21·0	14·7	19·0	24·0	20·3	18·7	29·8	25·0	22·7	17·0	19·5
	Mean	35·6	35·5	32·0	31·3	27·8	30·3	30·2	33·3	28·9	31·4	33·1	34·1	31·0	31·3	29·5
April	Min.	28·6	25·1	24·0	27·0	27·0	26·5	24·0	24·0	25·1	21·0	22·5	26·1	26·7	26·0	22·0
	Mean	35·2	37·8	36·3	36·1	38·3	37·1	38·7	35·2	38·1	32·0	37·0	35·8	34·3	36·3	33·3
May	Min.	28·3	30·4	25·4	31·2	27·2	26·6	30·5	32·0	28·5	25·0	29·2	29·0	28·0	27·0	30·3
	Mean	41·6	44·9	38·1	42·5	43·1	35·5	41·7	42·0	40·1	36·9	38·7	39·0	37·9	36·6	39·2
June	Min.	42·6	37·1	37·2	33·0	35·2	35·8	38·0	36·2	32·2	43·0	34·8	36·0	37·2	30·1	36·0
	Mean	50·6	45·4	46·5	44·7	46·2	48·7	46·7	44·9	43·0	45·9	44·9	46·3	46·7	43·6	45·2
July..........	Min.	45·4	39·6	35·0	40·7	39·1	38·5	39·0	40·2	41·5	43·0	42·5	41·8	39·2	38·0	36·0
	Mean	52·8	47.1	45·0	47·7	50·6	48·4	47·2	51·6	50·6	52·0	49·3	52·7	46·8	48·7	49·2
August	Min.	42·5	38·8	37·1	33·0	36·2	40·3	38·0	40·2	34·2	35·1	42·0	39·2	39·3	38·4	43·3
	Mean	52·3	47·5	49·2	44·3	47·5	48·6	49·3	50·4	46·6	48·4	49·0	49·7	40·7	47·0	50·6
September	Min.	36·7	35·0	33·8	29·8	36·7	34·2	29·8	37·0	38·0	33·3	31·3	31·0	30·0	37·0	39·1
	Mean	46·7	46·8	42·6	43·9	47·0	46·4	46·0	45·6	47·6	41·2	45·4	46·3	41·2	45·7	48·1
October	Min.	36·2	24·2	30·4	32·0	27·2	27·3	26·2	23·0	22·7	28·8	27·0	28·3	21·3	25·9	26·1
	Mean	47·3	40·9	42·3	40·1	38·5	44·2	38·3	35·5	38·6	38·9	36·9	38·1	35·4	40·6	38·4
November	Min.	18·5	20·2	24·1	23·2	24·0	24·3	20·8	23·0	20·5	23·0	16·5	26·7	22·4	23·8	24·2
	Mean	31·5	31·3	36·5	32·5	34·5	33·8	33·0	33·8	33·3	31·8	27·5	36·0	33·1	32·9	33·4
December	Min.	22·6	28·4	22·0	11·7	24·4	22·2	16·7	27·3	11·8	7·0	8·7	25·0	18·8	13·0	20·0
	Mean	32·4	34·7	33·1	31·3	33·2	33·9	30·3	36·6	28·6	25·4	29·3	34·8	30·9	23·7	31·0

TABLE XVII.

SOLAR RADIATION AT WISBECH.

Year and Month.	Mean of 10 Maxa. of Radiation.	Departure from Average.	Mean Vapour Tension, at 9 a.m.	Mean Radiation, whole month.	Departure from Average.
1869	°	°	In.	°	°
May..	56·3	−2·1	·313	43·2	−7·0
June..	53·9	−1·7	·374	49·5	+0·2
July..	52·3	−2·8	·482	45·3	−3·6
Aug...	51·1	−4·0	·453	43·5	−5·4
Sept...	50·0	−2·3	·397	43·8	−1·8
Oct...	45·5	−2·1	·311	38·4	+3·9
Nov...	36·5	−4·1	·231	23·5	−2·8
Dec...	33·9	−0·6	·189	21·0	+1·2
1870					
Jan ..	35·5	−0·4	·190	21·5	−0·1
Feb ..	47·2	+2·4	·180	29·5	+2·8
Mar ..	49·9	−2·4	·203	34·0	−6·9
Apr ..	49·8	−5·4	·277	45·2	−3·2
May..	55·9	−2·5	·329	50·3	+0·1
June..	53·5	−2·1	·404	46·1	−3·2
July..	51·5	−3·6	·495	44·4	−4·5
Aug....	55·4	+0·3	·448	48·7	−0·2
Sept...	51·5	−0·8	·382	45·3	−0·3
Oct...	49·2	+1·6	·317	28·6	−5·9
Nov...	40·9	+0·3	·222	27·3	+1·0
Dec...	38·9	+4·4	·159	20·6	+0·8
1871					
Jan ..	37·6	+1·7	·149	21·2	−0·4
Feb ..	41·6	−3·2	·240	25·5	−1·2
Mar..	49·1	−3·2	·247	45·3	+4·5
Apr ..	54·4	−0·8	·283	45·7	−2·7
May..	58·7	+0·3	·305	51·4	+1·2
June..	57·3	+1·7	·375	48·0	−1·3
July..	57·1	+2·0	·449	51·0	+2·1
Aug ..	56·5	+1·4	·487	52·8	+3·9
Sept...	51·9	+2·6	·374	44·3	−1·3
Oct...	49·3	+1·7	·321	35·9	+1·4
1871	°	°	In.	°	°
Nov...	42·5	+1·9	·185	29·2	+2·9
Dec....	36·0	+1·5	·198	20·4	+0·6
1872					
Jan ..	34·5	−1·4	·221	19·5	−2·1
Feb ..	45·0	+0·2	·247	26·0	−0·7
Mar...	56·7	+4·4	·261	43·3	+2·4
Apr ..	58·2	+3·0	·293	51·6	+3·2
May..	61·7	+3·3	·300	53·6	+3·4
June..	57·2	+1·6	·442	53·0	+3·7
July..	58·2	+3·1	·530	51·6	+2·7
Aug ...	57·5	+2·4	·438	48·7	−0·2
Sept...	51·2	−1·1	·408	46·6	+1·0
Oct ..	47·2	−0·4	·312	32·0	−2·5
Nov ..	40·1	−0·5	·257	25·8	−0·5
Dec...	30·8	−3·7	·235	18·0	−1·8
1873					
Jan ..	38·1	+2·2	·227	24·5	+2·9
Feb ..	45·7	+0·9	·180	22·0	−4·7
Mar..	52·9	+0·6	·216	39·5	−1·4
Apr....	58·0	+2·8	·262	50·0	+1·6
May..	59·4	+1·0	·310	52·8	+2·6
June..	56·1	+0·5	·421	49·8	+0·5
July..	56·2	+1·1	·472	52·1	+3·2
Aug ..	55·0	−0·1	·455	51·5	+2·6
Sept...	54·0	+1·7	·374	48·0	+2·4
Oct...	46·8	−0·8	·268	37·8	+3·3
Nov ..	43·2	+2·6	·250	25·5	−0·8
Dec....	33·0	−1·5	·220	19·0	−0·8
1874					
Jan...	34·7	−1·2	..	21·4	−0·2
Feb ..	41·7	−0·1	..	27·4	+0·7
Mar...	53·1	+0·8	·236	42·5	+1·6
Apr ..	55·8	−0·6	·306	49·5	+1·1

TABLE XVIII.—(SOLAR RADIATION.)

MONTH.		1861.	1862.	1863.	1864.	1865.	1866.	1867	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.
January	Highest	62·8	55·5	57·2	60·0	52·0	84·3	89·7	82·8	87·0	81·7	77·0	82·0	81·8	86·5	84·0
	Mean	40·9	45·9	47·8	45·3	44·3	57·9	60·3	52·6	64·8	60·8	52·8	61·0	65·0	63·6	61·7
February	Highest	66·5	68·0	66·1	61·5	64·1	95·0	108·0	97·7	99·1	92·0	94·0	100·7	89·3	98·4	93·8
	Mean	52·8	50·9	55·1	50·7	47·5	74·5	74·2	75·9	73·7	65·7	69·7	74·5	56·9	70·2	68·1
March	Highest	77·2	78·2	74·3	76·0	67·3	110·8	113.0	114·2	103·7	112·3	113·3	114·0	109·4	111·8	116·3
	Mean	61·3	55·4	63·3	58·4	52·5	92·8	83·4	90·4	81·7	77·8	95·9	94·1	84·3	91·4	89·5
April	Highest	88·8	94·1	83·7	97·0	92·0	128·1	129·0	131·8	128·5	131·2	118·0	128·0	119·3	126·3	131·3
	Mean	69·5	71·1	71·7	73·1	78·6	107·5	98·3	106·0	105·2	109·6	100·3	109·8	102·4	108·1	101·6
May	Highest	96·5	101·8	92·8	102·5	99·0	130·6	133·6	144·0	131·2	126·7	129·0	131·8	123·5	132·0	142·0
	Mean	79·1	86·6	79·5	80·2	82·2	110·2	115·2	136·9	104·9	111·4	115·7	114·4	111·7	113·6	118·1
June	Highest	104·0	97·0	97·0	99·8	101·1	137·6	141·7	146·7	141·7	130·8	129·0	134·2	134·8	135·5	145·3
	Mean	85·0	83·7	85·7	87·3	87·0	116·3	111·5	138·2	119·8	112·8	111·7	121·1	118·4	120·4	126·6
July	Highest	96·8	97·5	99·2	102·0	99·4	142·5	137·0	*150·3*	143·0	138·2	137·0	135·2	140·0	138·8	138·8
	Mean	84·6	86·4	88·5	90·5	90·3	115·3	118·0	125·6	120·1	115·0	120·7	124·6	127·4	130·6	113·8
August	Highest	99·5	98·6	99·4	100·2	95·5	131·8	137·4	*147·0*	145·1	130·8	139·0	134·6	135·3	138·5	132·1
	Mean	85·3	86·6	88·4	87·0	87·2	112·6	117·7	122·2	118·4	117·7	127·7	118·2	122·8	120·4	119·8
September	Highest	95·7	93·4	87·0	90·6	100·8	128·5	129·3	135·7	134·0	121·0	136·5	125·0	125·6	136·0	127·5
	Mean	76·2	79·3	77·8	82·7	91·0	102·2	112·0	113·6	108·8	109·9	106·7	108·1	111·3	108·7	111·1
October	Highest	87·5	84·0	77·1	78·1	91·5	114·5	109·1	112·1	116·4	119·7	111·4	109·0	111·7	116·2	113·7
	Mean	73·6	65·6	66·5	68·0	68·0	83·7	89·1	89·4	92·2	85·1	91·2	83·4	87·3	86·7	86·7
November	Highest	61·5	65·2	67·0	61·5	64·7	99·3	86·3	92·2	95·7	98·4	92·3	96·0	95·7	101·8	88·8
	Mean	49·9	49·3	56·0	55·3	57·1	75·1	62·8	65·1	68·0	70·5	70·9	73·2	69·5	70·5	65·3
December	Highest	56·4	58·0	60·3	59·1	58·8	82·8	84·1	84·1	77·6	77·0	77·8	81·0	79·0	73·5	75·7
	Mean	46·5	48·6	50·1	43·1	49·0	60·4	55·2	58·6	56·5	54·6	59·7	59·8	61·2	54·3	55·9

SOLAR RADIATION.

The foregoing Table (XVIII.) contains a summary of observations made with a solar radiation thermometer, at Wisbech, from 1861 to 1875 inclusive.

During that period great changes took place in the construction of instruments for taking thermometric readings in the sun's rays. In the first five years the black bulb used was bright, and without a vacuum jacket of glass; but from 1866, a dull blackened bulb maximum thermometer (that is, a bulb blackened outside), placed in a vacuum, was employed. The thermometer was always placed near the grass. But the readings given in the table are not supposed to give the *actual* thermal intensity of the sun's rays. The *amount* of solar radiation is to be found by subtracting the maximum reading in the shade from the maximum in the sun's rays.

By referring to the Tables VIII. and XVIII. it will be seen that

	°
— the highest reading in sun's rays, in July 1868, was	150·3
— the highest reading in the shade, same date, was ...	92·4
The difference equals the *amount* of solar radiation	57·9

These Tables, however, give us merely the radiation at Wisbech, and they are not really comparable with the observations made elsewhere.

In the year 1869 a series of *Solar Radiation* observations was commenced by the under-mentioned observers. All the details were placed in the hands of the Rev. FENWICK W. STOW, M.A., F.M.S., from whose paper on Solar Radiation, the following quotations are made :—

REMARKS.

"It will be understood that all the observations have been taken with 'solar thermometers,' that is, with blackened bulb maximum thermometers *in vacuo*, freely exposed to sun and air at the height of at least 4 feet."

"The instruments used by my observers have all been compared directly or indirectly with the original instrument (the first made with the stem blackened), which I use as a standard. The comparison is made by exposing the instruments to be compared to the sun's rays for a few weeks side by side, and noting the readings both on cloudless and other days."

STATION.	OBSERVER.
Worthing	W. J. Harris, Esq.
Southampton	R. C. Hankinson, Esq.
Bath	Colonel Ward.
Strathfield Turgiss............	Rev. C. H. Griffith.
Camden Square	G. J. Symons, Esq.
Wisbech	S. H. Miller, Esq.
Aghalee	L. Turtle, Esq.
Halifax	L. J. Crossley, Esq.
Huddersfield	Captain Chichester.
Hawsker & Harpenden	Rev. F. W. Stow.
Chislehurst	F. Nunes, Esq.

"The neighbourhood of the sea appears somewhat to diminish solar radiation, as in the case of Worthing, where there is about 5 per cent. less radiation than at Strathfield Turgiss in summer, and the amount observed at Hawsker in 1869 fell short by a similar amount of that given by observations which were taken at Ripon in that year. In 1871 the observations at Hawsker can be compared with those at Willow Hall, Halifax, with a like result. It is to be observed, however, that this does not apply to the cold period from November to April."

TABLE XIX.

AVERAGE FOR FIVE YEARS (SOLAR RADIATION.)

MONTHS.	Mean of 10 greatest Amounts of Radiation in each month.								Mean Radiation on all Days of each Month.							
	Worthing.	Southampton.	Bath.	Strathfield Turgiss.	London.	Wisbech.	Aghalee.	Seven Stations.	Worthing.	Southampton.	Bath.	Strathfield Turgiss.	London.	Wisbech.	Aghalee.	Seven Stations.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January	..	43·0	42·6*	37·9	26·1	35·9	40·2	37·6	..	25·1	25·7*	21·7	14·1	21·6	24·3	22·1
February	..	51·9	52·1*	47·4	37·8	44·8	48·5	47·1	..	32·9	33·8*	28·9	20·2	26·7	32·7	29·2
March	55·5	59·3	58·9*	55·6	45·5	52·3	56·5	54·9	44·4	46·9	44·4*	44·2	31·8	40·9	42·3	42·1
April	60·1	62·6	63·0*	59·4	51·9	55·2	61·8	59·1	49·7	54·1	53·8*	51·4	42·7	48·4	50·7	50·1
May	61·9	63·8*	65·2	65·0*	56·0	58·4	65·0	62·2	54·6	56·2*	56·4	56·9*	47·4	50·2	54·9*	53·8
June	61·1	63·4*	64·2	64·2*	56·4	55·6	63·8	61·2	53·9	55·2*	57·3	55·6*	47·9	49·3	52·4*	53·1
July	59·5	63·2*	63·3	63·2*	54·0	55·1	63·8	60·3	53·6	55·6*	55·6	56·2*	47·4	48·9	53·7*	53·0
August	58·1	61·8*	60·1	60·6	53·2	55·1	59·8	58·4	51·9	53·2*	54·1	53·9	45·9	48·9	50·4*	51·2
September	55·2	59·5*	58·4	57·2	50·6	52·3	58·2	55·9	46·6	49·9*	53·1	47·8	40·6	45·6	44·1*	46·8
October	49·0	53·5*	52·7	49·4	40·8	47·6	50·4	49·1	36·6	41·2*	39·6	37·8	27·3	34·5	37·6	36·4
November	..	47·0	44·0	40·5	32·2	40·6	43·6	41·3	..	32·4*	30·6	26·8	19·0	26·3	29·3	27·4
December	..	43·1	39·2	36·5	23·8	34·5	37·4	35·7	..	24·4	22·4	19·8	11·6	19·8	20·5	19·7

* Average for 4 years only.

"In dealing with the observations made, it seemed desirable to obtain figures to express the amount of radiation uninfluenced by the occurrence of cloudy days, which affects the mean of *all* the daily maxima in the sun.

"The mean of the ten greatest amounts of radiation in each month has therefore been taken. It sometimes happens that the sun does not shine out fully on as many as ten days in the month, but usually this gives the desired measure of radiation on clear and bright days; while by comparing it with the mean of all daily amounts of radiation, we get a measure of the prevalence of sunshine during the month. It is hoped that the care which has been taken in working out and correcting the results of the observations, has secured that the amount of radiation at each station shall be pretty exactly comparable with that at any other, that is to say, to within 1°, or some 2 per cent. of the radiation.

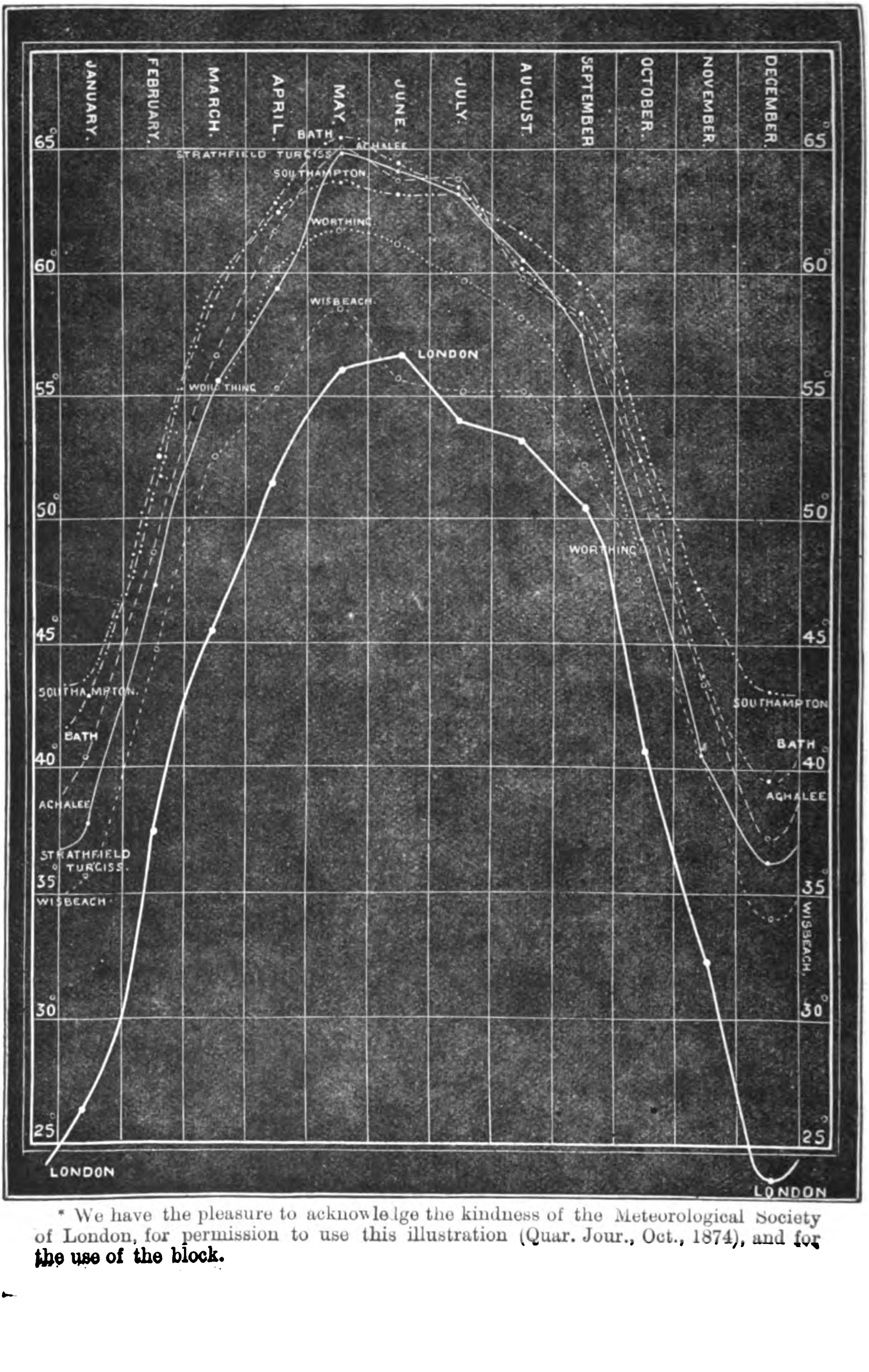
"The amounts of radiation thus obtained are given in Table XIX., and the departure in each month from the average for that month will be found in Table XVII.* The vapour sion at 9 a.m. is also given, worked out by means of a sliding scale which was contrived so as to give the same results as would be obtained from Glaisher's Tables. The averages in Table XIX. are shewn by means of curves in *the diagram*, by which means the average changes in radiation throughout the year at the seven principal stations can be seen at a glance."

"It will be seen that radiation attains its maximum in May at every station except London. This is to be attributed to the prevalence of northerly winds, and consequent dryness of the atmosphere. December is the month of least radiation."

Table XVII. shews the Wisbech results alone.

* XVII. and XIX. correspond to I. and II. in the original paper.

Diagram shewing the curves, representative of the monthly mean of Solar Radiation.*



* We have the pleasure to acknowledge the kindness of the Meteorological Society of London, for permission to use this illustration (Quar. Jour., Oct., 1874), and for the use of the block.

"It will also be observed that the western stations show more radiation than the more easterly ones. The amount near Bath exceeds, slightly in summer and considerably in winter, that at Strathfield Turgiss, and that at Aghalee in the north of Ireland considerably exceeds the radiation observed at the Yorkshire Stations, and at Wisbech. Huddersfield shows the least radiation of all stations, probably owing to smoke, although on the high ground on which Mr. Crossley's observatory stands, near Halifax, sunshine is much more powerful. London air, even in the suburbs, proves, as might be expected, exceedingly impervious to the sun's rays, the amount of radiation at Camden Square being only two-thirds to seven-eighths of that at Strathfield Turgiss. The air of the fens at Wisbech is also somewhat opaque. It appears to be very hot there in summer, and the amount of moisture is large, and it is probable that the haze and mist, which is common in low-lying districts, has exercised a very distinct effect in intercepting radiation, in addition to that of the vapour held in suspension."

"In summer there is less radiation on the coast than inland. Even Southampton falls below Strathfield Turgiss at that season, and it is very likely that the proximity of the sea influences the results, both there and at Wisbech. The air over the sea is for the most part heavily loaded with vapour in the summer season, and it is to this fact that I would attribute the diminution of solar radiation on the coast."

EVAPORATION.

Exsultant æstu latices.—VIRGIL, Æn.

In the atmosphere of our globe two great processes constantly obtain, namely, *vaporization* and *condensation*, and these are dependent upon the action (*a*), and modification (*b*), of heat. To these operations may be traced results most important to animal and vegetable life. (*a*) By the action of heat, water on the surface of the earth is vapourized—the aqueous element (being lighter than all bodies except hydrogen and ammonia) rises in the atmosphere, through which it is diffused; (*b*) when the vapour is brought into a region having a temperature lower than its own, condensation takes place—the vapour is formed into vescicles and drops which descend to the earth as rain. If there were perfect equilibrium of temperature, vapour, being once diffused, would remain as a permanent constituent of the air, and no aqueous deposition could ever occur.

Over the ocean, in tropical regions, the amount of vaporization is enormous; over rock and sand it is very small. In a clear atmosphere, the higher the temperature is, the more evaporation is accelerated, but at what degree of temperature it ceases—if at all—is not known, for an appreciable quantity is found to pass off from ice in one winter's day. But in any given spot the rate of evaporation varies with every varying breeze.

Vapour rises from every stream and pool—from the bare soil—the pastures—the growing corn—from plants of every kind—from all the trees of the wood.

The climatal influence of trees is very great, and pasturage is, perhaps, only second in importance. Trees are active evaporators—their roots strike into the ground, and bring up the deep waters which are thrown off by every leaf, in the form of vapour. Thus, they are drainers of the soil, and in winter some are also absorbents of vapour.

To a great plain like the Fenland, trees and pasturage are very important, for to denude this district of trees, to plough up its fine pastures and to drain it thoroughly would prove the most effectual means to lead the way to sterility.

From the facts given in the following tables certain practical results may be deduced. Of course, the rainfall statistics must here be used.

(1) The amount of water which falls on any given area of the district is easily ascertainable, and it may be calculated in inches of depth or in gallons of quantity, or tons in weight, taking 101 tons per acre for every inch in depth of rain.

(2) Then estimate the amount of water thrown off by evaporation from the surface of rivers, &c., from the pasturage,* from soil (under fallow or during early growth of crops) and from trees, allowing that trees, not in a thick wood, on an average, throw off three times the weight of rainfall over the area they cover.

(3) Subtract this from the rainfall and we ascertain the amount of water left for vegetation itself,† for irrigation, for storage and for drainage, and percolation.

Table shewing the total yearly evaporation from a surface of water during 14 years (1862—75), also the ratio of evaporation to rainfall during the same period.

	1862	1863	1864	1865	1866	1867	1868
Total Evaporation in inches	17·54	22·47	21·97	23·40	18·55	18·69	24·14
Ratio of Evaporation to Rainfall	0·89	1·16	1·37	0·85	0·70	0·70	1·05
	1869	1870	1871	1872	1873	1874	1875
Total Evaporation in inches	19·33	15·83	14·30	15·29	16·81	17·76	17·38
Ratio of Evaporation to Rainfall	0·72	0·61	0·57	0·39	0·89	0·89	0·58

* Corn crops may fairly be reckoned as *long grass*.

† In fresh meadow grass 72 per cent. of its weight is water. In air-dried meadow grass (or hay) 15 per cent. is water, therefore, 57 per cent. of the water is evaporated into the air. (See "*How Crops Grow.*" p. 38.)

Thus we find that evaporation exceeded the rainfall in 1863, 1864, and 1868 only.

The mean yearly evaporation = 18·80 inches.
The mean yearly rainfall = 24·23 ,,
Ratio of evaporation to rainfall = 0·77

The Maximum monthly amount of Evaporation:—

In May, 2·96 inches in 1867, and 2·79 in 1870.
In June, 3·10 inches in 1866.
In July, 3·06 in., 1862; 3·81 in., 1863; 3·67 in., 1864; 4·23 in., 1865; 5·25 in., 1868; 4·55 in., 1869; 2·36 in., 1872; 3·39 in., 1873; 3·70 in., 1874; 3·08 in., 1875.
In August, 2·53 in., 1871.

TABLE XX.

Mean Monthly amount of Evaporation from *Water*, *Soils*, and *Vegetation*.

(*a*) Water; (*b*) Humus, or ordinary soil; (*c*) Peat; (*d*) Silt; (*e*) Clay-soil; (*f*) Long grass (*festuca pratensis*); (*g*) Short grass (*anthoxanthum odoratum*); (*h*) Red Clover (*trifolium pratense*); (*i*) White Clover (*trifolium repens*).

[The Means of Evaporation from soil are deduced from three years' continuous observations—those from vegetation from four years.]

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)	(*h*)	(*i*)
	In.	In.	In.	In.	In.	In.	In.	In.	In.
January	0·49	0·53	0·55	0·51	0·54	1·54	0·50	0·91	0·62
February	0·52	0·28	0·37	0·39	0·24	0·90	0·50	0·81	0·48
March	1·01	1·20	1·07	0·84	1·15	2·37	1·07	2·10	0·98
April	1·85	1·63	1·12	1·30	1·35	4·17	2·37	4·42	3.10
May	2·75	2·13	1·82	1·92	1·83	5·44	3·37	9·97	5·11
June	2·87	1·60	1·52	1·63	1·63	6·57	3·75	9·12	5·43
July	3·38	2·71	2·60	2·53	2·27	7.82	4·29	9·76	5·40
August	2·52	2·28	1·95	2·30	1·93	7·33	3·55	7.10	4·94
September	1·64	1·73	1·57	1·37	1·43	6·04	2·80	5·02	3·30
October	0·95	0·61	0·67	0·68	0·66	4·24	0·89	2·83	1·37
November......	0·46	0·31	0·26	0·42	0·39	1·18	0·31	0·95	0·30
December	0·35	0·11	0·12	0·14	0·16	0.56	0·10	0·44	0·12
Total in the year.	18.79	15.12	13.62	14.03	13·58	48·16	23·50	53·44	31·15

There is not space to describe fully the method of observation, and therefore it must suffice to say that a system of cylinders, plunged into the ground to the surface-level, was used. The cylinders were competent to drain the soil, or supply it with moisture, as the rain or evaporation demanded.

If the yearly amount of evaporation from water (*a*) be taken as *unity*, then from (*b*) it equals 0·80; (*c*) = 0·72; (*d*) = 0·74; (*e*) = 0·72; (*f*) = 2·56; (*g*) = 1·25; (*h*) = 2·83; (*i*) = 1·65.

The evaporation from shaded soil, that is from soil shaded from the direct influence of the sun's rays, was about two-fifths of exposed soil (*b*).

During the night and early morning, soils frequently absorb moisture from the dew.

General conclusions on Evaporation from Plants & Trees.

The SUNFLOWER (*Helianthus angustifolius*). A plant having a single stem and a single flower was under observation in 1874. From August 2nd to October 17th, daily records were made. The greatest amount of water evaporated by the plant in one day was 23 ounces on the 20th August, the temperature in the shade was 83°, and a black bulb thermometer placed near the flower registered 134°. The total weight of water evaporated in the period above stated was 42½lbs. avoird.

In 1876 a branching plant, with several flowers, showed a far greater amount of transpiration. It was observed daily from July 11th to October 5th. The greatest amount of exhalation in one day, on 13th August, was 5lbs. 4ozs. (temp. 91° in shade and 132° in sun's rays.) The total weight of water exhaled in the season named was 156lbs. 14ozs. from this one plant.

The PRIMROSE (*Primula acaulis*). This is an active evaporator, and is impatient of drought. The leaves of one under observation had an average *area* of 54 square inches. The greatest daily evaporation was 11ozs. on 2nd. June, 1875. Total exhalation from beginning of April to 18th July, was 30lbs.

GERANIUM (*Pelargonium Vesuvius*). This plant, under observation from June 4th to September 3rd, 1873, had an average evaporating surface, including the stem, of 196 square inches, the total amount of transpiration for each square inch was 1¾ozs. Apply this to a single garden bed of 100 plants of equal area to that observed, and we have, in the period named, about 18 cwts. of water discharged into the atmosphere by these 100 plants.

The CABBAGE (*Brassica oleracea*). One cabbage, which grew to an average size, was observed from June 1st to August 31st, 1876. On the 13th August, 36ozs. of water evaporated from this plant, and the total amount in the three months was 68lbs. 7ozs.

TREES. Experiments have been made with two trees, a Spruce and an Oak. Trees of the fir kind, on account of their persistent foliage, give off a greater amount of vapour than deciduous ones, like the oaks; the latter, however, as well as the former, are very active evaporators from May to September, the amount then varying from four to five times the rainfall over the same area. The spruce has been observed to absorb moisture in the winter months.

[EVAPORATION is too large a subject to be fully treated of in this book, but the reader will find many details in *Symons's British Rainfall* for 1869—72; in the *Fenland Meteorological Circular* for 1874—7, and also in a Prize Essay (by the present writer) about to be published by the Society of Arts and Sciences of Utrecht.]

TABLE XXI.—SEASONAL PHENOMONA.

WISBECH.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.
FOREST TREES *(in leaf.)*															
Field Elm......	2 Ap.*	..	..	..	21 Ap.	21 Ap.	29 Ap.	..	..	..	..	..	2 May	..	..
Wych Elm	..	..	..	..	25 Ap.	23 Ap.	30 Ap.	27 Ap.	25 Ap.	6 May	5 May	19 Ap.	30 Ap.	..	30 Ap.
Oak	20 May	..	..	..	4 May	15 May	6 May	11 May	7 May	15 May	..	..	10 May	..	5 May
Lime	10 Ap.	19 Ap.	25 Mar*	19 Ap.	19 Ap.	25 Ap.	18 Ap.	4 Ap.	15 Ap.	20 Ap.	4 Ap.	7 Ap.	18 Ap.	9 Ap.	22 Ap.
Sycamore	10 Ap.	..	13 Ap.	..	21 Ap.	26 Ap.	20 Ap.	22 Ap.	21 Ap.	21 Ap.	21 Ap.	23 Ap.	22 Ap.	..	24 Ap.
Horse Chesnut..	8 Ap.	20 Ap.	30 Mar*	16 Ap.	15 Ap.	14 Ap.	14 Ap.	5 Ap.	14 Ap.	18 Ap.	9 Ap.	9 Ap.	14 Ap.	8 Ap.	15 Ap.
Common Poplar	14 Ap.	..	..	..	18 Ap.	21 Ap.	15 Ap.	5 Ap.	17 Ap.	20 Ap.	12 Ap.	9 Ap.	..	..	..
Walnut	8 June	..	..	29 Ap.	25 Ap.	28 Ap.	3 May	..	27 Ap.	26 Ap.	20 Ap.	14 Ap.	..	..	28 Ap.
Hawthorn......	31 Mar.	..	..	..	14 Ap.	12 Ap.	13 Ap.	23 Mar	..	20 Ap.	..	..	13 Ap.	..	23 Ap.
FRUIT TREES *(in blossom.*															
Apple	31 May	20 Ap.	15 Ap.	26 Ap.	27 Ap.	25 Ap.	27 Ap.	14 Ap.	17 Ap.	29 Ap.	18 Ap.	12 Ap.	2 May	..	1 May
Pear	6 Ap.	..	..	19 Ap.	25 Ap.	22 Ap.	19 Ap.	5 Ap.	16 Ap.	22 Ap.	16 Ap.	6 Ap.	19 Ap.	..	22 Ap.
Cherry	22 Ap.	20 Ap	24 Ap.	..	22 Ap.	18 Ap.	16 Ap.	13 Ap.	14 Ap.	..	11 Ap.	..	23 Ap.	..	..
Peach	..	5 Ap.	6 Mar.	20 Mar.	6 Ap.	18 Mar	30 Mar	15 Mar	20 Feb.	31 Mar	22 Mar	8 Mar	26 Mar	20 Mar	30 Mar
Plum	21 Ap.	..	..	21 Ap.	19 Ap.	13 Ap.	16 Ap.	3 Ap.	31 Mar	..	..	3 Ap.	14 Ap.	9 Ap.	..
HARDY SHRUBS *(in blossom.)*															
Lilac	13 May	1 May	6 May	8 May	6 May	9 May	3 May	28 Ap.	27 Ap.	7 May	29 Ap.	23 Ap.	12 May	..	..
Honeysuckle ..	..	10 May	..	17 May	18 May	21 May	9 May	7 May	18 May	25 May	..	..	..	..	..
Mountain Ash ..	14 May	..	..	13 May	16 May	22 May	13 May	9 May	11 May	21 May	..	..	25 May	20 May	15 May
Syringa........	13 June	..	..	4 June	28 May	3 June	27 May	..	30 May	3 June	..	..	8 June	25 May	27 May
Laburnum	..	5 May	3 May	12 May	7 May	12 May	8 May	30 Ap.	9 May	15 May	12 May	29 Ap.	21 May	6 May	10 May
Acacia	..	..	..	..	6 June	..	..	..	..	..	..	..	..	..	4 June
Privet	..	11 May	..	18 June	10 June	..	..	..	..	..	..	..	..	..	5 July
BIRDS *(arrived.)*															
Cuckoo	29 Ap.	22 Ap.	15 Ap.	16 Ap.	14 Ap.	15 Ap.	19 Ap.	18 Ap.	18 Ap.	15 Ap.	22 Ap.	28 Ap.	30 Ap.	16 Ap.	29 Ap.
Swallow	9 May	24 Ap.	26 Ap.	20 Ap.	16 Ap.	13 Ap.	12 Ap.	21 Ap.	23 Ap.	25 Ap.	18 Ap.	27 Ap.	20 Ap.	21 Ap.	17 Ap.
Nightingale	..	..	15 Ap.	..	15 Ap.	..	..	..	..	16 Ap.	7 Ap.	..	..	24 Ap.	28 Ap.

* Leaf bud appeared. Barley in Ear 20th June, 1868. March 1870, Vegetation was in a very backward state; sharp frosts continued to the end of the month.

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TABLE XXII.—BAROMETER MEANS (REDUCED TO SEA LEVEL, ALSO CORRECTED FOR INDEX-ERROR, CAPILLARITY AND DIURNAL RANGE.)

Month.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.
January ..	30·188	29·842	29·740	30·200	29·542	29·801	29·649	29·874	29·993	29·963	29·813	29·596	29·699	29·996	29·879
February ..	29·829	30·083	30·269	29·914	29·864	29·647	30·025	30·070	29·904	29·873	29·975	29·795	30·080	30·007	30·056
March	29·712	29·682	29·855	29·671	29·888	29·694	29·812	29·945	29·816	30·029	30·023	29·771	29·801	30·139	30·143
April	30·173	29·990	29·953	30·082	30·134	29·918	29·739	29·930	29·988	30·136	29·789	29·886	29·986	29·851	30·045
May	30·087	29·870	30·018	30·006	29·907	29·984	29·908	30·009	29·826	30·038	30·077	29·888	29·948	29·969	29·977
June	29·791	29·848	29·861	29·919	30·230	29·914	30·085	30·132	30·043	30·093	29·923	29·870	29·939	30·101	29·878
July	29·723	29·883	30·110	30·006	29·933	29·915	29·863	30·060	30·075	29·976	29·809	29·910	29·924	29·966	29·951
August	29·995	29·937	29·871	30·072	29·847	29·762	29·968	29·878	30·115	29·965	30·107	29·956	29·891	29·903	30·014
September...	29·838	30·029	29·808	29·901	30·231	29·693	30·031	29·868	29·753	30·050	29·899	29·793	29·926	29·882	30·025
October	30.011	29·847	29·772	29·862	29·591	30·097	29·870	29·925	30·004	29·693	29·944	29·687	29·825	29·831	29·774
November ..	29·666	29·973	30·002	29·771	29·865	29·896	30·276	29·998	29·890	29·792	29·993	29·646	29·866	29·936	29·756
December ..	30·133	29·981	30·043	30·032	30·218	29·891	29·993	29·485	29·773	29·918	30·067	29·588	30·024	29·762	30·081
Means ..	29·928	29·913	29·941	29·954	29·937	29·851	29·934	29·931	29·981	29·960	29·951	29·782	29·909	29·945	29·964

TABLE XXIII.—BAROMETER.

QUINQUENNIAL MEANS.

Month.	1861—1865	1866—1870	1871—1875
January	29·902	29·856	29·798
February ..	29·991	29·903	29·982
March	29·761	29·859	29·975
April	30·066	29·942	29·911
May	29·977	29·953	29·971
June	29·929	30·053	29·982
July........	29·931	29·977	29·912
August	29·940	29·937	29·974
September ..	29·961	29·879	29·905
October	29·816	29·917	29·812
November ..	29·855	29·974	29·839
December ..	29·934	29·952	29·904

The barometer used at the Wisbech Observatory is a standard, (the bore of the tube being 0·4 in. in diameter), by Messrs. Negretti and Zambra, of London. It was compared with the Greenwich Standard, by Mr. Glaisher; and the readings made with it have been uninterrupted through the 15 years, 1860-1875. From these readings, the *tables*, herewith given, have been calculated.

In Table xxii. the monthly means, from two readings daily are given; these have been corrected for the small index error of the instrument—for the capillarity of the tube, (0·007 in.)—for diurnal range according to Mr. Glaisher's tables—and then reduced to sea level—the cistern of the barometer being 14 feet above mean sea level—and are thus comparable with the returns in the reports of the Registrar General of Births, &c.

In Table xxiii. the quinquennial means are inserted, and from this we see that the barometer ranges highest between April and June, and almost invariably lowest in October and November. In the appendix will be found a more extended table of arithmetical means, corrected for index error, capillarity and temperature, that is reduced to 32°

Fahr., but not for diurnal range. This table supplies, too, the highest and lowest of all readings for each year, and therefore also for the 15 years.

THE WIND.

The direction of the Wind was registered by an OSLER'S Anemometer; 9 a.m. and 9 p.m. being taken as the times of record, the number of days of the prevalent direction of the wind referred to the different points is given in the table subjoined.

TABLE XXIV.

Year.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
1861	58	28	17	19	94	66	33	55
1862	31	38	24	49	30	104	32	57
1863	14	22	26	56	29	129	35	54
1864	29	59	40	43	25	79	27	64
1865	26	52	38	41	43	75	35	55
1866	20	52	23	36	24	128	27	55
1867	19	55	23	30	17	120	44	57
1868	25	53	17	53	17	124	32	45
1869	32	54	27	43	31	102	38	38
1870	30	63	28	34	20	106	28	56
1871	29	51	34	55	25	95	33	43
1872	14	35	24	79	31	112	26	45
1873	34	37	17	39	27	126	34	51
1874	21	35	13	31	37	126	40	62
1875	30	70	20	40	27	107	28	43
Mean	27·1	46·9	24·7	43·2	31·8	106·6	32·8	52·0*

The per centage, in order of prevalency, deduced from the means of the above table, appears as follows—

	S.W.	N.W.	N.E.	S.E.	W.	S.	N.	E.
Per cent. ..	29·2	14·2	12·9	11·8	9·0	8·7	7·4	6·8

* For the purpose of comparison with Table XXIV. we take the following—
From 20 consecutive years' observations made at Greenwich by MR. GLAISHER, (see "The Atmosphere" p., 33), the annexed results are deduced.
The wind blows on an average from the

N. 41 days, N.E. 48, E. 22, S.E. 20, S. 34, S.W. 104, W. 38, N.W. 24.

Thirty four days are given as "calm."

We have not recorded any days as completely calm, for a perfectly steady anemometer vane has but rarely occurred for the space of 12 hours.

TABLE XXV.

The most prevalent DIRECTIONS OF THE WIND at Wisbech, during each month *of 15 years*—1861-1875.

Year.	Jan.	Feb.	March.	April.	May.	June.
1861	N., S.	S.W.	S.W., W.	N., N.E.	N., N.W.	N., N.W.
1862	S.E., S.W.	Variable.	N.E., N.W.	S.W.	S.W.	S.W.
1863	S.W.	S.W.	N.W., S.W.	N.W.	S.W., N.E.	S.W.
1864	N.E., S.E.	N.W.	N.E., S.W.	Variable.	N.W.	S.W.
1865	S.W., N.W.	E.	N.E., N.W.	N., N.E.	S.W.	Variable.
1866	S.W.	S.W.	Variable.	N.E., S.W.	N.E.	S.W.
1867	S.W., N.W.	S.W.	N.E.	S.W.	E., S.W.	N.E., S.W.
1868	S.W., S.E.	S.W.	S.W., W.	S.W., N.	S.W.	S.W.
1869	S.E., S.W.	S.W.	N.E., N.	Variable.	N.E., E.	S.W., N.E.
1870	Variable.	N.E., S.E.	N.E., S.W.	Variable.	S.W.	S.W.
1871	S.W., N.E.	S.W.	S.W.	S.W.	N.E., N.W.	N., N.E.
1872	S.W., S.E.	S E.	S.W.	Variable.	S.W.	S.W.
1873	S.W.	N.W.	N.E.	N.	Variable.	S.W.
1874	S.W.	Variable.	S.W., W.	N.W., S.W.	N.W., N.E.	N.E., S.W.
1875	S.W.	N.E.	N.E.	N.E.. S.W.	S.W.	S.W.

Year.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
1861	S., S.W.	S., S.W.	S., S.W.	N., S.	S., N.W.	S.W.
1862	S.W.	S.W.	N., S.W.	S.W.	N.W.	S.W.
1863	Variable.	S.W.	S.W.	S.E., S.W.	S.E., S.W.	S.W.
1864	N.W., S.W.	N.W.	S.W.	Variable.	S.W.	Variable.
1865	S.W.	Variable.	S.W., N.E.	Variable.	N.W.	S.E.
1866	S.W.	S.W.	S.W., S.	N.E.	S.W.	S.W.
1867	S.W., W.	S.W.	S.W.	S.W.	N.W.	Variable.
1868	Variable.	S.W.	N.E., S.E.	S.W.	N.E.	S.W.
1869	S.W., S.E.	N.E., S.W.	S.W.	Variable.	S.W., W.	N.E., S.W.
1870	S.W., N.E.	N., N.W.	S.W.	S.W.	S.W., N.W.	N.E.
1871	S.W.	Variable.	N.E.	S.E.	Variable.	S.W., N.W.
1872	S.W., S.E.	Variable.	S.W.	S.W.	S.W.	Variable.
1873	S.W.	S.W.	S.W.	S.W.	S.W., N.E.	S.W.
1874	S.W.	S.W.	S.W.	S.W.	N.W., S.W.	N.W.
1875	Variable.	S.W.	N.E., S.W.	S.W., N.E.	S.W., N.E.	S.W.

From this table we gather the following broad results respecting the *most prevalent* winds—(m = month.)

In 1861 S.W. prevailed 4 months; S. 3; N. 2¼; N.W. 1¼; N.E. & W. ¼ each.

„	1862	S.W. 8 m;	N. 1⅓;	S.E., N.E., N.W. ½ each;	Variable 1
„	1863	S.W. 8 m;	N.W. 2;	S.E., N.E. 1 each;	Variable 1
„	1864	S.W. 4 m;	N.W. 3⅓;	N.E. 1; S.E. 1½;	Variable 3
„	1865	S.W. 3 m;	N.W. 2;	N.E. 1½; E. & S.E. 1; N. ⅓;	Variable 3
„	1866	S.W. 8 m;	N.E. 2½;	S. ½;	Variable 1
„	1867	S.W. 7 m;	N.E. 1½;	N.W. 1½; E. & W. ½;	Variable 1
„	1868	S.W. 7⅓ m;	N.E. 1⅓;	S.E. 1; W. & N. ½;	Variable 1
„	1869	S.W. 5 m;	N.E. 2⅓;	S.E 1; N., E., & W. ½;	Variable 2
„	1870	S.W. 5½ m;	N.E. 2½;	N.W. 1; S.E. & N. ½;	Variable 2
„	1871	S.W. 5 m;	N.E. 2¼;	N.W. & S.E. 1; N. ½;	Variable 2
„	1872	S.W. 7 m;	S.E. 2;		Variable 3
„	1873	S.W. 7⅓ m;	N.E. 1½;	N.W. & N. 1;	Variable 1
„	1874	S.W. 7 m;	N.W. 2⅓;	N.E. 1; W. ½;	Variable 1
„	1875	S.W. 7 m;	N.E. 4;		Variable 1

Thus we find that S.W. winds prevail on an average, rather more than 6 months in the year—N.E. barely 2 months; N.W. rather more than ½ a month; S.E. and N. less than ½ a month, and for more than 1½ month the wind is variable or pretty equally divided among the different directions. In arranging the table, the rule observed was, that the wind was considered prevalent, if the direction had been registered during at least one third of the number of days in the month; if more than half the month was fairly divided by two separate directions—the two were inserted and the one with the greater number of days placed first.

The above table and results may be usefully compared, by the reading with MR. GLAISHER's discussion of the subject in a paper on the direction of the wind at Greenwich, during 10 years ending 1870. Vide "Quarterly journal of the Met. Soc. London, 1871."

TABLE XXVI.—GALES as recorded at WISBECH, by an OSLER's Self-registering Anemometer,

The pressure plate of which is one square foot, fixed about 50 feet above sea level.

[N.B. The pressures during 1861, were found by estimation on the scale (0—6) squared for lbs.] All pressures above 5 lbs. are entered in the table, fractions of a lb. being omitted.

Month.	1861			1862			1863			1864			1865			1866			1867		
	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.
			lbs.			lbs.			lbs.			lbs.			lbs.			lbs.			lbs.
Jan. ..	..	..	..	8	S.W.	8	2	W.	11	..	..	..	6	W.S.W.	14	2	S.	15	30	S.W.	10
..	..	..	..	11	W.	12	4	S.W.	5	..	..	..	7	S.W.	10	8	S.W.	*20*	..	..	..
..	..	..	..	24	S.	8	19	W.	14	..	..	..	..	..	..	11	N.N.E.	14	..	..	..
..	..	..	..	25	S.W.	9	20	W.	12	..	..	..	..	..	..	17	S.S.W.	5	..	..	..
..	..	..	..	..	..	..	21	W.S.W.	16	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	24	S.	13	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	27	W.	13	..	..	..	..	..	..	..	..	..	..	..	..
Feb. ..	3	S.W.	6	1	W.S.W.	8	5	W.	9	13	S.	11	19	S.W.	10	4	S.S.W.	15	6	S.W.	15
..	4	S.W.	5	6	N.W.	6	..	..	..	16	S.W.	5	20	W.N.W.	9	5	W.S.W.	10	..	..	..
..	5	S.W.	12	21	S.E.	6	..	..	..	..	..	..	..	..	..	6	S.W.	15	..	..	..
..	21	S.W.	9	25	N.E.	5	..	..	..	..	..	..	..	..	..	23	S.S.W.	18	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28	N.N.E.	6	..	..	..
March ..	3	S.W.	*16*	6	S.S.W.	9	7	S.W.	5	11	S.	7	26	N.N.E.	6	21	S.E.	15	26	S.W.	7
..	4	W.	12	7	S.W.	7	28	N.W.	7	..	..	..	..	..	..	..	..	..	..	..	..
..	17	S.	9	8	S.E.	7	29	W.	6	..	..	..	..	..	..	..	..	..	..	..	..
..	19	N.W.	10	9	S.S.E.	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	10	S.W.	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	22	N.	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
April ..	..	..	..	22	S.W.	6	6	S.	12	2	W.	5	..	..	..	..	..	..	8	W.S.W.	17
..	..	..	..	24	S.W.	7	23	W.N.W.	8	..	..	..	..	..	..	..	..	..	9	W.	*19*
..	..	..	..	..	..	..	24	W.N.W.	6	..	..	..	..	..	..	..	..	..	11	W.	17
..	..	..	..	..	..	..	28	W.N.W.	13	..	..	..	..	..	..	..	..	..	14	S.W.	17
..	..	..	..	..	..	..	29	N.N.W.	8	..	..	..	..	..	..	..	..	..	15	S.W.	8
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21	W.	12

TABLE XXVI. *(continued.)*

Month.	1868			1869			1870			1871			1872			1873			1874			1875		
	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.
			lbs.			lbs.			lbs.			lbs.			lbs.			lbs.			lbs.			lbs.
Jan. ..	18	S.E.	16	..	..	..	7	S.W.	11	16	S.	12	5	S.W.	8	3	S.	10	2	S.W.	5	1	E.S.E.	5
..	24	S.E.	10	..	..	..	8	S.W.	24	..	..	..	18	S.S.W.	9	5	S.W.	8	16	S.S.E.	5	17	W.S.W.	10
..	31	S.W.	9	..	..	..	15	S.W.	5	..	..	..	24	S.W.	13	13	S.W.	5	20	S.S.W.	7	19	S.W.	9
..	..	..	..	..	..	..	31	S.E.	6	..	..	..	..	..	..	18	S.S.W.	7	..	..	..	20	S.W.	17
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24	W.S.W.	15
Feb. ..	1	S.W.	24	8	S.W.	6	2	S.E.	7	5	S.E.	8	..	..	..	2	E.	5	26	E.S.E.	7	17	N.	6
..	..	..	..	27	W.	7	6	S.E.	7	10	E.	5	..	..	..	10	N.	5	..	..	..	..	..	..
..	..	..	..	..	..	..	7	S.E.	6	27	S.S.W.	7	..	..	..	12	N.N.W.	8	..	..	..	..	..	..
..	..	..	..	..	..	..	8	S.E.	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	12	E.	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	13	N.E.	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	14	N.E.	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	21	N.N.W.	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	22	N.N.W.	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	24	W.S.W.	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	28	S.	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
March ..	8	W.	14	5	S.W.	6	1	S.W.	7	9	S.S.W.	12	19	N.N.W.	7	7	S.W.	14	11	N.W.	5	9	S.W.	15
..	..	..	..	..	..	..	4	N.E.	7	13	S.S.W.	9	..	..	..	9	S.W.	7	19	S.S.W.	5	17	N.N.E.	5
..	..	..	..	..	..	..	6	E.N.E.	9	27	N.E.	5	..	..	..	15	N.E.	5	28	W.S.W.	5	27	W.	7
..	..	..	..	..	..	..	7	N.	7	..	..	..	..	..	..	..	..	..	30	W.S.W.	7	..	..	..
..	..	..	..	..	..	..	11	N.	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	15	S.	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	23	N.W.	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
April ..	21	S.W.	7	..	..	..	24	S.W.	5	..	..	..	21	N.N.E,	11	6	N.N.W.	5	2	S.W.	17	5	S.	7
..	..	..	..	..	..	..	..	..	..	..	..	..	24	S.S.E.	6	27	N.	10	6	W.	5	8	N.N.E.	5
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13	S.	6	..	..	..

TABLE XXVI. *(continued.)*

Month.	1861 Day.	1861 Direction of the Wind.	1861 Force on sq. ft.	1862 Day.	1862 Direction of the Wind.	1862 Force on sq. ft.	1863 Day.	1863 Direction of the Wind.	1863 Force on sq. ft.	1864 Day.	1864 Direction of the Wind.	1864 Force on sq. ft.	1865 Day.	1865 Direction of the Wind.	1865 Force on sq. ft.	1866 Day.	1866 Direction of the Wind.	1866 Force on sq. ft.	1867 Day.	1867 Direction of the Wind.	1867 Force on sq. ft.
			lbs.			lbs.			lbs.			lbs.			lbs.			lbs.			lbs.
May ..	..	..	..	..	..	..	13	S.W.	6	..	..	..	28	S.	5	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	30	W.S.W.	11	..	..	..	..	..	..
June ..	..	..	..	14	S.W.	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	28	N.W.	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
July ..	25	S.	7	20	S.W.	6	..	..	..	...	..	..	..	..	..	..	..	..	..	..	..
Aug. ..	3	S.W.	12	8	S.W.	9	..	..	..	..	..	..	..	..	..	4	S.W.	12	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	S.W.	15	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	17	W.S.W.	5	..	..	..
Sep. ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	S.S.E.	6	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11	S.	7	..	..	..
Oct. ..	..	..	..	17	S.W.	6	31	S.W.	10	20	S.W.	*20*	25	W.S.W.	15	..	..	..	..	..	..
..	..	..	..	20	S.W.	12	..	..	..	..	..	..	26	E.	7	..	..	..	..	..	..
..	..	..	..	21	S.W.	10	..	..	..	..	..	..	29	S.E.	7	..	..	..	..	..	..
..	..	..	..	22	S.S.W.	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	23	S.W.	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	24	W.	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nov. ..	2	N.W.	9	..	..	..	2	S.S.W.	12	18	S.W.	10	22	S.E.	*24*	14	W.	5	..	..	..
..	14	W.	*16*	..	..	..	4	W.S.W.	5	25	S.W.	5	24	S.S.E.	15	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	25	S.	12	..	..	..	..	..	..
Dec. ..	..	..	..	19	W.N.W.	*18*	2	W.	10	..	..	..	29	S.S.E.	15	26	S.S.W.	14	2	N.W.	14
..	..	..	..	20	S.S.W.	*18*	3	W.S.W.	*20*	..	..	..	31	S.	20	..	..	..	3	N.W.	12
..	..	..	..	21	N.W.	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	27	S.W.	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

TABLE XXVI. *(continued.)*

Month.	1868			1869			1870			1871			1872			1873			1874			1875		
	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.	Day.	Direction of the Wind.	Force on sq. ft.
			lbs.			lbs.			lbs.			lbs.			lbs.			lbs.			lbs.			lbs.
May ..	..	..	..	..	..	..	2	N.W.	5	4	W.	5	4	S.W.	10	3	W.	5	15	N.N.W.	6	21	S.E.	6
..	..	..	..	..	..	..	12	S.W.	11	28	N.	5	13	N.E.	6	23	W.	6	..	..	..	23	S.W.	10
..	..	..	..	..	..	..	14	S.W.	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
June ..	..	..	..	..	..	..	11	W.	9	7	N.	7	9	S.	5	25	S.W.	6	11	S.W.	8	7	S.W.	7
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16	N.N.E.	5	11	W.S.W.	5
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15	S.S.W.	10
July ..	..	..	..	..	..	..	..	..	..	4	S.S.E.	6	..	..	..	..	..	..	..	..	..	11	S.W.	8
..	..	..	..	..	..	..	..	..	..	26	S.W.	5	..	..	..	..	..	..	..	..	..	..	..	..
Aug. ..	..	..	..	..	..	..	28	S.W.	6	24	S.	7	11	S.W.	6	13	W.	5	6	W.N.W.	5	10	S.S.E.	5
..	..	..	..	..	..	..	..	..	..	26	S.W.	5	..	..	..	28	S.	7	11	S.W.	7	31	W.	5
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	29	S.	5	..	..	..
Sept. ..	..	..	..	10	S.S.E.	10	2	S.	7	24	N.N.E.	5	25	S.W.	9	10	S.W.	5	1	S.S.W.	10	27	S.W.	6
..	..	..	..	12	S.W.	15	5	S.S.E.	8	30	N.W.	7	27	S.W.	10	17	S.	5	10	S.W.	5	..	..	..
..	..	..	..	13	S.W.	12	8	W.	7	..	..	..	..	..	..	..	..	..	22	S.	5	..	..	..
..	..	..	..	..	..	..	10	S.W.	17	..	..	..	..	..	..	..	..	..	26	W.S.W.	5	..	..	..
Oct. ..	24	S.S.E.	15	16	S.W.	10	8	S.S.W.	5	..	..	..	10	S.W.	6	11	S.W.	5	2	S.	5	10	W.S.W.	6
..	..	..	..	..	..	..	13	W.	17	..	..	..	..	..	..	20	W.	5	6	S.	7	..	..	..
..	..	..	..	..	..	..	16	S.S.E.	6	..	..	..	..	..	..	22	S.W.	5	21	S.W.	15	..	..	..
..	..	..	..	..	..	..	17	W.S.W.	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	19	S.S.W.	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	24	S.	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nov. ..	4	W.	6	..	..	..	23	S.W.	6	17	N.W.	7	1	S.	6	9	N.E.	5	25	S.S.E.	7	10	S.W.	5
..	..	..	..	..	..	..	..	..	..	..	..	..	15	N.N.E.	12	23	W.	5	29	S.	10	14	S.	12
..	..	..	..	..	..	..	..	..	..	..	..	..	28	S.S.E.	10	29	S.W.	10	..	..	..	19	S.W.	13
..	..	..	..	..	..	..	..	..	..	..	..	..	26	S.S.W.	10	..	..	..	..	..	..	..	..	..
Dec. ..	7	S.W.	12	18	S.W.	10	14	S.S.E.	8	1	N.	7	9	W.S.W.	23	16	S.W.	5	9	N.N.W.	12	22	S.W.	7
..	27	S.W.	12	19	S.W.	12	..	..	..	20	S.	5	16	N.W.	5	..	..	..	14	N.W.	8	..	..	..
..	28	S.W.	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	17	N.W.	5	..	..	..

TABLE XXVII.—SUMMARY OF GALES.

	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
5 lbs. and under 10......	6	21	10	4	5	6	2	3	3	31	17	11	22	24	17
10 lbs. and under 15	4	5	10	2	5	4	4	4	5	6	2	7	4	3	5
15 lbs. and under 20	2	4	1	0	3	6	5	3	0	2	0	0	0	2	3
20 lbs. and above	0	0	1	1	2	1	0	1	1	1	0	1	0	0	0
Total number of Gales ..	12	30	22	7	15	17	11	11	9	40	19	19	26	29	25

REMARKS ON THE GALES.

From the table we learn that during the 15 years the number of gales having a

Pressure of	5 lbs.	and under	10 lbs.	was	182
,,	10 lbs.	,,	15 lbs.	,,	70
,,	15 lbs.	,,	20 lbs.	,,	31
,,	20 lbs. and upwards was				9
Making a total of....................................					292

That is rather less on the average, than 20 gales per year.

It must be observed however, that pressures above 5 lbs. occurred on a greater number of days than 292, because the table shews in most instances the highest pressure of separate gales, some of which commenced in one day and continued during many hours into the next—or in some cases moderated and sprang up again with a veering of the wind. Occasionally records are given for two or three consecutive days, as in February and October, 1870, but the Anemometer traces seemed to justify their being given as separate gales.

Now taking the total in its relation to the months we find the following result—during 15 years there were in

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total.
Gales	41	41	40	25	15	11	5	16	20	27	25	26	292
	14	14	$13\frac{3}{4}$	$8\frac{1}{2}$	$5\frac{1}{4}$	$3\frac{3}{4}$	$1\frac{3}{4}$	$5\frac{1}{2}$	$6\frac{3}{4}$	$9\frac{1}{4}$	$8\frac{1}{2}$	9 per cent.	

The greatest per centage of gales occurred then during the first three months of the year, while April, October, November, and December, were about equal; and only *one gale* in three years occurred in July, and no pressure, above 8 lbs. on square foot in this month.

[S. H. M.]

THE MIRAGE. The illustration, (p. 226) at the head of this chapter represents *a Mirage*, seen in the Fens, on 29th May, 1873, from the parapet of the March and Spalding Railway. MR. SKERTCHLY, who had sometime previously observed a similar phenomenon in a place south of this position, had mounted the parapet and seeing the mirage, called my attention to it.

A letter, which appeared in *Nature*, in June 1873, contained the substance of the following description.

At some miles distant from the Railway Bridge there was the appearance of a lake of considerable size. The illusory waters, of a bluish grey colour, were raised above the ordinary level, and they presented the perspective of a Mere of a mile or two in breadth. But this was not a dull expanse; there were variously formed indentations, islands dotted here and there, pollard willows inverted and the reflection of tall poplars and elms on the glassy surface. The use of a field glass brought these features more distinctly to the eye. As we stood on the bridge we were looking towards W. by S. to W. Whittlesea Church was 8 miles distant, (the spire is seen in the picture) and Thorney Abbey was 7 miles. The Mirage was stretched out from Eastrea Fen over Prior's Fen to the W. of Thorney, *i.e.* 3 or 4 miles. There was a fresh breeze from the N.E., the sky was not half obscured by cloud, and there was no mist or haze to be seen in any part of the horizon. The conditions of the atmosphere were favorable to rapid evaporation—the sunshine was bright and warm while the N.E. breeze was cool, hence we conclude there were low strata of air of varied temperature and humidity.

[S. H. M.]

METEOROLOGY OF THE FENS OF SOUTH LINCOLNSHIRE,

From Observations taken by W. H. WHEELER, C.E. at Boston.

Longitude 0°.3 W. Latitude 52.°59 N. Height above mean Sea Level or Ordnance datum 24·48.

Barometer.

The monthly Mean Pressure and Maximum and Minimum Readings, of 10 years (1864—73), are given in the following table. The readings are uncorrected either for temperature or elevation. For the latter ·024 must be added to reduce the readings to sea level.

Month.	Mean Pressure of the Month.	Highest Reading in the Year.		Lowest Reading in the Year.	
January ..	29·80	30·68	1864	28·20	1872
February ..	29·86	30·83	1873	28·77	1867
March	29·86	30·82	1867	29·04	1866
April	29·92	30·50	1870	28·90	1868
May	29·99	30·96	1873	29·20	1869
June	30·03	30·65	1867	29·35	1872
July	30·02	30·57	1868	29·33	1871
August	29·97	30·47	1864	29·17	1868
September .	29·94	30·80	1873	29·10	1869
October ..	29·86	30·60	1870	28·75	1865
November..	29·90	30·67	1868	28·75	1865
December..	29·98	30·72	1865	28·65	1872
Mean of year	29·92	..	..	..	..

This appears to be about ·28 above the mean at Greenwich. The lowest recorded reading at Greenwich is 27·89 in 1821, and the highest 30·89 in 1825.

Temperature.

The mean and extreme Temperature of the Fens, as deduced from observations taken during the past ten years (1864—73) at Boston, is as follows:—

Month.	Mean Temp. of the Month.	Maximum of the Year.		Minimum of the Year.	
		°		°	
January ..	39·9	58	1866	5	1871
February ..	34·1	59	1868	14	1864
March	40·4	62	1871	21	1867
April	45·9	72	1873	28	1868
May	49·6	87	1868	32	1867
June	58·6	85	1865	38	1864-67
July	62·5	90	1868-72	42	1866
August	61·0	93	1867	40	1869
September ..	53·3	86	1868	35	1872
October ..	45·5	71	1873	25	1873
November ...	44·1	61	1872	25	1871
December ..	39·9	60	1866	10	1870
Mean of year	47·9	..	..	..	..

The highest maximum temperature since 1866, as will be seen from the above table, is 93° on August 15th, 1867. The next highest recorded are 90° on July 22nd, 1868, July 26th, 1872, and July 22nd, 1873. The lowest maximum temperatures during any one day were 21° on 5th and 14th Jan., 1867, 22° on 24th Dec., 1870, and 25° on the 30th Dec., 1870, and 1st Jan., 1871.

The lowest minimum readings during any one day were as follows: 5° on 2nd Jan., 1871, and 10° on 2nd Jan., 1867, and 24th Dec., 1870. The highest minimum being 67° on 26th July, 1872, 65° on 6th Aug., and 22nd July, 1868, and 15th Aug., 1867.

The mean temperature is 1·°6 below that given from the Royal Observatory at Greenwich. The greatest variations being in the months of February, May, September, and October, when the difference varies from 4 to 5 degrees.

Rainfall.

The rainfall of the district is very small as compared with other parts of England, a very great advantage where nearly all the water which falls from the clouds has to be disposed of by artificial means, and a large per centage lifted by steam power. Were the rainfall as great in the Fens as on the western side of the country, the cost of engine power and coals would be double what it is, and the drainage taxes correspondingly increased. The average annual rainfall of the whole country is a little over 30 inches, on the west of England it rises to 40 inches, and in the Lake districts reaches four times this quantity, the average at the Stye being 165 inches. From observations taken at Boston, the average fall for 46 years from 1826 to 1873 is 22·85 inches. The average of the first period of 20 years of this time (1830—49) was 23·58 inches, and of the second period (1850-69) 22·08 inches. The average of the last 20 years (1854-73) is 22·38 inches. From this it may be gathered that although the rainfall has been less than it used to be, yet that it is now again gradually recovering the lost ground. The greatest fall in one year during the past 46 years was 32·69 inches in 1872, the next 32·64 in. in 1848. The least falls 13·79 inches in 1854, 14·66 in 1834, 14·94 in 1864, and 15·43 in the notoriously dry year of 1826. In 1844 the fall was 21·64, and in 1874 18·22; thus shewing that a dry season has recurred every tenth year. The heaviest fall in one day from 1826 to 1851, 2·65 inches in July 24th, 1851, and 2·10 in June 15th, 1839. Since 1867, the heaviest fall recorded in one day 9 a.m. to 9 a.m. was 1·54 inches May 10th, 1867, and 1·23 inches Sept. 29th, 1871.

Taking an average of the last 20 years,* it appears that the least rain falls in the months of February and April, and the most in August and October.

Month.	20 years average 1854-73.	Extreme falls 1854-73.	Month.	20 years average 1854-73.	Extreme falls 1854-73
January ..	1·75	3·67	July	2·27	5·29
February ..	1·30	2·18	August	2·35	5·35
March	1·50	3·22	September...	1·88	3·99
April	1·53	3·26	October ..	2·30	4·68
May	1·84	3·86	November..	1·74	2·94
June	1·93	4·21	December..	1·99	5·87
	..	..		22·38	...

Taking an average of the past seven years (1867-73) the number of days on which rain fell is 174, and of these the wind was blowing from N.E. on 18·26 days, S.E. on 15·88, S.W. on 44·32, N.W. on 21·54 days.

It is the rain which falls in the six months from October to March that has to be dealt with in the drainage of the Fen lands, and that can alone be counted on for the supply of springs and reservoirs depending on land drainage. The rain falling in the other months nearly all passes away by evaporation or is absorbed by the vegetation. Taking an average of the 20 years (1853-72) the quantity falling during the six months, October to March, is 10·58 inches. For drainage purposes an average maximum must be taken or 12·32 inches, equal to about 1250 tons per acre, whereas for water supply only an average minimum should be relied on, or 8·82 inches or 200,000 gallons per acre. Owing to the geological character of the Fen district, the only source of water supply for cattle and for domestic purposes is from surface wells and the rain water collected in tanks. In dry seasons the former

* The figures given for the years previous to 1864 are from observations taken by Mr. Veal, who formerly resided at Boston.

frequently fail, and therefore it is the more important to take every care of the rain which, if properly husbanded, will yield a sufficient supply to every house for washing and drinking purposes.

Taking the rainfall at an average of 22 inches per annum every 100 feet of ground covered by a slate roof will yield a supply equal to about 3 gallons a day. Storage room should be provided for 76 days supply to cover dry periods, and from calculations proved correct by experience, it may be taken that 0·36 cubic feet of storage room or a space capable of holding about 2¼ gallons should be allowed in a cistern or tank for every square foot of ground covered by slate roofs.

The Crops as affected by the Atmosphere.

Year.	Date of wheat coming into ear.	Mean Temperature of July.	Aug.	Date of Harvest.		Yield.	Remarks.
1864	June 11	63·3	63·6	Aug. 18	3 days early	Good	—
1865	June 10	66·4	62·7	Sept. 1	10 late	Good	July very wet
1866	June 15	62·6	58·1	„ 4	13 late	Bad	Wet summer
1867	June 23	60·7	63·5	Aug. 16	5 early	Bad	May and July wet
1868	May 27	65·3	64·1	July 22	30 early	Very good	Dry summer
1869	June 25	63·8	60·6	Aug. 25	4 late	Very bad	May and Sept. wet
1870	June 15	66·2	61·0	„ 10	11 early	Very good	Very dry summer
1871	June 24	61·6	62·6	„ 23	2 late	Below average	Warm August
1872	June 16	66·1	62·5	„ 14	7 early	Very bad	—
1873	June 22	62.5	61·0	„ 13	8 early	Variable but below average	Sunny in July and Aug—bad wet seed time—mild winter and cold spring.
1874	June 9	64·4	59·9	„ 12	9 early	Very good	Very good seed time warm weather early in spring, then very cold and frosty but dry; warm dry summer.
	Average.	62·5	61·0	Aug. 21	..	..	

The staple produce of the Fen district being wheat, it may be of service to shew to what extent this crop is affected by the condition of the atmosphere. With this view the foregoing particulars have been tabulated, the essentials to a good crop being taken as a dry seed time in order that the land may be properly prepared for the seed bed, and a dry summer with the temperature of July and August not below 60 degrees.

The Tides in the Estuary.

As the height of the Tides has an important bearing on many questions affecting the Fen district, the following figures may be of service. The mean height of the Tide, as affecting the marsh land outside the sea banks, is an important datum, the Board of Trade on behalf of the Crown claiming all the soil covered by ordinary high water mark.

The mean or ordinary high water mark is found by adding all the tides together for a considerable period and taking the average, and the figures relate to the Tides at the north-west end of the Estuary.

The direction of the wind makes a very considerable variation in the time and height of the Tides in the Estuary, a brisk N.W. wind bringing them on sooner and raising them considerably above their normal height, and a S.W. retarding and depressing them in the same proportion.

The extent of this variation may be taken at $\frac{1}{12}$ of the height of the tide, or nearly two feet, but occasionally the variation is as great as six feet. Thus in Feb. 1868, when an unusually high tide occurred, the tide rose at 6 a.m. to 17ft. 0in. above Ordnance datum, the previous tide being only 11ft. 1in. and the succeeding tide 14ft. 0in. This was caused by the wind suddenly changing to N.E. after a strong gale from the N.W. on the night of 7th and morning of 8th.

The Flood Tide runs southward from Flamborough Head nearly direct into Lynn Deeps, which are separated from Boston Deeps by a long ridge of sands which rise Seven feet above Low Water. In the deepest part of Lynn Deeps or "The Well" there are 27 fathoms of water, whereas in Boston Deeps there are only 7 fathoms, the northern end of which is also blocked by a bar having only 1½ fathoms at low water. The Tides therefore having a larger and deeper channel run with greater velocity into Lynn Deeps, and set westward through the lows in the sands into Boston Deeps, the Tide being about 20 minutes later there than in Lynn Deeps. On the return of the Ebb, there being no bar to Lynn Deeps, the water falls out rapidly that way; but after it gets below the level of the dividing ridge of sands, the Ebb water is separated into two channels, the Northern or Boston Deeps channel discharging its own tidal waters with the fresh water from the rivers Witham and Welland over its own bar and thus maintaining the channel open.

High water flows in Boston Deeps at full and change of the moon at 6·30, the Highest Tides occurring 3 days after.

According to the observations of COMMANDER CALVER as published in the last edition of the Admiralty Chart of Boston Deeps, the following is the variation in the rise of Tides at different parts of the Estuary.

		Ft. In.		Ft. In.
Lynn Roads	Spring Tides Rise	23·8	Neaps	9.1
Clay Hole	,,	23·4	,,	9·2
Lynn	,,	22·5	,,	9·5
Sutton Bridge......	,,	20·6	,,	9·5
Wisbech	,,	15·2	,,	8.4
Boston	,,	13·2	,,	6·0
Fosdyke Bridge ...	,,	12·2	,,	5·5
Spalding	,,	4·0	,,	0·0

The flood Tide takes about 3½ hours to reach from off Freiston to Hobhole, and less than one hour from Hobhole to Boston, the distance being about the same; and flows about two hours at Boston.

The following observations as to the time and rise of the Tides are taken from the minutes of Evidence given before the Admiralty Commissioner on the Lincolnshire Estuary Bill in 1857.

Ordinary Spring Flood Tide from low to high water the 11th September, 1843, 3rd day after full moon, wind N.W., calm.

Place.	Time of Low Water		Lift of Tide.		Time of High Water	
	Hrs.	Min.	Ft.	In.	Hrs.	Min.
Shore off Leake	2	3	20	2	8	5
Hull-sand Beacon	2	45	19	4	8	15
Westmark Knock	2	45	19	6	8	15
Clay Hole	2	45	19	9	8	7
Hob-hole Sluice........	5	25	15	4	8	10
Fosdyke Bridge........	6	30	10	9	8	50
Sutton Bridge	4	15	16	9	8	21
Ferry at Lynn	5	30	14	5	8	35
Off Snettisham Shingle	3	4	19	10	8	35

The following are the highest known Tides, during this Century, respecting which any information can be obtained.

		Above ordnance datum Ft. In.	
1791	Oct. 19th	17·0	Mark on Boston Church.
1807	....	17·7	Ditto.
1810	Nov. 10th	17·11	Ditto.
1836	Feb. 17th	17·5	Ditto.
1853	Feb.	17·0	In Boston River,
1854	Feb.	17·2	
1868	Feb.	17·0	
1874	Oct.	16·5	

The Tide of 1810 was a most disastrous one for the district, being accompanied by a very heavy gale which dashed the water against the Sea Banks, causing several breachs and doing an immense amount of damage.*

The following table gives the relative heights of the Tides, the Sea Banks, Fen Lands, and Cills of Sluices on the Northern side of the Estuary, showing how important to the preservation of this District is the maintenance of the Sea Banks, erected for the protection of the country from the overflow of the Tidal wave.

	Above ordnance datum.	
Mean High Tide or "Ordinary High Water..	10·52	
Highest known Tide	17·93	
Ordinary Spring Tide	13·34	
Mean Neap Tides, High Water	6·69	
Low Water, Spring Tides in Clay Hole......	9·86	Below datum.
Ditto Neaps	2·47	Ditto.
High Salt Marshes	13·25	
Low ditto, (fit for embankment)...........	11·50	
Samphire Marshes........................	9·00	
Sea Banks, (average)......................	20·62	
Black Sluice Cill, Boston	8·70	Below datum.
Grand Sluice, ditto	3·20	Ditto.
Hobhole Sluice, ditto	7·32	Ditto.
Nene Valley datum	25·82	Ditto.
North Level Sluice Cill	5·82	Ditto.
Boston Town, Highest part	19·57	Above datum.
Ditto, Lowest	8·63	
Lincoln, High Street......................	28·42	
Ditto, Minster............................	217·71	
Low Fen Lands, bordering on the Witham ..	6·80	
Banks of the Witham as raised under the Act of 1865..............................	17·80	
East Fen Land	4·30	
Fen Lands, Black Sluice District, lowest	6·55	
Ditto " " highest	9.35	

* Further information about the 10th of November Gale and the Tides, will be found in History of Fens of S. Lincolnshire, p. 27.

CHAPTER X.

BOTANICAL SKETCH.

SECTION I.—*Botany of the Fenland.*

[Communicated by Mr. W. MARSHALL, Ely.]

OF the Plants which grew upon the area now covered by the Peat of the Fenlands previous to the changes which led to its formation, we have little positive evidence save in the trunks of Oak, Yew, and Fir, and the Acorns, Fir cones, and Hazel Nuts, which are found in considerable quantities either underlying the Peat stratum or bedded in it.

The Oaks, as one would have expected, appear to have flourished most wherever the soil on which they grew was stiff and tenacious, while the Yews are found upon that which is sandy and gravelly. In some parts of the Fens the Fir is also found, but not in the lowest parts as in Denmark.

My experience is that when Oak, Yew and Fir occur together, the Fir is uppermost.* I have never found remains either of the Elm or the Ash, although on one occasion several years ago there was brought to me what was declared by the person who brought it, to be a veritable Horse Chesnut, to which it bore a strong resemblance; but which on examination proved to be a Fungus generally found upon the Ash. It is the *Hypoxylon concentricum* of GREVILLE. This Fossil Fungus will be found figured in the next section of this chapter.

* See section in Illustration page 304.

There can be no doubt that the Flora of the period referred to differed but little from that of the present time. Neither did the indigenous Flora of the Fens, before the modern changes produced by drainage and cultivation, differ in any respect from the Marsh plants of the opposite continent, and to this day may be found growing in profusion in various parts of the Fens of Holland, many of the plants of the Fenland which have now become either very scarce or have lately ceased to exist.

We find no description by ancient writers of the special Flora of the Fenlands. The *Liber Eliensis*, written by a monk of Ely in the 12th century, describes the Fens in general terms as "magnas aquas, gurgites et paludes latas," but, although speaking in terms of admiration of the fishes and birds, he makes no special mention of any plants then found in the Fens.

But without any particular description by any ancient writer, it is not at all difficult to imagine the vigour and profusion of the vegetation of these ancient Fens in summer. In the winter, the whole level would be covered with water, but when summer came, there would be dry places, intermingled with spongy swamps and large lakes and pools of water offering every condition suitable for all the varieties of Marsh plants which must have covered the surface at that season.

Nor indeed until the general drainage in the time of CHARLES the 2nd, was any alteration effected in the Flora of the Fenlands. Even after that time the drainage was so imperfect that abundance of river, lake, and swamp remained, in and on which the Marsh plants revelled in their ancient luxuriance; indeed, we may truly say that until the period of living memory the drainage of the Fens was so partial and imperfect, that numerous places remained, in their primitive wildness so as to allow all the plants of the district to maintain themselves in vigour although in diminished numbers.

The Fen Poet, WM. HARRISON, (whose works ought to be published and in the hands of every Fenman) well describes the Floral aspect of the Fens, as it appeared to his poetical eye and as it no doubt really was; because, being a true poet, he was a close observer as well as an accurate depicter of nature.

In his "*Bedford Level*" he says—

"When Spring displayed her quickening powers
Up sprung aquatic plants and flowers,
So thick, the sun could scarcely trace
His image in the liquid glass.
Rearing its brilliant head between
Broad floating leaves of glossy green
The *Yellow Water Lily*[1] swum
Upon the surface of the scum.
Like serried groves of hostile spears
The *Reeds*[2] uprais'd amidst the Meers
Their pointed heads of dusky brown
By every passing breeze bow'd down.
There rose the *Waterflag*[3] which decks
Its golden leaf with purple specks,
And *Water plantain*[4] to the view
Appearing like the pictur'd yew.
The *Bulrush*[5] overlook'd the rest
With polish'd shaft and knotted crest
And many more which to describe
Would puzzle half the simpling tribe,
Which when drear Autumn nipt their bloom
Sunk down into the watery tomb."

1 Nuphar lutea. 2 Arundo phragmites. 3 Iris pseud-acorus. 4 Alisma plantago. 5 Scirpus lacustris, not Typha latifolia.

It was not until drainage by mills had given place to drainage by steam, and the value of Fen land had made it worth while to enclose and cultivate every bit of it, that any serious attack has been made upon the indigenous Marsh plants; but so long as rivers, drains, and ditches remain with water in them, most of the submerged plants will survive, although in diminished numbers, while those aerial plants whose roots require to be always kept in a wet state, such as the Marsh Fern (*Lastrea Thelypteris*), are almost certain to disappear, when the land has been thoroughly desiccated for only a comparatively short period. One long drought has been sufficient within the experience of the writer, completely to exterminate in West Fen and another Fen near Ely, such plants as the Bog Pimpernel, (*Anagallis tenella*), the Marsh Violet, (*Viola Stagnina*), the Marsh Fern, the Sedge (*Cladium mariscus*), and the Sweet Gale (*Myrica gale*).

The plants which in ancient times were conspicuous in the Fens, from their size and frequency and also for the use made of them, would be the Reed and the two Bullrushes (*Scirpus lacustris and Typha latifolia*), and those who are old enough to remember the aspect of Whittlesea Mere before it was drained, with its thick belt of the former and its islands of the latter, with the water studded with patches of Water Lilies, may form some idea of the quaint and picturesque character of the Flora of the primitive Fens.

The first writer who has made any distinct reference to any particular Fen Plant, is CAMDEN, who (by the way) was said to have explored England with two eyes, Scotland with one, and Ireland with none, but CAMDEN'S botanical eyes were those of RAY, the then Professor of Botany at Cambridge, whom he well described as the "great botanist of our age."

Writing in his "Britannia" of the whole tract of the Fens, he says "all this country in the winter time, and sometimes for the greater part of the year is laid under water by the rivers Ouse, Grant, Nene, Welland, Glen, and Witham, for want of sufficient channels and passages, but when these keep to their proper channels, it so abounds with grass and a sort of rank hay (by them called '*Lid*,') which, when they have mown enough for their own use, in November they burn the rest, about which time one sees all this moorish country in a flame, to his great wonder and surprise." This grass is most likely the *Glyceria*, formerly *Poa aquatica* figured in English Botany 1315, and is still usually known by the name of "White Leed." It was once the principal grass of the *Wash* lands, and composed the bulk of the "Fodder" obtained from such localities. Although still very plentiful, its area has been greatly limited by drainage.

CAMDEN again, after referring to "Reeds, alders, and other water shrubs, especially willows," adds, "besides these there grow large quantities of *Scordium* or Water Germander upon the banks of ditches." This is the *Teucrium Scordium* of modern botanists, and is still found near Ely.* It has become one of our very scarce Fen plants.

CAMDEN then adds a formal list, furnished by RAY, of "Rare plants growing wild in Cambridgeshire," of which the following belong to the Fens. We give in each case the modern name by which the plant is now known, and the round-about description made use of by botanists of RAY'S time, before the grand reform in the names of plants introduced by LINNÆUS a hundred years after.

Cambridgeshire.

STRATIODES ALOIDES or Water Soldier.

Aloe palustris C.B., *i.e.*, Militaris aizoides *Ger. Water Sengreen, or Freshwater-Soldier. In the Rivers and Fen ditches in many places of the Isle of Ely, as in the River and ditches near Stretham Ferry and about Audrey Causey.*

* See Illustration page 304.

SAMOLUS VALERANDI or Brook Weed.

Anagallis aquatica rotundifolia *Ger.* aquat. tertia. *Lob. Round-leaved Water-Pimpernel. On Teversham, Hinton and Trumpington moors in the ditches, and by the Water-courses plentifully.*

HYPERICUM ELODES or Round-leaved St. Peter's Wort.

Ascyron supinum villosum palustre *C B. Park, Marsh S. Peter's-wort, with hoary leaves. On the boggy grounds near Gamlingay.*

MALAXIS PALUDOSA or Least Bog Orchis.

Bifolium palustre, *Park. Marsh Twayblade. On the boggy and fenny grounds near Gamlingay.*

ERYSIMUM CHEIRANTHOIDES or Treacle Worm-seed.

Camelina *Ger.* Camelina sive Myagrum alterum amarum, *Park*, Myagrum siliqua longa, *C.B.* Myagro affinis planta siliquis longis, *J.B.* cui and Erysimum Galeni, and Theophrasti censetur. *Treacle-Wormseed.* In the Osier holts about the bridge at Ely abundantly and in all the other Osier grounds by the River-side there.*

CINERARIA PALUSTRIS or Marsh Flea Wort.

Conyza foliis laciniatis *Ger. emac* helenitis foliis laciniatis *Park*, Aquatica laciniata *C.B. Great jagged Fleabane. In the Fen ditches about Marsh and Chatteresse in the Isle of Ely.*

SENECIO PALUDOSUS or Great Fen Ragwort.

Conyza palustris *Park*, palustris serratifolia C.B. Virgæ aureæ sive solidagini angustifoliæ affinis, lingua avis Dalechampii *J.B. Marsh Fleabane or Birds' Tongue. In the Fen ditches and banks in the Isle of Ely, but more rarely.*

CLADIUM MARISCUS. The "Sedge" of Burwell Fen. Wicken Fen

Cyperus longus inodorus sylvestris *Ger.* long. inod. vulgaris *Park*, long. inod. Germanicus *C.B. Long Bastard Cyperus. In the watery places of Hinton-moor and in divers Fen ditches.*

MYRICA GALE, Sweet Gale or Bog Myrtle.

Elæagnus cordi *Lob.* Rhus myrtifolia Belgica C.B. Myrtus Brabantica *Ger.* Rhus sylv. sive Myrtus Brabantica aut Anglica *Park*, Gale frutex odoratus septentrionalium. *J.B. Sweet-willow, Gaul, Dutch Myrtle. In the Fens in the Isle of Ely in many places abundantly. This is wont to be put among cloaths to communicate a sweet scent to them.*

STELLARIA GLAUCA or Glaucous Marsh Stichwort.

Holosteum medium Eliense† foliis rigidioribus glaucis, Caryophyllus holosteus foliis gramineis Mentzel, forte. *The middle sort of Stichworth. It grows plentifully on the Fen banks in the Isle of Ely.*

* This plant seems always to have been regarded as a rare Local plant, and until within the last 40 or 50 years it remained so. It has since become an extremely common corn weed in the Fens, and is popularly known by the name of "Tarrify" because, I suppose, it terrifies the farmer and weeder. So plentiful has it become in some parts of the Fens, that I am credibly informed the seed, which is very minute, has been threshed out and sold to merchants as an oil seed.

† That this should be called "Eliense" is curious, as the plant is generally distributed. [W. M.]

SCHŒNUS NIGRICANS or Black Rog-rush.

Juncus palustris paniculâ glomeratâ ex rubro nigricante, Cant. semine Lithospermi Bot. Mon. *Round black-headed Marsh Rush or Bog-rush with Gromill-seeds. Every where in the watery places of Hinton and Teversham moors.*

UTRICULARIA (probably VULGARIS) or Bladder Wort.

Millefolium palustre galericulatum *Ger. emac.* aquaticum flore luteo galericulato. J.B. aquaticum lenticulatum C.B. *Hooded Water-Milfoil. In the brook Stour by the Islet it makes, and in many of the great Fen ditches in the Isle of Ely plentifully. There hath a lesser sort of this, with a small flower, been observed on Teversham moor.*

STURMIA LŒSELII or Two-leaved Bog Orchis.

Orchis lilifolius minor sabuletorum Zelandiæ Bataviæ. *J.B.* chamæorchis lilifolia. *C.B. Dwarf Orchies of Zealand, or rather Marsh bastard Orchies. In the watery places of Hinton and Teversham moors.*

POTAMOGETON COMPRESSUM, or flat-stalked Pond Weed.

Potamogiton ramosum caule compresso, folio Graminis canini. *Small branched Pond-weed with a flat stalk. In the River Cam.*

POTAMOGETON PECTINATUM or Fennel-leaved Pond Weed.

Potamogiton millefolium seu foliis gramineis ramosum. An gramineum ramosum *C.B. J.B. Park.* Millefolium tenuifolium *Ger. emac. ico. Fine or Fennel leav'd Pond Weed. In the River Cam plentifully.*

RANUNCULUS LINGUA or Greater Spear Wort.

Ranunculus flammeus major, *Ger.* palustris major, *C.B.* longo folio maximus, Lingua Plinii *J.B. Great Spear Wort. In some ditches at Teversham moor, and abundantly in many great ditches in the Fens in the Isle of Ely.*

DROSERA LONGIFOLIA or Long-leaved Sundew.

Rorella sive Ros solis foliis oblongis *J.B. Park.* folio oblongo *C.B. Long-leav'd Rosa solis or Sundew. On Hinton moor about the watery places plentifully.*

SALIX HELIX or Rose Willow.

Salix humilior, foliis angustis subcæruleis ut plurimum sibi invicem oppositis, Salix tenuior, folio minore, utrinque glabro fragilis *J.B. The Yellow dwarf Willow. By the horse way side to Cherry Hinton, in the close just by the water you pass over to go thither.*

TEUCRIUM SCORDIUM or Water Germander.

Scordium *J.B. C.B. Ger.* legitimum, *Park. Water Germander. In many ditches in the Isle of Ely and in the Osier holts about Ely City. Also in a ditch on the left hand of the road leading from Cambridge to Hinton about the mid-way.*

This list of rare plants is very far from complete, or it would not have omitted such plants as *Villarsia nymphæoides*, *Lathyrus palustris*, *Veronica scutellata*, *Alisma ranunculoides*, *Butomus umbellatus*, and others. There is a much fuller list of Cambridgeshire and Isle of Ely plants in "Martyn's Plantæ Cantabrigienses," 1763, under the head of "Herbationes Cantabrigienses," pp. 28—43.

Dugdale makes no allusion to the Flora of the Fens in his History of Embanking and Drainage. He contents himself with speaking of the Fen country as "for the space of many years until of late years, a vast and deep Fen affording little benefit to the realm other than Fish and Fowl, with over much harbour to a rude and almost barbarous sort of lazy and beggarly people." A title which, by the way, is in nowise applicable to the industrious, enterprising, and well-to-do people who now inhabit the same locality.

In Lyson's Cambridgeshire (1808) a list is given of a number of rare plants which had been met with in the county, amongst which are the following Fen plants.

1. Schœnus (now Cladium) mariscus.
2. Selinum (now Peucedanum) palustre.
3. Cicuta virosa.
4. Teucrium scordium (specially noticed by Camden).
5. Lathyrus palustris.
6. Ophrys (now Sturmia) Lœselii.
7. Malaxis paludosa.
8. Sparganium natans.

All of these except 3, 4, and 7, were until lately to be found in or near a primitive tract of undrained Fen called Wicken Sedge Fen,* and with the exception of 6 (which has lately become extinct) may certainly still be found there.

* See View of this Fen at page 160.

Watson in his History of Wisbech, 1827, pp. 448-9, gives the names of a few of the Plants growing in the County, but they are mainly taken from Camden, and are withal so illspelt that of 32 names given, no less than 12 are incorrect, and the same plant occurs under two names.

Wells, in his History of the Bedford Level (1830) in his chapter on the "Phenomena of the Fens, its Plants and natural productions," touches in the slightest manner, the Botany of the Fens; all he tells us is that "the turf moors are covered with such plants as the ~~Heath, Ling~~, and Fern. The *Myrica Gale*, plants and natural productions, and a grass with a beautiful white tuft called the Cotton Grass, are found in abundance." The Cotton Grass (*Eriophorum angustifolium*) was, 40 years ago, a conspicuous feature of the Fens, but it lingers now only in a few places. The rest of the statement is incorrect. The old surface of the Fens was no-where in Mr. Wells' time, or probably at any time, covered with Heath, Ling and Fern, and those who knew Mr. Wells ~~as intimately~~ as the present writer, will think it no detriment to his acknowledged ability in all matters relating to the History of Fen Drainage, that he should not have regarded the Fens with the eye of a botanist.

Mr. Wells' remark as to the Fens being covered with Heath, Ling, and Fern, suggests the observation that the *deep* Fens of Cambridgeshire differed very much in their Flora from the shallow bogs and moors which are found on the higher lands. In the latter, we find the Heaths (*Calluna vulgaris*, *Erica tetralix* and *cinerea*), the Sundew (*Drosera rotundifolia*, *intermedia* and *Anglica*), the Butter Wort (*Pinguicula vulgaris*), the Cranberry (*Vaccinium oxycoccos*), the Marsh St. Peter's Wort (*Hypericum elodes*), the Bog Asphodel (*Narthecium ossifragum*), and Sphagnums, which hardly belong to the real *Fen* Flora.

A statement concerning the peculiar Flora of the Fens would hardly be complete, if no allusion were made to the *absence* from a given district of common plants, which absence often has a peculiar significance. Two very common plants are almost absent from the Fens—the Primrose (*Primula vulgaris*), and the Sweet Violet (*Viola odorata*). The writer of this thinks he may venture to affirm, that the whole Isle of Ely *proper* does not contain a single wild Primrose, and that a circle of some miles drawn round Ely Cathedral as a centre, does not contain one. The Cowslip, though absent from the Fen lands proper, is nevertheless tolerably plentiful in the oldest pastures on the higher grounds, and it may be worthy of remark, in reference to the general opinion that the common Oxlip (not the *Primula elatior* of JACQUIN, but the *Primula vulgaris, var. Caulescens*), is only a stalked form of the common Primrose, that the Oxlip is never found in this part of the Fen country. Burwell Fen

PROFESSOR BABINGTON in his excellent Flora of Cambridgeshire (1860), gives in an Appendix, a list of Plants then recently found in Wicken Fen, which as a valuable memorandum of the Flora of one of the very few bits of primitive undrained Fen left in the Bedford Level I venture to subjoin.

Professor Babington's Note.

"As the kind of vegetation which formerly occupied the Great Level of the Fens, is very little known to Botanists, to most of whom the Fens are nearly a 'terra incognita,' it seems desirable to give a complete list of the plants which have been recently found growing in Wicken Fen; an asterisk is appended to the names of those which most abound there. The plant which forms the great mass of the herbage is *Cladium Mariscus*, which is still there Sedge regarded as a crop, although an uncultivated one."

List of Plants in Wicken Fen.

*Thalictrum flavum.
Ranunculus heterophyllus.
R. Flammula.
R. Lingua.
R. acris.
R. sceleratus.
Caltha palustris.
Nymphæa alba.
Nuphar lutea.
Erysimum cheiranthoides.
Armoracia amphibia.
*Viola stagnina.
Lychnis Flos-cuculi.
Sagina nodosa.
Stellaria glauca.
Malachium aquaticum.
Hypericum quadrangulum.
Linum catharticum.
Rhamnus catharticus.
Vicia Cracca.
Lathyrus palustris.
Spiræa Ulmaria.
Potentilla anserina.
Comarum palustre.
Rubus Balfourianus.
Lythrum Salicaria.
Epilobium hirsutum.
Myriophyllum verticillatum.
M. spicatum.
Hippuris vulgaris.
Hydrocotyle vulgaris.
Apium graveolens.
Sium latifolium.
S. augustifolium.
Œnanthe fistulosa.
Œ. Lachenalii.
Œ. Phellandrium.
Angelica sylvestris.
*Peucedanum palustre.
Galium uliginosum.
G. palustre.
G. elongatum.
Valeriana sambucifolia.
*V. dioica.
Eupatorium Cannabinum.
Senecio aquaticus.
S. paludosus.
Centaurea nigra.
Carduus palustris.
*C. pratensis.
Thrincia hirta.
Menyanthes trifoliata.
Convolvulus sepium.
Symphytum officinale.
Myosotis palustris.
Scrophularia aquatica.
Pedicularis palustris.
Rhinanthus Crista-galli.
Veronica Anagallis.
Mentha aquatica.
Lycopus europæus.
Scutellaria galericulata.
Utricularia vulgaris.
Hottonia palustris.
Lysimachia vulgaris.
L. nummularia.
Samolus Valerandi.
Plantago lanceolata.
Rumex Hydrolapathum.
Ceratophyllum demersum.
Callitriche verna.
Salix cinerea.
S. Caprea.
S. fusca.
Hydrocharis Morsus-ranæ.
Stratiotes aloides.
*Orchis incarnata.
*Iris Pseud-acorus.
Juncus effusus.
J. obtusiflorus.
J. acutiflorus.
J. lamprocarpus.
J. supinus.
*Luzula multiflora.
Alisma Plantago.
A. ranunculoides.
Sagittaria sagittifolia.
Butomus umbellatus.
Triglochin palustre.
Sparganium ramosum,

Those which have come in through drainage and cultivation are mostly of an *Arenarian* type as *Draba verna*, *Sedum acre*, *Cardamine hirsuta* and *Arabis hirsuta*, or corn-weeds as the Poppy, *Galeopsis versicolor*, *Silene noctiflora*, *Chenopodium polyspermum*, *C. album* and such like. The importations due to railways are all Highland Plants, and have for the most part been introduced with the ballast with which a good many of the lines traversing the Fens have been made. Amongst them are found *Hedysarum Onobrychis*, *Diplotaxis muralis*, *Reseda lutea*, *R. luteola*, *Linaria vulgaris* and *L. minus*, *Silene inflata*, *Melilotus arvensis*, *Erigeron acre*, *Verbascum nigrum*, *Calamintha acinos*, *Erodium cicutarium*, *Arabis thaliana*, besides several foreign species, not indigenous to England.

But the most remarkable of the recent introductions is the submerged water plant, *Anacharis Alsinastrum*, now alas too common, to which the watermen of the district have given the most appropriate name of "Thyme weed," and by which name it is now generally known throughout the Fens. The plant has received other trivial names, such as the "New Weed," "The American Weed," &c., but the one already mentioned is that which will adhere to it as long as it occupies its present obnoxious position of an impeder of drainage and a source of considerable expense to our Fen Districts. On its first appearance some writers pronounced it an indigenous plant which had been hitherto overlooked by the local Botanist; but when, soon after, it exhibited its prodigious powers of increase that view was no longer tenable and has long since been abandoned. It is now known to belong to a genus of Plants, peculiar to the North American Continent. Although no one can say precisely when or how it first got into our canals, no doubt now exists that in some way or other it was imported into England from North America probably

Canada, where, owing it may be to the difference in climate, it does not behave itself as it has done since it has found its way into our English waters.

The first notice of the plant in Britain by a practical botanist, was on the 3rd August, 1842, when it was found by Dr. GEORGE JOHNSTON of Berwick-on-Tweed, in the lake of Dunse Castle in Berwickshire. The lake is situate upon a tributary of the Whitadder river, which flows into the Tweed. Specimens were sent at the time to Professor BABINGTON; but the discovery was lost sight of until the autumn of 1847, when it was again discovered by Miss KIRBY of Lubbenham, in reservoirs adjoining the Foxton Locks on the canal near Market Harborough in Leicestershire. The plants were *all females*, and were found in considerable abundance closely matted together. Miss KIRBY had not observed it there before, and the reservoirs had been cleaned out two years previously. Miss KIRBY'S re-discovery awakened the attention of botanists to the subject, and Professor BABINGTON published a description of the plant, with a plate, in the "Annals of Natural History," for February, 1848. Dr. JOHNSTON, the first discoverer, on reading Prof. BABINGTON'S account, at once recognised it as the plant he had found in the lake at Dunse Castle, and in the following Autumn found the plant at two stations in the Whitadder river. The same season, but later, it was found by Mr. JAMES MITCHELL in Nottinghamshire, in the Lene, (a tributary of the Trent), near Nottingham, growing in great profusion for about a quarter of a mile in extent. In November of the same year it was found in Northamptonshire in the Watford Locks by Mr. KIRK, very abundant. The Watford Locks are on the same line of canal as the Foxton reservoirs. Mr. KIRK observed that when water was drawn from either of the locks, the force of the current detached small sprigs of the *Anacharis*, which were carried into the body of the canal. Mr. KIRK considered it to be an introduced plant. His plants were also *all females.* He likewise described it as growing in such dense masses that it was with difficulty good sized specimens could be detached owing to its extreme brittleness. Mr. KIRK was informed by the lock-man that the plant was quite as abundant when he first came to the locks five years before, although the reservoirs had been cleaned out once or twice during that period. The lock-man further stated that he had formerly resided at the Foxton Locks, and that the reservoirs there were "full of it more than twenty years back," also that it had been plentiful in the Market Harborough Canal during the whole of that period. A short time after this conversation took place, two labourers belonging to the locks came up, and both of them confirmed the statement of its being plentiful in the Market Harborough Canal, and one of them added that the "Welford Branch," a narrow canal comparatively little used, was so full of it that the passage of boats was impeded and the canal necessitated to be cleared out once or twice a year, and that it had been so for many years. In August, 1849, it was found in Derbyshire and Staffordshire by Mr. EDWIN BROWN, growing in profusion in the Trent near Burton-on-Trent, and also in the canal there. Mr. BROWN was convinced that the plant was new to that locality; he described it as forming "very large submerged masses of a striking appearance." All his plants were *females.* At Christmas, 1850, it was found by Mr. KIRK in Warwickshire, near Rugby, in the greatest abundance, and in July, 1851, by the same gentleman in the Oxford Canal near Wyken Colliery. The Rev. W. M. HIND, writing from Burton-on-Trent in July, 1851, describes the plant as occupying a much larger portion of the river than when first noticed eighteen months before, and adds "in fact it bids fair in a short time to block up one of the two streams into which the Trent here divides."

It was in 1851, that the *Anacharis* was noticed by myself at the entrance to the Roswell Hill Pits below Ely, and by myself and others in the river between Ely and Cambridge, but not in great quantities. In 1852, it had increased enormously. It came down the river in great bundles, not floating like other weeds, but rolling over and over upon the bottom like woolpacks and lodging at the bridges in vast quantities, till it seemed like a solid bed on which one might walk.

Most of our water plants require, in order to their increase, to be rooted in the bottom or sides of the river or drain in which they are found, but this plant is independent altogether of that condition, and actually grows as it drifts slowly down the stream. Its mode of growth may best be seen in still and narrow waters or ponds, where it seems at first to spring from the sides and bottom, meeting at length in the middle and completely filling up the water-course (as I have seen in some cases) apparently to the exclusion of the water. The year 1852 may be taken as the date at which the *Anacharis* became a trouble to the river Cam. In that year it needed not to be sought for, it might be found everywhere in more or less quantity from Cambridge downwards, choking up the mouths of docks, sluices, and narrow water-courses, and impeding both navigation and drainage in the upper reaches of the river. I remember the railway docks at Ely suddenly became so full of it that boats could neither get in nor out till it had been cleared out. The South Level dredging machine, which is kept in a "Docking" or excavated creek near Roswell Hill Pits, Ely, was blocked in and could not be got out without first removing the weed.

It had, moreover, become a source of annoyance to the watermen navigating barges on the river, by the universal complaints which were made of the obstructed state of the river Cam. At the backs of the Colleges at Cambridge, the river had become so blocked that extra horses had to be yoked on before barges could be got up to Messrs. FOSTER'S mills. Rowers, too, found it interfere with their amusements, and swimmers remarked that it clung to them "like scratch weed," and that when overtaken by a lump of it they were likely to be entangled and dragged by it into deep water. The fishermen also complained that they could no longer ply their nets as they were wont, and the practice of setting hooks and lines across the river was discontinued, because the "new weed" either carried them away bodily or stripped them both of baits and fish. The drainage, too, became impeded, the effect of its presence in the river having the effect of holding up the water several inches.

It will be noted that at the time referred to (1852) the weed was confined to the *river*. It was then only descending the Cam from its point of inoculation, Cambridge. I can vouch that it had not then ascended the "Old West" or the "Lark," except for a few yards above their confluences with the main river. It had not yet invaded the Fen Districts, although it was not long before it gained an entrance either through the mill races or through the numerous tunnels, by which fresh water is let in in summer time, and took possession of the main drains of the commissioners and soon after of the ordinary division ditches. Again the plants were found to be *all females*, and the male has *never* yet been found in England.

But how it first effected an entrance into England it is and always will be impossible to say with certainty. Looking however at the evidence connected with its second discovery in the Foxton Locks, it will be remembered they are situated on the Union Canal connecting Market Harborough with Leicester, and the river Welland, with the Soar, and (through the Soar) with the Trent. When therefore it was found in the Lene near Nottingham, it should be remembered it was a part of the same water system. Afterwards it was found in the locks at Welford and Watford near Northampton; but these points are within a very short distance of each other, and both are on the same line of canal as the Foxton Reservoir. In 1849 it was found in the canal near Burton on Trent and in the Trent river; but these points, although in two new counties, are all in water communication with the previous stations. Again when it was found in Warwickshire near Rugby and in the Oxford canal, these are within ten or twelve miles of the Watford station, and on the same line of Canal. These several midland localities may therefore be regarded virtually as but one—because the *Anacharis* when once introduced would in a few years inoculate any connected water system from one end to the other.

Indeed, if any one will take the trouble to look at a good map of England, it will appear clear that there was hardly a spot so well calculated as a centre from which to inoculate our English rivers, as Rugby or the Watford Locks, near the Crick Railway Station. From such a point, situate at an altitude above the sea of about 350 feet, and very nearly at the line of water-shed which divides England into the river-basins of the Severn on the west, the Trent on the north, the Ouse on the east, and the Thames on the south, a few detached sprigs, travelling different ways, would enter the Severn through the Avon *viâ* Rugby and Warwick; the Thames through the Cherwell at Banbury, and thence by Oxford; the Nene above Northampton; the Ouse at Buckingham; the Welland at Market Harborough; the Trent above Burton, by the Anker and Tame; and again, lower down, at Nottingham, by the Soar; and from Nottingham the Witham could be reached by the Grantham canal,* and thence by Lincoln, the drains of North Lincolnshire would be impregnated. Then, when the pest had

* The writer of this at a very early period of the invasion happened to be at Grantham and he was greatly astonished to find the Plant in the Witham near that town. He had not then considered the inoculation view of the question.

travelled as far down (on the Trent, for example) as the top of the Humber, the tides and the numerous vessels ascending the great valley of 4000 square miles drained by the Yorkshire Ouse, would carry it up with them, aud so inoculate that ample river and its numerous tributaries.

Assuming it to be correct, that we received the Plant from some part of North America, the question naturally arises, by what means was it conveyed? There are various ways in which a plant may be imported. A botanist, in the ardour of that botanical instinct which prompts him to surround himself with as many as possible of the various forms of vegetable life, might have introduced it; but we have no evidence that such has been the case, although botanists have been known to do such things. If one might hazard a conjecture, I should say that it was most likely introduced, at or about Rugby, with American timber, during the execution of some of the numerous railways which meet at that point. We know that in North America the timber is floated in rafts down the rivers, in which case fragments of the American weed would cling to it, or seeds might find their way into the clefts of the wood; and if but *one* seed or *one* fragment retained its vitality, in some moist cranny, till it reached its final destination, I verily believe it would be sufficient to account for the myriads of individuals that now exist in England. Indeed, from the circumstance of all the plants hitherto found being of one sex, the hypothesis of its propagation from a single seed or fragment is rendered more probable than by supposing a number of seeds or fragments to have been imported.

But some one will be asking, as the plant could not possibly have found its way *by water* from Rugby or Watford to Cambridge, how came it in the Cam? This question, through the kindness of PROF. BABINGTON, I am enabled to answer distinctly. In 1847 a specimen sent from the Foxton Locks was planted in a tub, in the Cambridge Botanical Garden; and in 1848 the late MR. MURRAY, the Curator, placed a piece of it in the Conduit stream that passes by the new garden. In the following year, on PROF. BABINGTON asking what had become of the stick which marked the site of the plant, he was informed that it had spread all over the ditch. From this point it doubtless escaped, by the waste pipe, across the Trumpington road into the "Vicar's brook," and thence into the river *above* FOSTERS mills, from which point the river below, and all the tributaries have received their supplies. Thus, in the case of the Cam, we see it proved to demonstration, that the short space of four years was sufficient for *one* small piece of the *Anacharis* to multiply so as to impede both navigation and drainage. When PROF. GRAY, of Boston, U.S., was at Cambridge, PROF. BABINGTON mentioned the circumstances to him, at which he expressed surprise, as the *Anacharis* is not found to spread in this active manner in America. Perhaps our sluggish streams, especially our mild winters, (which enable the Plant to increase all the year round), the lime held in solution in our Fen Rivers and Ditches, added to the fact, that the plant is living a kind of unnatural life in the absence of its *male* companion, may serve to account for its more rapid increase here than in America.

But strange to say, it has altered its behaviour since its first introduction. Being what is called a diæcious Plant, that is, one where the male and female organs are on distinct plants, and it having so happened that only the female plant has been imported, the consequence is that no seeds are ever perfected, and the plant can only propagate itself by buds, which it does most readily, witness the enormous extent to which it has multiplied since its first introduction. When it first enters into any water system it increases most rapidly by perpetual subdivision, filling the canals, drains, or docks quite full, monopolizing every bit of the water as if it would smother and destroy all the native plants. *This phase is only transitory*; after behaving itself for a few years in this extraordinary manner the vigour of the weed seems to abate, and at the present time in most places where it has been introduced for several years, it no longer exhibits its wonderful powers of increase but seems content to settle down and live on friendly terms with the aboriginal inhabitants. The rationale of this remarkable phenomenon has never been explained. The usual suggestion is that it has exhausted the water of some special stimulus or element of food, but that explanation can hardly be accepted, seeing that the plant behaves in the same way in *moving* streams where a full supply of whatever substance may be the exciting cause of its stupendous increase is continually renewed and can therefore never be withdrawn or exhausted, as might happen if the plant grew upon the land. Even where there is no movement in the water the proposed explanation is equally unsatisfactory, because the plant decays in the winter and, being a submerged plant, must yield up again to the water, whatever it had received from it during its growth. It would be an occupation worthy of a Botanist and Chemist, possessing the requisite leisure, to make experiments with the view of discovering the true cause of so remarkable a phenomenon.

The *Anacharis alsinastrum* or "Thyme weed" must by this time be well known to every Fenman, but a full sized figure of it is given at p. 305.

The history of the plant's first introduction into England and into the Fens, was discussed and described in 1852, by the writer of this in a series of letters addressed to the local papers, which were afterwards collected and published in a pamphlet form by Wm. Pamplin, of Frith St. Soho, in the same year; under the title of "The New Water Weed." The letters are now out of print, but may be found in volume IV. of the "Phytologist" for 1852, pp. 705-715.

SECTION II.—*The Fenland Fungi.*

[Communicated by Mr. C. B. PLOWRIGHT, M.R.C.S., Lynn.]

As far as our observation goes and from all that can be gathered from botanists residing in the district, the Fenland of to-day cannot be regarded as rich in fungi. There seems to be no lack of individual members of this group of plants; but in most districts equal in size to the Fens, the number of species is very much greater. This is doubtless due in a great measure to the physical aspect of the country. The soil is rich, the surface of the land even, the drainage good, and agriculture in an advanced and rapidly advancing condition. Every available square foot of ground is carefully ploughed, cleaned, manured, and cropped, so that many of the larger species of fungi are kept under, just as the weeds are. The general fertility of the land, to a great extent precludes its being employed in such a slowly remunerative manner as in the cultivation of timber, consequently whole hosts of the *Hymenomycetes* are banished. It is very probable this may have much to do with the paucity of mycologists. For what is so likely to arouse the interest of a tyro as the glowing tints, the graceful forms or the evanescent nature of the larger agarics?

Time was when the aspect of the country was strangely different, when instead of golden corn fields, reeds and rushes covered the district and harboured flocks of wild-fowl; when instead of the puff of the traction engine we should have heard the whistle of the plover. The fungologist would then most likely have reaped as rich a harvest as the agriculturalist now does; but even under the subsisting circumstances fungi occur with sufficient frequency, amply to reward any one who will undertake to study them.

The least observant amongst us, must at some time or other have had his attention drawn to members of this class of plants. If an agriculturalist, he cannot have failed to notice the mildew upon the cereals, the bunted wheat, or the smutted ears of barley :—nor has the Fenland been exempt from the potato disease a manifestation of fungal life, not of mere scientific interest alone, but a calamity coming home more or less closely to every one. Or it may be the dry rot, (*Merulius lacrymans*, Fr.) has attracted our attention, a fungus which ravages our tenements most mercilessly, sapping the strength from the joists and floorings in such an insidious manner, that our first intimation of its presence often consists in the giving way of the whole structure beneath our feet.

The so called Fairy Rings too, those remarkable geometric tracings, common in most meadows, can scarcely have escaped our notice. In our immediate neighbourhood the utilitarian inhabitants call them "mushroom rings." Apart from either of these names, however, they are highly interesting phenonoma, the dark green of the grass which forms the ring stands out boldly at all seasons of the year distinct from the rest of the field. The exact cause of these objects is a problem which has been keenly discussed by mycologists. In some manner they are undoubtedly due to the presence of agarics, but why they should be reproduced year after year, with such unerring symmetry, is a question by no means easy of solution. The ring itself is formed by a greater or less number of agarics, and then the question naturally arises, are they the cause or the result of the ring? These agarics vary, not only in number; but what is most remarkable, in species as well. Thus the same ring will produce in Spring, *Agaricus gambosus*, Fr.; in Summer, *Marasmius oreades*, Fr.; in Autumn, *Agaricus campestris*, Linn; or far more commonly *Agaricus arvensis*, Schœff; and towards the end of the year *Agaricus personatus*, Fr. We are not prepared to assert that every ring necessarily produces the above mentioned rotation of fungoid crops, without intermission: it must be remembered, on the contrary, that these species usually occur sporadically, and to all appearance quite independently of one another. The disposition to grow in circles is a common character of fungi. One of the most feasible explanations seems to be, that the mycelium starting from a central point spreads equally in all directions, until it attains a maximum degree of development, when subject to conditions of which we are ignorant, its further extension ceases, and at its periphery or circumference it produces fructification—in this instance, agarics.

From the essentially transient nature of the vast majority of the larger fungi, it is not surprising so little is known of their existence in bygone epochs of the world's history. When once phænerogamic vegetation was fairly established, the presumption is that fungal forms existed too, but from their unstable character, few, if any, species are preserved in the carbonaceous and even subsequent formations.

Fig. 17.—*Polyporus lucidus Fr., from the Fens of Cambridgeshire.*

Fig. 17 represents a very interesting specimen of *Polyporus lucidus* Fr., found in the Fens of Cambridgeshire, and communicated by the Rev. Wm. Hailstone, to Mr. Berkeley. As it is one of the first, if not the first, specimen of a hymenomycetous fungus which has been found belonging to the peat age, we have given a Figure of it. The original specimen is deposited in the Kew Museum.*

Mr. MARSHALL, of Ely, has kindly communicated a specimen of *Hypoxylon concentricum* Grev., found a few years ago in the peat at Downham Fen. It does not appear to have suffered materially from pressure effects, but retains all its original characters; we even succeeded in finding a few sporidia in some of the perithecia. It is represented by Fig. 18.

FIG. 18.—*Hypoxylon concentricum, Grev., from Downham Fen.*

Passing to less remote times, we find record of the Fenland producing interesting Fungi. In SOWERBY'S classical work† a specimen of *Thamnomyces hippotrichioides,* Ehr. is represented, which was found by "Mr. JONATHAN PECKOVER, growing on an old sack of sawdust in his wine cellar at Wisbech." The figure shews the perithecia, and in the letter-press we learn that the ends of the fibres were covered by a farinaceous powder — most probably the conidia.

During the early part of this century, the Rev. M. J. BERKELEY resided for a short time in the Fens, and records the occurrence of *Geaster Bryanti*, Berk. (Fig. 19).

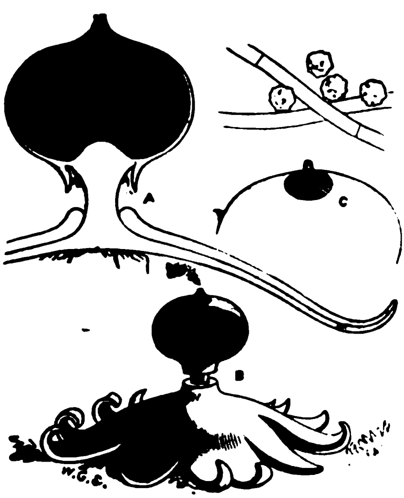


FIG. 19.—*Geaster Bryanti. Berk.*

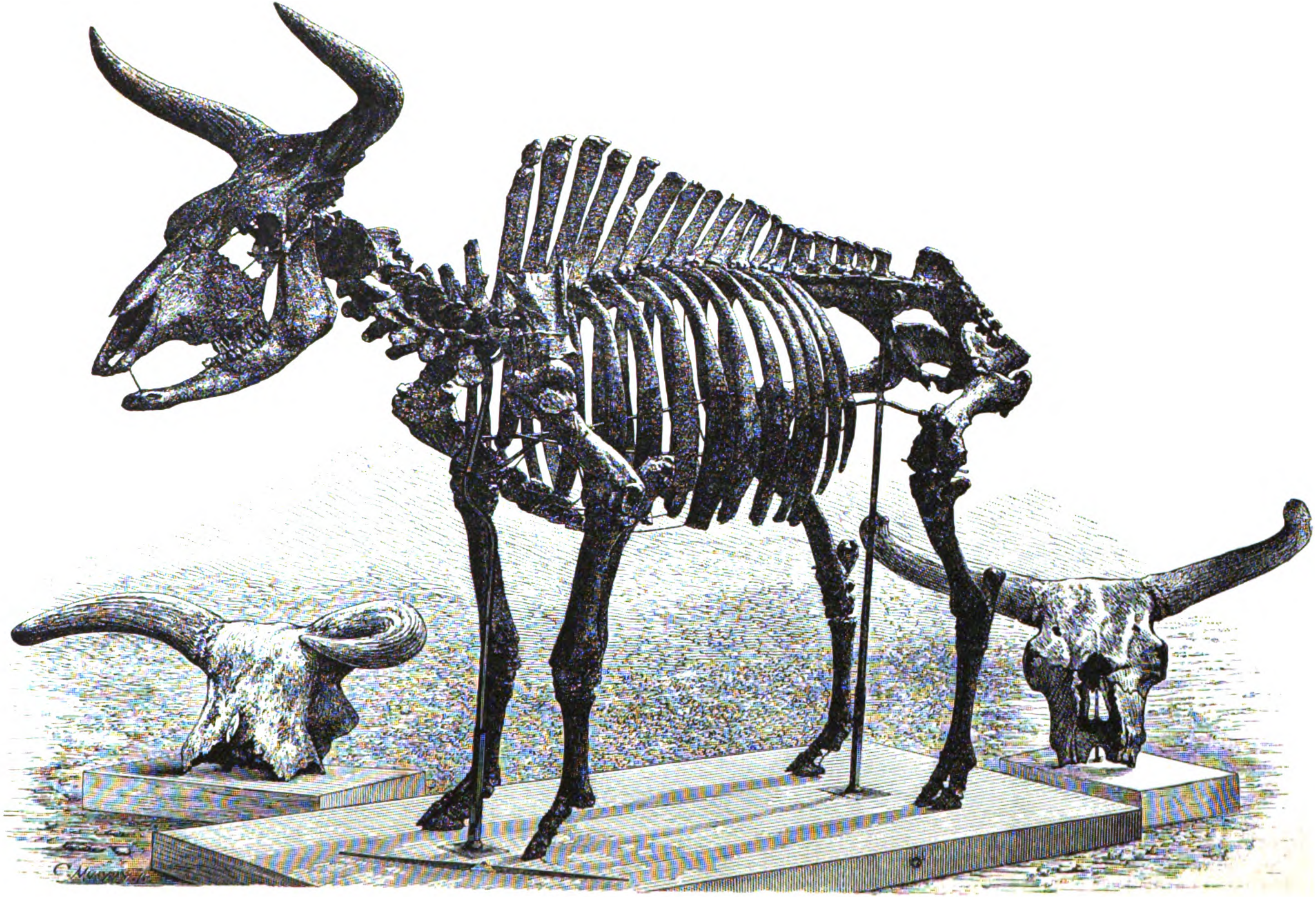
* English Fungi, by JAMES SOWERBY. London, 1799. Vol. II. p. 200.

† Notes on a Fungus found imbedded in the Fens of Cambridgeshire, by the Rev. M. J. BERKELEY, F.L.S. Journal of Linnean Society, vol. I., p. 52.

Mr. MARSHALL also finds this plant near Ely, and we have done so upon more than one occasion near Lynn.

From the meagre materials at our command, it would be impossible to give any enumeration of the Fungi of the Fenland, that would convey a fair idea of its Fungus Flora. Many species of interest and rarity have been met with in the district, a few of which are given in the foot note;* these it is hoped will be sufficient to shew that the mycology of the district will well repay work.

*AGARICUS CORTICATUS. Fr. Several fine specimens were found on an ash tree, Lovell's Hall, Terrington St. Clement's, Oct. 1874.
„ SUBPALMATUS. Fr. West Walton.
„ LIGNITALIS. Pers. In hollow Elms, Terrington.
„ TAYLORI. Berk. By the sea shore, King's Lynn.
„ BOMBYCINUS. Schœff. Lovell's Hall, Terrington St. Clement's, Sept. 1875.
„ OBTURATUS. Fr. Common.
„ MERDARIUS. Fr. King's Lynn.
„ INUNCTUS. Fr. In Ely Churchyard, November 1870, Mr. W. Marshall. And in Lynn 1872.
HYGROPHORUS FORNICATUS. Fr. Lovell's Hall.
LACTARIUS UVIDUS. Fr. Wood Hall, Mr. R. Cuffe.
„ PYROGALUS. Fr. Wood Hall, Mr. R. Cuffe.
„ THEIOGALUS. Fr. Wood Hall, Mr. R. Cuffe.
RUSSULA VETERNOSA. Fr. Chatteris, J. Fryer, Esq.
POLYPORUS LUCIDUS. Fr. Terrington St. Clement's.
„ CHIONEUS. Fr. Wood Hall, Mr. R. Cuffe.
THELEPHORA PALMATA. Fr. Wood Hall, Mr. R. Cuffe.
HYMENOGASTER LUTEUS. Vitt. Lovell's Hall.
„ VULGARIS. Tul. Lovell's Hall.
CLATHARUS CANCELLATUS. Lim. A specimen of this Fungus was found near Lynn a few years since by Miss Rabett.
PUCCINIA TRIPOLII. Wallr. An ASTER TRIPOLIUM, Nov. 1874.
VERPA DIGITALIFORMIS. Pers. Terrington St. Clement's, May, 1875.
MORCHELLA SEMILIBERA. D.C. Hellgate Lane, Terrington, May, 1875, in great abundance.
PEZIZA SEPULTA. Fr. Lovell's Hall, October, 1874.
„ HEPATICA. Batsch. Terrington, January, 1875.
„ PLANTAGINIS. Fckl. Lynn.
SACCOBOLUS VIOLACEUS. Boud. Lynn.
TUBER RUFUM. Pico. Lovell's Hall, 1874.
DIAPORTHE SARMENTORUM. Plow. On ash keys, Lovell's Hall, 1874.
HYPOCREOPSIS PULCHRA. Winter. Terrington.
SPAÆRIA POMIFORMIS. Pers. On Elm, Terrington.
„ HYPOTEPHRA. B. & Br. Lovell's Hall.



Skeleton of Bos Primigenius, in the Collection of the Cambridge Museum.

CHAPTER XI.

THE PREHISTORIC FAUNA OF THE FENLAND.

. . . . "Many a tribe has sunk supprest
Powerless its kind to gender."

LUCRETIUS.

TO enter at once upon a description of the present mammals of the Fenland, without alluding to their immediate predecessors, would be wilfully closing our eyes to some of the most interesting facts concerning the history of the district. It would, however, be going beyond our limits to enlarge upon the fossils preserved to us in the ancient strata which underlie the true fen beds, for we are concerned only with the Fenland, and not with the entire geological history of the area now called by that name. It is necessary so far to anticipate the geological description as to mention that the oldest of the true fen beds consist of gravels, and that there are at least two sets of these. The older series consists of isolated patches at March, Crowland, Kyme, and elsewhere, and in reality are more ancient than the Fenland itself—they are, in point of fact, the remains of deposits formed in estuaries before the Fen basin was excavated—remains which alone have withstood the ravages of time. The newer gravels comprise the old beach which surrounded the Fenland when it was a great island-studded bay and the gravel which was deposited upon its base at the same time, just as similar beds are being formed in the Wash. Above these gravels come alternations of silt and peat which bring the geological history down to the present time.

Old Gravels.

Commencing with the oldest gravels we find that they preserve to us an interesting relic of the marine and terrestrial faunæ of the fens, after the ice of the Glacial epoch had finally departed from the district. The following details of species are culled from my own researches, and those of Messrs. F. W. Harmer, F.G.S., and Prof. H. G. Seeley, F.G.S.; Mr. Miller has tabulated the remains preserved at Cambridge, and Mr. A. Bell of London, has kindly given me an exhaustive epitome of all the remains hitherto found in the Fenland, from his own collection, and that of Mr. Dewick.

Marine Species.

Mollusca.

Aporrhais pes-pelicani.	Turritella communis.
Buccinum undatum.	Astarte borealis.
Dentalium dentalis.	,, compressa.
Fusus antiquus.	,, elliptica.
Lacuna crassior.	,, sulcata.
,, divaricata.	Cardium edule.
Littorina littoræa.	Corbula nucleus.
,, obtusata.	Cyprina islandica.
,, rudis.	Cyrena fluminalis.
Nassa nitida.	Mactra elliptica.
,, reticulata.	,, solida.
Natica Islandica.	,, ovalis.
,, catena.	Mya arenaria.
,, helicoides.	,, truncata.
Pleurotomaria pyramidalis.	Mytilus edulis.
,, rufa.	,, modiolus.
,, turricula.	Nucula nucleus.
Purpura lapillus.	Ostrea edule.
,, var. imbricata.	Pholas dactylus.
Rissoa ulvæ.	Scrobicularia piperata.
Scalaria communis.	Tellina Balthica.
Trochus cinerarius.	,, proxima?
Trophon clathratus.	Tapes pullastra.
,, truncatus.	Venus (Artemis) exolita.
Turritella terebra.	Rhynchonella psittacea.

Estuarine Species.

Cardium edule.
Rissoa ulvæ.
Helix ericetorum.
Bulimus montanus.
Limnæus glaber.
Bithinia tentaculata.
Planorbis glaber.
„ spirorbis.
Valvata piscinalis.
Pisidium amnicum.

Fresh-water and Terrestrial Species.

Mammalia.

Bos primigenius, the *Urus* of Cæsar.
„ longifrons, Keltic Short-horn.
„ brachyceros.
Cervus megaceros, Great Irish Elk.
Elephas antiquus, an extinct Elephant.
„ primigenius, Mammoth.
Equus caballus, Wild Horse.
Felis spelæa, Cave Lion.
Hippopotamus major, Hippopotamus.
Rhinoceros tichorhinus, Woolly Rhinoceros.
Sus scrofa, Wild Boar.

Aves.

Cygnus ferus? Wild Swan.

Mollusca.

Ancylus fluviatilis.
„ lacustris.
Azeca tridens.
Bithinia tentaculata.
Bulimus montanus.
Carychium minimum.
Clausilia rugosa.
„ biplicata.
Helix arbustorum et vars.
„ concinna.
„ ericetorum.
„ fruticum.
„ fulvus.
„ hispida.
„ nemoralis.
„ pygmæa.
„ pulchella.
„ rufescens.
„ rotundata.
(Zonites) cellarius.
(Zonites) nitidulus.
„ nitidus.
„ radiatulus.
„ fulvus.
Hydrobia marginata.
Limnæus auricularia.
„ palustris.
„ peregra.
„ truncatula.
Planorbis carinatus.
„ contortus.
„ complanatus.
„ glaber.
„ nitidus.
„ spirorbis.
„ vortex.
Pupa marginata.
„ umbilicata.
(Vertigo) antivertigo.
„ pygmæa.

Mollusca.

(VERTIGO) MOULINSIANA.	CYCLAS CALYCULATA.
SUCCINEA PUTRIS.	PISIDIUM AMNICUM.
,, ,, VAR. MAJOR.	,, FONTINALE.
,, GRACILIS.	,, HENSLOWIANUM.
VALVATA CRISTATA.	,, NITIDUM.
,, PISCINALIS.	,, PULCHELLUM.
,, VAR. ANTIQUUA.	UNIO LIMOSUS.*
ZUA LUBRICA.	,, LITTORALIS.
CYRENA FLUMINALIS.	,, PICTORUM.
CYCLAS CORNEA.	,, TUMIDUS.

Plants.

SEEDS OF CHARA.

It will be interesting to compare this, the oldest Fenland fauna, with the later Tertiary deposits which undoubtedly preceded the Glacial epoch. These newer Tertiaries are known as

1. Coralline Crag, 2. Red Crag,	(*Older Pliocene.*)
3. Fluvio-marine Crag, 4. Chillesford Beds, 5. Bure Valley Beds,	Norwich Crag or Laminated series. (*Newer Pliocene.*)

An excellent epitome of the characters of these beds will be found in "The Geology of England and Wales," by my friend and colleague Mr. H. B. WOODWARD, F.G.S., to which work we must refer the reader for more extended information. The oldest member, the Coralline Crag, consists of a series of shelly sands and marls, having a thickness of from 40 to 60 feet. The Red Crag is usually a dark red, false-bedded, shelly sand, attaining a thickness of 25 feet. The Fluvio-Marine Crag consists of buff-coloured shelly sands and shingles varying in thickness from 5 to 10 feet, and contains a mixture of marine and freshwater shells. The Chillesford Beds consist of clays and sands with a maximum thickness of 25 feet. The

* Mr. A. JUKES BROWN tells me this species is a variety of *pictorum*.

Bure Valley Beds consist of irregular patches of pebbly sands and pebble beds, with bands of clay in some places.

These pliocene strata are found almost exclusively along the eastern portions of the counties of Norfolk, Suffolk, and Essex, and the representatives of some of them occur on the opposite coast of Europe. Although they are so thin in England, and never reach an elevation of more than about 60 feet above the present sea-level, they nevertheless represent a vast interval of time. In Sicily they are 800 feet in thickness, and are found 3,000 feet above the sea. Perhaps a clearer notion of the age of this epoch may be gathered by knowing that Mount Etna, 11,000 feet in height, has been entirely formed since its close.

Above the Bure Valley Beds come in succession a series of rocks, including glacial beds, which Messrs. S. V. Wood and F. W. Harmer have shewn to occupy the following positions—

Great Chalky Boulder Clay, the oldest part of their Upper Glacial.

Sand, Gravel and Brickearth, called by them Middle Glacial.

Contorted Drift,	
Cromer Till,	
Bure Valley Beds,	Called by them Lower Glacial.
Forest Bed,	

The Forest Bed is a thin bed of peat with tree stumps overlying a gravelly deposit, locally known as "pan." The Cromer Till is a glacial clay. The Contorted Drift is a series of dark brown loams, often well stratified, with occasional seams of gravel. The two upper members are, as their names express, sands and glacial clay.

If we compare the faunæ of these different beds with each other, and then contrast them with the newer strata of the Fenland, we shall arrive at the remarkable conclusion that the fauna of the old gravels is more closely allied to the Lower Glacial, and even to the Pliocene, than to the recent fauna, and this, coupled with the physical evidence to be brought forward in the Geological section of this work, will be found to have an important bearing upon the history of the glacial epoch and the antiquity of man.

For example, we have the Cave Lion represented by an extinct lion (*F. pardioides*) in the Red Crag. The Mastodon, a kind of elephant ranges from the Coralline Crag to the Forest Bed, where it is associated with an extinct elephant (*E. antiquus*) which is also found in the gravel; another extinct elephant (*E. meridionalis*) ranges from the Red Crag to the Forest Bed The horse is found in the Norwich Crag, the Forest Bed and the gravels, and is represented in the Red Crag by the Hipparion, a horse-like animal with antlers like a stag; and intermediate in structure between these animals is *Equus plicidens* common to the Norwich Crag and gravels. Rhinoceri range from the Norwich Crag to the gravel, and so do extinct species of oxen and deer. The hippopotamus is found in the Norwich Crag, Forest Bed, and gravel. None of these animals is found in the newer beds. No less than 11 genera are found in the old gravels, which are unrepresented in the true fen beds, as may be seen by the accompanying table; and of these, seven are common to the Norwich Crag and old gravels.

Hence we are justified in saying that the fauna of these old gravels, is more nearly allied to the older than to the newer deposits. Again of 28 species of mammals living when the old gravels were formed 19 have disappeared from Britain, and 5, or perhaps 7, have become extinct. On the other hand all the species whose remains are found in the true Fen beds, are either living there now, or have done so within the historic period. The important fact that the old gravel fauna is more closely allied to ancient than to modern times, has never been sufficiently insisted upon, but the evidence in its favour is irresistible.

Species.	Norwich Crag.	Old Gravels.	Fen Beds.
HOMO.	*	—	—
URSUS ARCTOS.	*	—	—
„ FEROX.	—	—	*
„ SPELÆUS.	?	—	*
„ PRISCUS.	—	*	*
MACHAIRODUS LATIDENS.	—	—	*
HYÆNA CROCUTA.		—	*
„ STRIATA.		—	*
FELIS LEO.		—	*
CASTOR FIBER.		—	—
LEMNUS (?) GRÆNLANDICUS.		—	*
SPERMOPHILUS SUPERCILIOSUS.		—	*
BISON PRISCUS.	—	—	*
BOS PRIMIGENIUS.		—	*
„ LONGIFRONS.		*	—
OVIBOS MOSCHATUS.		—	*
CERVUS MEGACEROS.	—	—	—
„ BROWNI.	*	—	*
„ TARANDUS.	*	—	—
„ CAPREOLUS.	*	—	—
„ ELAPHUS.	*	—	—
EQUUS PLICIDENS.	—	—	*
„ CABALLUS.	—	—	—
MASTODON ARVERNENSIS.	—	*	*
ELEPHAS MERIDIONALIS.	—	*	*
„ ANTIQUUS.	—	—	*
„ PRIMIGENIUS.	*	—	*
RHINOCEROS TICHORHINUS.	*	—	*
„ ETRUSCUS.	*	—	*
„ LEPTORHINUS.	—	—	*
„ HEMITÆCHUS.	*	—	*
HIPPOPOTAMUS MAJOR.	—	—	*

⁂ The dash indicates the presence, the asterisk the absence of a species.

The following animals may be taken as a fair list of the species yielded by the gravels of England, which correspond in age with those we are discussing, the Fenland forms are marked with an asterisk.

*Homo. L. Man.
Ursus arctos. L. Brown Bear.
,, ferox. L. & C. Grizzly Bear.
Mustela erminea. L. Ermine.
Lutra vulgaris. L. Otter.
Canis vulpes. L. Fox.
,, lupus. L. Wolf.
Hynæa crocuta. Zim. Var. spelæa. Gold. Cave hyæna.
*Felis leo. L. Var. spelæa. Cave Lion.
Machaerodus latidens. Sabre-toothed Lion.
*Cervus megaceros. Hart. Irish Elk.
,, Browni. Dawk. Extinct Fallow Deer.
,, tarandus. L. Reindeer.
,, capreolus. L. Roedeer.
,, elaphus. L. Stag.
Ovibos moschatus. Bl. Musk-Sheep.
*Bos primigenius. Boj. Urus.
Bison priscus. Owen. Bison.
*Hippopotamas major. Des. Large Hippopotamas.
*Sus scrofa (ferus). L. Wild Boar.
*Equus caballus. L. Horse.
Rhinoceros hemitæchus. Fale. Slender Rhinoceros.
* ,, tichorhinus. Cuv. Woolly Rhinoceros.
*Elephas antiquus. Falc. Narrow-toothed Elephant.
* ,, primigenius. Blum. Mammoth.
Lemnus (? grœnlandicus). Lemming.
Spermophilus (? superciliosus). Pouched Marmot.
Lepus timidus. L. Hare.
Mus musculus. L. Mouse.

This list is taken from the oft-quoted paper by Prof. Boyd Dawkins.

To these are often added *Bos longifrons* and *B. brachyceros*, the former, Prof. Boyd Dawkins has shown strong grounds for believing to be foreign to these deposits, and the latter is only a variety of it, so I have eliminated them although they are given in the list from Barnwell.

If we had to seek living specimens to illustrate this fauna we must travel to Africa to find the lion, hyæna, and hippopotamus, and visit the arctic regions to secure the musk-sheep and reindeer, while the intermediate regions would yield us the brown bear, wolf, and stag. In other words we have in these old gravels representatives of the tropic, temperate and arctic zones; animals which now never live together. This is clearly shown by grouping the animals according to their present habitats, thus:—

WARM.	TEMPERATE.	COLD.
CAVE HYÆNA.	BROWN BEAR.	REINDEER.
CAVE LION.	GRIZZLY BEAR.	MUSK-SHEEP.
SABRE-TOOTHED LION.	ERMINE.	WOOLLY RHINOCEROS.
HIPPOPOTAMUS.	OTTER.	MAMMOTH.
SLENDER RHINOCEROS.	FOX.	LEMMING.
NARROW-TOOTHED ELEPHANT.	WOLF.	MARMOT.
	IRISH ELK.	
	EXTINCT FALLOW DEER.	
	ROEDEER.	
	STAG.	
	URUS.	
	BISON.	
	WILD BOAR.	
	HORSE.	
	HARE.	
	MOUSE.	

Now if these groups were found in different strata, we should at once declare that they represented warm, temperate and cold periods in the world's history; but what conclusion can we draw when all the species are mixed in the same bed? Prof. BOYD DAWKINS solves the difficulty by reference to the migrations of animals such as we now observe in North America and Siberia, where the Arctic species invade the territory of the temperate fauna in the winter, and the latter extend their travels into the region of the former in summer. He supposes that the mountainous portions of Britain still nourished glaciers, round whose chill solitudes the Arctic mammals lived; while the plains were warm enough in summer to lure the lion and hippopotamus from their southern homes, and the intermediate areas at the same time supported the temperate species. The summers were very warm, the winters intensely cold; and, when the chilly autumn set in, the animals gradually retreated southwards, to return again with the genial summer-time. In other words, he thinks that the different groups occupied the same area, Barnwell for instance, at different seasons. "Could we," asks the Professor, "predicate, for instance, the temperature of the sub-himalayas from the contemplation of the central ridge? or the summer heat of Lombardy or Provence from the glaciers of the Alps?"*

Dr. J. GEIKIE objects to this view, that so long as western Europe is washed by the warm Atlantic waters, and its physical configuration is practically as now, it never can have such a 'continental' climate as Prof. DAWKINS imagines. Moreover, he observes, "Britain is not in the latitude of Northern India, neither is it in that of Lombardy or Provence, while in comparison with the Alps and Himalaya our mountains sink into utter insignificance."† Again, the cases of the migrations are not parallel. The Arctic mammalia at present overlap the region of the temperate, but never of the tropical, yet we must suppose such to have been the case in ancient Britain. Dr. GEIKIE also observes that the hippopotamus is not migratory, and being amphibious could not exist in a country in which the rivers were frozen every winter. It has been suggested that this creature was protected by a shaggy coat like the mammoth and woolly rhinoceros, but DAWKINS pertinently remarks that "such a change in the physique of the animal . . . .

* Classification of Pleistocene Strata, Journ. Geo. Soc., vol. xxviii. p. 432, 1872. See also his "Cave Hunting."

† Great Ice Age, 2nd ed., p. 513, 1877. The whole of chap, xxxviii. deserves careful study, as also does DAWKINS' argument in "Cave Hunting."

could not have existed without leaving behind greater differences than we find between it and its living African representative." DAWKINS asserts that the hippopotamus *is* migratory as its remains have been found in Nubia, showing that it once ranged further north in the Nile than now. "If its present range be compared with that during the Pleistocene, it is impossible to deny that in has migrated from Africa to Yorkshire, or *vice versa*."† To this I would reply that the hippopotamus has vanished from the lower Nile, much as the bear has vanished from Britain, not by migration but by extermination; or to come closer home, it has gone like the bittern from the Fenland. It appears quite ludicrous to imagine so unwieldy a brute migrating from Yorkshire to Africa, as it must have done inasmuch as migration means individual travel. It seems to me that migration is here confounded with the gradual diffusion of life over fresh areas, and the equally slow withdrawal from old homes—the one supposes individual travel, the other mere extension and contraction of territory. The hippopotamus has no more migrated from Yorkshire to Africa, than the buried oaks of the peat have migrated from the Fenland to Huntingdonshire and Lincolnshire.

Dr. GEIKIE suggests and Sir JOHN LUBBOCK partly agrees with him, that this confusion of faunæ must be interpreted as a confusion of deposits, and I am quite of the same opinion. We know, and all geologists admit, that these gravels represent what DAWKINS himself calls "a vast lapse of time," and the materials are so incoherent that those formed at one time may easily be commingled with those made at another. Everyone who has studied the action of rivers, must be aware how curiously they swing from side to side of their valleys, eating away and redistributing to-day what they have accumulated in time gone by.

* Journ. Geol. Soc., vol. xxviii., p. 431. † Ib. p. 432.

Dr. GEIKIE, then, argues that there was a cold period after the ice had left the locality, and during which the arctic animals lived; that as the climate ameliorated they gradually spread northwards and were succeeded by the temperate group, which in turn was displaced by the tropic forms when the climate became warm enough to entice them hither. These changes may, and probably did, recur more than once, and from those times to the present the gravels have been turned over again and again by the rivers. GEIKIE appeals to climatal instead of seasonal change. I think evidence of this can be shown by the study of palæolithic implements, as will be pointed out in the sequel. Prof. DAWKINS argues that "we ought to find the remains of the animals in two distinct suites in the river deposits, corresponding to the climatal changes of long duration. We should find the hippopotamus and spotted hyæna in those which were accumalated during the warm, the reindeer, glutton, and marmot, in those which were deposited in the cold period. After seeking for this evidence for the last ten [fifteen] years, I cannot find the slightest trace of any such sequence in Britain or on the Continent."*

It has been shown how improbable it is that the several deposits, which in many cases may have been formed almost uninterruptedly, should have escaped the usual fate of river gravels; but there, nevertheless, *does* exist a trace of sequence. Prof. PRESTWICH has remarked that the shells in the high-level (older) gravels generally have a more northern aspect than those from the low-level (newer) beds,† and this seems to point to a difference of climate, and is the more valuable inasmuch as the shells lived *in* the river, and the mammals did not. We might expect some confusion among the latter, if from no other cause than that only chance carcases or bones (which may have lain for

* Geol. Journ., vol. xxvii., p. 431. † Phil. Trans., 1864., p. 279.

years before being carried into the water) could become entombed in the gravels. Sir JOHN LUBBOCK has pointed out "That our ancient hippopotamus has been less frequently found in association with these two species [mammoth and woolly rhinoceros] than with *E. antiquus* and *R. hemitœchus*, FALC, (*leptorhinus*, OWEN) which . . . . have a more southerly range. Thus in this country it has only been found in four bone caves, those of Durdham, Down, Kirkdale, Kent's Hole Cavern, and Ravenscliff in Gower, and in the two former it was associated with *E. antiquus* and *R. hemitœchus;* at Walton and Folkestone with *E. antiquus;* at Peckham with *E. antiquus* and *E. primigenius;* at Bedford with *E. antiquus*, the tichorhine rhinoceros and the reindeer, and at Barton with the mammoth and *R. hemitœchus*."*

Prof. DAWKINS in replying to Dr. GEIKIE respecting the seasonal migrations of the hippopotamus makes the following remarkable statement, "So far from holding this view, I have always maintained that in the vast lapse of time represented by the Pleistocene . . . . every inch of ground in Middle Europe was fought over by the invading and retreating forms, not at one time, but at successive times."† Had this passage appeared from the pen of anyone else, I should have claimed the writer as an advocate of the view here supported, but when used as an argument *against* that view I confess my inability to understand it. If the temperate fought the arctic, and the tropic the temperate forms, during long ages as they slowly advanced and retreated—that is just our argument; but if the hippopotamus battled with the reindeer, that is exactly what GEIKIE objects to, and what DAWKINS says he does not believe!

* Prehistoric Times, 2nd ed. p. 290.

† Journ. Geol. Soc., vol. xxviii., p. 433.

Prof. DAWKINS might use a stronger argument from his own experience. In his "Cave Hunting" he figures and describes a skull of the woolly rhinoceros gnawed by hyænas,* apparently this is an instance of an arctic animal having been prayed upon by a tropic one, thus showing that the two groups did live together. The only way out of this difficulty is the probability that the hyæna was able, like the tiger, to withstand considerable cold, and the Professsor himself admits that it may have possessed "the elasticity of constitution which we know to have been possessed by the lion."†

I have examined this question of ancient climate at some length, from its intrinsic importance, and have chosen the mammalia in preference to the mollusca as illustrations, because the latter are not nearly so susceptible of change as the former, which have been so admirably worked out by Prof. DAWKINS, to whom students of recent geology are more indepted than can easily be told.

A few words may here be said concerning the mammals themselves. The oxen will be described presently. The Irish elk is an extinct species found in great numbers in some of the Irish peat bogs, whence its name. It was larger than any living deer, and was not rare in the Fenland during the newer stone age. The *Elephas antiquus* was allied to the African species and is quite extinct. It is easily recognised by its molar teeth the plates of which, as well as the whole tooth, are narrower than those of the mammoth. The mammoth is an extinct elephant, in many respects similar to the present Indian form, covered with long brown shaggy wool and hair, to fit it to endure the cold of northern winters. On the continent it survived the

* I take it for granted that the skull was gnawed by hyænas, and not by some other animal such as the glutton, which is eminently capable of such a deed.

† Op. cit., p. 427.

glacial period in Siberia, where its remains are so plentiful that from the beginning of the century its tusks have formed a valuable article of merchandise. It is probable that it is only just extinct, for carcases are now and then found in the Lena so fresh that dogs will devour the flesh. Three years ago it was reported that a herd of these creatures had been seen in Siberia and Prof. HULL, writing to me mentioned that Prof. OLDHAM, the late Director of the Indian Geological Survey considered it not improbable; the rumour, however, has never been verified. The wild horse has little to distinguish it from the modern horse except the disproportionate size of the head. It has already been mentioned that drawings of the two latter and other animals, made by palæolethic man have been found in France. The cave lion is a larger variety of the African lion, and the same remarks apply to the cave hyæna. The hippopotamus is closely allied to the African *H. amphibius*. The tichorhine or woolly rhinoceros was a two horned species with a shaggy coat like that of the mammoth, and was able to withstand severe cold.

If we now turn to the mollusca we shall find a similar, though less prominent, assemblage of forms. Molluscs have a more cosmopolitan range than mammals; they are not nearly so amenable to climatal influence, and they are more persistent. Thus,· we cannot find a single existing genus of mammals older than the Tertiary system, whereas the genera of existing shells can be numbered by scores. Sir C. LYELL remarks "that the association in the post-pliocene deposits of shells, exclusively of living species, with many extinct quadrupeds, betokened a longevity of species in the testacea far exceeding that in the mammalia."* In the upper part of the newer pliocene, for example, only 9

* Principles of Geology, 1st ed., vol. viii. p. 140, 1830 and all subsequent editions.

species of shells out of 94 are extinct, and in the old gravels all the species are now living, whereas we have seen that among the mammalia no fewer than 7 species are extinct, and 19 no longer live in these latitudes. If this persistence is true of marine mollusca, it is still more applicable to freshwater forms, which are few in species compared with the denizens of the ocean, and present a wonderful uniformity of type all over the globe. For example, Mr. LOVELL REEVE, speaking of the pond-snails (*Lymneacea*) remarks that "there are not six species, it may be safely stated, in all Europe, more than there are in Britain . . . . . There is no evidence to show whether the alleged progenitors of our British species were created in Siberia, Hungary, or Thibet. There is scarcely any variation either in form or number of species in those remote localities."* Fresh-water shells are carried to distant pools and rivers, as Mr. DARWIN has shown, by adhering to the feet of aquatic birds. Beetles also, such as *Dityscus*, though aquatic, nevertheless fly considerable distances. He also tells us that "we should not forget the probability of many fresh-water forms having formerly ranged continuously over immense areas, and then having become extinct at intermediate points."† My friend Mr. T. BELT, who has thought much upon this and kindred questions, and has travelled over the greater portion of the globe, has excellently explained the cause of this extensive range. I am tempted to give a long extract because of the great interest which attaches to this question in relation to the antiquity of the old gravels, to be discussed in another chapter. "It is evident that there must have been less variation [among fresh-water than among land shells,] or that the varieties that arose have not been

* British Land and Fresh-water Mollusks, p. 255.

† Origin of Species, 6th ed., p. 346.

preserved. I think it probable that the variation of fresh-water species of animals and plants has been constantly checked by the want of continuity of lakes and rivers in time and space. In the great oscillations of the surface of the earth, of which geologists find so many proofs, every fresh-water area has been again and again destroyed. It is not so with the ocean—it is continuous; and as one part was elevated and laid dry, the species could retreat to another. On the great continents the land has probably never been totally submerged at any one time; it also is continuous over great areas, and as one part became uninhabitable, the land species could in most cases retreat to another. But for the inhabitants of lakes and rivers there was no retreat, and whenever the sea overflowed the land, vast numbers of freshwater species must have been destroyed, fresh-water fauna gave place to a marine one, and the former was annihilated so far as that area was concerned. When the land again rose from the sea, the marine fauna was not destroyed—it simply retired farther back.

"There is every reason to believe that the production of species is a slow process, and if fresh-water areas have not continued as a rule through long geological periods, we can see how variation has been constantly checked by the destruction, first in one part, then in another, of all the fresh-water species; and on these places being again occupied by fresh-water they were colonised by species from other parts of the world. Thus species of restricted range were always exposed to destruction because their habitat was temporary and their retreat impossible, and only families of wide distribution could be preserved. Hence I believe it is that the types of fresh-water productions are few and world-wide, whilst the sea has molluscs innumerable, and the land great variety and wealth of species.

Their variety is in the ratio of the continuity of their habitats in time and space.

"It follows also, from the same reasoning, that old and widespread types are more likely to be preserved in fresh-water areas than on land or in the sea, for the destruction of wide-ranging species is affected more by the competition of improved varieties than by physical causes; so that when variation is most checked, old forms will longest survive. Therefore I think it is that amongst fishes we find some old geological types still preserved in a few of the large rivers of the world."*

From these considerations we should expect that the mollusca would present fewer specific differences than the mammalia, and the fresh-water mollusca much fewer than the marine. This accordingly is just what we do find, for while there are 16 species of marine shells in the old gravels which are not British, only 7 of the fresh-water forms are foreign.

The marine mollusca of these gravels can be grouped into arctic, temperate and southern groups, just as was the case with the mammals, though from their being less susceptible of change the inferences to be drawn from their coexistence are not so certain. In the northern group we may place such shells as *Natica Islandica*, *Trophon clathratus*, *Astarte borealis*, *Cyprina Islandica*, and *Tellina proxima*. The temperate group would comprise such forms as *Buccinum undatum*, *Littorina litorea*, *L. rudis*, *Purpura lapillus*, *Scalaria communis*, *Cardium edule*, *etc.* The southern group would include *Cyrena fluminalis*, and *Corbula nucleus*.

Perhaps the best, though not the most striking, proof of the antiquity of these gravels is the change in the fresh-water fauna which has taken place since they were deposited. The following species are now quite extinct in Britain—

* Naturalist in Nicaragua, pp. 334—6.

HELIX FRUTICUM.
HYDROBIA MARGINATA.
CYRENA FLUMINALIS.
PUPA (VERTIGO) MOULINSIANA.
VALVATA PISCINALIS, V. ANTIQUA.
UNIO LITTORALIS.
„ PICTORUM, VAR. LIMOSUS.

When we consider how persistent the fresh-water fauna is both in time and space—that in the oldest fresh-water formation known to us, the Old Red Sandstone, a fresh-water mussel (*Anodonta*) is found not very different from those in the present Fen drains; and in the fluviatile formations of the secondary rocks we find genera such as *Physa*, *Lymnæa*, *Planorbis*, *Paludina* and *Valvata*, which thrive in all our streams—and that wherever we travel over the face of the globe, similar forms greet us—we cannot fail to be impressed with the idea that these gravels are separated from us by a long interval of time, and that great physical changes must have ensued to modify to such a great extent these almost unchangeable forms of life. Those causes we find in the recurrence of glacial conditions to the north of our area; and, if this be not admitted, I know not where to look for a solution of the difficulty. The distribution of the earlier remains of man, of deposits similar to those whose fauna we have been examining, and the changes in the configuration of the country since the gravels were formed, all point in one direction, as will be presently seen, and form a thread of cumulative evidence which, it seems to me, will be with difficulty broken.

Peat and Silt.

The true Fen beach and floor gravels are practically without fossils, a fact whose significance will be discussed hereafter. Hence we proceed at once to the peat and silt deposits, which are taken together because they are homotaxial to a large extent, that is to say they were forming simultaneously in different parts of the Fens.

A vast interval of time, which may be reckoned by tens of thousands of years, intervened between the formation of the old gravels we have been discussing and the beds whose organic remains we now proceed to examine. During this interval Britain had been entirely depopulated, the southern animals with palæolithic man had departed never to return, and the new immigrants were of types identical with the present forms. The fossils hitherto obtained from Peat are:—*

Mammalia.

Homo	Man.	Cervus elaphus	Stag.
Bos longifrons ..	Keltic Short-horn.	„ megaceros ..	Irish Elk.
„ brachyceros ..	Variety of ditto.	„ tarandus.. ..	Reindeer.
„ primigenius ..	Urus.	Lutra vulgaris	Otter.
Canis lupus	Wolf.	Martes abietum	Marten.
„ vulpes	Fox.	Sus scrofa	Wild Boar.
Capra hircus.. ..	Goat.	Equus caballus	Horse.
Castor fiber	Beaver.	Ursus arctos..	Brown Bear.
Cervus capreolus..	Roedeer.		

Aves.

Ardea stellaris.. ..	Bittern.	Pelicanus crispus, or	
Cygnus musicus	Swan.	onocrotalus	Pelican.
„ olor	Tame Swan.	Podiceps cristatus ..	Crested Grebe.
Fulica atra..	Coot.	Querquedula creca ..	Teal.

Reptilia.

Emys lutaria .. .. Tortoise.†

Pisces.

Esox lucius .. .. Pike.

Insecta.

Copris lunaris.	Elator, sp.
Donacia linearis.	Neuroptera, indet.

* Remains of Hippopotamus and Rhinoceros have been found in the peat, but they are certainly washed from out of the gravel: Walrus and Grampus bones from the peat are preserved at Cambridge, but they belong evidently to the silt fauna. A few marine shells such as Cockles and Mussels are found in places, as in Crowland, Morton Fen, &c.

† Wretham Mere, Norfolk.

Mollusca.

BITHINIA TENTACULATA.	PLANORBIS SPIRORBIS.
HELIX NEMORALIS.	„ VORTEX.
LYMNEA AURICULARIA.	PHYSA FONTINALIS.
„ PALUSTRIS.	CYCLAS CORNEA.
„ PEREGER.	VALVATA CRISTATA.
PLANORBIS COMPLANATUS.	PISIDIUM AMNICUM.
„ LÆVIS.	„ OBTUSALE.

Plantæ.

BETULA NANA ..	.. Dwarf Birch.	ULMUS .. .. Elm.
FAGUS SYLVATICA	.. Beech.	HYDRODICTYON UTRICULARIS.
FRAXINUS	.. Ash.	HYPNUM FLUITANS.
SALIX CAPRA ..	.. Great Sallow.	„ FILICIUM.
„ REPENS ..	.. Creeping Willow.	JUNCUS AQUATICUS.
QUERCUS ROBUR..	.. Oak.	LASTREA.
PINUS SYLVESTRIS	.. Scotch Fir.	SPHAGNUM.
TAXUS BACCATA ..	.. Yew.	CONFERVÆ.

Fungi.

POLYPORUS FOMENTARIUS.
„ SQUAMOSUS.
SPIERIA (?) CONCENTRICUS.

This list (for which I am chiefly indebted to Mr. A. BELL, to whose kindness is due, in fact, the completeness of my lists) contains all the species yet recognised from the peat. It is a land fauna and flora, and links us without a break to the present time. From it can be learned in a vivid manner what is meant by the expression so often and so sadly used by geologists, "the imperfection of the geological record." One cannot but be struck in looking down this list, at the lack of evidence of the existence of animals and plants which *must* have flourished. Where are the rats, the mice, the rabbits, the hares, the weasels, the stoats, the squirrels, which we are sure helped to make up the mammalian list? Where are all the small birds—say the reed warblers—which sang in the ancient Fen—for it is absurd to suppose that only seven species of birds existed in those times. Where the snakes and frogs, and toads and newts? Where are the fish that thronged the waters—the insects that hovered over the sallows—and what entomologist does not know how rich a haunt that is?—Where, too, are the sweet gale, the sedges, and the reeds?—Unrepresented as yet—Yet there are people who ask us why we have not found the bones of our palæolithic ancestors in the river-gravels which teem with the tokens of his handicraft! As Mr. PENGELLY says, we have not yet found the remains of any animal so small as man in those beds—they are too perishable. Who could find the bones of the squirrel in the pine woods in which they live? I have seen scores of the pretty creatures day by day, yet never found a skeleton. Who could depict the forest growth, and all the beauty of summer flowers, from the dead leaves which autumn scatters? Yet less than this is preserved to the geologist. We must be grateful for what is preserved to us, and strive to extend our knowledge, and in this weird Fenland there is scope for everyone, were it only to treasure every specimen of plant or animal remains that may be found.

The Silt, being a marine formation, has entombed for us a few specimens of the denizens of the sea, as yet we have only obtained:—

Mammalia.

BALÆNA MYSTICETUS	Greenland Whale.
DELPHINUS TURSIO	Dolphin.
ORCA GLADIATOR	Grampus.
PHOCA VITULINA	Common Seal.
PHOCŒNA CRASSIDENS	Porpoise—a rare or extinct species.
TRICHECUS ROSMARUS	Walrus or Morse.

Mollusca.

RISSOA ULVÆ. CARDIUM EDULE. MYTILUS EDULIS. SCROBICULARIA PIPERATA. LITTORINA LITOREA. L. RUDIS. MYA TRUNCATA. M. ARENARIA.

Before endeavouring to analyse this fauna with reference to the climate it indicates, a few words may be said about some of the species.

Bos longifrons. This is one of the two species of oxen which have been domesticated in Britain, the other being the Urus. It is a small, fine-legged, short-horned animal, and was domesticated in Europe during the early part of the newer (*neolithic*) Stone Age. Its remains are not, according to Prof. DAWKINS, found in strata of the older (*palæolithic*) Stone Age;* and it may have been introduced into Britain by the Basque immigrants. It seems, however, to have reverted to its wild condition, and was probably hunted. Prof. DAWKINS calls this animal the Keltic short-horn, because it was the only domestic ox of the Kelts. It was certainly domesticated before the Keltic invasion, and the term long-faced ox is perhaps preferable. It was the only ox in Britain at the time of the Romans, and afforded sustenance to their legions. From it the small, dark breeds of Wales and Scotland are descended; and it survived until recently in Cornwall, Cumberland, and Westmoreland.

The remains of *B. longifrons* are plentiful in the Fens and seem to have afforded a staple article of food in the neolithic period. I found immense numbers of the bones of this animal in what are probably the remains of a Stone Age lake-dwelling at Crowland. At the great flint-implement manufactory at Grimes Graves, near Brandon, the remains of this ox are very plentiful and belong chiefly to very young calves. "It would appear from this that a principal element in the food of these people was milk, and therefore they could not afford to keep the calves, which must have consumed a large portion of what would otherwise have been available for the use of the household."†

* Remains of this animal are found associated with the mammoth, &c., in the valley gravels of the Thames, at Barnwell, &c., but DAWKINS believes them to be accidental admixtures.

† GREENWELL. Grimes Graves. Journ. Eth. Soc., vol. ii. p. 431. 1871.

Bos primigenius, the gigantic ox called Urus by CÆSAR, was a grand animal, readily distinguishable from the other species by its massive build and larger bones. The fossil remains of the wild animal are found in British palæolithic deposits, but not in neolithic. It was, however, domesticated during the late neolithic age in Switzerland and Italy, and co-existed with the smaller *B. longifrons*. It was re-introduced into England by the English invaders about A.D. 449, and eventually took the place of the smaller species, except in those parts of the country, which, from their mountainous character, afforded shelter to the oppressed Britons.

The urus seems to have become wild in Britain, and their descendants still live in a semi-wild state in a few of the English parks. Of these the Chillingham breed belonging to Lord TANKERVILLE are the purest. "They are white, with the inside of the ears reddish-brown, eyes rimmed with black, muzzles brown, horns white tipped with black."* This park is very ancient and is mentioned as early as the year 1220. At Hamilton, in Scotland, a similar breed exists, and the old forest formerly extended between the two places. Sir WALTER SCOTT was of opinion that the cattle preserved in these parks are remnants of the original inhabitants of the forest, and Mr. DARWIN thinks this not improbable. A similar breed is preserved at Chartley, the seat of Lord FERRARS; and formerly at Burton Constable and Gisburne, and by the Duke of QUEENSBERRY. Most of our common cattle are descended from the urus type.

A magnificent articulated skeleton of the urus found in Burwell Fen, and preserved in the Zoological Museum at Cambridge, is represented in the preceding Figure at the commencement of this chapter. The two-foot rule lying in front of the skeleton will give some idea of its size.

* DARWIN, Dom. An. and Cult. Plants.

The following are some of the measurements of the specimen, made by Mr. MILLER:—

Distance between the tips of the horns	2 ft.	1	in.
Length of skull	2 ,,	1	,,
,, ,, third dorsal spine	1 ,,	4·5	,,
Height of dorsal from hoof	5 ,,	3	,,
Length of left femur	1 ,,	7	,,
,, ,, tibia	1 ,,	4	,,
,, ,, humerus	1 ,,	5	,,
,, ,, ulna and radius	1 ,,	8	,,

We are indebted to Mr. J. W. CLARK M.A. for the photograph from which this illustration is engraved.

CÆSAR having described the elk and reindeer of the Hercynian forest, which lay between Helvetia and the Danube, says, *tertium est genus eorum qui uri appellantur*—the third kind of them is called the urus—and he magniloquently rather than accurately describes them as being little less than elephants—*Hi sunt magnitudine paulo infra elephantos;* and then, descending to fact, remarks that they have the appearance, colour and shape of bulls—*specie et colore et figura tauri.*

Canis lupus, the Wolf. Everyone knows that this animal was once common in England. The date of its extermination, however, is unknown. The last wolf in Scotland was shot in the year 1680, and the last Irish specimen in 1710, but the English specimens had previously become extinct.

Wolves, as Mr. DARWIN has shown,* are with other Canidæ, the parents of the different races of dogs, and though the remains of these animals have not yet been exhumed from the fen beds we may hope to find them ere long, as their bones are tolerably plentiful at Grimes Graves.

* Domesticated Animals and Cultivated Plants. To this and the works of Prof. BOYD DAWKINS, M. RUTIMEYER, Sig. GASTALDI, &c. I am indebted for most of the information respecting the old races of domesticated animals.

It is to the wolves and jackals that we must look for the parentage of our dogs; and we accordingly find that the domestic dogs of savage races are closely allied to the wild *Canidæ* of the district. Thus the dogs of the Indians are so like the North American wolves, that RICHARDSON has mistaken a band of wolves for the dogs of a party of Indians. Dr. KANE has seen in his sledge team Eskimo dogs with the oblique eye, drooping tail* and scared look of the wolf. They are so savage that when hungry they will attack their masters, and they readily become feral, and are often crossed with wolves to improve their breed. There seems to be a considerable difference in the disposition of wolves, if I may judge from my own limited experience. I had a wolf whelp about a week old brought to me in Abyssinia, which though moderately tame with me was an object of terror to our Arab servants. And whereas a beautiful Eskimo dog, belonging to Miss PECKOVER of Wisbech, is as tame as a poodle, some of the Hungarian dogs, on the other hand, are so wolfish that Mr. PAGET has known a Hungarian to mistake a wolf for one of his own dogs.

Domestic dogs differ from wild ones in voice; wild canidæ never bark, but the power is soon gained for it is said that a wolf whelp reared by a bitch barks. Dogs which have run wild, as on Juan de Nova in the Indian Ocean, become dumb in many cases, but in others retain this faculty, as in La Plata.

No wild *canidæ* have drooping ears, neither have those domestic races whose sense of hearing is valued, as in the collie; but on the Assyrian monuments (from 3400 B.C. to 2100 B.C.) a hound with drooping ears is figured, thus testifying to the ancient domestication of this animal, even

* LINNÆUS relied to distinguish them from dogs, upon the supposed fact. that wolves never carry their tails curved upwards, but Sir. J. RICHARDSON saw a family of wolves which when playing together, occasionallly carried their tails dog-fashion. Fauna Boreale Americana Mammalia. See also NOTT and GLIDDON, Types of Mankind, p. 383. Philadelphia, 1860.

if remains had not been met with in neolithic deposits. This antiquity is further shown by the representation of several distinct breeds on the monuments in question, mostly resembling greyhounds. Pariah dogs, common hounds, mastiffs, house dogs, lapdogs, and turnspits, are known by ancient writings and figures to have existed between 4000 and 5000 years ago, but, as might have been expected, they differ from their modern representatives.* The great differences in size offer one of several sound arguments against the dog having descended from a single wild species, and it is most probable that the larger races find their parentage in wolves, and the smaller ones in jackals.

The most ancient dog known lived in the neolithic period in England and on the continent. I am not aware that the remains of dogs have been found in the fens, but they were plentiful at Grimes Graves, where the old ones, being useless, seem to have been used as food. The species is not stated. In the same way the Fuegians eat their old women in times of scarcity, because "old women no use, dogs catch otters."† Prof. RÜTIMEYER, from an examination of the Swiss remains, tells us that it was of moderate size, intermediate between the wolf and jackal in the characters of the skull, and somewhat resembled our hounds, setters or spaniels. This variety existed throughout the neolithic period and was succeeded in the Bronze Age by a larger race. The same sequence is shown in the Danish deposits, and, further, a still larger variety was introduced in the Iron Age. It is very probable that the two latter kinds are not the modified descendants of the first, but fresh races introduced by invading tribes.

* The greyhounds and hounds on Egyptian sculptures of the 4th dynasty (B.C. 3400 years) on Egyptian sculptures at Beni-Hassan, and the Assyrian mastiff at Babylon have drooping ears. See the works of ROSSELINI, WILKINSON, LAYARD and NOTT and GLIDDON.

† DARWIN, Dom. An. and Cult. Plants., vol. ii. p. 215.

The discrimination of the bones of dogs from those of wolves and jackals, is a difficult task: but that the Danish ones, for instance, are really remains of domestic animals seems proved by finding that in the refuse heaps only those bones which dogs cannot devour, remain intact, as if dogs had fed upon the remainder.

The neolithic dogs, however, were not solely used for the chase, but as food also. Prof. DAWKINS found that in the refuse heap at Perthi-Chwarin, in Denbighshire." The remains of the domestic dog were rather abundant, and the per centage of young puppies implies also that they, like the other animals, had been used for food."* Similar evidence was found in the caves at that place, among the neolithic tumuli of the Yorkshire Wolds, and at Grimes Graves.

Castor fiber, the Beaver. The remains of the beaver are tolerably abundant in the Fens. The animal became extinct in England in the 12th or 13th century, but it still survives in the Rhone and in the rivers of Lithuania and Scandinavia. So far as my observation goes the beaver did not build dams in the Fens, owing, in all probability, to the abundance of still water. The late J. K. LORD, himself an experienced trapper, informed me that in North America the beaver only constructs dams in running streams, and chooses still water where possible to save the trouble of architecture.

Cervus capreolus, the Roedeer; and *C. elaphus*, the Stag. These animals were very plentiful in the ancient Fens, even within historic times. When the great forest of Kesteven (which, be it remembered, was not woodland, but merely wild, uncultivated waste, as are many deer-forests at present), was a royal hunting ground, the borderers often got into sad disgrace for disturbing them. Thus the

* Cave Hunting, p. 344.

people of Whittlesey, Thorney, and Ramsey, in the year 1306 "wasted all the fen of Kyngesdelfe, of the alders, hassacks, and rushes . . . . so that the king's deer could not have harbour there."—(*Dugdale.*) We are further informed that a certain wicked JOHN LE WODE burnt a great portion of the same fen, "which caused great loss to the king, in his harts, hinds and goats."—(*Dugdale.*)

Some of the stags attained noble dimensions. I have seen many antlers which measured 9 inches in circumference just above the brow tine.

Cervus tarandus, the Reindeer. We have no historic evidence of this animal having lived in the Fens, or even in England, but it is mentioned as living in Caithness as late as the year 1057. It is recorded by CÆSAR as inhabiting the Hercynian forest, where it has long been extinct. At present it is confined to the regions lying north of about lat. 60°.

Sus scrofa, the Wild Boar. The wild boar, still plentiful on the continent, lingered in Britain until the year 1620. It is one of the ancestors of our modern pigs, and much interest attaches to it in this connection.

The modern pigs are the descendants of the wild boar mixed with the domesticated *S. indica*, which comes from China. As this mixture has taken place in recent times, only the *S. scrofa* type concerns us; but it is necessary to remark that the foreign pig, commonly known as the Chinese, had a broader skull and shorter snout, which characters have been transmitted to the mixed race. The pure wild boar type is now, perhaps, unknown in England, but may still be seen in central and northern Europe. The narrowness of the head, the length of snout, and certain differences in the palate bones and pre-molar teeth, at once distinguish it from the Chinese type, though it must be remembered that the two last characters are found in the mixed breed.

"RÜTIMEYER has made the remarkable discovery that there lived contemporaneously in Switzerland, during the later Stone, or Neolithic period, two domesticated forms, the *S. scrofa*, and the *S. scrofa palustris* or Peat pig (*Torfschwein*). RÜTIMEYER perceived that the latter approached the Eastern breeds, and, according to NATHUSIUS, it certainly belongs to the *S. indica* group; but RÜTIMEYER has subsequently shown that it differs in some well-marked characters. This author was formerly convinced that his *Torfschwein* existed as a wild animal during the first part of the Stone period, and was domesticated during a later part of the same period. NATHUSIUS, whilst he fully admits the curious fact first observed by RÜTIMEYER, that the bones of domesticated and wild animals can be distinguished by their different aspect, yet, from special difficulties in the case of the bones of the pig, is not convinced of the truth of this conclusion; and RÜTIMEYER himself seems now to feel some doubt. As the *Torfschwein* was domesticated at so early a period, and as its remains have been found in several parts of Europe, belonging to various historic and pre-historic ages, and as closely allied forms still exist in Hungary and on the shores of the Mediterranean, one is led to suspect that the wild *S. indica* formerly ranged from Europe to China, in the same manner as *S. scrofa* now ranges from Europe to Hindostan. Or, as RÜTIMEYER apparently suspects, a third allied species may formerly have lived in Europe and eastern Asia."*

I am not aware that the Peat pig has been found in British neolithic deposits, but we may hope to add it to our fauna when the animals of the Fen peat have been examined.

Capra hircus, the Goat. It is generally believed that our goats are descended from the wild *C. ægagrus* of the Asiatic

* DARWIN. Dom. An. and Cult. Plants, vol. i. p. 67.

mountains. It seems to have been domesticated before the sheep, probably in consequence of its hardiness, and the goats in neolithic deposits, such as those at Grimes Graves, are in noways distinguishable from their modern descendants.

Equus caballus, the Horse. The horse is found fossil in beds of pliocene age in France and Italy; but, as yet, it has not been met with in England in beds older than the pre-glacial Forest beds of Norfolk. Its remains occur in considerable plenty in the palæolithic deposits, but it does not seem to have been domesticated until neolithic times. It was, however, used as food in palæolithic times, and continued to be an article of diet until the introduction of Christianity, when "it was forbidden by the church because it was eaten by the Scandinavian peoples in honour of ODIN . . . . . The present prejudice against its use is a remarkable instance of the change in taste, which has been brought about by an ecclesiastical rule aimed at a long-forgotten faith."* Here we have an admirable instance of prejudice, a variety of superstition, being as Mr. E. B. TYLOR says, "the standing over of old habits into the midst of a new and changed state of things."†

The proof of the use of horse-flesh for food, is found in the remains of bones which, like those of the deer, ox, goat, &c., have beeen split for the sake of the marrow. These have been found in the refuse heaps of palæolithic age, as in Périgord, of neolithic age, as in the cave near Cefn, St. Asaph; of the bronze, iron, and historic periods, as at the Victoria Cave, near Settle.

Indeed I take it that the domestication of the horse was first undertaken from its value as a food animal, for it is hard to conceive any savage boldly reasoning that such a creature would carry him with swiftness, and convey his

* DAWKINS. Cave Hunting, p. 132. † Early Hist. Mank., p. 218.

burdens with ease, and then capturing one to experiment upon. Much more likely is it that the docility of the horses which were to serve as food suggested their use as beasts of burden, and when this was found feasible some reckless dare-devil might trust his precious body upon the back of one, from which time it would not take long to produce a race of horse-riders timerous it may be at first, like the modern Dahoman nobles who take equestrian exercise with the aid of three men, one upon each side to hold his magnificence on by the legs, and one to lead the steed; and who, even then, if their streaming faces be taken as proof, find it dangerously exciting.* More probably such a stage was not passed, for a hunting race would be more courageous than the do-nothing Africans, and good riders may have been speedily produced as was the case in America. There is no proof that horses were ridden before the introduction of metals, but when Cæsar landed here the Keltic natives were certainly fine horse-men.

The horse, we have seen, is indigenous to Europe, and the fossil remains show no specific characters to distinguish them from modern races. Certain peculiarities there were, of which the disportionate size of the head was one, as shown in a skeleton from a palæolithic stratum at Solutré, now in the museum at Lyons; and it is a striking proof of the authenticity of the palæolithic drawings above mentioned that they represent the wild horses with this peculiar feature.†

It may be of use to the student to know that only male horses have canine teeth as a rule, but they are occasionally found in mares.

Ursus arctos, the Brown Bear. This animal is known historically as a British species, but we can only say respecting it that it became extinct between A.D. 500 and 1000. Its

* Skertchly. Dahomey As it is. † Dawkins. Cave Hunting, p. 344.

most western extension in Europe is the Vosges and Pyrenees in the south, and Norway in the north. Prof. BOYD DAWKINS has pronounced a *requiescat in pace* over the myth that the last British bear was destroyed in Scotland by the founder of the GORDON family, for he shows their crest to be not a b*e*ar's, but a b*o*ar's head.

In trying to determine the climatal conditions under which the above, and the associated animals and plants flourished, we are brought face to face with a similar difficulty to that which we encounted in respect to the old gravels—the commingling of forms which did not live together. But in this case, with the single exception of the pelican, the fauna and flora bespeak a climate colder than the present one, and this is especially the case with the marine mammalia. It must be remembered that the list given makes no distinction between specimens found deep beneath the surface and those close to it, nor between those occuring near to, and specimens found far from the coast. A relic from the peat may be of any age from the oldest of the fen beds to just before the Roman period; and the silt specimens may vary from the same age to the present according to the depth of the find and its proximity to the sea.

I believe it, however, to be a fact that the more boreal species occur in positions which indicate considerable antiquity. I have notes respecting the following which all occur in the older parts of the fen deposits :—

Reindeer	at	5	feet in	Feltwell Fen.
Grampus	,,	3	,,	Thorney Fen.
Walrus	,,	10	,,	Fens near Ely.
Greenland Whale	,,	30	,,	Swineshead.

I am not aware that this last animal has been recorded as found in British seas. The specimen alluded to is in the possession of Mr. W. LITTLE of Heckington, who gave me the information respecting it. The dwarf birch is not now indigenous to England, but is found in Scotland. From the presence of these species I think we are justified in concluding that the climate in the early part of what may for convenience be called the 'fen period' was colder than at present and has gradually ameliorated. This conclusion is further strengthened by the fact that the bark of the Scotch firs in the old buried forests is much thicker than in the living representatives of the same area; and it agrees with the purely geological evidence, as will be shown in the sequel. The fresh-water molluscs tell us nothing upon this point—they might have been gathered in Lapland or in Italy.

Summary.

A careful consideration of the fossil remains found in the Fenland seem to justify us in drawing the following conclusions:—

1.—That the Old Gravels possess a fauna which is more closely allied to pre- than to post-glacial times.

2.—That the remarkable admixture of boreal, temperate, and southern forms shows the period to have been one of long duration, in which great climatal changes occurred.

3.—That the old gravels are separated from the present by an interval of time greater than that which separates the oldest of the true fen beds from our era.

4.—That even the fresh-water species exhibit considerable change, although they are of such persistent character.

5.—That these gravels are separated from the peat and silt by a series of almost unfossiliferous gravels.

6.—That the peat and silt faunæ closely resemble the present one.

7.—That the older portions indicate a colder climate than the present one.

8.—That the climate has gradually ameliorated.

[S. B. J. S.]

CHAPTER XII.

THE MODERN FAUNA OF THE FENLAND.

SECTION I.—*The Fauna of the Early Historic Period.*

AN early notice of the Natural History of the Fens is found in the *Liber Eliensis*, where an account of the Natural Products of the Isle of Ely is given in terms which we shall presently quote. The period is that of the 11th century—the time of the Norman Conquest. Many a man had in vain attempted to enter this Isle but had failed, and their "bodies were long after found putrified in their harness, and dragged from the bottom of the river; but one only, man (whose name was BEDA) getting into the Isle." (DUG., ii. ed., p. 186). This BEDA succeeds in returning to the Norman army; his account displeases WILLIAM DE WARREN, but if the record be true the Conqueror himself receives a report somewhat to the following effect (the latin text and a commentary on it is given below.)

The Island was plentifully enriched,—it was supplied with different herbs, and excelled the other parts of Anglia in the fruitfulness of its soil, the charming pleasantness of its fields and pastures and in the immense number of its flocks and herds. Its vineyards were not worthy of equal praise, but it possessed forests stored with animals of chase, and was surrounded by great waters and wide Swamps, as if it were locked in by a strong rampart.

In the Island there was an abundance of domestic animals and a multitude of wild creatures—of stags, little roes (*dammularum*), goats and hares in the woods, and near the morasses. Also a fair number of otters, weasels, ermines, ferrets which in severe winters were caught in traps, snares or by other devices.

By the flood-gates of the Fen innumerable eels were netted, great pike, pickerels, perch, roach, barbel, lampreys (which were called water snakes), and sometimes shad and a royal fish, the turbot, was taken.

Then as to birds—there were vast quantities of geese, "*fis-cedulæ*," coots, cormorants, gulls, herons, and ducks, of which last there was a great number in winter-time; and and when the birds were moulting, they were often caught by hundreds at a time. They were taken by snares, nets, and bird-lime. The latin text is as under.

"Si optatis audire quæ novi et vidi, cuncta vobis retexam. Intrinsecus insula copiose ditatur, diverso gramine repletur, et cæteris Angliæ locis uberiore gleba præstantior. Agrorum quoque et pascuorum amœnitate gratissima, ferarum venatione insignis, pecoribus atque jumentis non mediocriter fertilis, silvis, vineis non æque laudabilis, aquis magnis et paludibus latis velut muro forti obsita. In qua domesticorum animalium habundantia est et ferarum multitudo, cervorum, dammularum, caprarum, et leporum in nemoribus et secus easdem paludes. Insuper luterium,[1] mustelarum,[2] erminarum,[3] et putesiarum,[4] satis copia est, quæ nunc gravi

[1] luterium—otter. [2] mustela—weasel. [3] ermina—ermine, stoat.

[4] putesiarum, etc. = putacius, cati seu felis species. [Aremoricis *Pulask*, nostris *Putois*, Historie naturalis Scriptoribus *Putorius*, idem ut videtur qui Græcis ἰκτὶς dicitur]; sic nuncupata, quod fœteat, de quo Scaliger contra Cardanum cap. 210, num. 3. "Inter ea quinque," inquit, "catus fætens quoque est; pilo obscuriore; sed tam tetro odore, ut Putin Liguribus Taurinis, in Gallia Putois sit cognominatus. Silvester Giraldus in Topograph. Hiberniæ dist. I. cap. 21 et ex eo Bromptonus. "Caret herminis, caret et Putaciis." Du Cange.

hieme muscipulis,[5] laqueis, vel quolibet capiuntur ingenio. De genere vero piscium, volatilium, atque natancium quæ illuc pullulant quid dicam? Ad gurgites in gyrum aquarum illarum innumerabiles anguillæ irretiuntur, grandes lupi aquatici,[6] et luceoli,[7] percidæ,[8] roceæ,[9] burbuces[10] et murenæ,[11] quas nos serpentes aquaticas vocamus. Aliquando vero isicii[12] simul et regalis piscis, rumbus,[13] a pluribus capi

[5] muscipulis—Felis, quod muribus insidias faciat, sic dictus. Du Cange.

[6] lupi aquatici—Pike (?) but compare Isicium given below.

[7] luceoli—Pickerel (?)

[8] percidæ—perch. Du Cange perchia, perticæ. Vivaria, stagna, lacus, servoria et hujus modi piscarias suas quisque discretius bresmiis et Perchiis faciat instaurari. Fleta, lib. cap. 73, § 20.

[9] roceæ—roach. Piscis genus. Gall. *Rosse*, Gesnero *Rutilus*. Chronicon Trudonense, tom. 7. Spicilegum D'Achery, p. 509. "Pisces qui afferebantur de Mosa, quos poetica licentia vocare possümus Roceas et Bardos." Du Cange.

[10] burbuces—Du Cange gives Bardus, Piscis. Gall. Barbeau, quoting the above. Also he says "Barbula = Barbæ species. Gall. Barbillon, *pili qui in utraque oris parte quorundam piscium nascuntur*. And Boyer, Fr. and Eng. Dict. 1817, gives "barbel" as the translation of 'barbeau' and 'barbillon.' See also Littre's Dict.

[11] murenæ—eel pouts or lampreys.

[12] Isicii—Isicium (farcimentum) . . . . Jacobus-a-partibus in Glossis ad Alexandr. Iatrosophistam lib. ii. cap. 73. "Isicia sic fiunt. coquuntur pisces, et postea ponuntur in aceto, vel vino, et super aspergitur pulvis aromaticarum specierum. Isidor lib. xx. orig. Isocem piscem quendam vocant, ex quo primum isitia facta sunt et quamvis ex alio genere piscium fiant, initium tamen piscis hic et vocabulum dedit. Henry of Huntingdon's history of Britain. "Fluviis vero abundant valde piscosis . . . precipue Isicio redundat et anguilla." Lampridius first made this dish; directions for cooking it are given in Apicius lib. 2. cap. i. de Hysitiis. Cæsarius, lib. vj. Miracul: cap. 5, "Accipe ositium et ossibus rejectis cum piperamentis præpara, sicque appones et dices. "Comedite de bono rhombo." Isix = Pisci genus, aliis Esox, Gall. Alose. Du Cange. But Boyer gives "alose = shad. sorte de poisson de mer." Esox = a large fish found in the Rhine, and by some supposed to be a salmon, a lax, ἴσοξ. "Genus piscis qui in Rheno insigni magnitudine crescit, alii Lucium alii Salmonem esse putant." Pliny Hist. Nat. lib. ix. c. 16.

The modern scientific name of 'pike' is '*Esox lucius*.' Compare the well-known coat of arms of Lucy of Charlcote, given in Dugdale's Antiquities of Warwickshire, where three silver fishes are borne in the name of Lucy. From these passages we may conjecture isicii to be salmon or salmon trout, but the meaning is uncertain.

[13] rumbus—Turbot.

memoratur. De avibus namque quæ ibidem et juxta mansitant, sicut de cæteris, nisi fastidio sit, exprimemus. Anseres innumeræ, fiscedulæ,[14] fulicæ,[15] mergæ,[16] corvæ aquaticæ, ardeæ et anetes, quarum copia maxima est brumali tempore vel cum aves pennas mutant, per centum et tres centas captas vidi plus minusve: nonnunquam in laqueis et retibus ac glutine capi solent."

[14] fiscedulæ—The becafico is never found in England, and the name must be used for some other bird—finches. (?)

[15] fulicæ—coot. avis aquatica anate paulo minor, sed corporis forma consimilis. Facciolati.

[16] "mergus = a sea fowl, a cormorant: a sea gull; a heron, a divedapper." Facciolati.

I am indebted to the REV. D. J. STEWART, M.A., *Editor of Liber Eliensis, for these notes.* [S. H. M.]

SECTION II.—*Mammalia.*

(THE PRESENT).

IN the preparation of the following list the writer has consulted a manuscript, deposited in the Museum of Zoology and Comparative Anatomy at Cambridge, by the Rev. LEONARD JENYNS, M.A. This MS. is entitled "Collections towards a Fauna Cantabrigiensis"—also, he has referred to part i. of the Fauna of Norfolk, by THOMAS SOUTHWELL, in the Transactions of the Norfolk and Norwich Naturalists' Society, 1870-71, and LUBBOCK's "Fauna of Norfolk." To these sources of information the writer is specially indebted.

Cheiroptera.

VESPERTILIO.

1. *V. Noctula.* (Gmel.) Great Bat or Noctule of BUFFON.

Very common in the neighbourhood of Cambridge. The extent of the wings is 13 inches, have often been taken under the eaves of Queen's College, Cambridge. (*Jenyns.*) Not rare at Brandon. (*S.B.J.S.*)
Not uncommon throughout Norfolk. (*Southwell.*)

2. *V. Pipistrellus.* (Gmel.) The Common Bat.

The *Flitter Mouse* of some people, called Haddabat near Brandon. General in the district.

VESPERTILIO.

3. *V. Nattereri.* (Kuhl.) Reddish Grey Bat.

Occurs in hollow trees in gardens and orchards. (*Jenyns.*)
Found in Norfolk. (*Southwell.*)

4. *V. Mystacinus.* (Leisl.) Whiskered Bat.

This species occurs, though rarely, in Cambridgeshire. (*Jenyns.*) ✓

PLECOTUS.

5. *P. Auritus.* (Geoff.) Long-eared Bat.

Common in most places, resorting in great numbers to churches and the roofs of houses. (*Jenyns.*)

[*P. brevimanus.* (Jen.) A specimen was taken in Grunty Fen, and was supposed by the author to be a variety of the above.]

Not uncommon in Norfolk. (*Southwell.*)

BARBASTELLUS.

6. *B. Daubentonii.* (Bell.) Barbastelle.

Has been caught at Bottisham Hall by Mr. JENYNS. Taken in Norfolk and Suffolk. (*Southwell.*)

Insectivora.

ERINACEUS.

1. *Erinaceus europæus.* (Linn.) Hedgehog. Common.

TALPHA.

1. *Talpa vulgaris.* (Linn.) Mole. Common.

A cream colored variety has occured in Norfolk. (*Southwell*), also (*E. L. K.*)

SOREX.

1. *Sorex araneus.* (Linn.) The Common Shrew.

"Frequent in the Fens where it sometimes attains a large size." (*Jenyns.*)
Local name in Norfolk "Ranny." (*Southwell.*)

[*var. S. castaneus.* (Jen.) Chesnut Shrew. A pair obtained in Burwell Fen many years ago.]

2. *S. hibernicus.* (Jen.) Irish or Rustic Shrew.

"I have taken it in a single instance in Horningsea Fen, but not elsewhere." (*Jenyns.*)

3. *S. fodiens.* (Pall.) The Water Shrew.

By no means uncommon in the Fens. (*Jenyns.*)
It occurs in Norfolk, but not so generally as the Common Shrew. (*Lubbock.*)

4. *S. remifer.* (Geoff.) The Oared Shrew.

This has been taken both in Norfolk and Cambridgeshire; Mr. JENYNS doubts whether the foreign specimen in the British Museum (marked *S. remifer*) is identical with the species originally described by GEOFFROY.

Carnivora.

Meles.

1. *Melus taxus*. (Fleming.) Badger.

Of very uncommon occurrence in Cambridgeshire at the present day. One was trapped at Bottisham Hall in Nov. 1844, and is now in the Mus. of Camb. Phil. Soc. (*Jenyns*.)

The last one taken in Norfolk, as recorded in Mr. Southwell's list, was in 1868, at Somerton.

On the 10th Feb., 1868, a fine female was killed at Gorefield near Wisbech, and is now in Wisbech Museum. (*Zool. 1868*, p. 1176.)

Lutra.

1. *Lutra vulgaris*. (Desm.) The Otter.

It occurs, though rarely, in Burwell Fen. (*Jenyns*.)

Since the Fens are drained so thoroughly and all the Meres are dried up, it is very doubtful if it is ever found here at the present day; but in Norfolk where the 'broads' still exist it is pretty plentiful. (See *Lubbock's* Fauna of Norfolk, and *Southwell's* list.)

It is also found in the secluded rivulets of W. Norfolk. A litter of Otters was taken in the Little Ouse at Brandon in March, 1877. (*S. B. J. S.*)

Mustela.

1. *M. vulgaris*. (Gmel.) Common Weasel.

Common in Norfolk where it is called *Mouse hunter*.

2. *M. erminea*. (Linn.) The Stoat.

Occasionally met with during severe winters, in a pure white or ermine state. (*Jenyns*.) It is found so in Norfolk. (*Southwell*.)

3. *M. putorius*. (Linn.) Polecat.

Although generally met with it is by no means common in Norfolk. (*Southwell*.)

I should think never found in Marshland until after clumps of trees were grown. (*E. L. King*.)

Martes.

1. *Martes foina*. (Linn.) Marten.

Rather rare in Cambridgeshire. (*Jenyns*.)

"Paget writing in 1834 says, "the Marten was formerly found at Herringfleet, Norfolk, but is now extremely rare." (*Southwell*.)

It is not probable that it exists in the Fen district at the present time, and certainly not in the days of no trees. (*S. H. M.*)

Vulpes.

1. *Vulpes vulgaris*. (Flem.) Fox.

"Frequents the woodland parts of the county chiefly." (*Jenyns*.)

Recently a straggler committed depredations among the poultry in the farm-yards between March and Wisbech, and for some weeks eluded its pursuers. (*S. H. M.*)

Not unfrequent in Lincolnshire on the borders of the hunting districts, whence it has escaped. I have seen it in Bourn Fen. (*S. B. J. S.*)

See note in Norfolk List by *Southwell*.

PHOCA.

1. *Phoca vitulina.* (Linn.) Common Seal.

It is frequently seen in large numbers in the Wash, basking on the sand banks. Seals' Sand, named from the abundance of this animal, lies about 6 miles from the Norfolk coast and between the outfalls of the Nene and Ouse. (*S. H. M.*)

Rodentia.

SCIURUS.

1. *Sciurus vulgaris.* (Linn.) Squirrel—called Puggy around Brandon.

Common in some of the more wooded parts of Cambridgeshire, but rare elsewhere. (*Jenyns.*)

Also in Norfolk, and more frequantly found in the Fen. (*E.-L. K.*)

Very numerous round Brandon. (*S. B. J. S.*)

MUS.

1. *M. messorius.* (Shaw.) Harvest Mouse.

Of frequent occurrence in corn fields about Ely, &c. (*Jenyns.*)

Found also near Brandon. (*S. B. J. S.*)

Somewhat local but not uncommon. Two females brought forth young ones in captivity in Lynn Museum. (*Southwell.*)

2. *M. Sylvaticus.* (Linn.) Long-tailed Mouse.

3. *M. musculus.* (Linn.) House Mouse.

4. *M. rattus.* (Linn.) Black Rat.

5. *M. decumanus.* (Pall.) Brown Rat. Abundant.

The *Black Rat* is extremely rare if not quite extinct in Norfolk.

Frequents houses and is truly indigenous; but is now much less general than the *Brown Rat.* (*Man. of Brit. Vertebrates. Jenyns.*)

It is supposed that the Brown Rat is the cause of the extermination, in the neighbourhood of maritime towns we have lost the Black Rat, and the Brown Rat has become abundant, the Black Rat is only found in distant Rural Villages. (*E. L. K.*)

ARVICOLA.

1. *A. amphibia.* (Linn.) Water Vole.

Not unfrequent in the Fens about Ely. (*Jenyns.*)

Common in marshes and low ground. (*Southwell.*)

Plentiful in Suffolk Fens. (*S. B. J. S.*)

2. *A. arvalis.* (Pall.) } Field Vole.
3. *A. agrestis.* (Flem.) }

Extremely common in low damp pastures; in certain seasons abounding in the Fens to an astonishing degree. (*Jenyns.*)

4. *A. rubidus.* (*Baillon.*) } Bank Vole.
5. *A. riparia.* (*Yarr.*) }

Not common. (*Jenyns.*)

LEPUS.

1. *L. timidus.* (Linn.) Common Hare.

Very abundant. See the note in Norfolk list by *Southwell* for parti-colored variety.

2. *L. cuniculus.* (Linn.) Rabbit.

Very common in most parts of the district.

Cetacea.

PHOCÆNA.

1. *Phocœna communis.* (F. Cuet.) Common Porpoise.

Sometimes enters the harbours. (*Southwell.*) Common in the Wash.

BALÆNA.

1. *Balœna physalus.* (Linn.)
2. *Physalus antiquorum.* (Gray.) } Razor-back common fin Whale.

1842. One taken in Estuary near Lynn; it measured forty-two feet in length.
1858. One taken off Wainfleet measured thirty-two feet. (*Southwell.*)

HYPEROODON.

1. *Hyperoodon rostratus.* (Chem.) Bottlehead.

One measuring 24ft. 8in. in length was stranded near the entrance of the Ouse in 1858; two others near the same spot on 23rd Sept., 1867. Mr. E. L. KING states that the female measured 26ft. 8in. and the male 18ft. 6in. (*Southwell.*)

Whales have been frequently stranded upon the shores of the estuary in the neighbourhood of Boston. (*Thompson's Hist. of Boston, p. 682.*)

SECTION III.—*Birds of the Fenland.*

(THE PAST.)

WHEN the Fen district was subject to yearly inundations, or the islets alone were the permanent abode of man—when vast tracts, which have now become corn fields, were a wilderness of sedge and reeds—wild fowl innumerable had a home on this watery plain. The waders and the swimmers found abundant retreats for nesting, unmolested—and

. . . . . "the living clouds on clouds arose!
Infinite wing! till all the plume-dark air
And rude resounding shore were one wild cry."

The cotemporaries of St. Audrey were comparative strangers to the song of birds, save, perhaps, the twitterings of the Sedge-warbler, or the "harsher melody" of the Reed Sparrow. The birds abundant in the 12th century have already been noticed in the quotation from *Liber Eliensis*.

An East Anglian writer says, "The Norfolk Fens must in days of yore have literally swarmed with different species of birds . . . . But Norfolk in its present state, is the last stronghold of several aquatic species."*

The list here taken from the 36th vol. of the Archeologia, furnishes us with some notion of what birds were plentiful in Marshland in the 16th century.

"From a list of Presents received at the Wedding of the daughter of Mr. Moor of Losely in 1567, from M. Balam, Esquire, out of Mershland in Norfolk."

Cranes................	ix.
Hernshawes	v.
Curlewes.............	j.
Ducks Mallards	xliiij.
Teeles	xxvj.
Plovers	ix. dozen.
Swannes	ix.
Larks	xxxviij. dozen.
Bytters	xvj.
Knotts................	iiij. dozen iiij. or.
Styntes	vii. dozen di.
Godwytts	xxij.

A recent writer expatiating on the grandeur of Whittlesea's shining mere as it was in its old wilderness state—remarks. "But grand enough it was . . . . . while dark green alders, and pale green reeds, stretched for miles round the broad lagoon, where the Coot clanked, and the Bittern boomed, and the Sedge-bird, not content with its own sweet song, mocked the notes of all the birds around; while high overhead hung, motionless, Hawk beyond Hawk, Buzzard beyond Buzzard, Kite beyond Kite, as far as the eye could see. Far off, upon the silver mere, would rise a puff of smoke

* Observations on the Fauna of Norfolk, by the Rev. Richard Lubbock.

from a punt invisible from its flatness and its white paint. Then down the wind came the boom of the great stanchion-gun; and after that sound another sound, louder as it neared; a cry as of all the bells of Cambridge, and all the hounds of Cottesmore; and overhead rushed and whirled the skein of terrified wild-fowl, screaming, piping, clacking, croaking, filling the air with the hoarse rattle of their wings, while clear above all sounded the wild whistle of the Curlew, and the trumpet note of the great wild Swan. They are all gone now."* They are gone as regular breeders in the Fens, but are yet occasional or regular visitants. Fifty years ago the three species of Harriers (Buzzards) and the short-eared Owl were numerous, but as drainage progressed and land was cultivated, these birds were driven from their old resorts. The Marsh Harrier went first, then the Hen-Harrier; the Mantagu's and the short-eared Owl lingered while they could find a breeding place.† The Ruffs and the Reeves and others of the *Scolopacidæ*, formerly so numerous "that a fenman told PENNANT he once caught six dozen in one morning (*Yarrell*) these are now only summer visitants. "The Snipe, the Water-Rail, and the Spotted Crake still, but in very small numbers, frequent the Fens for the purpose of breeding, and with them concludes the list of those birds which still abide in the district of which they must have been at one time most characteristic."‡

not so since

The following note from STEVENSON'S birds of Norfolk was written by Mr. FOSTER, late curator of the Wisbech Museum. Mr. FOSTER a short time before his death offered to supply a similar description for "THE FENLAND."

Plover Netting in the Fens.

"The capture of birds by means of a net has long been practised by fowlers in the fens of Cambridgeshire, near

* Prose Idylls, the Fens, by Canon CHARLES KINGSLEY.

† See STEVENSON'S Birds of Norfolk, vol. i., p. 57. ‡ IBID.

Wisbech, and has in days gone by, been a very lucrative occupation. The birds so taken are principally Waders and include Dunlins, Knots, Ruffs and Reeves, Redshanks, Lapwings, Golden Plovers and occasionally Curlews, and black and bar-tailed Godwits. On one occasion within the last twelve years a small flock of nine Dusky Sandpipers or Spotted Redshanks (*Sotanus fuscus*) was so obtained, and I purchased them alive. The Zoological Society's Gardens have frequently been enriched by fen-birds which have been caught by nets in this locality. The nets are brought into requisition twice in the year, viz. at Michaelmas (September and October) and Lady-day (March and April) at which periods birds visit the washes. I personally know one fowler who has taken as many as four dozen and nine Lapwings at one time, and twenty-four dozen in the course of one day. The market price of this species is sixpence each. Guyhirn and Whittlesea Marshes were at one time periodically flooded, and many varieties of wild fowl visited them. Since the improved drainage of those parts of the Fens, it is seldom that the washes are naturally flooded, and the fowler's occupation would be gone were not artificial means adopted. This latter mode of flooding is by means of a "slacker" or small sluice, through which water is admitted, and an erea of eight to twelve acres is thus covered with water from six to eight inches in depth. In one portion of this lake the fowler constructs a small island about thirty-six feet in length and from four to five feet in breadth, Upon this his net is spread, which is stained the colour of the ground, and its meshes proportioned to the size of the birds he is likely to take; some nets having meshes one and a half-inch, and others three inches in size. The fowler keeps some live "decoy" birds (Lapwings or Ruffs) and a dozen stuffed skins or "stales" and these are placed on the island, close outside the range of the net.

The living birds being tethered, are made to flutter their wings, whilst the fowler with a whistle imitates the call of the birds on the wash; they are thus tempted to alight on the island and are ultimately captured. The net, covering the surface, is so arranged that the fowler, who sits at a distance of upwards two hundred yards, by means of a string attached to pullies, throws over the net, and the birds are jerked into the water and covered by it. The fowler rapidly approaches, and either takes the birds alive, or at once breaks their necks and draws them through the meshes. The following is the method of arranging the net:—When stretched on the ground the net is fastened down with small pegs on the side nearest the fowler. It is held out in its narrow width by two poles, four feet in length, having a groove at the end, through which a rope passes from pullies fixed parallel to the poles and some few feet from them, and from which is also carried at right angles the long line held by the fowler. The two poles work in joints, and, at the fitting moment, the fowler pulls the line, then the net is suddenly cast over and falls towards the pullies, throwing the birds into the water, and covering them as before stated. Lapwings fly with the wind, Ruffs and Reeves against it, and as they are sometimes taken when on the wing, the net is arranged accordingly, being held out by poles ten feet in height."

We may say in brief, that the aquatic birds have retired from the Fens, and the songsters have occupied the land. Most of the common birds have found their way hither. Every orchard or wooded part is vocal with the song of the Thrushes and Blackbird, and from every corn-field rises the joyful Lark. Our list shows that more than twenty of the *Sylviadæ* are found in the Fen country. The Nightingale, no doubt, was a recent comer, but when we do not know. It is heard in the Isle of Ely certainly, although at times "the exquisite notes of the common Song-thrush" may be mistaken for those of Philomela. We have known such to be the case in Marshland.

A list of Fen Birds (early part of 17th century) is given in

DRAYTON'S POLYOLBION, 25th SONG,

(From Holland's Oration.)

My various Fleets for Fowle, O who is he can tell,
The species that in me for multitudes excell!
The *Duck* and *Mallard* first, the Falconers onely sport,
(Of Riuer-flights the chiefe, so that all other sort,
They onely Greene-Fowle tearme) in euery Mere abound,
That you would thinke they sate vpon the very ground,
Their numbers be so great, the waters couering quite,
That rais'd, the spacious ayre is darkened with their flight;
Yet still the dangerous Dykes, from shot doe them secure
Where they from Flash to Flash, like the full Epicure
Waft, as they lou'd to change their Diet euery meale;
And neere to them ye see the lesser dibling *Teale*
In Bunches, with the first that flie from Mere to Mere,
As they aboue the rest were Lords of Earth and Ayre.
The *Gossander* with them, my goodly Fennes doe show,
His head as *Ebon* blacke, the rest as white as Snow,
With whom the *Widgeon* goes, the *Golden eye*, the *Smeath*,
And in odde scattered pits, the Flags, and Reeds beneath;
The *Coot*, bald, else cleane black, that whitenesse it doth beare
Vpon the forehead star'd, the *Water-Hen* doth weare
Vpon her little tayle, in one small feather set.
The *Water-woosell* next, all over black as Ieat,

. . . .

The diuing *Dob-chick*, here among the rest you see

. . . .

With which last little Fowle . . . .
The *Puffin* we compare, which coming to the dish,
Nice pallats hardly judge, if it be flesh or fish.

. . . .

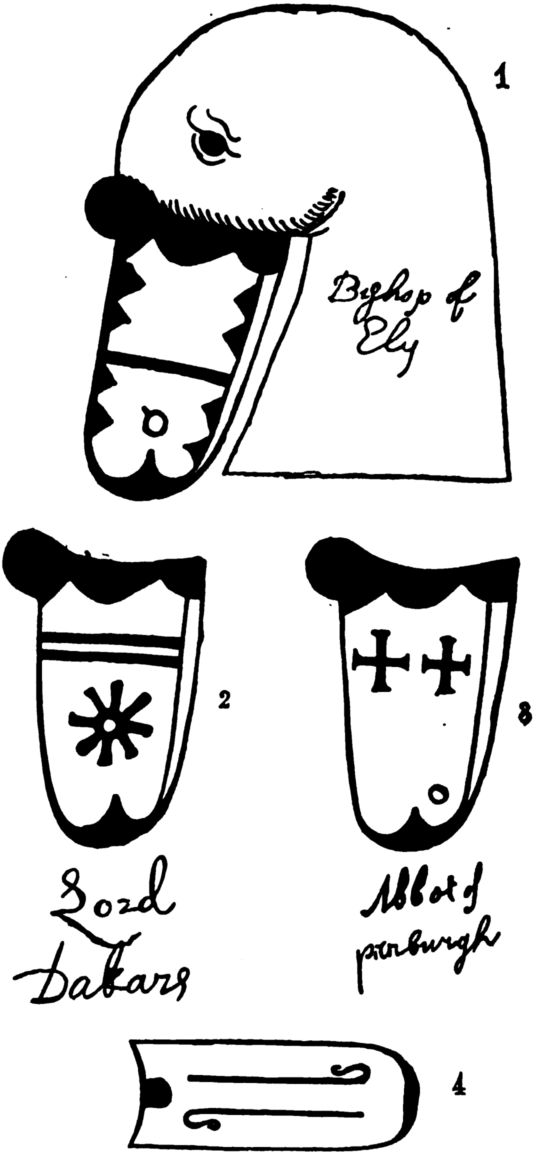
Here in my vaster Pooles, as white as Snow or Milke,
(In water blacke as *Stix*) swimmes the wild *Swanne*, the *Ilke*,
Of *Hollanders* so tearm'd . . . . ,

There stalks the stately *Crane*, as though he march'd in warre,
By him that hath the *Herne*, which (by the Fishy Carre
Can fetch with their long necks, out of the Rush and Reed,
Snigs, Fry, and yellow Frogs, whereon they often feed:
And vnder them againe, (that water neuer take,
But by some Ditches side, or little shallow Lake
Lye dabbling night and day) the pallat-pleasing *Snite*,
The *Bidcocke*, and like them the *Redshanke*, that delight
Together still to be, in some small Reedy bed,
In which these little Fowles in Summers time were bred,
The Buzzing *Bitter* sits, which through his hollow Bill,
A sudden bellowing sends, which many times doth fiill
The neigbouring *Marsh* with noyse, as though a Bull did roare;
But scarcely have I yet recited halfe my store:
And with my wondrous flocks of *Wild-geese* come I then,
Which looke as though alone they peopled all the Fen,

. . . .

Now such as flying feed, next these I must pursue;
The *Sea-meaw*, *Sea-pye*, *Gull*, and *Curlew* heere doe keepe,
As searching euery Shole, and Watching euery deepe,
To find the floating Fry, with their sharpe-pearcing sight,
Which suddenly they take, by stouping from their height.
The *Cormorant* then comes, (by his deuouring kind)
Which flying o'r the Fen, imediatly doth find
The *Fleet* best stor'd of Fish, when from his wings at full,
As though he shot himselfe into the thickned skull,
He vnder water goes, and so the Shoale pursues,
Which in to Creeks doe flie, when quickly he doth chuse,
The Fin that likes him best, and rising, flying feeds.
The *Ospray* oft here seene, though seldom here it breeds.

We cannot omit one subject to which some interest attaches, especially in reference to the Fenland itself, and that is the "Swan Marks." Certain persons had the privilege to preserve their Swans on the streams or meres and YARRELL tells us "In the 22nd year of the Reign of EDWARD the fourth, 1483, it was ordered that no person who did not possess a freehold of the clear yearly value of five marks should be permitted to keep any Swans."



Specimens of Swan Marks.

(1) This is an exact representation of the drawing of the heads, in "The Collection of Swan Marks used in the Isle of Ely," with fac-simile of inscription, "Bishop of Ely."

(2) "Lord Dakars." } From the same collection, the drawing of the head being omitted.
(3) Abbot of Peterborough. }

(4) The Swan Mark of the Abbey of Swinstede on the Witham (see Yarrell, vol. iii., p. 123).

In the Wisbech Museum there are two documents on vellum containing the "Marks." One of these has no title page nor manuscript reference; the "Marks" represent the devices, on the upper mandible of 540 different markings, but 86 are duplicates.

The first one is the royal swan mark of HENRY the eighth, and is figured in YARRELL (vol. iii., p. 124).

The second document is contained in a beautifully illuminated book, with a title page as follows:—

This collection of

SWAN MARKS,

used in the Isle of Ely, 1581, is a fac-simile of the original Register, in the Possession of

C. R. COLVILE, ESQ., M.P.,

and Presented by him to the Trustees of the Wisbech Museum, 1866.

There is a list of 92 Marks, of which we give three specimens; No. 4 is a swan mark of the Abbey of Swinstede on the Witham (from YARRELL).

SECTION IV.—*The Decoy.*

When those artificial and secluded pools called DECOYS were first used in the Fens, for alluring and netting wild ducks, mallards, teal, etc., we are not able to state.

In BLOMEFIELD'S *Norfolk*, we are informed that, "Sir WILLIAM, son of Sir W. WOODHOUSE lived in the reign of JAMES first, and is said to have been the first person who in England invented and erected decoys for taking wild ducks."

OLDFIELD'S History of *Wainfleet* contains an interesting account of the decoys of East Fen. The description is stated to have been taken from GREGORY'S Cyclopædia, art.

decoy, and to have been revised by W. SKELTON of Friskney. In one season, a few years previous to the inclosure of the Fens, ten decoys, five of which were in the parish of Friskney, furnished 31,200 ducks, widgeon, and teal, for the London market.*

The drainage of the Fens has entirely altered the condition of the country, and the wild fowl are driven from their old breeding resorts. The great bulk of our wild fowl nest on the Continent to the N. and N.E. of the British Isle, but visit this country in winter to seek for food, which perhaps is more easily obtained here, owing to our milder winters, than on the continent, they do not however come in such vast numbers as formerly and our decoys are not so commercially flourishing as in times gone by, yet we presume that the ready transit by rail and the better prices obtained in these days are some compensation for the loss of number. When Friskney sent 30,000 fowl per year to London they would not be worth half so much per brace as the birds are now.

BOROUGH FEN DECOY.

In the accompanying illustration, the plan of a decoy is that in High Borough Fen, between Peakirk and Crowland. The writer visited that spot in June 1876, and is thus enabled to give the following description from personal observation.†

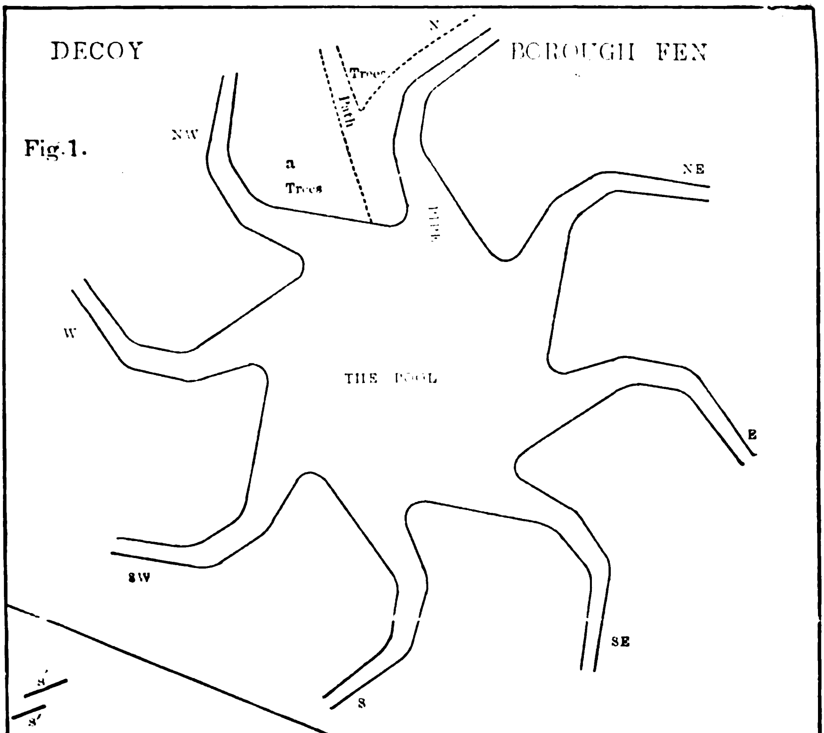
This decoy, which lies in a very retired spot, is approached by a long narrow road planted on each side with willows and flanked by ditches, and the visitor is impressed with the perfect quietude of the place.

* See also THOMPSON'S His. Boston, p. 676.

† The writer was very courteously treated by Mr. WILLIAMS, the present occupant, who permitted a sketch plan to be made on the spot. When making a tour to the west of the Fenland, in Aug. 1873, Mr. SKERTCHLY, with the writer, went to this decoy, but could not obtain admission to the pool as the wild fowl were in the decoy at that time.

DECOY BOROUGH FEN

Fig. 1.

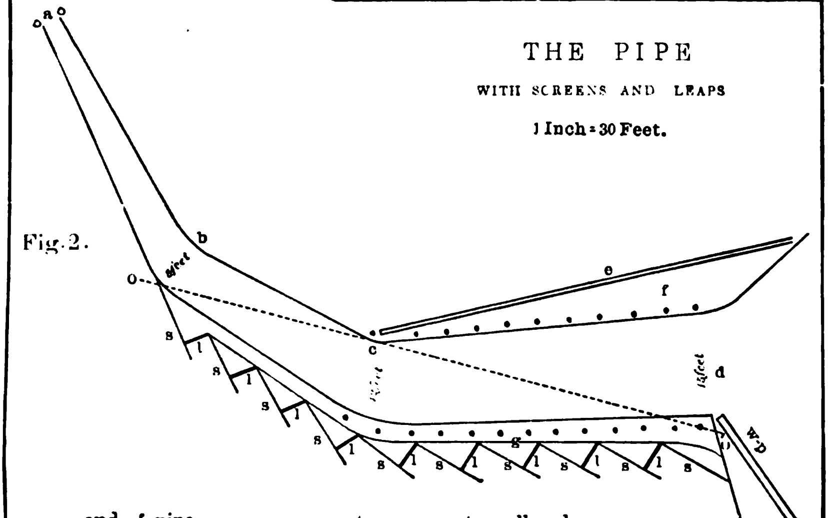


THE PIPE

WITH SCREENS AND LEAPS

1 Inch = 30 Feet.

Fig. 2.



a—end of pipe.
b—beginning of small end.
c—elbow.
d—head-end.
e—back-screen.
f—back-shore.
g—fore-shore.
l—leaps (short thick lines).
s—screens.

s'—screens at small-end.
w p—wingpole.
. .—place of poles.
o o'—dotted line to show that the pool cannot be seen from small part of Pipe.
s—shore of Pool (screened).

S. H. M

Noiselessness is the essential condition to the *existence* of a decoy, and there is a right to prevent any gun being fired within a mile of the place.

The area of the ground enclosing the decoy is 18 acres, 3 roods 26 perches—the area of the water 2½ acres.

[The Pool] Fig. 1 (see illustration) shows the form of the *pool* and the channels, called *pipes*, leading from it. These pipes (in this decoy there are 8) lie in the direction of the main points of the compass, as indicated by *N.*, *N.E.*, etc. Every approach to the margin of the pool and pipes is carefully screened by reed screens 6 ft. high, or by trees and underwood. The 8 areas (marked *a*) between the pipes are [the thickets] thickly planted with willows (*Salix Russelliana*) and osiers (*S. vitellina*) and such trees or shrubs as form a good shelter—there are also poplars and firs. Paths are left in the thickets by which the decoymen can reach the screen near the *head-end* (*d*) or mouth of the pipes; another entrance is made near the point or *small-end* (Fig. 2., *a*) this is screened by two reed fences placed as in Fig. 2. *s s*; so that a passer by is not seen even from the small-end of the pipe.

The decoymen work on the convex side of the pipes—the concave one being entirely shaded by bushes and trees.

[The Pipe.] In Fig. 2. the plan of the pipe is shown with its *screens*, etc.; *a* to *b* is the small end; *b* to *c* the elbow; *c* to *d* the head-end.

The triangular shaped piece of ground between the line *c d* and the screen marked *e*, is called the back shore (*f*) and is made for the wild fowl to lodge upon. On the side with the zig-zag line is a narrow shore (*g* the fore shore). The dots ... indicate the points where the poles are driven into the shores; these ash-poles, stripped of their bark, are bent over the pipe to receive the net which covers the pipe; from the head-end to the small-end, these arches become smaller, and the small-end has iron hoops to uphold the netting; the net is made of cord and the meshes are about 3 or 4 inches square. As the head-end of the pipes is 15 feet across the arch which spans, it requires a considerable area of netting at the elbow, the pipe narrows to 12 ft. at the beginning of the small-end, at *b* it is 8 ft. and at the termination at *a* it is 2 ft. across. At this point a moveable net is placed; by means of two stakes, shown at *a* Fig. 2., this is the *tunnel*, having several hoops, two feet apart, within it; the tunnel-net (called by some the purse net) is open to the small end of the pipe, and into this the fowl are driven and captured. The netting of a pipe costs about £15.

Two opposite pipes are the channels by which the height of the water (there are generally 18 to 14 inches) is regulated in the pool and pipes. These opposite pipes have small sluices—one of them admits the fresh water into the pool, the other runs it off.

[THE SCREENS.] The screens made of reeds and supported by oak posts are placed as marked on the plan Fig. 2. *s s* and the decoymen can walk from the first screen up to the head-end, without being seen by the birds in or near the pipe. A dotted line *o o* shows that after a person has passed the screen near the small end, opposite *b*, he cannot see the mouth of the pipe, and is not seen by the birds, whether they are in the POOL on the back-shore, or resting on the wingpole, marked *w p* in Fig. 2. There are ten screens to each pipe, the thicker lines marked *l* represent *the leaps*, over which the dog jumps when he "works" at the decoy.

[THE PIPER.] A well trained little dog—"the piper" is a necessary agent in the work of decoying; of course two or three dogs are kept in training. Every "piper" must be well educated. He is early trained to leap over boards on receiving a piece of cheese as his reward. He is taught not to bark nor to be sportive when on duty, nor to take any notice of the fowl. His business is to come quietly whenever he is called, to leap the fences when required and to return to his master for further orders.

[THE DECOY DUCKS.] In the decoy here described, about forty ducks, of the wild duck colour, are kept in the pool. They generally lay their eggs on the shores—sometimes they secrete their nests and bring off their brood unexpectedly. They are not trained to enter the pipes, but only to come to the head-end in answer to a faint whistle, and there to be fed. The principal feeding takes place at night when the wild ducks have left the decoy, but the appearance of the dog on the fore-shore is mostly a sufficient signal for bringing the tame ducks towards the pipe's mouth. Then the wild-fowl follow.

[THE DECOYING.] The wild birds generally come over to the decoy in August, but are left in quiet possession of the Pool till November. The season for catching them continues from November to March.

It must be understood that the ducks, etc., leave the decoy as night approaches and return in the day for shelter and apparent security.

Suppose a north-easterly wind blowing, the decoymen would take pipe marked *N.* so that the wind would blow from the point (nearly) towards the pool. The back-shore would then be a good shelter. There are two decoymen, placed near the extremities of the screens. A piece of wood is put in the reeds and a small opening made by moving, this enables them to see the position of the birds, they may be "banked" on the back shore, or resting on the wing pole. The man nearer the mouth of the pipe determines to commence work, throws the dog a piece of cheese, "the piper" leaps over the nearest low fence (already described) and runs along the fore-shore and comes through a hole in one of these fences—the fowl are watched through the little openings in the screens—the man near the small of the pipe, gives sign, another piece of cheese is thrown and the dog leaps again—tame ducks and wild ones are in the mouth of the pipe, the decoyman throws a few seeds (small dark refuse seeds) over the screen, the *tame ducks* begin to feed, the dog leaps again, higher up the pipe, the wild-fowl persue him to gratify their curiosity, and leave the decoy ducks at their feeding, the man near the end of the screens sees that the fowl are well in the pipe, and makes a signal to the further man, by a certain number of wavings of his hat, which screen he should "show at," he comes to the open and holds up his hat, but makes no noise, and then passes to the next and so drives the fowl into the small end of the pipe and thence into the tunnel net, the end of which is raised from the stakes at (*a*) (Fig. 2.) the end suddenly twisted, closes the mouth of this net and the birds are secured.

SECTION V.—*Birds of the Fenland.*

(THE PRESENT.)

IN arranging the following list the writer has been greatly aided by examining the Collection of Birds in the Wisbech Museum—and almost every bird noted in the list has been carefully compared with the descriptions in "YARRELL'S *British Birds*," and STEVENSON'S *Birds of Norfolk*." *

Most of the specimens in the Museum were taken in the neighbourhood; and this collection, it is believed, represents very fully the *Birds of the Fenland*.

A few in the list are not, perhaps, found in the district generally, and these are stated to be "*East-Anglian*. Any that are not in the Museum,

* The arrangement and nomenclature are adapted from YARRELL'S *Brit. Birds*, vol. I. 4th ed. (Professor NEWTON'S), and HARTING'S *Handbook of British Birds*—VAN VOORST, 1872.

but are given in YARRELL'S History, or STEVENSON'S *Birds of Norfolk*, have "YARRELL" or "STEVENSON" placed after the generic name.

A few references have been made to JENYNS' *British Vertebrates*.

The writer acknowledges the kind assistance rendered by Mr. JOHN CORDEAUX, of Great Cotes, Lincolnshire: that gentleman revised the list, added several names of birds to the same, and supplied valuable notes which are marked thus—(1) to (56.)

Of the total number of Birds found in the district, there are—

(*a*)	Permanent inhabitants, that is, nesting in greater or less numbers in the district ...	101
(*b*)	Regular visitants, not nesting, but appearing regularly each year either in the spring or autumn	74
(*c*)	Rare and occasional visitants	69

ORDER I.—BIRDS OF PREY.

(This is divided into three families, *Vultures*, *Falcons*, *Owls*; only the two latter belong to this district).

Fam.—*Falconidæ*.	RAPTORES.
Falco peregrinus.	The Peregrine Falcon.
F. subbuteo.	,, Hobby.
F. æsalon.	,, Merlin.
F. tinnunculus.	,, Kestrel
Accipiter nisus.	,, Sparrow-Hawk.
Milvus ictinus. (1.)	,, Kite.
Buteo vulgaris. (2.)	,, Common Buzzard.
B. lagopus. (3.)	,, Rough-legged Buzzard.
Pernis apivorus.	,, Honey Buzzard.*
Circus æruginosus. (4.)	,, Marsh Harrier.
C. cyaneus. } (5.)	,, Hen-Harrier.
C. cineraceus. } (5.)	,, Montagu's Harrier.

(1) *Milvus ictinus*, Kite. Formerly common, now, probably, extinct as a breeder in Lincolnshire—the last eggs were taken in 1870, from a nest in Bullington Wood, near Wragby. Since this date it has not been seen.

(2) *Buteo vulgaris*, Common Buzzard. Still nests in some localities in Lincolnshire—probably not more than a few pairs left—occurs sometimes as a migrant in the Autumn.

(3) *Buteo lagopus*, Rough-legged Buzzard. Occurs occasionally as a migrant in the Autumn.

* Has been met with several times in Cambridgeshire, JENYN'S Brit. Vert., p. 88.

(4) *Circus æruginosus*, Marsh Harrier. Formerly abundant in the Fens, and nesting. Now never occurs except as an occasional visitant, generally in the Autumn.

(5) *Circus cyaneus*, Hen-Harrier. *Circus cineraceus*, Montagu's Harrier. } The same remark will apply as (4.)

Fam.—*Strigidæ.*	RAPORTES.
Asio Otus.	The Long-eared Owl.
A. accipitrinus. (6.) (STEVENSON, vol. i., p. 50).	,, Short-eared Owl.
Strix aluco.	,, Tawny Owl.
Aluco flammeus.	,, White or Barn Owl.

ORDER II.—PASSERINE BIRDS.

Fam.—*Laniidæ.*	PASSERES.
Lanius excubitor. (7.)	The Great Grey Shrike.
L. collurio. (8.) (STEVENSON, vol. i., p. 62).	,, Red-backed Shrike.
L. auriculatus.	,, Woodchat Shrike.
Fam.—*Muscicapidæ.*	
Muscicapa grisola.	,, Spotted Fly-catcher
M. atricapilla. (9.)	,, Pied Fly-catcher.
Fam.—*Cinclidæ.*	
Cinclus aquaticus. (10.)	,, Common Dipper.
Fam.—*Turdidæ.*	
Turdus viscivorus.	,, Mistletoe Thrush.
T. pilaris.	,, Fieldfare.
T. musicus.	,, Song Thrush.
T. iliacus.	,, Redwing.
T. merula.	,, Blackbird.
T. torquatus. (11.)	,, Ring Ousel.
Fam.—*Sylviidæ.*	
Accentor modularis.	,, Hedge Sparrow.*
Erithacus rubecula.	,, Redbreast.
Daulias luscinia.	,, Nightingale.
Ruticilla phœnicurus.	,, Redstart.

(6) *Asio accipitrinus*, Short-eared Owl. A common Autumnal migrant—no doubt once remained to nest in the Fen district.

See CAMDEN'S 'Britannia' (GOUGH'S edition) vol. ii., p. 381.

(7) *Lanius excubitor*, Great Grey Shrike. An Autumn and Winter visitant only.

(8) *L. collurio*, Red-backed Shrike. A Summer migrant only, and of very rare occurrence in the Fens.

(9) *Muscicapa atricapilla*, Pied Fly-catcher. PROBABLY occurs as a migrant in the Spring and Autumn, passing through the County, but not nesting.

(10) *Cinclus aquaticus*, Dipper. Only occurs as an occasional immigrant, the Scandinavian form *Cinclus melanogaster*, having a black band across the abdomen instead of a chestnut as in the British form, has been obtained occasionally both in Norfolk and Suffolk.

(11) *Turdus torquatus*, Ring Ousel. Occurs only as a Spring and Autumn migrant.

*]The *Alpine Accentor*, *A. collaris*. A native of the European Alps, has now many times occurred in this country, in the first instance, a pair was observed at Cambridge, by Dr. THACKERAY, Nov. 22nd, 1822.] 'Zoological' Journal, 1824, (1. p. 134.)

Fam.—*Sylviidæ.*	PASSERES.
Ruticilla titys. (12.)	The Black Redstart.
Saxicola rubicola.	„ Stonechat.
S. rubetra.	„ Whinchat.
S. œnanthe.	„ Wheatear.
Acrocephalus nævius.	„ Grasshopper Warbler.
A. schœnobœnus.	„ Sedge Warbler.
A. palustris. (13.)	„ Marsh Warbler.
A. luscinioides. (14.)	„ Savi's Warbler.
A. Streperus (STEVENSON, p. 115).	„ Reed Warbler.
Sylvia atricapilla.	„ Blackcap.
S. salicaria.	„ Garden Warbler.
S. rufa.	„ Common Whitethroat.
S. curruca.	„ Lesser Whitethroat.
Phylloscopus sibilatrix.	„ Wood Warbler.
P. trochilus.	„ Willow Warbler.
P. collybita.	„ Chiffchaff.
Regulus cristatus.	„ Golden-crested Wren.
R. ignicapillus (JENYNS, p. 114.)	„ Fire-crested Regulus.
Fam.—*Troglodytidæ.*	
Troglodytes parvulus.	„ Wren.
Fam.—*Certhiidæ.*	
Certhia familiaris.	„ Tree Creeper.
Fam.—*Sittidæ.*	
Sitta cæsia.	„ Nut-hatch.
Fam.—*Paridæ.*	
Parus major.	„ Great Tit.
P. cœruleus.	„ Blue Titmouse.
P. ater.	„ Coal Titmouse.
P. palustris.	„ Marsh Titmouse.
Acredula caudata.	„ Long-tailed Tit.
(YARRELL and STEVENSON.)	
Fam.—*Panuridæ.*	
Panurus biarmicus. (15.)	„ Bearded Tit.

(12) *Ruticilla titys*, Black Redstart. A male was captured at Gedney Drove-End, South Lincolnshire, on October 25th, 1867. (*Birds of the Humber District*, p. 218.)

(13) *Acrocephalus palustris*, Marsh Warbler. One taken in Wicken Fen, Cambridge, Summer of 1861. (Zoologist 1861, p. 7755.)

Two, Whittlesford, Cambridge. See paper in "The Field," 6th May, 1871, by J. E. HARTING, "on the occurrence in England of the Marsh Warbler."

(14) *Acrocephalus luscinioides*, Savi's Warbler. "Formerly a regular Summer migrant to the Eastern Counties, until the Fenlands were drained, and used to nest annually in the Fens of Wicken, Burwell, and Whittlesea." (HARTING'S, Handbook of British Birds, p. 15.)

(15) *Panurus biarmicus*, Bearded Titmouse. Formerly a most abundant species in the Fen districts—now rare and confined probably entirely to the Broads district in Norfolk.

Fam.—*Ampelidæ.*	PASSERES.
Ampelis garrulus (East-Anglian.) (16).	The Waxwing.
Fam.—*Motacillidæ.*	
Motacilla lugubris.	„ Pied Wagtail.
M. sulphuræa. (17).	„ Grey Wagtail.
M. flava (East-Anglian).	„ Grey-headed Wagtail.
M. raii. (18.)	„ Yellow Wagtail.
Anthus trivialis.	„ Tree Pipit.
A. pratensis.	„ Meadow Pipit or Tit-lark.
*A. obscurus.**	„ Rock Pipit.
Fam.—*Alaudidæ.*	
Alauda arvensis.	„ Skylark.
A. arborea.	„ Woodlark.
Otocorys alpestris.†	„ Shorelark.
Fam.—*Emberizidæ.*	
Plectrophanes nivalis.	„ Snow Bunting.
Emberiza miliaria.	„ Common Bunting.
E. schœniclus.	„ Black-headed or Reed Bunting.
E. citrinella.	„ Yellow Bunting or Yellow Ammer.
E. cirlus (East-Anglian).	„ Cirl Bunting.
Fam.—*Fringillidæ.*	
Fringilla cœlebs.	„ Chaffinch.
F. montifringilla.	„ Brambling, or Bramble Finch.
Carduelis elegans.	„ Goldfinch.
C. spinus, (*Vide* JENYNS, p. 138.)	„ Siskin.
Linota cannabina.	„ Common Linnet.
L. flavirostris.	„ Twite.‡
L. linnaria.	„ Mealy Redpole.
L. rufescens.	„ Lesser Redpole.
Passer montanus.	„ Tree Sparrow.
(YARRELL, vol. p. 472. JENYNS, p. 135.)	
P. domesticus.	„ House Sparrow.
Coccothraustes chloris.	„ Greenfinch.
C. vulgaris.	„ Hawfinch.
Pyrrhula vulgaris.	„ Bullfinch.
Loxia curvirostra.	„ Common Crossbill.

(16) *Ampelis garrulus*, Waxwing. Only occurs as an irregular winter visitant, and usually preceding exceptionally severe weather.

(17) *Motacilla sulphuræa*, Grey Wagtail. Occurs as a winter visitant to the Fen district.

(18) *Motacilla raii*, Yellow Wagtail. A common summer migrant, nesting everywhere in the district.

* Occasionally in the autumn seen on Lincolnshire coast.

† Has occurred frequently on the coast of Norfolk as a winter immigrant.

‡ In flocks in autumn and winter in coast marshes.

Fam.—*Sturnidæ.*	PASSERES.
Sturnus vulgaris.	The Common Starling.
Pastor roseus.	„ Rose-coloured Pastor.
Fam.—*Corvidæ.*	
Corvus corone.	„ Carrion Crow.
C. cornix.	„ Hooded Crow.
C. frugilegus.	„ Rook*
C. monedula.	„ Jackdaw.
Pica caudata.	„ Magpie.
Garrulus glandarius.	„ Jay.
Nucifraga caryocatactes.	„ Nutcracker.†
Fam.—*Picidæ.*	
Picus viridis.	„ Green Woodpecker.
P. major.	„ Great Spotted Woodpecker.
P. minor.	„ Lesser Spotted Woodpecker.
Jynx torquilla (East-Anglian).	„ Wryneck.
Fam.—*Upupidæ.*	
Upupa epops. (19.)	„ Hoopoe.
Fam.—*Cuculidæ.*	
Cuculus canorus.	„ Common Cuckow.
Fam.—*Coraciidæ.*	
Coracias garrula. (20.)	„ Roller.
Fam.—*Alcedinidæ.*	
Alcedo ispida.	„ Kingfisher.
Fam.—*Hirundinidæ.*	
Hirundo rustica.	„ Swallow.
H. urbica.	„ House Martin.
H. riparia.	„ Sand Martin.
Fam.—*Cypselidæ.*	
Cypselus apus.	„ Swift.
Fam.—*Caprimulgidæ.*	
Caprimulgus Europæus.	„ Nightjar or Fern Owl.

ORDER III.—THE SCRATCHERS.

Fam.—*Columbidæ.*	RASORES.
Columba palumbus.	The Ring Dove or Wood Pigeon.
C. œnas.	„ Stock Dove

* A specimen of this Bird in the Wisbech Museum has a third leg (behind the right one) which has five toes. This is a mature bird and was shot at Sutton Bridge near the Nene Outfall.

† This was shot near Wisbech, 8th Nov. 1859. See STEVENSON, vol. i. p. 284. recorded in the Zoologist for 1859, p. 6809.

(19) *Upupa epops*, Hoopoe. Occurs occasionally in the spring and autumn as a migrant. A mature female was shot at Graby, near Bourn, early in May, 1875.

(20) *Coracias garrula*, Roller. An example of this beautiful species was shot by Mr. MARSHALL at Elsthorpe Grange, near Bourn, early in May, 1871 (Birds of the Humber District) p. 71.

Fam.—*Columbidæ.*	RASORES.
C. livia.	The Rock Dove.*
Turtur Auritus. (21.)	„ Turtle Dove.*
Fam.—*Peteroclidæ.*	
Syrrhaptes paradoxus. (22.)	„ Pallas's Sand Grouse.
Fam.—*Phasianidæ.*	
Phasianus Colchicus. (23).	„ Common Pheasant.
Fam.—*Tetraonidæ.*	
Tetrao tetrix.	„ Black Grouse.
Perdix cinerea.	„ Common Partridge.
P. rufa. (24.)	„ Red-legged Partridge.
Coturnix vulgaris.	„ Common Quail.

ORDER IV.—WADING BIRDS.

Fam.—*Otididæ.*	GRALLATORES.
Otis Tarda. (25.)	The Great Bustard.†

* Both the Rock Dove and Turtle Dove appear in the collection at the Wisbech Museum, labelled as Fen birds. But the writer presumes that they are only very occasional visitants to this district The Rock Dove is occasionally shot on the Lincolnshire coast marshes in the winter months.

(21) *Turtur auritus*, Turtle Dove. Nests annually in the neighbourhood of Lincoln, also in North Lincolnshire. [Is common near Brandon. S.B.J.S.]

(22) *Syrrhaptes paradoxus*, Pallas's Sand Grouse. Professor NEWTON records a male and female shot out of a flock of 13, on the 25th of May, at Leake, in South Lincolnshire. (Ibis, vol. vi. p. 205.) [East-Anglia, see STEVENSON.]

(23) *Phasianus colchicus*, Pheasant. The fine old breed untainted by any cross is now very rarely met with—Our English Pheasants are more or less crossed with the Ringneck, *P. torquatus*.

(24) *Perdix rufa*, Red-legged Partridge. I am told is of much more common occurrence than formerly in South Lincolnshire, in that part of the district bordering the Wash. [This bird may exterminate its more sombre relative, for it attacks it furiously and successfully, and destroys it eggs. This is well known at Brandon. S.B.J.S.]

† "This bird has now become extremely rare, and almost confined to the open parts of Norfolk and Suffolk, where the species still continues to breed in small quantities. Single individuals are occasionally observed in Cambridgeshire, and a fine male specimen was killed near Ickleton in that County in January, 1831." (JENYNS, *British Vertebrate Animals.*)

(25) *Otis tarda*, Great Bustard. *Probably* became extinct on the Lincolnshire Wolds about the commencement of the present century—but I have no positive evidence of this. One was seen near Halton-Holgate, Spilsby, in April 1866, and a pair at Candlesby in the same neighbourhood, a few years before. [See STEVENSON'S "Birds of Norfolk," vol. ii., p. 30.] No doubt these were immigrants from the European Continent.

The last occurrence of this noble species as a wanderer, was in January, 1876, when a fine male appeared in a Fen near Feltwell, Brandon, on the property of H. M. UPCHER, Esq. Much pains and trouble were taken by Mr. UPCHER to prevent the disturbance of so illustrious a stranger, and with such success that it remained several weeks in this locality, finally, however, disappearing towards the end of the following month. Through the liberality of Lord LILFORD, a female Bustard was turned down in the vicinity, with the hope of inducing the male bird to remain; the two birds took well to each other, but unfortunately, shortly afterwards, the female was found dead, having succumbed to the inclement weather in the middle of February. Lord LILFORD had another female turned down but without the desired effect, as a few days later the wild male disappeared altogether from the neighbourhood, J.C.

Fam.—*Otididæ.*	**GRALLATORES.**
O. tetrax.	**The Little Bustard.***
Fam.—*Charadriidæ.*	
Œdicnemus crepitans.	**„ Great Plover or Stone Curlew.†**
Glareola pratincola.	**„ Collared Pratincole.**
Charadrius pluvialis.	**„ Golden Plover.**
Squatarola helvetica.	**„ Grey Plover.**
Vanellus cristatus.	**„ Lapwing or Peewit.**
Eudromias morinellus.	**„ Dotterel.**
Ægialitis hiaticula.‡	**„ Ringed Plover.**
***Strepsilas interpres.* (26.)**	**„ Turnstone.**
Hæmatopus ostralegus.	**„ Oyster-catcher.**
Fam.—*Scolopacidæ.*	
***Recurvirostra avocetta.* (27.)**	**„ Avocet.‖**
Himantopus candidus.	**„ Black-winged Stilt.**
Totanus glottis.	**„ Greenshank.**
***T. fuscus*, (STEVENSON, vol. ii. p. 205.)**	**„ Spotted Redshank.**
***T. calidris.* (28.)**	**„ Common Redshank.**
T. ochropus.	**„ Green Sandpiper.**

* See STEVENSON, vol. ii. p. 45. JENYNS, p. 176.

† The Stone Curlew appears of late years to have decidedly increased in some localities in Norfolk. Mr. J. H. GURNEY, jun., mentions in the "Zoologist" for 1876, p. 4801, having in 1875 seen as many as fifty together.

‡ Mr. SOUTHWELL of Norwich has kindly afforded me the following note respecting this bird, in connection with the occurrence of maritime lepidoptera on the heaths round Brandon. (S.B.J.S.)

"I think Mr. BARRETT's observations of very great interest; and, when we consider that the same district is, or rather was till very recently, the summer home also of a shore breeding bird, viz: the King Dotterel (*C. hiaticula*), the fact is still more interesting and suggestive.

Brandon heaths have, I believe, been broken up and the King Dotterel has deserted its old nesting places; but at Thetford Warren it still breeds, arriving in the end of February, and departing in August. That this bird, whose natural breeding place is the sandy shore immediately bordering upon the sea, should be found in summer far inland, frequenting tracks of country so closely resembling its usual nesting place, appears to me to admit only of one conclusion; borne out as it is by the additional evidence so ably set forth by Mr. BARRETT. There seems very little doubt that birds return to nest to the district in which they are hatched, and that the circumstances of the locality remaining suitable, the local race will continue to resort to its native locality so long as any of its members remain alive, such being the case is it not fair to presume that the birds now frequenting Thetford Warren are descendants of the King Dotterels which rested on the shores of the pre-historic bay, the sandy margins of which are now the barren wastes of Thetford and Brandon heaths.?"

(26) *Strepsilas interpres*, Turnstone. Common on the Lincolnshire coast and the shores of the Wash in the spring and autumn.

‖ "Opposite Fosdyke wash, during summer, are vast numbers of Avocettas, called there 'yelpers' from their cry." (CAMDEN.)

(27) *Recurvirostra avocetta*, Avocet. Colonel MONTAGU, at the beginning of the present century, speaks of them as still breeding in our Fens—its extinction as a Lincolnshire bird probably took place very shortly after this date.

(28) *Totanus calidris*, Common Redshank. Nests still in a few localities in Lincolnshire.

Fam.—*Scolopacidæ*.	GRALLATORES.
Machetes pugnax. (29.)	The Ruff (male.)
	„ Reeve (female.)*
Tringoides hypoleucus.	„ The Common Sandpiper or Summer Snipe.
Tringa rufescens, (*vide* YARRELL.)	„ Buff-breasted Sandpiper.
T. canutus.	„ Knot.
T. glareola.	„ Wood Sandpiper.
T. pectoralis. (STEVENSON, vol. ii. p. 368.)	„ Pectoral Sandpiper.
T. subarquata. (30.)	„ Curlew Sandpiper.†
T. maritima.	„ Purple Sandpiper.
T. alpina.	„ Dunlin.
T. minuta.	„ Little Stint.
T. Temminckii.	„ Temminck's Stint.
Calidris arenaria.	„ Sanderling.
Phalaropus fulicarius.	„ Grey Phalarope.
Scolopax rusticola.	„ Woodcock.
S. major, (East-Anglian, STEVENSON.)	„ Great Snipe.
S. media.	„ Common Snipe.‡
S. gallinula.	„ Jack Snipe.
Limosa lapponica.	„ Bar-tailed Godwit.
L. ægocephala. (31.)	„ Black-tailed Godwit.
Numenius arquatus.	„ Common Curlew.
N. phæopus.	„ Whimbrel.
Fam.—*Tantalidæ*.	
Ibis falcinellus.	„ Glossy Ibis.

(29) *Machetes pugnax*, Ruff and Reeve. Extinct as breeders—occasionally occurring in district as spring and autumn migrants, more commonly in the latter season.

* "The Rev. J. F. DIMOCK wrote me word that some Reeves (the name applied to the females) still breed in Cawlish Wash, near Spalding. I have a note of ten dozen of these birds, fatted for the table, coming to Leadenhall market on the same day in the year 1824." (YARRELL.) The present writer has been informed that recently these birds have be sold for 15*s*. a pair.

This bird still lingers in Bourn Fen, as does the bittern, but the murderous propensities of 'sportsmen' are fast clearing them off. (S. B. J. S.)

† "Rather locally distributed. Principally confined to the marshes of Lincolnshire, Norfolk, and Isle of Ely." (JENYNS, p. 208.)

(30) *Tringa subarquata*, Curlew Sandpiper. Occurs on the Lincolnshire coast as a spring and summer migrant.

‡ "It would appear that formerly in the Fen district many more Snipes were snared than shot, being thus of more value for the table. The snaring was generally practised during hard weather, when there were but few runs of open water. The snares were of horse hair and set wherever the ground was soft." (STEVENSON.)

(31) *Limosa ægocephala*, Black-tailed Godwit. *Formerly nested* in the Fens. Still occasionally visits the south Lincolnshire marshes in pairs in the spring, but I have no notice of their having remained to nest. (*Birds of the Humber District*, foot note, p. 116.)

Fam.—*Plataleidæ.*	GRALLATORES.
Platalea leucorodia. (32.)	,, White Spoonbill.
Fam.—*Gruidæ.*	
Grus cinerea. (32*a*.)	,, Crane.
Fam.—*Ardeidæ.*	
Ardea cinerea.	,, Common Heron.* ✓
Fam.—*Ardeidæ.*	
A. alba, (*vide* STEVENSON.) (33.)	The Great White Heron.
A. purpurea, (JENYNS, p. 187.)	,, Purple Heron.
A. garzetta.	,, Little Egret.
Nycticorax griseus. (JENYNS, p. 192.)	,, Night Heron.
Botaurus stellaris. (34.)	,, Common Bittern. ✓ rare
B. minutus (*vide* STEVENSON.)	,, Little Bittern.
Fam.—*Scolopacidæ.*	
Phalaropus fulicarius.	,, Grey Phalarope.
Fam.—*Rallidæ.*	
Rallus aquaticus.	,, Water Rail.
Crex pratensis.	,, Land Rail or Corn Crake.
C. porzana. (35.)	,, Spotted Crake. ✓ rare
Gallinula chloropus.	,, Moor Hen. ✓
Fulica atra. (36.)	,, Coot. ✓

(32) *Platalea leucorodia*, White Spoonbill. Before the drainage of the Fens, was undoubtedly resident in this county, as was the case in Norfolk, where they formerly nested in trees like Herons. (See Mr. STEVENSON'S remarks on Sir THOMAS BROWNE'S notes of this species in Norfolk. *Birds of Norfolk*, vol. ii. p. 184.)

(32*a*) *Grus cinerea*, Crane. RAY informs us that this species occurred in his time (1628) in large flocks during the winter in Lincolnshire and Cambridgeshire. At the Neville banquet, temp. EDWARD IV. 204 Cranes were provided. See also note THOMPSON'S 'Boston,' p. 675.

* This bird is still plentiful, and is frequently seen, seeking its food, by the small drains and shallow waters of the Fens. But its breeding places must be sought near the boundaries of this district or where tall fir trees are plentiful. The present writer saw a heronry in the park near Watlington Hall, (Norfolk), late the residence of J. THORLEY, Esq., where the young birds were numerous, in the summer of 1875.

YARRELL says, that PENNANT mentions having himself counted more than eighty nests upon one oak at Cressy Hall, near Spalding, in Lincolnshire.

(33) *Ardea alba*, Great White Heron. One, Thorney Fen, Cambridgeshire, June, 1849. In the collection of Dr. STRONG, Peterboro'. (See HARTING'S *Handbook of British Birds*, p. 148.)

(34) *Botaurus stellaris*, Common Bittern. Now only occurring as an occasional winter visitant in Lincolnshire, (regularly in the Broad's district in Norfolk), formerly very common, resident and nesting annually in the Fen district. (In recent nesting in Norfolk, see STEVENSON, vol. ii. p. 164.)

(35) *Crex porzana*, Spotted Crake. "Before the Fenlands were so extensively drained, it used to breed commonly in the Eastern Counties of England." (HARTING'S, *Handbook of Brit. Birds*, p. 58.)

(36) *Fulica atra*, Coot. Formerly bred in immense numbers in the Fens. See WILLIAM of Malmsbury's account (*temp.* A.D. 1200) of numbers of Coots taken in Fens.

ORDER V.—THE SWIMMERS.

Fam.—*Anatidæ*.	NATATORES.
Cygnus musicus. (37.)	The Whooper or Wild Swan. [Shot near Nene Outfall, 1837.]
C. immutabilis.	,, The Polish Swan. [Shot at Nordelph, 1837.]
C. minor.	,, Bewick's Swan.
C. olor. (*vide* YARRELL.)	,, Mute Swan.
Anser ferus. (38.) (*vide* YARRELL.)	,, Grey lag Goose.*
A. segetum.	,, Bean Goose. [Shot at Terrington.] †
A. brachyrhynchus. (39.)	,, Pink-footed Goose.
A. albifrons.	,, White-fronted Goose or Laughing Goose.
A. leucopsis.	,, Bernicle Goose.
A. bernicla.	,, Brent Goose.
A. ruficollis. (*vide* YARRELL.)	,, Red-breasted Goose. [Shot at Cambridge, winter of 1813.]
A. Canadensis.	,, Canada Goose. [Shot at Guyhirn, 1842.]
A. Egyptiacus.	,, Egyptian Goose. [Shot at Guyhirn, 1845.]
Tadorna valpanser.	,, Common Shieldrake.
Anas boschas.	,, Wild Duck.
A. strepera.	,, Gadwell. [Shot at Guyhirn.]
A. clypeata. (40.)	,, Schoveler or Broad-bill.

(37) *Cygnus musicus*, the Whooper or Wild Swan. Not uncommon in the Wash in severe winters. *Cygnus minor*, *Bewick's Swan*, has frequently occurred in the Humber and on the Lincolnshire Coast.

(38) *Anser ferus*, Grey-lag Goose. See '*The Ibis*' for 1870, p. 301, on the derivation of the word LAG. The editor says, "By so great an authority on early English as Mr. SKEAT, the adjective 'lag' means originally late, last, or slow, whence we have 'laggard' and 'lag last,' a loiterer, 'lagman,' the last man. Accordingly the Grey Lag Goose is the Grey Goose which, in former days, *lagged* behind the others to breed in our Fens, as it now does on the Sutherlandshire lochs, when its congeners had betaken themselves to their more northern summer quarters." See also PENNANT on Geese kept in the Fens, plucking, etc. The Grey-lag formerly nested in considerable numbers in the Fens—breeds still in very limited numbers in some parts of Scotland and in the Hebrides.

* "The Grey-lag Goose is said to have been formerly very common in the Fens of this country, residing there the whole year, breeding, and bringing up eight or nine young: the general system of draining pursued in Cambridgeshire, Norfolk, and Lincolnshire, has been the means of driving them away." (YARRELL.)

† The locality in which the specimens in Wisbech Museum were taken is sometimes stated.

(39) *Anser brachyrhynchus*, Pink-footed Goose. An undoubted winter visitant to the Fens, also in Norfolk where the Grey lag is rarely obtained.

(40) *Anas clypeata*, Shoveler. Formerly abundant, nesting in the Fens.

Fam.—*Anatidæ.*	NATATORES.
A. acuta.	The Pintail Duck. [Shot at Guyhirn.]
A. penelope.	,, Widgeon.
Querquedula crecca.	,, Teal. [Shot at Guyhirn.]
Q. circia.	,, Garganey or Summer Teal. [Shot at Guyhirn.]
Fuligula ferina.	,, Pochard.
F. rufina. (41.)	,, Red-crested Duck.
F. ferruginea. (42.)	,, Ferruginous Duck.
F. marila. (43.)	,, Scaup Duck.
F. cristata. (44.)	,, Tufted Duck.
Clangula glaucion.	,, Golden Eye.
Harelda glacialis. (45.)	,, Long-tailed Duck.
Ædemia nigra. (46.)	,, Common Scoter.
Æ. fusca.	,, Velvet Scoter.
*Somateria molissima.**	,, Eider Duck.
Mergus albellus.	,, Smew. [Shot at Upwell.]
M. serrator.	,, Red-breasted Merganser [Shot in Whittlesea Wash.]
M. merganser.	,, Goosander. [Shot at Welney.]
Fam.—*Colymbidæ.*	
Colymbus glacialis. (47.)	,, Great Northern Diver.
C. arcticus.	,, Black-throated Diver.
C. septentrionalis. (47*a*.)	,, Red-throated Diver. [Shot at Guyhirn.]

(41) *Fuligula rufina*, Red-crested Duck. One, Boston, Jan. 1826. YARRELL, Zool. Journal, vol. ii., p. 492.

(42) *Fuligula ferruginea*, Ferruginous Duck. Is a rare spring visitant to the Eastern Counties of England, and has undoubtedly occurred in the Fens.

(43) *Fuligula marila*, Scaup Duck. Common on Lincolnshire Coast and Wash in Winter.

(44) *Fuligula cristata*, Tufted Duck. A Winter visitant, common in Humber, Wash, and Lincolnshire Coast. *Clangula glaucion*, Golden Eye. The same remarks apply.

(45) *Harelda glacialis*, Long-tailed Duck. Occurs off the Coast Autumn and Winter months.

(46) *Ædemia nigra*, Common Scoter. Very common off Coast and in Wash, many remaining throughout the year, but does not nest in England.

* Occasionally off the Coast in the Autumn and Winter.

(47) *Colymbus glacialis*, Great Northern Diver. Not uncommon off Lincolnshire Coast and in Wash in the Winter months.

(47*a*) Common off coast, Autumn, Spring, and Winter, occasionally in Summer.

Fam.—*Podicipidæ.*	NATATORES.
*Podiceps crisatus.**	The Great Crested Grebe.
P. rubricollis.	„ Red-necked Grebe. [Shot at Guyhirn.]
P. cornutus.	„ Sclavonian Grebe.
P. auritus.	„ Eared Grebe. [Shot at Terrington.]
P. minor. (48.)	„ Little Grebe.
Uria troile.	„ Common Guillemot.
Fam.—*Alcidæ.*	
Fratercula arctica.	„ The Puffin. [Shot in the Nene.]
Alca torda.	„ Razor-bill. [Shot at Nene Lighthouses.]
A. alle. (49.)	„ Little Auk.
Fam.—*Pelecanidæ.*	
Graculus carbo. (50.)	„ Common Cormorant.
Sula bassana.	„ Gannet. [Shot at Sutton Marsh.]
Fam.—*Laridæ.*	
Sterna cantiaca.	„ Sandwich Tern. [Shot at Hunstanton.]
S. fluviatilis.	„ Common Tern.
S. hirundo. (51.)	„ Arctic Tern.
S. fissipes. (52.)	„ Black Tern. [Shot at Guyhirn.]

*Mr. SOUTHWELL, of Norwich, in a recent letter to Mr. SKERTCHLY makes the following interesting observations upon the effect of the American weed *Anacharis alsinastrum* upon the bird fauna. "Since the *Anacharis* found its way into Honiton Broad it has increased to such an extent as to drive away the Great Crested Grebe, and those water-fowl which seek their food below the surface of the water; whereas to the surface feeding species, like the Widgeon, it proved a great attraction. This doubtless applies to other Broads where this plant established itself. The small Broad at Honiton contained several Great Crested Grebes, but here the clay bottom was unfavourable to the growth of the weed, and the water, in consequence, was free from it. I have not been to Honiton Broad this year, but believe the *Anacharis* is rapidly dying out, having fairly grown itself out, and by its own luxuriance checked itself. When I saw it last it was lying about in great masses like wool, floating on the surface, and no divers could get through it. This is a small matter, but I think significant of how changes of Fauna are brought about."

(48) Grebes, Fam.—*Podicipidæ.* There is no doubt that all the Grebe family formerly nested in the Fens. [Met with principally in the Winter months, but according to MONTAGU, breeds in the Fens of Lincolnshire, JENYNS, p. 254.]

(49) *Alca alle*, Little Auk. A Winter visitant to our Coasts.

(50) *Graculus carbo*, Cormorant. Very common in the Wash, where I have seen them sitting on the buoys.

(51) *Sterna hirundo*, Arctic Tern. The Arctic Tern is a Summer visitant to the Lincolnshire Coast, a few pairs still nesting with us.

(52) *Sterna fissipes*, Black Tern. Formerly bred in considerable numbers in the Fens. The Rev. JOHN LUBBOCK, in his 'Fauna of Norfolk,' 1845, says that eggs of the Black Tern had been recently obtained at Crowland Wash. Mr. ADRIAN, the bird stuffer of Lincoln, has quite recently informed me, that Black Terns in bands, 20 together, were seen in the Fens both in the Spring and Autumn of the year 1875. Does not now, as far as I know, nest any where in the district.

Fam.—*Laridæ*.	NATATORES.
S. minuta.	The Lesser Tern. [Shot at March.]
Larus minutus.	,, Little Gull.
L. ridibundus.	,, Black-headed Gull.
L. tridactylus.	,, Kittiwake.
L. canus.	,, Common Gull.
L. leucopterus.	,, Iceland Gull.
L. argentatus.	,, Herring Gull.
L. marinus.	,, Great Black-backed Gull.
L. fuscus.	,, Lesser Black-backed Gull.
Lestris catarrhactes. (53.)	,, Great Skua.
L. parasiticus.	,, RICHARDSON'S Skua.
L. longicaudus.	,, BUFFON'S Skua.
L. pomatorhinus.	,, Pomatorhine Skua.
Fam.—*Procellaridæ.*	
Puffinus anglorum.	,, Manx Shearwater.
Fulmarus glacialis. (54.)	,, Fulmar.
Procellaria pelagica. (55.)	,, Storm Petrel.
P. leachii. (56.)	,, Fork-tailed Petrel.

(53) All the four Skua Gulls occur off the Coast of Lincolnshire in the Autumn, or early Winter, *Lestris parasiticus* is, however, by far the most common.

(54) *Fulmarus glacialis*, the Fulmar Petrel. Has undoubtedly occurred off the Coast and in the Wash; is frequently seen and obtained off Flamborough Head in the Autumn.

(55) *Procellaria pelagica*, Storm Petrel. On Lincolnshire sea-board and Wash in, and before, stormy weather.

(56) *Procellaria leachii*, Fork-tailed Petrel. Two (T. W. HARRISON, Spalding) taken alive in that neighbourhood, early in December 1867, "*Field*" Newspaper. Both this and the preceeding species are frequently driven inland during severe and continuous gales.

SECTION VI.—*Reptilia.*

IN preparing this list the following authorities have been consulted—JENYNS'S "Collection," (quoted under Mammalia); SOUTHWELL'S list in Transactions of Norf. and Nor. Nat. Soc.; BELL'S *British Reptiles*, and *Our Reptiles* by M. C. COOKE; also JENYNS'S Manual.

Sauria.

ZOOTOCA.

1. *Zootoca vivipara.* (Wagl.) Common Lizard.

Often seen in the drier parts of the Fens. (*Jenyns.*)

Frequent in heaths, hedge-banks, and dry places. Local name 'Swift.' (*Southwell.*)

Saurophidia.

1. *Anguis fragilis.* (Linn.) Blind Worm—Slow Worm.

It is apparently less common in Cambridgeshire than in most other parts of the country. (*Jenyns.*)

Not uncommon on heaths and in dry woods. (*Southwell.*)

I have taken it near Bourn in the Fens. (*S.B.J.S.*)

Ophidia.

1. *Natrix torquata.* (Ray.) Ringed or Common Snake.

Very abundant, especially in the Fens, where it attains a large size, sometimes measuring four feet in length. (*Jenyns.*)

Not so common in Norfolk, as formerly, but still abundant in places. (*Southwell.*)

[In order to disabuse the minds of some who still fear the presence of this creature, we quote from "*Our Reptiles*," p. 47. "However one may shudder at the sight of a snake, this species is perfectly harmless, indeed rather tractable under confinement, and certainly, in common with the rest of its tribe, exceedingly graceful in its undulations, and possessed of a truly fascinating eye. As we write this paragraph, a lively individual about two feet in length is gazing intently at the movements of our fingers, as if to divine therefrom whether any malignant libel is being penned, or whether the movements are those of flattery."]

Very common in all parts of the Fens. It is a beautiful swimmer and invariably takes to the water when disturbed. (*S.B.J.S.*)

2. *Pelias Berus.* (Merr.) Common Viper.

Has occurred in the neighbourhood of Cambridge, but is apparently very rare in the county. (*Jenyns.*)

I have had a small one taken near Wisbech; and have seen it on the borders of the Fens in Norfolk, this year 1876. (*S.H.M.*)

[Var. 8. (Jen.) Black Viper. "In Cambridgeshire very rare."]

I have seen one in Bourn Fen. They are plentiful in Hockwold Fen, Norfolk. (*S.B.J.S.*)

Batrachia.

1. *Rana temporaria.* (Linn.) Common Frog.

It is not so abundant as formerly, the drainage of the Fens having made the old breeding resorts dry. (*S.H.M.*)

2. *R. esculenta.* (Gesn.) Edible Frog.

Mr. Jenyns's MS., in the Cambridge Museum, contains an original letter dated Jesus Coll. Camb., Jan. 11th, 1844, this was written by J. P. Wollaston to Mr. Jenyns, informing him of the discovery of *R. esculenta*, by Mr. C. Thurnall of Duxford, in Foulmire Fen, Sept., 1843.

But whether the Edible Frog is indigenous to Britain, is still a moot point.

It is true that it has not been assumed to be a *Fen* reptile—although it has been called "Cambridgeshire nightingale" and "Whaddon organ," yet if the climate of Foulmire was suited to its constitution, it is difficult to imagine why the animal never reached the Great Level.

And Canon Kingsley says (in *Prose Idylls*, p. 101) "But if he be ndigenous, his presence proves that once he could hop across the Straits of Dover or swim across the German Ocean."

Strange indeed it would have been, if its footsteps were directed to Foulmire alone, or that it should have been banished from all other parts of south-east

Britain. Directly after the discovery, Mr. BELL remembered his father's observation on the peculiar croaking of the frogs, and wrote thus, "I have often heard my father, who was a native of those parts, say that the croak of the frogs there was so different from that of others, that he thought they must be of a different kind." (Hist. of *Brit. Rept.* p. 111.) The writer of this chapter is disposed to make just such a remark about the croaking of the frogs in the marshes of the Yare and Waveney valleys, for he has never heard such frog-choruses elsewhere.

The Norfolk list, however, does not include the *R. esculenta* as a native—Mr. SOUTHWELL remarks "there does not seem to be sufficient evidence to support the claim."

Now it appears that Prof. A. NEWTON, while driving in Norfolk several years ago, was attracted by an unusual noise, and found it was the croaking of Edible Frogs. Prof. NEWTON afterwards learnt through Mr. J. H. GURNEY that Mr. GEORGE BERNEY had imported these animals from Paris in 1837. "These were deposited in the ditches and in the meadows at Morton, in some ponds at Hockering, and some were placed in the Fens at Foulden, near Stoke Ferry. They did not like the meadows, and left them for the ponds." (*Zoologist*, p. 6539.)

Mr. BERNEY imported more in 1841, and in 1842 as many as thirteen hundred.

Now as the first batch was imported six years before the discovery at Foulmire, is it possible that some of these travelled from Foulden to Foulmire, a distance of about 40 miles? Perhaps they might have been taken at intermediate stations if *naturalists* had been in search of them.

In 1874, I wrote a letter to *Nature* (vol. x. p. 483), to obtain if possible further information as to the *naturalization* of this reptile. Lord ARTHUR RUSSEL in reply (*Nat.* vol. x. p. 520) stated that he had, some 12 years ago, brought some from Paris and placed them in a pond at Woburn Abbey, and adds, "They thrived and multiplied there; but our summers are seldom hot enough to enable the tadpole to attain his full development before the cold autumnal nights set in . . . . I believe that in our climate the young will pass the winter as tadpoles and complete their transformation in the following spring. But this would require more accurate observation before I can affirm it with certainty."

There is then no evidence that *R. esculenta* is indigenous to Britain, but only that it has been introduced from the continent to the neighbourhood of the Fens.

Prof. A. NEWTON, writing to me on 23rd Nov., 1876, says "At the end of last May I rediscovered the Edible Frogs in Norfolk—a very fair colony of them—but the place is further from your district than Wretham." (*S.H.M.*)

See an article in Norf. and Nor. Nat Soc. Transactions, 1876-7, in which Prof. NEWTON relates his re-discovery, and remarks—"the species has made good its existence in Norfolk for at least *thirty-four* years." Also in *Zoologist* for 1876-7, p. 61.

1. *Bufo vulgaris.* (Laur.) Common Toad.

Abundant in earlier times, but the numbers are much lessened by drainage.

2. *B. calamita.* (Laur.) Natter Jack.

This toad was first observed near Revesby Abbey, Lincolnshire, by Sir JOSEPH BANKS, (*Jenyns*), from whom PENNANT obtained his knowledge of it—the latter first published it as a British reptile. (*Bell.*)

It has lately been obtained for me, near the shores of the Wash, in the neighbourhood both of Hunstanton and Wootton. (*S.H.M.*)

1. *Triton cristatus.* (Laur.) Great Warty-Newt.

2. *T. punctatus.* (Bonap.) Common Smooth Newt.

Both common.

[*Lissotriton palmipes.* Palmated Smooth Newt. Is given in the Norfolk list as being found at Sparham, but I cannot hear of its being found in the Fens.]

SECTION VII.—*The old Fisheries.*

SEVERAL historical references lead to the belief that the Fish of this district formed a considerable article of food in early Saxon-times.

In INGULPH'S history of Crowland, there is a charter attributed to King ETHELBALD, and this contains the following—"together with several piscary in the rivers Welland and Nene, as far as the before-mentioned limits of either of the said marshes, and in all the waters that encompass the said Island."* Whatever dispute there may be as to the genuineness of the charter, it is certain that the above passage points to the fact that the fisheries were early preserved and were considered of great importance.†

SHARON TURNER tells us that "the Saxons eat various kinds of fish, but the kind most profusely noticed is the *eel*. They used eels as abundantly as swine. Two grants are mentioned, each yielding five thousand eels, and by another, ~~two thousand were received as an annual rent.~~ Four thousand eels were a yearly present from the monks of Ramsay to those of Peterborough. We read of two places purchased for twenty-one pounds, wherein sixteen thousand of these fish were caught every year; and in one charta twenty fishermen are stated, who furnished during the same period, sixty thousand eels to the monastery."

The same author cites a dialogue composed by one ELFRIC; in which a fisherman is interrogated, and mentions eels, haddocks, minnies, eelpouts, skate, and lampreys, as being caught in the rivers. [The Saxon names of these

* RILEY'S trans. in BOHN'S Antiquarian Library, p. 6.

† There is a reference to the fishery in the charter attributed to BERTULPH, KING of the Mercians. Ibid, p. 24, also in EDGAR'S charter. Ibid, pp. 86, 93.

are, *ælas, hacodas, mynas, ælepután, sceotan, and lampredan.*] And herrings and salmon, porpoises, sturgeons, oysters, and crabs, muscles, wincles, cockles, flounders, plaice, lobsters and so forth, being caught in the sea. [The Saxon names are, *herinegas, leaxas, mereswyn,* (*i.e. sea-swine*), *stirian, ostrean, crabban, muslan, wine winclan, sæ coccas, fage, floc, lopystran.*] Then follows a question about the *whale* which with the porpoise, oysters, and other denizens of the sea come under the denomination "fish."*

In the main our Saxon forefathers appear to have had similar tastes to ourselves, "though our taste has declined for the porpoises," but the supply did not equal the demand for fish, porpoises, etc.

DUGDALE† after describing the second foundation of the Monastery of Ely, says, "I must not forget the gift of Staney thereunto. This was bestowed on it by the before-mentioned WULSTON DE DELHAM who had it, with the fen belonging thereto, of the grant of one ESCUEN, a widow: which fen the monks afterwards demised for the rent of two thousand eels, unto a certain kinsman of the said ESCUEN: who having been tenants to it formerly, and continuing so likewise during the life of the said King EDGAR, did at length hold it as their own, without any sentence or law of the citizens and hundreds."

A great trial was held at Cambridge.‡ The judges decreed that the Abbot ought to have the same again; as also the whole fen and fishing . . . and the said REIGMUND

* See His. of Anglo-Saxon, chap. iii., book viii., p. 44.

† DUGDALE His. of Imbanking, etc., 2nd. ed, p. 183.

‡ This is cited by SHARON TURNER as an illustration of "Lawsuits about Land." See His. of Anglo-Saxons.

What DUGDALE calls STANEY, evidently refers to Stuntney (South-east of Ely); for BENTHAM (p. 70) quoting from *Lib. Elien.* c. 18, remarks "*Walslan* of *Delham*, about the same time (EDRED's reign), gave them *Stuntney*, and a Fishery belonging to it." See Liber Eliensis, Anglia Christeana Soc., vol. i., p. 133.

and the other defendants should pay to the same Abbot the arrear of fish due for six years." This demand for the arrear of 12,000 eels shows that the quantity in the waters must have been very great; for the yearly rent of 2,000 eels would be required as well; and as there was no equivalent specified, it is clear that *eels* were demanded; there was a forfeiture to the King in addition to the arrear, and if the whole were not paid freely, the decree was that "they should be distrained by their cattle."

By EDGAR'S charter "10,000 eels part of the royal revenues due from the village of Wyllan," were granted to Ely.*

For the endowment of Ely, the Bishop of WINCHESTER and Abbot BRITHNOTH purchased "two fisheries in Stretham."‡

WLFIUS, his wife and their son ALSIUS gave to the same monastery one fishing let annually for the rent of 1,000 eels, and a moiety of a mere called Livermere.†

In the reign of EDWARD third the fen fisheries were of great importance, as we learn from the fact that the Abbot of St. Edmundsbury obtained a precept from the King to prevent certain persons from diverting the course of the Welle creek, and stopping "the river of Nene, running to a certain fishing, called Livermere, lying in the town of Welle. The Abbot claimed this fishing in the waters of Crike of the gift of CANUTUS, sometime King of England." The Abbot urged that if the waters of the Nene were diverted from the lake that he "would totally lose the

* BENTHAM'S Ely, p. 73. DUGDALE (p. 307), says Welle was before called Wylla.

‡ BENTHAM'S Ely, p. 75. See also BRITHNOTH'S endowment, supra p. 84.

† See BENTHAM, also DUGDALE, 2nd ed., p. 355.

On an old map in Wisbech Museum, the Livermere mentioned above is placed West of Upwell, in the neighbourhood of the "old Nene" and Elm Leam. This map of the hundred of Wisbech was copied in the year 1657, from one dated 1597.

benefit of his said fishing to the damage of the King himself."

DUGDALE quotes the following (from a description of the Isle of Ely, attributed to one BEDA who is said to have gained a footing on the Isle and taken back an account to the Conqueror).

"And of fish and fowl which there breed, what shall I say? At the flood-gates upon the skirts of these waters, what a vast company of eels do they take in nets! as also mighty pikes and pickerells, perch, roach, and sometimes greater and royal fishes." If the last named were sturgeons we may infer that those fish formerly ascended far up the Fen rivers.

Dr. JOHN LOWE* in his notes on the Sturgeon, quotes thus from Sir T. BROWNE. "Some have been taken at Yarmouth, and more in the Great Ouse, but their heads are not so sharp as represented in the Icons of RONDELETINS and IOHNSTONUS."

Mr. THOMPSON† mentions that the fisheries on the Witham were very famous so early as the 13th century, and that the Abbot of Bardney had eleven fisheries in the Witham about 1250.

"Sturgeons are occasionally caught in the Witham. This fish was formerly called 'a fish royal,' and was granted by charter to the Mayor and burgesses of Boston."‡

DRAYTON, in his *Polyolbion*, while describing the Fennes, says (in 25th Song), Holland's Oration—

And for what part of me, which men high *Holland* call,
Where *Boston* seated is, by plenteous Wytham's fall,
I peremptory am, large Neptunes liquid field,

* See Trans. of the Norfolk and Norwich Nat. His. Soc., 1874.

† His. of Boston, p. 679. ‡ Ibid p. 682. The date of the charter is not given.

Doth to no other treat the like abundance yeeld,
For that of all the seas invironing this Isle,
Our *Irish*, *Spanish*, *French*, however we them enstyle,
The *German* is the great'st, and it is only I,
That doe upon the same with most advantage lye.
What Fish can any shore, or *British* Sea-town show,
That's eatable to us, that it doeth not bestow
Abundantly thereon: the *Herring* king of Sea,
The faster feeding *Cod*, the *Mackrell* brought by May,
The daintie *Sole* and *Plaice*, the *Dabb*, as of their blood;
The *Conger* finely sous'd, hote Summers coolest food;
The *Whiting* knowne to all, a generall wholesome dish;
The *Garnet*, *Rochet*, *Mayd*, and *Mullet*, dainty fish;
The *Haddock*, *Turbet*, *Bert*, Fish nourishing and strong;
The *Thornback* and the *Scate*, provocative among:
The *Weaver*, which although his prickles venom bee,
By fishers cut away, which Buyers seldom see:
Yet for the Fish he beares, tis not accounted bad;
The *Sea-Flounder* is here as common as the *Shad*;
The *Sturgeon* cut to *Keggs*, (too big to handle whole)
Gives many a dainty bit out of his lusty Iole,
Yet of rich *Neptunes* store, whilst thus I idely chat,
Think not that all betwixt the *Wherpoole* and the *Sprat*,
I goe about to name, that were to take in hand
The Atomy to tell, or to cast up the sand:

In recent years the fish in the fen waters have been greatly reduced in quantity; this has arisen from two causes mainly, first the drainage which has left the smaller drains and the ditches completely dry in the summer; these small drains contained an abundance of pike, eels, roach, and perch, even 20 years ago, but at present not a single fish can be found in them. Another cause is the admission of salt water into the larger drains; for instance the salt water is let in at Salter's Lode Sluice, for purposes of navigation, in dry seasons, to the great destruction of fish,—and in the lower part of the North Level Main Drain the water is often brackish.

SECTION VIII.—*The Fishes.*

(THE PRESENT.)

THE following list is extracted from a paper contributed by Dr. JOHN LOWE of Lynn, to the Transactions of the Norfolk and Norwich Naturalists' Society.

The writer desires to thank Dr. LOWE for his assistance in drawing up the list and for his revision of the same.

SUB-CLASS I.—TELEOSTEI.

Order I.—*Acanthopterygii.* Fam.—I. GASTEROSTEIDÆ.

Gasterosteus aculeatus. (L.) Three-spined Stickleback.
"Immense quantities are caught in the Ouse."

Fam. III.—PERCIDÆ.

Perca fluviatilis. (L.) Perch.
Some caught in fen drains, weighed 2¼ lbs. (*S. H. M.*)

Labrax lupus. (Cuv.) Bass.
"One caught in the Norfolk Estuary in 1865, weighed 10 lbs."

Acerina cernua. (Günth.) Ruff or Pope.
Found in the Ouse above Denver.

Fam. VII.—SPARIDÆ.

Cantharus lineatus. (White.) Black-sea Bream.
Fine specimen in Lynn Museum.

Fam. X.—TRIGLIDÆ.

Cottus scorpius. (L.) Father Lasher.
Very common.

Trigla cuculus. (Bl.) Elleck. Red Gurnard
Taken in Norfolk Estuary in 1865. (*Mr. E. L. King.*)

Trigla hirundo. (Bl.) Tubfish.
Norfolk Estuary. (*Mr. E. L. King.*)

Trigla gurnardus. (L.) Grey Gurnard.

Trigla pœciloptera. (C. and V.) Little Gurnard.
Very rare Norfolk Estuary. (*Dr. J. Lowe.*)

Agonus cataphractus. (L.) Pogge.
Norfolk Estuary, common.

Trachinus draco. (L.) Greater Weever.

Trachinus vipera. (Cuv. and Val.) Weever.

Scomber scomber. (L.) Mackarel.

Zeus faber. (L.) Doree.
It is sometimes taken in the Wash.

Lampris luna. (Gm.) Opah.
One captured off Hunstanton in July 1839, is in the Wisbech Museum; it is mentioned by YARRELL, vol. i., p. 195.

Fam. XVII.—CARANGIDÆ.

Trachurus trachurus. (L.) Scad. Horse Mackarel.

One taken in the Norfolk Estuary weighed 2 lbs.

Fam. XIII.—XIPHIIDÆ.

Xiphias gladius. (L.) Swordfish.

See Dr. LOWE's note on one caught near Lynn; it was 10 ft. 2 in. long. The sword of one found in the Wash is in the Wisbech Museum.

Fam. XIX.—GOBIIDÆ.

Gobius unipunctatus. (Yar.) One-spotted Goby.

Gobius auratus. (Risso.) Yellow Goby.

Gobius rhodopterus. (Günth.) Speckled Goby.

Gobius minutus. (Gm.)

Gobius pusillus. (Dr. J. Lowe.) See note.

Callionymus lyra. (L.) Gemmeous Dragonet. Yellow Skulpin.

Common in Norfolk Estuary, but adult male rare.

Fam. XX.—DISCOBOLI.

Cyclopterus lumpus. (L.) Lump fish.

"I have seen five or six large ones taken in the Norfolk Estuary, within the last 10 years." (*J. L.*)

Liparis vulgaris. (Cuv.) Sea Snail.

Liparis montagui. (Cuv.) Montague's Sucker.

Fam. XXII.—PEDICULATI.

Lophius piscatorius. (L.) Angler.

Norfolk Estuary: not common; sometimes of large size.

Fam. XXIV.—BLENNIDÆ.

Anarrhichas lupus. (L.) Wolf Fish.

"One in the Wisbech Museum was taken in the Norfolk Estuary."

Centronotus gunnellus. (Bl. Schn.) Butterfish.

Zoarces viviparus. (L.) Viviparous Blenny.

Fam. XXXVII.—ANTHERINIDÆ.

Atherina presbyter (Cuv.) Atherine.

Norfolk Estuary frequent in summer.

Fam. XXXVIII.—MUGILIDÆ.

Mugil capito. (Cuv.) Grey Mullet.

Mugil chelo. (Cuv.) Lesser Grey Mullet.

"Both found in Norfolk Estuary." Sometimes comes up the Nene as far as Wisbech, (*S. H. M.*)

Order II.—*Acanthopterygii pharyngognathi.* Fam. II.—LABRIDÆ.

Labrus maculatus. (Bloch.) Ballan Wrasse.

Lynn Roads, Nov 14th, 1869. (*E. L. King.*)

Labrus mixtus. (L.) Green Wrasse.

A specimen in Wisbech Museum, Norfolk Estuary 1850.

Order III—*Anacanthini.*	Fam. III.—Gadidæ.
Gadus morrhua. (L.)	Cod.
Gadus æglefinus. (L.)	Haddock.
Norfolk Estuary, common.	
Gadus luscus. (L.)	Bib.
Gadus merlangus. (L.)	Whiting.
Gadus virens. (L.)	Coal-fish. Green Cod.

A large one, now in Wisbech Museum, caught in Norfolk Estuary 1845.

Lota vulgaris. (Yar.)	Burbolt.

"Sir Thomas Browne mentiones it, to be had in Norwich river . . . . . as also in the rivers of Marshland."

Molva vulgaris. (L.)	Ling.
Norfolk Estuary.	
Motella tricirrata. (Bl.)	Three-bearded Rockling.
Motella mustela. (L.)	Five-bearded Rockling.
Raniceps trifurcus. (Walb.)	Lesser Forkbeard.

These last three taken in Norfolk Estuary. (*Mr. C. B. Plowright.*)

Fam. IV.—Ophidiidæ.

Ammodytes tobianus. (L.)	Larger sand-launce.
Ammodytes lanceolatus. (Lesauv.)	Lesser sand-launce.

Both found in Norfolk Estuary.

Fam. VII.—Pleuronectidæ.

Hippoglossus vulgaris.	Holibut.
Rhombus maximus. (L.)	Turbot.
Rhombus lævis. (L.)	Brill.
Pleuronectes platessa (L.)	Plaice.
Pleuronectes limanda. (L.)	Dab.
Pleuronectes flesus. (L.)	Flounder.
Pleuronectes microcephalus. (Donov.)	Smeared Dab.
Solea vulgaris. (Quensel.)	Sole.

All in the Norfolk Estuary.

Order IV.—*Physostomi.*	Fam. VII.—Salmonidæ.
Salmo trutta. (Flem.)	Salmon trout.

"Frequently caught in the Ouse and the Estuary.

Osmerus eperlanus. (L.)	Smelt.

"Very abundant in the Estuary."

Fam. XII.—Esocidæ.

Esox lucius. (L.)	Pike.

Plentiful in the drains and ponds of the Fenland. Pike weighing from 20 to 24 lbs. are occasionally taken in the Middle Level Drains. The largest known pike was taken when Whittlesea mere was drained. It weighed over 100 lbs. and is in Mr. Frank Buckland's collection. (*S.H.M.*)

Fam. XIV.—Scombresocidæ.

Belone vulgaris. (Flem.)	Garfish.

Lynn Roads. (*E. L. King.*)

Hemiramphus Europæus. (Yar.)	European half-beak.

See Dr. Lowe's note in Transactions of Norf. and Norwich Nat. Soc.)

Fam. XVII.—CYPRINIDÆ.

Cyprinus carpio. (L.) Carp.

Gobio fluviatilis. (Flem.) Gudgeon.

Leuciscus rutilus. (L.) Roach.

Abundant in Fenland drains. (*S.H.M.*)

L. cephalus. (L.) Chub.

"Is very large in some Norfolk rivers—the Ouse, the Thet, and the Wissey, near Stoke Ferry." (*Lubbock.*)

L. erythrophthalmus. (L.) Rudd.

One taken in Nene weighed 3 lbs. (*S.H.M.*)

L. vulgaris. (Cuv.) Dace.

Some, 12 inches long, have been taken in the Nene. (*S.H.M.*)

L. phoxinus. (L.) Minnow.

Tinca vulgaris. (Yar.) Tench.

Found in ponds, but not so plentifully as formerly. (*S.H.M.*)

Abramis brama. (L.) Lake Bream.

Bream weighing as much as 5½ lbs. are often taken in the Fen drains. (*S.H.M.*)

A. blicca. (Bl.) White Bream.

Alburnus lucidus. (Hecket-Knev.) Bleak.

"Very abundant in ditches at N. Wootton."

Nemachilus barbatulus. (L.) Loach.

Fam. XXI.—CLUPEIDÆ.

Engraulis eucrasicholus. (Cuv.) Anchovy.

"Frequently caught during the summer months, in stow nets in the river opposite Lynn." (*Dr. Lowe.*)

Clupea harengus. (L.) The Herring.

(See Dr. LOWE'S notes on LEACH'S Herring, Trans. of Norf. and Norwich Nat. His. Soc.)

C. sprattus. (L.) Sprat.

"On the coasts of Norfolk and Lincolnshire many hundreds of tons of Sprats are annually used for manure—a waste of valuable food, much to be regretted." (*Dr. Lowe.*)

C. alosa. (L.) Allis Shad.

"Norf. Estuary, 1851; specimen in Wisbech Museum."

C. tinta. (Cuv.) Twait Shad.

Lynn Roads, Sept. 1848, and Oct. 1867. (*E. L. King.*)

Fam. XXVII.—SYMBRANCHIDÆ.

Anguilla vulgaris. (Flem.) Sharp-nosed Eel.

A. acutirostris.

Very common. "YARRELL mentions having seen the preserved skins of two of the sharp-nosed species which had weighed together 50 lbs.; the heavier of the two having been 27 lbs.; these Eels were taken in draining a Fen dyke at Wisbech. No other fish of any sort were found in the dyke."*

A. latirostris. (Risso.) Broad-nosed Eel.

Conger vulgaris. (Cuv.) Conger.

"Norfolk Estuary. Not uncommon.

* "The Angler-Naturalist," by H. CHOLMONDELEY-PENNELL. ROUTLEDGE, 1863.

Order V.—*Lophobranchii.*	Fam. II.—SYGNATHIDÆ.
Siphonostoma typhle. (L.)	Broad-nosed Pipe-fish.
Sygnathus acus. (L.)	Greater Pipe-fish.
Nerophis æquoreus. (L.)	Ocean Pipe-fish.
N. ophidion. (L.)	Straight-nosed Pipe-fish.

"Norf. Estuary, June 12th, 1871." (*E. L. King.*)

Order VI.—*Plectognathi.*	Fam. II.—GYMNODONTES.
Orthagoriscus mola. (L.)	Sun-fish.

"Lynn, two, Nov., 1850; Oct. 1863. E. L. KING . . . . one in Wisbech Museum, taken at Yarmouth in 1835."

SUB-CLASS III.—GANOIDEI.

Order II.—*Chrondrostei.*	Fam. I.—ACIPENSERIDÆ.
Acipenser sturio. (L.)	Sturgeon.

"Frequently caught in the rivers and along the coast." (*Dr. Lowe.*)

SUB-CLASS IV.—CHONDROPTERYGII.

Order II.—*Plagiostomata.*	Fam. I.—CHARCHARIIDÆ.
Canis galeus.	Tope.

Norfolk Estuary, abundant.

Mustelus vulgaris.	Smooth Hound.

Norfolk Estuary.

Fam. III.—SCYLLIIDÆ.

Scyllium canicula. (L.)	Lesser-spotted Dog-fish.
S. stellare. (L.)	Large-spotted Dog-fish.

Both in Norfolk Estuary,

Fam. VII.—SPINACIDÆ.

Acanthias vulgaris. (L.)	Picked Dog-fish.

Fam. VIII.—RHINIDÆ.

Squatina vulgaris. (Gray.)	Monk-fish.

"One captured in the Norfolk Estuary, by Mr. E. L. KING, in 1865, measured 4 ft. in length, by 2½ ft. in breadth."

Sub-Order II.—*Batoidei.*	Fam. IV.—RAIDÆ.
Raia clavata. (L.)	Thornback Ray.
R. batis. (L.)	Skate.
R. maculata. (Yar.)	Homlin or Spotted Ray.

Fam. V.—TRYGONIDÆ.

Trygon pastinaca. (L.)	Sting-ray.

Fam. VI.—MYLIOBATIDÆ.

Myliobatis aquila. (L.)	Eagle-ray.

SUB-CLASS V.—CYCLOSTOMATA.

Petromyzon marinus. (L.)	Sea Lamprey.
P. fluviatilis. (L.)	Lamprey.

Caught in Norfolk Estuary.

[S. H. M.]

SECTION IX.—*Lepidoptera.*

[Communicated by Mr. JAMES BALDING, Wisbech.]

IN getting together for the first time the records of *Lepidoptera* taken in the district of which this work treats, one circumstance soon forces itself into notice,—the small extent of the locality that has been examined. This is doubtless due to the paucity of resident entomologists, who are far from being as numerous as might be expected in a district which has been so famous for its insects, and which is now, perhaps, more rich and varied than any other in England. Forty or fifty years ago English entomologists depended upon the Fens of Huntingdonshire and Cambridgeshire for many choice species, while Monkswood, on the western edge, was almost as celebrated for its rarities. In the dense Fens near Whittlesea the splendid Swallow-tail Butterfly then abounded, and the Large Copper in almost equal profusion spread its brilliant wings to the sun. Extensive drainage works have annihilated this once rich entomological hunting-ground, so that to the references which are given to Whittlesea Mere in the list of species, the word "formerly" must generally be understood. Holme Fen, which adjoins Whittlesea Mere, is to some extent still unaltered, as also is a portion of Wicken Fen (which is intended where ~~Wicken is~~ mentioned.) The latter fen, with its dense growth of water plants and its broad expanse of reeds and rushes, is one of the best, if not the only, remaining example of the old Fens; and now furnishes a greater number of Fen insects than any other equal area in the district. The higher ground, bounding the flat level of the Fenland, supplies highland forms of insect life, while the woods on the western and northern edge contribute wood-loving species. These two classes of insects are not confined to the borders of the Fenland, but are found on the gravelly islands of the Fens, and appear to be spreading where their existence is rendered possible by the introduction and cultivation of their food plants. In this respect a great change is taking place, Fenland forms of life giving place to those more essentially highland, and additional species from the surrounding highlands will no doubt be found in the future. Most of the heath-insects of the district have long disappeared. Were it possible to know, with some degree of completeness, what common species were formerly taken in the district, it would be very interesting to record the changes that have taken place; but unfortunately no such record appears to have been made. The species recorded are principally those which were noticeable at the time for their rarity, or for not being then taken elsewhere; consequently our knowledge of the more common insects is almost entirely of recent date.

The number of species at present recorded in the district is 1161. Of these 57 are butterflies, and form a good proportion of the 67 British species. The moths, 1104 in number, are not much more than half of the known British species, which now amount to about 2000. But little search appears to have been made for the smaller insects, in which respect the list is doubless capable of being largely increased, as the present captures indicate that the district is likely to be very productive of rarities. During the past year several species new to Britain have been taken. These are noticed in the list.

Among the more conspicuous insects which are peculiar to the Fenland, not being taken elsewhere in England, are *Polyommatus hippothoë*, *Nonagria concolor*, *Noctua subrosea*, *Macrogaster arundinis*, *Orgyia cænosa*, *Nascia cilialis*, and *Dictyopteryx lorquiniana*. The first three of these are probably now extinct; not having been taken for many years past.

The reason of this is, doubtless, the loss or interruption of some condition necessary to the well-being of the insects, in some one or more of their stages. *Polyomnatus hippothoë*, (the Large Copper) abounded in Whittlesea Mere and the Fens immediately adjoining, but appears to have become scarce nearly ten years before the Mere was drained. The Rev. E. C. F. JENKINS, writing, in 1859, says, "this beautiful insect, some thirty years ago, was so abundant in the unreclaimed Fens about Whittlesea, that I never expected to hear of its utter extermination. Its brilliant appearance on the wing in the sunshine I shall never forget, and to watch it sitting on the flower of the *Eupatorium cannabinum* and show the under side of its wings, was something ever to be remembered. I once took sixteen in about half an hour on one particular spot, where the above-mentioned plant was very plentiful; but unless the sun was very bright they were very difficult to find. In those days the larva was unknown, and I attribute the disappearance of the butterfly to the discovery of the larva, to the unceasing attacks of collectors, and to the burning of the surface-growth, which is done when they are to be reclaimed.

Thirty years ago the Fens about Whittlesea Mere were most interesting localities for the entomologist, the botanist and the ornithologist. I lived then in that neighbourhood, and those pursuits were my delight. *Papilio machaon* might then be had to any amount; the flight of *P. hippothoë* was abundant in July; the moth *L. dispar* was very plentiful; besides many other rare and beautiful insects. Now however, everything is totally changed. The Great Northern Railroad runs through a part of the Fen where, when I was a boy, one could scarcely walk; at the spot where I used to land from my boat, on the edge of the mere stands a farm-house; my favourite locality for *P. hippothoë* —where the bog myrtle used to grow in profusion and scent the air with its delicious perfume—was (as I myself saw last season) converted into a field of stinking cole-seed, with a flock of sheep eating it off."* Mr. J. W. DOUGLAS, author of "The World of Insects," considers its extinction due to a flood which occurred while the insect was in the larva state and drowned the whole brood. In 1841 he went to the Mere to see the insect alive, but it rained every day during the week he was there, and he only saw a solitary specimen which ventured to open its wings during a transient gleam of sunshine. He adds, "Now whenever I look at that butterfly in my cabinet, the recollection of the moment, when it flashed its glory before me, comes like a new pleasure."† The last capture recorded in the Mere was four years after this—1845—and six years before the Mere was drained. In Yaxley Fen it lingered until 1847 or 1848, when five specimens were taken.‡ The larva of *P. hippothoë* fed upon the Great Water Dock (*Rumex hydrolapathum*) which was abundant in the Fen. The Large Copper appears to be one of those insects which attach themselves to a favourite space. This is a very striking habit of many species which may be found abundantly year after year in some limited spot, as the corner or side of a field, a few yards of a lane side, or some portion of a fen or wood, which spot does not appear to possess any distinctive characteristic to account for its selection in preference to the surrounding locality. Even when *Polyommatus hippothoë* was so abundant that it was annually taken by hundreds, (probably by thousands), it was never seen away from its special localities in the Mere, or the lodes leading to it. This is the more remarkable when it is remembered that there were many other fens, both in this level and in Norfolk, which appeared as

* Ent. Intel., 1859, p, 79. † Ib. p. 95.

‡ NEWMAN'S Brit. But., p. 115.

suitable for the species as Whittlesea Mere. HAWORTH, BOISDUVAL, and other early entomologists, considered the Whittlesea Mere insect distinct from the true continental *P. hippothoë*, being larger, with bolder and darker markings, and it was named by the former *P. dispar*. It is not, however, now regarded as more than a local variety of *P. hippothoë*. At the time the species was freely taken at Whittlesea Mere, two other Large Coppers were reputed to be taken in England; *P. virgaurea*, called the Scarce Copper and *P. chryseis*, the Purple-edged Copper. The former was said to be taken in the marshes of the Isle of Ely and Huntingdonshire, and the latter at Ashdown Forest in Sussex. Both are somewhat common on the continent, and as their capture in England appears to rest upon the authority of insect-dealers, and the precise localities and circumstances of their capture have not been defined, they are not now considered as British species.

With regard to the next Fenland extinct species—*Nonagria concolor*, it is one of the closely allied and numerous group of insects known as "Wainscots," and so much resembles other species that it has led some of our best naturalists into error. It is a comparatively recently discovered insect, being first recorded in 1844. In 1848 and 1849 it was taken in abundance, but has not been seen for many years. The food plant of the larva is not known.

The third species, *Noctua subrosea*, (The Rosy Dart) is a rather obscure looking, brownish insect, and presents one of those apparently inexplicable mysteries which frequently occur in the insect world. It is one of the early Mere insects, being taken in one part of Holme Fen, where it literally swarmed. In a few years, however, not a specimen could be found, although the locality had not, apparently, undergone the slightest change. The larva of this species fed upon *Myrica gale* (the Bog Myrtle), which was formerly abundant in the Fens. This shrub was believed to have been extinct in Cambridgeshire since 1850, but was found last year lingering near March. In Holme Fen, where *N. subrosea* was taken, it also still exists.

With regard to the three other species which have not been taken elsewhere in England, the first mentioned, *Macrogaster arundinis*, (the Reed Leopard, so called from the larva feeding in the reed,) has only recently been known. It was discovered in 1841 in Holme Fen, by Mr. DOUBLEDAY, the eminent entomologist, who found a specimen floating on the water of a ditch in the Fen. It was not seen again until 1848, when he took two other specimens in the same place, and two years later, in 1850, he found it in abundance at Whittlesea Mere. The insect is now almost confined to Wicken Fen, where it is becoming scarce. Attempts have been made to introduce it into the Norfolk Fens, but without success. *Orgyia cœnosa* is another of the old Whittlesea Mere insects, and from being taken there was called the "Whittlesea Ermine." Its larva fed upon the reed and *Cladium mariscus* (the Common Sedge). Both plants were abundant at Whittlesea Mere, and are so still at Wicken Fen, where the insect has its last resort, and like the last-mentioned moth is decreasing in numbers. The two other local species, *Nascia cilialis* (the Orange Cloud), and *Dictyopteryx lorquiniana*, are smaller species, and not so limited in their habitats. The latter is choice, and but seldom taken. Its larva feeds upon *Lythrum*. The food plant of *N. cilialis* is not known.

Many Fen species might be mentioned which have become rare of late years, or have entirely disappeared from the district, although they are still taken elsewhere in England. Strikingly conspicuous is *Papilio machaon* (the Swallow-tail Butterfly), which once spread generally over the Fens, and has frequently been taken or seen wandering at a considerable distance away. It is now found regularly in Wicken Fen only, where it is a glorious spectacle wheeling and gliding over the Fen jungles or sporting high out of reach. The larva feeds principally upon *Peucedanum palustre* (the Marsh Milk-Parsley), which is a common Wicken plant. The insect is much less abundant than formerly, and from continued drainage, together with its unstinted capture, and the destruction of the pupa by the annual cutting of the sedge, will probably soon cease to be found. *P. machaon* is found in various parts of the world, and varies much in its habitats; Mr. SKERTCHLY informs me that in the deserts of Arabia and Abyssinia he found it flying around the peaks of the mountains. On the continent it is common in gardens, where the larva feeds upon the foliage of carrots; but although in confinement this is generally what the larva thrives upon, it does not appear that in this country the insect will exist naturally apart from its Fen haunts. The choice and beautiful little *Bankia argentula* (the Silver Barred), used to be taken by the side of Whittlesea Mere. It is also said to have occurred at Beachamwell in Norfolk, but its only locality now is Killarney in Ireland. It is interesting to notice that although the larva feeds upon grasses—(what grasses, do not appear to have been noticed) the insect itself is partial to the vicinity of *Myrica gale*, thus shewing at Killarney its partially for a local condition apart from the food of its larva, which condition existed also at Whittlesea Mere when the insect was found there. It is an interesting subject for enquiry how far these local conditions and surroundings are necessary to the economy of the species. *Liparis dispar* (the Gipsey Moth), according to WOOD, had its principal locality in the Huntingdonshire Fens, where the larva fed upon the *Myrica gale*, then abundant there. With one or two exceptions this insect has scarcely been taken within the memory of living entomologists, either here or in the Norfolk Fens. The supply for cabinets has been kept up by breeding, it being as easily reared as the silkworm moth. The larva and insects have frequently been turned out in localities where they were once taken, but do not survive. Whittlesea Mere used also to be a principal locality for the gorgeous "Scarlet Tiger," (*Callimorpha dominula.*) Wicken Fen is now its last resort in the district. also called "Arctia" D.

Few records exist of heath or moor insects, but, even were there no other evidence, they are sufficient to prove the former existence of a heather-studded moorland in the Fens.* Forty years ago *Celæna Haworthii* (HAWORTH'S Minor) was taken in abundance by the margins of Whittlesea Mere, but has long since disappeared. This is really a Fen moorland insect, being taken on heaths and moors, in Yorkshire, and the North of England, and also in the Norfolk Fens sparingly. The larva feeds upon the Cotton Grass (*Eriophorum*), which grows upon the drier edges of moorland bogs. This plant still lingers in the district, but when *C. Haworthii* was abundant the plant also must have been common. *Euthemonia russula,* (the Clouded Buff) is stated by WOOD to have been a Cambridgeshire insect, but has not been taken during the memory of existing collectors. It is probably never seen away from a heathy locality: the conspicuous insect (usually the male) being trampled out of heather or ling,—the usual method of searching for it. Another pretty heath insect, *Anarta myrtilli,* (the Beautiful Yellow-underwing) has lingered in the district, being often still taken at Holme Fen. This moth flies in the sunshine about heather, on which the larva feeds. The existence of insects like these in the past indicate a physical condition

* Heather used to grow plentifully in prehistoric times, during the dry periods in which the buried forests lived. See the account of the Peat in the Geological Section of this work. [S. B. J. S.]

long obsolete. A plant of heather or ling does not probably now exist in the Cambridgeshire Fen district. Gamlingay was the nearest locality in that county given by BABINGTON seventeen years ago. As another remnant of a heath fauna might be instanced *Saturnia Carpini*, (the Emperor Moth) one of our largest and most handsome species. This is not solely a heath insect, as the larva will feed upon other plants. But it is so generally found feeding upon heath, and in heathy localities, that it was hardly likely to attach itself to a district where this plant did not exist. At Wicken Fen, where the species still remains, the larva feeds upon *Spiræa Ulmaria*, the Meadow Sweet.

In a district which has undergone such great superficial changes by drainage and agriculture, not many evidences of an old coast line can be expected to remain in the insect fauna. A few however exist. *Agrotis valligera*, a sea-coast species, has been taken at Upwell and St. Ives, showing the former existence of tidal influences sufficient to form a congenial home for this species; and as but very little of the boundary line has been investigated it will probably be found that this and similar insects are more abundant than is supposed. At Chatteris, once a tide-washed island, *Agrotis tritici*, another coast species, is found in abundance, and several maritime plants likewise grow there, as *Scirpus maritimus*, (Salt Marsh Club Rush) and *Scirpus tabernæmontani*, (Great Club Rush). These coast insects have also occurred on the sandy "brecks" around Brandon, in Norfolk) as first pointed out in a valuable paper by Mr. BARRETT),* which district at the present day, having remained partially uncultivated, possesses its old coast fauna in an eminent degree. Another insect, *Agrophila sulphuralis*, probably presents a still more curious distribution. Not quite forty years ago it used to be taken near Duxford, south of

* Trans. Norf. and Nor. Nat. Soc., 1871-2, p. 61.

Cambridge, where there are deposits of flood gravel and sand, the remains of an old coast line, similar to that at Brandon. The species was not then known elsewhere, and soon succumbed to the attacks of collectors. It was considered extinct until 1845, when Mr. J. F. DUNNING accidentally found it at Brandon, and it is now taken freely for a considerable extent along the old inland littoral there. This insect has not been found on any existing coast line, those named being its only known localities. At Whittlesford, a short distance from Duxford, *Spilodes palealis*, one of our present seaside species has been taken.

The comparative absence of fir plantations in the Fens is marked by a corresponding absence of fir Lepidoptera, many of the most abundant species, not being recorded in the district.

While the disappearance of some insects may be traced to the loss of local conditions necessary to their existence, the increased abundance of other species follows the extensive cultivation of particular plants before uncommon. Familiar instances of this are numerous. The common White Butterfly (*P. rapæ*) the larva of which feeds upon cruciferous plants (mustard, turnip, etc.) could not exist in such numbers as it does, had it to depend upon the wild plants of this family. Also may be instanced the Large White Butterfly (*P. brassicæ*), and the Cabbage Moth (*Mamestra brassicæ*), the larvæ of which feed upon cabbage; *Agrotis segetum* and *Agrotis exclamationis*, whose larvæ do so much injury to turnips and other similar roots by eating into them; *Hecatera dysodea*, the larva of which eats lettuces; *Caradrina cubicularis*, the larva of which does great injury by eating seed wheat when sown; *Vanessa urticæ*, (the Tortoise-shell Butterfly) *Plusia chrysitis* (the Burnished Brass Moth) *Hypena proboscidalis* (the Snout) *Botys urticalis* (the Magpie Moth) and other abundant stinging-nettle species, (for the stinging-nettle seldom thrives to any extent apart from cultivation). To these might be added the many species feeding upon hawthorn, and upon trees grown for ornament or shelter, but even those above will be seen to include the great majority of our most numerous species, and all owing their profusion to the abundance of their food plant through cultivation.

The Fens in this district have not a monopoly of local Fen insects, as Horning and Ranworth Fens, in East Norfolk, have furnished *Lithosia muscerda*, *Nonagria brevilinea*, *Crambus paludellus*, and *Sericoris Doubledayana*, which have not hitherto been taken elsewhere in England. It may also be mentioned that in Western Norfolk, within four or five miles of the western edge of the "Fenland" district, are taken *Lithosia mesomella*, *Ephyra pendularia*, *Fidonia piniaria*, *Platypteryx falcula*, and *Trachea piniperda*. As some of these occur in considerable abundance, it seems strange that they have not already been detected in this district.

Cordial thanks are due to the following gentlemen who have kindly furnished lists of their captures in the district. Mr. F. D. Wheeler, of Norwich, and Mr. Gilbert Raynor, of Hazeleigh Rectory, Maldon, for extensive lists of Macro-lepidoptera taken at Cambridge, Wicken Fen, etc.; Mr. E. Meyrick, a valuable and numerous list of recent captures of Micro-lepidoptera at Cambridge, Wicken, and Monkswood; Mr. Wm. Farren, of Cambridge, for the localities of a considerable number of rarities taken by him in the district; Mr. Daniel Fryer, of Chatteris, for a very numerous list of captures; Mr. A. Harold Ruston, of Chatteris and Mr. Herbert F. Fryer, Chatteris, for lists of captures at Chatteris, Doddington Wood, Warboys Wood, March, etc.; Mr. J. F. Balding and Mr. Fred. Ollard, for captures at Upwell; Mr. A. Thurnall, of Whittlesford, for a list of several hundreds of South Cambridgeshire species, chiefly Macro-lepidoptera; Mr. J. EVANS for a list of Bourn Macro-lepidoptera; Mr. J. A. SKERTCHLY, F.R.G.S., a list of Ely and Wicken Fen captures; Mr. SAMUEL SMITH, Wisbech, for captures at Bourn Wood; Mr. M. N. RICHARDSON, of Clare College, Cambridge, for a numerous list; and Mr. CHAS. M. HUFTON, of Cowbitt, for a list of captures in that neighbourhood.

Where published records exist of captures in the district of insects not recorded in the lists received, the authority has in all cases been given upon which such records rest. In the case of references to STAINTON'S Manual it is indicated thus:—(S. M.)

The list of species will be found in the Appendix.

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CHAPTER XIII.

THE SANITARY CONDITION OF THE FENS.

SECTION I.—*The General state of Health.*

IF any one should base his notions of the present hygienic condition of the Fen country, upon some of the poetic and historic allusions, which writers of the past have made to it, he would undoubtedly arrive at very erroneous conclusions. And there is in many parts of our country, a vague idea that the Fens are really gloomy, unhealthy, and swampy, even at the present day.

We find writers using, in relation to the district, such epithets as the following —"the foggy Fens"—"a dismal Fen"—"a muddy land"—"its banks of slimy mud" and CAMDEN* says—

"The city of Ely is not inconsiderable nor yet to be boasted of for beauty or populousness, being situate in a marshy soil and unhealthy air."

The same authority gives us an account of the Fens, as depicted by FELIX who lived at Crowland about 730 A.D.

"There is a Prodigious fen beginning from the banks of the Roman Gronta, extending a great way, intersected sometimes by sedge, sometimes with streams of *black water*, with woody islands, and crooked banks from the South to the North as far as the sea."

* GOUGH'S CAMDEN, Fol., vol. ii., p. 127.

Now although there are here no direct references to the *sanitary* state of this fenny tract, yet it is natural to infer that the description of a country abounding in muddy lands and black stagnant waters would convey the impression of insalubrity.

But if we may rely upon WILLIAM OF MALMSBURY, who wrote about the year 1100, the state of some parts of the Fens was favorable not only to productiveness but to health also: for speaking of Thorney, he says "it represents a very Paradise: for that in pleasure and delight it resembleth Heaven itself," and further—"the very marshes abounding with trees"—"the plain there is as level as the sea"—"neither is there any waste place in it."

Relying somewhat upon MALMSBURY, DUGDALE concluded that in the 11th century the outfalls were clear and open to the sea, and adds, that this "argueth a greater care in the people inhabiting this flat country in those days than hath been for several ages since."

And Sir HENRY HOBART, Attorney General to King JAMES I, says "that the grounds now sought to be drained are such as naturally and anciently were dry grounds."*

History however does not furnish us with any exact data upon which to base a numerical estimate of the prevalence of diseases or of mortality in past ages, and the oft used expressions of "foggy Fennes" or "unhealthy air" teach us very little.

Tradition and recent history tell us that Ague and Rheumatism, especially the former, were the commonest complaints among the Fen-people. We shall now speak more particularly of Ague, an endemic, incommunicable, paroxysmal fever.

Now what are the causes which favour the prevalence of this disease? The general idea has been that it is due to

* BADESLADE His. of the Ancient and Present state of the Nav. of the Port of King's Lynn 1766. Sec. iii., p. 15.

the excessive humidity of the air, but probably *excessive* humidity fails to account for more than a general depression of bodily vigour, and therefore the real cause of the ague must be sought elsewhere. Humidity may be a favouring agent, but it is certain that miasmatic emanation in the air is the essential factor in producing ague.

What is the source of this noxious exhalation? It is undoubtedly wet decaying organic matter. Now, it is found that the malaria arising from this, is most intense just after the water has left the surface of soil charged with decomposing organic substances; and when the surface of the lands has again become covered with water the ague diminishes.

Again, malaria is worst of all where the land has been recently covered with a mixture of *salt* and *fresh* water. Bargemen are very subject to ague in consequence of their living and sleeping in barges, which frequently lie for hours on river banks when the tide is out. But turning over soil by ploughing will in some districts, where the land has not been disturbed for several years, bring out malarial exhalations.

The climatal conditions favouring the development of malaria are these:—

(*a*) A high summer temperature rather than a high annual temperature.

(*b*) Much rain, followed by great heat (the wet organic matter being thus suddenly exposed to a high temperature.)

(*c*) A sudden fall of temperature and of barometric pressure.

It may be well in this place to state that by the term *malaria* we mean air or a mixture of air and any gaseous medium impregnated with *miasma*, *i.e.* fine floating particles of poisonous matter exhaled from putrefying vegetable or animal substances.

This poison occurs in different states of concentration in different strata of the atmosphere, the lowest statum being the most heavily charged with miasma, as it evidenced by the fact that persons living on the lower floors of a house in a malarial district suffer more from ague than those on the higher floors; from this it seems that the poisonous matter is somewhat heavier than air, but still it may be carried upwards by air currents even to a height of some hundreds of feet.*

We gather, then, that ague is caused by poison introduced into the blood; and our next enquiry is by what means is it conveyed thither?

First.—By the air in breathing, which is the most frequent mode of introduction.

Second.—By drinking marsh water. Experimentally it has been shown that dew collected from the leaves and grass, and the top waters taken in the morning from the surface of ponds in a malarial region, are capable of producing ague in man and a simlar ailment in the lower animals. Horses, cows, pigs, and dogs, have often suffered from malarial diseases, but the symptoms were not exactly like those in men though sufficiently similar to be easily recognized. Hence it appears that dew carries down the miasma from the lowest stratum of the air.†

The author of this chapter has heard it stated, by medical men, that the spleen of fen-dwellers is often enlarged, and this abnormal state of the organ has been attributed to Humidity, but that humidity alone caused the disorder has not been substantiated. HIPPOCRATES states that the

* See Dr. A. E. PARKES' Practical Hygiene, 3rd ed., comp. of air, Malaria.

† We are chiefly indebted to Dr. J. RUSSELL REYNOLD'S Lectures on Medicine, for this account of the origin of malaria and its influence in producing ague.

spleens of those who drink the water of marshes become enlarged and hard; and RHAZES not only asserted this but affirmed that it generated fevers," (Dr. PARKES). Recent evidence goes to show that marsh or fen air is not the only cause of ague or intermittent fever.

"Twenty years ago Mr. BLOWER of Bedford mentioned a case in which the ague of a village had been much lessened by digging wells, and he refers to an instance in which, in the parish of Houghton, almost the only family which escaped ague at one time was that of a farmer who used well water, while all the other persons drank ditch water."

"At Versailles a sudden attack of ague in a regiment of cavalry was traced to the use of surface water taken from a marshy district."*

The writer is disposed to attribute a great deal more mischief at the present day, to the drinking of the *Fen-water* than to the breathing of the *Fen-air*. In the past, malaria has, no doubt, been the cause of many ills to the Fen-people, but who shall say what proportion of the mischief has been due to the water.?

It is not possible in this book to go deeply into the subject of Chemical Climate—the reader must be referred to Dr. R. A. SMITH's work on "Air and Rain" (p. 520), and to what is there quoted from "*Il Miasma Palustre*," etc.

One extract from "Air and Rain" deserves a place here: "There seems to be a confusion in many minds between peat-bogs and marshes, but the difference is very great. No peat-bog gives out marsh fevers and agues, although the cold and wet may induce rheumatism. The acid peat prevents decomposition, and so removes all the results of putrefaction, which some people suppose to be the origin of the evil in marshes. The living plants, which may be the cause, are not in the peat-bogs."

* Dr. E. A. PARKES' "Manual of Prac. Hygiene," p. 71.

But Dr. SMITH has also pointed strongly to the fact that there are two sources of malaria from marshes, the *living* and the *dead* plant, and that when water (stagnant?) contains more vegetable matter than it can oxidise by means of the absorbed air, then some exhalation from the unoxidized vegetable matter is given off and the results are bad. This being so, the apparent abatement of malaria when the rainfall is decreasing is reasonably accounted for.

A few historical references to the comparative prevalence of ague in former and recent times may now be noted.

In WATSON'S history of Wisbech published in 1827,* some details of the census of 1821 are given, and it is stated that in a population of 6515, there were living forty persons between 80 and 90 years of age and *three* from 90 to 100, and the author remarks, "and yet many are fearful of entering the Fens of Cambridgeshire, lest the Marsh Miasma should shorten their lives." He then notices a book on "Intermittent Fevers" written by one Dr. BROWN of Boston, in which it is observed that these fevers were then not so frequent as they had been half or a quarter of a century previous, "an observation made, not only by the older inhabitants, but by the medical practitioners: the cause of which (decrease) is naturally to be attributed to the great improvements effected in the drainage of the country, by the increase of a fertile and productive soil, although it is acknowledged that the ague still exists; but prior to such improvements, few families escaped having their inmates labouring under the ague, even in some instances throughout the year."

In THOMPSON'S History of Boston, published in 1856, we find this: "it was remarked that immediately after the drainage of the Fens commenced, there was a greater prevalence of aguish complaints among the inhabitants of

* His. Acct. of Wisbech, by W. WATSON, F.A.S., published by H. and J. LEACH.

the surrounding district than before; but since it has been completed, agues, and all that class of diseases, have almost entirely disappeared. When the wet muddy surface was first left bare, *malaria* arose from it; but as the moisture exhaled, the malaria ceased," (p. 639).

Looking to the southern part of the Fenland, we find similar testimony given by the Rev. LEONARD JENYNS, who commenced Meteorological observations in 1823. He says, "When I commenced residence at Swaffham Bulbeck in 1823, this complaint (ague) was so prevalent among the poor of the village, that it was necessary to keep constantly on hand a stock of proper medicine for the relief of those afflicted with it. Of late it has become so infrequent, that hardly more than one or two cases occurred to my knowledge during the last ten years of my living in the neighbourhood."*

Mr. JENYNS goes on to remark that the class of intermittent fevers is not removed simply by the Fens being drained, for the humidity of the air or humidity with a high temperature will not engender fever. "It would seem requisite that there be a certain amount of decayed vegetable matter upon which these agents can exert their influence. Local intermittents, therefore, would be more promoted by the alternate flooding and drying-up of the meadows, according to the season of the year, than by the land being always under water."

The same author remarks that certain species of *Chara* and *Potamogeton* abound, that these cause a large accumulation of vegetable remains which emit an offensive effluvium, and which during the putrefactive processes, largely contribute to the miasma arising from the Fens of Cambridgeshire.† This being the case, it is evident that

* Observations on Meteorology, p. 371.

† But *Chara* while growing is a source of purification to water, as it gives off a large amount of oxygen and oxidises and renders innoxious the organic matter dissolved in the water. (PARKES.)

the cultivation of the land generally, as well as drainage, has had very much to do with the eradication of Fen fevers.

We have the testimony of resident medical men* of long practice, that within their memory the prevalence of malarial diseases, formerly so common, especially among the labouring population, has been reduced almost to nihility.

The ordinary type of the disease was *quotidian;* the *tertian* was always less prevalent.

Persons were attacked with severe shiverings and intense pain in the limbs, and when those symptoms subsided, *fever* and thirst ensued. Such was what is now called the *old-fashioned ague;* its milder representative of the present day is denominated *intermittent fever.* If we are warranted in making any distinction between the two, it is this—the paroxysm of the *cold stage* was much more severe in the former than in the latter, and we believe much more persistent.

Many medical men who have been in practise for several years past in the Fen district, have seen scarcely more perhaps than one or two cases of genuine intermittent fever—in fact the 'young doctors' would think it 'very interesting' to be able to note from personal observation the whole course of the paroxysm in the *rigors* or *shivering stage*, and the *hot* or sweating stages.

But people talk about having 'the intermittent' when it really appears to be nothing more than the ordinary effect of cold or debilitation, attended by a chilliness and a sense of dyspnœa in a slight degree; if these symptoms assume anything like periodicity, then the ailment must have come from the *Fen malaria!* The stigma of insalu-

* Particularly Mr. F. Fawssett, F.R.C.S., who has practised here some 45 years.

brity attaching to a district—like the odium of the once blemished reputation of a person—is not easily obliterated, even though changes the most radical may have been wrought in the one as in the other.

So much that has been written has vividly pictured the evil of the past, while the actual condition of the present has been but faintly represented.

It is true, as KINGSLEY says,* "The foul exhalations of autumn called up fever and ague, crippling and enervating, and tempting, almost compelling, to that wild and desperate drinking which was the Scandinavian's special sin." But who can wonder? In the past, neither home nor clothing afforded the same means of resisting the stern attacks of climate, as now,—neither could the old Fen-men obtain such remedies for ague and rheumatism as our times afford; stimulants were the readiest assuagers of their woe.

The writer just quoted, after enumerating what birds and insects have departed since the Fens were drained and cultivated,† remarks, "Ah, well, at least we shall have wheat and mutton instead, and no more typhus and ague; and it is to be hoped, no more brandy-drinking and opium-eating; and children will live and not die."

Canon KINGSLEY's hopes have not been realized; brandy-drinking has not ceased, but we do not suppose for a moment that it is greater in the Fens than elsewhere. Temperance advocates may have a wide field for labour, but why should they not attack the *opium-eating?*

If 'desperate drinking' was the special sin of our Scandinavian forefathers, *opium-eating*—the most insidious of habits—is the special vice of their descendants in the Fens. We fear, too, it is the labouring class who are the most

* HEREWARD THE WAKE, of the Fens, p. 18. † Prose Idylls—the Fens, p. 97.

addicted to this practice. It is with the sincere desire that something may be done to arrest this evil that we speak so strongly upon it.

Under the influence of this drug, men and women exist in a state of inanity, and their persons betray their habits; they look wan and emaciate; and more, the amount of money spent in this way is almost incredible—*a poor family will spend from eight-pence to one shilling per day for opium alone.* When the habit has taken such deep root, the desire for the periodic dose becomes irresistible, and every consideration of home necessities is sacrificed. Nay, the habit is handed down from parents to their offspring, for children are in infancy habituated to opium, in the form of GODFREY'S Cordial, and as they grow up are sent to the shop for the penny-worth or more of opium every day, and several times. What is so constantly before them induces a desire, and the children in their turn grow into opium-eaters.

But whence came this habit?

Perhaps the old Apothecaries administered opium for ague, long before the use of quinine was known—perhaps the drug was used for rheumatism as well; both the ailments were very painful, and the patient sought a present alleviation in opiates.

Thus, what was at first used simply as a medicine came, in time, to be habitually resorted to as a stimulant.

We have no means of estimating the proportion of the people addicted to opium eating, though the quantity of the drug sold in different places is ascertainable.

The modern opium-eaters of the Fens belong, in the main, to that class of people who would be topers elsewhere—a people to whom stupor or excitation has become 'a second nature.' In fine, to attribute the practice at the present time to climatal causes, is entirely fallacious.

The Fen district having been drained and cultivated now, for a considerable period, the organic accumulations which lay on the surface of the land, formerly subjected to periodic inundations, have undergone complete decomposition, and have ceased to emit noxious vapors. The animal and vegetabie deposits have been assimilated by the permament soil or humus which forms the basis of the rich pastures and arable land of the country.

Now we come to the question—does the almost constant presence of Ozone demonstrate the absence of Miasma? Certainly the co-existence of Malaria and Ozone is contrary to experience. For instance, when cholera was prevalent in 1849, and when the mortality from small-pox was great in Paris in 1870, very little or no ozone was detected by the usual test.*

The exact nature of Ozone is not at present fully understood, because that substance has not been isolated and chemically examined. The generally received opinion is, that it is a modification of oxygen, whose molecules consist of *three* atoms instead of *two*. Each molecule of Ozone very readily parts with one atom of oxygen, which at the instant of liberation is very active and tends to combine energetically with organic matter and even with the noble metals, the least oxidizible of all. Probably it is in consequence of this oxidizing power of Ozone, that its persistence and manifestation are incompatible with the presence of miasma.

Of course observations on Ozone have not been very numerous in the Fenland, but as Wisbech is situated as nearly as possible in the centre of the district, it forms a good representative station for the same, and therefore we

* See a paper on Ozone in Quarterly Journal of Meteorological Soc. for 1875, p. 383, et seq.; also "the Atmosphere" by FLAMMARION, pp. 65-6.

give the result of observations made here for 15 years (1861-1875).

But we wished to compare the Wisbech Ozone observations with those at some other station in England, and we have chosen Oxford, for two reasons, (*a*) because the records have been constantly kept there for the same 15 years, and (*b*) the place is considerably removed from the sea.

At Wisbech the ozonometer is placed 16 feet above mean sea-level, and the scale ranges from 0 to 10. In the table the means of each month for 15 years are given—also the average number of days, on which ozone was registered in each month.

At Oxford the observing station is 210 feet above sea-level. The average number of days at Oxford has not been obtained.

At Wisbech Days.	Jan. 19	Feb. 19	March 22	April 23	May 27	June 26
Ozone. At Wisbech.	4·0	3·6	3·6	4·0	4·9	4·5
At Oxford.	2·3	3·1	3·7	4·2	4·8	4·4
At Wisbech. Days.	July. 27	Aug. 25	Sept. 22	Oct. 17	Nov. 14	Dec. 17
Ozone. At Wisbech.	4·3	4·1	3·7	2·7	2·4	2·9
At Oxford.	3·0	2·3	2·8	1·1	1·3	1·0

Looking at the details before us, we note a few facts which the above table does not shew. In some years Ozone has been registered at Wisbech on every day in May, June, July, and Aug., notably in 1861,'62,'63,'67,'73,'74; it was in defect in the summers of 1869 and 1871; in the former year diarrhœa was prevalent, and in the latter small-pox. In June (1871) some cases of small-pox were reported—again in July, Aug., and Sept., and in Oct. there were *4* deaths, in Nov. *3*, and in Dec. *5*; there were deaths also from typhoid and diarrhœa, and it is remarkable that Ozone was weaker during the autumn of 1871 (especially in Nov. when it was recorded on 4 days only) than at any period during the 15 years. In Jan. 1872, Ozone was about an average, but fell below again in Feb. and March; there had been a partial cessation of the disease and then a fresh outbreak. But we find one other period when Ozone was deficient, viz: in the autumn of 1864. In Sept. of that year, the town was reported 'in a healthy state,' and our record states that Ozone was observed on 24 days, shewing an average of 4·0; in Oct. it was registered on 8 days only with an average of 1·1, and in this month some cases of small-pox occurred in the town—there were 2 deaths from the disease—in Nov. *one* death; the disease still lingered and *one* death took place in the Jan. of 1865, but in Feb. the disease had disappeared and we find that in this month Ozone was recorded on 20 days with an average of 4·0, which by a reference to *the table* appears to have been above the average of that month for 15 years.

We cannot attempt an exhaustive investigation of the relation between the manifestation of Ozone and the prevalent diseases on the rate of mortality—all we hope to do is, by making these comparisons drawn from carefully recorded statistics, to aid in bringing about a correct interpretation of the nature and action of this important atmospheric element.

By looking at the table it will be found that Wisbech compares very favourably with Oxford, in the amount of Ozone registered.

From Somerleyton, Suffolk, we have a return of Ozone observations for six consecutive years (1870—75), by the Rev. C. J. STEWARD, M.A. The station is 50 feet above sea-level, and 2½ miles from the sea. Scale (0—10.)

	Jan.	Feb.	Mar.	April	May	June
Mean..	7·3	7·2	6·7	6·7	6·8	6·9
	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mean..	6·2	6·4	6·7	6·6	6·3	6·2

The average daily amount was in

1870	1871	1872	1873	1874	1875
7·2	7·6	7·0	6·7	5·0	6·6

It might be imagined that proximity to the sea has something to do with this large average amount, but on enquiry it does not appear to be so, for at Silloth, Cumberland, where the greatest amount of Ozone is recorded of any place in the British Isles, with the land-breezes the tests (MOFFAT'S) are often nearly black. Several years ago the scale at this station was raised to 20 (0—20). The returns will be found in Mr. GLAISHER'S reports to the registrar General. The station is 28 feet above sea-level.

SECTION II.—*The Water Supply.*

WATER is the natural drink of man. This perhaps, is a truism which will meet with general acceptance. But we contend that it is *pure* water which nature demands, that is, the chemical combination of ozygen and hydrogen (H^2O) alone. This is evident from the fact that so large a portion of the human body has water in its composition. In the blood there are about 79 per cent. of water and 21 per cent.

of solid matters,* therefore water forms rather more than three-quarters of the bulk of the blood, and is an important component of various tissues. If, then, it is habitually introduced into the system in an impure state the consequences cannot be otherwise than injurious, especially when it is ingested during a sense of thirst, for the absorption of the fluid by the veins of the stomach is almost instantaneous.

Dr. CARPENTER, after quoting the well known case of lead poisoning of LOUIS PHILIPPE'S family at Claremont, says, "an excess of the saline ingredients which appear to be innocuous in small quantities, may produce a marked disorder of the digestive organs, and (through them) of the system generally; . . . . . the presence of a very small amount of putrescent matter is quite sufficient to produce the most pernicious results, . . . and these results, on the one hand, manifest themselves in the production of certain disorders which appear distinctly traceable to the direct action of the poison so introduced; whilst, *on the other, they become apparent in the extraordinary augmentation of the liability to attacks of such zymotic diseases as may at the time be prevalent.*" (The italics are ours.)

We contend therefore that water should not, except in medicine, be the vehicle for introducing *any solids whatever*, into the human system. All demands for solids should be met by the supply of a sufficent variety of natural food.

The objection to hardness, beyond a certain degree, arises from the unfitness of the water for washing and for cooking purposes, especially of vegetables, and from its causing constipation, and, in some persons, a derangement of the digestive organs. Of the most hurtful substances suspended in water we must enumerate these: "Animal organic

* For detailed analyses see CARPENTER'S *Principles of Human Physiology;* Comp. of Blood.

matter especially when of fæcal origin; vegetable organic matter when derived from marshes; and some salts," (PARKES).

There is one question which ought not to be entirely omitted here, that is whether an *undue degree of hardness in drinking water gives rise to the formation of calculi in the bladder?* Medical men are not agreed on this point, and when Dr. PARKES wrote his "Practical Hygiene" he had to state that statistics on this subject, on a large scale, were still wanting. (The stone is composed of uric acid combined with alkaline earths and soda). We are assured however, by a gentleman of high professional standing in the London medical schools, that drinking water containing much carbonate of lime greatly tends to the production of calculus.

Hardness is greatly reduced by boiling. Thus the Cherry Hinton (Cambridge) water has a *total* hardness of 23·9 degrees but after boiling, the hardness, which is permanent and due to sulphates of lime and magnesia, is only 6·3 degrees. The temporary hardness is 17·6 degrees (one degree of hardness = 1 lb. of carbonate of lime in 10,000 gallons of water.)

The time is near we hope when sanitarians will insist, more and more, that the frequent services of the chemist shall be required to tell us what is the condition of the *water we drink.**

But *quantity* as well as *quality*, is an important element in this enquiry as to Water Supply, and these two points will now be considered in the relation of this question to the Fen district.

At the onset, the enquiry presents itself, what are the sources of supply?

* Under the head of 'pure and wholesome water,' Dr. PARKES, says, "It should be transparent, without suspended matters, smell or taste, and well aerated. The total solids should not exceed 8 grains per gallon, of which only one should be dissipated by heat, unless it be a chalk water, in which case the total solids should not exceed 14 grains per gallon of calcium carbonate, and should contain only traces of calcium sulphate," Prac. Hyg., p. 26.

We shall answer that, Firstly, in relation to the Towns, and Secondly, in relation to the Villages.

[*Geological Notes representing the Water Supply.* The question of water supply from wells in the Fenland, might almost be written like the celebrated chapter on "Snakes in Ireland." There are no snakes in Ireland, says the astute author. There is no good water supply says the geologist. The Fenland must be looked upon as a great shallow basin excavated entirely in clay which is not of water-bearing nature. The Fen beds themselves are all more or less pervious, and unfortunately their permeability is not confined to wholesome water, but extends to noxious matter also. Being very shallow (never in fact exceeding 40 feet in thickness) they are naturally the recipients of all the sewage and effete organic matter, and I have no hesitation in condemning the whole of the shallow wells in the district as unfit for potable purposes. By what may be called a singular geological accident, the underlying beds for a depth of at least 1,200 feet in most places, are barren of springs. This will be the more evident by reference to the following diagram. The average dip or slope, of the strata from the highlands on the west, is towards the south east, so that water-bearing beds would be carried under the Fens, and as the dip is very slight (less than a degree) they would be within reach of boring everywhere. We may roughly divide the Fenland into a north-western portion extending from Lincoln to Stamford, in which the Lower Oolites yield the water, and a south-western portion from Stamford to Ely in which the Middle oolites bear the water. In the northern area the water-bearing stratum is the Inferior Oolite which is over-and under-laid by practically impervious beds. In the following diagram-section it is shown as a white bed, and it will be noticed that it thins out towards the Fens. The gathering ground of this bed is the district around A where it crops out upon the surface. The water flows in the direction A, B, C, and naturally gets more and more penned up. At such a point as B the water is at a great pressure, and if it be there tapped by a bore a copious supply will be obtained, and the pressure will be sufficient to throw it up some distance above the ground: it will in fact form an Artesian well.

FIG. 20.—*Diagram-section showing the lie of the Water-bearing strata.*

This is precisely the state of things at, say, Bourn, where a splendid supply is attainable, which has recently been utilised for the benefit of Spalding. The Fen beds are represented at C, and the diagram shows that the water-bearing limestone has died out before reaching any great distance beneath them.

In the southern area the basement of the Fens consists of two thick strata of clay, the Kimeridge Clay which comes on about the longitude of March, and the Oxford Clay which occupies the area to the west, neither of these can be relied upon as a source of water; for although they, here and there, contain thin water-bearing beds, these are very inconstant, and the chance of getting an adequate supply, even if they were reached, is reduced to a minimum. To the south of the district a series of water-bearing limestones comes in between these two clays, but they have thinned out long before reaching the Fenland area, just as is the case to the north.

There are subsidiary sources of good water in the country around Thorney and Whittlesea, but as these are questions of detail unsuited for this work, they may be passed over.

I should however be happy to afford such information to anyone interested in the problem. (S. B. J. S.)]

Firstly.—The Water Supply in the Towns.

CAMBRIDGE is supplied with water from two sources (*a*) from a spring in the chalk hills at Cherry Hinton. The works belong to a company. The water is reported to be "of most excellent quality for dietetic purposes."* The supply is constant. The total solid impurity however is given as 31·02, that is 21·7 grains per gallon, Dr. PARKES standard as already stated is 14 grains, as an admissible maximum.

(*b*) Water is also conveyed into the town by HOBSON'S conduit, but it is "not of unimpeachable quality."

ELY is supplied from the River Ouse. This source is given as a specimen of the unfitness of river water for domestic purposes (see R. P. C., p. 54). "The maximum evidence of anterior pollution was found in the Ouse just above Bedford. This river exhibited evidence of previous contamination equal to that which would be caused by the admixture of nearly 10 per cent. of average London Sewage with its water. This water after flowing about 70 miles and receiving the sewage of Cambridge and other places, is afterwards drunk by the inhabitants of Ely." There is an error in the report respecting the Ouse water, for the Bedford water does not pass Ely, it enters the 100ft. River at Earith; so the chief source of pollution comes from the Cam.

But the water is filtered. Specimens submitted for analysis *after filtration* showed a total of 46·6 of impurity,

* See Rivers Pollution Commission, Sixth Report 1874, pp. 326, 327. (Other references to this report will be marked R. P. C., and the page given, as R. P. C., p. 327).

that is, 32½ grains per gallon. The report states (p. 341) "This water could not be used for domestic purposes without risk to health; it is not, in our opinion, suitable for the supply of a town. It is so excessively hard as to be almost useless for washing."

From a recent analysis of the Ely water, by Mr. W. M. Hamlet, F.C.S., it appears that this water is contaminated with sewage; and although the specimen analysed shewed a water not directly dangerous, yet such waters, like most other river waters, running near or through towns, are by no means desirable for household purposes and may, under given unfavourable conditions, become positively hurtful to the community.

Analysis of Ely water supply, April, 1877—

Total solid impurity	37·8	grains per gallon.
Chlorine...........................	1·87	,,
Free Ammonia	0·01	parts per million.
Albuminoid Ammonia	0·15	,,

Peterborough has been very badly off for water. The people have depended chiefly on the supply from shallow wells. The water taken from the Town Pump contained 149½ grains, of solid impurity per gallon, a large amount of previous sewage and a high degree of hardness, (R.P.C., p. 88.) Mr. John Addy, C.E., reports thus—

A provisional order from the Local Government Board, confirmed by Parliament, was obtained by the Corporation of Peterborough, in Session 1876, under the powers of the Public Health Act, 1875, to obtain a supply of water from Wilsthorpe in the county of Lincoln, distant 11 miles from the municipal boundary. It was originally intended to acquire the famous Braceborough Spa spring,* but on account

* This spring contains a large quantity of carbonic acid gas, but does not possess any peculiar mineral ingredients. (S. B. J. S.)

of the exorbitant demand made by riparian proprietors upon the river Glen (into which stream the Spa springs discharge) for compensation, I determined to bore for water upon land adjacent the Spa, and in September 1875 was successful in tapping a spring, at a depth of 28ft., which rose in the form of a fountain to a height of 15ft. above the surface, and yielded from a 4in. bore, 7 gallons per second. A second boring was made about a quarter of a mile distant, and at a depth of 52ft., a similar fountain of water appeared, yielding 1½ gallons per second from a 4in. bore. These springs have continued discharging a copious supply ever since. In the immediate neighbourhood of the latter boring, a well has been sunk, and the water will be pumped to a high level covered reservoir on Obthorpe Hill, 169·00ft. above Ordnance Datum, from whence it will gravitate to and supply Peterborough and other Towns and Villages along the route, under a constant pressure. The water probably

Bourn Water, from Well-head at Bourn, November 1873.		Wilsthorpe Water, second boring, March 1876.	
Temperature Centigrade	10·50	Temperature Centigrade	11·11
Total Solid Impurity	42·92	Total Solid Impurity	40·5
Organic Carbon	·104	Organic Carbon	0·089
Organic Nitrogen............	·020	Organic Nitrogen............	0·025
Ammonia	·0	Ammonia	·0
Nitrogen as Nitrates and .. Nitrites	·0	Albuminoid Ammonia	0·002
Total combined Nitrogen	·020	Nitrogen as Nitrates and .. Nitrites	0·000
Previous Sewage or Animal contamination	·0	Total combined Nitrogen	·025
Chlorine	8·10	Chlorine	1·95
Hardness: Temporary	23·40	Hardness	21·50
Hardness: Permanent	11·80	Permanent	6·70
Hardness: Total	35·20	Total	28·20

issues from fissures in the Great Oolite formation, and is similar in quality to the famous Bourn Water. Dr. Odling, M.A., (Waynflete) Professor in Chemistry, in the University of Oxford, gives an analysis which I have compared with the analysis of Bourn Water, contained in the 6th report of the Rivers Pollution Commission (1874); see these analyses in the preceding Table.

W. Thompson, M.D., Medical Officer of Health for Peterborough, also gives an analysis of Wilsthorpe water, viz.:—

Colour.	None.
Smell.	None.
Suspended matter.	None.

After distillation with Nessler's test it was perfectly *free* from organic matter. Chlorine = 1·2 grains per gallon.

It is a very good and pleasant water for domestic purposes.

The whole of the contracts are let, the well is constructed, and yields 800,000 gallons a day, and it is hoped that the works will be completed in 1878, at an estimated cost of £69,000.

Whittlesea has been supplied from shallow wells the water of which shows as bad, and in some instances, worse qualities than the Peterborough pump supply. Analysed samples were foul from the percolation of sewage. "They were very dangerous waters, and their use for domestic purposes ought to be prohibited," (R. P. C., p. 409). We should be glad to see all water from shallow wells prohibited, for it is rarely, if ever, fit for either man or beast, and as populations increase it must become worse. Even after it is boiled and tea made of it, a sediment is deposited in the teacups, (see analysis).

March. We have simply to refer to the analyses of pump water used in this town, to show that the authorities should give the water supply question their most earnest and immediate attention. The water obtained from shallow wells in the gravel.

WISBECH. This town has had a good supply of water from the Marham springs for some years past.

The water gravitates by a main 6¾ miles and falls into a well at St. Germains, this being the pumping station; the rest of the main is 11 miles long; there is no reservoir at Wisbech.

The works were executed by Messrs. EASTON and AMOS and were opened in the autumn of 1865, and have proved to be a success, commercially. The share capital is £20,000 with further powers to raise £6,000 more, £1,000 of which has been issued; the new shares are preference ones at 4⅓ per cent. The original capital is receiving 5 per cent payable half-yearly.*

The table gives the analysis of rain water such as the writer has been accustomed to use for drinking purposes for some years, but water of this quality cannot be obtained in the midst of the town houses.

SPALDING. This town is supplied by a company with water, from an artesian well at Bourn. The works were being constructed when the Rivers Com. Report was in preparation. An analysis of the water from the Well-head† is given in that report at p. 118, and is said to be "clear, palatable, wholesome, and of excellent quality for dietetic purposes, but it is too hard for washing."

HOLBECH. On a recent visit to this town we observed a pump by the church-yard wall, and on enquiry found that the water from it is largely used for domestic purposes. The well is under the middle of the street, but certainly not removed from church-yard contamination, and we are not sure that street drainage is altogether excluded. We could not obtain any account of analysis of this water, but the Medical Officer of Health described it as "very bad."

* Wisbech is mainly indebted to Mr. GEORGE DAWBARN for originating the works.

† The *Well-head* is represented in our engraving of the site of HEREWARD's Castle.

The well water of this town must be impure. The subsoil is silt. The drainage goes into dry wells or into large brick sewers with open joints. In Summer the sewage is stagnant, there being no water supply to flush the 'big sewer.' Some people *prefer* the water from the church wall pump, but many persons use *filtered rain water*. The Clerk to the Local Board of Health seemed fully alive to the necessity of providing good water, but spring water can be obtained only by going westward about 17 miles, to the neighbourhood of Rippingale.

At present the people should look to an efficient storage of rain water as the best means of supply.

LONG SUTTON is supplied with water from shallow wells.

BOSTON. Our informant on the water supply of this town is Mr. W. H. WHEELER, C.E. A company has a reservoir at Miningsby, 11 miles off; it covers 33 acres of ground. The water is very good and the supply abundant. The reservoir is fed by a small brook, and by springs. The daily consumption in Boston is about 300,000 gallons. The analysis shows no evidence of previous sewage and only 14° of hardness, (see R. P. C. report, p. 52).

LINCOLN is supplied daily with 400,000 gallons of water derived from springs and from a gathering ground of 2000 acres, one third of which is cultivated, the rest woodland.

The Corporation has power to take water from the Witham. The quality of the water supplied to this city does not appear to be entirely satisfactory, (see R. P. C. report, pp. 52, 367).

LYNN. The water supply to this town is somewhat variable in quality. The channel by which it runs towards the town is of doubtful purity, and the storage ground and filtering beds are very close to the town. The authorities ought to look to this water supply question as a vital one, and place it beyond all personal or party interest, in a commercial point of view. The details of analyses made at different periods of the year, will show how far it reaches the standard of good water. If the water were brought directly from the source of supply, it would be unexceptionable in quality, provided the hardness were reduced.

[*Note to 5, 6, 7, 8, in Table.*—The water supplied to the borough of King's Lynn is of fairly good quality, the average of a large number of analyses extending over a period of three years, shewing that as a spring water coming as it does from the chalk, it is a perfectly safe and wholesome water, and in every respect fitted for domestic use. It is no harder than chalky waters usually are, and most of this hardness is of the temporary kind, which may readily be removed by boiling, or by CLARKE's process for the softening of waters.]

As confirmatory evidence of its character, it may be mentioned that one of the London water companies—the Kent Co. supply a similar water, derived from deep wells in the chalk; and its composition and quality as a potable water are almost indentical with that of Lynn water. This will readily be admitted by comparing the above analyses with those of the Society of Medical Officers of Health, London.

LITTLEPORT. Mr. C. T. ENNALS, M.R.C.S. reports thus—the water most used for drinking purposes in this district is Rain Water. It is either collected in cisterns, or tubs (the latter mode I consider most objectionable). The cisterns in many cases are badly constructed, and in close proximity to cesspools and drains, and the water must necessarily become contaminated with sewage matter.

The lower part of the village is supplied with river water, which is conveyed by means of pipes, and pumps are placed at convenient distances for the people in that part of the village. The water has been analysed and is of fair average purity. Filters are not generally used, though they are in more request than they were. As Medical Officer of Health, I have strongly insisted upon the importance of filtering all drinking water, and I hope in the course of time, filters will become more general than they are now.*

Secondly.—Water Supply in the Villages.

From what has been said respecting the water supplied to the towns, it may be inferred that in villages also it is very inferior.

The village pump water is no better than that in the towns. The water from the artificial rivers or drains is used by many people, and this is greatly polluted. In dry seasons there is great privation in the villages on this account. Holes are dug in the dried up *pits* or ditches, and a little soakage water thus obtained.

Where there is a good cistern for holding rain water and the houses are slated, the people are fairly supplied.

Rain water caught on the roofs of village houses, and stored in tanks impervious to all external pollution, is the best that can be had—perhaps *the best* that any people could drink. The idea that *rain water* is depressing to the human system is mythical.

This question of water supply in Fen villages has been very fully discussed in *The Fenland Meteorological Circular*, vol. i, and Mr. W. H. Wheeler, C.E., Boston, has shown in an article in that journal that a *sufficient* supply of rain water may be obtained by proper storage. The Sanitary Authorities will do well to enforce, that all cottages should be supplied with the means of catching and storing the rain water, where good water cannot be obtained by other means, which is very rare.

* In 1873 I made an examination of the water supply at the request of Dr. Thorne, of the Medical Department of the Local Government Board, and found in places a perfectly horrible state of things. This was afterwards confirmed by that officer, in a report dated November 1873, and his recommendations have since been carried out with marked success. (S. B. J. S.)

ANALYSES OF POTABLE AND POLLUTED WATERS.

DESCRIPTION.	Expressed in Grains per Imperial Gallon.						Expressed in Parts per Million or Milligrams per Litre.		OBSERVATIONS.
	Total solid Impurity.	Hardness.			Chlorine.	Nitrogen as Nitrates and Nitrites.	Organic Matter.		
		Temporary.	Permanent.	Total.			Free Ammonia.	Albuminoid Ammonia.	
Hall's Pump, March ....(1)	177·55	0	5·3	5·3	14·45	5·211	1·32	·35	Yellow tinge, saline taste, clear.
Barley's Pump, March ....(2)	161·15	0	5·5	5·5	13·36	7·138	·01	·56	Suspended matter, palatable, clear.
The White Pump, March ......(3)	136·25	0	5·8	5·8	13·79	4·31	·16	·27	Clear.
Whittlesea ....(4)	175·43	35·4	50·2	85·6	16·22	7·885	·07	·50	Clear, palatable.
Lynn Water Supply, June, 1876 (6)	21·46	10·0	6·2	16·2	1·30	·153	·05	0	Slightly turbid.
,, ,, 24th Oct., 1876 (5)	25·22	9·8	6·1	15·9	1·25	·105	0	·02	Clear.
,, ,, Nov., 1876 (7)	25·60	10·8	5·2	16·0	1·25	·108	0	·02	Clear.
,, ,, Nov., 1877 (8)	25·72	9·8	6·2	16·0	1·30	·280	0	·02	Slightly turbid.
Wisbech rain................ (9)	1·75	0	3·5	3·5	·25	0	0	0	Clear.

REMARKS.

(1) and (2). The water from both Hall's and Barley's pumps are both polluted with sewage, and that to a very large extent; the one known as Barley's pump being the worst. The proportion of chlorine, nitrates and organic matter is excessive, the latter is about thirty times more than it ought to be. There is no good feature about them. Both are unfit for human consumption and have, moreover, the properties of being clear and of a palatable taste, thus masking completely their bad characters. To compare with Previous Sewage Contamination, of the 6th Report of Rivers Commission, I should assign the following:—

Hall's .. .. 70,500 pts. per 100,000. Barley's .. .. 112,000 pts. per 100,000.

(3). I am of opinion that the above is a sample of surface drainage. The water is soft; contains a good deal of vegetable matter, and is contaminated with sewage. It is unfit for domestic use. (4). The Whittlesea sample is another disgustingly polluted water.

(5), (6), (7), (8). *For Remarks, see under Lynn Water Supply, p. 437.* (9). This is a very pure water.

Chemical Laboratory, Athenæum Chambers, King's Lynn. WILLIAM M. HAMLET, F.C.S.

Analysis of village well water, Terrington 1877.

Total Solid Impurity	115·75.
Total Hardness	6·50.
Chlorine	10·83.
Nitrogen as Nitrates and Nitrites....	7·63.
Free Ammonia	6·21.
Albuminoid Ammonia	·32.
Clear	

This water is polluted with sewage and decaying vegetable matter to an enormous degree, and is simply unfit for human consumption in any form.

No amount of filtration, however efficient, can possibly purify it: distillation is its only remedy.

General Remarks.—The Sanitary state of the towns and villages is improving, in this, as we would fain hope in other parts of our country.

Recent Sanitary Acts are having a salutary influence. People are awakening to the truth, that "cleanliness is next to godliness," that, if filth is allowed to collect in and around their houses, the inmates cannot enjoy the blessings of health; that it is not sufficient for a man's own house to be clean and adapted to health, it being equally necessary that his neighbours' houses should be in a like state, for foul air is never confined to the spot on which it is generated. (We are not scrupulous here about expressing these matters in strictly scientific phraseology.) The most wretched hovels may be found in very close proximity to the best class of houses.

The well appointed stable, clean, warm and well ventilated, is a palace compared with the labourer's hut hard by, a place in which the young lady of the mansion would not allow her pet dog to be lodged. The houses in the main road may be all that a sanitarian can wish, but the real sanitary question hinges on this, What is the state of the houses in the back street? What the condition of the back yards and cesspools? for disease germs, and effluvium will be wafted to the front street or the terrace.

The lack of healthful arrangements in the lower class of houses is not due to poverty alone, (and nothing is more likely to produce poverty, and to make people burdensome to others, than want of health) but to ignorance or indifference. Plagues have been stern but efficient teachers.

Had sanitary science grown apace with the population, the *burden* of necessary improvements would not be felt so heavily as it is at the present day, (when indeed, Hygeia is but a youthful lady), yet, as our towns and villages enlarge, good water and the proper means of keeping our houses clean are more and more needed. This appears evident, when we consider that our rivers, even, are contaminated by many causes which had no existence half a century ago. The Science of Health is of the greatest importance to mankind, since the joys of health surpass all others, and whoever provides for these grudgingly and sparingly practises a terribly *false* economy. Improvements may be costly, but ill health is far costlier.

Though we have stated that the towns and villages in the Fens are improving in healthfulness, we are not able to name one town which approaches the *standard* of a "City of Health."

There is however a village, which we would mention—if not in the glowing terms of old MALMSBURY, yet, as the well built, clean and pleasant village of Thorney. This village belongs to the estate, called the "Thorney Lordship," which consists of about 19,000 acres, the property of His Grace the DUKE OF BEDFORD. The greater part of the village has been rebuilt in recent years. The cottages are of white brick and substantial, but not of that rigid uniformity of architecture which would give a visitor the idea that he was entering a rural barracks. There are indications that further improvements in the village are contemplated,—and certainly by the removal of some old houses, the widening of part of the road and the extension of the rows of trees, the spot will be rendered still more picturesque.

Thorney is in many respects a model village. Every thing about it seems under careful supervision. There are good elementary schools; no children are seen loitering on the road during school hours, and those in the school look well clad, cheerful and rosy. Here we had, on a recent visit, an index to the general sanitary state of the place. Persons of a larger growth are likewise cared for, as there is provision for rational amusement or mental culture—and how can a community develop in *real manhood* when these are entirely wanting? There are a reading room supplied with daily papers, periodicals, and books; a lecture hall comfortably fitted and ventilated, and a working men's club in course of formation, all carried on with due regard to the principles of local self-government; while the temptation to drinking habits is reduced to a minimum.

Here we found water-works, sewage-works, and gas-works. All cottages are lighted with gas, have water taps, a good arrangement for carrying off waste water, and in about two-thirds of them the earth-closet system is employed. Every cottager has a good garden and may have a plot of ground of half an acre at a small rental. The death rate is 16 per 1,000.

Travellers going on the Midland Railway from Peterborough to Wisbech may see a large building, with a tower, standing between the railway and the Thorney Abbey. In the tower is a reservoir to hold 10,000 gallons of water, and from this the village is supplied. The water comes into the estate from the Nene and runs up the "The Thorney

River," and all is done that can be to purify it by filtration ere it is pumped into the reservoir. In the building referred to there are two fine engines of 25 horse power each; they are employed for pumping this water, and also the sewage which is used for irrigation. In the same building are spacious work-shops and store-rooms containing the necessary appliances *for keeping things in order.*

We have no analysis of the water, and while we are satisfied that it is well filtered and that the filter beds are periodically cleansed, yet we know it is *river water*; however we observed a liberal supply of tanks placed above ground for catching rain water.

This brief note on Thorney may not convey to the reader an adequate idea of what the village really is, and therefore we say to any who wish to know more—visit it.

[S. H .M.]

SECTION III.—*Vital Statistics and their relation to Sanitary Conditions.*

[Communicated by Mr. J. MITCHELL WILSON, M.B., sometime Medical Officer of Health, Chatteris.]

THE genuine and wide spread interest that has recently been awakened in such subjects, is of itself evidence that there is a confident belief in the intimate relation subsisting between the sanitary condition of any district, and the records of its birth and death-rates. Although attention has been, until now, mainly drawn to these relations as they exist in large towns, happily, the legislation of late years has recognised that even the health and comfort of rural districts is deserving of some consideration, and as this subject will in the future occupy a still more prominent and important place, we are justified in believing that even this sketch will assist sanitarians and others to estimate not only the present condition of our Fens, but will also serve as a source of comparison of the benefits which may confidently be expected to follow from the more complete and better devised measures of another generation.

There are few, if any, districts in England, where the present could not be advantageously compared with the past condition, but the Fens possess an exceptional interest, arising from the fact that the very works, successful in reclaiming and making the once wide waste now valuable land, have also been effectual in eradicating the Ague that seemed a natural heirloom of the inhabitants. It will afterwards be shown that the prevaling opinion outside our district, of the almost necessary association of Ague and the Fens, has happily no foundation in the present day.

Statistics have for their object, a reducing to numbers having an universal and definite signification, the opinions formed upon any number or groups of facts, which would otherwise be expressed, biased by the hopeful, gloomy, or other predisposition of the observer. Their trustworthiness depends upon the accuracy with which these facts have been recorded, and also upon their number being sufficiently numerous to prevent any accidental or temporary circumstance influencing the conclusions drawn from the sum of the observations. The statistics here presented are based on the returns of the Registrar General, which also afford the necessary data for making those comparisons which form an essential part of all statistical tables.

The Isle of Ely, comprising the four unions of Wisbech, Ely, North Witchford, and Whittlesea, has been chosen as a representative district, in which are found the soil, extensive drainage works and other natural characters peculiar to the Fens. The population of this district increased between the (census) years 1861, and 1871, from 77,000 to 79,000, and during that period 15,800 deaths have been registered, giving us a large number of facts from which to calculate the different averages of ages, mortality, etc. The relative numbers of the population living at the different ages is a most important perliminary inquiry, which governs the value both of the birth and death-rates, and in the present case, serves to prove how largely our country parishes are taxed to supply large towns and populous centres with young and healthy lives. From 1861 to 1871, the births registered in the Isle exceeded the deaths by nearly 10,000, but at the census taken in the latter year, the increase of population was found to be only about 2,000, shewing that 8,000 or 10 per cent. of the total population had removed from the district during these years. In studying the distribution of the population in groups of ages, we find the per centage of persons living up to the age of 15 nearly equal to the average for the rest of England and Wales; and it is only when we compare the numbers living between that age and 35, that we find the disproportion shewing itself: thus while in the one case between these ages the number of persons is 335 per 1,000 of the whole population, 300 per 1,000 was the ratio in this district. After the age of sixty years the balance is restored; the number of persons living in England and Wales after this age being at the rate of 75 per 1,000, while the ratio for the Isle is found to be 95 per 1,000. When the relative number of either sex is much in excess of the normal proportion, a slight correction is necessary in calculating the true death-rate; in our district the excess of females is 2 per 1000 under the relative proportion of the sexes found at the census of 1871, in the whole of England and Wales, and this difference is too small to have any disturbing influence.

In instituting a comparison of the death-rate existing in any district, the usual standard is that of the whole country, but we find it largely influenced by the death-rate in towns, and therefore a more natural comparison is with that of certain healthy rural districts, this being the standard to which all sanitary and other improvements tend. In this district, we must remember that our population is deprived of a large per centage of lives at ages during which the death-rate is only about 10 per 1,000, and has an unusual proportion of persons living at ages in which the death-rate is between 60 and 70 per 1,000. This correction will enable us to see that the annual average for the 10 years at all ages (20·2 per 1,000) is greater than it would be in a population living under the same influences, but distributed more in accordance with the normal standard of number and age. During the first 5 years of the decade, the mean of the annual deaths was equal to a rate of 21 per 1,000, while that of the last 5 years was equal to 19 per 1,000; there is therefore good reason for believing that sanitary measures are not being altogether neglected in the district. The annual death-rate in healthy rural districts being only 17·4 per 1,000, and as the Registrar General has said that every death beyond that rate is an unnatural one, or may be said to be caused by preventible disease, our figures clearly point to the operation of some of these diseases among us, and such facts should be sufficient to invest this subject with a wider and more personal interest. It will be immediately shown what particular diseases are causing this excess of deaths, and the lower mortality from these in other and better situated districts, should be sufficient encouragement for further improvements in our own. Another test of our sanitary condition is the death-rate among young children, their lives being largely influenced by their immediate surroundings, such as food, etc.

In proof of this we find that the deaths among children under 5 years of age, equal 38·7 per cent. of total deaths, while in our own district the deaths have been equal to 42·5 per cent. The deaths among persons over 60 years of age is somewhat higher than the general average, but this is to be expected when we consider the increased proportion of aged persons in our population, and, as the numbers for England and Wales are 25 per cent. of the total deaths, and in our district 27 per cent., the slight difference serves to bear out the fact that many Fen-people live to the ages of 80 and 90 years.

The birth-rate is largely influenced by the proportion of persons living at a marriageable age, and also by the degree of prosperity of the inhabitants; in our district, the births have been equal to 32·9 per 1000, a rate which is in excess of that in many agricultural counties.

TABLE I.

Estimated Population in the Isle of Ely at the end of the year 1870--79,000.

Total number of Deaths during the ten years, (1861-70)—15,840.

Annual Rate per 1000.		Proportional numbers in a Population of 1000.	
Births.	Deaths.	Males.	Females.
32·9	20·2	489	511*

Number of persons living at different ages per 1000.		Per centage of Deaths registered at these ages.
Under 5 years........	135	42·5
5 to 15 ,, ...	238	9·5
15 to 35 ,, ...	300	13·0
35 to 60 ,, ...	232	7·9
Over 60 ,, ...	95	27·0

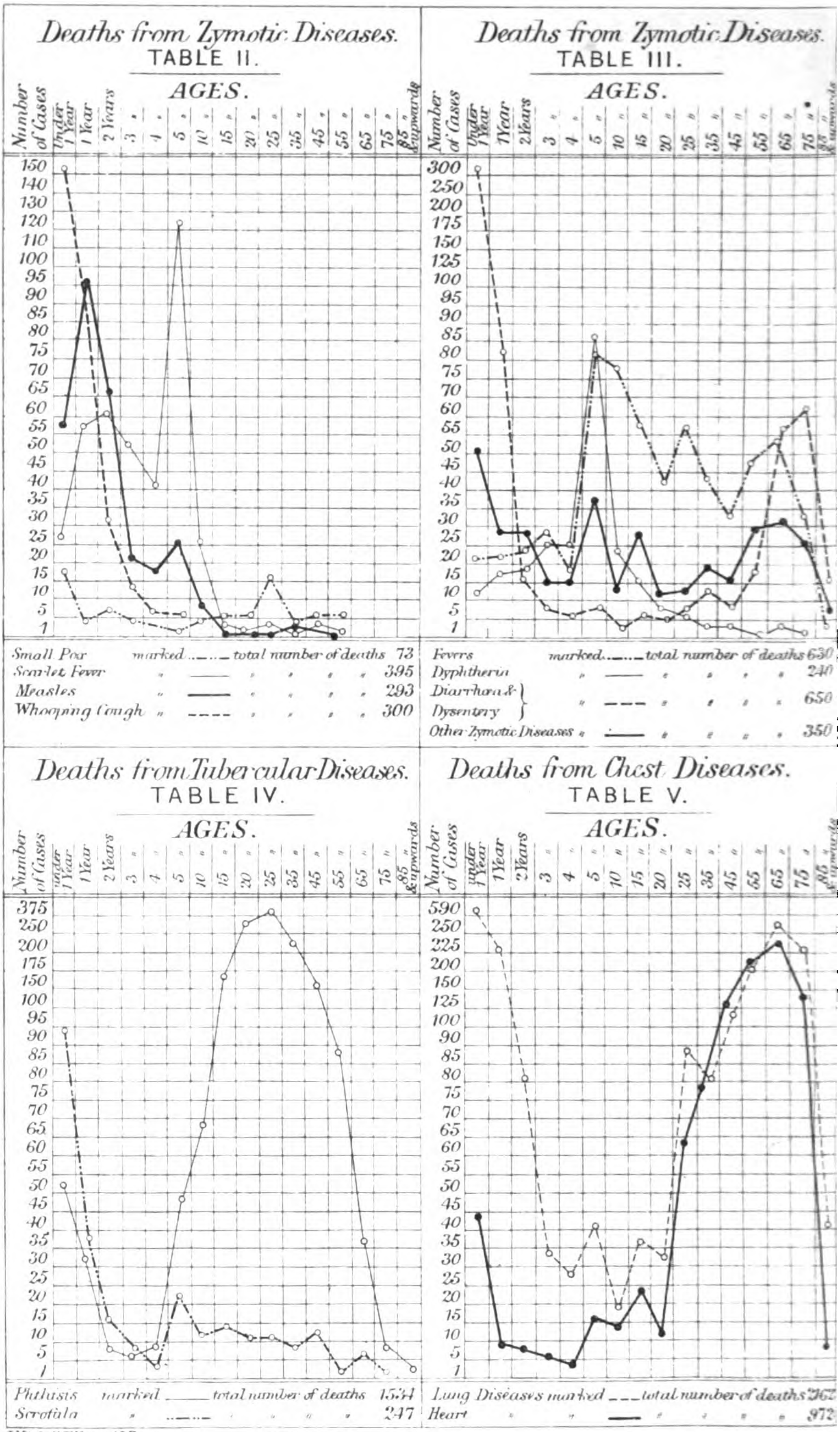
* The relative numbers in the population of England and Wales are—Males, 487; Females, 513.

The mean of the total birth-rate for the first 7 years of the decade equalled 32 per 1,000, while that of the last 3 years equalled 34, shewing an increasing rate closely approaching the average for England and Wales.

Tables II. and III.* are intended to represent in groups the number of deaths from the zymotic class of disease. Those in table II. are originated and spread by infection, while the majority of those in Table III. are infectious, and can also originate from such causes as impurities in our food, drinking water, and neglect of sanitary measures.

The diseases registered in table II. are peculiar to young children, there being very few deaths from any of them after the 10th year, with the exception of small-pox. It will be seen that more than two thirds of the deaths registered from whooping cough occur before the second year, and for 10 years no death from this disease occurred after the 5th year. As we might expect, the deaths from small-pox are controlled by the protecting influence of vaccination, for we find a large number of the deaths from this disease took place during the 1st year, or before vaccination, and between the 15th and 20th years, when the protective effects of infantile vaccination had become exhausted. Scarlet fever seems to have reached its highest fatality at the 5th year; and a death from this disease, one from measles and several from small-pox, occurred at the advanced age of 55 years. Table III. shows us the very large number of deaths in children under one year from diarrhœa, a disease which is strongly influenced by atmospheric changes; *e.g.* the year 1868 was remarkable for its very hot Summer, and during that year the deaths from 12 selected diseases were almost all below the annual average number, while those from diarrhœa far exceeded the number for any other year of the ten.

* See Diagram of Vital Statistics.



J. Mitchell Wilson, M.B.

Vital Statistics. THE FENLAND.

Fever, especially the enteric or rural variety, is essentially a disease of adolescents, when the organs of assimilation which are also usually the main seat of the disease—are particularly active in preparing additional materials for the growth of the body. It might seem strange that ague should have been omitted, especially in the Fen district, from this table, but the deaths from this disease are only significant from their rarity; thus in the year 1870, in the county of Cambridge, of which the Isle of Ely forms the smaller half, only two deaths from ague were registered; this was no exceptional year, as the deaths due to this disease in England and Wales were 120, a number slightly above the annual average of the 10 years. These tables give the number of deaths from Zymotic diseases, which have been equal to 3·72 per 1,000 persons living. The close connection between these diseases and the unwholesome conditions surrounding our dwellings, is borne out by the fact that the death rate varies in healthy and sparsely populated districts, from 2 per 1,000, to three times that number in counties where the population is largely composed of the inhabitants of closely packed manufacturing towns, where in addition to increased means of spreading these diseases by contagion, their existence is at the same time largely influenced by the concentration of numerous sanitary defects.

Table IV.* shews the deaths from scrofula and phthisis, diseases having an intimate relation both in their origin and diffusion; the former disease claims a large majority of its victims before the end of the second year, while from the latter the deaths are comparatively few until the fifth year is reached; after this age a continuous increase in the mortality occurs until the maximum is reached at the 25th year. The deaths from phthisis have been equal to 2·9 per

* See Diagram of Vital Statistics.

1,000, which is lower than the average of ordinary rural districts. Table V.* includes the deaths from other diseases of the respiratory organs, and shows the very large mortality from diseases of the lungs in young children, and also the rapidly increasing mortality, from diseases of the lungs and the heart, from the age of 45 and upwards. Here again we have to note that atmospheric changes, especially extreme and long continued cold, are everywhere followed by an increase in the mortality from these diseases, shewing that the body enfeebled by old age, is often unable either to carry on the additional work necessary to preserve its warmth, or to rally from the depressing effects of cold.

TABLE VI.

Annual Birth and Death Rates per 1000 of the population.
Rainfall, Temperature, and Total Mortality from several Diseases.

	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870
Birth rate......	32·9	32·8	33·7	32·3	32·9	31·7	31·0	34·0	34·1	34·2
Death ,, ...	22·3	20·3	20·8	22·5	21·6	18·2	18·7	18·4	20·1	20.0
Rainfall Inches	21·26	21·30	19·35	15·99	27·43	26·39	26·08	22·84	26·53	20·48
Temperature.	°	°	°	°	°	°	°	°	°	°
Annual Mean ..	49·1	48·8	49·8	48·6	50·0	49·5	48·7	51·5	49·0	48·5
Highest monthly	62·2	58·7	61·5	61·3	64·1	60·4	62·7	66·9	64·1	64·2
Lowest ,,	33·4	38·3	40·6	35·8	35·4	40·5	34·7	37·7	36·9	33·1
Deaths from—	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.
Small pox......	5	9	8	15	12	2	18	2	1	0
Measles	120	13	3	3	55	23	0	4	62	10
Scarlatina	4	44	104	123	30	3	3	12	24	48
Diphtheria	20	24	69	56	24	15	10	5	9	9
Whooping Cough	73	22	11	58	19	10	45	12	33	20
Diarrhœa	76	28	45	49	96	50	52	116	60	78
Fevers	86	103	64	61	64	51	49	42	55	55
Phthisis	155	127	127	169	184	160	167	151	140	154
Heart disease ..	59	56	85	62	74	75	87	66	73	86
Lung ,, ..	224	246	212	228	235	168	213	162	232	242

* See Diagram of Vital Statistics.

Table VI. shows the most prominent points of each year bearing on the connection between the mortality and the yearly Rainfall and Temperature; these latter are only two of the many questions requiring consideration in an extended study of the climate of any district; but taken in connexion with the very general prevalence of our cold, moisture-holding clay subsoil, and the constant evaporation from the large area of our superficial drainage arrangements, they are found to exercise a very considerable influence on the course of many diseases. Similar to the effects of these agents on our mortality, is the fact of the prevalence in an epidemic form of any of the Zymotic class. Years which, but for these epidemics, would be marked as having a low death rate, are by them made to rank with those in which the yearly death rate is up to, or above, the average.

The effects of temperature and seasonal changes upon different diseases, is a subject which has been studied since the time of HIPPOCRATES, and as the result of observations and deductions in that age, the four seasons were supposed to have their characteristic groups of diseases, varying in severity with the atmospheric changes. A recent writer on this subject states that the foundation of seasonal diseases is the varying degree of vital action going on within the body at the different seasons of the year. He divides the year into the—

First quarter	or period	of	Maximum vitality.
Second	,,	,,	Maximum and Decreasing.
Third	,,	,,	Decreasing and Minimum.
Fourth	,,	,,	Minimum and Increasing.

It is during the first and third periods that we find atmospheric agencies having their greatest effects, which are shown more particularly in the mortality from two groups of diseases, viz: chest diseases and those of the digestive organs. These periods of vitality must not be confounded with the periods of greatest activity of the animal system; for the separate diseases included in these groups are most frequently the result of an excess of the natural functions, which at those seasons are in a state of maximum activity. We thus find the period of minimum vitality coincides with that of maximum activity, in those organs which suffer most from the effects of a continued high temperature. This is proved by a comparison of the highest monthly temperature of the years 1865-68-70, with the excess of deaths during these years from diarrhœal disease; on the other hand, we find the years in which the lowest number of deaths occurred from this group are 1862,3,4,6, in each of which the highest monthly temperature was below the average. The rainfall of the early months of the year becomes an important element in judging of the effects of the high temperature of the summer and autumn months, depending as many are, in the district, for the water supply either on rain or water from surface wells. The coincidence of a short early rainfall and a hot season, compels many to use water so impure as to increase the already existing tendency to intestinal diseases. It is interesting also to trace the connexion between years in which the lowest monthly temperature was below the average, and the mortality during these years from phthisis and other chest diseases. The temperature of the month of January for the years 1861,4,5,7, and December of 1870, was in each case below the corrected average, and during these years we find a proportionate increase in the mortality from chest affections, and particularly so is this the case when we find a low temperature and an excessive rainfall come together: thus, January of 1865 was 2° warmer than the corresponding month of 1860, but the rainfall of the former year was more than 6 inches in excess of the latter, and while the deaths from chest diseases were high in both years, the numbers for 1865 were the highest for any year of the ten, and so the year which is both wet and cold becomes the poor man's doubly unwelcome visitor. The extremes of the temperature for the year are thus more important than the mean of the whole year—the annual variations during the 10 years have not been more than 3° between the highest and lowest years—while the range between the highest monthly temperatures was 8·°2, and that of the lowest 7·°5.

It is impossible, here, to continue this interesting subject. One or two of the main facts only have been examined, but almost any of the diseases enumerated in Table VI. would serve to illustrate the fact of how largely we are at the mercy of agencies external to us, and of the necessity for our taking full advantage of those measures that science and common sense have designed to modify and combat some of the evils surrounding us.

CHAPTER XIV.

ANTIQUARIAN RELICS.

SECTION I.—*British or Keltic Relics*, (*Pre-Roman*).

ANCIENT BRITISH COINS.

Cunobelinus.

REFERENCE has already been made to CUNOBELINUS in the Historical Sketch, (p. 33), and now we proceed to describe the coins figured in the accompanying plate. We are indebted to Dr. J. EVANS, F.R.S. for all that we can say on this subject. That gentleman very generously and promptly responded to our request for permission to copy some of the engravings of coins, offering at the same time to revise the Numismatic portion of the book.

The following extracts seem essential, to a clear understanding of details of each coin.

"The coins of CUNOBELINE present a considerable range of types, some few of them being purely British in their character, but the majority of them showing the influence of Roman art, and many of them bearing devices borrowed from Roman coins. Even on the coins of TASCIOVANUS we have seen that this was, to a certain extent, the case, especially with what are supposed to be his later coins.

But under CUNOBELINE it seems pretty evident that Roman engravers or engravers brought up in the Roman work-shops, were employed in the mint of Camulodunum. . . . . It must, however, be observed that this adoption of classical types is confined to the silver and copper coinage, for the gold coins of CUNOBELINE still retain the original British types, though in a somewhat modified form. On some indeed (see plate, Fig. 1.) we find a close approximation on the obverse, to the cruciform ornament formed of two wreaths, while on the reverse, the second horse of the biga reappears. On the majority of them, however, the sole remembrance of the original laureate bust (see engraving on p. 52.) is the wreath-like ear of corn, and a single horse is all that is left of the biga on the reverse, (plate, Fig. 2)."

"On some few of the silver and copper coins, the types are also either purely British or else more nearly allied to coins of other British princes, than to those of Rome."

The variableness of workmanship and the diversity of the type and execution are stated as proofs, that the reign of CUNOBELINE was of long duration. An abbreviated form of Camulodunum is found on all the gold coins, and it is probable that the silver and copper coins were minted in that town, which DION CASSIUS asserted was the *βασίλειον* of CUNOBELINE. "Its site has been supposed by CAMDEN and others to have been at Maldon in Essex; but there can be no doubt that Colchester is its modern representative."

Dr. EVANS then divides the silver and copper coins into three classes.

1. Those on which the name of CUNOBELINE appears alone.
2. Those on which it appears in conjunction with that of his father TASCIOVANUS, (see plate).
3. Those on which it is found in conjunction with the name of the place of mintage.

Our plate will not illustrate all these divisions because we have selected such coins as have been found in or near the Fenland.

Gold Coins of Cunobelinus.

No. 1.

Obr.—CAMVL on a tablet with beaded edges, placed across a five-fold wreath; in the angles are V-shaped figures, alternately plain and wreathed; in each of the plain ones is an oval between two round pellets. The tablet is placed between two ring ornaments and its ends are curved inwards. The ends of the wreath next the tablet, are formed by narrow crescents, and the lines of which the wreath is composed are alternately beaded and plain.

Rev.—CYNOBELI . . Two horses galloping to the left; above, a large leaf, and a pellet below the tail; under the horses a wheel of four spokes, with pellets between them. A curved exergual line separating the legend from the field, and the whole is surrounded by a beaded circle.

N. (aurum, gold) $82\frac{8}{10}$ grains.

This coin was found near Cambridge, and is in Dr. Evans's possession.

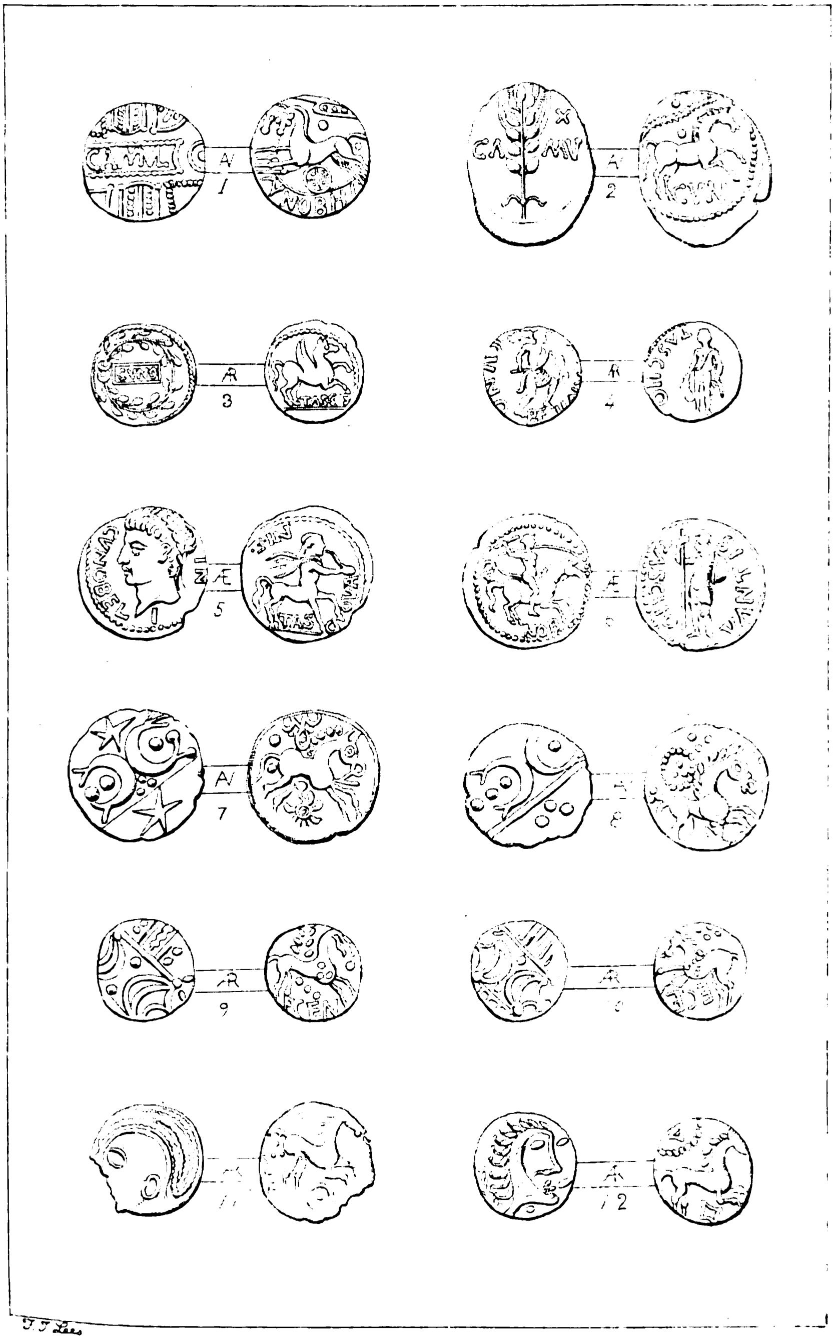
No. 2.

Obr.—CA-MV, ear of bearded corn, with leaflets at its base; in the field a small cross.

Rev.—CVN, horse prancing to the right; above, a branch between two pellets. No exergual line.

This coin was found at Childerley Gate near Cambridge, in 1854.

Another of precisely the same type, but not showing the small cross, was found near Potton in Bedfordshire, about 1858. Dr. Evans describes a gold coin, weighing 21 grains, found at Swaffham, Cambridgeshire. An ear of corn upon it has seven grains and has leaflets at the base; the stalk is shown all the way up the ear.



J. T. Lees

ANCIENT BRITISH COINS

Silver Coins of Cunobelinus.

No. 3.

Obv.—CVNO on a tablet in the centre of a wreath. The whole within a beaded circle.

Rev.—TASC.F. Pegasus prancing to the right. There is an exergual line, and the whole is surrounded by a beaded circle.

Æ. (*argentum*, silver) 18¾ grains.

This was found at Sandy, Bedfordshire, in 1837. A coin of this type was published by CAMDEN (GIBSON'S Ed., Plate I. 18), who, however, read the legend on the reverse as TASCE, and this error is repeated by STUKELEY, Plate VIII. 6: and PEGGE, cl. III. 2.

This coin, it will be seen, bears the name of TASCIOVANUS, CUNOBELINE'S father, Dr. EVANS shows TASC.F. on this and other coins is analogous with DIVI.F. on the coins of AUGUSTUS and TIBERIUS. The coin above described preserves the character of a purely British coin, while the Pegasus on the reverse testifies Roman influence. The Pegasus is of much more frequent occurrence on the coins of TASCIOVANUS than on those of CUNOBELINE.*

On Plate X., Fig. 8. (Anc. Brit. Coins) is shown a coin with a beardless head on the obverse, and a horse galloping on the reverse, a specimen of which was found at Sandy, Bedfordshire, and presented to Dr. EVANS by Mr. JAMES WYATT, F.S.A., of Bedford.†

No. 4.

Obv.—CVNOBELINVS. Partially draped figure marching to the right, holding in his right hand a short staff or sword, and carrying a dead animal on his shoulders. The whole within a beaded circle.

Rev.—TASCIIOVANI . . (?). Partially draped figure standing to the left; in the left hand a bow, the right pointing to the head of an animal standing behind. The whole within a beaded circle.

Æ. 17 grains.

* Ancient British Coins, p. 306. † Ibid., p. 310.

This coin, and another found at Cotton End, near Bedford, and now in Dr. EVANS's collection, are the only two coins of this type, at present known.

Copper Coins of Cunobelinus.

Copper coins of this prince are figured on Plate xii. of Dr. EVANS's book. These have been found at Oundle and other places in Northamptonshire, at Biggleswade and Sandy in Bedfordshire and in the neighbourhood of Cambridge.

No. 5.

Obv.—CVNOBELINI. Laureate, beardless head in profile to the left. The whole within a beaded circle.

Rev.—TASCIOVANI.F. Centaur to the left, with a mantle over his shoulders, and blowing a horn. There is an exergual line, and the whole is within a beaded circle. Æ. (*æs*, copper) 86 grains.

This coin was found in the neighbourhood of Biggleswade, others of the same type have been found in Northamptonshire and Essex.

The reason for our selection of this and next one to be described, will be obvious from the quotation following.

"The laureate head on the obverse, and the form of the legend CVNOBELINI, connect these coins with those in silver, Plate X., Fig. 1.* Their fabric is such that there can be little doubt of their having been the work of Roman artists, and of the portrait being that of CUNOBELINE represented after the manner of the Roman emperors. The centaur on the reverse, unlike that on the copper coin of TASCIOVANUS, is blowing a single horn, instead of playing on the double flute." . . . . .

The type appears to be original, and not derived from that of any Roman or Greek coin."

* Ancient British Coins.

No. 6.

Obv.—CVNOB. Naked horseman galloping to the right, brandishing a dart in his right hand, and holding a large oval shield on his left arm. The whole within a beaded circle.

Rev.—TASCIIOVANTIS. An armed figure standing, with a plumed helmet on his head, his right hand resting on a spear, and with his left holding a circular buckler. There are greaves or boots upon the legs, and there is some appearance of a kilt round the loins, and possibly of a short sword. There is no exergual line, but the whole is surrounded by a beaded circle.

Æ. 40¼ grains.

This splendid coin is in the British Museum; it was found at Sandy, Bedfordshire.

The horseman on the obverse appears to be intended for a British warrior, who is armed in the same manner as the horseman on the coins of TASCIOVANUS, though not wearing a cuirass. The military figure on the reverse must I think be regarded as a British foot soldier, accoutred to a great extent in the Roman fashion, and not, as RUDING suggests, a Roman soldier. The helmet, Dr. EVANS thinks, was known in Britain in the days of CUNOBELINE, though they could never have been in general use.

The coins represented on our plate, are figured on Plates IX., X., and XII., and the descriptions are given on pages 295 to 329 of "The Ancient British Coins."

Gold Coins of the Iceni.

Although Icenian gold coins do not appear to have been found in the Fenland itself, but several miles east of it, we have thought it necessary to give specimens of them in our Plate, in order to make our illustrations complete; and we think that their not having been discovered here, is no proof that they were not current in the district when the Iceni possessed the land.

No. 7.

Obv.—Two solid crescents back to back, their cusps forked; in each of of them two pellets; between them, above, a star of five points; below, a triangle of pellets. A line runs below the crescents, beyond which the field is sunk to a lower level, and on this is another star.

Rev.—Rudely-formed horse galloping to the right; above, a peculiar looped figure combined with pellets, and bearing some general resemblance to a bucranium; below, a sort of flower of seven leaves and a pellet; behind, two pellets; beneath the horse's head a V-shaped figure. Ꞥ. 82 grains.

This coin, which is in the British Museum, was found at Oxnead, Norfolk, in 1831. Mr. Akerman remarks upon it in the "Numismatic Journal," vol. i., p. 224, that its type and place of finding are "in favour of an opinion entertained by some of our best numismatists, that the ancient British coins may some day not only be shown to belong to England, but also to particular districts." Mr. Beale Poste, however, was the first to assign this coin, and the next to be described, with any degree of confidence to the Iceni. The type of the obverse is one of the most degenerate of the descendants of the Philippus, nothing being left even of the cruciform development, except the central crescents and a row of pellets.

No. 8.

Obv.—Similar to No. 7, but without the stars, and with the triangle of pellets on the sunk part of the field.

Rev.—Horse prancing to the right; above, a beaded ring enclosing a triangle of pellets, and with others on each side; below, a star of five points. Ꞥ. 81¼ grains.

This coin was found near Norwich, and is now in the British Museum.

The comparatively light weight would seem to show that these coins were struck at a late period of the British coinage.

Silver Coins of the Iceni.

No. 9.

Obv.—Two open crescents back to back, with two pellets between them; on their concave sides two curved lines meeting and forming a foliation at their junction; above and below a transverse line with foliated ends: and beyond those a five-fold wreath, the outer and centre lines corded, the others plain.

Rev.—ECEN. Horse galloping to the right; above, a beaded ring ornament and pellets, and a sort of laurel branch instead of mane; three pellets on the shoulders of the horse: beneath the tail two pellets; beneath the head an S-shaped figure. The E connected to the horse's hind-leg. Æ. 19½ grains.

Specimens were in the hoard found at Weston, Norfolk, Battle in Sussex, and March in Cambridgeshire.

No. 10.

Obv.—As No. 9.

Rev.—ECE. Horse prancing to the left, its fore-legs bifurcated upward from the knee; the nose and mouth represented by a sort of trefoil: above, a star of pellets. Æ. 19½ grains.

The obverse, beyond all doubt, is a reminiscence of the type of the gold coins derived originally from the Macedonian stater. The five-fold wreath with the crescents in the centre, is a sufficient evidence of this fact.

Dr. Evans has fully discussed the meaning of the legend ECEN on p. 384 and 385 of his book.

No. 11.

Obv.—Head in profile to the left, the principal features being the eye and ear; the hair formed by a crescent of three beaded lines enclosed by plain lines on either side.

Rev.—Horse to the right, with one fore-arm divided, the tail branched; beneath it a triangle of pellets; above, an open crescent (?); below the mouth a S-shaped figure. Æ. 14½ grains.

This coin, which is apparently unique, was found at March, Cambridgeshire. The hoard out of which it came seems to have consisted entirely of Icenian coins; and the branched tail and general character of the horse on the reverse, prove this coin to belong to that class.

No. 12.

Obv.—Barbarous head in profile to the right, the features being rendered by raised lines, and the outlines of the neck and cheek forming a sort of triangle, with a curved end projecting, to form the eye-brow or forehead.

Rev.—Horse to the right, its nose foliated and its tail branched, both its fore legs continued in relief across its shoulder; above, a compartment formed by three beaded or corded lines, enclosing a triangle with its sides curved inwards; below, a diamond with its sides curved inwards, and a pellet at each angle, and sometimes in the centre; above and below the tail, a pellet. Æ. 19¾ grains.

The coin here engraved, belongs to Dr. EVANS; it was found in the Weston hoard. A coin like this, found at March, is engraved in the Num. Chron., vol. i., pl. ii. 15.

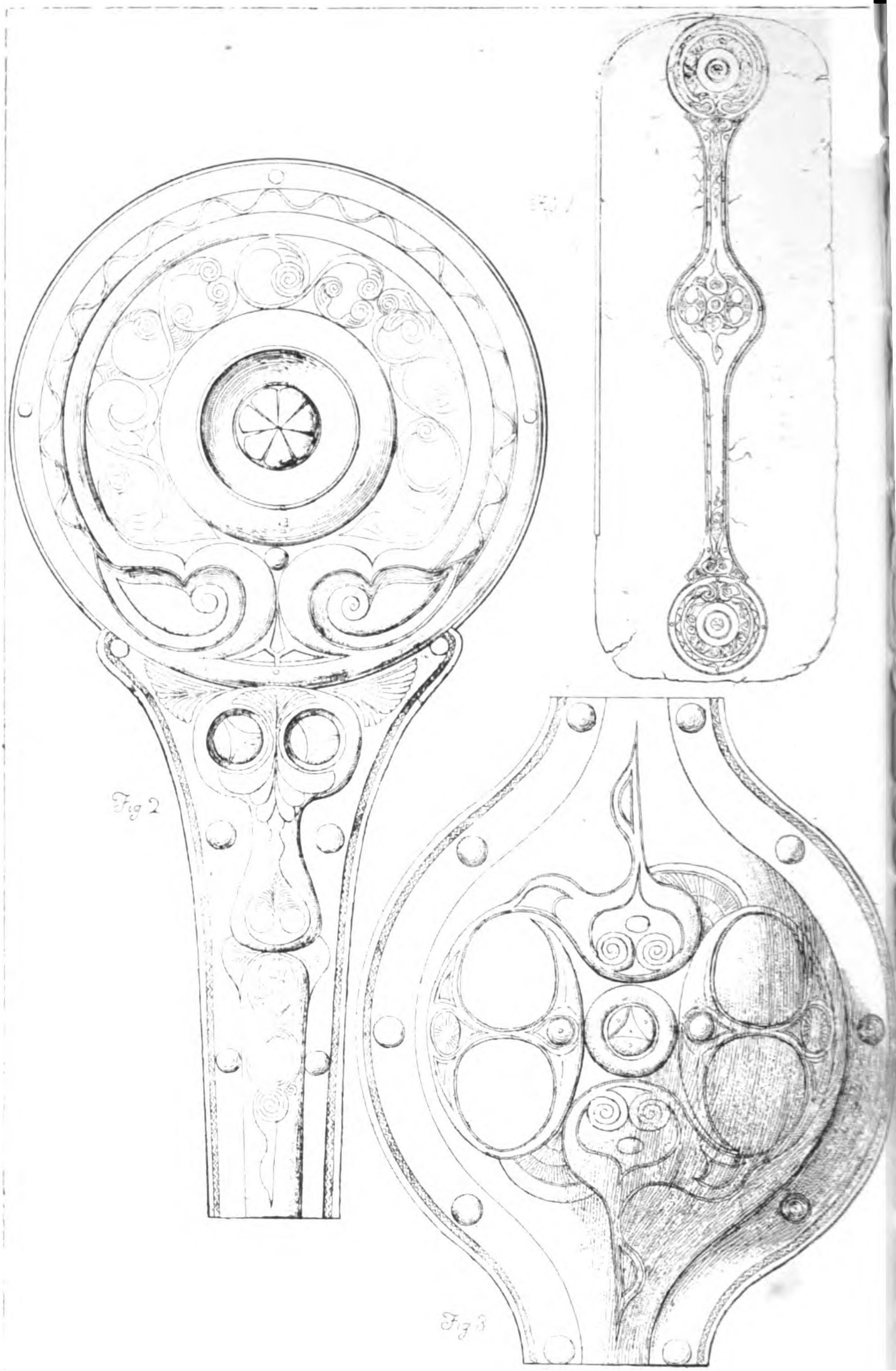
Another coin, with a boar-like animal on the *obverse* and a horse on the *reverse*, found at March, is engraved pl. xvi., No. 11, of the "Ancient British Coins."

CELTS, ETC.

Many celts and other stone implements have been found in the Fens. Some of which are in the possession of Antiquarians in different parts of the district.

The term celts, as applied to axe-like implements of stone and bronze, has no reference to the Keltic people, but is derived from the Latin *celtis* or *celtes*, a chisel.* They have never been used within the historic period. Towards the close of the newer Stone Age (*neolithic*) they were very symmetrical, and often bored. The bronze specimens, at first, were metal copies of their stone predecessors, but they soon developed into new types, and were eventually

* See Vulg. JOB, xix. 24: "stylo ferreo—vel celte sculpantur (sermones) in silice"; the classic writers however used *cælum*, a chisel.



ANCIENT BRITISH SHIELD

(Found in the river Witham)

made hollow, with an eye outside to bind them securely on to the curved wooden handle that fitted their sockets. Stone celts are found in most parts of the Fens, but bronze ones are rare; having only been found, as far as we know, at the places indicated below.

Swords, spears, arrow heads, etc., were found when the bed of the Witham was cleansed in 1788.*

The metal coating of the shield, figured in the accompanying engraving, (Ancient British Shield) was also found in the Witham; it is supposed to have been of British manufacture, of a period when the Britons had adopted the Roman fashions. It has some resemblance to the Roman Scutum.

Fig. 1 shows the whole contour of the shield and ornament.

Fig. 2 is an enlarged view of the upper and lower portion of the ornament.

Fig. 3 is an enlargement of the centre.

"It appears, originally, to have been gilt, and is adorned on the umbo or boss with the common red carnelian of the country. While its shape is Roman, the ornamental detail partakes strongly of the character of the British patterns."

Some years ago the above was in the Meyrick collection, and the proprietor observed, "It is impossible to contemplate the artistic portions without feeling convinced that there is a mixture of British ornaments, with such resemblances to the elegant designs on Roman works, as would be produced by a people in a state of less civilization."†

Keltic Pottery and Implements.

Mr. Marshall Fisher, of Ely, who has been a collector of Fen Antiquities for many years, possesses good specimens of Keltic pottery and implements.

* Gent. Mag.. 1788, p. 926. † Archæologia, vol. xxiii.

1. He has a very perfect example of a *Cinerary Urn*, of the same type as one figured on page 87 of JEWITT's "Manual of Archæology,"* to which book we may refer for other illustrations; also a handled *Drinking Vessel*, (JEWITT, p. 108, where he says, "One of these is in the Ely Museum, and the other in the Bateman Museum.)

2. Implements of stone—celts and hammers.

3. Bronze celts—some with sockets and loops—(like figs. 183, 188, 189, 196, in JEWITT)—and a bronze dagger, like fig. 198 in the same book, the handle having been attached by rivets.

In Wisbech Museum is a *Cinerary Urn*, found in Bardolph Fen. *Bronze Dagger* with rivet holes, found at Popenhoe.

Bronze Celts with loops have been found at Whittlesea, near Ely, and at Kyme. On Wangford Warren, near Brandon, there stands a Keltic tumulus, which has been rifled by the intensely ignorant tenant, and the relics destroyed as being "of no account." Mr. SKERTCHLY found in the *débris* quantities of pottery in fragments, a simple bronze brooch, and other pieces of that alloy, with very many iron nails. There were also a few mussel and cockle shells. At Baston, in the Lincolnshire Fens, there is a burial ground probably of this date, from which cinerary urns and a very fine bronze fibula have been obtained.

SECTION II.—*Roman Relics.*

THE Keltic remains in Britain are a measure of the early British civilization; the Roman ones merely give us a question of *more* or *less* in respect to the extent of their preservation. They are essentially the Roman antiquities

* Grave-Mounds and their Contents, by L. JEWITT, F.S.A. GROOMBRIDGE and SONS, 1870.

of the Roman world elsewhere:—pavements, altars, metallic implements and ornaments, pottery (the specimens of the Samian ware being both abundant and beautiful), earthworks, encampments, walls, roads, coins, inscriptions. (SMITH'S *Dict. of Gk. and Rom. Geo.*)

Roman relics have been found very generally in the Fens, and we must refer our readers to local histories for details which need not be quoted here.*

Romano-British Pottery, etc.

Castor on the Nene once possessed extensive potteries. In 1844, a kiln was discovered by Mr. ARTIS, at Sibson, near Wansford, about 7 miles W. of Peterborough. He was able to trace out the process of the manufacture. He supposes that 2000 men were employed at the potteries, which appear to have extended 20 miles along the Nene.† This pottery called *Durobrivian* "is especially interesting, from its being covered with ornaments and figures in relief, like those of the Samian ware, but not like it, cast from moulds." Some of this pottery of Castor was indented in the sides, and Mr. FISHER, of Ely, has a fine specimen, found near March, (JEWITT, fig. 226.)

The Ely Museum contains specimens of *Roman Pottery*, found at Ely, Coveney, Stonea, Manea, Lakenheath, &c. *Romano-British arms, Bronze Spear-heads*, (JEWITT, fig. 302), *Bronze Sword* (Ibid. fig. 299). In the same Museum are *Iron Battle-axes* and *Spear-heads*, of various kinds, not assigned to any period; also a Saxon Iron spear.

In Wisbech Museum are, a *Durobrivian vase*, ornamented, (of the type fig. 214, JEWITT), found at Chatteris; *Indented*

* See WATSON'S Hist. of Wisbech, p. 11. THOMPSON'S Hist. of Boston, pp. 17 and 18, etc.

† See figure in JEWITT, p. 152; also, "The English Archæologist's Handbook," by H. GODWIN, F.S.A. PARKER and Co., London, 1867, p. 60. Another pottery existed near Icklingham, in Suffolk.

vase (fig. 229 JEWITT); *Roman vase*, 16 inches high, found 10 feet below the surface in Waldersea Fen; *Sepulchral urns*, found at Chatteris, Somersham, and Earith; *Domestic pottery*, several specimens; *Roman statuette* found at Lincoln.

Jupiter Martialis.

Rev. S. S. LEWIS, M.A., of Cambridge, exhibited a bronze Statuette of Roman work found at Earith, Huntingdonshire, before the Society of Antiquaries, June 2nd, 1870. This beautiful work of art was about 8¼ inches high;* and represented an armed warrior with helmet thrown back from the face; the right hand was carried forward, and appeared originally to have held a lance. The patterns on the breast and back plates and greaves were carefully chased and heightened in parts by inlaid studs of silver.

Mr. LEWIS communicated, in connection with this exhibition, the following illustrative remarks:

"The bronze Statuette which I have the honour to exhibit this evening, belongs to Mr. JOHN BROWN, of Earith, Hunts., and was found at the enclosure of the parish in 1814, at the depth of about 18 inches.† The neighbourhood itself is very interesting, being like Cambridge, one of the promontories which the high land throws out upon the great level of the East Anglian Fen, and most appropriately occupied by the Romans with a strongly intrenched fort, on a spot which still bears the name of the *Bulwark*,‡ and yields, from time to time, pottery of early date.

Before attempting to speak with any certainty of the attribution or age of the relic before us, I would call attention to the exquisite proportions of the figure and the noble curves which it displays, whether studied in front, in

* Our engraving shows the exact size. This is done from a photograph by Mr. W. FARREN, of Cambridge. The engraver, Mr. C. MURRAY, compared his drawing on the wood with the statuette in the British Museum. † See Map, p. 470. ‡ Ibid.

Jupiter Martialis.

rear, or laterally. In these respects, I venture to think that it will appear to advantage, when compared with any one of the three similar statuettes in the Bronze room of the British Museum. A bronze figure 2⅞ inches (equivalent to 3 Roman inches) in height, representing the same subject, was found, in the year 1864, on the property of Mr. LAWRENCE, of Wycomb, near Cheltenham, but this is far inferior in style and only one-third of the size of the statuette now exhibited. From a comparison of an engraved sardonyx, of the time of Hadrian, in the possession of the Rev. C. W. KING, and another, of the same period, in the Blacas Collection (which used to be called Pyrrhus, but is now more justly denominated MARS), we may infer that the right hand must have been intended to grasp a lance, probably of silver, while the left would rest on a large shield of the same material and of the oval form used in the heroic ages; thus a balance would be provided to the thrown-back helmet, and greater stability given to the whole figure. At first sight, the artist's idea appeared to be to represent a MARS, armed cap-à-pied, and standing at ease (the left leg being slightly thrown forward), in readiness to draw down his vizor and begin the fray. The helmet, however, (though most correctly furnished with eyeholes and nosepiece), is far two short to cover the whole head, thus presenting a strong contrast to the ample dimensions of the head-gear of MARS on the coins of CAPUA, METAPONTUM, BRUTTII, &c. Neither are the truly *Jovial* prominence of the forehead or the heavy locks escaping from under the helmet characteristic, so far as I know, of the genuine MARS. The beard also shows exactly the arrangement which has of itself led to the identification of many fragmentary gems, with JUPITER rather than with MARS, who is either beardless (compare Mus. Borbon, xiii. 26 and xv. 36 with *ibid.* xi. 39) or has his hair arranged in *vertical* curls. These considerations, and also the presence of that unerring sign of the Father of gods and men—the thunderbolt—which it will be observed is introduced as an ornament of the greaves—force on me the conviction that we have before us, rather, a representation of *Jupiter Martialis*, than of the ever-youthful and impetuous God of War. To M. G. FEUARDENT I am indebted for a most happy confirmation of this idea. He has kindly brought under my notice a bronze coin, of great rarity, once in the Cousinéry Collection, bearing on the reverse a figure, which I judge from MIONNET's description (iii. p. 353, No. 291) to be identical with the one before us. Hence I venture to infer that our relic is no mere portrait-statuette, but rather a reduced copy of some famous Zeus Areios, it may be of the period of ALEXANDER THE GREAT or his immediate successors, which possibly adorned the agora of the wealthy town of Iasus, in Caria, for I believe that only statues of *long-established* reputation find a place on coins.

It has been objected that the ornamentation of the cuirass is of the character of the age of the early Cæsars (*e.g.* the statue of AUGUSTUS, found in Livia's villa), but here, again, numismatics come to our aid, for I possess two bronze coins of HIERO II., which show on their reverse precisely similar tracery.

Immediately above, in the centre, is affixed a Gorgon's head, in early Greek art, the characteristic ornament of the *ægis* of Pallas Athene, and in the Cæsarian period of the corslet of the Roman emperors. Thus Servius, commenting on VIRGIL, Æn. viii., 435—8 :—

Ægidaque horrificam turbatæ Palladis arma
. . . . ipsamque in pectora Divæ
Gorgona desecto vertentem lumina collo,

remarks, "sicut in antiquis imperatorum statuis videtur," and quotes MARTIAL, vii. 1:—

> Accipe belligeræ crudum thoraca Minervæ,
> Ipsa Meduseæ quem timet ira Deæ.

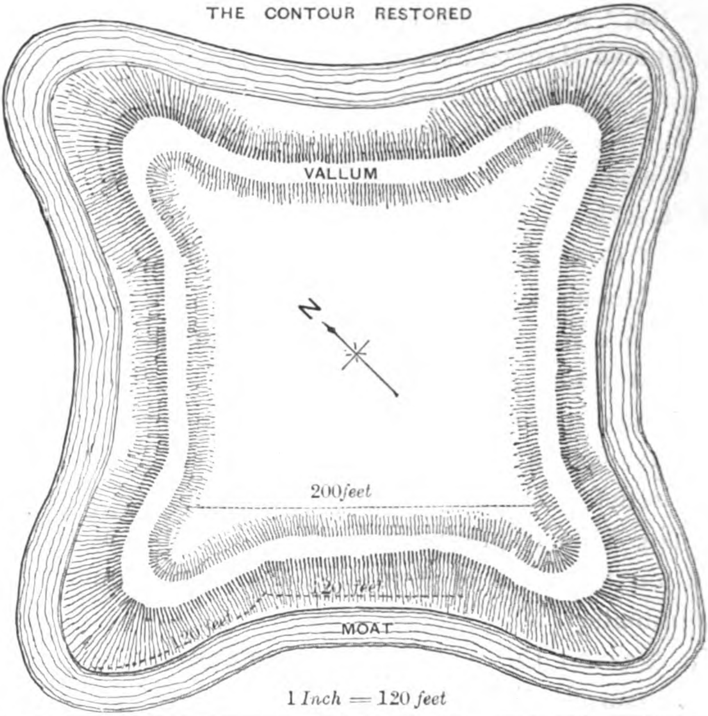
An argument in favour of the Greek origin, or at least Greek style, of our relic may be drawn from the simplicity of the "Corinthian" helmet, as the vizored kind was called in distinction from the "Athenian," which left the face open. We may form a clear idea of the plume, for which the socket was placed, from a coin of TARENTUM, figured by CARELLI (Num. M. G. cxvi. 256), from a sard given by Mr. KING as an illustration to HORACE (C. i. 29), and from a bas-relief in the Louvre, figured in MULLER's Denkmäler (II. No. 194), representing VULCAN and his attendants at work on the arms of ACHILLES, and from numerous other monuments.

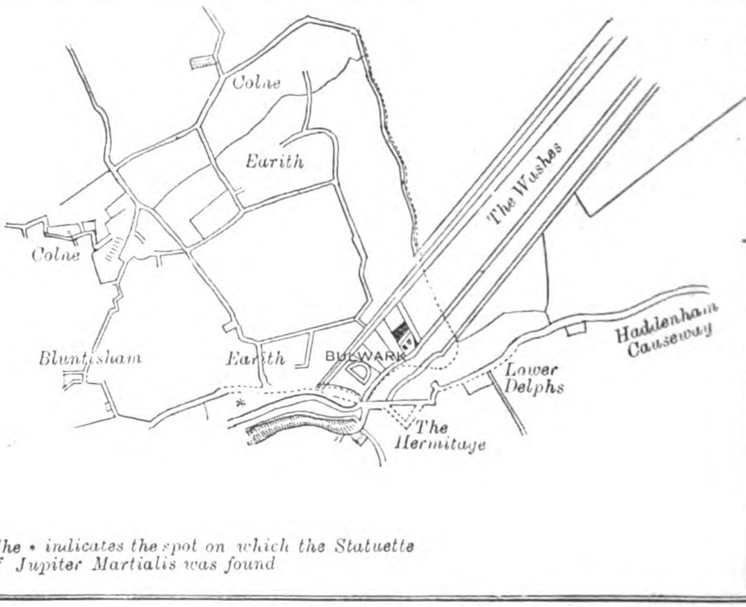
In drawing this sketch to a close, I would call attention to the conscientious care of the artist, who has not neglected to render clearly the cross-straps which fasten the greaves behind, as well as the bands at the top and bottom (the only attachments usually shown), and to the delicacy with which he has ornamented the juncture of the *θώραξ* and *μίτρα* (cf. *χαλκεομίτρας Κάστωρ*, PIND. N. v. 170) with acanthus leaves, and how the studs on the *μίτρα* are alternately silver and copper. The fringe, probably of leather, which forms a short sleeve to the *χιτων* is doubtless intended to protect the shoulders, in much the same way as our modern epaulettes. The undulations of the *θώραξ* seem to cover a vigorous frame, an all but beating heart, and well express the active rest of him at whose nod Olympus trembles.

This statuette, perhaps the most interesting antique of the kind ever found in Great Britain, was purchased in May, 1871, for £130, by the Trustees of the British Museum."

EARITH BULWARK.

THE CONTOUR RESTORED





*The * indicates the spot on which the Statuette of Jupiter Martialis was found*

SHM

The accompanying map shows the spot on which the statuette was found, and the proximity of the *Bulwark*. For an account of Earith Bulwark, see p. 38.

Bronze Vessel discovered in the Isle of Ely.—In the Archæologia (vol. 28, p. 436) is figured a Bronze vessel with an ornamented handle, discovered in April 1838, in the hamlet of Prickwillow (in Ely Trinity) in Burnt Fen, on an estate called Little Shallows. It was discovered by the occupier, whilst digging clay to improve the land, 7ft. below the surface. There can be no doubt that the vessel is of Roman origin.

In the same work (vol. xiv., p. 273) is described a Bronze Car of Mars, found in the Fossdyke.

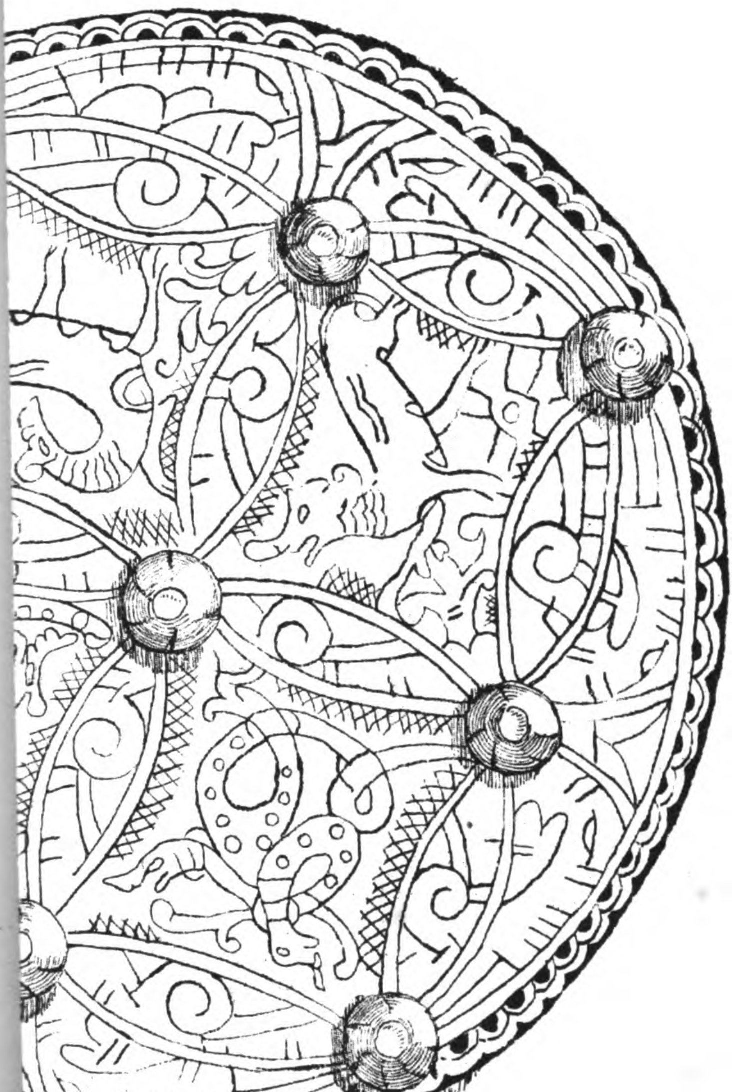
Roman Urns, etc.—" March;—in 1730, when the road from this place to Wisbech was made, three urns were discovered, full of ashes and burnt bones; and a pot was likewise dug up containing 160 Roman denarii of all the emperors from VESPASIAN to ANTONINUS PIUS, but more especially of the latter. Many other coins have been found in this neighbourhood; an altar 21 inches high was discovered at Elm; and at Welney different coins have been found in urns within reach of the ploughshare." (PATTERSON on Roads, p. 316.)

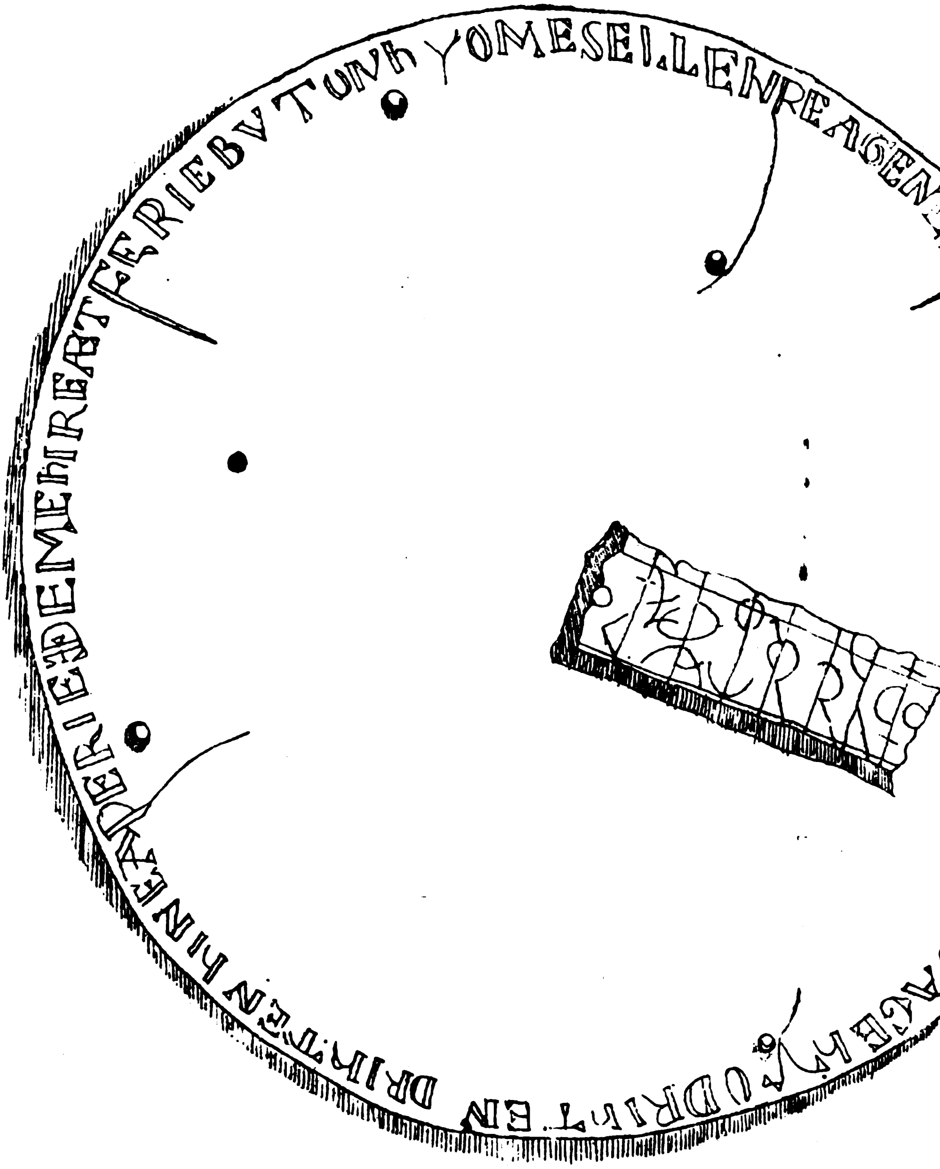
Umbo with Runes.—" Many Umboes have been found in England, but only one bearing runes; and this, as far as I know, now no longer exists. About 160 years ago it was in the hands of an English antiquary. This *Silver Boss* came to light in 1694 at Sutton, in the Ile of Ely Cambridgeshire. It is figured (the size of the original) and described pp. 186-88 in a letter dated 1704, appended by the learned HICKES' to ANDREW FOUNTAINE'S 'Numismata Anglo-Saxonica and Anglo-Danica,' Oxford 1705, the closing treatise in the first volume of HICKES' famous Thesaurus.

In answer to my letter of enquiry, our accomplished Mr. Franks of the British Museum, has informed me that the said Silver Umbo is now entirely unknown, altogether lost to science. I therefore think it my duty to re-engrave it here, printing it in silver, otherwise exactly copied from Hickes' copper plate. I do this the more willingly as it is almost unknown, the great Thesaurus being so rare and costly; as it is the only Runic Shield hitherto found in England; as it is in several respects more than usually interesting; and as the translation offered by Hickes'—the only one I have seen—who lookt upon the Old-English carving as a magical Formula and the shield as a magical Shield, is a great failure. I need not say that I engrave *full size*. The inscription, as we see, is on the reverse, as usual.

"I give a portion of the letter translated, 'While your treatise, wisest Sir, on the Saxon and Dano-Saxon Coins was yet in the press, the Reverend and most learned John Taylor, Vicar of Harlow in Essex, and Canon of Peterburgh Cathedral, sent me a Silver Shield (or rather Shield-boss) of the size engraved on the opposite page. It was turned up from the earth 10 years ago by a peasant, as he was ploughing a field near Sutton, a town in the Ile of Ely. This piece, which bears on its inner or concave side a Dano-Saxon inscription, was cunningly hidden in a thin sheet of lead, together with 5 heavy and costly golden rings, 100 silver coins struck in the reign of William the Conqueror, and an uninscribed silver chain.'

"If we now examine this precious antiquity in the light of modern science, we shall see that its style and workmanship apparently date from the 10th century, that the carving round the inner rim is in Old-English, and that it also bears a fragment with Scandinavian runes.





"The English inscription, properly divided is as follows :—

+ÆDVWEN ME AG. AGE HYO DRIHTEN.
DRIHTEN HINE AWERIE DE ME HIRE
ÆTFERIE, BVTON HYO ME
SELLE HIRE AGENES WILLES.
ÆDUWEN ME OWNS.

OWN SHE the—DRIHTEN (=may she possess the Lord, may the Lord bless and keep her alway!) DRIHTEN (the Lord) HIM AWARIE (accurse) THE (who) ME from-HER may-AT-FARE (shall take, carry off) BUT (unless) SHE ME should-SELL (should give, unless she gives me to him) of-HER OWN WILL (of her own free will, voluntarily, of her own accord).

"(= I belong to ÆDUWEN, whom Christ take into His holy keeping!—God curse him who beareth me from my owner, unless she should deliver me to him of her own free will!)

"The Runic inscription in the centre I cannot read. Apparently the one half has been broken away. The rest seems to be in stave runes, several runes on the same stave, a short-hand we can seldom decipher when carried to excess as here.

"There is something romantic in this English risting, for it shows that its owner was a Lady, a Shield-may, some Princess or other highborn dame accustomed to fight at the head of her troops, as we so often hear of in old English and Scandinavian history.

"The shield would seem to have been made for her. She may have fallen in battle, and her silver weapon then came into the hands of one of the Scandinavian marauders in the 10th century who ravaged England about the time of King ALFRED. This new owner fastened a slip, bearing Scandinavian runes, on to the inner side. In King WILLIAM's time, say towards the close of the 11th century, the boss was regarded as so much precious metal, and the whole hoard of gold and silver, wrapt up in lead, was buried (in what was then a wild moss) till better days, probably by an Englishman who had fought against the Normans and—lost. But those better days never came, and it remained in the earth till the year of CHRIST 1694!

"The name of this Shield-may is very rare. It would probably be spelt EADWEN in the usual Old South English. I only remember to have met with it once elsewhere. It was borne by (AEDWEN) the mother of S. GODRIC, the Hermit-saint born in East Anglia, but who lived and died at Finchale in Durham. He was born at the beginning of the 11th century.*

"Then there is another interesting point in this inscription. It contains the *formula of imprecation*, the old heathen curse which past over into the documents of the Christian early and middle age."—(From STEPHEN'S Runic Monuments, p. 289).

Metal Disk (*Lanx*) (*Roman*).

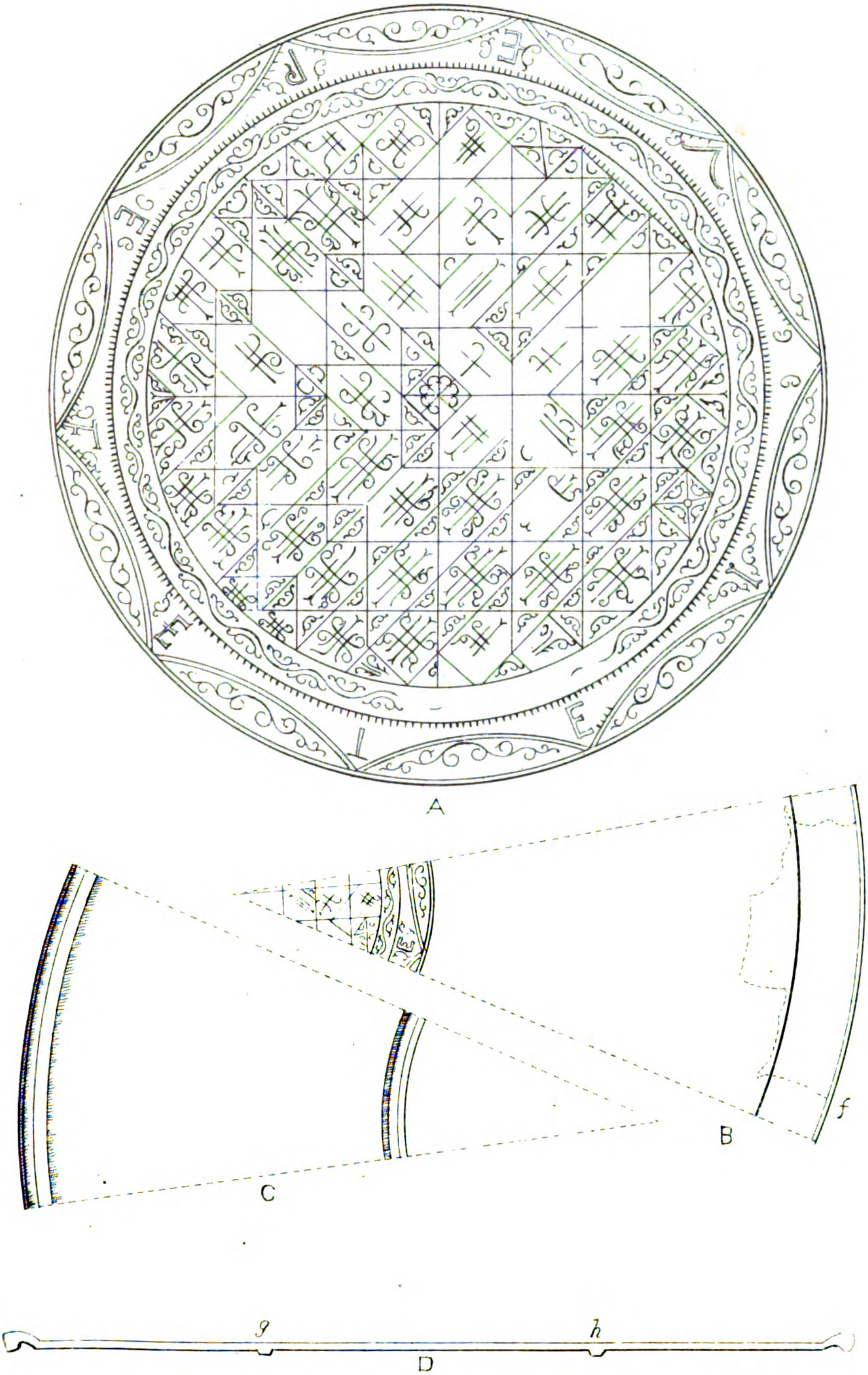
Found at Welney in 1864.

This disk was ploughed up on Mr. GEORGE E. DAINTREE'S farm, about 200 yards east of the 100 feet River and one mile north of the Welney Suspension Bridge. For some years it has been the property of Mr. ALBERT GOODMAN of St. Ives, who has kindly made the drawing for the accompanying copper plate engraving, and given the present writer a very full description of this interesting relic.†

Fig. (*A*) represents the centre of the disk which is $8\frac{2}{3}$ inches in diameter; the drawing is half that diameter.

* For further notice of St. GODRIC see appended Biographical notes.

† A paper on this Disk, or "Roman Lanx," appeared in the Archæological Journal, vol. xxvii., from the pen of the Rev. S. S. LEWIS, M.A.; F.S.A. Fellow and Librarian of Corpus Christi Coll., Camb. See also Proc. S. A. L, 2. s. iv., p. 425, and a paper by the same, read before the Camb. Phil. Soc., Mar. 21, 1870.



ROMAN DISH

As will be seen by the engraving, part of the ornamentation has been lost by exfoliation.

Fig. (*B*) shows the upper part of the rim with a small portion of the centre; it is *one-fourth* of the real size. The dotted line, indented from the curve (*e*, *f*) indicates a portion lost.

Fig. (*C*) represents the under part of the rim and a portion of the centre. Neither (*B*) nor (*C*) is a complete sector.

Fig. (*D*) is a section of the whole disk, *one-sixth scale*, of 28½ inches diameter. From (*g* to *h*) lies the centre, given in Fig. (*A*), and under (*g* and *h*) are shown the projections of the base, a portion of which is seen also towards the angle of Fig. (*C*).

Professor LIVEING made an analysis of the metal for Mr. LEWIS and found that it is composed of 80 per cent. of tin, 18½ lead, and a trace of iron, "thus nearly corresponding with the *argentarium* of PLINY."

The thickness, tested near the edge is about ¼ inch, the thickest of the rim, see Fig. (*D*), ⅝ inch. The exfolation cannot have been more than $\frac{1}{32}$ of an inch.

The disk is somewhat bent, but workers in metal think that the fracture shown in Fig. (*B*) must have been made by cold chisel and hammer, and did not arise from the accidental tread of a horse or the passing wheel of a loaded waggon.

Mr. GOODMAN informs me that when the disk was discovered, the man was holding one of the largest clunching ploughs, drawn by six horses; that the plough was completely thrown out of the furrow, and the ploughman looking back to find the cause of this, saw the disk, which was so tough that it was but slightly bent and on examination it was found that the plough coulter had made only a faint groove in the metal, Mr. GOODMAN has made some pertinent remarks on the design and has pointed out the unlikeness to modern patterns. The divisions in the inner circular area correspond in no measure to the divisions of the band around. The outer band has 10 divisions, but diameters drawn from the angles formed by the arcs do not coincide with any diagonals of the squares. "We may say with safety that no modern European would have drawn such a pattern . . . . . An English workman would have been unhappy to think that no single half, quarter, or eighth, of his circle corresponded to any other, and yet it will be seen that a general regularity has been arrived at."

In the ten equal spaces of the outer circle there are *letters*, some of which are indistinct.

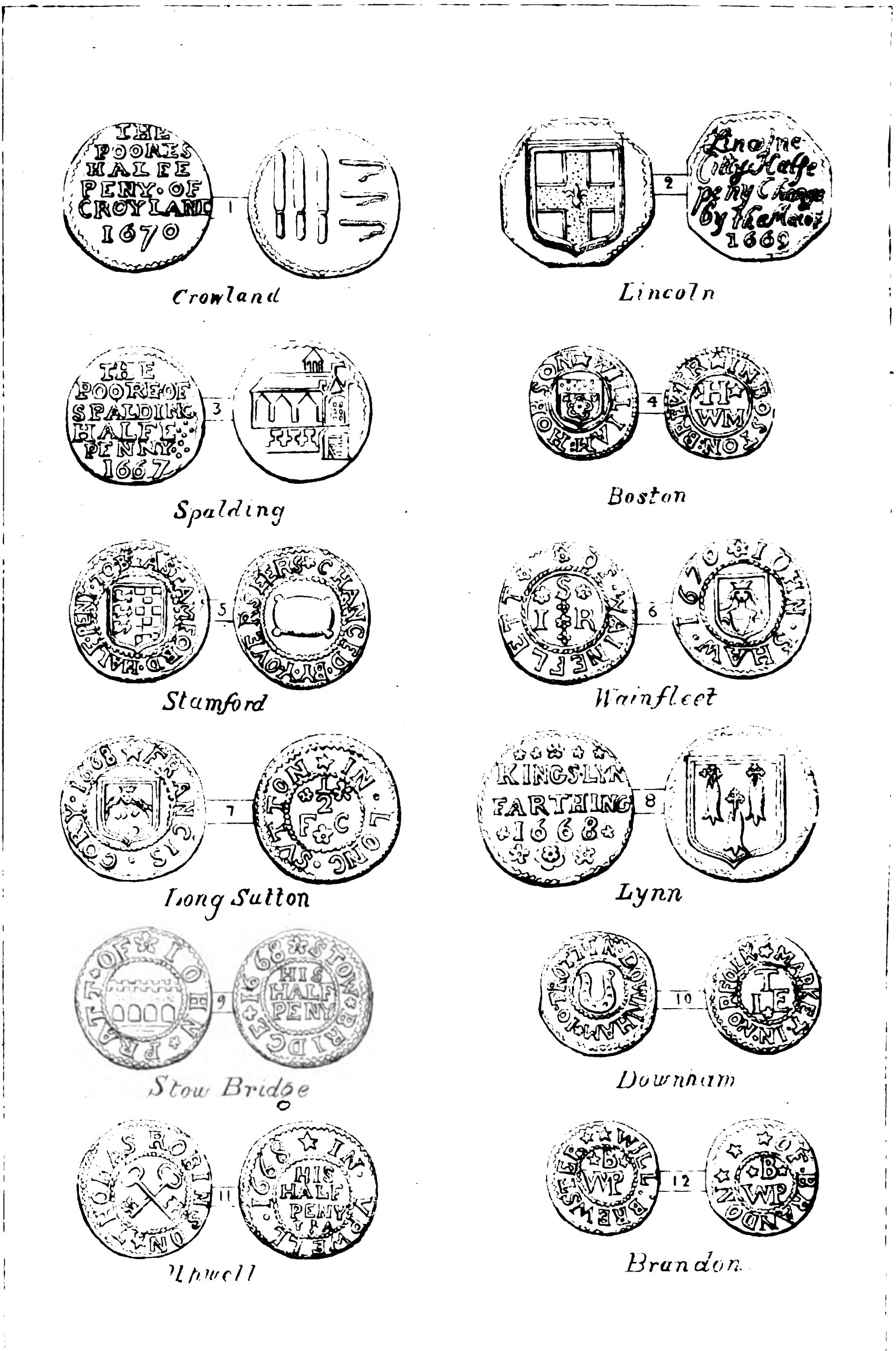
V—Is very distinct and cannot be mistaken.
E—Is likewise distinct.
||—So much of this character is distinct, but it may be only the portion of a letter.
E, F, E—Are unmistakeable.
⊥—The surface of the metal is much defaced at this part.
E—very distinct.
||—This is distinct but may have formed part of a letter.
The tenth space has no distinct letter or portion of one.

Mr. Lewis, who had the aid of Mr. Albert Way, conjectures that the inscription may be rendered VTERE FELIX and adds by note that this kindly aspiration may be compared with Macbeth's

> "Now good digestion wait on appetite
> And health on both."

Fenland Tokens.

In preparing the drawings of the Tokens, represented in the accompanying plates, I have consulted the admirable work by Mr. Boyne; some illustrations I have drawn from



Fenland Tokens of The 17th Century

Tokens in the possession of Mr. SAMUEL SMITH of Leverington Terrace, Wisbech, viz: those of Long Sutton, Wainfleet, Downham, Upwell, Brandon, Littleport, St. Ives, and St. Neots.

I am indebted Mr. S. SMITH for the following notes from BOYNE, and for the descriptions of the coins.

'These Tokens began to be current soon after the death of CHARLES I. The earliest dates are 1648, 1649, and 1650, but Tokens of these years are scarce. From 1650 to 1660 they are more plentiful. Nearly the whole of them are farthings, a few half-pennies, but no pennies. Those of a date subsequent to the restoration of CHARLES II. are the most abundant. Half-pennies are very common among them, and there are a good number of pennies. The years 1665, 1666, 1667, 1668, and 1669 are the most prolific, particularly 1666, the year of the great fire in London; in 1670, 1671, and 1672 they again became scarce; of the latter year there are very few. In 1672 CHARLES II. struck farthings (which are still tolerably plentiful), and the Tokens were then at once put down by a stringent proclamation' (BOYNE). Seven of the inhabitants of Wisbech struck Tokens, and their variation in the mode of spelling is amusing—WISBICH, WISBIDG, WISBECH, WISBECHE, WISBITCH. Peterborough was treated much the same, having been spelt ten different ways; JAMES TALER was very clever, he wrote PEETERBOVROWGH.

Plate I.

CROWLAND.

1. *Obv.*—THE POORES. HALFE.PENY. CROYLAND. 1670. ½
   (In six lines.)
   Rev.—Arms of Crowland Abbey, three knives in pale, three whips in fess.

LINCOLN.

2. *Obv.*—Lincolne City Halfepeny, Chaingd by the Maior. 1669. ½
   Rev.—Arms of Lincoln; on a cross a fleur-de-lys. Octagonal.

SPALDING.

3. *Obv.*—THE. POORE. OF. SPALDING. HALFE. PENY. 1667. (In six lines.) ½
Rev.—A public building. (The Town Hall. (?) S.S.)

BOSTON.

4. *Obv.*—WILLIAM. HOBSON. Arms of the Hobson family. A cinquefoil, a chief checky. ¼
Rev.—IN. BOSTON. BREWER. W.M.H. (William and Mary Hobson. (?) S.S.)

STAMFORD.

5. *Obv.*—A. STAMFORD. HALF. PENY. TO.BE. Arms of Stamford; three lions passant gardant, impaling, checky. ½
Rev.—CHANGED. BY. YE. OVERSEERS. A woolpack.

WAINFLEET.

6. *Obv.*—IOHN. SHAW. 1670. The Mercers' Arms. ½
Rev.—OF. WAINEFLETT. I.R.S.

LONG SUTTON.

7. *Obv.*—FRANCIS. CORY. 1668. The Mercers' Arms. ½
Rev.—IN. LONG. SUTTON. F.C. ½

LYNN-REGIS.

8. *Obv.*—KINGS. LYN. FARTHING. 1668. (In three lines). large ¼
Rev.—Arms of Lynn, three conger eels' heads erect, in the mouth of each a cross crosslet fitchée.
(See RICHARD's *History of Lynn*, vol. ii. pp. 824-5.)

STOWBRIDGE.

9. *Obv.*—IOHN. PRATT, OF. A bridge of four arches. ½
Rev.—STOW. BRIDGE. 1668. HIS HALFPENY.
(Stow Bridge crosses the Ouse near Stow Bardolph.)

DOWNHAM MARKET.

10. *Obv.*—ION. TROTT. IN. DOWNHAM. A horse shoe. ¼
Rev.—MARKET. IN. NORFOLK. I.E.T.
(? Trotter, a name even now well known in Downham. S.B.J.S.)

UPWELL.

11. *Obv.*—THOMAS. ROBINSON. Crosed keys. ½
Rev.—IN. VPWELL. 1668. HIS. HALFPENY. T.A.R.
(Upwell is in the counties of Cambridgeshire and Norfolk.)

BRANDON.

12. *Obv.*—WILL. BREWSTER. W.P.B. ¼
Rev.—OF. BRANDON. W.P.B.

Plate II.

CAMBRIDGE.

1. *Obv.*—WILLIAM. SMITH. The Leathersellers' Arms. ½
Rev.—IN. CAMBRIDGE. 1670. HIS. HALF.PENY. W.E.S.

ELY.

2. *Obv.*—WILLIAM. WAGSTAFE. Arms of the Wagstaff family in a heart-shaped shield; two bends raguly, in chief an escallop shell. ¼
Rev.—MERCER. OF. ELIE. A device. (? a Merchants's Mark. S.S.)

DODDINGTON.

3. *Obv.*—IOHN. IOHNSON. A Windmill. ½
Rev.—OF. DODDINGTON. 1669. HIS. HALF.PENY.
(The Mill is still standing. S.S.)

LITTLEPORT.

4. *Obv.*—LITTLEPORT. ILE. OF. ELY. A key. ¼
Rev.—YE. OVERSEERS. OF. YE. POOR. 1668.
(? If the key be not a frying pan.—S.S.)

CHATTERIS.

5. *Obv.*—THOMAS. COAPE. AT. THE. A gate. ½
Rev.—AT. CHATTRIS. FERREY. HIS. HALF.PENY. 1670.

MARCH.

6. *Obv.*—THOMAS. TOWERS. A tower. ½
Rev.—IN. MARCH. 1669. HIS. HALF.PENY.

WHITTLESEY.

7. *Obv.*—ROBERT. IVES. 1667. A woolcomb. ¼
Rev.—OF. WHITTLESEY. R.I.I.

WISBECH.

8. *Obv.*—IOHN. BELLAMY. 1667. The Grocers' Arms. ½
Rev.—OF. WISBICH. GROCER. HIS. HALFE.PENNY. I.I.B.

ST. IVES.

9. *Obv.*—The. Overseers. Halfe.Peny. of. St. Ives. 1669. ½
(In five lines.)
Rev.—POOR. WOMEN. Two women washing at a tub.

COTTENHAM.

10. *Obv.*—PHILIP. CHAMBERS. HIS. HALF. PENY. ½
Rev.—IN. COTTENHAM. 1668. A wild man with club over his shoulders.

ST. NEOTS.

11. *Obv.*—THE. OVERSEERS. OF. THEIR HALFE.PENY. ½
Rev.—THE. TOWNE. OF. ST. NEOTS. Two women seated making lace.

PETERBOROUGH.

12. *Obv.*—The. Overseers. half. peny. of. Peterbrough. 1669. ½
(In five lines.)
Rev.—(No legend). Two swords in saltire, between four crosses, pattée fitchée. Octagonal.

THE WISBECH MUSEUM.

It seems fitting to place in connection with *Fenland Antiquities*, some account of a museum which occupies a central position in the district, and which is intended to be a receptacle for those interesting relics of antiquity that so frequently turn up during the operations of draining, excavating or ploughing. Without such an institution, many valuable remains would be for ever lost to the historian and antiquary—and who shall say what has been lost to history and science, for want of earlier institutions, designed for the preservation of the remnants of our forefathers' handiwork? But the museum is the repository, too, of specimens of local natural history, and these, preserved and classified, offer great advantages to the young student. Here, likewise, we have deposited standard works of art, memorials of local celebrities, and objects of general interest and instruction.

Fenland Tokens of the 17th Century.

The Wisbech Museum is excellent for the great variety of its contents, and bears a very favourable comparison with most provincial ones. It possesses not only a good collection of natural history objects, found in the neighbourhood, but many choice works of art and virtu. May it be valued as it deserves! We venture to express a hope that it will receive not alone the support of generous donors, but also the appreciation of the public in general.

For some time the Museum has existed side by side with "THE LITERARY INSTITUTION," a society originated in 1781, and which for many years, had its library and reading room in the house now occupied by LEACH and SON in High Street; but in time more commodious premises were needed.

THE MUSEUM was commenced in 1835, the nucleus of the present handsome collection of objects being formed in a room in the Old Market Place.* This, like the above society, soon found the need of more space.

The supporters of these two institutions, in order to obtain sufficient room for each, resolved upon the erection of the present building, situated near the church. It was commenced in 1846: the cost was about £3000, which was raised in £25 shares.

The Museum and Literary Society existed as separate organizations till Dec. 1876, when an amalgamation of the two was effected by mutual arrangement. Let us hope that here it will be found, that 'Union is strength.'

* Having been permitted to consult an original document, containing a list of the founders and first supporters of the Museum, we desire here to record their names:—*Founders*: Revs. H. FARDELL and JEREMIAH JACKSON, Messrs. WILLIAM and ALGERNON PECKOVER, CHAS. METCALFE, JNO. GIRDLESTONE, ROBT. J. WALES, HENRY LEACH, HUGH JACKSON, and J. R. WEATHERHEAD. *Early Contributors*: Dr. W. STANGER, Messrs. J. JECKS, J. MAULE, Rev. E. BATES. *First Subscribers*: (In addition to the above) Messrs. W. G. TOWNLEY, JAS. USILL, STEED GIRDLESTONE, R. F. PATE, H. M. USILL, JNO. TAYLOR, THOS. STEAR, ABRM. USILL, J. G. KELK, R. CROSS, M. LEACH, W. G. JACKSON, W. JECKS, C. JECKS, FREDK. TREVOR, GEO. M. LEFEVER, E. JACKSON, T. ORTON, Dr. FRASER, S. STANTON, Mrs. FARDELL, Messrs. ROBT. DAWBARN, J. R. CHRISTOPHERSON, W. WALES, F. FAWSSETT, J. BELLAMY, W. GROUNDS.

The TOWNSHEND bequest* was received in 1868-69. By that gift a good library of handsome books was acquired; and the combination of this, with the former one of some 5000 volumes belonging to the Literary Society, will afford a source of reference and reading, whose value ought to be highly appreciated in the town and neighbourhood.

The Building.—There are three rooms occupied by the Museum and Library, viz:—

I. A central room (formerly intended for a lecture room); this contains works of art and antiquities chiefly.

II. The west wing, devoted to Natural History and Ethnology.

III. The east wing, containing the books.

I. The central room.

(*a*) In this is the "*Townshend Collection*†" of works of mediæval art—Dresden, Sevres, English, and Oriental porcelain, (including NAPOLEON'S breakfast service taken at Waterloo)—choice Italo-Greek, Flemish, and other pottery—Venetian and German glass ornaments, &c.—sculptured rock-crystal and agate—ivory carvings (among them a set of chessmen formerly belonging to LOUIS XIV.)—various articles of virtu and bijouterie—a safe of gold and silver coins and gems.

(*b*) There are likewise in this room, two cases containing specimens of English and Foreign Ceramic art—a case of local antiquities, already referred to under the head of 'Keltic' and 'Roman,' also mediæval relics—and another of objects and drawings illustrative of Biblical antiquities.

II. The west or larger room.

* By Will dated 6th Aug. 1863.

† Left under the Will of the late REV. CHAUNCY HARE TOWNSHEND, M.A., who died 25th February, 1868.

(This is 70 ft. long, 26 ft. broad, and 20 ft. high, with a gallery.) It contains—

(1) A small collection of British and Foreign *mammalian* specimens.

(2) A collection of *Birds*, already named in the chapter on Birds—also a general selection of Foreign birds, all in wall cases.

(3) A few specimens of *Reptilia* and *Amphibia*.

(4) Fish—some referred to already.

(5) A case containing a small collection illustrative of comparative osteology.

(6) Conchology—Two cases of *univalves* and *bivales*, arranged principally according to WOODWARD.

(7) Insects—The British beetles (*Coleoptera*) are better represented than the butterflies and moths (*Lepidoptera*). It is very desirable the latter should be well represented in this museum.

(8) Crustacea—a few of several orders.

(9) Radiata (*Cœlenterata*)—a few specimens of Gorgonidæ, etc.

(10) Fossils illustrating British Palæontology (chiefly), in wall cases of west gallery; these were arranged stratigraphically by Prof. R. TATE, A.L.S,, F.G.S., now of the Adelaide University.

(11) A collection of minerals, formed originally by the late Dr. STANGER—a good typical series, arranged in four table cases, partly on Dr. STANGER's plan, but according to PHILLIPS', principally.

(12) Ethnology—this is very choice. CLARKSON's collection from W. and S. Africa, preserved as "Memorials of the Slave Trade." Dr. STANGER's, brought by him from S. Africa and the Niger Expedition. Admiral SWAINE

deposited here some garments, &c., from N. W. America and Polynesia.*

In the wall case in this room, are specimens of the costume of the Chinese, Japanese, Burmese, Siamese, etc.; also a "Lamba" or coloured native cloak or scarf of Palm-fibre, brought from Madagascar by Rev. W. Ellis, the Missionary.

The warlike weapons are plentiful and interesting.

III. The library and reading room.

[We hope that the readers of this book will use their influence, when opportunity offers, to preserve from destruction any relics which may be turned up by ploughing, trenching, or diking.]

[S. H. M.]

APPENDED NOTES.

Wisbech.†

It has not been our purpose to give a topographical description of the towns of the Fenland, for that may be found in Gazetteers and Directories, and if we have given Wisbech a certain degree of prominence it is because of its central position in the district, and indeed it is sometimes denominated "the Metropolis of the Fens," and because

* Admiral Swaine accompanied the great navigator Vancouver, when he commanded H.M.S. "Discovery" (after Cook's last voyage) on an expedition to the North-west coast of America. This famous expedition, with H.M.S. "Chatham" as an armed tender, sailed April, 1791, having for its objects (after receiving tha Spanish surrender of Nootka), a Survey of the coast northwards, and of the water-communication with Canada; and also a Survey of the Sandwich Islands. It returned Sept., 1795, having circumnavigated the globe.

† The view of Wisbech facing page 481, was taken from the east side of the "Recreation Ground" (by Wheeler) and this gives an aspect which has never before been pictorially represented. The principal building which comes into the view is the North Cambridgeshire Cottage Hospital, built through the munificence of Miss Trafford Southwell; the following is the inscription on the foundation stone:—

This stone was laid on the 16th day of October, 1872.
By Margaret Elizabeth,
eldest daughter of Sigismund Trafford Southwell, Esq.,
She founded this Hospital,
'To the praise and glory of God,'
and for the benefit of the sick and poor, and appointed as Trustees,
Alexander Peckover. Francis Jackson.
Robert Wherry. Rev. John Scott, M.A.

T. WHEELER, DEL. A. DURRINGTON, SC.

certain scientific results culminated there and this book originated there.

One subject, however, may be fittingly introduced in this place, and that is the spelling of the name *Wisbech*, the orthography here given being finally settled upon by the Post Office and Railway Authorities at the very time this book was in the press. Notwithstanding the arguments adduced in WATSON's History of Wisbech, (p. 115) 50 years ago, the form *Wisbeach* has been very often used and has caused confusion in the minds of strangers. The word *beach* conveys a different idea from that which was originally the second member of the compound. *Beach* is a comparatively modern word in our language, not being found in the early lexicographers; it was applied by HACKLUYT (according to Dr. RICHARDSON) to the pebble stones that lie between the water's edge and the main land. The spelling 'beach' is never once used by any old writer, and there has not been a beach near the town since the word came into our language.

Without refining the argument too much we may say that *Wisbech* appears to be compounded of *Wis*, an old Keltic word for *water*, and *becc*, (not *béc* which was the plural of *boc*, a book), the Saxon for a rivulet or stream. Thus the word was a compound of Keltic and Sax., and *Wis-becc* was modified into Wisbech by certain phonetic changes following the Norman Conquest; the *c* in Sax. was hard like *k*, but the Sax. *cese* and *cild*, under Norman influence, became *cheese* and *child*, so also *becc* became *bech*.

Sometimes the *e* terminal was tacked on, and an old chronicler had Wisbece, and we find it spelt *Wisbeche* later on.

In DUGDALE's Hist. of Imbanking, 2nd ed.

Wisbeche occurs 29 times (vide p. 175, etc.)
Wisebeche „ 36 „ (vide p. 247, etc.)

And the same word is used in connection with fen, hundred, lode, etc.

The argument holds good for other names which of late have been spelt *beach*. DUGDALE has *Holbeche*, (p. 288 and 11 other places) *Waterbeche*, (p. 406) Langbeche, (p. 348) as in the phrase "thence to the drain called Lanbech."

NOTABLE MEN.

S. GODRIC.

REFERENCE is made in this chapter (p. 474) to ÆEDWEN, the mother of S. GODERIC; this name is found in the following passage in "The Life of S. GODERIC, Hermit of Finchdale," a publication issued by the *Surtees Society*, pub. 1847.

"Vocabatur enim unus eorum Æilward more Anglorum notissimo, quod Latino expressum eloquio sonat Custodem beatitudinis;" altera vero Aedwen, quod consone significat "Beatitudinis amicum," seu "Societate beatam."

REGINALD, monk of Durham, (who wrote the life of the Hermit,) in veneration for the parents, rendered the name of the father ÆILWARD, "the keeper of Blessedness," and the mother ÆDWEN, "the friend of Blessedness," or "the Blessed in Society."

They belonged to Norfolk, but there are some discrepancies in the geographical references to their location; thus—"Hi in provincia Anglorum quæ Norhfole dicitur, nati sunt; et in villula quadam quæ Hanapol dicitur oriundi;"—Now Hanapol was not in Norfolk; it should have been Walpole, as an anonymous legend gives it. We conclude then that GODERICUS was born at Walpole, a village of Marshland, and as he grew up he was wont to wander on the sea-shore—at that time the sea was nearer the village of Walpole than now; this gave GODERIC a liking for a wandering life, and he became a Fen pedlar.

We have a story of his wandering too far one day in search of booty, and being overtaken by the tide and then escaping miraculously,* but in this we cannot reconcile the position of "Wellestrem" with "Spauding."

"Est quidem locus ille Wellestrem dictus, villæ quæ Spauding dicitur pene contiguis; ubi detectis arenis, mos erat ipsios provinciæ incolis loca maris patentia explorandi gratia perlustrare, et prædas, et forte alia aliqua quæ æstus marini consuescunt ad portus secum conducere, suis inventa usibus reservare."

The editor of the book published by the *Surtees Society*, assumed that *Wellestrem* means Welland, but the question is, has not Spalding been erroneously introduced at some time or other? We can easily understand GODERIC's wandering from Walpole to the outfall of the river mentioned by DUGDALE in this passage (2nd ed. p. 301)—"The king receiving further information concerning the obstruction of the water of *Welstreme*, at the town of Welle before mentioned, whereby merchants and others were hindered from passing with their ships, boats, and other vessels, from the town of Lenne unto Yakesle, (Yaxley) Holme, and other places lying in the county of Huntingdon." In another paragraph it is said, "divers persons of Cambridge . . . . passed with ships and victual from the parts of Lenne to Welle."

We do not find the Welland called Wellestream, but often Weland by DUGDALE.

Spalding was too far from Walpole for a day's wandering.

We do not purpose giving a biographical sketch of this remarkable man GODERIC. The reader will find the story of his life, told in a popular way, in "The Hermits," by Canon CHARLES KINGSLEY.

DUGDALE speaks of Walpole as "a place of no small note, by reason it gave birth to S. GODERIC the hermit, of whom M. PARIS maketh ample mention." (1170.)

* DE VITA ET MIRACULIS, S. Goderici, cap. iii.

HICKATHRIFT OF THE SMEETH.

In his description of Marshland, Dugdale says, "This country, on the east, is bounded by the stream of Ouse; on the west, with Wisbeche river; on the north, with the sea bank; on the south with the new Po-dike, and containeth no less than thirty thousand acres; whereof part is a famous plain, called the Smeeth; which being common to all the towns therein maintaineth at least thirty thousand sheep; and yet is not of a larger extent, in the widest part of it, than two English miles.

"Of this plain I may not omit a tradition, which the common people thereabouts have, viz: that in old time, the inhabitants of the neighbouring villages had a fierce contest with one Hickifric (then owner of it), touching the bounds thereof; which grew so hot, that at length it came to blows; and that Hickifric, being a person of extraordinary stature and courage, took an axletree from a cart, instead of a sword; and the wheel for his buckler; and being so armed most stoutly repelled those bold invaders." (2nd ed., p. 244.)

From a manuscript lecture, by Mr. Jonathan Peckover, of Wisbech, we gather further information about this doughty hero. The place bearing the name of Hickathrift is situate within a short distance of the Smeeth Station of the Great Eastern Railway (the line between Wisbech and Lynn). It is a grass field at the junction of four roads; in the centre is a circular hollow with a low mound enclosing it. In the corner nearest the Station, close to the road-side is a mound with the marks of an entrenchment visible around it. This is called the giant's grave, and the people of the neighbourhood have a tradition that it is hollow. In former times a stone called Hickathrift's candlestick stood on its summit, but it is said to have been removed to the churchyard of Terrington St. John's where a curious stone is still to be seen. The remainder of the field is rough and broken. The hollow bears the name of HICKATHRIFT'S handbasin. As the tradition goes, HICKATHRIFT performed many mighty deeds which have their similitudes in the legends of northern Europe.

It is the opinion of some of the people of Marshland that the story is allegorical, that the giant whom HICKATHRIFT subdued represents the sea, the wheel and axle, the weapons for banking it out and that the name of HICKATHRIFT is derived from *Hitch* and *Thrive;* the hero, then, was some early encloser of the Fens, who became powerful by continually moving his banks further out.

In the churchyard of Tilney All Saints, is a long tombstone still bearing the faint traces of a large round cross carved upon it. This is pointed out as the resting place of the great HICKATHRIFT, and as a proof, the marks in the stone are affirmed by the villagers to represent the wheel and the axle with which he destroyed the giant. He was a great benefactor to his country, a sort of EADGAR in the Fens, for his story ends thus—

> "My friends while I have strength to stand,
> Most manfully I will pursue
> All dangers, till I clear the land
> Of lions, bears and tigers too."

HENRY BRIGGS, THE MATHEMATICIAN.

MR. HENRY BRIGGS, M.A. (of Cambridge) was a contemporary of NAPIER, the inventor of Logarithms. Mr. J. W. L. GLAISHER, F.R.S., informs me that "BRIGGS was a Cambridge man" that is, he took his degree at that University. In HUTTON'S History of Logarithms (1801) we read "Mr. HENRY BRIGGS, not less esteemed for his great probity, and other eminent virtues, than for his excellent skill in mathematics, was, at the time of the publication of NAPIER's logarithms, in 1614, Professor of geometry in Gresham College in London, having been appointed the first Professor after its institution; which appointment he held till January 1620, when he was chosen, also the first, Savilian Professor of geometry at Oxford, where he died January 26th, 1631, aged 74 years."

After NAPIER had published his logarithms, BRIGGS applied himself vigorously to the study and improvement of them—wrote to Mr. (afterwards Archbishop) USHER, expressing great admiration for NAPIER's work and stated his intention to visit "NAPIER, Lord of Markinston." This visit took place and BRIGGS pointed out certain improvements which he proposed and which appear to have had the approval of the Scotch Baron.*

It appears that BRIGGS was the inventor of the present scale of logarithms, in which 1 is the log. of the ratio of 10 to 1, and 2 that of 100 to 1. Those who wish to know more of the History of logs. may consult the work already referred to, and more particularly, for a discussion on the relative merits of NAPIER and BRIGGS, to the "*Report of the committee on Mathematical Tables,*" Brit. Assoc. Rep., 1873.

"In the calendar of State Papers (Domestic Series) 1600-1638, BRIGGS's name occurs several times. He was a Commissioner of Sewers for Norfolk, Suffolk, Cambridgeshire, etc., and in conjunction with Sir ANTHONY THOMAS, JOHN WORSOPP, HILDE-DEBRAND PRUSEN, and others, was an undertaker for draining the *Fens* (December 2nd, 1629). When in February 1625 the tides overthrew 1120 rods of bank in the neighbourhood of Yarmouth, BRIGGS was consulted with regard to the levels." Mr. J. W. L. GLAISHER, M.A. *on Early Logarithmic Tables and their Calculators*, in Phil. Mag., May 1873.

* That is the impression stated in *Tables* PAR FRANCOIS CALLET, à Paris, 1795, p. 4.

SIR JONAS MOORE, F.R.S.

THIS eminent Surveyor and mathematician deserves mention here in virtue of his having some 200 years ago, produced a fine map, (on the scale of two inches to the mile) of the *Great Level of the Fens.* He is several times referred to in the British Association Report on Mathematical Tables, 1873. It is there stated that his table of Natural and log. versed signs from 0° to 90° to every minute, to 7 places, was the first produced in England, (DE MORGAN).

Sir JONAS MOORE was Surveyor General to King CHARLES II., was a Governor of Christ's Hospital, London; he earnestly applied himself to the improvement of the Mathematical School, and wrote a "New System of the Mathematicks" in furtherance of that design. This was published in 1681.

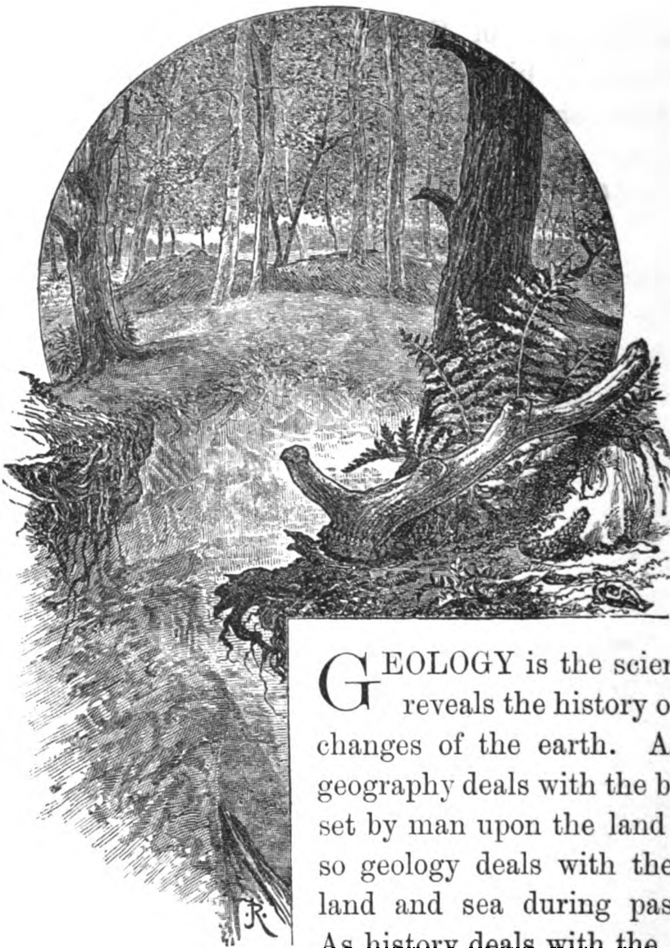
[S. H .M.]

CHAPTER XV.

GEOLOGY.

The Nature of the Geological Record.

see p. 579.



GEOLOGY is the science which reveals the history of physical changes of the earth. As political geography deals with the boundaries set by man upon the land and sea, so geology deals with the areas of land and sea during past epochs. As history deals with the actions of man in modifying the constitution, etc., of countries, so geology deals with the action of natural forces in modifying the face of the globe. Geology is the physical geography and ancient history of the earth. As the historian goes to the records of by-gone times for the materials of his work, so the geologist goes for a like purpose. The records of the historian are inscribed on paper, those of the geologist in rock. By the term *rock* the geologist describes not only hard stony material like granite, but soft beds such as clay and peat.

These rocks are mostly formed by the agency of the water, and generally with inconceivable slowness. One of the first lessons the young geologist has to learn is that geologic time is not measured like historic time, but deals with vast ages, whose limits in years can hardly ever be assigned. This lesson is not difficult of acquisition by the Fen-man; for he sees around him land being made by the sea, and traces in the successive lines of sea-walls records of the slowness with which the rock is deposited. The thickness of the various rocks which are developed in this country is about 20 miles, and the Fen-man can readily appreciate how vast a period must have elapsed since the oldest of these was formed.

Nor does this alone, stupendous as it is, adequately represent the whole question. Between the formation of many successive rocks in our land long intervals of time have supervened, during which great series of strata forming whole mountain ranges have been produced elsewhere.

Again, any stated area which has undergone alternations of land and marine conditions, must have experienced many long intervals of land-nature during which mountains, valleys, and plains, have been sculptured. These ages must be added to to the time already conceived, before we adequately comprehend the immensity of the time with which geologists deal.

Nevertheless these ages though countless are not immeasurable, and Sir WILLIAM THOMSON thinks there are grounds for believing that the habitable crust could not have been formed less than 20 millions of years ago, nor more than 400 millions of years since. My distinguished colleague Dr. J. CROLL, F.R.S., has recently advanced reasons for deeming this limit far too small. Within some such space of time as this, which may itself be but a fragment of the earth's age, have been formed all the rocks which geologists have to study.

These rocks, as developed in Europe, appear to fall naturally into three great, though very unequal divisions known as Palæozoic, Mesozoic, and Cainozoic; the two first correspond with the terms Primary and Secondary, the last with the Tertiary and Post-Tertiary (or Quaternary). Of these the Palæozoic division, which as its name implies, is the oldest, is by far the grandest, embracing strata of the united thickness of abut 89,500 feet, or 89·5 per cent of the whole British rocks. The forms of life preserved in its beds are, with very few exceptions, utterly different from those of the present day. No example of these rocks occurs in the Fenland or its vicinity.

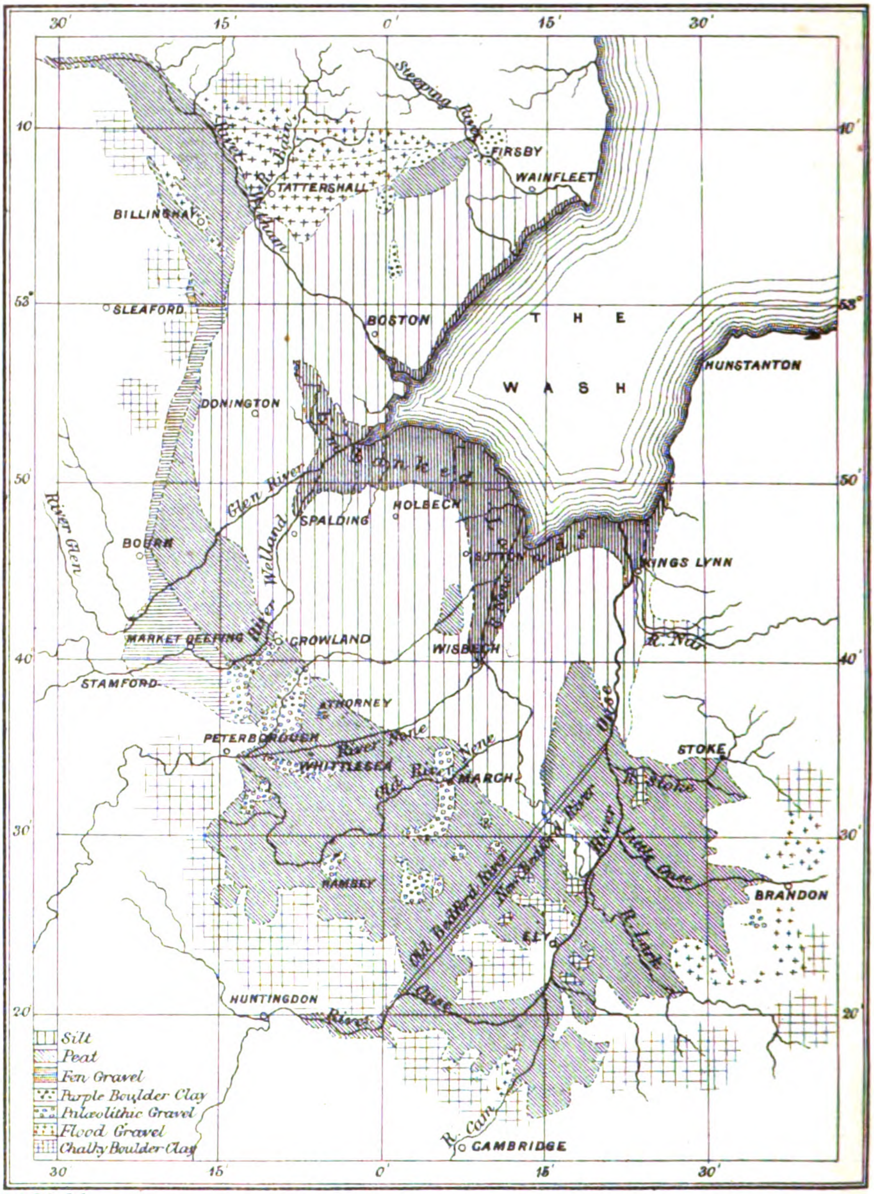
The Mesozoic rocks have a thickness of about 11,900 feet, or only about one eighth of the thickness allowed by the older strata. The life-character is more nearly allied to that of to-day than is the case with palæozoic remains, but is still very different from it. The two upper divisions of these rocks are the Cretaceous and Oolitic Systems, the former named from the chalk, its principal member; the latter from the frequent development of limestones having a peculiar structure resembling the roe of a fish: these are called *Oolites*, and Bath and Ketton Stone may be cited as examples. The Oolites are again divided into Lower, Middle, and Upper series, the two last being developed in our area. Underlying most of the Fen are two very thick beds of dark blue, stiff clay; there are the Oxford (Middle Oolite) and Kimeridge (Upper Oolite) Clay, so named from localities when they can be well studied. The Cretaceous system overlies the Oolitic and occupies the east, south, and part of the north border of the Fenland. It consists of four divisions the Neocomian (or Lower Greensand) of which the Carstone is a representative, the Gault, a stiff blue clay, the upper Greensand very thin in this area, and the chalk its upper member. None of these Mesozoic rocks form part of the Fen-beds proper, but they flank and underlie them.

The Cainozoic, the most recent and smallest of the great divisions, is that in which the forms of life are nearly allied to those of the present day, and indeed embraces those deposits which contain the remains of recent species. It is divided into two great sections, the Tertiary and the Quatermary. The thickness of the former may by taken at about 2,600 feet; that of the latter is too variable to be estimated with any degree of accuracy, but in this area it attains the very exceptional thickness of nearly 600 feet. It is to this last division that the Fen-beds belong, and to the most recent part of it. Thus we see that the geological history of the Fens belongs to the very latest of the records of the earth's development.

Geology reveals more than the antiquity of the solid crust; it expounds the changes in the physical geography, climatology, and forms of life. Thus we learn, for instance, that every portion of the British Isles has many times been submerged beneath the sea, that it has experienced every variety of climate from tropical warmth to arctic cold, and that the forms of life have developed from the most ancient types to the modern faunæ and floræ.

It must be remembered that the positions in which we find rocks at present are very seldom those in which they have been deposited, otherwise we should seldom have a chance of studying the older beds. By the action of upheaving and depressing forces, the strata have been tilted, and crumpled and dislocated to a considerable extent; and, by forces presently to be described, portions have been worn away until sometimes but a wreck remains. Nevertheless, gigantic as have been the crumplings, and violent the dislocations which the rocks have undergone, they have never been inverted except in a very few limited areas: so that newer beds always repose upon older ones. The general geological structure of England and Wales is very simple. The newest beds are on the east, the oldest on the west; the newest lie most evenly, the oldest are most tilted. The beds dip or slope to the south-east, so that in travelling from east to west we pass in succession from the newest to the oldest rocks, and they become more highly inclined as we travel westward. On the other hand it is possible to walk from the south coast to the north of England, upon the same strata; thus we could go from Dorsetshire to Flamborough Head without getting off the chalk.

The scenery of the land, however, is not to any great extent determined by the upheavals and depressions that the beds have undergone. Thus, it by no means follows that those strata which have been most upheaved constitute the highest ground; the summit of Snowdon, for instance, lies geologically in a hollow. The sculpturing of the surface of the land into hill and dale is mainly due to the eating away by the sea, of rocks of different hardness, by rain, by frost, and by rivers. This action is called *denudation*, and to it the softer strata have yielded more readily than the harder ones, and these latter form, generally, the boldest scenery.



S.B.J.S. del.

GEOLOGICAL MAP OF THE FENS

From this preliminary sketch we will proceed to the geological features of the Fens.

Fenland Strata.

The Fenland occupies a basin chiefly hollowed out in the Oxford and Kimeridge Clays. The process of formation of this hollow will be discussed presently. Overlying much of these clays, and thus forming the true basement are two singular deposits, known as Boulder Clays, which are older than any of the true Fen-beds, but whose history has an important bearing upon our subject. Above these Boulder Clays come the actual Fen-beds. The sequence is as follows, the newest beds being placed at the top of the table:—

Silt and Clay Peat Beach Gravel	*True Fen Beds.*
Boulder Clay Old valley Gravels	*Older than the above.*
Flood Gravels Chalky Boulder Clay Brandon Beds	*Belonging to the great Cycle of the Glacial Epoch.*

A more detailed table will be given at the end of this chapter.

Commencing with the oldest rocks connected with the Fens, it will be necessary to describe briefly the nature of the beds immediately preceding the glacial deposits. These are unrepresented in our area, but are typically developed in the neighbourhood of Norwich and along the coasts of Norfolk and Suffolk, where they have for many years been studied by such devoted geologists as the veteran Rev. J. GUNN, Messrs. SEARLES V. WOOD, Junr., and F. W. HARMER, to whose continued researches we are indebted for the broad features of the deposits. My colleagues Messrs. H. B. WOODWARD and CLEMENT REID, are at present carrying on the Geological Survey of that most interesting area, and I have enjoyed the privilege of visiting most of the localities under their guidance, and frequently in company with my venerable and esteemed friend GUNN. To the two colleagues named I am beholden for the accuracy of the information here detailed respecting these particular deposits, they having generously supplied me with the full abstract of their work which follows.

Immediately beneath the lowest glacial deposits of Norfolk (the so-called Cromer Till or Lower Boulder Clay) are a series of sands, gravels, loams, and clays, to which the collective name of Norwich Crag Series is given. They constitute the newest member of the Tertiary System.

The Norwich Crag series is generally divided into three series, 1. Fluvio Marine Crag; 2. The Chillesford Beds; 3. The Forest Bed Series, which immediately underlies the glacial deposits.

The Fluvio Marine Crag consists of a series of sands, gravels, and loams, which seldom exceed 10ft. in thickness. As the name implies, they were formed along a coast-line where marine and freshwater conditions alternated. Their fossil contents comprise numerous mammalian remains and mollusca. The former, Mr. GUNN has pointed out, are most frequent in a shingly bed at the extreme base of the series, and contain genera such as *Mastodon*, *Elephas*, *Hippopotamus*, *Rhinoceros*, *Equus*, *Cervus*, *Bos*, *etc.* The molluscs generally indicate a colder climate than that which prevailed during the older Crag periods, and this boreal aspect is more marked at the upper than at the lower part of the beds.

The Chillesford Beds consist of a series of micaceous clays forming lenticular masses amongst beds of fine sand. These attain a thickness of 25 feet, are entirely marine, and their fauna is decidedly more arctic than that of the Fluvio Marine Crag. Above the Chillesford series, in certain localities, come pebbly sands and pebble beds, which Messrs. Wood and Harmer consider to be unconformable to the Chillesford Series. To these the name of Bure Valley Beds is given.

However useful these subdivisions may be in minute work, their similarity of composition, and the insensible gradations of one bed into the other, seem to point to a common origin, and Mr. H. B. Woodward looks upon them as successive portions of one series, to which he has given the name of Norwich Crag Series. In this determination I entirely agree with him, and I think the point one of greater importance than has hitherto been recognised. These beds constitute the upper part of the Tertiary system, and the terms Tertiary and Post-Tertiary (or Quaternary) are often used as if there were a break, or unconformity, between the two; whereas, in point of fact the one shades so insensibly into the other, both with respect to physical and palæontological characters that only an arbitrary division can be formed. Messrs. Wood and Harmer, for instance, place the Bure Valley Beds in their glacial series, thus removing them from the Tertiary, basing their conclusion upon a break they affirm to exist between these beds and the Chillesford beds below. This evidence does not appear to me conclusive. The gradual approach of arctic conditions is indicated throughout the entire Crag or Pliocene series, and it seems to me arbitrary in the extreme to draw a distinction of such importance anywhere in the series. The cold came on very gradually, and in east Norfolk we have a practically unbroken series of strata leading direct to the glacial deposits. To take the upper portion of such strata and call them glacial does not strike me as being the best use of terms. Such a term as pre-glacial is exceedingly useful, and indeed absolutely necessary, and may very well be applied to the beds in question when we discuss their relations to the glacial deposits, but it should not be used as a proper name; still less should it be applied to a bed merely because it is overlaid by boulder clay, *unless it can be shown to be older than the most ancient glacial deposit.* This limitation is of the highest importance and it will be abundantly shown further on how much misapprehension, useless discussion, and illogical argument (if such can be) have arisen from the want of this self-evident restriction.

Similar remarks also apply, and with even greater force, to the use of the allied term post-glacial, which must be confined to such strata as are newer than all glacial deposits. Mr. S. V. Wood further complicates matters by calling the Hessle boulder-clay post-glacial, a use of terms that can hardly be defended. Unless we rigidly define these terms we are led into inextricable confusion, in discussing beds which may be post-glacial as regards one area, glacial as respects another, and pre-glacial in a third. This is no imaginary difficulty, and I could point to volumes of 'criticisms' respecting beds which Dr. J. Geikie and I place in the glacial series, all arising from the writers not having appreciated the fact that a rock may repose upon one boulder-clay and yet be older than another boulder-clay. I would confine the term glacial to those deposits included between the oldest and newest beds of ice-origin (boulder-clays) using Dr. J. Geikie's term *inter-glacial* for such as, though showing the existence of more or less mild conditions, are nevertheless intercalated between true ice-formed rocks. The term post-glacial I would restrict to beds newer than the most recent boulder clay, and in this sense these terms will be used in this volume.

The similarity of physical conditions which we have seen to subsist throughout the Norwich Crag Series, appears to have been repeated throughout the entire glacial epoch. Whenever the ice melted away the similar sands, gravels, loams, and clays, again formed, as we shall see when we describe the so-called Contorted Drift and Middle Glacial beds. The boulder-clays, in fact, are episodes—important and long-continued beyond all doubt, but still episodes—in a long range of similar physical (not climatal) conditions.

Above the beds already described, along the coasts of Norfolk and Suffolk, appear a set of beds known as the Forest Bed series, whose interest was pointed out by Mr. Gunn. This series has long been a bone of contention among geologists, but my colleagues Messrs. H. B. Woodward and C. Reid, have recently done much to eliminate the truth. I will, therefore, call upon them to state their case.

*Norwich Crag.**

In the neighbourhood of Norwich, resting upon the Chalk and overlaid by the glacial deposits, is a very variable series of pebbly gravels, sands, and laminated clay-bands, which contain here and there seams or patches of shells. The entire series attains a thickness of about 30 feet.

The term Norwich Crag was originally applied to the shell-bearing beds exposed at Thorpe, Postwick, and Whitlingham, near Norwich; and at Horstead, Coltishall, Wroxham, and other places in the Bure valley.

As the fauna of the beds at these several localities came to be particularly examined, it was found that there were certain local distinctions. Thus at Bramerton, where two horizons of shells have been exposed, the upper layer of crag was noticed to contain fewer species than the lower, and these are indicative of deeper water and of a colder climate, than the shells of the lower division, with

* This article on the Norwich Crag was kindly written for me by Messrs. H. B. Woodward, F.G.S., and C. Reid, F.G.S.

which remains of land and fresh-water shells are rarely commingled.

It has been further determined that the fauna of the lower crag is very closely related to that of the upper portions of the Red Crag, while the fauna of the upper crag can be correlated with a shell-bed overlying the Red Crag at Chillesford in Suffolk.

Thus the following comparisons have been made, between the beds exposed at Bramerton and those developed at Chillesford:—

Bramerton.		*Chillesford.*
Upper Crag (marine.)	=	Chillesford shell-bed.
Lower Crag (fluvio-marine.)	=	Red Crag (upper part.)

Owing to the occurrence of a bed of laminated clay above the shell-bed at Chillesford, many geologists have been led to attempt a further correlation, on lithological grounds, between this clay bed and certain beds of laminated clay in Norfolk. Unfortunately this has been productive of a great deal of confusion, for an attentive study of the crag formation in Norfolk, shows that laminated clay-beds are characteristic of the entire series, and do not mark any one horizon, occurring as they do in lenticular or isolated masses, and in layers often as much false-bedded as the sands and gravels which combine to make up the deposit.

Hence the only divisions, if such they can be called, are those of a palæontological character, or in other words zones, whose lithological equivalents, when the fossils as often happens, are absent, cannot be determined with precision.

The lower or fluvio-marine shell-bed has been identified at Bramerton, Postwick and Thorpe, and contains the following species:—

Buccinum Dalei.	Modiola modiolus.
,, undatum.	Nucula Cobboldiæ.
Purpura lapillus.	Cardium edule.
Trophon antiquus.	Tellina obliqua.
Cerithium tricinctum.	,, lata.
Turritella terebra.	,, prætenuis.
Scalaria Grœnlandica.	Scrobicularia piperata.
Litorina litorea.	Mactra ovalis.
Melampus pyramidalis.	Mya arenaria.
Mytilus edulis.	,, truncata.

The upper or Chillesford shell-bed, which contains no species that are not found in the lower bed, has been identified at Bramerton, Brundall, Aldeby, and Coltishall, at which latter place it rests directly upon the Chalk.

The more abundant fossils are the following:—

Purpura lapillus.	Astarte borealis.
Scalaria Grœnlandica.	,, compressa.
Litorina litorea.	Cyprina Islandica.
Mytilus edulis.	Tellina obliqua.
Nucula Cobboldiæ.	Mactra ovalis.
Leda oblongoides.	Mya arenaria.
Cardium edule.	,, truncata.

A still higher zone of crag appears to occur in places in the Bure valley, at Wroxham and Belaugh, and this bed is characterized by the occurrence of *Tellina Balthica*. The other shells associated with it are such as occur in the upper and lower crags previously noticed. The beds containing this shell have however been specially designated as the *Bure Valley Beds*, and even classed with the lower glacial series, by Messrs. Wood and Harmer. They are however so intimately connected with the Norwich Crag on stratigraphical grounds, that no definite line can be drawn between them.* If we do not regard the occurrence of this shell as due to local distribution, we may place the bed as a higher zone in the crag series, and equivalent undoubtedly to the Weybourn crag, which yields a similar fauna.

* See my remarks *ante*. (S.B.J.S.)

One point of particular interest connected with the crag series, is the occurrence at its base of a bed of rolled and partially rolled flints, called the "stone bed," and in which the mammalian remains (which led to the application of the name Mammaliferous Crag), are usually, though not always, found. These remains include the *Mastodon*, *Elephas meridionalis*, *Hippopotamus*, *Rhinoceros leptorhinus*, *Cervus*, *Equus*, *Bos*, *Lutra*, *Trogontherium Cuvieri*, etc. Whether the *Mastodon* was living at the time of the formation of the Norwich Crag, has been disputed, owing to the fact that its remains have never been met with in the "Forest bed"; and thus the stone-bed has sometimes been considered as the remains of an old land-surface. There is however no doubt, that as we now find it, the stone-bed is a marine accumulation of slightly different ages in different localities where it directly underlies the several zones of crag. Shells are frequently commingled with the flints of the stone-bed, and the surface of the chalk itself at Postwick is bored by Annelides, and that at Bramerton by Pholas. Until further evidence is produced, it must therefore remain a disputed point as to whether the remains of *Mastodon* found in the Norwich crag belonged to animals living at the period, or were derived, as Mr. HARMER considers, from some pre-existing deposit in which their bones were entombed.

On the coast in the neighbourhood of Cromer, between the glacial deposits and the chalk, there lies a variable series of clays and sands with beds of lignite. Under the names "Cromer Forest Bed," "Bure Valley Beds," "Westleton Beds," "Laminated Beds," etc., these have been variously divided and classified by different authors. The correct succession appears to be :—

Glacial Deposits.

Myalis Bed (purely marine, formed in 5 or 10 fathoms.)

Upper Fresh-water Bed.
Weybourn Beds (estuarine.)
Chalk.

Resting on the chalk there is a very variable estuarine series known as the Weybourn beds. Near Weybourn itself, these beds consist of alternating clays and sands full of marine shells, but as the beds are traced southward they gradually change, large quantities of drift wood appearing and the fauna becoming fluvio-marine. In this state they are known as the "Cromer Forest Bed," though the tree stumps which have been considered to indicate a land surface, are all drifted, and often a good deal worn. The stumps are generally upright, as when laden with earth and stones they would naturally sink with the roots downwards, but they occasionally occur in all positions and even upside down.

In the estuarine clays and gravels of the Weybourn beds a large number of mammals have been found, the bones being generally fractured though not much worn. A large number of the specimens in museums have been picked up on the beach, and it is at present uncertain what bed they come from. The list given below includes several species from the fresh-water bed, as the faunæ of the two beds have not been properly separated. It is copied from the list given by Lyell on the authority of Professors Boyd Dawkins and Owen, with the addition of two species lately discovered.

l. = living. ex. = extinct.

ex.	Elephas meridionalis.	l.	Sus scrofa.
ex.	,, antiquus.	ex.	Urus speleus.
ex.	,, primigenius, *various ?*	ex.	,, arvernensis.
ex.	Rhinoceros etruscus.	l.	Canis lupus.
ex.	,, megarhinus.	l.	,, vulpes.
l.	Equus caballus.	ex.	Machairodus, sp. (latidens ?)
ex.	Hippopotamus major.	l.	Lutra, sp.

ex.	Bos primigenius.	ex.	Trogontherium Cuvieri.
ex.	Cervus megaceros.	l.	Talpa Europæa.
l.	Cervus capreolus.	l.	Sorex moschatus.
l.	,, elaphus.	l.	,, vulgaris.
ex.	,, Polignacus.	l.	Arvicola amphibia.
ex.	,, cornutorum.	l.	,, agrestis.
ex.	,, verticornis.	l.	Trichecus rosmarus.
ex.	,, Sedgwickii.	l.	Monodon monoceros.
l.	Castor fiber.	l.	Balœnoptera (various.)

In the Weybourn beds we find occasional cakes of peat evidently derived from an older fresh-water formation. These cakes are often full of leaves, seeds, and wing-cases of beetles, but unfortunately the flora has been mixed with that of the Upper Fresh-water Bed, and the examination of fossils is not sufficiently far advanced for it to be separated. The relation of this Lower Fresh-water Bed to the Norwich Crag has not yet been made out.

In places rootlets penetrate three or four feet into the underlying Weybourn beds, marking the position of a land surface beneath the fresh-water deposits, or else showing the occurrence of islets in the lakes. This has been described by Prof. Prestwich as the "Forest Bed," and it appears to be the only pre-glacial landsurface shown on the coast, for the so-called "Cromer Forest Bed" of Norfolk geologists is at a lower horizon and consists entirely of drifted materials.

Under the Myalis bed, or where that is absent, directly beneath the Boulder Clay, are shown extensive deposits of fresh-water sand, clay, and peat. These beds appear to have been formed in shallow lakes like the present "broads" of Norfolk. In places they are very fossiliferous, yielding many species of mammals and molluscs, besides beetles, birds and seeds, which have not yet been identified. The mammals already known include the *Palæospalax*, *Trogontherium*, and several other extinct forms. At West Runton, which appears to be the most fossiliferous locality, the following species of land and fresh-water shells have been obtained :—

Paludina contecta.	Ancylus (Velletia) lacustris.
" vivipara.	Limax, 2 sp.
Hydrobia.	Succinea putris.
Valvata piscinalis.	Helix arbustorum.
" cristata.	" hispida.
Bythinia tentaculata.	" nemoralis.
" Leachii.	Zua lubrica.
Planorbis albus.	Pupa, sp.
" complantus.	Carychium minimum.
" contortus.	Clausilia, sp.
" corneus.	Corbicula fluminalis.
" nautileus.	Sphærium corneum.
" nitidus.	Pisidium amnicum.
" spirorbis.	" fontinale, var. Henslowana.
Limnæa palustris.	" pusillum.
" peregra.	Unio pictorum.
" stagnalis.	Anodon cygneus.
" truncatula.	
Physa fontinalis.	

All the above species are now living in England, with the exception of the *Corbicula fluminalis*, not to be found nearer than the Nile, and a *Hydrobia* not yet identified.*

The climate, as shown by the animals and plants of the fresh-water bed, was but little, if at all, colder than at present. The occurrence of the mole seems quite incompatible with Arctic conditions, and the plants are all now living in Norfolk.

Near Cromer we commonly find directly beneath the Boulder clay, sands, pebble gravels and thin loams. These are rarely fossiliferous, but where fossils do occur, they form colonies, with the bivalves generally in their natural position. To this deposit the name "Myalis bed" has been given. Very little is yet known of its fauna, which appears to have a more recent facies than that of the

* Compare with statements in Ch. XI.

Weybourn beds, though the reversed whelk occurs. This bed has yielded the following species of mollusca:—

BUCCINUM UNDATUM.
LACUNA, sp.
LITORINA LITOREA.
,, RUDIS.
NATICA, sp.
PURPURA LAPILLUS.
TROPHON ANTIQUUS (reversed var.)
*ASTARTE BOREALIS.
CARDIUM EDULE.
*CYPRINA ISLANDICA.
*LEDA MYALIS.
*MYA TRUNCATA.
MYTILUS ELULIS.
*OSTREA EDULIS.
PINNA, sp.
TELLINA BALTHICA.

The general order of succession of the Newer Pliocene Beds of Norfolk is as follows:—

Norfolk Crag.	Myalis Bed	
	Upper Fresh-water Bed	
	Weybourn Beds and Forest Bed	Norwich Crag Series.
	Chillesford Crag	
	Fluvio-marine Crag.	

Glacial Beds.

The object of the above long disquisition was to prove (what is admitted by all geologists) that during the latter part of the Tertiary period the climate of England grew gradually colder and colder. At length it assumed Arctic, and even more than present Arctic severity, and a certain class of phenomenon, to be presently described, marks with unmistakeable vividness the culmination of the cold.

Before entering into a description of the beds formed during this epoch, to which the name of Glacial Epoch is admirably given, or as Dr. GEIKIE more poetically terms it the Great Ice Age, it will be as well to ask the question "How can these great changes of climate be brought about?" The answer has been given by Dr. J. CROLL, F.R.S.

* In their natural position with the valves united.

Every school-boy knows that the earth rotates upon its axis once in 24 hours, that it revolves about the sun in a little more than 365 days, that its path or orbit is not circular but slightly elliptical, that its axis is inclined to the plane of its orbit, and that this inclination remains "parallel to itself" at all times and seasons.

But it is not so generally known that these motions are liable to cycles of slow, irregular changes. Let us see how these can be brought about. The fundamental law of gravity assures us that *every particle of matter in the universe attracts every other particle with a force directly as the mass, and inversely as the square of the distance.* It need hardly be said that this law has been subjected to the most refined tests and has never been found wanting, so that we can be absolutely certain that it is true. Now if the earth were the only planet, it would circle about the sun for ever in a certain orbit. But it has companions which journey around the same luminary in different times, and these companions are of different sizes. In consequence of the differences in their periodic times (as the duration of each journey is called) some of these planets at certain periods pull the earth away from the sun, and at others exercise comparatively little influence upon it. Moreover the direction of the pull is not always the same; and further, the earth not being spherical, the external bodies so act upon the protuberant equatorial regions that the earth is made to "wobble," as the uninitiated have it. (I know no more appropriate term than this).

The resultant of all these actions is as follows, and may be thus illustrated. If we take an india-rubber band, and placing our fore-fingers in it, slightly stretch it, we transform the circle into a ellipse, which will illustrate the earth's orbit at a given period. Now if we cause our fingers to revolve about each other the longest diameter of the ellipse (the major axis) will point successively in all directions. If at the same time we vary the tension on the band, the ellipse will vary in shape, sometimes being considerably elongated, and at others approaching circularity. Now these are exactly the changes that the shape of the earth's orbit undergoes, owing to the action of the various planets, and the times occupied by these changes are variable.

Winter in either hemisphere, occurs when that hemisphere is turned away from the sun, and summer when the hemisphere is directed towards the sun. At present the northern hemisphere is turned from the sun, and winter occurs, when the earth is nearest to the sun. Suppose the earth to remain stationary in its orbit. It is clear that after a certain time it will be carried to its extreme distance from the sun, in consequence of the changes of orbit above described. The northern winter will then happen when the earth is farthest from the sun, and summer when it is nearest. This will equally be the case if the earth travel round the sun. Consequently, we may be certain that during past geological ages, summer and winter in either hemisphere have taken place at all possible positions in the orbit, and during every variety of eccentricity (or deviation of the orbit from circularity).

When the earth is furthest from the sun it evidently receives less heat than when it is closer to it. Hence it is an easy inference that at those times when winter occurs in the most distant part of the orbit, and the orbit has attained to a great degree of eccentricity, the climate will be coldest, and may readily be of arctic severity in such latitudes as ours. This was suspected long ago; but, unfortunately for this easy explanation, it was pointed out that as the earth approaches the sun its speed increases, so that although we have a short summer at such a time, it is also a hot one. The time of the earth's circuit about the sun cannot change:

when it has to make a longer journey it travels faster, and consequently the total amount of heat received from the sun is the same at all times. Hence in our own latitude, for instance, we receive the same quantity of heat per annum at all times.

Dr. Croll, however, has pointed out that the variations of the earth's orbit cannot *directly* give rise to changes of climate, they must do so *indirectly*. He shows us that during periods of high eccentricity the hemisphere that has its winter in aphelion, (that is when farthest from the sun) is rendered colder than usual and the opposite hemisphere warmer.

Our winters are now about eight days shorter than our summers, but when the eccentricity of the orbit was greatest, they would be thirty-six days shorter. The winters would then be very cold, because less heat would be received daily, and because the winters would be longer. Much of what is now precipitated as rain would fall as snow, and hence we should have a great accumulation of ice and snow during winter.

This ice and snow would tend to lower the temperature of the air by radiation, for no matter how fiercely the sun's rays might beat upon the surface, the temperature could not be raised above the freezing point. Moreover, the presence of so much snow and ice would tend to lower the temperature by chilling the air and giving rise to fogs, as may now be witnessed in ice-clad regions.

Exactly the opposite of all this would be taking place in the other hemisphere.

Another very powerful result of high eccentricity, tending also to cool the hemisphere whose winter occurred in aphelion, is the deflection of the ocean-currents which would ensue. As is well known, the trade-winds are caused by the difference of temperature between the poles and the tropics. At present the difference is slightly greater in the southern than in the northern hemisphere. Hence the south-east trades blow stronger than the north-east, and one consequence is that the Gulf Stream is driven into the northern hemisphere, and conveys its welcome burden of warmth to western Europe. Were it not for this flow of warm water, our land would be as drear and desolate as Labrador, which is in the same latitude.

But when our winter occurred in aphelion during a time of high eccentricity, England would have a temperature very near the freezing point, while the southern hemisphere would be much warmer than now. The north-east trade-winds would consequently be much stronger than the south-east, and the Gulf Stream would be deflected southwards and leave us to the dire influence of frost.

This, then, is in brief the explanation Dr. Croll offers of the glacial epoch. It gives us, moreover, a means of estimating the probable date of the glacial period, and it appears that the last epoch at which the requisite astronomical conditions occurred, commenced about 200,000 years ago and terminated about 80,000 years since.

One very remarkable necessity attaches to the acceptance of this theory, namely, that the glacial epoch could not be one of unmitigated cold, but must have possessed several intercalated warm periods, to which the name of inter-glacial periods may be given. If geology show this was not the case, the theory will not hold good. If on the other hand, the theory be sound, geologists must account for the absence of beds of inter-glacial age if they do not exist.

Happily no such task has been imposed upon us, for although at one time all glacial beds were supposed to be of the same age, we now know at least four boulder-clays and these are separated from each other by beds which indicate temperature and warm periods. Nevertheless in some high places this great truth is hardly recognised, and has led to much mis-apprehension.

The four boulder-clays hitherto recognised are named respectively—

1. The Hessle Boulder Clay.
2. The Purple Boulder Clay.
3. The Great Chalky Boulder Clay.
4. The Lower Boulder Clay, or Cromer Till.

Mr. J. TRIMMER was the first to recognise the existence of boulder-clays of distinct ages in East Anglia, but it is to Messrs. S. V. WOOD, jun. and F. W. HARMER that we are indebted for the first trustworthy elucidation in this matter in the Eastern Counties. Mr. WOOD and the Rev. J. ROME have since largely added to our knowledge of the glacial beds of Yorkshire and Lincolnshire. The officers of the Geological Survey have carried on this work in all parts of the kingdom with marked success, and Dr. J. GEIKIE has made the subject peculiarly his own by his masterly work on the "Great Ice Age."

Of the above boulder-clays the Cromer Till is the oldest. In all probability it does not occur in the Fenland. The Great Chalky Boulder Clay, the most important member of the glacial series, marking as it does the culmination of the cold, is excellently represented in this district, and the Hessle Boulder Clay comes on in the Lincolnshire Fens.

All boulder-clays are pretty much alike, inasmuch as they consist of stiff clayey matter stuck full of stones in a perfectly higgledy-piggledy manner. There is, however, every conceivable variety of admixture—the material being sometimes very free from clay, sometimes almost all stones, and at others sandy and gravelly.

As a rule boulder-clay is easily recognisable, for the aspect of the stones or boulders is most peculiar. They are seldom either angular or rounded, but are sub-angular or blunted, and often one side is ground quite flat, or two faces may show this feature. If the material is such as will admit of it, the whole stone is covered with scratches or striæ, especially on the flattened surfaces, where they are generally more or less parallel. These features can be well studied in the chalk boulders in the boulder-clay of the Fens.

It is well worth while to collect and examine some of these striated stones, for they are amongst the most interesting of geological specimens, and tell a story of surpassing interest. The boulder-clay must be well known to all Fenmen, as underlying most of their district. It is known in Lincolnshire as 'creachy clay,' and in other parts as 'chalky' or 'stony' clay.

To find modern examples of these striated stones we must visit some such country as Switzerland or Norway where the mountain-valleys bear their burden of solid ice, creeping silently down towards the lowlands, instead of holding sparkling, dancing, rippling, tawny-coloured mountain-torrents. Where these stealthy ice-rivers end, succumbing to the genial influence of sunshine, a turbid current issues, and in its bed may be found just such curious scratched stones as may be picked up in the Fens. Or better still, we should go to frost-bound Greenland, where all the high hills are covered, and all the deep glens filled with one immaculate sheet of ice and snow. Over these solitudes nothing meets the eye but one monotonous spread of virgin white. But along the shores, where the ice breaks up into huge ice-bergs, myriads of striated stones may be found, and they are the precise counterparts of Fenland specimens. Even more to the point, were it possible, we might visit that yet more desolate southern continent, whose shores are only visible here and there, where long capes point northwards towards warmth and life. League after league our bark may sail, imperilled by floating bergs, in sight of ice-cliffs which overtop the mast-heads—ice-cliffs which tell us of a continent buried miles deep beneath blue ice. Could we penetrate beneath that chilly mass we should assuredly find, that as it dragged itself along, ever journeying sea-wards, it carried with it an increasing burden of crunched rock, partly triturated into clay, partly pebbly, and all these pebbles would be ground down and scratched just like the familiar stones of this low Fendom. Frozen into the solid ice, these rock-fragments abrade the solid beds beneath, smoothing their asperities, rounding the pinnacles into hummocks, scoring and grooving themselves and the bed-rock, and ever collecting and dragging onwards dêbris rent from the ground.

Just so the boulder-clay has been formed. Our land was buried beneath a sheet of ice whose thickness we cannot determine here, but which was certainly three-thousand feet in parts of Scotland.

It used generally to be believed that boulder-clay was a marine formation. All geologists are agreed that in some way or other ice has been a principal agent in its formation, but only of late years has the opinion been broached that it is to land-ice and not ice-bergs that we must look for a solution of the problems presented by this remarkable formation.

The advocates of the marine theory suppose that the material has been carried by ice-bergs, frozen into their bases, and that as the bergs melted this material was quietly dropped upon the sea-bottom. In this way was explained the occurrence of boulders of rocks foreign to the locality, and as these *erratics*, as they are called, are mostly derived from the north, the bergs were supposed to have come in a southerly setting current.

2 L 2

Those geologists whose lot fell daily amongst boulder-clay and glaciated rocks, began to doubt the accuracy of this determination, and at present the land-ice theory is rapidly gaining ground, and will, I feel certain, eventually be universally admitted.

I have brought forward the reasons which led me to abandon the marine theory, and as they are of importance to our subject, will venture to repeat them.

Let us consider first the mode in which ice-bergs gather their burdens, and in which they can distribute it. A berg is merely a portion of a glacier which has been broken off from the parent mass where it protrudes into the sea. The glacier, abrading the rocks over which it travels, drags along beneath it the detrital matter, as already described. If rocky peaks stand above the ice, frost-riven fragments will fall upon the glacier and be carried on its bosom, as may be observed in any of our European glaciers.

An ice-berg can only carry some of the material thus gathered by the glacier, and most of it will be that which has become frozen into the base of the ice.

Imagine such a berg, heavily laden, to drift away in an ocean-current far southwards until it runs aground in shallow water. Here it will stop, gradually melt, and discharge its burden into the sea-bed. The rubbish will be more or less sorted and arranged in falling through the water, and so far will acquire the character of a sedimentary rock. The material will therefore be to some extent bedded. Again, the deposit must of necessity be composed of fragments of the rock over which the parent glacier flowed, and can only by rare accident be like the rocks on which it falls.

If, therefore, the boulder-clay of the Fens be of marine origin it will assuredly possess two clearly-marked features—it will be bedded, and be composed of rocks foreign to the fens.

Now the mass of the boulder-clay shows no trace of these peculiarities. *It is a tough, compact, utterly unstratified mass, and is chiefly composed of rocks like those on which it lies.* Its toughness is proverbial, and is often described as being "as hard as if it had been rammed." This would naturally be the case if it had borne the pressure of the ice as we have described. I do not know of one place in the Fens, or for many miles around, in which the Chalky Boulder Clay shows the slightest trace of bedding.

Its composition requires more detailed description. The greater portion of the Fenland is underlaid by clays—dark-blue Kimeridge Clay on the east and as far west as a curved line from Lincoln by Boston to March and Sutton-in-the-Isle, or thereabouts—lighter blue Oxford Clay to the west of this line—still paler Gault Clay about Stoke. Chalk takes the ground on the north-east, south-east, and south.

The Chalky Boulder Clay takes its name from the prevalence of chalk in its composition, and this becomes more and more marked as the chalk areas are approached, and in some parts, as near the chalk wolds in Lincolnshire, and all the district about Brandon, that rock forms the bulk of the material, which is consequently almost white. Near Mareham-le-Fen it is so pure as to be burnt for lime, and at Thetford it is often exceedingly difficult to discriminate between it and the solid chalk.

Next let us take the case of the Kimeridge Clay, whose peculiar dark-blue colour renders it of easy recognition to the trained eye. The Boulder Clay over the area in which the Kimeridge Clay takes the ground is very largely composed of the latter, insomuch that (to take two cases far removed from each other) about Woodhall Spa and March, careful examination alone shows that it is a glacial deposit at all.

So, too, with the Oxford Clay. It impresses its light-blue character upon the Boulder Clay in a most striking manner, as may be seen anywhere over the area in which it outcrops.

The Gault Clay, again, takes the ground in but a small area in the Fens, but the Boulder Clay 'picks it out,' as it were, and at Modney Bridge brickyard, near Hilgay, for example, I have known the glacial bed to be mistaken for Gault by persons quite familiar with the latter.

In like manner I might cite the numerous formations over which I have mapped this interesting deposit, and show how in every case the Boulder Clay is made up of the wreck of the subjacent rocks, as is shown in the next figure. I have laid down upon my working maps the characters of the Boulder Clay, and have everywhere found this broad feature to come out; though, of course, isolated exceptions might be found in plenty. That this plain fact was not before insisted upon, has often surprised me, but I have never pointed it out to a brother hammerer without his being equally struck with its truth.*

If this Boulder Clay be of marine origin how can we account for this 'selective affinity' of the Boulder Clay? What manner of ice-berg is that which, with the skill of a geological surveyor, sheds its Kimeridge Clay *dêbris* upon Kimeridge Clay, its Chalk rubbish upon Chalk, and so on through the whole series of British rocks!

Moreover, as we have proved, these materials must have been picked up by the berg-producing glacier in regions where these rocks take the ground. Where is that region? The Boulder Clay is found 500 feet above the sea with chalk fragments scattered through its mass. That place

* I am here speaking of the Chalky Boulder Clay, for the fact was well known in other districts, such as the north of England, Scotland, Norway and North America. A paper has recently been published to disprove my assertion in this matter, but the very section given conclusively proves my case.

must have been under water for the berg to reach it, and the water must have been deep to float a berg of sufficient size to carry much matter. However, to be entirely within bounds, let the bergs be so small as to strand in water a hundred feet deep, and let there have been no denudation to lower the hills since the clay was deposited. Then the land must have been submerged 600 feet below its present level, in which case every bit of Chalk, Kimeridge Clay, and Oxford Clay, in Europe would be buried fathoms deep beneath the waves. Where would the gathering-ground of the glaciers be then?

The adherents of the marine theory have to admit that glaciers *can* grind up the rocks, otherwise their pet bergs could not be fed. Why is it necessary for boulder-clay to go on a voyage before being deposited? Why may we not believe that English ice made English Boulder Clay?

These considerations are sufficient to ensure the rejection of the marine theory, but I will add another argument, thrice to slay the slain. Brandon is the seat of the gun-flint industry, and the flints used are of peculiar characters that can be distinguished with great facility. They occur *in situ* only in the chalk over a limited area of some thirty square miles. Yet these flints are found in the Boulder Clay of that area and to the south. Could *they* have been brought by ice-bergs?

There is a peculiar modification of the above law of the dependence of the Boulder Clay upon the rocks beneath that is very instructive, inasmuch as it is not only inexplicable on the marine theory, but tells us volumes as to the direction in which the great ice-sheet moved.

The accompanying figure represents very rudely the lie of the older rocks north of the Fens in Lincolnshire, the section being from west to east. It is similar to one I gave in "The Great Ice Age" for Dr. GEIKIE, and is merely a diagram, although it emphatically illustrates a great truth. I am particular in thus stating that the section is diagrammatic for my former one was criticised as representing a section along a definite line.

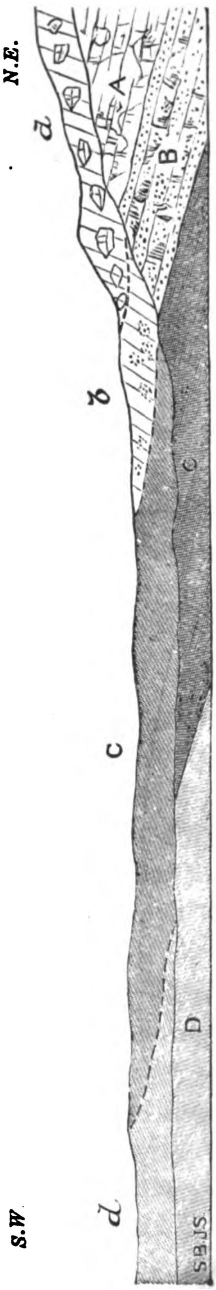


FIG. 21.—*Diagram Section showing the lie and character of the Boulder Clay, etc., just north of the Fens.*

A. Chalk. *a*. Boulder Clay, mostly of Chalk. *C*. Kimeridge Clay. *c*. Boulder Clay of Kimeridge Clay.
B. Neocomian. *b*. " " of Neocomian Rocks. *D*. Oxford Clay. *d*. " " of Oxford Clay.

This diagram shows how the composition of the Boulder Clay is dependent upon the character of the subjacent rocks.

But it also brings out the fact that the boulder-clay of one sort invades and overlaps the boulder-clay of another outcrop. Thus the very chalky boulder-clay extends over that formed of Neocomian rocks*; this invades the territory of the Kimeridgian boulder-clay (if we may so term it) this latter, in like manner, sweeps over the Oxfordian boulder-clay, and so on. The obvious explanation is that the ice moved from the right to the left in the diagram—that is, roughly from N.E. to S.W.

It might fairly have been expected that the flow would have been in the opposite direction, or towards the sea, but this trend away from the coast is a very common phenomenon, and clearly points to some obstruction in the German Ocean. This obstruc-

* The chalky detritus really extends very much further, but I have limited it in the diagram for the sake of simplicity.

tion was in all probability ice—the ice that was shed from parts of Scandinavia, etc., which flowing south, dammed the shallow sea, and pressing against the English ice, forced it back upon the land.*

An attempt has been made to explain the phenomena of the glacial epoch by the action of coast-ice upon a shore undergoing upheaval. The land is supposed to be at first submerged, and as it gradually rose, shore-ice and bergs drove ashore under the influence of tides, currents, and winds. This action is utterly incompetent to explain the facts even of this district, but when we try to apply it to those northern areas in which the hard rocks are grooved and striated the failure is complete. Shore-ice, and ice-bergs have never been known to have striated rocks. An ice-berg even if shod with striating material, such as stones, on coming in contact with hard rock will of necessity stop. The stone jetties along the St. Lawrence have not become striated, although they are smoothed and polished by the ice. It is no answer to say that sufficient time has not elapsed to allow of striation, for a scratch must be made at once, and if the ice cannot scratch in one year it cannot in a thousand.

Even apart from striæ, in such a district as this, the coast-ice theory seems utterly to fail. Where are there any traces of marine action? Why is not the boulder-clay always contorted, as it would be by the perpetual driving ashore of tremendous pack-ice? Is it conceivable that mere coast-ice could form such a vast deposit as the Chalky Boulder clay, which attains a thickness of 300ft. on the high land of Huntingdonshire overlooking the Fens, and of 400ft. in the Fens themselves beneath Boston?

We must then, it seems to me, admit that this clay is the *moraine profonde* of an ice-sheet comparable to that which

* See The Great Ice Age, ch. xxix., also Climate and Time, pl. v.

now hides the antarctic continent, but of much larger dimensions.

Moving on the whole southwards, it dragged along its evergrowing burden, which not being able to collect in force in the mountain valleys, accumulated in force in the comparatively low country to the southward. Often the boulder-clay shows evidence of having been rolled along over itself, and we can imagine what the nature of the motion was by supposing a pole driven through the ice, and moraine beneath, so as to touch the rocks below. The motion is fastest at the surface and slowest at the bottom, so that the pole will bend over in the direction of the flow. Moreover the ice below sometimes stops and the upper part slides on, in which case the pole will be broken across. This may often have taken place in the boulder-clay itself, and about Thetford appearances of this kind are very plain.

It should follow from this that very frequently the lowest portions of the boulder-clay will be very little moved, and such is often the case around Brandon, the base of the boulder-clay being simply moved chalk with very few striated stones, or none at all. I have seen sections in which it is quite impossible to draw a decided line between boulder-clay and chalk. North of Thetford, on the road to Croxton, this is very well shown in a fine pit-section. The boulder-clay at the top is of a most decided character full of striated chalk and flints. These become rare below and at length cease. Just above the chalk nothing but chalk rubble is visible, and the chalk itself for the space of a yard in depth is broken and contorted. Here and there huge fragments of chalk, a dozen yards long and a couple of yards thick, have been bodily moved, and only the presence of finely ground-up chalky clay beneath enables us to decipher the records of glacial action.

It has been asked how, on the theory here advocated, we can explain the presence of rocks (such as granite) from the far north. Nothing is simpler. As the ice came along it brought with it parts of its burden, most of which became triturated into clay as it journeyed on, but some of the hardest fragments survived this action and remain to attest the lengthy travels of the ice. It is also clear how occasionally rock fragments have been pushed up the gentle undulations that serve as hills in this country. Coprolites from the Gault have thus been carried up the Gog-Magog Hills 200ft. above their natural level.

In fine, this land-ice theory will explain all the facts of the case—nay more, it enables us in many cases to predict what we shall find in new districts—and no other explanation can do more than account for some of the phenomena.

Over thousands of miles this sheet of Chalky Boulder Clay is spread more or less continuously. Every ounce of it represents so much torn from the parent rocks. Who can adequately realise how vast a denuding agent this great ice-sheet was! It has gripped the hardest rocks and ground them down, it has ploughed out the soft beds. Before it crept over the land the streams had formed alluvial flats, and deposited gravels as they are doing now. Mud and clay had accumulated in lakes and morasses, and all these loose materials lay ready to hand, and were carried away by the ice to help to form its ground moraine. That any such loose, incoherent beds should have escaped is almost a marvel. They are, indeed, very rare; but here and there, in sheltered spots, their sadly worn remains are occasionally found, revealing to us the nature of the times ante-cedent to the coming of the ice.

But as we follow the spoor of this omnivorous giant southwards, where his power began to wane, we begin to come upon fragments of underlying sands and gravels, often much disturbed, which have escaped destruction. Still further south this becomes yet more marked, and along the coasts of Norfolk and Suffolk we can walk for miles along the cliffs wherein boulder-clay reposes upon soft clays, sands and gravels. This has been urged as the strongest argument against the land-ice theory, as if the ice-sheet was obliged to devour every bit of soft food upon the earth. Sometimes, as about Pakefield, the boulder-clay reposes almost horizontally upon the soft beds beneath, and we are triumphantly asked how our all-powerful ice-sheet passed over such rocks without disturbing them.

Whether this can be explained by an ice-sheet or not, it is certainly absolutely fatal to the ice-berg and shore-ice hypotheses, for clearly amidst the tumult of driving ice the subjacent beds must have suffered violence.

But I think the land-ice theory demands such phenomena. The ice, as already explained, was losing its eroding powers as it thinned away southwards, and to my mind, at least, it is easy to understand how the slowly moving ice might over-ride soft beds without disturbing them. The bottom ice might hardly move at all, and even the boulder-clay might gather very slowly and itself serve as a protection to the rocks beneath. Nevertheless, this can only occur where the ice is thin and moves slowly.

In examining the coast section from north of Cromer to south of Lowestoft I was prepared to find much clearer evidence of this superposition of boulder-clay upon undisturbed rocks, from the confident manner in which the section had been described. But I found that in reality considerable erosion *had* taken place, and that contortions of the beds below were quite common in Norfolk. and grew less frequent as I went south, just as might have been expected; and, still further, the underlying beds which dip at a small angle, have been entirely planed off by the boulder-clay. So striking is this that my friend and colleague Mr. C. REID was led to adopt my views from a careful examination of this very coast.

In the next figure I have given a diagram of what I believe to be the general effects upon soft rocks of the boulder-clay where it has largely lost its eroding power. The sands are supposed to have originally stretched

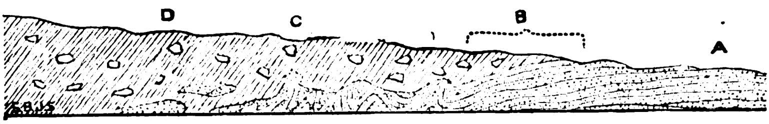


FIG. 23.—*Diagram showing the effects of Boulder Clay upon Sands.*

A. Undisturbed Sands.
B. Comparatively undisturbed Sands.
C. Sands contorted.
D. Sands caught up in Boulder Clay.

continously across to the left of the diagram, from which side the boulder-clay travelled. At *A* the sands are undisturbed. At *B* the boulder-clay exercises very little influence upon the sands. At *C* the sands are contorted, and also commingled with the boulder-clay, an instructive phenomenon of somewhat frequent occurrence. At *D* the continuity of the sands is quite lost, and portions are caught up in the boulder-clay. Beyond this point all trace of the sand is lost.

This catching up of portions of incoherent beds I find to be of far more usual occurrence than has been suspected. I have seen large masses of gravel and fine sand included in the boulder-clay which have certainly been so derived. Such masses are often broken up by tiny faults. The presence of such masses has much puzzled some geologists, but it is easy to be understood on the above theory. It is not unlikely that these sands were saturated with water and frozen hard, in which case they would be readily moved *en masse*.

Besides this gathering up of fragmentary beds, the steps in the process are often visible, and it is a very common thing to see a mass of boulder-clay intruded beneath an older bed, which is then most frequently more or less contorted. I could cite scores of such cases around Brandon.

Occasionally very large masses of rock have been bodily transported in the boulder-clay. The best example perhaps in the kingdom, is the enormous mass of chalk and gault at Roslyn Hole, Ely, about which so much has been written, and which I have figured and fully described in my official "Memoir on the Geology of the Fenland."

The immense antiquity of the Chalky Boulder Clay, about which we have been writing is shown by the great denudation that has taken place since its formation. Deep valleys have been cut through it, nearly the whole of the Fen-basin has been scooped out of it, and the Gog-Magog hills have been cut back three miles since its formation, by the slow action of springs, rain, and rivers, as will be made clear here-after. This formation belongs to the earlier stages of the great cycle of the glacial epoch, the Cromer Till being the only glacial clay of more ancient date. It marks, indeed, the culmination of the cold—the Cromer Till and the newer boulder-clays having been formed under less intense conditions.

To Mr. S. V. Wood, junr. and his coadjutors Messrs. F. W. Harmer and Rome, geologists owe a heavy debt of gratitude for elucidating the general sequence of the glacial beds in the eastern counties. It is difficult to over-estimate the value of their researches, and it is with unfeigned sorrow I learn that the former admirable field-geologist has been compelled to lay by the hammer that has taught us so much. Different as are the views I hold from those so ably expounded by Mr. Wood, no amount of theoretical antagonism can for a moment shake the stability of his stratigraphical discoveries, and this I say as one, who winning daily bread by his hammer, has gone over much of the ground Mr. Wood surveyed, and profited by his experience more than my pen can state.

These gentlemen have proved that the general sequence of strata is as follows, beginning at the top of the series :—

1.	Plateau Gravels.	Post Glacial.*
2.	Hessle Boulder Clay.	Last Glacial Period.
3.	Hessle Gravel.	Inter-Glacial.
4.	Purple Boulder Clay.	Third Glacial Period.
5.	Gravel, &c.	Inter-Glacial.
6.	Chalky Boulder Clay.	Second Glacial Period.
7.	Middle Glacial Sands, &c.	Inter-Glacial.
8.	Contorted Drift.	First Glacial Period.
9.	Cromer Till.	

The above table shows us that there are four Boulder Clays, and it is suggestive that between each there occurs a set of sands, gravels, loams and clays.

The Hessle Boulder Clay which marks the real close of the glacial period, so far as this area is concerned, extends southwards in Lincolnshire close to the Fens, and it may be the deposit marked Purple Boulder Clay on our geological map is that deposit, the engraver having omitted a ? after the name. It is, I believe, a true ground-moraine, formed under an ice-sheet, but this sheet, though of huge dimensions was the least, and certainly the last that devastated the eastern counties.

The Hessle Gravel is only be represented in the Fenland around Steeping and Firsby. It forms part of what

* These notes are my own, Mr. Wood considers all above the Purple Boulder Clay to be Post Glacial.

I should deem the inter-glacial gravels of palæolithic age, hereafter described, and it is of the same date as the March and allied gravels.

The Purple Boulder Clay has not yet been recognised in south Lincolnshire, unless the patch above alluded to about Firsby be of this date. This I was first inclined to believe, but now deem it far more likely to be the Hessle Clay, as Messrs. WOOD and his companions assert. I was not aware of their determination of these beds when mapping at Firsby.*

The Inter-Glacial Gravel between the above and the Chalky Boulder Clay have not been recognised in this area, but they may possibly be represented in part by the Flood Gravel shown on the map.

The Chalky Boulder Clay, we have seen, is the most important member of the glacial series, and underlies all the Fens except those south of Ely.

The Middle Glacial beds were probably reached at a depth of 400 feet at Boston, but are elsewhere unknown in the Fens. In the neighbourhood of Brandon I have recognised them, and they have proved to be of surpassing interest as containing flint implements.

The Lower Boulder Clay cannot be recognised in the Fens and probably does not exist there. It may be present below some of the Middle Glacial beds around Brandon, but this I have not yet made certain.

The relations of the above Boulder Clays to the inter-Glacial beds, and to each other, are illustrated in the accompanying section, which is drawn to illustrate a principle, and not to explain any particular line of country. I have drawn it because the relations of the different Glacial and inter-Glacial beds are often mis-understood, even by

* Mr. WOOD considers this Boulder Clay to be of marine origin, but it appears not to differ in any essential feature from the Chalky Boulder Clay, and must, therefore, be considered to be the product of land-ice. See Great Ice Age, chapter xxx.

geologists. The Cromer Till is omitted, as being beyond our purpose, but it would be a repetition to the south of what is shown on the right.

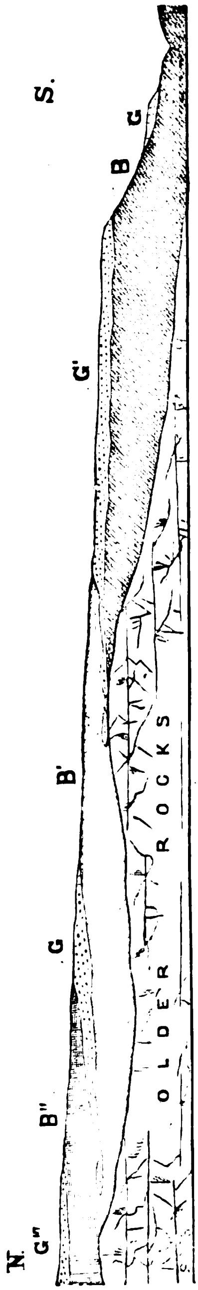


Fig. 23.—*Diagram showing the relations of the Boulder Clays and Inter-Glacial deposits.*

B. Chalky Boulder Clay. *B''* Hessle Boulder Clay. *B'* Purple Boulder Clay. *G* Valley Gravel.
G' Inter-Glacial beds. *G'''* Plateau Gravels. *G''*. Inter-Glacial Gravels.

Suppose, then, in expounding this section, that the Chalky Boulder Clay has just been formed, and that it stretches right across the diagram towards the north, as it must have done, for all in that direction was covered with thick ice. Let the climate be ameliorating, and it is easy to predict what will be the result. From the melting ice will issue great streams of water. From the evaporating ice will arise dense fogs and mists, which will often condense into torrents of rain, and swell the ice-born streams into torrents and floods, by which the country will be overwhelmed. These great floods will work up the Boulder Clay, washing much of the fine matter from its upper portions, leaving behind the stony components as a coarse gravel, which will partly be swept into the valley and there accumulate. The rocks will be saturated with water, and the climate being still very cold, much of the water will be frozen in the winter, and hardly thaw in the summer, and by this ice quantities of the gravel, etc., will be bound up into solid masses. The succeeding summer floods may transport great masses of this frozen matter to some distance. The snows of winter will cover the ground with a thick mantle. The summer floods will stain its purity and sprinkle gravel over it, and partly thaw it away. So season after season the country around the ice-foot will be smothered with a shroud of stained snow and rough angular gravel. As the climate grows more genial all the snow will pass away and the thawed gravel will slowly sink down, bearing for ages the tokens of its origin. These tokens we will return to anon. It is because of the strange characters so impressed upon the beds that I have ventured to call them Flood Gravels.

Passing over the mild inter-Glacial period, whose records are written in the gravel G', let us picture the coming on of another dreary ice-age. Steadily the gathering ice will creep southwards, grinding and tearing up the rocks in its passage. The Gravels and Boulder Clay of former times lie ready to hand, and will speedily be worked up into the new Boulder Clay—the ground moraine of the new ice-sheet. Here and there these older beds will escape destruction, their relics forming often the sole evidence of the former state of things. The new ice does not extend so far south as that which preceded it, and so along and beyond its terminal front the rocky tokens will be left, as has already been described.

Then follows another mild inter-glacial period when all is repeated again. But the floods, not being confined to the ice-bound regions will sweep over part of the area devastated by their predecessors—will mingle with them, and so obscure the evidence of their antiquity. In this way will be formed the beds G'' which, however, will stretch far across the outcrop, it may be, well on to G'.

Repeat all these changes for the Boulder Clay B'', and the gravels G'', and we have a vivid picture of what I believe is the history of the great epoch of the Glacial period. From this time no ice-sheet has invaded eastern England, and the insidious frost and rain and rivers have, from that time, been wearing away the rocks, moulding them into new forms, and re-modelling the landscape, until we find the beds denuded into some such contour as that depicted in the diagram.*

While all this was going on, the relative levels of land and sea were not constant. There are many reasons for believing that during the time of the formation of the Chalky Boulder Clay the land was of greater extent than now. To mention a few; about Boston a deep valley cuts down five hundred feet below the sea-level and this valley is almost entirely filled with boulder-clay. The sea could not have cut such a hollow, which is evidently an old river-valley. But for a valley to be cut at that depth, the sea must have been relatively at least 500 feet lower than at present, and this would lay bare the whole of the German Ocean, and make England part of the continent.

Another proof of the former extension of land is found in the submerged forest north of Hunstanton, which flourished when the present coast of Norfolk was considerably inland.

The changes which have taken place since early glacial times in the fauna also attest that England more than once has been united with the continent. The animals which were driven out by the approaching ice, and those which were lured back again with the advent of more congenial times, needed dry land to travel on.

There are also clear proofs, here and elsewhere, that depressions of the land also took place. Marine shells are

* Not wishing to complicate the diagram I have not attempted to indicate the relative extent of the various deposits.

found in the gravels in the Fens close to Peterborough and 30ft. above the level of the sea, and other cases might be cited by going further afield. Sufficient has, however, been said, to prove that during the great cycle of the glacial period, considerable alterations in the extent of the land occurred, some perhaps due to actual elevation and depression, and others to variations in the sea-level. Those who desire to enter more particularly into these and kindred questions must study the work of my friend Dr. GEIKIE—"The Great Ice Age," so frequently alluded to before.

Another lesson may be learned from the diagram, and it is a most important one. On the right hand side is represented a valley-slope, at whose base is shown the bed of a stream. On the slope is lying a patch of gravel, *G*, of the kind called from its position *valley-gravel*. What can we learn respecting its age? It overlies the boulder-clay, *B*, (in which the valley is cut) and is clearly more recent than it. *But it may be of any age between that of the bed B and the present time.* This is evident because its site has not been over-ridden by either of the boulder-clays *B′* or *B″*. To conclude that it is post-glacial because it overlies the bed *B*, is clearly illogical, so far as stratigraphical evidence is concerned.

Now it is in exactly such positions that the gravels containing palæolithic implements are found. We have already brought forward the weighty palæontological evidence in favour of the great antiquity of such gravels. The stratigraphical evidence now begins to appear. The one shows that a very long period is required to account for the changes in the fauna, and to allow of the necessary climatal variations; the other merely assures us that the gravels are newer than the Chalky Boulder Clay. We have shown that the fauna of these gravels is more nearly allied to that of the beds which preceded the boulder-clay than to those which succeed the newest glacial beds, and on these grounds alone, in my opinion, we should be justified in ascribing to such beds an interglacial date. Yet upon the mere super-position of the gravels upon the Chalky Boulder Clay was based the idea that they were all of post-glacial age, a supposition that is even now generally believed. Dr. GEIKIE has done much to overthrow this idea, and I have added my share, having been driven from the older opinion by finding it impossible to elucidate the geology of the Fens on any other grounds.

Having now briefly sketched the relations of the different Boulder-clays to each other, and to the associated strata, let us enter into a description of the Interglacial Beds.

Interglacial Beds (Gravels, etc.)

The interglacial beds which fall within the compass of this work are as follows, the newest being at the top.

1. Palæolithic Gravels of Modern Valleys.
2. Palæolithic Gravels of Ancient Valleys.
3. Flood Gravels.
4. Brandon Beds, probably of Middle Glacial Age.

1. *Palæolithic Gravels of Modern Valleys.* I have decided to use the term *palæolithic* to designate those beds which contain the remains of palæolithic man, the savage ancestors of the human race, whose implements of stone are rudely chipped and never ground or polished. (See Chapters II. and XI.) These relics are associated with the remains of extinct animals, such as the mammoth, etc. When, therefore, we find deposits containing the same fauna, we may ascribe a like antiquity to them, though they may be destitute of human remains. In like manner when we find beds with these peculiar mammalian remains associated

with shells some of which are extinct, we are equally justified in classifying them with the others. In this extended sense the term palæolithic is applied to strata.

Respecting the shells there is one species *Cyrena* (*Corbicula*) *fluminalis* (now living in the Nile), which we may take as a type, inasmuch as it is *known* to occur in deposits overlaid by glacial clays, as at Kelsea Hill, near Hessle, on the Humber; it is not now living in Europe; and it has *never* been found in beds which are indisputably post-glacial.

When we are dealing, then, with beds which contain (1) remains of extinct mammalia, such as the mammoth, (2) shells of extinct species, such as *Cyrena fluminalis*, or (3) palæolithic implements, we shall designate them palæolithic beds.

By this we do not infer that they are all of the same age, although the generally received opinion is that palæolithic implements belong to one unbroken series—some a little newer or older than others, as the case may be, but still geologically speaking of one date. This, my own researches have proved to be far from the case, as will appear. Dr. Geikie prophesied such would be the case. I have proved it. And fresh evidence in confirmation has come, and doubtless will continue to come, from different parts of England, from Switzerland, and from America.

The gravels in the modern valleys which have yielded palæolithic implements, occupy such positions as that shown at *G.* in the preceding diagram. They are seldom continuous for any great distance, are generally well stratified, and usually coarser at the base, where implements are more numerous than elsewhere.

As this gravel may be of any age newer than the Chalky Boulder Clay the test of super-position cannot be here applied. But when we reflect upon what will be the probable tokens of great antiquity, light begins to shine upon this obscure problem. This area has not been ice-ridden since early glacial times, consequently the river-deposits have been suffered to accumulate with comparatively little interruption, and if they are of great antiquity they may reasonably be expected to be more extensive than the gravels of rivers whose basins were smothered in ice in late glacial times. The old valley deposits in these latter rivers will have suffered repeated denudation by the successive ice-sheets, and the only beds we can reasonably expect to find are such as have been formed in post-glacial times. If the palæolithic valley-gravels be post-glacial they ought to approximate in extent to those of districts in which the age is indisputable. But few facts are more patent to geologists than the grandeur of the valley-deposits of south-eastern, southern, and south-western England, as compared with the meagre development of such beds in other parts of Britain. Here, then, we see a marked difference between the palæolithic valley-gravels and true post-glacial deposits of the same nature, and the difference points towards the greater antiquity of the former.

Another line of argument points in the same direction. It has been shown in chapter XI. how utterly distinct are the mammalian and molluscan remains in the palæolithic beds from those of true post-glacial age. We know, moreover, that the extinct animals roamed far and wide over England and Wales, as their relics, preserved in caves, attest. The bones of these animals have been stored in the valley-gravels of this and more southern regions, and there can be no reason why they should not also occur elsewhere if the northern gravels are of the same age. Yet with the one solitary exception* not a bone of an extinct animal or a single palæolithic implement has ever been found in surface deposits in the north.

* That of a skeleton of a *Hippopotamus*, found in brick-earth of uncertain age, near Leeds. Proc. Geol. and Polytech. Soc. W. Riding of Yorkshire, vol. III. p. 831. 1853.

If we relegate all the palæolithic beds to interglacial times how simple the explanation is! The northern valley-gravels, which assuredly once did exist, and as certainly contained the remains of mammals and of man's handiwork, have been ground out by the subsequent ice. Indeed if we lay down upon a map (as I have done) the positions of the beds we are dealing with, we shall have rudely mapped out the area over which the last ice-sheet never passed. This argument, one of Dr. GEIKIE's, has never been answered, and seems to me unanswerable. It explains why the southern gravels are so largely developed; it shows us why the palæolithic fauna is absent from the surface beds of the north, and why we still find them preserved there in caves, into which the ice could not penetrate, or remove them if it did. This is true, not only of Great Britain, but of the whole of Europe.

In England palæolithic implements have been found in the following districts, which tell the above story very plainly:—

Valley of the Great Ouse.	Valley of the Gade.
,, ,, Little Ouse.	,, ,, Stort.
,, ,, Lark.	,, ,, Cray.
,, ,, Cam.	,, ,, Darent.
,, ,, Waveney.	,, ,, Medway.
,, ,, Stour.	,, ,, Itchen and Test.
,, ,, Colne.	,, ,, Avon.
,, ,, Thames.	,, ,, Stour.
,, ,, Way.	,, ,, Axe.

As well as quite recently at West Runton in Norfolk. Although these deposits are ascribed to one age, I feel sure they must be of more than one date, as indeed I have proved in certain cases; but this does not affect the present argument.

The great antiquity of the valley-gravels is in some cases proved by the great height to which they extend above the present rivers, though good illustrations do not occur in or near the Fens, the supposed case of the Little Ouse not being to the point, as I find the gravel belongs to the series next to be described.

Another point is likewise clearly shown by these gravels, and by some of the valleys to which they belong. The chalk area about Brandon, for instance, is intersected by a number of little valleys, down which no water ever flows, but which must at one time have held considerable streams, as the gravels lying upon their flanks indicate. One can follow the windings of these valleys up to their heads, where the traces of the springs which fed them of yore are still visible. These spring-heads are roughly about 60 feet above the present river, and wells sunk on the plateau above go down about 50 feet into the chalk before water is reached. When the springs bubbled forth the line of saturation in the chalk must have been at least 50 feet higher than now, and this vividly illustrates the excessive raininess of those times.

Mr. A. TYLOR has insisted upon similar evidence in the case of most rivers, and has pointed out the flood-origin of much of the gravel that had been deemed of river or marine formation. Hence he drew the conclusion that subsequent to the glacial epoch there was a *Pluvial Period*. I have already shown how on the retreat of each ice-sheet tremendous floods arose, and these are eminently capable of accounting for the phenomena so ably worked out by Mr. TYLOR. But that geologist, not recognising the existence of several boulder-clays, ascribed all these peculiarities to our age, whereas it is clear that there must have been as many pluvial periods as ice-ages.

2. *Palæolithic Gravels of Ancient Valleys.* One of the reasons which has led to the idea that palæolithic implements belong to one era is the paucity of the stratigraphical evidence to the contrary. So long as the Glacial Period was looked upon as an epoch of continuous cold, which gradually culminated, and as slowly waned, the only inference deducible from the presence of boulder-clay beneath implement-bearing beds was that they were post-glacial. But now that it has been proved that there were several ice-ages, and that the Chalky Boulder Clay belongs to the earlier part of the great cycle of the glacial epoch, this deduction loses all force, and in the face of all the evidence on the other side must be universally abandoned sooner or later.

From what has already been said it is evident that gravels of widely different ages may, nay must, become commingled in any given river-valley. It is, therefore, practically hopeless to look for any very clear evidence of considerable differences in age.

But if we could find relics of valley-gravels belonging to a drainage system anterior to the present rivers, we should then possess reliable data for dividing the palæolithic beds into at least two sections, the one appertaining to the ancient, the other to the modern valleys. This is exactly what I have found in, and around, the Fenland.

The islets upon which Chatteris, Wimblington, March, etc., are built consist of gravels capping the Kimeridge Clay. They run roughly north and south, and about at right angles to the present rivers. From the neighbourhood of Whittlesea Mere, by Whittlesea, Thorney, and along the course of the northern branch of the old river Nene, and from Peterborough to Crowland, other gravels of like character occur which are more or less independent of the present rivers.

The questions relating to climatal change have been as fully discussed in chapter XI. as space would permit.

These gravels differ from the rest of the gravels in the Fens, amongst other things, in being fossiliferous, yielding both molluscan and mammalian remains. These belong to the palæolithic fauna. The fauna has already been described, but I may remark that besides the well-known localities about March, Chatteris, Whittlesea, and other places among the islands, I have found the gravel to be fossiliferous at Eye, Eye Green, Northam House, Noman'slandhirne, and Crowland. *Cyrena fluminalis* occurs at March, Chatteris, Noman'slandhirne and Whittlesea. Mammalian remains, such as bones of the mammoth, rhinoceros, etc., are more widely distributed, being found pretty well wherever gravels of this kind occur. Around Billinghay, Kyme, and Firsby, they have been obtained, but no shells have yet been detected at these places.

The molluscan fauna proclaims these gravels to be marine or estuarine, and they have hitherto been considered to be true Fen gravels, deposited (like the beach-gravel from Bourn to Peterborough) when the Fen basin was a great bay. From this opinion I was driven, after some years daily study of the beds. That there *are* true beach-gravels is certain, but the conclusion I arrived at was that these fossiliferous gravels, which for brevity we will designate the March Series, are far older than any of the Fen beds proper, and even than much of the Fen basin itself. Perhaps the best way of showing the differences between the Fen gravels and the March Series is to describe their characters in parallel columns, as under:—

The March Series.	*The Fen Series.*
1. Cap the islands and never fringe them.	1. Fringe the old Fen shore, and never cap islands.

2. Do not run far under the Fen.	2. Run under the Fen almost everywhere, forming a floor of gravel to the basin.
3. Are frequently contorted.	3. Are seldom contorted.
4. Are often highly fossiliferous.	4. Are never very fossiliferous, but generally entirely destitute of organic remains.
5. Contain a palæolithic fauna.	5. Contain a recent fauna.
6. Sometimes contain palæolithic implements.	6. Never contain palæolithic implements.

We thus see that both stratigraphically and palæontologically these gravels are distinct. The March Series in its extension bears no relation to the configuration of the Fen basin, the other gravels are intimately connected therewith. The former belong to palæolithic times, the latter to the recent period.

The distinctions of these gravels from each other affords us the first clue to the history of the Fenland. The March Series evidently belong to the valley systems of certain rivers, being estuarine in character. But when we ask to what rivers they belong, the answer is by no means as easy as might be expected; for, although about Crowland and Noman'slandhirne they lie roughly in the line of the Welland and a branch of the Nene respectively, the March and Chatteris portions run pretty much at right angles to the present streams. The complete interpretation of this peculiarity has been given by my colleagues Messrs. Penning and Jukes Browne, who mapped the district around Cambridge.

These geologists found in the dry valleys of the Gog-Magog Hills patches of gravel of considerable thickness, showing that the now dessicated valleys once bore considerable streams. This, as above stated, was not in itself remarkable, *but these gravels extend some miles beyond the present valleys.*

Tracing them down from the hills we find the valley sides decreasing in height at a higher angle than the gravels. At length the gravels stand at the same height as the chalk, and finally they appear as ridges along the low ground at the foot of the hills.

In Fig. 24, I have shown diagrammatically this interesting feature. The gravels are shown by dotted patches.

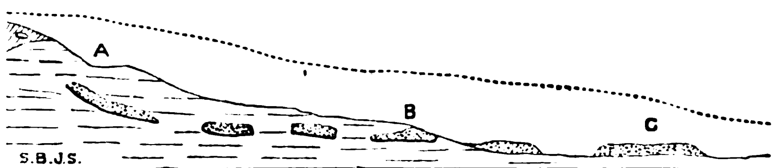


FIG. 24.—*Diagram Section of Valley with Gravels in the Gog-Magog Hills.*

At *A*, and to the right towards *B*, they lie in the valley. At *B*, the gravel is at the same height as the valley, which ends at this point. But the gravel continues along the plain as shown at *C*, where it stands up as a ridge.

It is evident that when the bed at *C* was formed it lay in a valley. In other words the hills, composed of soluble chalk, have been cut back by denudation, and the hard insoluble gravel has to a large extent withstood the wasting action of atmospheric agents. When the gravels were formed the chalk must have stood as high, and extended as far as the dotted line.

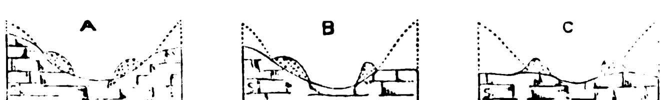


FIG. 25.—*Transverse Sections of the Valley shown in* FIG. 24. *The letters A, B, C correspond to the positions so lettered in that figure.*

How this has been effected is shown by Fig. 25, which gives transverse sections at the points A, B, C, in the former figure; the dotted line showing the original contour of the chalk. These cuts illustrate three stages in the denudation of the chalk, and are self-explanatory.

The hills have been cut back *three miles* since the gravels were formed! When we remember that this is entirely the effect of the imperceptible action of rain and frost, an action so slow that, although still in progress, the historic period is too short to indicate any appreciable change, we are struck most forcibly with the antiquity of these gravels.

Again the gravels run at right angles to the Cam, so that in treating of them we are dealing with ages so far ago that some of the rivers had not begun to carve their present channels. Yet this was long subsequent to the formation of the Chalky Boulder Clay, and even to the flood-gravels next to be described. I know of no more forcible argument than this to prove the great antiquity of the Chalky Boulder Clay. Standing on the hills 300ft. above the sea, overlooking the wide plain of the Fens, one can trace these ancient water-courses and their gravels far into the lowlands, and restore in imagination the old landscape. Then, and not till then, does the full significance of this discovery come home to the mind.

These gravels are the inland continuations of the gravels of Chatteris, March, etc., which lie in the same straight line. In some places they contain fresh-water shells of recent species, and bones of the palæolithic fauna. These latter include the genera *Elephas*, *Rhinoceros*, *etc.*, but they have not been collected or described, as it is to be hoped they will be in the future.

On the extreme northern border of the Fens, around Firsby, Steeping, etc., similar gravels are found, which have yielded bones of the elephant and rhinoceros. Messrs.

WOOD and ROME first described these beds and showed that they are part of their Hessle Gravel, being overlaid in many places by the Hessle Boulder Clay. It was not until long after leaving that area that the full interest of these beds dawned upon me; but on Mr. JUKES BROWNE taking up the Geological Survey from where I left it, I directed his attention to these points. Since then I have visited the district with him, and found the Hessle Boulder Clay reposes directly upon the gravel in very many places, as Mr. WOOD and his colleague had intimated.

The history of these beds is as follows.—In the year 1868 Messrs. S. V. WOOD, junr. and the Rev. J. ROME published a paper on the Glacial and Post-glacial structure of Lincolnshire and South-east Yorkshire* in which they recognise the super-position of the Hessle Boulder Clay about Steeping upon the gravels, and correlate them with the March gravels. From 1869 to 1876 I was engaged upon the Geological Survey of the Fenland and fully confirmed the views of those gentlemen. Indeed it was not until after I had formed my conclusions that I was aware of their determination. I determined, besides, (1) that these gravels were older than the true Fen gravels and quite distinct from them, (2) that they were formed before the denudation of the Fen basin, (3) that they belong in part to an obliterated valley system, (4) that they are newer than much of the flood gravel. In 1876 Mr. PENNING and Mr. JUKES BROWNE showed that the March gravels were the continuation of their old valley gravels. I am anxious thus to show how the explanation of these beds was determined, because it has been more than hinted that there was nothing new in my views. WOOD and ROME first showed their age, I determined their character, PENNING

* Quart. Journ., Geol. Soc., vol. xxiv. p. 146. The authors confound these with the true Fen Gravels.

and JUKES BROWNE found the remains of the old valley to which they belong.*

It would seem, then, that before the Fen-basin was scooped out the land stood relatively 30ft. lower than at present. This was probably soon after the Purple Boulder Clay was formed, and certainly before the Hessle Boulder Clay was deposited. At this time the drainage system was very different from what it is now, some of the rivers in Cambridgeshire and Suffolk running at right angles to the present rivers Cam, Lark, and Little Ouse. The Gog-Magog Hills were higher than now and extended close to what is now the Fens. The old rivers flowed northwards, and the tides ran up their estuaries close to what is now the highland border of the Fens. Palæolithic man lived along the borders of the streams.†

3. *Flood Gravels.* Even older than the above are the gravels to which I have given the name of *Flood Gravels,*‡ as is proved by some of the valleys being cut through them. Although so ancient they are newer than the Chalky Boulder Clay; overlying it, indeed, in very many places, and being, in fact, derived in a great measure from the wreck thereof. They do not occur in force in the Fens, though I think much of the gravel and sand about Tattershall is of this nature. They can be admirably studied around Brandon, where they spread pretty well all over the land, covering hill and dale as with a sandy pall. They never seem to run to a higher level than about 200ft.

They have been described as marine, but their character precludes the possibility of their having been formed in any

* See East Anglia during the Glacial Period by W. H. PENNING, F.G.S., Quarterly Journal Geol. Soc., 1876, p. 190.

† Mr. JUKES BROWNE's results will appear in his official memoir on the Geology of Cambridge.

‡ They are also known as Plateau Gravels, Denudation Gravels, and Cannon-shot Gravels.

such way. Their composition, structure, and distribution alike point to some such origin as I have above described—the great floods which arose on the melting back of the ice-sheets.

Their composition is essentially local. That is to say they are invariably composed of detritus of the rocks in the immediate vicinity. In many cases this is boulder-clay, and all the rocks of which that heterogeneous material is made up, are found in the gravels. So true is this that wherever any particular rock, such as greenstone, is found in the boulder-clay in any spot, the same rock will be found in the Flood Gravels.

There are also proofs, in many places, that the gravel has been moved but a short distance. For example a fine patch of this material occurs at Sutton in the Isle. The boulder-clay there contains an unusual quantity of Red Chalk, and the gravels are equally remarkable for the presence of this well-marked rock. Again, so slight has been the movement to which the pebbles have been subjected, that the glacial striæ have not been obliterated from the chalk pebbles in some places, as can be well seen at Sutton. The striæ are worn, and look like what Prof. Ramsay incisively calls the *ghosts* of scratches. If these pebbles had ever been rolled on a beach, a week would have been amply sufficient to erase the scratches. After stating this, it need hardly be said that nearly all the stones retain the well-known blunted shape, so typical of glaciated fragments.

The arrangement of the material is equally suggestive of the mode of origin. The stones are very seldom arranged in regular strata, or rounded like water-worn pebbles. They are nearly all more or less angular or blunted, and fine and coarse material are mingled together promiscuously—all which is against their marine or even fluviatile origin. Besides this, most of the large stones stand more or less on end; long, thin flints sometimes being quite perpendicular. If this material had been deposited in water all the stones would have lain with their longer axes horizontal; for clearly, in falling through water, or being rolled along, it would never happen that great long stones should have been poised on end almost universally.

When, however, we reflect upon the tumultuous rush of waters from the melting ice, and consequent heavy rains, sweeping detritus helter-skelter over fields of snow and bare rocks, we can understand the chaotic aspect of the gravels. If, too, as I have supposed, the material became considerably embedded in snow, we have a ready explanation of the "up-endedness" of the big stones; for as the snow melted they would gradually settle down, and assume in time more or less upright positions.

I have also pointed out that the material must have been saturated with water, which, freezing in the winter, would bind great masses into solid lumps. These might easily be transported *en bloc*, and would retain for ages the tokens of their origin. Such masses are not uncommon in the Flood Gravels, where they look like lumps of distinct material amidst the rest. Where these masses have retained the ghosts of striæ on their pebbles, and such tokens are wanting in the main mass, the appearance is very striking.

The Flood Gravels, as might have been expected are quite unfossiliferous, but I have found on Elvedon Warren a very rolled palæolithic implement in them, which must have been derived from an older bed.

4. *Brandon Beds*. All the above beds are newer than the Chalky Boulder Clay; and we now come to those which are of older date, as they underlie the boulder-clay. These have proved to be of surpassing interest,

by my discovery of palæolithic implements in them, thus for ever setting at rest the question of whether man did, or did not, exist during the great cycle of the glacial period. We have already given reasons for ascribing the palæolithic implements of the gravels to inter-glacial times, but here we come face to face with a deeper problem; for, knowing as we do, that the Chalky Boulder Clay not only marks the culmination of glacial cold, but belongs to the earlier part of the glacial period, we have no resource left but to admit, as many geologists believed, and as Dr. GEIKIE predicted upon purely philosophical grounds, that man was a moderately well-cultured being somewhere about 200,000 years ago.

Let me first describe the beds, and afterwards return to the relics of man. In the Fen itself these beds are missing unless they were reached at a depth of 400 feet at Boston. Neither were they known to occur so far east as the Brandon area, until I came across them in the course of my professional work.

They consist of clays, brick-earths, sands and gravels. They are usually well stratified, and in the case of the brick-earths often very finely laminated. The clays are usually of a red, blue, or mottled colour. The brick-earths are frequently of a buff colour passing into a dirty, muddy-looking loam not unlike *loess.* The clayey laminæ are frequently parted by fine layers of buff sand, and in some places they pass almost insensibly into sand. The sands are generally buff-coloured, the gravels well-stratified, and sometimes of considerable thickness, 30 feet or more.

These beds, which I propose to call Brandon Beds, are of great industrial value in the chalk district for many miles around Brandon, yielding, as they do, the only clay available for brick-making. They have been worked for ages; and it may be remarked in passing, that the pots by means of which HEREWARD obtained admission into the Norman Camp at Brandon (p. 107), were formed of this material. The beds seldom attain a greater thickness than about 30 feet and are often much less.

In some places they have yielded fossils. At West Stow (near Icklingham) I found fresh-water shells in several pits; plant-remains are frequently shown by black specks of carbonaceous matter, and less frequently by pieces of wood and impressions of leaves. Mammalian bones have been found at Brandon, Mildenhall, and West Stow. Those from the last named locality were determined for me by Prof. HUXLEY, to belong to the genera *Bos* or *Cervus* or both, their immaturity and fragmentary character preventing more accurate verification. Hence they tell nothing as to the age of the beds.

The most interesting point was my discovery of flint implements of palæolithic type in the beds. I have up to this time found them at Brandon in one pit, at Mildenhall in two pits, at West Stow in one pit, at Bury St. Edmund's in two pits.

I am not at liberty to describe in detail the evidence I have accumulated on this question, as it forms the subject of a memoir I am preparing for the Geological Survey. I may however epitomise the chief results.

The Brandon beds are always fragmentary, and in this differ from the valley deposits of the present rivers. Moreover, though they are often exposed along the valley sides, in consequence of the denudation of the boulder-clay, they are quite as common in other places.

The boulder-clay is very much denuded over this area and often occurs only in patches. *Now the Brandon Beds are always associated with the boulder-clay.* If they were newer than the glacial deposit this would be utterly inexplicable, for wherever the Brandon Beds occur the boulder-clay is either present at the spot or close at hand. *This clearly shows an intimate connection between the two.* Moreover, if these beds be older than the boulder-clay we should expect to find (1) that they were fragmentary, (2) that they would often be much disturbed, (3) that they would be best exposed where the boulder-clay had been much denuded, (4) that sometimes they would be caught up in the boulder-clay, (5) that tongues of boulder-clay should sometimes be intruded beneath them.

All these points are applicable solely to beds which are older than the boulder-clay, and in no sense can appertain to newer beds. *The Brandon Beds exhibit all these peculiarities.*

I have examined the Brandon Beds in thirty different localities, and the following is an analysis of their mode of occurrence:—

They are seen to underlie Boulder Clay	at 16	places.
,, ,, with Boulder Clay above and below - - - -	at 6	,,
,, ,, with Boulder Clay below	at 2	,,
,, ,, isolated from Boulder Clay	at 3	,,
Their relation to the Boulder Clay is unknown - - - -	at 3	,,
	30	

The three isolated cases are really reducible to one, inasmuch as two of them are pits in localities where boulder-clay is seen reposing upon beds which are continuations with that in question. The three cases in which no boulder-clay is at present seen, evidently tell us nothing respecting the age of the beds. The two cases in which the Brandon Beds are seen above boulder-clay are the only evidence in favour of their post-boulder-clay age, and these have to be set against 16 cases in which they are seen under the boulder clay, and 6 in which boulder-clay is seen above and below them. Moreover these two cases refer to very small patches which might easily have been caught up in the glacial clay, and if the latter were denuded from the surface the apparent super-position would be accounted for. Indeed this is the most probable explanation of the phenomenon.

It is clear that the boulder-clay can neither surround nor overlie beds newer than itself. The Brandon Beds are, therefore, older than the Chalky Boulder Clay.

In six cases, we have said, the boulder-clay underlies the Brandon Beds. Without entering fully into the matter it may be remarked that the underlying boulder-clay may be:—

1. An intrusive tongue of Chalky Boulder Clay.
2. A patch of Lower Boulder Clay.
3. Boulder Clay of intermediate date.

I am at present inclined to believe the first is the true solution of the problem, and that the Brandon Beds are of so-called "Middle Glacial" age; for I see, as yet, no adequate grounds for dividing the Chalky Boulder Clay into two parts, or for believing the Lower Boulder Clay occurs there. I have not definitely termed them Middle Glacial because it is possible they may be somewhat newer or older than that period. The term Brandon Beds puts no theoretical interpretation upon them.

This much I hold to be proved, that these beds are older than the Chalky Boulder Clay; that they are of fresh-water origin; and that they contain human relics. The question will be fully discussed in my forthcoming work on Palæolithic Man.

Collecting the various beds we have been describing into their natural order we find them to lie as under:—

1. Hessle Boulder Clay,
2. Palæolithic Gravel of Modern Valleys.
3. ,, ,, Ancient Valleys.
4. Flood Gravels.
5. Chalky Boulder Clay.
6. Brandon Beds.

Beds 2, 3, and 6 have been shown to differ much in age, but to agree in containing flint implements. Between beds 1 and 5 the Purple Boulder Clay comes in, though it is not represented in our area. I am strongly inclined to intercalate it between beds 2 and 3,* as it will then account for the three divisions of palæolithic man. In that case we should have the succession of human occupations as follows:—

1.	*Neolithic Period*	Post Glacial.
2.	Hessle Boulder Clay	Last Glacial.
3.	*Modern Valley Palæoliths*	Inter-Glacial.
4.	Purple Boulder Clay	Glacial.
5.	*Ancient Valley Palæoliths*	Inter-Glacial.
6.	Chalky Boulder Clay	Early Glacial.
7.	*Brandon Beds*	Inter-Glacial.
8.	Cromer Till	Glacial.

The correlation of the human relics in different parts of this and other countries is not yet complete, but I think I see my way clearly to ascribe the finely worked flints, such as those from Santon Downham, and the engraved bones† of France and England to No. 3.

* Beds 4 may be in part newer than the Purple Boulder Clay and No. 1.

† P. 16, *ante*. Since writing that chapter Messrs. DAWKINS and MIALL have discovered an engraved bone representing a horse, in the Caves of Creswell Crags, Derbyshire. Quart. Journ. Geol. Soc., vol. XXXIII. p. 592, 1877.

True Fen Beds.

The beds which constitute the Fens now call for description. By Fen Beds I wish to be understood those formations which have made the great erst-marshy plain, by filling up the shallow basin which the sea excavated out of the Oxford, Kimeridge, and Boulder Clays. The beds are as follows:—

1. Silt, still forming on the coast.
2. Peat, not now forming.
3. Shell Marl, intercalated in the Peat.
4. Beach and Floor Gravels.

(1–3: Contemporaneous in many places.)

General Structure of the Fenland. The general structure of the Fenland is illustrated in Fig. 26. This section, though not taken across any particular line, shows the broad features of the district. In this, as in so many cases, I have been compelled to differ from preceding writers, who, not having had the opportunity of examining the whole Fenland, have naturally been misled. In my official 'Memoir on the Geology of the Fenland' I have given four sections, drawn to scale, across the Fens, the data being obtained from hundreds of exposures. These sections are run, 1, from Sleaford, through Boston to the Wash; 2, from Bourn through Holbech to the Ouse at Lynn; 3, from Peterborough through Wisbech to the Ouse at Lynn; 4, from Cambridge to Crowland. Those who desire to enter into detail must consult that work.

It used to be considered that the general structure of the Fens was as follows. A bed of Upper Peat occupied the surface over most of the area, under which came a bed of Buttery Clay; beneath this was the Lower Peat with a Buried Forest at its base; lowest of all was the Fen gravel. The great Silt formation was unrecognised. I find, however, that the distinction between an upper and lower peat is only a local one, that there are many beds of peat in some places, and only one in others; but that the mass of the peat can be divided into three horizons. Instead of one Buried Forest I found no less than *five.* The Silt is sometimes clay (one form of which is the well-known Buttery Clay), sometimes a sandy warp. It occupies most of the sea-ward portions of the Fens, but runs into the peat in many places. As a rule the peat lies thickest on the west: the Silt is in great force upon the east, as shown in the Geological Map. There is indeed a more or less perfect dove-tailing of beds of silt and peat, showing that from the gravel upwards, land, fresh-water, and marine conditions have alternated. When the country was flooded more or less completely with fresh-water the peat grew; when the surface became dry forests flourished; when the sea obtained the mastery silt was deposited.

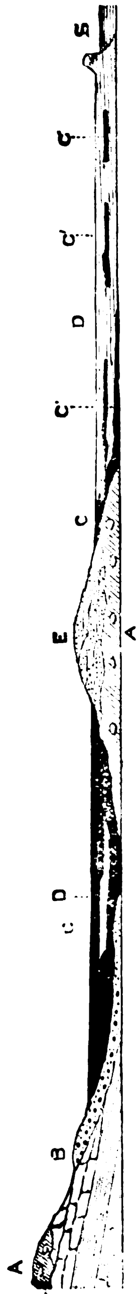


FIG. 26.—*Diagram Section to illustrate the General Structure of the Fenland.*

A Highland, consisting of limestone and clays dipping seawards, and capped with boulder-clay.
B Beach Gravel, passing right under the Fens and forming Floor Gravel.
C Peat, generally thinning out seawards. *C'* Isolated patches of peat in the Silt.
D Silt thickening out seawards. *D'* Intercalated bed of Silt in the Peat. *S* The Sea.
E An Island, such as March, consisting of Ancient Valley Gravels, lying upon Boulder Clay.

The gravels, I have already shown, are of different ages, some being older than the true Fen beds.

It will be convenient to reverse the order in which we studied the older beds, and commence with the gravels.

Beach and Floor Gravels. The beach gravels stretch in a pretty continuous band from Sleaford to Peterborough, at both which points they merge into valley gravels. They can be best studied in the neighbourhood of Bourn. As their name implies, they form a border or beach along the old shore-line of the Fens, being about 40 feet above the Fen level close to the highland, and sloping gradually down to, and passing under, the peat and silt.

The gravel land was the earliest portion of the Fens that came under cultivation, as it afforded great facilities for reclamation. We consequently find much of it consists of pasture and arable land, the fields being divided by hedge-rows. These hedges stop suddenly short where the peat comes on in force, and thus there is a great contrast between the long-cultivated, hedge-studded gravel land, and the great sweep of open country formed by the peat.

The gravel is made up of well-rounded pebbles of the rocks of the neighbourhood, the oolitic limestones and ironstone forming a considerable per centage; flint, sandstone, and other foreign rocks, being very plentiful wherever boulder-clay is at hand from which they would be derived.

The beds are generally well and evenly stratified, and the thickness varies from one or two feet to thirty, ten feet being about the usual amount.

One of the most singular features of these gravels is the almost total absence of fossils. I have never found a shell, and only once a marine organism of any kind—a patch of *flustra* on a pebble. In this respect these gravels form a marked contrast to those of the March series, and I cannot but think that had they ever contained shells they must have been preserved to us. There seems no resource left but to infer that at the time when the great basin of the Fens was a bay, upon whose surf-beaten shore these gravels accumulated, there was little or no molluscan life. The explanation of this peculiarity is yet to be sought, and it may have some relation to the cold which prevailed on the retreat of the Hessle Boulder Clay.

Passing under the Fen beds, these gravels form a more or less complete flooring to the basin, just as at the present time the bottom of the Wash is similarly covered. Much of this material is derived from seawards, being pushed along the bottom.

These gravels belong entirely to the history of the Fenland, and their connection with the beds of peat and silt which overlie them, is shown by the occurrence here and there of patches of those materials in the gravel itself. Moreover the mammalian remains belong to the recent period, like those of the superior beds, and not to the palæolithic period, like those of the older gravels.

The questions of the date of the excavations of the Fen basin, and the conditions prevailing at the time will be dealt with separately.

The Peat. Passing now to the peat, it must be recollected that much of the silt is contemporaneous therewith.

Peat, as is well known, is of vegetable origin, consisting entirely of the remains of plants, sometimes easy of recognition, sometimes reduced to an amorphous mass, in which latter condition it forms a useful fuel. The plants which form the bulk of the peat are naturally such as grow in marshy places, moss being one of the chief of these. The bog-moss, *Sphagnum*, which constitutes the bulk of the peat of Ireland and much of that of England and Scotland, is in the Fens quite a rare plant, its place being taken by a strong-growing form of *Hypnum fluitans.* In some places, as in the Isle of Ely, especially at Coveney, the peat at a depth of four feet is entirely made up of this plant, and is of a golden colour like mild returns tobacco.

My friend and old botanical teacher, Mr. A. Grugeon, examined some of the more amorphous black peat for me, and found remains of rushes, sedges, conferva, *hydrodyction*, *lastræa*, and other well-known forms, together with spiral vessels which attest the existence of flowering plants of higher orders. The careful examination of the peat from different localites and depths would be an interesting study for a competent botanist, and be fruitful in results.

Peat is not now growing in the Fens, except in a very few dank, sheltered nooks, but is everywhere wasting away with great rapidity under the influence of drainage and cultivation, to say nothing of its bodily removal for fuel. It is entirely confined to the temperate zones of the earth, and is most plentiful in the cooler portions thereof. At the present time the climate of Britain is too mild to allow of its vigorous growth, and even in Scotland it is wasting away quicker than it grows. Its presence in the Fenland therefore attests the existence in pre-historic times of a cooler climate.

The age of the peat of the Fenland has been very much under-estimated. The buried forest was supposed to have been destroyed by the Britons and Romans, and the overlying peat was consequently believed to have grown since the Roman occupation. The 'Roman' road from Downham to March and Peterborough (which Mr. Miller has shown to be a British way, p. 40), was stated by Dugdale to be covered with two or three feet of peat, and this statement has been quoted ever since as proof of the growth of peat in recent times. Unfortunately there is not one word of truth in the assertion. I have walked over every step of the existing road, and paid especial attention to this point, yet in no place was there any trace of peat upon the road. In speaking to Mr. W. Marshall, of Ely, of this he entirely confirmed my observation from his own experience.

No other evidence of weight has ever been brought forward; for the occurrence of Roman vessels three feet down in the peat, no more proves the peat to be post-Roman, than the bones of a horse that had sunk into a bog would prove the horse to have been older than the bog.

On the other hand the evidence of great antiquity is not only strong, but irresistible. One such proof will be sufficient to establish this point.

The Fens, it is necessary to remember, are part of a silted up bay, of which the Wash is the only part now covered by the sea, and it too is slowly silting up. In travelling from the Wash inland we consequently pass from newer to older portions of the Fens. Now I have calculated that the maximum rate of accretion is not more than 59 feet per annum.* If we travel in a direct line along the line of quickest accumulation, we have to pass over 12 miles of silt before we come upon the first traces of surface peat in Deeping Fen. Now, 4 miles of land have been formed in the past 1700 years, and at the same rate it would have taken 5100 years to have silted up 12 miles. Adding the 12 miles inside the banks to the 4 miles outside the banks we have 6800 years ago as the latest possible date of the newest part of the peat in Lincolnshire.

So far for what may be termed the mechanical proof of the antiquity of the peat. The geological proof I cannot better state than by quoting what I have said as to reasons for the obscurity of the boundary lines between the peat and the silt.

"But the peat had to contend with a more formidable foe than the sea: the climate was growing [milder and] drier; the waste soon became more rapid than the growth,

* This is on the theory that the old Sea Walls are of Roman date. Mr. MILLER has shown (*ante* p. 47) that they are probably older than this, in which case the rate would be less. It is certain, therefore, that I have not under-estimated the speed of accretion.

and eventually peat ceased to grow at all, save in a very few, favoured, sheltered nooks. At present there is no evidence of the formation of peat under natural conditions in the Fenland, with the solitary exception of a slight moory deposit near Eriswell and Mildenhall in Suffolk; where, in a dank valley, the sedges and rushes thrive luxuriantly, their matted roots decaying into a fibrous mass, black when sodden with water, but light brown when dry, which is dug in slabs and used for fencing. As the peat advanced towards the sea, it did so with continually diminishing vigour, and finally died upon the march. Hence one of the reasons for the obscure nature of the boundary. It was beaten in the struggle against climate, and the thin edges, like fallen outposts attest how hardly it succumbed.

"In proof of this decay of peat, the Lincolnshire boundary may be adduced. It was formed upon marine silts in the later days of what we may call for convenience the 'peat period.' Hence we might conclude that, being formed subsequently to most of the peat, it would be thin. Such we find to be the case, and over much of the area it has wasted almost entirely, and only left a moory trace upon the land, to attest its former presence. Beneath the protecting grass-land it may still be found, and deep-ploughing brings up the less-decayed fragments to tell of its former existence.*"

It never seems to have struck those who advocated the recent origin of the peat, that if it had grown vigorously up till, and long after, the Roman occupation, it would have encroached much further upon the silt than is the case. Instead of a distance of 12 miles intervening between it and the so-called Roman banks, we should have had at most but a narrow strip of bare silt.

It must, therefore, be considered settled that the peat of the Fenland is of pre-historic date: that the climate had

* Geology of the Fenland. *Mem. Geol. Surv.*, p. 130. 1877.

ceased to be favourable for its accumulation long before the Romans invaded Britain. In this it differs from much of the Scottish peat, which Dr. J. GEIKIE has shown to overlie undoubted Roman relics. This we might have anticipated, for Scotland, lying to the north, would continue cold long after the climate of the Fens had become comparatively mild.

The greatest thicknesses of peat known to me in the Fens are in Whittlesea Wash, near Earith, and in Warboys parish near Plow Puttock Drove, in both of which places it has been proved to a depth of 18 feet. It there reposes directly upon the gravel, no silt beds being intercalated therewith. It must therefore be the equivalent in time of much of the silt.

We must not, however, conclude that in such places peat grew uninterruptedly from the gravel upwards. Its growth was checked (as completely as at present) by long intervals, as proved by the succession of forests; for, as we shall presently see, they indicate periods of comparative dryness. This being the case, the thickness of the peat does not afford a measure of the time occupied in its formation, for we cannot as yet fill in these gaps, even if we possessed data respecting the rate of growth in the Fens (which we do not), and if the rate was uniform at different places, and at different times (which it is not.)

The peat is the surface deposit over about 600 square miles in the Fens, and if we take the Marshland and Boston areas in which the same beds that crop out elsewhere run under the silt, we must add another 300 square miles to our estimate.

It used to be asserted that there were two distinct beds of peat, to which the names of Upper and Lower were given. This I find is not the case. It is quite true that over much of the Fens of Cambridgeshire, for instance, two beds of peat are very commonly met with, but they are not always of the same age. An analysis of over two hundred sections, together with an examination of the ground, have shown me that, while there are very many minor beds of peat, three distinct horizons exist besides the peat which occurs at the surface. The uppermost of these subterranean beds extends from 4 to 12 feet below the surface. The second lies from 13 to 18 feet deep, and the lowest from 19 to 24 feet. The different beds are not continuous but lie in patches, which may perhaps represent the remains of one wide-spread peat bogs.*

The chief area of the surface peat is the Bedford Level, which it almost entirely covers, with the exception of a great indentation east and south of March, that marks the site of the estuary of the ancient Ouse (see Geological Map.) From this district it runs northwards through Deeping Fen to near Sleaford, where its continuity is broken. It comes on again in the valley of the Witham, and isolated areas exist about Steeping and N.W. of Wisbech.

It is interesting to find that while the surface peat never approaches within seven miles of the coast, some of the subterranean beds run right up to it. This is very clear in Marshland and from Wainfleet to Boston. Hence it is certain that the Fen basin did not silt up steadily to the present level, but that after reaching a certain elevation the deposition of silt stopped, the area was converted into land by a slight upheaval, or by an alteration of the tides or water-level. Upon this new land peat steadily accumulated. Then it was again submerged and silt was deposited upon the peat. This seems to have taken place at least three

* I must here, as in other cases, refer for details to my work on the "Geology of the Fenland." Results only can be given in this work, which treats of the general structure of the Fenland. I have, however, entered more fully into the interpretation of certain phenomena than was consistent with the needs of a Government Report. Peat is always called Turf or Moor in the Fens—the word peat being unknown.

times, as shown by the three subterranean peat beds. As some of these lie full twenty feet below the mean tide-level, it would appear that oscillations of level actually did occur, for it is not easy to comprehend how a modification of the geographical configuration of the district could so effect the tides as to prevent them over-running such low-lying tracts.

The physical history of the Fens as told by the peat is very simple. The climate was more rigorous than now; at first it was indeed quite cold, as proved by the northern plants such as the Dwarf Birch and Creeping Willow, and by such animals as the reindeer. Afterwards the climate ameliorated but was still colder than now, as is proved by the great thickness of the bark of the fir trees in the buried forests. At least 7000 years have elapsed since the climate was favourable for the growth of peat. How long this period was we have but scant means of judging. The Hessle Boulder Clay is about 80,000 years old. The Fen beds are all newer than this, but whether they represent the entire space of time is a question the consideration of of which must be deferred for the present.

Scenery of the Peat. The peat lands possess distinctive features which are very impressive. Not a town stands thereon; the roads are perfectly straight; the landscape is as flat as the open sea; not a hedge-row breaks its monotony, neither does a tree appear, save in the long lines of tremulous aspens which skirt the main drains.

It is upon these black plains that the mirage is most frequently to be observed. In the course of my geological rambles I was witness of many, some as perfect as any I have seen on the burning sands of Africa. I have seen from the battlements of Crowland Abbey, the whole of the Wash refracted upwards, and traced the black smoke of the steamers. At other times I have seen beautiful, silvery, shimmering lakes, reflecting every tree upon their bosoms. Yet again, the landscape has been distorted, trees and spires being inverted, and looming in gigantic proportions.

The peculiar sense of openness which pervades the peat-land is very striking, and the contrast between it and the gravel on the one side, and the silt upon the other, is most marked.

Agricultural and Economical value of Peat. Newly reclaimed peat-land is of comparatively little value. It contains a large quantity of acid matter that is deleterious to the growth of agricultural products, the peculiar flora of a peat-bog showing clearly that it is better fitted for the sustenance of such plants as sedges and cotton-grass than of cereals or root crops. Nevertheless peat-land is very valuable, for it contains the relics of the decay of hundreds of generations of plants, and is consequently rich in nitrogen and other mineral matters necessary for the welfare of crops. Sir H. Davey remarked upon this that "a soil covered with peat is a soil covered with manure;" but before its riches are available for the agriculturist the peculiar peaty acid must be got rid of, and in many cases the deficiency of phosphoric acid made good.

The deleterious peat acid is removed by drainage, and crops can soon afterwards be raised upon the reclaimed bog. The ashes of certain peats contain phosphoric acid, but whether such is the case here I cannot say. At any rate the practice of burning peat-soil, so prevalent in the Fens, is a very good one; and it is strange that the system is not more generally pursued elsewhere. The only continental place known to me where burning is pursued is on the Königsmoor, near Grauenburg, in Germany, where it has proved very successful; buck-wheat is sown and harrowed in as soon as the ash is cold, and the results are very good.

The practice of claying the land, that is of spreading clay dug from below over the peat surface, has been in much favour in the Fens for the past 20 years or so. By this means the argillaceous and siliceous matters, so frequently deficient in the peat, are added to the soil. At the same time the soil is rendered heavier, no slight advantage in this case, for the peat when dry breaks up into a powdery mass, which during high winds is carried in great clouds like miniature copies of the sand-storms of the deserts. When such storms occur soon after sowing, the seed is often carried away.

Peat might be used with very great advantage as a manure upon the light sandy lands about Brandon. The great object in these places is to supply nitrogen to the soil in such a way as to be available for the nutrition of plants. Now dry peat (especially when broken up by the frost and hence useless as fuel) when thoroughly mixed with a poor soil decomposes, and parts with its nitrogen, some of which always passes away into the air and is lost. The remainder in wet weather, especially if lime be mixed with it, becomes gradually converted into ammonia; in dry weather nitric acid is produced, and both are available for plant-food. It is to be hoped that this method of improving the light sandy lands will be taken up; the peat waste is at hand and is inexpensive; the results are certain.

Highly as one may speak of peat as a soil and as manure, it is of very slight value as fuel. Since much misapprehension exists on this point in the Fens, I will give a brief epitome of the scientific proofs of my assertion. The valuable portion of a fuel is its carbon, and in this respect peat stands at the bottom of the scale, as is shown by the following table of the per centage composition of different fuels.

	Anthracite.	Cannel Coal.	Splint Coal.	Lignite.	Peat.
Carbon	91·44	66·4	79·58	71·0	60
Hydrogen	3·46	7·54	5·50	4·7	1·5
Oxygen	2·58	10·84	8·33	22·3	30
Nitrogen	0·21	1·36	1·13		0·5
Earthy Matter..	2·31	13·82	5·46	2·1	8

It therefore appears that for equal weights peat has only two-thirds the power of coal, as measured by its carbon. Besides this, while a cubic foot of coal weighs about 60 lbs., the same quantity of peat weighs only 30 lbs. Hence one-third more work can be got out of a given bulk of coal than out of twice the bulk of peat. Again, peat can only be dug on about 100 days in the year at the outside, whereas coal can be dug at any time. Further, coal when got contains comparatively little water, and is ready for use, whereas, peat contains from 60 to 90 per cent. of water, and must be dried for months before it can be used. Its bulk necessitates at least quadruple the storage and furnace room; this involves extra expense for carriage, and in the case of manufactures, extra hands. With all this against it, it is not singular that peat has *never* successfully competed against coal. Mr. F. A. Paget, C.E., has collected and examined the reports of every firm that has tried peat for fuel, that he could possibly obtain; and from every one, in both hemispheres, the same story comes, and he concludes "*That peat can only be sold at prices ranging from one-third to one fourth of the local selling price of average coal,*"* to contend with it at all. Now at present (Feb. 1878) peat fetches 15/-, and coal 23/-, per ton in Brandon, whereas to make it as cheap as coal it should be only 7/8. It cannot be gainsaid that the use of peat by the poor is mistaken

* Reports of the Vienna Exhibition, vol. II. p. 348. 1875.

economy, especially when it is purchased by sixpennyworth's as is often the case, at the rate of 30/- per ton!

But it has been, and still is argued, that all this applies merely to raw peat, and that manufactured into 'patent fuel' by removing the waste matter and by compression, it can successfully enter the lists against coal. This is adding confusion to chaos! *It is neither more nor less than trying to make a perpetual motion machine.* That this is so I will now illustrate.

Rigidly considered fuel is *stored up force.* By liberating that force by combustion we utilise it as *work.* NEWTON long ago showed that in motion action and reaction are equal, but the application of this law to force or energy is not so universally understood. This law, termed the *conservation of energy*, lies at the root of our problem.

The force in a piece of coal represents so much work done upon it, and just that amount and no more can be got out of it. In like manner the force in peat represents a certain amount of work done upon it. This work has been performed by the sun and by geological agencies, *and not by man.* Now if three or four times as much work has been put into coal by nature as into peat, it is just so much more useful. If we expend work upon peat in any way to make it better fuel, *the amount of work so put in is the exact measure of the extra quantity we can get out.*

It is impossible to get more, for we cannot create force. If the peat would clean and condense *itself* all would be well, but as this cannot be, any attempt to improve it by artificial means must fail. The force is capital that bears no interest.

Nevertheless this impossibility has been attempted over and over again, and always with one result—failure. To use an unrefined illustration it is like trying to lift oneself up by one's own waist-band! The lamentable collapse of the attempt recently made in this direction at Shrub Hill, near Feltwell, in Norfolk, should be sufficient warning to Fen-men not to embark money in schemes which are just as absurd as the Irish plan for emptying the sea by pumping water from one side of a ship and emptying it over the other!

Peat is dug for fuel around Billinghay and in the Isle of Ely. Full details of the methods of digging, the tools employed, etc., will be found in my Memoir on the Geology of the Fens.

The Buried Forests. The buried trees in the peat must have been known to Fen-men from time immemorial, but they were first brought before the scientific public by De la Pryme, in the year 1701, since which time they have been descanted upon over and over again. Nevertheless no one seems to have suspected the existence of the remains of more than one forest, or at least no one has published such an opinion.

Towards the close of the year 1874, in company with Messrs. Marshall, and Marshall Fisher, of Ely, I carefully examined the Fen between Ely and Littleport, and there found indisputable evidence of *five* successive forests as illustrated in the diagram accompanying Mr. Marshall's chapter on Botany in this volume.

Subsequently correllating the horizons of buried forests over the Fens, I found that traces of each of the above could be found in many places, and the full details are to be found in my official memoir. This succession of forests imbedded in peat was no new fact, having been observed in many places, more especially in Scotland, Ireland, Denmark, and Norway. In the first three of these countries the buried forests are three in number, and nowhere in Britain had more been observed until the Fens achieved eminence in the matter as stated. Since then M. Axel Blytt, of Christiania, has discovered no less than six successive forests in the peat-beds of Norway, and the conclusions he arrived at from a study thereof are identical with those deduced by me, though neither could have had the slightest idea of the other's work. This is a strong argument in favour of our views.

The trees comprise oak, elm, birch, Scotch fir, yew, hazel, alder, willow, and sallow. Of these the oaks constitute quite 80 per cent. Their wood is stained black, and they frequently attain colossal dimensions, several having been found 90 feet long, and 70 feet before throwing out a branch. The elms are rare; the birches are not common but may be seen around Billinghay, with the wood much decayed, but the silvery, papery bark intact. Firs I have only seen between Littleport and Ely where some of them were of majestic proportions, one being over a yard in diameter and 70 feet long. Their wood is still white, and emits a resinous odour. Yews are, as a rule, only found where a sandy subsoil exists, an exception being found in Wood Fen, where they are associated with firs. Their wood is unchanged, and may easily be recognised by its cedar-like colour. The yews are almost always small. Sallows and willows are abundant, especially in the newest forest, and call for no very special mention. The wood is for the most part in fair condition, and is frequently used for gate-posts, fencing, etc., but when sunk in the soil decays sooner than new timber; it is also extensively used for fuel.

The bark has generally crumbled away, *except on the lower surface.* This indicates that the growth of the peat was slow, and that the bark on the upper surface decayed by exposure, while that beneath, being in contact with the peat, was preserved. The great thickness of the bark is very noticeable, especially in the case of the firs, and indicates, as before remarked, a cold climate.

Unlike the Irish and Danish bogs, the different trees lived together. Thus in Digby Fen, oak, elm, birch, and hazel are found, and in Wood Fen, oak, fir, yew, willow, and sallow. The trees are generally very close together, and this with the straightness of the trunks, proclaims that they formed part of dense forests, and were not isolated clumps.

They are found almost everywhere around the Fens, wherever peat exists, but never run more than a few miles out into the Fens, with the exception of the willows and sallows which are ubiquitous.

Having already proved that the ancient forest of Kesteven was not a woodland, and that the newest of the peat long ante-dates the historic period, it is quite unnecessary to show in detail that the buried forests (then believed to be one only) cannot be the remains of that of Kesteven.

But it has been asserted again and again, and is still generally believed, that many of the trees of the buried forests show traces of having been hewn down in some places, and of destruction by fire in others. Inasmuch as the Newer Stone Folk flourished during the later parts of this era, and *might* have destroyed the woods, it is necessary to examine the evidence that has been brought forward in in support of such an opinion. Such evidence is comprised in three assertions, (1) that trees are frequently found which have been sawn across, (2) that hatchet marks are frequently found on the stools of the trees, showing that they have been chopped down, (3) that marks of fire are very common, proving the mode of destruction.

Now in reply to all this I may remark in the first place, that, having no reason to the contrary, I commenced the Geological Survey of the Fenland with a firm conviction of the truth of these statements, and diligently sought for evidence. *I never found it.*

Many weary miles have I plodded across the Fens to see these sawn trees, and they invariably turned out to be stumps that had broken across at about the same height, and their hollowed parts were filled up with peat. I have examined thousands of trunks and stumps, and never saw an axe-mark that was not of recent origin. For four years I sought evidence of burning before I found any. But in 1874 Mr. MARSHALL showed me some undoubted charred wood from the Fens near Littleport. I sought the place, and was successful. Charred bark and wood were plentiful, *but only on the upper sides of the trees, and only where the peat had been burned!* The charcoal might have been made yesterday. And so this myth died.

Although human agency was universally invoked for the destruction of 'the forest,' writers were no less eager to impress one with the undoubted fact that most of the trees lay in one direction, namely, with their heads to the N.E. It does not seem to have struck them that this very patent phenomenon was fatal both to the chopping and the burning theories. It had long before been pointed out that in the case of the bogs of the north of England, of Ireland, and of Scotland, the trees lay in this particular direction, and the just inference had been drawn that they had fallen under the blasts of the prevalent S.W. wind. This very natural explanation had not been applied to the Fens, yet it needs but slight consideration to show how probable such a suggestion is. The living trees all bend towards the N.E., and if they were killed would sooner or later fall, and lie in the same direction as their predecessors in the peat do. The S.W. wind is the prevalent one in these latitudes, and that it is so in the Fens can be at once seen by reference to Mr. MILLER's tables in the preceding pages.* When we reflect upon the vast antiquity of these forests, some of

* Pages 276, *et seq.*

which may date back 70,000 years, and see these vivid proofs that the same wind prevailed then as now, we cannot but smile at legendary superstition; for while land and sea have many times changed places, while climates themselves have altered, this 'fickle wind' which 'bloweth where it listeth' has remained unchanged.

That the trees fell under the influence of the S.W. wind admits of no doubt, but it affords only a fragment of the explanation of the phenomena of the buried forests. Suppose the peat to start growing now as vigorously as ever, any tree accidentally uprooted would fall and be entombed in the moss, but such catastrophes are so few and far between that they afford no explanation of such immense numbers of trees, *upon the same level*, lying close together. A solitary stem here and there would be the sole token of the aërial vigour.

Clearly whole forests must have died at a time. Something must have killed them. A ready solution of this problem is afforded by an examination of the tree stools, and curiously enough it is found in one of the phenomena which were pointed out as proving the intentional destruction of the trees by man. If we examine any district, such as Ring Moor, Soham Mere, or Wood Fen, where numerous stools are visible at one time, we shall notice that they are all broken off at about the same height; generally about three feet from the former ground level. If now we compare this height with the thickness of the peat, we shall soon convince ourselves that the peat once stood at just that height, and *that it was the cause of the destruction of the trees*.

Let us imagine a forest in the full force of vegetative vigour, in a tolerably well drained area. Now let peat begin to grow. It will gradually creep up the trunks of the trees and keep them constantly cold. Eventually the peat moss, cold and wet, will become so thick, that the trees will be chilled to the heart-wood. The sap will no longer be able to rise. The trees, which have long been languishing, will die, and for years stand gaunt, leafless, and dead. The dry withered branches crack and fall with every passing breeze. The trunks will rot at the surface of the peat, where they are exposed to the air and to continual moisture. Finally the trees will go down before the strong S.W. gales, and the peat, their destroyer in life, will become their preserver in death.

But what causes the peat to grow? Ask rather, what allowed the forests to grow, for peat is the rule, forests are the exceptions in the Fens. What checked the growth of the peat? It was not that the climate grew milder, for the thickened bark proclaims its severity. One explanation only can be given: the supply of water was stopped—the land became drier. Whether this was due to improved natural drainage or to cosmical changes, may be answered by taking a broad view of the subject. Forests and peat can no more live together than crabbed age and youth, yet all the British Isles, all northern Europe, and North America, proclaim the fact that forests have flourished *upon* peat, and been buried *in* peat. Any local explanation of improved drainage fails, then, to meet the requirements of the situation. It must have been a cosmical change. In other words there were alternate dry and wet periods, the former marked by forest growths, the latter by peat bogs. Five times at least this must have happened in the history of the Fens, for the five forests denote five dry epochs.

How long these dry intervals were who can tell? The limits of forests in places where no man interferes with them seem almost stationary. How slowly they extend their bounds can scarcely be related in years. Yet five times in succession the forests crept slowly down into the

Fens, and reached distances of several miles from the neighbouring highlands. We are very apt to under-estimate the duration of these dry periods, which may very well be 500 years long. First of all the purely aquatic plants would have to die, and their place be supplied by marsh forms; these in turn must pass away and be succeeded by such species as adorn our meadows. With them may have been associated sallows and willows (which would leave no trace, having no chance of burial in peat) that would hold their own for many years. Only after these had passed away could the true forest trees enter the Fens. Many of the oaks are 200 years old. They have spread six miles into the Fen. The last acorn that sprouted may have been too recent to witness the decay of the first imigrant into the lowlands. Surely 500 years is not too much to claim for each of these dry intervals.

The Shell Marl. Intimately associated with the peat is the white, friable substance, known as Shell Marl. It consists almost entirely of remains of the stems of the aquatic plants *Chara*, which are encrusted with carbonate of lime. Upon these plants innumerable fresh-water mollusca flourished, and their shells, added to the lime from the *Chara*, make up the shell-marl.

The shell-marl is only found in the Isle of Ely, so far as I have been able to determine, a circumstance apparently dependent upon the distribution of the Chara, which does not now, and by analogy, in former times did not, flourish in Lincolnshire. Why this should be is at present unknown, for the numbers of lakes in the old East Fens, appeared to be as favourable to the production of shell-marl as Whittlesea Mere, where it formed a deposit four feet thick in some places.

We are quite certain that the shell-marl was formed in shallow meres. It is now found in the upper portion of the peat almost everywhere in that portion of the Fenland lying south of a line drawn from Cottenham, by Stretham, Ely, and Littleport, to Southery. It attains its greatest development in Burnt and Sedge Fens, where it averages three feet in thickness over several square miles, and is dug for marling the land.

FIG. 27.—*Scene in Marshland during the Inundation of 1862. From a Photograph.*

The shell-marl speaks to us of a different state of things from that which obtained during the formation of the peat or buried forests. The peat tells of damp marshy ground, the forests of dry intervals, but the shell-marl indicates the existence of wide-spread shallow meres, during which the peat could not accumulate. The scenery then must have been much like that so often witnessed when the Fens are drowned, and of which Fig. 27, from a photograph kindly lent to me by Mr. S. Smith, of Wisbech, affords an admirable illustration.

The Silt. The last formation with which we have to deal is that great deposit of sandy silt and weak clay, to which I have given the collective name of Fen Silt. It occupies about 600 square miles of the surface, and on the Geological Map looks like a great extension of the Wash. Moreover, it runs more or less persistently over the whole area of the Fenland, the peat-beds alone breaking its continuity. It is, indeed, the main deposit of the Fens, and is nothing but the material brought up by the tides.

Its deposition can be watched along the coast of the Wash, and upon the shores of any of the tidal streams. The salt-marshes, which are gradually encroaching upon the Wash, are formed of it, and its mode of deposition has been described on page 223 *ante*.

Taking the so-called Roman banks as really the work of that people, I find that the greatest accretion takes place along the base of the Wash between the mouths of the Welland and Nene, where the mean rate for the past 1700 years is 10·73 feet. Calling this 100 we have the following comparative rates of deposition :—

	FEET.
Base of Wash	100
East Holland Coast	17·05
Norfolk Coast	6·15

The actual accretion along the base of the Wash is shown in the following table taken from my Geology of the Fenland.

ACCRETION ALONG THE BASE OF THE WASH.

DATES.	MAX. RATE PER ANN.	MIN. RATE PER ANN.	MEAN RATE PER ANN.
	FEET.	FEET.	FEET.
Between 2nd and 17th centuries	15·84	1·76	7·29
During 18th century..	89·76	21·12	48·65
,, 19th ,, ...	70·41	13·20	31·68
Mean for 1700 years..	59·00	3·88	10·73

From this table the important conclusion can be drawn that embankment facilitates the deposition of silt. Had the grand scheme been carried out by which it was proposed to reclaim nearly the whole Wash, there is little doubt that a very large area of fertile land would have been added to England by this time. Of the practicability of this scheme I have no doubt whatever, after having paid special attention to the subject for several years. The Wash has been silting up since post-glacial times, the entire Fenland, 1300 square miles in area, being nothing more than the silted up bay. All that is required is to assist nature, and so facilitate the process. How vast the benefit that would accrue is almost incalculable. Victoria county will yet be won, and its capital, VICTORIA, become the great eastern port of England.

The Silt occurs under two distinct forms, which however shade imperceptibly into each other, but both may be seen forming simultaneously on the coast. One is a light flocculent, pinky-brown coloured, very fine sandy warp, always beautifully laminated. The other is a reddish-brown, light blue, or mottled clay, seldom laminated, and of a 'weak' nature, as the brickmakers say. It is the source of all the bricks made in the Fens, and forms light, friable and generally poor bricks. The warp passes on the one hand into fine sand, and on the other into clay, and this clay is the deposit which was known as Buttery Clay, and was believed to be a distinct formation. As a rule the warp is wanting beneath the peat in the southern parts of the Isle of Ely.

Throughout the Silt numerous foraminifera are found, and in the newer portions shells, of which *Scrobicularia piperata* is the most generally distributed. Similar 'Scrobicularia Clays' are found in like situations around the shores of England and Scotland.

The source of the Silt is not difficult to ascertain. It is brought up by the tides, and not washed down by the rivers, and is nothing more than the waste of the coasts of North Lincolnshire and Yorkshire.

A glance at the Geological Map will show that the southern peat area is cleft by a great triangular shaped area of peat whose apex is at Littleport, and whose base points towards March. We have already seen that the Ouse once flowed out at Wisbech, and that its estuary, as marked by the sea-banks was much larger than now, and here we see the geological evidence that for thousands of years this process of silting up has been going on. Once the mouth of the Ouse was at Littleport, now it is ten miles north of Ely, and this must go on as long as the Wash continues to silt up. This great wedge of Silt is indeed nothing but the silted up estuary of the Ouse.

The Silt, being marine, cannot of course show traces of those alternations of dry and wet periods revealed by the peat; but, as described in Chapter XI., it affords equally good proof of the great severity of the ancient climate. The portions which border the Wash are newer than most of the peat, and the formation is still in progress.

The Silt forms one of the richest agricultural districts of Britain. The sweet pasture-land, the heavy corn-crops, and still more strikingly the immense quantities of asparagus grown in open fields around Wisbech, attest this fact stronger than any words.

Neolithic Man. In Chapter II. we have given a short analysis of the ethnology and culture of the men of the Newer Stone Age—the Neolithic period of geologists. It is requisite, nevertheless, that a few words be here said respecting his relation to the Fenland.

The relics of neolithic man are found over all the western and southern portions of the Fens, but so far as I have been able to determine they do not encroach upon the broad area of the peat, probably because that area was under water.

The remains consist almost exclusively of stone implements, such as polished celts, and arrow-heads, of which examples are shown in the following cuts, kindly lent by H.M. Geological Survey.

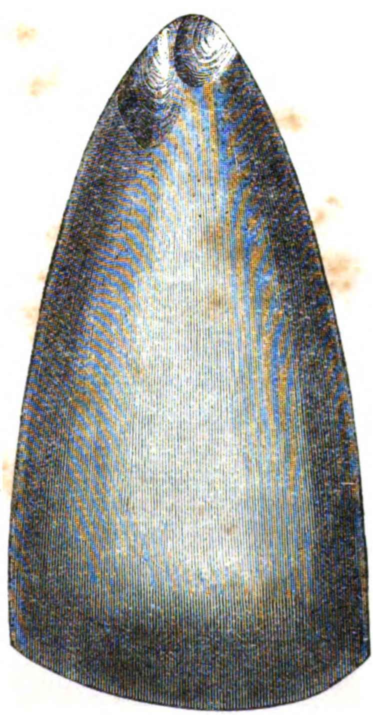


Fig. 28.—*Celt from Kate's Bridge.*

These people frequently built their villages on piles in lakes, as a safeguard from their enemies. Such lake-

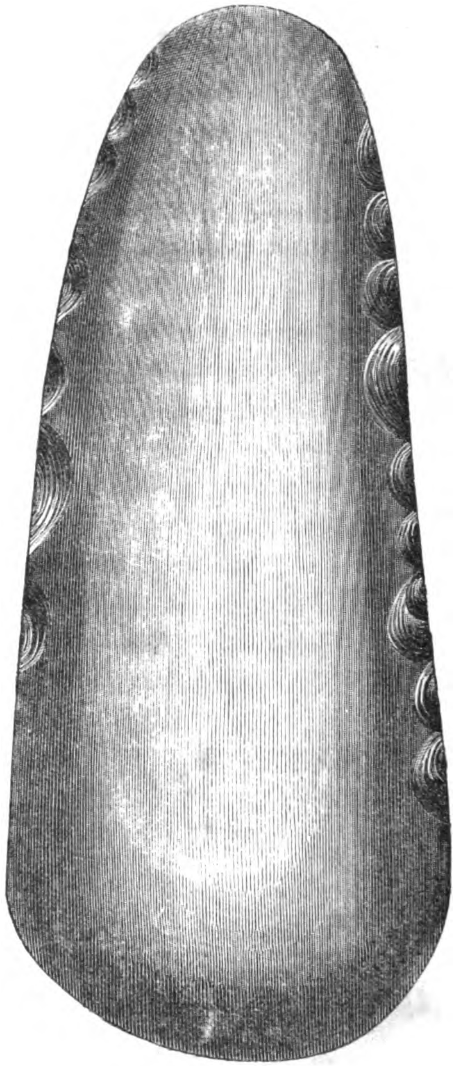


FIG. 29.—*Celt from Digby Fen.*

dwellings are common in Switzerland, but rare in Britain. I detected the remains of one at Crowland in the year 1870 during some excavations. The piles were of sallow planted very close together, upon these was laid brushwood, and over this a layer of gravel. Immense quantities of bones, chiefly of the Keltic Shorthorn, were found, together with a

FIG. 30.—*Flint arrow-head from Chatteris.*

FIG. 31.—*Flint arrow-head from Bourn Fen.*

few bone implements, and a curious ornament of jet. Near Ely, stakes have been found in the peat, but they do not seem to belong to a lake-dwelling.

Brandon has from palæolithic times been esteemed for the quality of its flint, and its vicinity is perhaps richer in relics of the stone age than any other. We have seen how the earliest known men occupied that area, and I have found flakes beneath the boulder-clay which show that the implements were made on the spot. This was in all probability about 200,000 years ago, and Brandon is still the seat of flint works. The neolithic people mined for the flint, and the remains of their pits are still extant at Grimes Graves, of which the beautiful vignette on page 492 is an illustration. I have in my work upon Gun Flints proved that the present flint-knappers are (so far as industry is concerned) the lineal descendants of the neolithic flint-workers. Probably this is the most ancient manufacture in the world.

I have found no records of flint implements from the lowest parts of the peat or silt, and they assuredly do not occur in the beach gravels. It would seem from this that man did not appear upon the scene until long after the glacial period; in fact until much of the Fen beds were formed.

It was not climate which prevented his immigration, for he had subsisted during much more inclement times; and the fact that he was so long in reaching England would seem to indicate that he had not the means of crossing the channel. When and how then could he come? I am tempted to suggest that he must have walked over from the continent, at the time of the formation of some of those lower beds of peat which point to a junction of England with the continent in post-glacial times.

Conclusion. Having now brought the history of this strange land down to the present time, it will be interesting to sketch rapidly the results at which we have arrived from a study of the geological phenomena.

Let us restore in imagination the landscape of pre-glacial times, which we can do with certainty. At the close of the Cretaceous period, when the Chalk was elevated above the sea, that formation stretched from Wales and Scotland to the Alps and Denmark, and there was no German Ocean. From that epoch many of our rivers date,* and since then the Chalk, and Oolitic rocks have been cut back to their present positions, and the British seas have been hollowed out.

About the close of the Miocene, or early in the Pliocene period, an easterly trend was given to some of the rivers, including those of the Fens. The chalk then spread over the entire Fenland and far out at sea. The resistless action

* On this subject the reader should consult The River-Courses of England and Wales, by Prof. RAMSAY, Quart. Jurn., Geol. Soc., vol. xxviii., p. 148, 1872.

of subaërial agents (ice, rain, rivers, &c.) gradually wore back the chalk escarpement until it formed merely a barrier across what is now the mouth of the Wash, and this barrier was breached by the Fen rivers and finally carried right away.

The denudation of the Chalk exposed the Oolitic strata, here, as we have seen, composed of soft clays which were speedily reduced to a low undulating plain—the future basin of the Fens. All this, as can be shown by irresistible geological reasoning took place before the glacial period.

Gradually the glacial period came on, the first ice-sheet crept over the country and ploughed up the beds, forming a boulder-clay whose relics we find in the Cromer Till. Then the cold passed away, and a mild interglacial period set in. England was peopled from the continent (to which it was united) by a fauna not very different from that which had existed just prior to the coming of the ice. Palæolithic man made his first appearance, and left his remains in the beds below the boulder-clay about Brandon. The climate, at first cold, was suitable to the wants of arctic species, which gradually spread northwards, and were succeeded by temperate and tropic species as it grew warm and equable. Presently the climate began to grow colder and first the tropic, then the temperate, and finally the arctic animals and plants were driven away, man retreating with them.

Then came the culmination of the glacial cold. The whole of England, as far south as the valley of the Thames at least, was buried under thick ice, by which the Chalky Boulder Clay was formed.

Eventually this state of things came to a close. The ice retreated, and after the floods, which invariably succeed an ice-period, had scattered their debris, the land was again peopled, and a similar cycle of changes took place to that which had previously occurred. Man again visited our country and established himself here.

Again the climate changed, and man and the other animals were driven away. Another ice-period, less intense but still very severe, came on. The ice stretched down into Lincolnshire and the Purple Boulder Clay was formed.

This ice waned, another interglacial period ensued, and yet again a pluvial period was succeeded by the peopling of the country with plants, animals, and man. By this time, although he had not learned the art of grinding or polishing his weapons, he had advanced in civilization to a considerable degree. His tools were neater and more varied, he laboured to ornament those which he had fashioned from wood and bone, and even depicted rude hunting scenes thereon. During this period a submersion occurred which buried Lancashire 1300 feet below the waves but only slightly affected the Fens.

For the last time the climate altered for the worse, and the old animals were driven away never to return, and man himself when he reappeared upon the scene was a comparatively civilized being. Ice once more overspread the land, invading the Fens of Lincolnshire. It melted back, and so closed the Glacial epoch.

The area of the Fens at this time was covered almost completely with boulder-clay, which now began to be eroded, until the area of the Fenland became a shallow bay like the Wash. Upon its shores was formed a beach, and over its floor was strewn sand and gravel.

From that epoch the history has been, on the whole, one of deposition, peat and silt being formed. Occasional interruptions took place, and once at least the land was so far elevated that England was united to the continent, from which it was peopled by the neolithic folk. The climate at first cold, has gradually ameliorated, and it has been varied by alternating dry and wet periods, which have left their traces in the buried forests, in the beds of peat, and in the shell marl.

This brings us down to the present time. And here we may appropriately close this volume. The story we have had to tell has been an interesting one, for it has been closely linked with the history of our race. That record is one of steady intellectual development, and on comparing what we once were, with what we now are, is it not justifiable to gaze into the future with pleasure, assured that still greater progress is in store for us, and that still nobler deeds will be accomplished.

[S. B. J. S.]

BAROMETE AND TEMPERATURE ONLY.

65.	18	1874.		1875.		The highest observed reading during 15 years.	Date.	The lowest observed reading during 15 years.	Date.
3 p.m. inches.	9 a.m. inches.	n. es.	3 p.m. inches.	9 a.m. inches.	3 p.m. inches.	inches.	*	inches.	*
29·520	29·789	05	29·972	29·865	29·868	30·656	3—64	*28·362*	24—72
·845	·652	06	·980	30·055	30·030	30·756	18—73	28·708	11—66
·871	·695	12	30·113	·135	·129	*30·800*	6—74	28·876	19—61
30·101	·917	47	29·827	·047	·015	30·634	9—61	29·140	16—69
29·880	·975	60	·949	29·974	29·964	30·524	21—66	29·190	7—69
30·181	·917	02	30·075	·882	·863	30·672	27—67	29·324	12—62
29·912	·906	69	29·938	·938	·939	30·560	13—63	29·346	5—61
·825	·758	09	·881	30·002	·994	30·600	21—74	29·340	29—66
30·200	·689	82	·856	30·022	·002	30·582	24—65 22—73	28·912	22—63
29·562	30·080	23	·814	29·768	29·754	30·672	1—70	28·820	24—70
·841	29·888	30	·908	·761	·777	30·704	6—64	28·628	29—74
30·169	·899	51	·744	30·073	30·059	30·740	11—65	28·616	24—68
29·910	29·847	42	29·921	29·9[illegible]0	29·949				

S. H. M.

l thus: 3—64 = 3rd of the month in the same line
time the Barometer read 30·656, this being the
ry in the 15 years; and 24—72 = 24th January,
t reading of any January for the same years—and

Tertiary.	Great Cycle of the Glacial Period.							Post-glacial.	
	Glacial.	Inter-glacial.	Glacial.	Inter-glacial.	Glacial.	Inter-Glacial.	Late Glacial.		

Tertiary.	Great Cycle of the Glacial Period.							Post-glacial.
	Glacial.	Inter-glacial.	Glacial.	Inter-glacial.	Glacial.	Inter-Glacial.	Late Glacial.	
17.	1(							

SYNOPTICAL TABLE OF STRATA.

		DEPOSITS.	FOSSILS.	PHYSICAL CONDITIONS.
	Post-glacial.	1. Blown Sand.	A few modern shells.	As at present.
		2. Peat.	Neolithic Fauna, p. 340. Iron, Bronze, and Neolithic Implements. Lake-dwellings. Buried Forests.	Alternate wet and dry periods, peat forme former, trees during latter; five such recognized. Slight oscillations of level ; o ably sufficient to unite England with the and allow of immigration of Neolithic M
		3. Shell Marl.	Recent fresh-water shells, *Chara*, &c.	Formed during wettest part of above, esp later times. Confined to Bedford Level also in beds of drained meres.
		4. Silt.	Occasional mammals as in peat. Whale, grampus, walrus, &c., *Scrobicularia piperata* and other recent shells.	As in the peat. Still forming on coast.
		5. Beach and Floor Gravel.	Generally wanting: when present of recent species.	Land submerged 50 feet. Climate probabl wet.
Great Cycle of the Glacial Period.	Late Glacial.	6. Hessle Boulder Clay.	None.	Arctic conditions. Great confluent glaciers into Lincolnshire Fens. Levels much as
	Inter-glacial.	7. Palæolithic Gravels of Modern Valleys.	Extinct mammals and shells, p. 322. Palæolithic Implements of good workmanship.	England at first continental, afterwards s 40 feet. Climate at first cold, then tempe warm, and returning to cold.
	Glacial.	8. Purple Boulder Clay.	None.	Arctic conditions. Great confluent glaciers much as now.
	Inter-glacial.	9. Palæolithic Gravels of Old Valleys.	Extinct mammals and shells, p. 322. Palæolithic Implements of moderately good workmanship.	Climate at first cold, then temperate and w finally cold again. England at first co No proofs of severence yet known.
		10. Nar Valley Beds.	Extinct mammals and shells.	Climate as above. Land submerged 50 feet
		11. Flood Gravels.	None.	Climate cold and excessively wet owing to back of ice-sheet. Partly of this age, p to melting of ice-sheets which formed N 9.
	Glacial.	12. Chalky Boulder Clay.	None.	Intense Arctic Conditions. Ice extended to the Thames. Land probably higher th
	Inter-glacial.	13. Brandon Beds.	Extinct mammals: shells and plants. Palæolithic Implements of crude workmanship.	England at first continental, then somewhat ged. Climate passed from cold to tempera and back to cold again.
		14. Middle Glacial.	Shells of warm types, many crag species, probably derived.	As above, and probably contemporaneous in
	Glacial.	15. Contorted Drift.	Fragmentary shells.	Land submerged to 50 feet or more. Pro part contemporaneous with above. Clim cold, with floating ice.
		16. Cromer Till.	Fragmentary shells.	Arctic conditions. Ice extended far into Land submerged 30 feet or so.
Tertiary.		17. Norwich Crag Series.	Many shells, forests, &c.	Forms of life showed gradual approach of cold. Levels much as now but oscillating a range of 50 feet. Breaching of chal completed.

APPENDICES.

TATTERSHALL CASTLE.

(*See page 98.*)

THE writers visited this castle in August 1873; the following description of it appeared in *The Architect* of August 16th of that year, and this is quoted as a faithful description of that noble remain of a baronial castle.

"The fine old ruin, which is commonly known as Tattershall Castle, is a very striking object, and so well have its massive walls withstood the assaults of time, that a distant observer might reasonably expect to find within all the arrangements of a mediæval mansion. It is, unfortunately, only a mere shell. The roof is entirely gone, and of the floors, one or two decayed beams alone remain. The castle is rectangular on plan, with huge octagonal turrets at the four angles; one of these contains a staircase, which is the only means of access to the three upper floors and to the battlements. The walls, of great thickness, are built of red brick, with dark brick patterns arranged somewhat irregularly. All door and window dressings, string courses, etc., are of stone. It is entirely devoid of buttresses, but the walls batter considerably, which gives it a real as well as an apparent solidity. A moat originally surrounded the castle, traces of which still remain; also the ruins of a low two-storey building at the west end, and more extensive remains eastward towards the church, the chief of these being a small domestic building still inhabited, with windows, etc., corresponding to those in the castle. This latter was, however, evidently the residence of the Seigneur, the surrounding buildings being subordinate to it; it is four-storeys in height, exclusive of a low vault or basement, and the plan is an imitation or development of the design of an earlier period. A large hall occupies the whole of each storey, entered on the ground-floor by a doorway, on the east side, which was protected by a low building, and probably approached by a drawbridge over the moat. On the upper floors access is gained from a staircase turret, which, on the first floor, opens into a lobby communicating with the great hall, and with an apartment formed in the body of the wall. On the second-floor the communication is by a corridor the whole length of the hall, and beautifully vaulted in moulded brick. The plan on the third-floor is similar to the first. This lobby is more elaborately vaulted than the corridor below, and gives access to what may possibly have been a minstrel's gallery as well as to the great hall. It is curious that, although moulded bricks have been so effectively used in this vaulting, they do not appear elsewhere in the building. The staircase is continued up to the machicolations, which are particularly effective, huge stone corbels supporting trefoil-headed arches, and above these a pierced corridor. The arcade of recessed windows has a very pleasing effect internally. At this level, and at the level of each of the floors below, chambers are formed in the angle turrets, the only access to them being, in most cases, from the great hall. Rooms are also formed in the body of the walls wherever practicable, and latrines, on the several floors have not been forgotten. A solid and picturesque brick chimney-stack, about 15 feet wide, and containing only three flues, still exists on the east side; its details resemble those of the "Old Hall," Gainsborough. The staircase is broad and easy of access, with stone handrail slightly projected, as at Wressil Castle, Yorkshire, where there is a similar staircase, and as at the ruins of the Bishop's Palace, at Lincoln, and elsewhere."

GENEALOGY OF THE KYMES.

(*See page 97.*)

William de Kyme	about	1100
Simon de Kyme	(son)	1136
Founded a Priory.		
Philip de Kyme		1168
Sheriff of Lincoln.		
Simon de Kyme		1195
Sheriff of Lincoln.	(died)	1220
Philip de Kyme	,,	1242
Simon de Kyme	,,	1248
Wm. brother to Simon	,,	1259
Philip son of Wm.	,,	1323
Wm. son of Philip	,,	1337

Here the estates passed to Lucy, sister of Wm. who married Gilbert de Umfraville, Earl of Angus.

Gilbert, son of the above	(died)	1421
Robert Umfraville (son)	,,	1437

Again the property descends to females

Burdons and Talboys ....

The name of Kyme reappears in 1450, *when* Thomas Kyme *is possessor* and is named as Commissioner of Sewers.

John Kyme, whose particular relationship to the former ones is unknown.

John, son of the above, who also had a son of the same name....	(died)	1555
Thomas (son)	,,	1591

John, son of Thomas had 2 sons John and Philip, neither of whom had sons.

FENLAND TUMULI.

(See page 47.)

1.	Friskney Row	2	miles from Roman Bank.
2.	Wrangle Red Lane	$\frac{3}{4}$	,, ,,
3.	"Kingshill," Wrangle Bank, Circular Camp	3	,, ,,
4.	Freiston	$1\frac{1}{4}$	,, ,,
5,6.	Fishtoft	$1\frac{1}{2}$	,, ,,
7,8.	Kyme Tower, Boston	3, $3\frac{1}{2}$	,, ,,
9.	"Sandholme," S.E. of Frampton	$\frac{3}{8}$	miles from Roman Bank, Circular Camp.
10.	S.E. of Kirton	1	miles from Roman Bank.
11.	Between Fosdyke and Kirton	$1\frac{1}{8}$	,, ,,
12.	Holbech Clough	$\frac{1}{8}$	,, ,,
13.	S. of ditto	$1\frac{1}{4}$	,, ,,
14.	Fleet	$1\frac{7}{8}$	,, ,,
15.	Gedney	$1\frac{1}{4}$	,, ,,
16,17.	Leverington, close to		,, ,,
18.	Walsoken	$\frac{1}{4}$	,, ,,
19,20.	Walpole St. Peter	$\frac{3}{4}$	,, ,,
21.	Terrington St. Clement	$\frac{5}{8}$	,, ,,
22.	Roman Road Binnimore Fen	8	no relation to Roman Bank.
23.	Swineshead Drayton	$1\frac{1}{2}$	miles from Roman Bank of B. Haven
24.	N. of Wigtoft	1	,, ,,
25.	Donington Eaudyke ?		on Roman Bank of B. Haven.

*** It will be noticed that all these mounds are in the vicinity of the sea-walls, and follow their sinuosities, as for instance round Bicken Haven and the Wisbech estuary. The only exception is in case of No. 22, and *this is close to the British Road.* Is it not a fair deduction that those who made the sea-walls raised the tumuli? [S. B. J. S.]

THE ANACHARIS.

(See page 307.)

The dying out of *Anacharis* seems to me a necessary result of the establishment of only one sex in England. Mr. DARWIN has shown by very numerous experiments how essential not merely fertilisation, but cross fertilisation, is for the maintenance of the vigour of plants. In this case the absence of the male prevents sexual reproduction entirely, and although the new conditions in which the plant found itself were very favourable for its development, it was certain to succumb sooner or later from its inability to propagate itself by seed. I firmly believe that if the male plant were introduced the *Anacharis* would permanently establish itself, to the exclusion of many of our native aquatic species. As it is, it is doomed to extinction. Many cases are known of similar introductions of plants into foreign habitats which have proved eminently suitable to their wants. As a rule plants and animals live where they can, not where they would, so severe is the struggle for life. [S. B. J. S.]

LIST OF MOLLUSCA FROM THE NORFOLK COAST.

By F. W. HARMER, F.G.S.

Lamellibranchiata.

Anomia ephippium. L.
,, ,, *var.* aculeata.
Ostrea edulis. L.
Pecten varius. L.
,, opercularis. L.
Mytilus edulis. L.
,, modiolus. L.
Modiolaria nigra. Gray.
,, marmorata. Forbes.
Nucula nucleus. L.
Leda minuta. Müll.
Montacuta bidentata. Montague.
Kellia suborbicularis. Montague.
Lucina borealis. L.
Cardium exiguum. Gmelin.
,, fasciatum. Mont.
,, edule. L.
,, norvegicum. Speng.
Cyprina islandica. L.
Astarte triangularis. Mont.
Venus exoleta. L.
,, ovata. Pen.
,, gallina. L.
Tapes virgineus. L.
,, pullastra. Mont.
Tellina balthica. L.
,, tenuis. Da. C.

Tellina fabula. Gron.
,, pusilla. Phil.
Psammobia telinella. Lam.
,, vespertina. Chem.
Donax vittatus. Da. C.
Mactra solida. L.
,, ,, *var.* elliptica.
,, stultorum. L.
Scrobicularia alba. Wood.
,, piperata. Bellon.
Solen ensis. L.
,, siliqua. L.
,, vagina. L.
Corbula gibba. Olivi.
Mya arenaria. L.
,, truncata. L.
,, Binghami. Turton.
Saxicava rugosa. L.
,, ,, *var.* arctica.
Pholas candida. L.
,, crispata. L.
Teredo navalis. L.

Gasteropoda.

Patella vulgata. L.
Tectura virginea. Müll.
Trochus helicinus. Fab.
,, tumidus. Mont.
,, cinerarius. L.
,, zizyphinus. L.
Lacuna crassior. Mont.
,, divaricata. Fab.
Littorina obtusata. L.
,, rudis. L.
Littorina litorea. L.
Rissoa parva, *var.* interrupta.
,, striata. Adams.
,, semistriata. Mont.
,, membranacea. Adams.
Hydrobia ulvæ. Penn.
Scalaria communis. Lam.
Odostomia rissöides. Han.
,, interstincta. Mont.
,, spiralis. Mont.
Eulima bilineata. Ald.
Neritina fluviatilis. L.
Natica catina. Da. C.
,, Alderi. Forbes.
Velutina lævigata. Pen.
Purpura lapillus. L.
Buccinum undatum. L.
Murex erinaceus. L.
Trophon truncatus. Ström.
Fusus antiquus. L.
,, gracilis. Da. C.
Nassa reticulata. L.
,, nitida. Jeff.
,, incrassata. Ström.
Pleurotoma rufa. Mont.
,, turricula. Mont.
Cypræa Europea. Mont.
Utriculus obtusus. Mont.
,, hyalinus. Turton.
Melampus bidentatus. Mont.
,, myosotis. Draparnaud.

Cephalopoda.

Loligo vulgaris. L.

*** This list is taken from a paper by Mr. F. W. Harmer, F.G.S., on the Marine Mollusca of the Norfolk Coast. Trans. Nor. Nat. Soc., vol. i. p. 42., 1869-74.

ELEVATION OF IMPORTANT POINTS IN THE FENLAND.

(Above Ordnance Datum.)

	FEET.		FEET.
Lynn Old Tower..	14·249	Holbech Church Tower	15·411
West Lynn Church Tower.. ..	17·332	Clenchwarton Church Tower ..	14·074
Sutton Wash Metal Bridge ..	18·528	Terrington St. Clement's Tower	15·332
St. Matthew's Church, Sutton Wash..	14·574	Sutton St. Mary's ,,	14·117
Chapel Bridge, Sutton St. Mary's	13·083	Gedney ,,	16·664
		Fleet ,,	15·190

	FEET.
Fossdyke Church Tower	13·882
Sutterton „	13·565
Algarkirk Church Chancel	13·062
Swineshead Church Tower	18·722
Wigtoft „	13·818
Sleaford „	51·962
Great Hall „	28·142
Heckington „	45·091
Asgarby „	29·923
Kirkby Laythorp „	40·940
Boston „	16·963
Skirbeck „	14·506
Fishtoft „	18·126
Marine Hotel, Freiston Shore	10·963
Butterwick Sea End	11·572
Bennington „	9·963
Wainfleet Church Tower	15·494
Friskeney Church Tower	12·587
Croft „	12·159
Eye „	27·537
Guyhirn Chapel of Ease	9·237
Wisbech St. Mary's Church Tower	10·500
Fletton Church Spire	29·690

	FEET.
Standground Church Tower	32·115
Peterborough Cathedral Spire	27·901
Thorney Church Tower	21·606
Wisbech „	16·680
Walpole Highway Church	7·842
Walsoken Church Tower	12·378
Tilney St. Lawrence „	9·243
St. John's Highway „	9·414
Tilney All Saints „	13·611
Tilney-cum-Islington „	11·442
St. Ives Church	25·678
Fenny Drayton Church	29·970
Fenny Stanton „	43·103
Trinity College, Cambridge	30·575
Walpole St. Peter Church Tower	8·5
Lynn „	18·5
Ely Minster (ground)	51·6
Admiralty Datum for Soundings	14·04
Boston Church Tower, top	286·5
Nene Valley Datum	– 25·82
Lynn Free Bridge Gauge (datum for Ouse)	– 5·82

*** See also page 293.

LIST OF FENLAND LEPIDOPTERA.

(*See page 401.*)

In addition to those gentlemen whose names are mentioned in the Section on Lepidoptera, p. 411, cordial acknowledgment is due to the following for lists and valuable information received since that portion of the work was printed. Lord Walsingham for a very numerous list of his captures at Wicken Fen and Brandon, including a large number of choice species of Tortrices and Tineæ, many of which have not been taken by others. Mr. Eadle, his lordship's collector, for localities of his rarer captures at Wicken, Soham, Waterbech, Fordham, Lakenheath, and Brandon. Mr. F. Bond, of "Fairfield," Staines, for valuable information as to his captures in the district. (Mr. Bond is probably the most successful Fenland collector. His captures were made for the greater part previous to the recent great changes by drainage and cultivation, and as for a number of years he visited frequently all the richer localities, and collected assiduously, he is enabled to supply localities of upwards of fifty species otherwise not recorded in the district, and the greater portion of which have probably become extinct in the district, besides much additional information as to other species.) Mr. William Gaze, of Great Thurlow, who resided at Ely between 1836 and 1840, and at Burwell between 1848 to 1855, and collected also at Stuntney, Littleport, Bottisham, Swaffham, Wicken, Reach Ditch, and Monkswood. Mr. A. Farn, of "The Daltons," Dartford, for a number of very interesting species taken by him in 1876 and 1877, at Wicken and neighbourhood, and at Ely. Mr. C. G. Barrett, of Pembroke, for a numerous list of his captures at Brandon taken during visits from 1870 to 1873 inclusively. Mr. F. D. WHEELER, of Norwich, also for a list of Brandon species, in addition to his Wicken list previously acknowledged. Mr. WM. WARREN, of Cambridge, for a considerable number of his rarer captures at Cambridge, Fulbourn, Whittlesford, Cherry Hinton, Madingley, Tuddenham, Trumpington, Horningsea, Waterbech, Wicken, Newmarket, Monkswood, &c. Mr. E. WAGSTAFF, of Chippenham, for records of Diurni and Noctuæ taken between the years 1854 and 1869, at Chippenham, Isleham, Newmarket, Bottisham, Wicken, &c. Prof. C. C. BABINGTON for information as to records in his diary of captures deposited in the Cambridge University Museum. These together with Prof. BABINGTON'S notices of captures published about 1830, make a valuable addition to our limited knowledge of the Lepidoptera of the district at that time. Another exceedingly rich fund of information has been a MS. Catalogue of Cambridgeshire Lepidoptera deposited in Cambridge University Museum by the Rev. LEONARD JENYNS, now the Rev. L. BLOMEFIELD, of Belmont, Bath. This contains records of the Rev. BLOMEFIELD'S captures at Swaffham Prior, Swaffham Bulbeck, Bottisham, Horningsea, Burwell, Wicken, Devil's Ditch, Newmarket, Monkswood, &c., made by him between the years 1815 and 1849, whilst then residing in the district, and also information as to the captures of other gentlemen about the same time, among whom may be mentioned Mr. E. L. LAYARD, (now H.M.'s Consul at New Caledonia, who was an assiduous collector while at College); Mr. CHARLES DARWIN, LL.D. (then also at College); Mr. AIKIN, Mr. DENNY, and Mr. DECK, then resident at Cambridge; Mr. M. LEE, Mr. WENMAN, Mr. J. C. DALE, Mr. L. P. GARNONS, &c. The Rev. L. BLOMEFIELD has also kindly furnished further information as to some of the more interesting records. In the list his former name of JENYNS is retained, as it is also used in other lists in this work. The names of the various early collectors are freely employed in the list in all cases where more recent records have not been received, as indicating approximately the date of capture. It may also be mentioned that one of Mr. GAZE'S localities—Reach Ditch—is the same as Devil's Ditch, but as he generally collected at the Reach end of the Ditch, that term is retained in his records.

DIURNI.

Papilio machaon. Linn. Still abundant at Wicken Fen. Specimens have been seen at Ely and Chatteris, but they were probably only stray individuals from Wicken. Less recently it has occurred at Horningsea, Bottisham, Swaffham, and Burwell Fens. It used to be abundant in all the fens between Cambridge and Ely, and has occurred at Madingley and Hinton. No notices have been received of recent captures at Whittlesea Mere, Holme Fen, Yaxley Fen, and the localities (except Wicken) where it was formerly taken abundantly. Mr. S. B. J. SKERTCHLY saw one taken in Bourn Fen in 1872.

Leucophasia sinapis. Linn. Monkswood; Peterborough; Bourn. Prof. BABINGTON in 1829 took it at Monkswood, and in 1835 at Gamlingay. Has also occurred at Stapleford.

Pieris cratægi. Linn. Peterborough; Monkswood. Taken in 1829 by Prof. BABINGTON near Monkswood.

„ *brassicea.* Linn. Abundant everywhere.

„ *rapæ.* Linn. Abundant everywhere. This is the first white butterfly that appears in spring.

„ *napi.* Linn. Abundant everywhere.

Pieris daplidice. Linn. Newmarket, where it has been frequently taken, and occurs most years. Holme Fen; Whittlesea Mere formerly, where one was taken in 1852 by Mr. BUXTON.

Anthocharis cardamines. Linn. Generally distributed throughout the district.

Gonepteryx rhamni. Linn. Common in the highlands; less frequent in the Fens where the food plants are rare.

Colias edusa. Fab. Occasionally common throughout the district; was plentiful in 1877. Occurs constantly at Newmarket, and has been met with even in the Fens for many consecutive years.

,, *hyale.* Linn. Less frequent than *Edusa*, but still of general occurrence, though at wider intervals of time. Constantly found at Newmarket; Whittlesford; Cambridge; Ely; Chatteris; Wisbech.

Argynnis paphia. Linn. A highland and woodland species, but has been found at Whittlesford; Ely; Monkswood; Peterborough; Cowbit; and Bourn. It was taken in 1829 by Prof. BABINGTON, with *aglaia* at Monkswood, and recorded by Rev. JENYNS at Gamlingay, Cambridge, Bottisham, and Swaffham Bulbeck. Also occurs at Chippenham and Brandon.

,, *aglaia.* Linn. Horningsea, Quy and Ely Fens; Holme Fen abundantly; Bourn wood. Used to be taken in Ely Fen by Mr. GAZE, has been taken at Rampton by Mr. DALE, the Rev. JENYNS found it sometimes in plenty at Great Swaffham, and has also taken it at Burwell, Bottisham, and the Devil's Ditch.

,, *adippe.* Linn. Wisbech once (in 1876): Bourn wood.

,, *lathonia.* Linn. This rare insect is recorded as having been taken at Gamlingay, Newmarket, and Wisbech. In PETIVER'S time (early in the last century) *lathonia* was not rare at Gamlingay. HARRIS'S "*Aurelian's Pocket Companion*," published in 1775, gives it as then occurring there. It has been taken there a few times since, but not recently. The record at Wisbech rests upon Dr. F. SCRIMSHIRE who assured HAWORTH he had seen a specimen which was taken in his father's garden at Wisbech.

,, *euphrosyne.* Linn. "Plentiful in the woods at Stapleford, in September, 1842."—*Zoologist*, p. 257. Used also to occur near Cambridge, and at Gamlingay, where the Rev. JENYNS found it in plenty in 1831. Formerly taken at Monkswood by Mr. GAZE, who used also to take *Selene* there.

,, *selene.* W. V. Cambridge; Monkswood; Bourn Wood. Not uncommon on the northern edge of the Fens, in woods. Used to occur in Whitewood near Gamlingay, and at Chippenham.

Melitæa artemis. Fab. Taken formerly at Whittlesford; at Ely (by Mr. MARSHALL FISHER); at Burwell Fen and Reach Ditch (by Mr. W. GAZE); at Yaxley rare. In 1829 Prof. BABINGTON took it near Monkswood. Mr. BOND has seen it swarming at Horningsea; the Rev. JENYNS used to take it at Bottisham, and Mr. WAGSTAFF at Soham and Chippenham.

,, *cinxia.* Linn. Two specimens are stated to have been taken at Stapleford on June 15th, 1842, by Mr. MELVILLE LEE, of Magdalen College, Cambridge, (*Zoologist*, p. 257.) It is very unusual now for the species to be taken so far from the south of England, though WESTWOOD records it as having occurred in Lincolnshire and Yorkshire, and RAY records it as abundant in Lincolnshire.

,, *athalia.* Esp. The Rev. JENYNS on the authority of Mr. LAYARD records this southern species as having been taken at Baitsbite, near Cambridge. About the same time it was found freely in the adjoining county of Bedford.

Vanessa c-album. Linn. Generally rare. Occurred not uncommonly at Shelford in 1842, (Mr. LEE, Zoologist, p. 257.) Has occurred at Coton; Ely (in 1842); Wisbech; Upwell; Monkswood; Peterboro'; Stamford; and Bourn.

Vanessa urticæ. Linn. Abundant everywhere.

" *polychloros.* Linn. Generally distributed and not uncommon; abundant at Chatteris.

" *antiopa.* Linn. Rare, but has been occasionally taken for many years past. Comparatively plentiful in 1872. Whittlesford; Cambridge; Witchford; Mepal; Isleham; Soham; Chatteris; Ramsey; Brandon. Seems to follow the course of the rivers in this district.

" *io.* Linn. Generally distributed and common.

" *atalanta.* Linn. Common everywhere.

" *cardui.* Linn. Generally distributed but irregular in its appearance. Rare most seasons, but rather frequent the last year or two.

Limenitis sibylla. Linn. The Rev. JENYNS states that Mr. LAYARD informed him this species had been taken at Stapleford; and WESTWOOD records it near Peterboro'.

Apatura iris. Linn. Monkswood; Brampton Wood; woods near Peterborough; formerly at Doddington Wood, its only known Fen locality; plentiful in Bourn Wood; not rare about Lincoln and Bardney.

Arge galatea. Linn. Whittlesford, rare; Warboys Wood; Monkswood; Peterboro'; Cowbit; Bourn Wood. Formerly at Fenstanton (STEPHENS); Rampton and near Cambridge (Mr. DALE).

Satyrus ægeria. Linn. Chippenham; Ely; Doddington Wood; Chatteris; March; Warboys Wood; Upwell; Wisbech; Peterboro'; near Tattershall. Rare in its Fenland localities.

" *megæra.* Linn. Common everywhere.

" *semele.* Linn. Whittlesford; Newmarket; Reach Ditch; Chatteris, rare; Peterboro'; Brandon; Lynn.

" *janira.* Linn. Common everywhere.

" *tithonus.* Linn. Common everywhere.

" *hyperanthus.* Linn. Whittlesford; Gamlingay; Ely; Chatteris, rare; Doddington Wood, rare; Warboys Wood; Monkswood; Bourn Wood; near Tattershall; Upwell; Wisbech; Bottisham, formerly.

Chortobius pamphilus. Linn. Common everywhere.

Thecla rubi. Linn. Madingley; near Cambridge (Mr. LEE); Fen Ditton (Mr. DALE); Sawtry (Prof. BABINGTON, 1828); Chippenham; near Lynn, common; Peterboro'; near Tattershall; Brandon.

" *quercus.* Linn. Ely formerly; Doddington Wood; Warboys Wood; Monkswood; Peterboro'; Brandon; near Lynn; Tattershall.

" *w-album.* Illig. Madingley; used to be taken at Monkswood by Mr. F. BOND; Stilton, where it used to swarm; Cowbit; Bourn Wood; a single specimen at Cambridge in 1827.

" *pruni.* Linn. Warboys Wood; Monkswood; Peterboro'. Was first announced as British in 1828 by a dealer who refused to give the locality; in the following year Prof. BABINGTON found it in plenty at Monkswood, and first drew attention to the entomological richness of the wood.

" *betulæ.* Linn. Monkswood; Peterboro'; formerly at Hatley Wood (Mr. AIKIN); Gog-Magog Hills; and one specimen at Swaffham Prior (Rev. JENYNS).

Polyommatus hippothöe. Linn. (*Dispar* Haw). Formerly in abundance at Whittlesea Mere and Holme Fen; both in Huntingdonshire. Nearly eighty years ago Mr. J. C. DALE recorded taking a specimen at Bardolph Fen, but the whole district has altogether changed since then. In 1851, the year Whittlesea Mere was drained, Mr. WAGSTAFF took a solitary specimen at Bottisham Fen. No specimen has been taken for over twenty years, so this splendid Fen species is no doubt extinct.

Polyommatus phlœas. Linn. Common everywhere.

Lycæna ægon. Bork. Whittlesford; Cambridge, formerly; Newmarket; Soham; Monkswood; Brandon.

„ *agestis.* W.V. Whittlesford; Gog-Magog Hills; Newmarket; frequent at Reach Ditch, formerly; Chatteris; Peterboro'; Brandon; Lynn.

„ *alexis.* Hüb. Common throughout the district.

„ *adonis.* W.V. Several specimens were taken at Newmarket by Mr. Wagstaff many years ago.

„ *corydon.* Fab. Whittlesford; Gog-Magog Park; Cherry Hinton; Cambridge; Newmarket; Chatteris, rare; Wisbech, rare; near Lynn; formerly abundant at Reach Ditch. This species is not confined to the chalk in this district, but is also rarely to be met with in the Fens, where it may possibly succeed in establishing itself.

„ *acis.* W.V. At Sawston, Cherry Hinton, Gog-Magog Hills, and Haslingfield, all near Cambridge, where Mr. Bond has known it to be taken many years ago; also at Stapleford (Mr. Lee); Hatley and Madingley Woods (Mr. Aikin); Horningsea (Mr. Layard); probably extinct now.

„ *alsus.* Fab. Cherry Hinton, common; Gog-Magog Hills; Cambridge (in 1829); Madingley; Fulbourn; Reach Ditch, formerly; Newmarket.

„ *argiolus.* Linn. Whittlesford, rare; Cambridge; Ely, scarce; Newmarket, rare; has occurred at Great Swaffham, and used to be abundant on the Gog-Magog Hills.

„ *arion.* Linn. A specimen recorded at Chatteris in the *Ento. Weekly Int.* It used to be taken at Monkswood.

Nemeobius lucina. Linn. Monkswood; Peterboro'; formerly at Anglesea Abbey and Chippenham. In the time of Ray it used to be taken near Cambridge.

Syrichthus alveolus. Hüb. Whittlesford, rare; Madingley (Mr. Bond); Peterboro.' Taken in 1829 near Monkswood and Wood Ditton by Prof. Babington. Mr. Gaze also used to take it at Reach Ditch and Ely, and the Rev. Jenyns frequently in Bottisham Fen and elsewhere.

Thanaos tages. Linn. Whittlesford, rare; Madingley; Peterboro.' Formerly at Reach Ditch and Ely; Wood Ditton in 1829; Bourn.

Hesperia paniscus. Fab. Monkswood; Peterboro'; White Wood, Gamlingay, where it was taken in 1803, and in 1842 Mr. Lee found larvæ there; Cambridge (Mr. Layard.)

„ *sylvanus.* Fab. Generally common, scarce at Wisbech.

„ *comma.* Linn. Whittlesford; Cherry Hinton; Newmarket. Used formerly sometimes to be plentiful at Reach Ditch.

„ *linea.* Fab. Not so common as *Sylvanus*, scarce at Wisbech.

NOCTURNI.

Smerinthus ocellatus. Linn. Common throughout the district.

„ *populi.* Linn. Common throughout the district.

„ *tiliæ.* Linn. Common throughout the district.

Acherontia atropos. Linn. Generally distributed, but not so common as formerly.

Sphinx convolvuli. Linn. Generally distributed, and common in some seasons. The pupæ are sometimes found in potato fields where *Convolvulus arvensis* grows.

„ *ligustri.* Linn. Abundant everywhere. Larva on Privet, Ash, Holly, etc.

Deilephila galii. W.V. Cambridge; Ely; Chatteris. Usually very rare. Has been taken at Ely and Reach Ditch by Mr. GAZE, and Mr. BOND remembers it being very abundant one year near Fulbourn.

„ *lineata.* Fab. A specimen of this rare insect in the collection of Cambridgeshire Lepidoptera presented to the University by the Rev. JENYNS was found near Cambridge, and CURTIS mentions the occurrence of a specimen near Lynn.

Chærocampa celerio. Linn. A fine specimen in the Rev. JENYNS's collection was taken in a fruiterer's shop at Cambridge in 1836, and another occurred near Isleham. Mr. F. SCRIMSHIRE found a larva in a garden at Wisbech, about the year 1805; in 1815 another larva was found in the Palace Gardens at Ely, and in 1865 the larvæ were found feeding on vine at Newmarket.

„ *porcellus.* Linn. Thinly distributed throughout the district, but less frequent in the Fens.

„ *elpenor.* Linn. Common throughout the district, especially in the Fens.

Macroglossa stellatarum. Linn. Generally distributed, in warm seasons often abundant.

„ *fuciformis.* Linn. Recorded near Cambridge by Mr. LAYARD who also took *bombyliformis*; Brandon.

„ *bombyliformis.* Esp. Wicken; Burwell and Bottisham Fens, formerly, (Mr. GAZE); Devil's Ditch (Rev. JENYNS); near Cambridge (Mr. LAYARD.)

Sesia myopæformis. Esp. Whittlesford, common; Wicken; Ely (Mr. GAZE.)

„ *culiciformis.* Linn. Brandon (Mr. WHEELER).

„ *formicæformis.* Esp. Whittlesford; Duxford and at Chesterton, near the railway bridge over the river (Mr. BOND); Fulbourn (Mr. OSBORN); Wicken.

„ *ichneumoniformis.* W.V. Whittlesford; Madingley (1833); Brandon.

„ *tipuliformis.* Linn. Shelford, rare; Cambridge; Ely; Wisbech, common; Cowbit.

„ *bembeciformis.* Hüb. Whittlesford; Cambridge (Prof. BABINGTON); Wicken; Willow Fen, formerly; Bottisham (Rev. JENYNS).

„ *apiformis.* Linn. Generally distributed.

Macrogaster arundinis. Hüb. Wicken, its only recent locality, where it is not so frequent as it used to be. Formerly abundant at Holme Fen, Yaxley Fen, and Whittlesea Mere, where it was first discovered by Mr. DOUBLEDAY. The discovery of the larva and pupa led to it being taken in abundance. After disappearing from this locality it was first detected at Wicken by Mr. BOND.

Zeuzera æsculi. Linn. Generally distributed throughout Cambridgeshire, but rather scarce except at Chatteris, where it is sometimes abundant.

Cossus ligniperda. Fab. Abundant throughout the district.

Hepialus hectus. Linn. Whittlesford, common; Ely, (Mr. GAZE); Warboys Wood; Wicken; near Lynn; used to be taken at Monkswood by Prof. BABINGTON and Mr. BOND.

„ *lupulinus.* Linn. Abundant everywhere.

„ *sylvinus.* Linn. Whittlesford; Cambridge; Wicken, common; Chatteris, common; Wisbech; Upwell; Brandon; Cowbit.

„ *humuli.* Linn. Abundant everywhere.

Procris statices. Linn. Formerly at Whittlesford (Mr. BOND); Gog-Magog Park (Mr. AIKIN); near Fordham formerly; Ely; Upwell; Peterboro'. Taken in 1829 by Prof. BABINGTON near Monkswood. Plentiful at Horningsea Fen formerly.

Zygæna trifolii. Esp. Whittlesford; Wimblington, in the Firelots, a small patch of uncultivated Fenland, which closely resembles Wicken Fen in its flora, and still produces *Myrica Gale*; Monkswood (Mr. GAZE); at Barrington Hill; near Linton, and Cherry Hinton (Rev. JENYNS); formerly at Bottisham (Prof. HENSLOW.)

„ *filipendulæ.* Linn. Whittlesford, common; Cherry Hinton, common, where the yellow variety seems constantly to occur; Madingley; Ely; Wisbech; Upwell; Eriswell, abundant; Brandon; Monkswood, abundant (Mr. GAZE.); Bottisham (Rev. JENYNS); near Fordham.

Nola cucullatella. Linn. Common throughout the district.

„ *cristulalis.* Hüb. Monkswood; Fulbourn and woods round Whittlesford, (Mr. BOND); near Lynn, rare.

Nudaria senex. Hüb. Common in south Cambridgeshire; Wicken, common; Whittlesea Mere, plentiful in 1825.

„ *mundana.* Linn. Ely; Wicken, common; Chatteris, common; Doddington wood; Wisbech, rare; Stapleford, formerly.

Calligenia miniata. Forst. Whittlesford; Chatteris; always rare.

Lithosia mesomella. Linn. Near Lynn. No recent records of this insect in Cambridgeshire have been received, although Mr. BOND used to see it swarming at Wicken, Burwell, and Yaxley Fens; in 1828 and 1829 it was plentiful at Swaffham Prior, and about the same time occurred at Linton and Hildersham.

„ *muscerda.* Hüb. Taken by Mr. EEDLE at Lakenheath by the side of the Little Ouse, together with *Crambus paludellus*. These insects have not before been recorded away from Horning and Ranworth Fens, and the sides of the Yare and Bure, which pass through those Fens. As these rivers have a communication with the Little Ouse, these hitherto very local insects appear by this means to be spreading westward, and if so should occur at intermediate places.

„ *aureola.* Hüb. Chatteris, one specimen (Mr. HAROLD RUSTON); Brandon abundant.

„ *lurideola.* Tr. [*Complanula.*] Common throughout the district.

„ *complana.* Linn. Wicken, rare; Chatteris, one specimen; Brandon, abundant.

„ *griseola.* Hüb. Common throughout the district; the variety *Stramineola* is sometimes common in the Fens, but is of uncertain appearance. Intermediate varieties are also sometimes taken.

„ *quadra.* Linn. Near Wicken; one at Ely; Chatteris, rare; Brandon; one near Lynn; Bottisham (Rev. JENYNS).

„ *rubricollis.* Linn. Whittlesford; Cambridge. Uncertain in its appearance. Sometimes it will be abundant in a locality for a season or two, and afterwards disappear altogether. This was the case in 1858 at Myntlyn Wood, near Lynn, where it then swarmed in dense myriads in mid day like a black snow storm, but except a few the following year has not since been seen.

Euchelia jacobeæ. Linn. Rare in South Cambridgeshire, widely distributed and often abundant in the Fens. Multitudes at Brandon. Mr. BOND has taken the yellow variety at Horningsea Fen.

or

ha *Callimorpha dominula.* Linn. Wicken, abundant; Whittlesea Mere and Burwell Fen, formerly. This beautiful species which now appears to be restricted to Wicken Fen, was formerly widely distributed in the Fens of Cambridge and Huntingdon, and used also to be taken at Chesterton, near Cambridge.

Euthemonia russula. Linn. Taken by Prof. BABINGTON at Holme Fen, and Horningsea Fen; by the Rev. JENYNS at the latter place and also Bottisham and Swaffham Fens; and in 1829 WOOD's *Index*

Entomologicus gives it as common in Cambridgeshire, but it has not been seen for many years in either Cambridgeshire or Huntingdonshire. It is common at Brandon; Lynn, &c. on the Norfolk border of this district.

Chelonia plantaginis. Linn. In LOUDON'S *Mag. of Nat. Hist.* for 1829, PROF. BABINGTON records taking this, and several other heath insects now extinct in this district, near Monkswood and Sawtry (Holme). Mr. GAZE also took it at Monkswood at a somewhat later period, and Mr. LAYARD near Cambridge, but it does not appear to have been taken in the district for many years past.

„ *caja.* Linn. Abundant everywhere.

„ *villica.* Linn. Whittlesford, rare; Cambridge in 1828 (Prof. BABINGTON); Brandon.

Spilosoma fuliginosa. Linn. Rare in south Cambridgeshire; Wicken, common; Chatteris; Doddington; Brandon; Skegness. Thinly distributed through the Fens. Formerly at Ely, Cambridge, Devil's Ditch, and Swaffham.

„ *mendica.* Linn. Whittlesford, rare; Cambridge; Brandon.

„ *lubricipeda.* Linn. Abundant everywhere.

„ *menthastri.* W.V. Generally distributed, but not so common as *Lubricipeda.*

„ *urticæ.* Esp. Wicken, rare; Horningsey Fen; Burwell Fen, formerly; neighbourhood of Cambridge (Mr. LAYARD).

Liparis chrysorrhœa. Linn. Whittlesford; Cherry Hinton; Red Cross Turnpike; Fen Ditton; Ely; Wicken; Skegness. Not common anywhere in the district; formerly at Cambridge, Bottisham, and Swaffham Prior.

„ *auriflua.* Fab. Abundant everywhere.

„ *salicis.* Linn. Whittlesford, rare; Cambridge; Denny Abbey; Swaffham Fen; Littleport; Bottisham; Wicken; Chatteris, common; Wimblington; Wisbech; Cowbit. Probably common throughout the Fens.

„ *dispar.* Linn. One larva at Cherry Hinton in 1874 by Mr. G. H. RAYNOR; formerly abundant at Whittlesea Mere. In 1845 Mr. BOND took the perfect insect, larvæ, pupæ, and eggs all at the same time off *Myrica gale* at Yaxley, Holme, and Ramsey Fens, where they were then in great profusion. The Rev. JENYNS also records it as occurring sparingly at Burwell Fen. This species probably still lingers in the Fens and bordering highland of Huntingdonshire, though so rarely as to render its speedy extinction more than probable.

„ *monacha.* Linn. A specimen at Cambridge (Mr. LAYARD); Brandon (Mr. WHEELER.)

Orgyia pudibunda. Linn. Whittlesford, common; Wicken; Brandon; Cowbit; formerly at Burwell, and Bottisham.

„ *fascelina.* Linn. Whittlesford; Cambridge; Skegness. Apparently restricted to the highlands in Cambridgeshire, but common where it occurs. Plentiful at Swaffham Prior in 1828.

„ *cœnosa.* Hüb. Wicken Fen. In this, probably its only known locality in this country, it is getting rare, and will doubtless soon be extinct. It was formerly abundant at Whittlesea Mere, having been first discovered on the Yaxley portion of the Mere in 1820 by Mr. STANDISH. It has also been taken at Burwell Fen, but with the destruction of that Fen and Whittlesea Mere was lost until Mr. BOND found it at Wicken.

„ *gonostigma.* Linn. Wicken, one specimen (Mr. WHEELER); bred in 1829 from larva found at Horningsea Fen by Mr. WENMAN.

„ *antiqua.* Linn. Abundant everywhere.

Demas coryli. Linn. Fulbourn and Monkswood, not common (Mr. BOND.)

Trichiura cratægi. Linn. Whittlesford; Cherry Hinton; Cambridge (Prof. BABINGTON); Wicken (Mr. FARN); Swaffham (Rev. JENYNS); Ely; Littleport (Mr. GAZE); Chatteris; Wisbech, common; Brandon.

Pœcilocampa populi. Linn. Whittlesford, rare; Cambridge, common; Ely; Chatteris; Warboys Wood; Wisbech, common; Cowbit.

Eriogaster lanestris. Linn. Whittlesford, common; Cambridge, common. Formerly at Ely and Swaffham Prior.

Bombyx neustria. Linn. Abundant everywhere.

,, *rubi*. Linn. Generally distributed and common, especially in the Fens, but has not been observed in the neighbourhood of Wisbech.

,, *quercus*. Linn. Common everywhere.

Odonestis potatoria. Linn. Abundant everywhere, especially in the Fens, where it varies greatly in colour.

Gastropacha quercifolia. Linn. Whittlesford, common; Cherry Hinton; Cambridge; Wicken; Burwell; Chatteris; Wisbech; Brandon; Monkswood; Cowbit. Larvæ abundant at Swaffham Fen in 1828.

Saturnia carpini. Bork. Whittlesford, common; Cambridge, common; Wicken, common. A cocoon at Soham Mere in 1874. Formerly at Burwell. At Cambridge the larvæ feed on the Whitethorn hedges and being gregarious when young, may then be taken in great numbers, the patches of larvæ being easily seen.

GEOMETRÆ

Ourapteryx sambucata. Linn. Generally distributed and common.

Epione apiciaria. W.V. Generally distributed throughout the district.

Rumia cratægata. Linn. Abundant everywhere.

Venilia maculata. Linn. Near Cambridge (Mr. LAYARD).

Angerona prunaria. Linn. Linton and Hildersham Wood (Rev. JENYNS); Cambridge (Prof. BABINGTON); Wicken; Warboys Wood; Brandon; Bourn Wood.

Metrocampa margaritata Linn. Generally distributed throughout the district.

Ellopia fasciaria. Linn. Brandon.

Eurymene dolobraria. Linn. Cambridge and Bottisham (Rev. JENYNS); Wicken (Mr. FARN); Chatteris; Doddington Wood; Monkswood; Brandon.

Pericallia syringaria. Linn. Whittlesford; Cambridge; Swaffham Prior; Soham; Wicken; Chatteris; Wisbech; Cowbit.

Selenia illunaria. Hüb. Generally distributed throughout the district.

,, *illustraria*. Hüb. Cambridge; Soham; Wicken; Stuntney, formerly; Chatteris; Monkswood; Brandon.

Odontopera bidentata. Linn. Granchester (Mr. LAYARD); Near Lynn; Bourn.

Crocallis elinguaria. Linn. Generally distributed throughout the district.

Ennomos tiliaria. Hüb. Whittlesford, rare; Cambridge; Wicken, common; Chatteris, common; Wisbech, abundant; Cowbit; Brandon. More plentiful in the Fens than in the Highlands.

,, *fuscantaria*. Haw. Whittlesford; Ely (Mr. GAZE); Soham; Chatteris, common; Wisbech.

,, *erosaria*. W.V. Ely (Mr. GAZE); Brandon.

,, *angularia*. W.V. Wicken, common; Chatteris; Bottisham, formerly.

Himera pennaria. Linn. Whittlesford, common; Cambridge, abundant; Ely (Mr. GAZE); Doddington Wood; Wisbech; Monkswood, common.

Phigalia pilosaria. W.V. Whittlesford, rare; Cambridge, common; Ely, formerly; Doddington Wood; Wisbech, sometimes common.

Biston hirtaria. Linn. Whittlesford, common; Cambridge, common; Bottisham; Ely; Chatteris; Wisbech, common.

Amphydasis prodromaria. W.V. Whittlesford, common; Cambridge; Ely, rare (Mr. GAZE); Wisbech, sometimes common.

,, *betularia.* Linn. Generally distributed throughout the district.

Hemerophila abruptaria. Thun. Whittlesford, common; Cambridge; Ely; Chatteris; Wisbech, common; Cowbit.

Cleora lichenaria. W.V. Whittlesford, rare; Lakenheath; Swaffham Prior; near Ely; Chatteris, common; Wisbech; Brandon; Cowbit.

Boarmia repandata. Linn. Whittlesford, rare; Cambridge, abundant; Ely; Warboys Wood; Wisbech, common; Brandon.

,, *rhomboidaria.* W.V. Generally distributed throughout the district.

Tephrosia crepuscularia. W.V. Stapleford (Mr. LEE); Lakenheath; near Lynn, scarce.

,, *extersaria.* Hüb. Soham; Monkswood (Mr. BOND).

,, *punctulata.* W.V. Wisbech; Brandon.

Pseudoterpna cytisaria. W.V. Devil's Ditch and Newmarket Heath (Mr. BOND); near Lynn; Brandon; Monkswood (Mr. GAZE); Soham.

Geometra papilionaria. Linn. Whittlesford; Cambridge; Wicken; Ely, (Mr. GAZE); Chatteris; Bourn.

Iodis vernaria. Linn. Whittlesford; Cambridge.

,, *lactearia.* Linn. Whittlesford; Cambridge, abundant; Wicken (Mr. FARN); Ely; Chatteris.

Phorodesma bajularia. W.V. Cambridge (Prof. BABINGTON); Doddington Wood; Warboys Wood; Soham.

Hemithea thymiaria. Linn. Generally distributed throughout the district.

Ephyra porata. Fab. Stapleford (Mr. LEE); Ely (Mr. J. A. SKERTCHLY); Brandon.

,, *punctaria.* Linn. Cambridge; Ely; Cowbit; Brandon.

,, *trilinearia.* Bork. Cambridge (Mr. DENNY); Brandon (Mr. WHEELER.)

,, *omicronaria.* W.V. Cambridge; Warboys Wood.

,, *pendularia.* Linn. One near Stuntney by Mr. GAZE; near Lynn.

Hyria auroraria. Gn. Wicken; Burwell Fen and Bottisham formerly; Holme Fen.

Asthena luteata. W.V. Whittlesford; Ely; Doddington Wood; Warboys Wood.

,, *candidata.* W.V. Whittlesford, common; Cambridge; Wicken and Warboys Wood, common; near Lynn.

Eupisteria heparata. W.V. Whittlesford, rare; Stuntney, (Mr. GAZE); Lakenheath; near Lynn.

Acidalia rubricata. W.V. Wisbech, one specimen; Brandon.

,, *scutulata.* W.V. Whittlesford, rare; Cambridge; Wicken, common; Chatteris, common; Doddington Wood; Wisbech, common; Brandon; Cowbit.

,, *bisetata.* Bork. Generally common.

,, *trigeminata.* Haw. Sutton (Mr. EEDLE.)

,, *interjectaria.* Bdv. [*Dilutaria.* Hüb.] Cambridge; Wicken; Chatteris; Doddington Wood; Brandon.

,, *incanaria.* Hüb. Whittlesford; Cambridge; Ely; Chatteris, common; Wisbech, common; Cowbit.

Acidalia ornata. Scop. Whittlesford, common, (Mr. A. THURNALL.)

,, *promutata.* Gu. Wicken, one specimen, (Mr. F. D. WHEELER); Wisbech; Brandon.

,, *subsericeata.* Haw. Cambridge (Mr. LAYARD).

,, *immutata.* Linn. Whittlesford, common; Cambridge and Bottisham (Rev. JENYNS); Wicken, abundant; Holme Fen; Chatteris; Wisbech; Brandon; Cowbit; in abundance on the borders of Whittlesea Mere (STEPHENS).

,, *remutata.* Hüb. Woods round Whittlesford, common (Mr. BOND); Cambridge (Mr. LAYARD); Ely (Mr. GAZE); Warboys Wood; Brandon; near Lynn; Cowbit.

,, *imitaria.* Hüb. Whittlesford; Cambridge; Swaffham Prior; Chatteris; Doddington Wood; Brandon; Wisbech; Cowbit.

,, *emutaria.* Hüb. Sutton; Cowbit.

,, *aversata.* Linn. Common everywhere.

,, *inornata.* Haw. Cambridge (Mr. LAYARD); Holme Fen; Brandon, common.

,, *emarginata.* Linn. Whittlesford, common; Cambridge (Mr. LAYARD); Wicken; Ely, (Mr. GAZE); Chatteris, common; Doddington Wood; Wisbech; Brandon; Cowbit.

Timandra amataria. Linn. Generally distributed throughout the district.

Cabera pusaria. Linn. Common everywhere.

,, *exanthemaria.* Scop. Common everywhere.

Corycia temerata. W.V. Whittlesford, common; Cambridge (1829); Doddington Wood, common; Warboys Wood; Monkswood, abundant; near Lynn.

,, *taminata.* W.V. Whittlesford, common; Cambridge.

Macaria notata. Linn. Cambridge (Mr. DENNY).

,, *liturata.* Linn. Brandon; Lynn.

Halia wavaria. Linn. Generally common.

Strenia clathrata. Linn. Generally distributed throughout the district, frequently common.

Panagra petraria. Hüb. Soham; Doddington Wood, one specimen (Mr. HAROLD RUSTON); Monkswood; near Lynn; Brandon.

Numeria pulveraria. Linn. In woods at Whittlesford and at Monkswood (Mr. BOND).

Fidonia atomaria. Linn. Whittlesford, rare; Sawston, formerly and Devil's Ditch (Mr. BOND); Bottisham Fen 1828; Wicken, abundant; Holme Fen, common.

,, *piniaria.* Linn. Babraham Plantation and Gog-Magog Hills (Rev. JENYNS); formerly near Six-Mile Bottom (Mr. BOND); Half-acre Wood, near Stuntney (Mr. GAZE); near Lynn, common; Brandon.

Aspilates strigillaria. Hüb. Sawston; Newmarket and Devil's Ditch (Mr. BOND).

,, *citraria.* Hüb. Fens about Whittlesford; Brandon.

Abraxas grossulariata. Linn. Abundant everywhere.

,, *ulmata.* Fab. Soham; Ely; Upwell; Cowbit. Always rare.

Ligdia adustata. W.V. Whittlesford, rare; Cambridge (Rev. JENYNS); Soham; Stuntney (Mr. GAZE); Wicken; Chatteris, rare.

Lomaspilis marginata. Linn. Generally distributed throughout the district.

Hybernia rupicapraria. W.V. Generally common.

,, *leucophæaria.* W.V. Cambridge, common; Cowbit.

,, *aurantiaria.* Hüb. Cambridge, scarce; near Lynn.

,, *progemmaria.* Hüb. Generally common.

,, *defoliaria.* Linn. Generally distributed.

Anisopteryx æscularia. W.V. Generally distributed throughout the district.

Cheimatobia brumata. Linn. Common everywhere.

Oporabia dilutata. W.V. Generally common throughout the district.

Larentia didymata. Linn. Generally common.

,, *multistrigaria.* Hw. Cambridge, common; Reach Ditch, formerly.

,, *pectinitaria.* Fuessl. Generally distributed throughout the district.

Emmelesia affinitata. Ste. Whittlesford, one specimen (Mr. A. THURNALL); near Wicken (Mr. F. D. WHEELER); Monkswood, common.

,, *alchemillata.* Linn. Stuntney (Mr. GAZE); Yaxley Fen very common when scarce every where else (Mr. BOND); Chatteris; Brandon; Cowbit.

,, *albulata.* W.V. Wicken; Ely (Mr. GAZE); Cowbit.

,, *decolorata.* Hüb. Whittlesford; Ely (Mr. GAZE); Brandon.

,, *unifasciata.* Hw. Near Cambridge (Mr. LAYARD); Wicken.

Eupithecia venosata. Fab. Formerly abundant near Fulbourn; Cambridge; Chatteris; Brandon; Cowbit; one at Swaffham Prior in 1829; Bottisham.

,, *consignata.* Bork. Cambridge, rare.

,, *linariata.* W.V. Whittlesford, rare; Wicken; Brandon.

,, *pulchellata.* Ste. Whittlesford, common; Ely; Brandon.

,, *centaureata.* W.V. Common throughout the district.

,, *succenturiata.* Linn. Cherry Hinton Chalk pits, scarce (Mr. BOND); Soham.

,, *valerianata.* Hüb. [*viminata.*] Wicken, common, where it was first taken by Mr. BOND. Bottisham (Rev. JENYNS.)

,, *subfulvata.* Haw. Cambridge; Ely; Chatteris; Wisbech; Brandon.

,, *subumbrata.* W.V. Wicken; Horningsea Fen, plentiful for several years in succession (Mr. BOND.)

,, *plumbeolata.* Haw. On gravelly banks round Whittlesford (Mr. BOND).

,, *isogrammata.* Tr. Whittlesford, common.

,, *pygmæata.* Hüb. Wicken, rare; Ely; Yaxley, formerly, where it was first discovered in 1850.

,, *castigata.* Haw. Cambridge, common; Wicken; Chatteris; Wisbech, common; Brandon.

,, *lariciata.* Freyer. Brandon (Mr. C. G. BARRETT.)

,, *pimpinellata.* Hüb. Whittlesford and Fulbourn (Mr. BOND); Wicken, one specimen, (Mr. F. D. WHEELER.)

,, *fraxinata.* Crewe. Whittlesford, rare; Soham.

,, *indigata.* Hüb. Wicken (Mr. EEDLE).

,, *nanata.* Hüb. Wicken; Brandon.

,, *subnotata.* Hüb. Whittlesford, rare; Chatteris; Wisbech; Brandon; Cowbit.

,, *vulgata.* Haw. Generally distributed and common throughout the district.

,, *absynthiata.* Linn. Whittlesford, rare; Wicken; near Wicken; Chatteris; Wisbech; Brandon.

,, *minutata.* Hüb. Wicken; Brandon.

,, *assimilata.* Dbl. Near Wicken; Chatteris; Wisbech; Cowbit.

,, *tenuiata.* Hüb. Wicken, common.

,, *subciliata.* Gu. Whittlesford, rare; Cherry Hinton (Mr. BOND).

,, *abbreviata.* Ste. Whittlesford, common; Ely (Mr. GAZE); Monkswood; Brandon.

,, *exiguata.* Hüb. Whittlesford; Cambridge; Wicken; Chatteris; Wisbech; Brandon; Cowbit.

Eupithecia sobrinata. Hüb. Chatteris (Mr. HAROLD RUSTON); Wisbech; Brandon.

,, *togata*. Hüb. Wisbech, one specimen.

,, *pumilata*. Hüb. Whittlesford (Mr. BOND); Wicken (Mr. FARN.)

,, *coronata*. Hüb. Whittlesford; Ely (Mr. GAZE); Chatteris; Wisbech.

,, *rectangulata*. Linn. Probably common throughout the district.

Collix sparsata. Hüb. Wicken.

Lobophora sexalata. Hub. Whittlesford, rare; Wicken, common; Wisbech, rare.

,, *hexapterata*. W.V. Whittlesford, rare, where it also used to be taken by Mr. BOND; Wicken.

,, *viretata*. Hüb. Whittlesford, rare.

,, *lobulata*. Hub. Woods round Whittlesford (Mr. BOND); Bottisham (Rev. JENYNS); Stuntney (Mr. GAZE.)

Thera variata. W.V. Whittlesford, common; Cambridge (Rev. JENYNS); Stuntney (Mr. GAZE); Brandon; Lynn.

,, *firmata*. Hüb. Wisbech; Brandon.

Ypsipetes ruberata. Fre. Cam side, rare; Ely (Mr. GAZE); Chatteris; Wisbech.

,, *impluviata*. W.V. Whittlesford, rare; Cambridge (Rev. JENYNS); Wicken; Ely (Mr. GAZE.)

,, *elutata*. W.V. Whittlesford; Cambridge (Rev. JENYNS); Wicken; Ely, (Mr. GAZE): Chatteris; Wisbech; Cowbit. Probably common throughout the district.

Melanthia rubiginata. W.V. Cambridge (Rev. JENYNS); Ely; Wicken, rare; Doddington Wood; Warboys Wood, common; Wisbech; Cowbit.

,, *ocellata*. Linn. Whittlesford, common; Cambridge, common; Swaffham Bulbeck; Wicken common; Ely (Mr. GAZE); Chatteris, rare; Wisbech, rare; Brandon, Cowbit.

,, *albicillata*. Linn. Whittlesford; Cambridge, 1829 (Prof. BABINGTON); Warboys Wood; Wisbech, rare.

Melanippe procellata. W.V. Cherry Hinton; also formerly by Mr. AIKIN.

,, *unangulata*. Haw. Wicken Fen and near Downham Market.

,, *rivata*. Hüb. Whittlesford, rare; Cherry Hinton; Madingley; Wicken.

[,, *galiata*. W.V. CURTIS records the variety *quadriannulata* to have occurred at Wisbech, and it is copied by STEPHENS, WESTWOOD, and others, but it is doubtless an error.]

,, *sociata*. Bork. [*subtristata*. Haw.] Generally distributed throughout the district.

,, *montanata*. W.V. Generally distributed and mostly common throughout the district.

,, *fluctuata*. Linn. Abundant everywhere.

Anticlea sinuata. W.V. Whittlesford; Cambridge; Newmarket; Brandon.

,, *rubidata*, W.V. Whittlesford, rare; Brandon.

,, *badiata*. W.V. Whittlesford, common; Cambridge, abundant; Soham; Ely; Chatteris; Wisbech; Brandon.

,, *derivata*. W.V. Whittlesford, rare; Soham; Bottisham (Rev. JENYNS); Wicken; Ely (Mr. GAZE); Chatteris; Cowbit; Brandon.

,, *berberata*. W.V. Whittlesford; Trumpington (Mr. LAYARD.)

Coremia propugnata. W.V. Rather plentiful round Cambridge (Mr. BOND); Soham.

,, *ferrugata*. Linn. Common throughout the district.

,, *unidentata*. Haw. Common throughout the district.

,, *quadrifasciaria*. Linn. Whittlesford, rare; Cambridge; Madingley.

Camptogramma bilineata. Linn. Common everywhere.

Camptogramma fluviata. Hüb. Wicken, (Mr. F. D. WHEELER); Wisbech, one; Brandon.

Phibalapteryx tersata. W.V. Whittlesford, common; Cherry Hinton; Chatteris.

" *lignata.* Hüb. Wicken, common; Brandon, common in Fens; Cowbit.

" *polygrammata.* Bork. Burwell and Wicken Fens, in the former locality abundant (Mr. BOND.) Has not been taken for many years, and is probably now extinct in the district.

" *vitalbata.* W.V. Cambridge, common; Cherry Hinton.

Scotosia dubitata. Linn. Whittlesford, common; Cambridge, common; Bottisham; Burwell and Ely (Mr. GAZE); Chatteris, common; Wisbech; Cowbit.

" *vetulata.* W.V. Cherry Hinton; Cambridge; Wicken; Burwell and Ely, (Mr. GAZE); Monkswood.

" *rhamnata.* W.V. Whittlesford, common; Cherry Hinton, common; Wicken; Monkswood; Cowbit.

" *certata.* Hüb. Whittlesford, common.

" *undulata.* Linn. Cambridge (Mr. LAYARD); Wicken; Wisbech, rare.

Cidaria psittacata. W.V. Cambridge (Mr. LAYARD); Bottisham, not common (Rev. JENYNS); near Lynn.

" *miata.* Linn. Common throughout the district.

" *corylata.* Thun. Soham; Doddington Wood, rare; Warboys Wood, common; Brandon.

" *sagittata.* Fab. Wicken, common; Chatteris, abundant; Wimblington, abundant; Holme Fen. This beautiful species was first found near Ely, in 1838, by Mr. MARSHALL FISHER, but he did not publish his capture, and it was not known as British until 1848, when Mr. DOUBLEDAY received a specimen from the old Whittlesea Mere locality.

" *russata.* W.V. Common everywhere.

" *immanata.* Haw. Cambridge (Mr. LAYARD); Wicken.

" *suffumata.* W.V. Whittlesford, common; Madingley; Cambridge (Mr. LAYARD.)

" *silaceata.* W.V. Whittlesford; Wicken, one specimen (Mr. F. D. WHEELER.)

" *prunata.* Linn. Cambridge, one specimen (Mr. F. D. WHEELER); Swaffham Prior (Rev. JENYNS); Wisbech, common; Brandon.

" *testata.* Linn. Common throughout the district.

" *populata.* Bork. An undoubted specimen taken at Barton Bendish, (Trans. Norf. and Norw. Soc. 1873-4.) Mr. LAYARD also gives Cambridge for it.

" *fulvata.* For. Whittlesford; Cherry Hinton; Cambridge, (Rev. JENYNS); Ely; Wicken; Chatteris; Doddington Wood; Wisbech; Cowbit.

" *pyraliata.* Bork. Common throughout the district.

" *dotata.* Linn. Whittlesford, rare; Wicken, abundant; Chatteris; Upwell; Wisbech; Brandon.

Pelurga comitata. Linn. Whittlesford, rare; Cambridge (Rev. JENYNS); Wicken, abundant; Chatteris, common; Wisbech; Upwell; Brandon.

Eubolia cervinaria. W.V. Probably common throughout the district.

" *mensuraria.* W.V. Common throughout the district.

" *palumbaria.* W.V. Sawston Fen, and used to be common at Devil's Ditch, (Mr. BOND); Soham.

" *bipunctaria.* W.V. Whittlesford; Cherry Hinton; near Cambridge, formerly; Swaffham Prior (1829); Brandon.

" *lineolata.* W.V. Used to be taken on the Heath at Newmarket and on the brow of Devil's Ditch plentifully (Mr. BOND.)

Anaitis plagiata. Linn. Whittlesford, common; Cambridge, common; Soham; Bottisham (Rev. Jenyns); Ely (Mr. Gaze); Chatteris, one specimen (Mr. Daniel Fryer); Upwell; Brandon.

Lithostege griseata. W.V. Brandon, on the "Breck" district.

Chesias spartiata. Fab. Cambridge; Chatteris; Mill Fen, near Lynn; Brandon.

" *obliquaria.* W.V. Brandon.

Tanagra chærophyllata. Linn. Gamlingay Heath in 1829 (Rev. Jenyns); Whittlesford, formerly (Mr. Bond.)

DREPANULIDÆ.

Platypteryx lacertula. Hüb. Wood (1839) gives a variety of this insect as then occurring at Monkswood.

" *falcula.* W.V. Ely and near Stuntney, (Mr. Gaze); Near Lynn.

" *hamula.* W.V. One female at Madingley (Mr. G. H. Raynor); Monkswood.

Cilix spinula. W.V. Generally distributed and common.

PSEUDO-BOMBYCES.

Cerura furcula. Linn. Whittlesford (Mr. Bond); Cambridge; Horningsea Fen, formerly; Wicken; Monkswood (1828); Chatteris; Wisbech.

" *bifida.* Hub. Whittlesford; Cambridge; Soham; Chatteris; Wisbech.

" *vinula.* Linn. Abundant everywhere.

Stauropus fagi. Linn. Formerly taken at Fulbourn by Mr. Bond, and at Ely by Mr. Gaze, who also found the larvæ on birch near Stuntney.

Petasia cassinea. Fab. Duxford and Fulbourn (Mr. Bond); Cambridge; Monkswood; Ely, formerly, on gas lamps (Mr. Gaze); Brandon.

Pygæra bucephala. Linn. Abundant everywhere.

Clostera curtula. Linn. Whittlesford, rare; Cambridge (Mr. Denny); Soham; Wicken; Chatteris, rare; Holme Fen; Yaxley Fen, common (Mr. Bond.)

" *reclusa.* W.V. Whittlesford, rare; Stapleford; Cambridge formerly; Horningsea Fen (Mr. Aikin); Wicken, rare; Holme Fen.

Ptilophora plumigera. W.V. Soham and Wicken (Mr. Eedle.)

Ptilodontis palpina. Linn. Whittlesford; Cambridge; Wicken; Littleport Fen (Mr. Gaze); Wisbech; Brandon; Cowbit; used formerly to be rather plentiful at Cambridge.

Notodonta camelina. Linn. Whittlesford, common; Cambridge; Bottisham (Rev. Jenyns); Ely; Chatteris; Wisbech, common.

" *cucullina.* W.V. Sutton (Mr. Eedle.)

" *carmelita.* Esp. Sutton (Mr. Eedle.)

" *dictæa.* Linn. Shelford; Cambridge; Baitsbite; Swaffham Prior (Rev. Jenyns); Wisbech. Used to swarm at Fulbourn in a plantation cut down in making the railway (Mr. Bond.)

" *dictæoides.* Esp. Cambridge (Mr. Layard); Wicken; near Stuntney (Mr. Gaze; Cowbit.

" *dromedarius.* Linn. Cambridge (Mr. Layard); near Stuntney (Mr. Gaze; near Lynn.

" *ziczac.* Linn. Stapleford (Mr. M. Lee); Cambridge; Wicken; Holme Fen; Ely and Stuntney (Mr. Gaze); Chatteris; Wisbech; Skegness.

" *dodonea.* W.V. Whittlesford; Shelford; Stapleford (Mr. Lee); Brandon; near Lynn; always rare.

Diloba cæruleocephala. Linn. Generally distributed and common throughout the district.

NOCTUÆ.

Thyatira derasa. Linn. Whittlesford; Cambridge; Chippenham; Wicken; Burwell; Chatteris; Doddington Wood; Wisbech; Upwell; Brandon. Widely distributed but not a common species anywhere.

" *batis.* Linn. Whittlesford, rare; Wicken; Ely; Peterboro'; Monkswood.

Cymatophora duplaris. Linn. Whittlesford; near Stuntney (Mr. GAZE); Lakenheath; Chatteris; Doddington Wood; Brandon. Always rare in the district.

" *diluta.* W.V. Ely, (Mr. J. A. SKERTCHLY.)

" *or.* W.V. Cambridge; Chippenham; Monkswood.

" *ocularis.* Linn. Whittlesford; Madingley Wood, formerly; Cambridge; Wicken; Chippenham; Newmarket; Brandon. Probably occurs throughout the district.

" *ridens.* Fisch. Near Lynn.

Bryophila glandifera. W.V. Cambridge, (Mr. E. L. LAYARD and Mr. W. WARREN). The insect taken by Mr. WARREN appears to be the variety known as *par.* About eight of these have been taken at Cambridge, while the true *glandifera* is not known to have occurred there, so that it would appear to be either a permanent local variety or a distinct species.

" *perla.* W.V. Common everywhere. The red variety has been taken at Whittlesford.

Acronycta tridens. W.V. Whittlesford, rare; Cambridge; Chatteris; Wimblington; Wisbech; Brandon.

" *psi.* Linn. Abundant everywhere.

" *leporina.* Linn. Cambridge (Mr. LAYARD); Soham; Holme Fen; Skegness.

" *aceris.* Linn. Whittlesford, common; Cambridge, common; Bottisham; Swaffham Prior; Chippenham; Soham; Ely, common; Chatteris; Peterboro'; Brandon.

" *megacephala.* W.V. Whittlesford, common; Cambridge; Wicken; Bottisham; Chatteris; Holme Fen; Peterboro'; Wisbech; Brandon; Cowbit.

" *strigosa.* Fab. Whittlesford; Fulbourn; Cambridge; Waterbech; Isleham; Wicken; Chatteris; Monkswood. Rare everywhere except at Fulbourn and Monkswood, at which places it has occurred in some abundance.

" *alni.* Linn. Whittlesford; Chatteris; one specimen at each locality.

" *ligustri.* W.V. Whittlesford, common; Bottisham; Soham; Chippenham; Skegness.

" *rumicis.* Linn. Whittlesford; Cambridge; Wicken; Chippenham; Chatteris; Wisbech; Peterboro'; Brandon; Cowbit.

Simyra venosa. Bork. Wicken Fen; Reach, Bottisham, and Chippenham Fens, formerly; Whittlesea Mere, formerly in great abundance in the larva state but very subject to Ichneumons (Mr. BOND). STEPHENS records two or three specimens at Wisbech.

[*Synia musculosa.* Hub. WOOD in 1839 gives Whittlesea and Yaxley Meres for this rare insect, doubtless an error. The only known captures of *musculosa* in England are two or three specimens at Brighton.]

Leucania conigera. W.V. Whittlesford, common; Cam side below Cambridge; Chippenham; Wicken; Ely (Mr. GAZE); March; Wisbech, common; Peterboro'; Cowbit.

" *lithargyria.* Esp. Generally distributed and common throughout the district.

" *albipuncta.* W.V. One specimen was found in a box of insects collected at Yaxley for the late Mr. ALLIS.

Leucania obsoleta. Hub. Near Whittlesford; Yaxley and Wicken (Mr. BOND); Holme Fen.

" *littoralis.* Cur. Near Skegness in 1858 by Mr. GASCOYNE of Newark.

" *pudorina.* W.V. Whittlesford, rare; Wicken, abundant; Holme Fen; Yaxley, formerly. Discovered in the New Forest in 1821, and the following year plentiful at Whittlesea Mere.

" *comma.* Linn. Whittlesford; round Cambridge; Wicken; Ely, formerly; Chatteris; Upwell; Wisbech; Brandon; Cowbit. Always rare.

" *straminea.* Tr. Whittlesford; Wicken; used to be common at Yaxley.

" *impura.* Hub. Common everywhere.

" *pallens.* Linn. Abundant everywhere.

" *phragmitidis.* Hub. Generally distributed throughout the district.

Meliana flammea. Cur. Chippenham Fen; Whittlesea Mere; Wicken, not uncommon; Brandon. Probably to be met with along the courses of the Ouse and Cam throughout the district.

Senta ulvæ. Hub. Wicken Fen; Upwell; Holme Fen; Yaxley Fen abundant in 1847 and 1848 (Mr. BOND).

Nonagria despecta. Tr. Generally distributed throughout the district, but not common.

" *fulva.* Hub. Whittlesford, common; Chippenham Fen; Whittlesea Mere, formerly; Wicken, common; Ely (Mr. GAZE); Chatteris, rare; Wisbech, common; Cowbit.

" *concolor* Gu. Whittlesford; borders of Whittlesea Mere and Yaxley Fen; Holme Fen; Wicken and Chippenham Fens (Mr. WAGSTAFF). This species has not been taken for some years, and is now probably extinct.

" *hellmanni.* Evers. Fens about Whittlesford, common; Chippenham; Wicken, common; Whittlesea Mere; Holme Fen; Monkswood, common; Chatteris, rare; Cowbit. First discovered in 1847 at Yaxley by Mr. BOND.

" *neurica.* Hub. Whittlesford, rare; Lakenheath; Whittlesea Mere. First discovered by Mr. BOND at Yaxley in 1847, and he has also taken it at Wicken.

" *geminipuncta.* Hatch. Whittlesford, common; Shelford; Chippenham; Yaxley and Wicken (Mr. BOND).

" *cannæ.* Och. Fens about Whittlesford; Whittlesea Mere. No recent captures are recorded. First taken in 1846 at Whittlesea Mere by Mr. SHEPHERD. In 1848 Mr. BOND bred it from larva.

" *typhæ.* Esp. Common throughout the district.

" *lutosa.* Hub. Whittlesford; Wicken; Ely; Chatteris; Wisbech; not uncommon.

Gortyna flavago. W.V. Whittlesford, common; Cambridge; Wicken; Stuntney; Chippenham; Newmarket; Ely; Chatteris; Wisbech, common.

Hydæcia nictitans. Linn. Whittlesford, rare; Wicken, scarce; Chatteris; Brandon; Wisbech, common; Peterboro'.

" *petasites.* Dbl. Wicken (Mr. EEDLE); Wisbech, 2 specimens in different years. First taken in England in 1846.

" *micacea.* Esp. Whittlesford, common; Cambridge; Baitsbite; Bottisham; Wicken, abundant; Chatteris; Upwell; Brandon; Wisbech, common; Peterboro'; Cowbit.

Axylia putris. Linn. Generally distributed throughout the district, often common.

Xylophasia rurea. Fab. Cambridge and Bottisham, (Rev. JENYNS); Ely; Chatteris, rare; Wisbech, common; Brandon; Peterboro'; Cowbit.

" *lithoxylea.* W.V. Generally distributed and common.

" *sublustris.* Esp. Whittlesford; Waterbech; Monkswood.

Xylophasia polyodon. Linn. Abundant everywhere.

,, *hepatica.* Linn. Whittlesford; Bottisham; Wicken; Ely; Doddington Wood.

Dipterygia pinastri. Linn. Wisbech, rare; Brandon, abundant (Mr. WHEELER.)

Neuria saponariæ. Esp. Whittlesford; Bottisham (Rev. JENYNS); Chippenham; Wicken; Chatteris; Brandon.

Heliophobus popularis. Fab. Generally common.

Charæas graminis. Linn. Fens about Whittlesford, rare; Swaffham Prior Fen 1832; Soham; Yaxley, formerly (Mr. BOND); Wicken, one specimen; Peterboro'; Brandon; Lynn.

Cerigo cytherea. Fab. Whittlesford, rare; Chippenham; Ely (Mr. GAZE); Chatteris, common; Wisbech, rare; Brandon; Cowbit; Peterboro'; Skegness; Probably common on all the gravelly islands of the Fens.

Luperina testacea. W.V. Generally distributed and common.

,, *cespitis.* W.V. Fulbourn and Devil's Ditch (Mr. BOND); Brandon (Mr WHEELER)

Mamestra abjecta. Hüb. Whittlesford; Cambridge; Wicken; Chatteris; Wisbech; Holme Fen; Monkswood; rare in all places except Monkswood, where it sometimes occurs abundantly.

,, *anceps.* Hüb. Cambridge; Bottisham; Chippenham; Wicken; Ely (Mr. GAZE); Chatteris; Wisbech; Peterboro'; Brandon. Plentiful at Chatteris in some seasons, but not constantly.

,, *albicolon.* Hüb. Brandon (Mr. BARRETT.)

,, *brassicæ.* Linn. Abundant everywhere.

,, *persicariæ.* Linn. Generally distributed and common.

Apamea basilinea. W.V. Whittlesford, common; Chippenham, common; Bottisham; Wicken; Ely (Mr. GAZE); Chatteris, rare; Wisbech, sometimes common; Peterboro'; Cowbit.

,, *gemina.* Hüb. Whittlesford, rare; Stapleford; Bottisham; Chippenham, common; Ely; Wicken, common; Chatteris; Wisbech, rare; Cowbit.

,, *unanimis.* Hüb. Whittlesford, common; Shelford (Mr. LEE); Cambridge; Bottisham; Chippenham, common; Wicken, common; Chatteris.

,, *ophiogramma.* Esp. Shelford, not uncommon in 1842 (Mr LEE); Chippenham (Mr. WAGSTAFF); Cowbit.

,, *fibrosa.* Hüb. Fens about Whittlesford, common; Cambridge; Whittlesea Mere in great profusion in 1822; Chippenham Fen; Wicken, common; Ely, formerly; Cowbit.

,, *oculea.* Linn. Abundant everywhere.

Miana strigilis. Linn. Abundant everywhere (Var. *æthiops* is the typical form in the Fens: Mr. F. D. WHEELER.)

,, *fasciuncula.* Haw. Whittlesford, rare; Chippenham; Wicken; Chatteris, common; Cowbit; Skegness.

,, *literosa.* Haw. Whittlesford, not common; Cambridge; Chippenham; Skegness.

,, *furuncula.* W.V. Generally distributed. Excessively abundant at Brandon.

,, *arcuosa.* Haw. Whittlesford, common; Cambridge; Wicken, common; Chatteris; Skegness.

Celæna haworthii. Curt. Taken formerly at Whittlesea Mere in great plenty, which was the only locality given by STEPHENS, WOOD, and other early writers. In 1847 Mr. BOND used to take it at Yaxley, but it was then scarce. It has long disappeared from the district.

Grammesia trilinea. W.V. Whittlesford; Madingley; Cambridge; Bottisham; Wicken; Chatteris; Wisbech; Peterboro'; Cowbit; usually common. Brandon abundant.

Hydrilla palustris. Hüb. Quy Fen, one specimen by Mr. G. N. SCHOFIELD, (see *Ento. Mag.*, 1870, p. 218.) Another specimen taken the same year near Cambridge, was in the collection of the late Mr. DOUBLEDAY, its capture being recorded by Mr. DUNNING in the Entomologist, vol. 10, p. 99. Several taken in 1877 at Wicken. Mr. WHEELER remarks that it flutters about *in* the grass and herbage, and seems hardly ever to fly up. The claim of this scarce insect to be considered British long rested upon a single capture near York.

Caradrina morpheus. Hufn. Probably common throughout the district.

,, *alsines.* Bork. Whittlesford, rare (Mr. THURNALL); Cambridge (Mr. DENNY); Wicken (Mr. FARN); Brandon; Wisbech.

,, *blanda.* W.V. Probably common throughout the district.

,, *cubicularis.* W.V. Abundant everywhere.

Rusina tenebrosa. Hub. Whittlesford, common; Wicken; Chatteris, rare; Wisbech, rare; Brandon, abundant (Mr. WHEELER).

Agrotis valligera. W.V. Stapleford, one specimen (Rev. JENYNS); Cambridge (Rev. JENYNS); Chippenham; Brandon, excessively abundant; Upwell; Lynn; Skegness; Extends up the Ouse to St. Ives. The attention of entomologists is especially called to this coast species to ascertain its distribution in the Fens.

,, *puta.* Hüb. Whittlesford; Cambridge; Chippenham; Ely; Wicken; Chatteris; Peterboro'; Brandon; Cowbit; common in all these localities.

,, *suffusa.* W.V. Generally distributed and common.

,, *saucia.* Hüb. Whittlesford; near Cambridge (Mr. BOND); Waterbech; Chippenham; Chatteris; Wisbech; not constant at these localities and always rare.

,, *segetum.* W.V. Abundant everywhere; larvæ often injurious to root crops.

,, *exclamationis.* Linn. Almost as abundant and injurious as the above species.

,, *corticea.* W.V. Whittlesford, rare; Cambridge, common; Chippenham; Ely (Mr. GAZE); Chatteris, rare;. Upwell, rare; Brandon; Wisbech, rare; Peterboro'; Cowbit; Skegness.

,, *cinerea.* W.V. Gog-Magog Hills (Mr. BOND); Brandon (LORD WALSINGHAM.)

,, *nigricans.* Linn. Probably common throughout the district, in some places abundant.

,, *tritici.* Linn. Whittlesford, common; Cambridge; Ely, formerly; Wicken; Chatteris; Brandon, common; Wisbech; Peterboro'; Skegness; formerly at Whittlesea Mere.

,, *aquilina.* W.V. Whittlesford, rare; Cambridge, rare; Chippenham; Wicken; Chatteris, common; Wisbech, rare; Brandon, common; Skegness.

,, *agathina.* Dup. STEPHENS records a specimen taken at Whittlesea Mere under the name of *albimacula*; Mr. WAGSTAFF took it at Newmarket more recently; and Mr. FARN at Ely in 1877.

,, *porphyrea.* W.V. Holme Fen; Ely (Mr. FARN); Brandon.

,, *præcox.* Linn. Brandon (Mr. WHEELER).

,, *ravida.* W.V. Whittlesford, common; Shelford; Cambridge; Bottisham; Wicken; Chatteris, sometimes abundant; Holme Fen; Peterboro'; Monkswood, common; Wisbech; Brandon; Cowbit; Skegness.

Tryphæna janthina. W.V. Whittlesford, common; Cherry Hinton; Chippenham, common; Wicken; Ely; Chatteris; Wisbech; Upwell; Peterboro'; Cowbit.

fimbria. Linn. Whittlesford, common; Madingley; Cambridge; Chatteris, rare; Brandon; Peterboro'; Cowbit; Skegness.

" *interjecta.* Hüb. Whittlesford, common; on the Cherry Hinton road in 1841 in great numbers; Cambridge; Wicken; Chatteris; Upwell; Wisbech; Peterboro.'

" *subsequa.* W.V. Brandon.

" *orbona.* Fab. Common everywhere.

" *pronuba.* Linn. Abundant everywhere.

Noctua glareosa. Esp. Isleham (Mr. Wagstaff).

" *augur.* Fab. Whittlesford, common; Bottisham; Chippenham, common; Ely; Wicken; Chatteris, common; Peterboro'; Cowbit.

" *plecta.* Linn. Whittlesford, common; Cambridge; Ely; Wicken; Chatteris; Upwell; Brandon; Wisbech; Cowbit.

" *c-nigrum.* Linn. Generally common throughout the district.

" *triangulum.* Ochs. Whittlesford, common; Cambridge; Madingley; Chippenham; Chatteris; Holme Fen: Brandon; Wisbech.

" *rhomboidea.* Tr. Whittlesford, rare. Whittlesea Mere formerly, where it was discovered in 1828 in which year four were taken there.

" *brunnea.* W.V. Cambridge (Mr. Bond); Chippenham; Wicken; Chatteris; Doddington Wood,; Brandon.

" *festiva.* W.V. Whittlesford; Chippenham, common; Chatteris; Doddington Wood; Wisbech; Brandon; usually rare in this district.

" *subrosea.* Ste. Yaxley Fen, formerly in abundance; first taken by Mr. Weaver, but the locality was not known until Mr. Stretton, a local collector, found it in 1846 and 1847. Mr. Bond first took the larva. The insect has not been taken for many years.

" *rubi.* Vie. Whittlesford; Cambridge; Yaxley; Wicken; Chatteris; Wisbech; Peterboro'; Brandon.

" *umbrosa.* Hüb. Whittlesford; Cambridge; Wicken; Chatteris; Lynn; Peterboro.' Generally common.

" *baja.* W.V. Usually common, but not taken at Wisbech.

" *neglecta.* Hüb. Newmarket (Mr. Wagstaff); Brandon, where Mr. Wheeler takes a most extraordinary deep red variety with narrow wings.

" *xanthographa.* W.V. Abundant everywhere.

Trachea piniperda. Esp. Near Stuntney (Mr. Gaze); Chippenham; Brandon; Lynn.

Tæniocampa gothica. Linn. Abundant everywhere.

" *rubricosa.* W.V. Whittlesford; Madingley; Cambridge; Chippenham; Ely (Mr. Gaze); Wicken; Chatteris; Brandon; Peterboro'; usually common where it occurs.

" *instabilis.* W.V. Abundant everywhere.

" *opima.* Hüb. Wicken (Mr. Eedle.)

" *populeti.* Fab. Whittlesford, rare; Chippenham; Wicken.

" *stabilis.* W.V. Abundant everywhere.

" *gracilis.* W.V. Whittlesford; Chippenham; Wicken, common; Ely (Mr. Gaze); Chatteris, rare; Peterboro'; Cowbit.

" *miniosa.* W.V. Occurs at Peterboro' and Monkswood, but does not appear to extend to the Fens.

" *munda.* W.V. Whittlesford; Chippenham; Wicken; Ely; Peterboro.'

Tæniocampa cruda. W.V. Whittlesford, rare; Cambridge, common; Chippenham, common; Ely (Mr. GAZE); Wicken, common; Chatteris; Doddington Wood; Peterboro'; Cowbit.

Orthosia upsilon. W.V. Whittlesford; Cambridge; Chippenham; Wicken; Chatteris; Wisbech; Peterboro.' Generally distributed and common.

,, *lota.* Linn. Whittlesford; Cambridge; Bottisham; Chippenham, common; Wicken; Ely; Chatteris; Wisbech; Peterboro.' Generally distributed and common.

,, *macilenta.* Hüb. Whittlesford, common; Cambridge; Chippenham; Bottisham; Wicken; Ely; Chatteris, rare; Peterboro'.

Anchocelis pistacina. W.V. Generally distributed and common.

,, *lunosa.* Haw. Whittlesford, common; Cambridge; Chippenham; Chatteris; Wisbech, abundant; Peterboro.'

,, *litura.* Linn. Whittlesford, common; Cambridge; Chippenham, common; Ely (Mr. GAZE); Chatteris.

Cerastis vaccinii. Linn. Whittlesford, common; Shelford; Cambridge; Chippenham, common; Ely (Mr. GAZE); Wicken; Chatteris, very rare; Doddington Wood, rare; Peterboro'; near Lynn.

,, *spadicea.* W.V. Generally distributed and abundant throughout the district.

Scopelosoma satellitia. Linn. Whittlesford, common; Cambridge; Chippenham, common; Wicken; Chatteris; Wisbech; Peterboro.' Widely spread in the district, but not so common, especially in the Fens, as it usually is.

Dasycampa rubiginea. W.V. Cambridge, two specimens in the College gardens, at ivy in 1873, by Mr. F. D. WHEELER.

Xanthia citrago. Linn. Whittlesford; Cambridge.

,, *cerago.* W.V. Whittlesford; Cambridge; Wicken; Littleport Fen (Mr. GAZE); Chatteris; Doddington Wood; Wisbech. Apparently rare throughout the district.

,, *silago.* Hüb. Whittlesford, common; Wicken; Littleport Fen (Mr. GAZE); Chippenham; Chatteris; Wisbech.

,, *gilvago.* Esp. Whittlesford, common; Chippenham (Mr. WAGSTAFF); Chatteris, abundant; Wisbech; widely spread but local; generally abundant where it occurs.

,, *ferruginea.* W.V. Usually abundant, not noticed at Wisbech.

Cirrœdia xerampelina. Hüb. Whittlesford, common; Stapleford (Mr. LAYARD); Chippenham (Mr. WAGSTAFF); Chatteris, rare.

Tethea subtusa. W.V. Whittlesford, rare; one near Stuntney by Mr. GAZE.

,, *retusa.* Linn. Round Cambridge and at Monkswood (Mr. BOND); Soham; Chippenham; Isleham.

Cosmia trapezina. Linn. Common throughout the district.

,, *pyralina.* W.V. Monkswood.

,, *diffinis.* Linn. Whittlesford, common; Cambridge; Chippenham; Newmarket; Wicken; Chatteris; Wisbech; Brandon; Peterboro.'

,, *affinis.* Linn. Whittlesford, common; Bottisham; Chippenham; Isleham; Wicken; Ely; Chatteris; Upwell; Brandon; Peterboro'; Skegness.

Eremobia ochroleuca. W.V. Whittlesford; Gamlingay; Cambridge; Reach Ditch (Mr. GAZE); Isleham; Wicken; Chatteris; Upwell; Peterboro'.

Dianthœcia irregularis. Huf. Tuddenham; Brandon.

,, *carpophaga.* Bork. Whittlesford, rare; Chippenham; Brandon, abundant.

Dianthœcia capsincola. W.V. Whittlesford; Chippenham; Wicken; Chatteris; Wisbech; Brandon; Peterboro'; Cowbit. Probably common throughout the district.

,, *cucubali*. W.V. Whittlesford, rare; Bottisham; Reach Ditch, formerly; Chippenham; Newmarket; Wicken; Chatteris, rare; Brandon.

,, *conspersa*. W.V. Whittlesford, rare; Soham; Chippenham; Wicken, one specimen (Mr. F. D. Wheeler); Yaxley, where it used to be taken freely by Mr. Bond, flying round thistle flowers.

Hecatera dysodea. W.V. Whittlesford, common; Cambridge, abundant; Chippenham; Newmarket; Wicken; Chatteris, abundant; Wisbech; Upwell; Brandon, common; Peterboro'. The larva of this species feeds upon the garden lettuce. The natural food plant is not known probably it is *Latuca saligna*, which formerly grew near Cambridge, and of which acres may now be found growing on the banks of the Hundred-foot drain. The larva was found upon a plant of *Latuca saligna* growing in a garden at Chatteris.

,, *serena*. W.V. Whittlesford, common; Cambridge, common; Chippenham; Isleham; Wicken; Chatteris, rare; Peterboro'; Brandon, common.

Polia flavocincta. Linn. Whittlesford, rare; Cambridge, common; Soham; Chippenham; Bottisham (Rev. Jenyns); Burwell (Mr. Gazel); March, rare; Brandon.

Epunda lutulenta. W.V. Whittlesford, common; Chippenham; Chatteris, rare.

,, *nigra*. Haw. Isleham; Chatteris, abundant; Peterboro'; Cowbit.

,, *viminalis*. Fab. Chippenham; Wicken; Wisbech; Peterboro'; Monkswood.

Miselia oxyacanthæ. Linn. Abundant everywhere.

Agriopis aprilina. Linn. Whittlesford, rare; Stapleford; Chippenham; Oxburgh; Brandon. This species must have escaped the observation of collectors in the Fenland, as it most likely occurs in the *Islands* of the Fens.

Phlogophora meticulosa. Linn. Abundant everywhere.

Euplexia lucipara. Linn. Cambridge, common; Bottisham; Chippenham, common; Ely, formerly; Wicken; Chatteris, rare; Wisbech, sometimes common; Cowbit; Skegness.

Aplecta herbida. W.V. Cambridge (Mr. Layard); Monkswood.

,, *occulta*. Linn. Whittlesford, rare; Wicken, one specimen; Cowbit.

,, *nebulosa*. Tr. Cambridge; Chippenham, common; Brandon; Peterboro'.

,, *tincta*. Bork. Chatteris, one specimen in 1875, (Rev. Chas. Gathercole.)

,, *advena*. W.V. Chippenham; Ely; Chatteris; Holme Fen; Monkswood; Brandon.

Hadena satura. W.V. One specimen taken some years ago at Yaxley.

,, *adusta*. Esp. Chippenham; Chatteris, sometimes common; Wisbech; Brandon.

,, *protea*. W.V. Wisbech, rare; Brandon, rare.

,, *glauca*. Hub. Taken near Skegness in 1858 by Mr. G. Gascoyne of Newark.

,, *dentina*. W.V. Whittlesford; Chippenham; Wicken; Ely, formerly; Chatteris; Upwell; Cambridge; Brandon. Probably common throughout the district.

,, *chenopodii*. W.V. Wicken; Chatteris; Doddington Wood; Wisbech; Peterboro'; Brandon. Not common.

Hadena atriplicis. Linn. Cambridge; all along the banks of the Cam but not common (Mr. F. D. WHEELER); Waterbech; Chippenham; Holme Fen; Chatteris; Wisbech, formerly. This species used to be rather common, but has been getting gradually scarce for some years. Although not contained in recent Wicken lists, Mr. BOND used always to find it commonly there. It appears from the end of May to September.

" *suasa.* W.V. Whittlesford; Cambridge; Wicken; Ely (Rev. JENYNS); Chatteris; Peterboro'; Cowbit. Not common.

" *oleracea.* Linn. Common throughout the district.

" *pisi.* Linn. Fens round Whittlesford; Cambridge (Mr. DENNY); Chippenham, common; Wicken, abundant; Ely, common; Chatteris; Doddington Turf Fen, abundant; Wisbech; Peterboro.' A Fenland insect in this district.

" *thalassina.* Rott. Whittlesford, common; Cambridge; Bottisham (Rev. JENYNS); Chippenham; Chatteris, rare; Peterboro'; Cowbit.

" *contigua.* W.V. The Rev. JENYNS records two specimens found at Stapleford by Mr. MELVILLE LEE.

" *genistæ.* Bork. Wicken; Chatteris, rare; Brandon.

Xylocampa lithoriza. Bork. Whittlesford, common; Newmarket; Bottisham; Chippenham; Ely (Mr. GAZE); Chatteris, common; Wisbech; Peterboro'.

Calocampa vetusta. Hüb. Duxford and Whittlesford (Mr. BOND); Chippenham (Mr. WAGSTAFF); Chatteris.

" *exoleta.* Linn. Probably common throughout the district.

Xylina rhizolitha. W.V. Whittlesford (Mr. BOND); Chippenham (Mr. WAGSTAFF.)

" *semibrunnea.* Haw. Whittlesford, common; Cambridge; Newmarket; Chippenham; Chatteris, rare.

" *petrificata.* W.V. Cambridge (Mr. F. D. WHEELER.)

Cucullia verbasci. Linn. Common and generally distributed. The larvæ appear to prefer *Scrophularia aquatica* and *Verbascum thapsus*, upon which they are found abundantly; they also occur upon *V. blattaria* and *nigrum* and *S. nodosa*.

" *scrophulariæ.* W.V. Formerly taken by Mr. BOND abundantly in the larva state in a railway cutting at Whittlesford. No recent captures have been recorded.

" *chamomillæ.* W.V. Chatteris, not common.

" *umbratica.* Linn. Common and generally distributed throughout the district.

Heliothis marginata. Fab. Whittlesford, rare; Madingley, common; used to be common at Fulbourn and Devil's Ditch (Mr. Bond); Chippenham; Peterboro.'

" *peltigera.* W.V. Fulbourn (Mr. BOND); Chippenham and Newmarket (Mr. WAGSTAFF).

" *armigera.* Hüb. Duxford rare, where it has been taken by Mr. BOND at ivy blossom; Chippenham (Mr. WAGSTAFF); Reach Ditch, rare, (Mr. GAZE); Brandon (Mr. WHEELER.)

" *dipsacea.* Linn. Mr. BOND took a larva on the site of the present Fulbourn Asylum; Cambridge (Rev. L. P. GARRONS); Chippenham (Mr. WAGSTAFF); Brandon (Mr. BARRETT.)

Anarta myrtilli. Linn. Near Newmarket (Mr. BOND); Chippenham, common (Mr. WAGSTAFF); Holme Fen; near Lynn.

Heliodes arbuti. Fab. Whittlesford; near Fulbourn, on a heath now cultivated, (Mr. BOND); Cambridge; Chippenham; Bottisham; near Wicken; Ely; Wisbech; Peterboro.'

Agrophila sulphuralis. Linn. Formerly at Duxford, where it was rare. although when first discovered Mr. BOND has taken four or five a day; Mr. WAGSTAFF has taken it at Chippenham; on the Brandon "breck" district it occurs freely. A specimen was taken at Wicken about seven years ago but it was probably a straggler.

Acontia luctuosa. W.V. Formerly abundant at Whittlesford and still occasionally taken (Mr. BOND); one specimen at Bottisham (Rev. JENYNS); Chippenham (Mr. WAGSTAFF); Brandon (Mr. BARRETT.)

Erastria fuscula. W.V. Cambridge (Mr. DENNY); Chatteris, rare; Warboys Wood, common; near Lynn.

Bankia argentula. Esp. Formerly near Whittlesea Mere. With the destruction of Whittlesea Mere this species was believed to have become extinct in the district, but since the introduction to this list was written, information has been received of Mr. A. FARN having taken two specimens at Wicken in 1877, while Mr. J. A. SKERTCHLY took several at Ely in 1873, and Mr. WAGSTAFF a specimen at Bottisham in 1859.

Hydrelia unca. Linn. Fens near Whittlesford; Horningsea Fen in 1829 (Prof. BABINGTON); Wicken, common (Mr. BOND); Holme Fen; Lakenheath; Brandon, on the station lamps (Mr. WHEELER.)

Brephos parthenias. Linn. Chippenham (Mr. WAGSTAFF); Monkswood in 1829 (Prof. BABINGTON); near Lynn, one specimen.

,, *notha*. Hüb. Mr. BOND believes he has taken this and the above species at Whittlesford; Chippenham (Mr. WAGSTAFF.)

Abrostola urticæ. Hüb. Generally distributed throughout the district.

,, *triplasia*. Linn. Thinly scattered throughout the district.

Plusia chrysitis. Linn. Common throughout the district.

,, *festucæ*. Linn. Whittlesford; Cambridge; Chippenham; Burwell; Wicken; Ely; Chatteris; Upwell; Cowbit. Never common.

,, *iota*. Linn. Whittlesford; Cambridge; Newmarket; Chippenham; Brandon; Chatteris; Upwell; Wisbech; Peterboro'; Cowbit, generally common.

,, *v-aureum*. Gu. Whittlesford, Duxford, and round Cambridge (Mr. BOND); Chippenham (Mr. WAGSTAFF.)

,, *gamma*. Linn. Abundant everywhere.

Gonoptera libatrix. Linn. Common everywhere.

Amphipyra pyramidea. Linn. Whittlesford, rare; Cambridge, common; Chippenham; Brandon, common; Peterboro'; Cowbit.

,, *tragopogonis*. Linn. Abundant everywhere.

Mania typica. Linn. Common everywhere.

,, *maura*. Linn. Whittlesford; Cambridge; Chippenham; Ely; Chatteris; Wisbech; Peterboro'; Cowbit.

Toxocampa pastinum. Tr. Sawston common but local, where it was taken by Mr. BOND, who also took it at Yaxley; Bottisham (Mr. WAGSTAFF); Wicken (LORD WALSINGHAM); near Ely (Rev. JENYNS.)

Catocala fraxini. Linn. Wisbech, one specimen, remarkably fine; Bourn, one specimen.

,, *nupta*. Linn. Common everywhere.

,, *promissa*. W.V. Monkswood, where it used to be in profusion (Mr. BOND); Chippenham (Mr. WAGSTAFF.)

Euclidia mi. Linn. Whittlesford; Cherry Hinton; Bottisham (Rev. JENYNS); Chippenham, abundant; Wicken; Ely; Doddington; near Lynn; Peterboro', common.

,, *glyphica*. Linn. Whittlesford; Cambridge (Rev. JENYNS); Chippenham; Littleport and Ely (Mr. GAZE); Wicken; Peterboro,' very common; near Lynn.

Phytometra ænea. W.V. Whittlesford; Newmarket Heath and the Fens (Rev. Jenyns); Chippenham; Littleport and Ely (Mr. Gaze); Soham; Wisbech. Mr. Bond has seen it in abundance near Cambridge, and commonly at Sawston, Devil's Ditch, and Wicken.

AVENTIÆ.

Aventia flexula. Fab. Whittlesford, rare; used to be abundant at Newton (Mr. Bond); Cambridge; Chatteris, rare; Doddington Wood, rare; Wisbech; Brandon. Though rare, more widely distributed in this district than usual.

DELTOIDES.

Hypena proboscidalis. Linn. Abundant throughout the district.

" *rostralis.* Linn. Common throughout the district.

Hypenodes albistrigalis. Haw. Ely; Wicken.

" *costæstrigalis.* Ste. Whittlesford, formerly (Mr. Bond); Whittlesea Mere; Wicken (Lord Walsingham.)

Rivula sericealis. W.V. Wicken; Chatteris; Doddington Wood; Wisbech; Warboys Wood.

Herminia barbalis. Linn. Whittlesford common, formerly; also at Monkswood (Mr. Bond.)

" *tarsipennalis.* Tr. Cambridge (Mr. Layard); Stuntney (Mr. Gaze); Wicken; Chatteris; Wisbech, common.

" *grisealis.* W.V. Chatteris; Doddington Wood; Warboys Wood; Wisbech, common.

" *cribralis.* Hüb. Ely; Wicken Fen, common; Whittlesea Mere; Bottisham (Rev. Jenyns.)

PYRALIDES.

Pyralis fimbrialis. W.V. Cambridge; Wicken; Ely; Chatteris; Brandon.

" *farinalis.* Linn. Common everywhere.

" *glaucinalis.* Linn. Soham; Wicken, at sugar (Mr. Bond); Ely; Chatteris; Doddington Wood; Wisbech; Brandon. Probably common throughout the district.

Aglossa pinguinalis. Linn. Common throughout the district.

" *cuprealis.* Hub. Wicken; Whittlesford; Ely (Rev. Jenyns.) Mr. Bond once took 94 specimens in an oil-cake chamber at Wicken, and believes this insect, usually considered very rare in the district, could be found freely if looked for in similar places.

Cledeobia angustalis. W.V. Soham (Mr. Eedle.)

Pyrausta punicealis. W.V. Gog-Magog Hills in great abundance (Rev. Jenyns); Wicken; Ely.

" *purpuralis.* Linn. Gog-Magog Hills and Newmarket Heath (Rev. Jenyns); Wicken, common; Monkswood, common; Brandon.

" *ostrinalis.* Hüb. Wicken, common.

Herbula cespitalis. W.V. Bottisham and Newmarket Heath plentiful (Rev. Jenyns); Wicken; Holme Fen; Wisbech; Brandon.

Ennychia cingulalis. Linn. Fulbourn; Newmarket and Devil's Ditch, formerly (Mr. Bond.)

" *anguinalis.* Hüb. Fulbourn; Horningsea Fen (Mr. Warren). Used formerly to be taken at the latter place, and also at Devil's Ditch by Mr. Bond.

Endotricha flammealis. W.V. Devil's Ditch (Mr. BOND); Wicken; Wisbech, rare; Brandon.

Nascia cilialis. Hüb. Fens round Whittlesford, rare: Cambridge; Yaxley, formerly; Wicken, rare, but has occurred the last two or three years rather plentifully at light (Mr. BOND.)

Cataclysta lemnalis. Linn. Common throughout the district.

Paraponyx stratiotalis. Linn. Common throughout the district.

Hydrocampa nymphæalis. Linn. Common throughout the district.

,, *stagnalis.* Don. Wicken; Ely; Chatteris; Brandon; Cowbit. Generally common.

Acentropus niveus. Oliv. Wicken; Chatteris, common; Denver Sluice; Hilgay; Brandon; Wisbech.

Botys pandalis. Hub. Recorded near Cambridge under the name of *terminalis* by Mr. LAYARD; Ely (Mr. J. A. SKERTCHLY.)

,, *verticalis.* W.V. Common throughout the district.

,, *lancealis.* W.V. Barton Bendish (Trans. Norf. and Nor. Nat. Soc. 1873-4.)

,, *fuscalis.* W.V. Wicken; Ely; Chatteris; Brandon.

,, *urticalis.* Linn. Abundant everywhere.

Ebulea crocealis. Tr. Whittlesford, used to be common (Mr. BOND); Wicken; Chatteris; Wisbech.

,, *verbascalis.* W.V. Wicken; Ely; Brandon (Mr. BARRETT.)

,, *sambucalis.* W.V. Common everywhere.

Pionea forficalis. Linn. Common everywhere.

,, *margaritalis.* Fab. Cambridge. One season very plentiful round Wicken, the larva found feeding upon charlock, since then rarely taken (Mr. BOND.)

,, *stramentalis.* Hüb. Wicken (Mr. J. A. SKERTCHLY.)

Spilodes sticticalis. Linn. Duxford (Mr. BOND); Brandon.

,, *palealis.* W.V. Whittlesford, very rare (Mr. THURNALL); Brandon (Mr. MEYRICK.)

,, *cinctalis.* Tr. Probably common throughout the Fens and southern part of the district.

Scopula lutealis. Haw. Common throughout the Fens.

,, *olivalis.* W.V. Common throughout the district.

,, *prunalis.* W.V. Common throughout the district.

,, *ferrugalis.* Hüb. Cambridge; Chatteris, one specimen (Mr. H. F. FRYER); Wisbech; Lakenheath.

Stenopteryx hybridalis. Hüb. Cambridge; Wicken; Chatteris; Wisbech; near Lynn. Apparently not so common in this district as in other places.

Scoparia ambigualis. Tr. Chatteris, common; Warboys Wood; Wisbech, common.

,, *basistrigalis.* Kngs. Banks of the Cam (Mr. WARREN); Brandon (Mr. WHEELER.)

,, *cembræ.* Haw. Wicken, common; Ely; Chatteris; Wisbech; Brandon.

,, *dubitalis.* Hüb. [*pyralella.* W.V.] Cambridge; Swaffham Bulbeck (Rev. JENYNS); Wicken, common.

,, *ingratella.* Zell. Brandon, rare (Mr. BARRETT.)

,, *lineola.* Cur. Ely (Mr. J. A. SKERTCHLY.)

,, *mercurella.* Linn. Common throughout the district.

,, *cratægella.* Hüb. Wicken; Chatteris; Brandon, abundant.

,, *phæoleuca.* Zell. Brandon, rare (Mr. BARRETT.)

,, *truncicolella.* Stn. Chatteris; Wisbech; Brandon.

Scoparia pallida. Gu. Formerly at Whittlesea Mere; Wicken, common; Brandon, in Fens (Mr. Barrett.)

CRAMBITES.

Platytes cerussellus. W.V. Brandon, abundant.

Crambus falsellus. W.V. Shelford (Mr. Bond); Ely; Chatteris, common; Wisbech, rare; Brandon.

,, *pratellus.* Linn. Common throughout the district.

,, *adipellus.* Linn. Wicken, very rare.

,, *hamellus.* Thun. Wisbech, rare.

,, *pascuellus.* Linn. Cambridge; Wicken, common; Chatteris, rare; Brandon.

,, *uliginosellus.* Zell. Wicken, rare.

,, *pinetellus.* Linn. Babraham, rare; Wisbech, rare; Monkswood, rare; Brandon.

,, *latistrius.* Haw. Brandon (Mr. Barrett.)

,, *perlellus.* Scop. Common throughout the district.

,, *warringtonellus.* Zell. Wicken; Brandon, rare.

,, *selasellus.* Hüb. Wicken; Chatteris.

,, *tristellus.* W.V. Common throughout the district.

,, *inquinatellus.* W.V. Cambridge; Brandon.

,, *contaminellus.* Hüb. Wisbech, rare.

,, *geniculellus.* Haw. Cambridge, common; Brandon.

,, *culmellus.* Linn. Common throughout the district.

,, *chrysonuchellus.* Scop. Bottisham, &c. (Rev. Jenyns); Brandon, scarce.

,, *hortuellus.* Hüb. Common throughout the district.

,, *paludellus.* Hüb. Lakenheath (see note to *Lithosia muscerda.*) Wicken Fen, rarely (Mr. Bond.)

Chilo phragmitellus. Hüb. Wicken, common; Chatteris; Holme Fen; formerly near Whittlesea Mere; Wisbech; Brandon.

Schœnobius forficellus. Thun. Cambridge; Wicken; Formerly at Whittlesea Mere; March; Wisbech; Brandon.

,, *mucronellus.* Scop. Wicken (Mr. Bond.)

,, *gigantellus.* W.V. Wicken, rare; Wisbech rather common the last few years; formerly taken at Yaxley Fen and Whittlesea Mere, rare; (Mr. Bond.)

Anerastia lotella. Hüb. Brandon, common.

Myelophila cribrum. Hüb. Cambridge; Wicken; Brandon.

Homœosoma nebulella. Hüb. Wicken and by the Cam side; Brandon.

,, *eluviella.* Dup. Wicken and by the Cam side; Brandon.

Ephestia elutella. Hüb. Chatteris; Wisbech.

,, *ficulella.* Cambridge (Mr. Meyrick.)

,, *pinguis.* Haw. Ely, in great plenty in 1844; Chatteris; Wisbech.

,, *cinerosella.* Zell. [*artemisiella.* Ste.] Chatteris, rare.

Cryptoblabes bistriga. Haw. Wicken, rare.

Plodia interpunctella. Hüb. Wisbech, very abundant.

Phycis carbonariella. Fisch. Holme Fen, common; Wisbech rare.

,, *abietella.* W.V. March; Brandon.

,, *roborella.* W.V. Doddington Wood, common; Wisbech.

Pempelia palumbella. W.V. Wicken; near Lynn; Brandon.

Rhodophæa formosa. Haw. By the Cam side; Wicken; Brandon.

„ *consociella.* Hüb. Cambridge; Wicken; Doddington Wood; Warboys Wood; Brandon.

„ *advenella* Zinc. Cambridge; Wisbech; Brandon.

„ *marmorea.* Haw. Wicken.

„ *suavella.* Zinc. Brandon.

„ *tumidella.* Zinc. Doddington Wood; Brandon.

„ *rubrotibiella.* F.R. Brandon (Mr. WHEELER.)

Oncocera ahenella. W.V. Wicken (Mr. FARN); Brandon (Mr. BARRETT.)

Melia sociella. Linn. [*colonella.*] Whittlesford; round Cambridge, and Wicken, very common (Mr. BOND); Swaffham Prior (1829); Chatteris; Wisbech; Brandon; Cowbit.

Galleria cereana. Linn. Whittlesford, Newton, and near Cambridge (Mr. BOND); Wicken; (Mr. FARN); Chatteris. Nearly four hundred imagos of this species were bred one year from a single hive by Mr. BOND, and among a quantity bred another year by his friend Mr. BARLOW were two quite black.

Meliphora alvearia. Fab. Mr. BOND has twice reared large numbers of this insect from honeycomb received of a beekeeper in Cambridge.

TORTRICES.

Halias prasinana. Linn. Cambridge; Hatley Wood (Mr. AIKIN); Wisbech; Bourn.

„ *quercana.* W.V. Cambridge.

„ *clorana.* Linn. Cambridge; Wicken, common; Chatteris, common; Monkswood (1828); Wisbech.

Sarrothripa revayana. W.V. Monkswood; Ely.

Tortrix podana. Scop. [*pyrastrana.*] Common throughout the district.

„ *cratægana.* Hüb. Monkswood (Mr. BOND); Warboys Wood.

„ *xylosteana.* Linn. Cambridge; Wicken; Chatteris; Doddington Wood; Wisbech.

„ *sorbiana.* Hüb. Warboys Wood, common; Wisbech.

„ *rosana.* Linn. Common throughout the district.

„ *dumetana.* Tr. Wicken; Monkswood.

„ *cinnamomeana.* Tr. Ely (Mr. J. A. SKERTCHLY.)

„ *heparana.* W.V. Cambridge; Chatteris, common; Doddington Wood, Wisbech.

„ *ribeana.* Hüb. Cambridge; Warboys Wood; Chatteris; Wisbech.

„ *corylana.* Hüb. Cambridge; Wicken, common; Chatteris; Doddington Wood; Wisbech.

„ *unifasciana.* Dup. Chatteris, common; Wisbech.

„ *costana.* W.V. Cambridge; Wicken, common; Doddington Wood; Wimblington; Wisbech; Brandon.

„ *viburnana.* W.V. Formerly at Whittlesea Mere (WOOD.)

„ *icterana.* Frol. Wicken, common.

„ *viridana.* Linn. Common throughout the district.

„ *ministrana.* Linn. Cambridge; Wicken; Doddington Wood; Wisbech.

„ *forsterana.* Fab. Cambridge; Cowbit.

„ *branderiana.* Linn. Monkswood.

Dichelia grotiana. Fab. Brandon.

Leptogramma boscana. Fab. Elm trees in Cambridge (Mr. FARREN); Ely.

Peronea sponsana. Fab. Cambridge.

,, *schalleriana*. Linn. Cambridge; Wicken; Doddington Wood; Wisbech.

,, *comparana*. Hüb. Cambridge (Mr. FARREN.)

,, *variegana*. W.V. Cambridge; Wicken; Chatteris; Wisbech.

,, *cristana*. W.V. Wicken.

,, *hastiana*. Linn. Wicken; Quy Fen; Doddington Wood; Wisbech; Brandon.

,, *ferrugana*. W.V. Cambridge; Doddington Wood.

,, *tristana*. Hüb. Wicken; Ely.

,, *aspersana*. Hüb. Wicken; Bottisham (Rev. JENYNS.)

,, *shepherdana*. Ste. Wicken, common; Bottisham Fen.

Teras caudana. Fab. Wicken, common; Horningsea Fen; Wisbech; Monkswood.

,, *contaminana*. Hüb. Common throughout the district.

Dictyopteryx lorquiniana. Dup. [*uliginosana*.] Two specimens were taken at Whittlesea Mere by Mr. BENTLEY in 1824, which were the only known examples for over 30 years. Its recent localities are Wicken; Ely. In 1876 and 1877 the larva was found plentiful at Wicken. It has not been taken elsewhere in England.

,, *læflingiana*. Linn. Madingley, common; Chatteris; Doddington Wood; Warboys Wood, common; Wisbech.

,, *holmiana*. Linn. Cambridge; Bottisham (Rev. JENYNS); Chatteris, common; Wisbech, common; Brandon.

,, *bergmanniana*. Linn. Cambridge (Prof. BABINGTON, 1829); Chatteris, common; Wisbech, common.

,, *forskaleana*. Linn. Cambridge, abundant; Doddington Wood; Warboys Wood; Wisbech, common.

Argyrotoza conwayana. Fab. Madingley; Cambridge; Chatteris, common; Warboys Wood, common; Monkswood; Wisbech.

Ptycholoma lecheana. Linn. Common throughout the district.

Ditula hartmanniana. Linn. Banks of the Cam (Mr. WM. WARREN.)

,, *semifasciana*. Haw. Monkswood.

Penthina picana. Frol. [*corticana*.] Wisbech; Brandon.

,, *betulætana*. Haw. Cambridge; Ely.

,, *capræana*. Hüb. St. Ives (Mr. EEDLE.)

,, *pruniana*. Hüb. Common throughout the district.

,, *ochroleucana*. Hüb. Cambridge; Wicken; Chatteris.

,, *cynosbana*. Linn. Cambridge; Monkswood; Wisbech, common.

,, *gentianana*. Hüb. Cambridge; Wicken; Warboys Wood.

,, *sellana*. Hüb. Cambridge; Wicken (Lord Walsingham.)

,, *marginana*. Haw. [*oblongana*.] Cambridge; Wicken.

,, *fuligana*. Hub. [*carbonana*.] Reared by Lord WALSINGHAM from larvæ found on *stachys* at Wicken, and the perfect insect also taken by him there. Of the latter his lordship remarks that they are "difficult to see and still more difficult to catch, as they fly very quick and low over rough sedge and broken ground."

Antithesia salicella. Zell. Cambridge; Wisbech.

Spilonota lariciana. Zell. Brandon.

,, *ocellana*. W.V. Cambridge; Chatteris; Wisbech; Brandon.

,, *aceriana*. Mann. Cambridge; Brandon.

,, *dealbana*. Frol. Cambridge; Brandon.

Spilonota neglectana. Dup. Cambridge; Doddington Wood.

,, *simplana.* Fisch. Wicken (Mr. J. A. SKERTCHLY.)

,, *suffusana.* Kol. [*trimaculana.*] Chatteris; Brandon.

,, *rosæcolana.* Dbl. Chatteris; Wisbech.

,, *roborana.* W.V. Cambridge; Chatteris; Wisbech.

Pardia tripunctana. W.V. Cambridge; Wicken; Chatteris; Doddington Wood; Monkswood; Wisbech.

Aspis udmanniana. Linn. Cambridge; Wicken, common; Ely; Warboys Wood; Wisbech.

Sideria achatana. W.V. Fulbourn; Cambridge; Chatteris, abundant; Wisbech.

Sericoris latifasciana. Haw. Monkswood (Mr. WARREN.)

,, *bifasciana.* Haw. Brandon (Mr. BARRETT.)

,, *fuligana.* Haw. [*abscisana.*] Wicken; Chatteris, common.

,, *doubledayana.* Barrett. Wicken (Mr. BOND.)

,, *cespitana.* Hüb. Cherry Hinton; Ely; Brandon.

,, *conchana.* Hüb. Wicken (Mr. J. A. SKERTCHLY.)

,, *lacunana.* W.V. Common throughout the district.

,, *urticana.* Hüb. Cambridge; Wicken; Wisbech.

,, *micana.* Hüb. Wicken.

Euchromia purpurana. Haw. Wicken; near Newmarket (Mr. BOND.)

Orthotænia antiquana. Hüb. Wicken, common; Chatteris; Wisbech, common.

,, *striana.* W.V. Wicken; Doddington Wood.

Eriopsela fractifasciana. Haw. Brandon, rare (Mr. BARRETT.)

Phtheochroa rugosana. Hüb. Horningsea Fen (Mr. BOND); Wicken; Chatteris; Wisbech.

Cnephasia politana. Haw. [*lepidana.*] Wicken.

,, *musculana.* Hüb, Doddington Wood; Monkswood.

Sciaphila nubilana. Hüb. Cambridge; Wicken; Chatteris.

,, *subjectana.* Gu. Common throughout the district.

,, *virgaureana.* Tr. Cambridge; Ely; Chatteris, abundant; Doddington Wood, abundant; Wisbech; Brandon.

,, *alternana.* W.V. [*chrysantheana.*] Near Wimpole, very common (Mr. BOND); Cambridge; Chatteris; Wisbech; Brandon.

,, *communana.* H.S. Wicken Fen (Mr. F. BOND); Chatteris and Doddington Wood (Mr. H. RUSTON.)

,, *pasivana.* Dub. Chatteris; Brandon.

,, *hybridana.* Hüb. Common throughout the district.

Sphaleroptera ictericana. Haw. Wicken (Mr. FARN.)

Clepsis rusticana. Tr. Wicken; Ely; used to be common in the Cambridgeshire Fens.

Bactra lanceolana. Hüb. Generally common throughout the district.

Phoxopteryx siculana. Hüb. Wicken.

,, *unguicella.* Linn. Cambridge (Mr. W. FARREN); Wicken (Mr. FARN.)

,, *uncana.* Hüb. Wicken.

,, *biarcuana.* Ste. Wicken; Monkswood.

,, *inornatana.* H.S. Wicken; Tuddenham.

,, *paludana.* Barrett. Wicken.

,, *comptana.* Frol. Fulbourn (Mr. W. FARREN.)

,, *lundana.* Fab. Cambridge; Wicken; Wisbech; Monkswood.

Phoxopteryx derasana. Hüb. Wicken.

,, *diminutana.* Haw. Wicken; Monkswood.

,, *mitterbacheriana.* W.V. Warboys Wood, one specimen (Mr. Harold Ruston); Monkswood.

,, *lætana.* Fab. Duxford, near Cambridge, beat from White Poplar (Mr. Bond.)

Grapholita ramella. Linn. [*Paykulliana*] Cambridge (Mr. W. Farren.)

,, *nisella.* Linn. Wicken.

,, *nigromaculana.* Haw. Wicken; Chatteris; Brandon.

,, *subocellana.* Don. (*campoliliana* W.V.) Cambridge; Monkswood.

,, *minutana.* Hüb. Brandon (Mr. E. Meyrick.)

,, *trimaculana.* Don. Cambridge; Chatteris; Wisbech.

,, *obtusana.* Haw. Monkswood among hazel (Mr. Bond.)

,, *nævana.* Hüb. Wicken; Wisbech.

,, *geminana.* Ste. Stated by Stephens to have been formerly taken at Whittlesea Mere.

Phlœodes immundana. Fisch. Cambridge.

,, *crenana.* Hüb. Lakenheath.

Hypermecia cruciana. Linn. Wicken.

Batodes angustiorana. Haw. Chatteris; Wisbech; Brandon.

Pædisca oppressana. Tr. Cambridge; Brandon.

,, *rufimitrana.* H.S. Cambridge. A new species to Britain taken by Mr. Jenkinson.

,, *corticana.* W.V. Cambridge; Wicken; Chatteris; Doddington Wood, abundant; Wisbech.

,, *profundana.* W.V. Wisbech.

,, *solandriana.* Linn. Wicken.

,, *semifuscana.* Haw. Wicken.

,, *sordidana.* Hüb. Whittlesea Mere. First known as British in 1852, having been received from Yaxley in a box of insects. Mr. Bond afterwards found it plentiful at Yaxley among alders.

Ephippiphora bimaculana. Don. Cambridge.

,, *cirsiana.* Zell. Wimblington; Monkswood.

,, *pflugiana.* Fab. [*scutulana.*] Cambridge; Sawston, Wicken, &c. (Mr. Bond.)

,, *brunnichiana.* W.V. Cambridge; Monkswood; Wisbech.

,, *fœneana.* Linn. Cambridge; Wicken; Stephens records it at Wisbech.

,, *nigricostana.* Haw. Cambridge.

,, *signatana.* Dougl. Doddington Wood.

,, *trigeminana.* Ste. Cambridge; Wicken.

,, *populana.* Fab. [*ephippana.*] Wicken.

,, *obscurana.* Ste. Wicken (Lord Walsingham.)

Semasia spiniana. Fisch. Fulbourn (Mr. Warren.)

,, *janthinana.* Dup. Cambridge; Chatteris; Wisbech; Brandon.

,, *rufillana.* Zell. Wicken (Lord Walsingham); Horningsea Fen (Mr. W. Warren.)

,, *wœberana.* W.V. Cambridge; Wicken; Chatteris; March; Wisbech.

Coccyx splendidulana. Gu. Chatteris; Warboys Wood.

,, *argyrana.* Hüb. Cambridge; Wicken; Monkswood.

,, *tædella.* Linn. [*hyrciniana.* Uslar.] Cambridge; near Lynn; Brandon.

,, *nanana.* Tr. Brandon.

Heusimene fimbriana. Ste. Cambridge; Doddington Wood.
Retinia buoliana. W.V. Cambridge; near Lynn; Brandon.
,, *pinicolana.* Dbl. Holme Fen; near Lynn.
,, *pinivorana.* Zell. Fulbourn (Mr. W. WARREN.)
Carpocapsa splendana. Hüb. Cambridge; Doddington Wood.
,, *grossana.* Haw. Whittlesford (Mr BOND); Cambridge.
,, *pomonana.* Linn. Cambridge; Chatteris; Wisbech, common.
Opadia funebrana. Tr. Cambridge (Mr. W. FARREN); Wicken (Lord WALSINGHAM.)
Endopisa nigricana. Fab. Whittlesford, Fulbourn, &c. (Mr. BOND); Wicken.
Stigmonota leguminana. Zell. In 1869 Lord WALSINGHAM took at Wicken an insect which the late Mr. DOUBLEDAY thought was *inquinatana* H.S., but Mr. BARRETT considers it a strongly marked form of *leguminana.*
,, *corollana.* Hüb. [*heegerana.*] Once at Whittlesea Mere.
,, *perlepidana.* Haw. Wicken.
,, *composana.* Fab. Cambridge; Wicken.
,, *weirana.* Doug. Cambridge.
,, *regiana.* Zell. Cambridge; Wicken; Chatteris; Wisbech.
,, *orobana.* Tr. Wicken.
Dicrorampha politana. W.V. Cambridge; Chatteris; Brandon.
,, *sequana.* Hüb. Cambridge.
,, *petiverella.* Linn. Cambridge; Wicken; Chatteris; Wisbech; Brandon.
,, *plumbana.* Scop. Cambridge; Chatteris; Monkswood; Brandon.
,, *plumbagana.* Tr. Cambridge; Monkswood; Brandon.
,, *acuminatana.* Zell. Cambridge; Monkswood.
,, *simpliciana.* Haw. Cambridge.
Pyrodes rhediella. Linn. Fulbourn; Cambridge; Chatteris; Doddington Wood; Wisbech.
Catoptria ulicetana. Haw. Cambridge; near Lynn; Brandon.
,, *hypericana.* Hub. Cambridge; Chatteris; Warboys Wood; Monkswood.
,, *cana.* Haw. [*scopoliana* of DOUBLEDAY.] Cambridge; Chatteris; Brandon.
,, *fulvana.* Ste. Cambridge; Brandon.
,, *scopoliana.* Haw. Wicken.
,, *conterminana.* H.S. Chatteris, the pinkish larva has been found in lettuce flowers at Chatteris by Mr. RUSTON, and reared; Wisbech.
,, *expallidana.* Haw. Wicken; Yaxley (Mr. BOND.)
,, *citrana.* Hub. Brandon, common.
Tycheris aurana. Fab. [*mediana.* W.V.] Cambridge.
Choreutes scintillulana. Hüb. Cambridge; Waterbech; Wicken.
Xylopoda fabriciana. Linn. Generally common.
,, *pariana.* Linn. Cambridge.
Lobesia servillana. Dup. Cambridge; Monkswood; Wicken.
Eupœcilia dubitana. Hüb. Horningsea Fen (Mr. W. WARREN.)
,, *atricapitana.* Ste. Cambridge; Brandon.
,, *maculosana.* Haw. Cambridge; Warboys Wood.
,, *hybridella.* Hüb. Cambridge.
,, *angustana.* Hüb. Wicken; Cambridge.
,, *curvistrigana.* Wilk. In a lane near Horningsea Fen (Mr. BOND.)
,, *vectisana.* Westw. Wicken (LORD WALSINGHAM.)

Eupœcilia udana. Gu. Cambridge; Wicken.
,, *geyeriana.* H.S. Wicken.
,, *degreyana.* McLach. Two specimens by LORD WALSINGHAM in 1868 and 1869 on a piece of ground near Wicken Fen which had been broken up. Brandon, first discovered on the "breck" sand district by Lord WALSINGHAM, after whom it was named.
,, *notulana.* Zell. Wicken, abundant.
,, *rupicola.* Cur. Wicken (LORD WALSINGHAM.)
,, *roseana.* Haw. Cambridge; Warboys Wood.
,, *ciliella.* Hüb. [*ruficiliana*] Cambridge; Wicken.
,, *anthemidana.* Cur. Brandon.
Xanthosetia zoegana. Linn. Whittlesford, common (Mr. BOND); Cambridge; Wicken.
,, *hamana.* Linn. Common throughout the district.
Chrosis tesserana. W.V. Cambridge; Brandon.
Argyrolepia baumanniana. W.V. Horningsea Fen; Wisbech, rare.
,, *sub-baumanniana.* Wilk. Cambridge; Wicken.
,, *zephyrana.* Tr. Fulbourn and Newmarket (Mr. WARREN); Cambridge (Mr. MEYRICK.)
,, *schreibersiana.* Frol. A single specimen taken at Yaxley by Mr. BOUCHARD (Ent. An. 1855); Mr. BOND took about a dozen specimens at Wicken.
,, *badiana.* Hüb. Wicken; Wisbech; formerly at Whittlesea Mere; Brandon.
,, *cnicana.* Dbl. Wicken, common; Warboys Wood.
Cochylis dilucidana. Steph. Whittlesford, Horningsea, and Wicken Fens (Mr. BOND.)
,, *smeathmanniana.* Fab. Wicken.
,, *stramineana.* Haw. Cambridge; Wicken; Wisbech.
Aphelia osseana. Scop. [*pratana*] Cambridge.
Tortricodes hyemana. Hüb. Cambridge; Warboys Wood.

TINEÆ.

Lemnatophila phryganella. Hüb. Trumpington; Cambridge; Monkswood.
,, *salicella.* Hüb. Cambridge.
Exapate gelatella. Zell. Cambridge.
Diurnea fagella. W.V. Common throughout the district.
Epigraphia steinkellneriana. W.V. Cambridge; Chatteris.
Talæporia pseudo-bombycella. Och. Cambridge (Mr. BOND.)
Psyche radiella. Cur. Lakenheath (Mr. EEDLE.)
Solenobia triquetrella. Hüb. Brandon.
,, *inconspicuella.* Stn. Madingley (Mr. WARREN.)
Xymastodoma melanella. Haw. Cambridge.
Phygas birdella. Cur. Whittlesford and Devil's Ditch (Mr. BOND.)
,, *bisontella.* Lienig. Devil's Ditch (Mr. BOND); Newmarket (Mr. LEE.)
Scardia carpinetella. Gu. Monkswood (Prof. BABINGTON); Brandon.
,, *granella.* Zell. Cambridge; Wisbech abundant.
,, *cloacella.* Haw. Wicken; Chatteris.
,, *arcella.* Fab. Cambridge, abundant in hedges (Mr. BOND.)
Tinea imella. Hüb. Wicken; Brandon.
,, *ferruginella.* Hüb. Cambridge.

Tinea rusticella. Hüb. Cambridge; Monkswood; Chatteris, common; Wisbech.
,, *monachella.* Hüb. Yaxley Fen (Mr. BOND.)
,, *tapetzella.* Linn. Common throughout the district.
,, *albipunctella.* Haw. Warboys Wood.
,, *misella.* Zell. Chatteris.
,, *pellionella.* Linn. Cambridge; Wisbech.
,, *fuscipunctella.* Haw. Cambridge; Wicken; Wisbech.
,, *ganomella.* Tr. [*lapella.*] Whittlesford (Mr. BOND); Cambridge; Monkswood; Chatteris.
,, *merdella* Zell. Cambridge (Mr. WARREN.)
,, *bisselliella.* Hemm. Cambridge; Wisbech.
,, *nigripunctella.* Haw. Cambridge (Mr. FARREN.)
,, *semifulvella.* Haw. Brandon (Mr. BOND.)
Lampronia quadripunctella. Fab. Cambridge; Monkswood.
,, *luzella.* Hüb. Cambridge; Monkswood; Warboys Wood.
,, *praelatella.* W.V. Cambridge; Warboys Wood.
,, *rubiella.* Bjerk. Cambridge; Monkswood; Wicken (Mr. BOND.)
Incurvaria masculella. W.V. Cambridge; Monkswood; Chatteris; Wisbech.
,, *capitella.* Linn. Shelford, abundant (Mr. BOND); Cambridge.
Micropteryx calthella. Linn. Cambridge; Monkswood; Wicken; Bottisham, not uncommon (Rev. JENYNS.)
,, *aruncella.* Scop. Cambridge; Monkswood.
,, *seppella.* Fab. Cambridge; Monkswood.
,, *thunbergella.* Fab. Monkswood.
,, *purpurella.* Ste. Woods round Whittlesford (Mr. BOND.)
,, *semipurpurella.* Ste. Woods round Whittlesford (Mr. BOND.)
,, *subpurpurella.* Haw. Cambridge; Monkswood; Chatteris.
Nemophora swammerdamella. Linn. Cambridge; Monkswood.
,, *schwarziella.* Zell. Cambridge; Monkswood; Wicken; Warboys Wood.
,, *metaxella.* Hüb. Wicken; Swaffham Prior (Rev. JENYNS.)
Adela fibulella. W.V. Gamlingay (1835); Cambridge; Monkswood.
,, *rufimitrella.* Scop. Cambridge.
,, *sulzella.* W.V- Cambridge; Wicken; Bottisham (Rev. JENYNS.)
,, *degeerella.* Linn. Cambridge; Doddington Wood; near Monkswood in 1829 by Prof. BABINGTON.
,, *viridella.* Linn. Cambridge; Wicken.
Nemotois scabiocellus. Scop. Mr. BOND believes this to be taken at Whittlesford.
,, *cupriacellus.* Hüb. Duxford (Mr. BOND.)
,, *minimellus.* Zell. Horningsea Fen (Mr. WARREN.)
Swammerdamia comptella. Hüb. [*apicella.*] Cambridge; Monkswood; Warboys Wood; Doddington Wood.
,, *caesiella.* Hüb. Cambridge.
,, *griseocapitella.* Stn. Cambridge; Chatteris.
,, *lutarea.* Haw. Cambridge.
,, *pyrella.* Vill. Cambridge; Chatteris; Wisbech.
Scythropia crataegella. Linn. Cambridge; Monkswood; Wicken (Mr. BOND.)
Yponomeuta plumbellus. W.V. Cambridge; Warboys Wood.
,, *padellus.* Linn. Cambridge; Chatteris; Wisbech, abundant.

Yponomeuta cognatellus. Hüb. [*evonymellus.* Scop. and Stn.] Doddington Wood; Warboys Wood; Wisbech.

,, *evonymellus.* Linn. [*padi.* Zell.] Cambridge (Mr. W. FARREN); Wicken.

Anesychia funerella. Fab. Wicken; Chatteris.

,, *decemguttella.* Hüb. Ely, common; Warboys Wood.

Pepilla curtisella. Don. Cambridge; Wicken; Chatteris; March; Wisbech.

Plutella Xylostella. Linn. [*cruciferarum.* Zell.] Cambridge; Wicken; Chatteris; Doddington Wood; Warboys Wood; Wisbech.

,, *porrectella.* Linn. Duxford, &c. (Mr. BOND); Cambridge (Mr. FARREN.)

Hypolepia sequella. Linn. Cherry Hinton (Mr. W. WARREN.)

,, *vittella.* Linn. Cambridge; Wicken; Chatteris.

,, *radiatella.* Don. Cambridge; Monkswood.

,, *costella.* Fab. Cambridge.

Harpipteryx harpella. W.V. [*xylostella.* Stn. and Linn.] Cambridge.

Pteroxia caudella. Linn. Cambridge.

Orthotælia sparganiella. Thun. The larvæ used to be found common in Whittlesea Mere in the tops of *Scirpus lacustris* by Mr. BOND, who has also bred it from stems of *Sparganium.*

Enicostoma lobella. W.V. Cambridge; Monkswood; Wicken.

Phibalocera quercana. Fab. Cambridge; Chatteris; Wisbech.

Depressaria costosa. Haw. Cambridge; Wisbech; Brandon.

,, *liturella.* W.V. Cambridge; Wicken.

,, *pallorella.* Zell. Wicken (Lord WALSINGHAM.)

,, *umbellana.* Ste. Duxford (Mr. BOND); Cambridge (Mr. FARREN.)

,, *assimilella.* Tr. Chatteris; Brandon.

,, *atomella.* W.V. Cambridge; Brandon.

,, *arenella.* W.V. Common throughout the district.

,, *propinquella.* Tr. Duxford, &c. (Mr. BOND); Cambridge; Wicken; Chatteris.

,, *subpropinquella.* Stn. Common throughout the district. The var. *rhodochrellus* has been taken at Duxford by Mr. BOND, at Cambridge by Mr. FARREN, and at Wicken by Lord WALSINGHAM.

,, *alstrœmeriana.* Linn. Common throughout the district.

,, *vaccinella.* Hüb. [*purpurea.*] Cambridge; Chatteris; Swaffham Bulbeck, not uncommon (Rev. JENYNS.)

,, *hypericella.* Hüb. Cambridge.

,, *conterminella.* Zell. Wicken, common; Yaxley (Mr. BOND.)

,, *angelicella.* Hüb. Wicken.

,, *ocellana.* Fab. Cambridge; Wicken.

,, *yeatiana.* Fab. Cambridge; Wicken; Chatteris; Brandon.

,, *applana.* Fab. Common throughout the district.

,, *ciliella.* Stn. Cambridge; Wicken; Chatteris.

,, *granulosella.* Stn. Brandon (Mr. BARRETT.)

,, *bipunctosa.* Cur. Wicken (Lord WALSINGHAM.)

,, *albipunctella.* Hüb. Cambridge; Wicken.

,, *chærophylli.* Zell. Cambridge; Wicken; Chatteris.

,, *ultimella.* Stn. Cambridge.

,, *nervosa.* Haw. Cambridge.

,, *badiella.* Hüb. Cambridge.

Depressaria discipunctella. H.S. [*pastinacella*.] Whittlesford, common (Mr. Bond.)

" *heracliana*. De Geer. Cambridge, common; Wicken; Wisbech, common.

Gelechia cinerea. Linn. Mr. Bond has bred it from larva taken at Wicken, where he has also caught the imago. Brandon (Lord Walsingham.)

" *rufescens*. Haw. Cambridge; Wicken.

" *inornatella*. Dgl. Wicken; Yaxley Fen (Mr. Bond.)

" *gerronella*. Zell. Wicken (Lord Walsingham.)

" *vilella*. Zell. Cambridge; Brandon.

" *malvella*. Hüb. In gardens at Whittlesford feeding on Hollyhock (Mr. Bond.)

" *populella*. Linn. Wicken; Wisbech; Brandon.

" *nigra*. Haw. [*cautella*.] Brandon (Mr. Meyrick.)

" *velocella*. Fisch. Cambridge.

" *fumatella*. Dgl. Wicken (Mr. Bond.)

" *mulinella*. Tisch. Wicken.

" *divisella*. Dgl. Wicken, rare. First discovered as British by Mr. Bond, at Yaxley about 1850.

" *palustrella*. Dgl. Yaxley Fen, where first discovered as British by Mr. Bond, about 1850. It has occurred at Wicken recently.

" *sororculella*. Hüb. Wicken (Lord Walsingham.)

" *cuneatella*. Zell. Banks of the Cam (Mr. Warren.)

" *alacella*. Dup. Brandon (Mr. Meyrick.)

" *diffinis*. Haw. Cambridge (Mr. Bond); Wisbech; Brandon.

" *terrella*. W.V. Cambridge; Chatteris; Brandon.

" *desertella*. Edlstn. Brandon, abundant.

" *acuminatella*. Sir. Cambridge; Wicken; Chatteris; Monkswood.

" *arundinetella*. Zell. Cambridge; Wicken (Mr. Bond.)

" *senectella*. Zell. Cambridge; Wicken; Brandon.

" *similis*. Dgl. Cambridge (Mr. Bond.)

" *affinis*. Haw. Cambridge; Chatteris; Wisbech; Brandon.

" *basaltinella*. Zell. Cambridge (Mr. Bond.)

" *domestica*. Haw. Chatteris; Wisbech.

" *rhombella*. Hüb. Fulbourn and Wicken (Mr. Warren.)

" *proximella*. Hüb. Cambridge, common.

" *notatella*. Hüb. Horningsea and Wicken (Mr. Warren.)

" *vulgella*. Hüb. Round Cambridge (Mr. Bond); Chatteris.

" *luculella*. Hüb. Cambridge; Warboys Wood; Monkswood.

" *scriptella*. Hüb. Hedges at Whittlesford, Shelford, and Cambridge (Mr. Bond.)

" *fugitivella*. Zell. Hedges at Whittlesford, Shelford, and Cambridge (Mr. Bond.)

" *distinctella*. Zell. Brandon (Mr. Barrett.)

" *costella*. Ste. Hedges at Whittlesford, Shelford, and Cambridge (Mr. Bond.)

" *fraternella*. Dgl. Cambridge; Brandon.

" *muscosella*. Zell. Wicken in 1869 (Lord Walsingham.)

" *maculiferella*. Mann. Hedges round Cambridge (Mr. Bond.)

" *marmorea*. Haw. Brandon, abundant.

" *sequax*. Haw. Cambridge.

Gelechia alcella. Fab. Monkswood.

,, *leucatella*. Linn. Whitethorn hedges round Cambridge (Mr. BOND.)

,, *nanella*. Hüb. Cambridge (Mr. WARREN.)

,, *mouffetella*. W.V. Whittlesford out of honeysuckle (Mr. BOND.)

,, *dodecella*. Linn. Fulbourn (Mr. WARREN); Brandon (Mr. BARRETT.)

,, *triparella*. Zell. Wicken, common (Mr. BOND.)

,, *tenebrella*. Hüb. Brandon.

,, *ligulella*. Zell. Cambridge; Brandon.

,, *tæniolella*. Tr. Cambridge.

,, *sircomella*. Stn. Cambridge.

,, *coronillella*. Tisch. Whittlesford and neighbourhood (Mr. BOND.)

,, *anthyllidella*. Hüb. Cambridge; Wicken; Brandon.

,, *atrella*. Haw. Wicken (Lord WALSINGHAM.)

,, *bifractella*. Mann. Cambridge.

,, *suffusella*. Dgl. [*oblitella*.] First taken in England at Yaxley about 1840 by Mr. BOND, who also took it at Wicken in 1850. In 1868 and 1869 Lord WALSINGHAM took it at Wicken.

,, *morosa*. Mulig. A species new to Britain. First taken at Wicken in 1868 and 1869 by Lord WALSINGHAM. About half a dozen specimens were taken, but as the insect belongs to a closely allied group, Mr. STAINTON, who saw them, thought it better to defer naming them until the larva was detected, and the capture, which was not published, appears to have been lost sight of. In June 1876, Mr. FARN and Mr. F. JENKINSON, of Trinity College, Cambridge, were collecting together at Wicken, when in a stem of *lysimachia* which the former had plucked, a *gelechia* larva was detected, which Mr. JENKINSON pronounced to be unusual. Five or six more were collected, and from these Mr. JENKINSON bred a specimen. In 1877 a number of larvæ were collected by Mr. FARN, Mr. JENKINSON, and Mr. MEYRICK, and the latter also took the imago. The identity of the species with that taken by Lord WALSINGHAM was not ascertained until March, 1878.

,, *lucidella*. Ste. Taken in a railway cutting between Duxford and Whittlesford, and at Wicken (Mr. BOND); Wisbech.

,, *næviferella*. Zell. Cambridge; Waterbech; Wicken; Chatteris; Doddington Wood; Monkswood; Brandon.

,, *hermannella*. Fab. Cambridge; Waterbech; Wicken.

,, *pictella*. Zell. Brandon (Mr. BARRETT.)

,, *subdecurtella*. Stn. First taken by Mr. BOND in England in 1858 at Wicken Fen. In 1868 and 1869 LORD WALSINGHAM found it there, and in 1877 Mr. MEYRICK, who also bred it from larvæ obtained at Wicken.

,, *ericinella*. Zell. Newmarket Heath, common (Mr. BOND.)

,, *inopella*. Zell. Cambridge.

,, *subocellea*. Ste. Wicken (LORD WALSINGHAM.)

,, *lathyri*. Stn. Wicken; This insect was formerly considered to be the continental species *nigricostella*, but Mr. T. BROWN, of Cambridge, having obtained larvæ, it was proved to be a new and distinct species.

Parasia lappella. Linn. Cambridge (Mr. BOND); Wicken (Mr. FARN.)

,, *metzneriella*. Dgl. Cambridge; Wicken.

Cleodora striatella. W.V. Yaxley Fen (Mr. BOND.)

Chelaria conscriptella. Hüb. Poplar trees round Cambridge (Mr. BOND.)

Macrochila fasciella. Hüb. Common one season at Monkswood (Mr. Bond.)
,, *marginella.* Fab. Cambridge.
Sophronia parenthesella. Linn. Horningsea Fen (Mr. Warren.)
Pleurota bicostella. Linn. Newmarket Heath (Mr. Bond.)
Dasycera sulphurella. Fab. Common throughout the district.
,, *oliviella.* Fab. Near Whittlesford (Mr. Bond.)
Œcophora minutella. Linn. Cambridge; Wicken; Chatteris; Wisbech.
,, *flavimaculella.* Stn. Wicken (Lord Walsingham.)
,, *tripuncta.* Haw. [*trisignella*] Cambridge.
,, *lunaris.* Haw. Whittlesford, &c. (Mr. Bond); Cambridge.
,, *tinctella.* Tr. Hedges and gardens near Whittlesford (Mr. Bond.)
,, *panzerella.* Ste. [*subochreella.*] Hedges and gardens near Whittlesford (Mr. Bond.)
,, *unitella.* Stn. [*fusco-aurella.*] Chatteris; Brandon.
,, *flavifrontella.* Hüb. Hedges and gardens round Whittlesford (Mr. Bond)
,, *fuscescens.* Haw. Hedges and gardens round Whittlesford very abundant (Mr. Bond); Brandon (Mr. Barrett.)
,, *pseudo-spretella.* Stn. Common throughout the district.
Œcogenia kindermanniella. Zell. In the town of Cambridge (Mr. Bond.)
Endrosis fenestrella. Scop. Common throughout the district.
Butalis fuscoænea. Haw. Devil's Ditch (Mr. Bond.)
,, *senescens.* Stn. Cambridge.
,, *chenopodiella.* Hüb. Near Cambridge (Mr. Bond.)
,, *cicadella.* Zell. Brandon is the original locality for this species.
Pancalia leuwenhoekella. Linn. Newmarket and at Six-mile Bottom (Mr. Bond.)
Acrolepia granitella. Tr. Whittlesford (Mr. Bond.)
,, *pygmæana.* Haw. [*autumnitella.*] Cambridge.
Glyphipteryx fuscoviridella. Haw. In all meadows round Cambridge (Mr. Bond); Wisbech.
,, *thrasonella.* Scop. Cambridge; Wicken; Brandon Fen.
,, *cladiella.* Stn. Wicken; Fens near Brandon (Mr. Barrett.)
,, *equitella.* Scop. Brandon, common.
,, *schœnicolella.* Boyd. Cambridge; Wicken.
,, *fischeriella.* Zell. Cambridge; Chatteris; Monkswood.
Æchmia dentella. Stn. Cambridge; Wicken, not rare about Buckthorn (Mr. Bond.)
Perittia obscurepunctella. Stn. Cambridge.
Tinagma sericiella. Haw. Cambridge.
Douglasia ocnerostomella. Stn. Brandon (Mr. Barrett.)
Argyresthia ephippella. Fab. Cambridge (Mr. Warren.)
,, *nitidella.* Fab. Cambridge; Wicken; Chatteris; Wisbech.
,, *semitestacella.* Cur. Brandon (Mr. Barrett.)
,, *spiniella.* Zell. Wisbech.
,, *albistria.* Haw. Cambridge; Doddington Wood; Wisbech.
,, *semifusca.* Haw. Wisbech.
,, *mendica.* Haw. Cambridge; Doddington Wood; Warboys Wood; Monkswood.
,, *curvella.* Linn. Cambridge (Mr. Warren.)
,, *pygmæella.* Hüb. Common round Whittlesford (Mr. Bond); near Lynn.

Argyresthia gœdartella. Linn. Common round Whittlesford (Mr. BOND); Wisbech.

,, *brockeella*. Hüb. Whittlesford and Cambridge (Mr. BOND.)

Cedestis farinatella. Zell. Fulbourn (Mr. WARREN.)

Ocnerostoma pinariella. Zell. Brandon (Mr. BARRETT.)

Gracillaria alchimiella. Scop. [*swederella*.] Cambridge; Chatteris; Warboys Wood; Monkswood.

,, *stigmatella*. Fab. Cambridge; Wicken; Chatteris; Wisbech.

,, *elongella*. Linn. Whittlesford (Mr. BOND); Wicken (Mr. FARN.)

,, *tringipennella*. Zell. Cambridge; Monkswood.

,, *syringella*. Fab. Cambridge; Wicken; Chatteris; Wisbech.

,, *phasianipennella*. Hüb. Whittlesford (Mr. BOND.)

,, *auroguttella*. Ste. Cambridge.

,, *ononidis*. Dup. Whittlesford (Mr. BOND.)

,, *imperialella*. Mann. Wicken; Horningsea Fen (Mr. BOND.)

,, *koilariella*. Zell. Brandon. Mr. BOUCHARD took one specimen which is in the British Museum. Mr. BOND has taken the larvæ on broom, but has not been able to rear it.

Coriscium brongniardella. Fab. Whittlesford (Mr. BOND.)

Ornix avellanella. Stn. Whittlesford, in woods (Mr. BOND); Cambridge (Mr. WARREN.)

,, *anglicella*. Stn. Cambridge; Monkswood; Chatteris; Wisbech.

,, *torquilella*. Stn. Cambridge (Mr. WARREN.)

,, *scoticella*. Stn. Cambridge, on apple (Mr. WARREN.)

,, *guttea*. Haw. Cambridge.

Coleophora fabriciella. Vill. Cambridge.

,, *melilotella*. Scott. Cambridge.

,, *alcyonipennella*. Koll. Cambridge; Wicken (Mr. BOND.)

,, *frischella*. Linn. Wicken (Mr. FARN.)

,, *paripennella*. Fisch. Monkswood.

,, *lixella*. Zell. Fulbourn (Mr. WARREN.)

,, *pyrrhulipennella*. Tisch. Newmarket (Mr. BOND.)

,, *albicosta*. Haw. Newmarket (Mr. BOND); Brandon (LORD WALSINGHAM).

,, *anatipennella*. Hüb. Cambridge; Wicken; Wisbech.

,, *palliatella*. Zell. Cambridge; Wicken (LORD WALSINGHAM.)

,, *ibipennella*. Hey. Cambridge; Wicken (Mr. FARN.)

,, *discordella*. Zell. Cambridge; Brandon.

,, *saturatella*. Stu. Brandon (Mr. BARRETT.)

,, *onosmella*. Zell. Brandon, common.

,, *inflatella*. Stn. Cambridge (Mr. WARREN); Brandon (Mr. BARRETT.)

,, *therinella*. Stn. Near Cambridge (Mr. BOND); Wicken (LORD WALSINGHAM.)

,, *troglodytella*. Stn. Whittlesford (Mr. WARREN); Cambridge; Wicken common.

,, *lineola*. Haw. Cambridge, common.

,, *murinipennella*. Fisch. Wicken.

,, *cæspititiella*. Zell. Cambridge; Wicken (Mr. FARN); Monkswood.

,, *annulatella*. Teng. Cambridge; Wicken; Brandon.

,, *apicella*. Stu. [*cacuminatella*] Wicken, where it was first taken by Mr. BOND, and believed to be its only English habitat until its occurrence in the Norfolk Fens.

Coleophora argentula. Zell. Cambridge; Wicken and Brandon (LORD WALSINGHAM.)

,, *laricella.* Hüb. Cambridge.

,, *albitarsella.* Zell. Cambridge (Mr. WARREN); Wicken (Mr. BOND.)

,, *nigricella.* Ste. Cambridge; Monkswood; Wisbech.

,, *fuscedinella.* Zell. Cambridge; Wisbech.

,, *gryphipennella.* Bouche. Cambridge (Mr. BOND); Madingley (Mr. WARREN.)

,, *viminetella.* Zell. Whittlesford (Mr. BOND); Wicken and other Fens.

,, *solitariella.* Zell. Cambridge (Mr. BOND.)

,, *lutipennella.* Zell. Cambridge; Wicken; Doddington Wood; Warboys Wood; Brandon; Wisbech.

,, *badiipenella.* Fisch. Cambridge; Wicken, common (Mr. BOND.)

,, *limosipennella.* Fisch. West Dereham.

,, *chalcogrammella.* Zell. Fulbourn (Mr. WARREN); Brandon.

Stathmopoda pedella. Linn. Brandon, where it was first taken in England.

Cosmopteryx druriella. Zell. In a drove near Yaxley (Mr. BOND.)

,, *orichalcea.* Stn. Mr. BOND took one specimen at Yaxley, and it has been since taken at Wicken several times.

,, *lienigiella.* Zell. Wicken, where it was first discovered by Mr. E. SHEPHERD.

Batrachedra præangusta. Haw. Banks of the Cam (Mr. WHEELER); Brandon (Mr. BARRETT.)

,, *pinicolella.* Zell. Brandon (Mr. BARRETT.)

Oinophila v-flava. Haw. Cambridge (Mr. WARREN.)

Chauliodus illigerella. Hüb. Wicken, common.

,, *chærophyllella.* Goe. Cambridge; Chatteris.

Laverna propinquella. Stn. [*paludicolella.*] Cambridge (Mr. BOND.)

,, *lacteella.* Ste. Taken by Lord WALSINGHAM at Wicken in 1868 and 1869.

,, *miscella.* W.V. Cambridge; Fulbourn.

,, *fulvescens.* Haw. [*epilobiella.*] Cambridge; Monkswood; Wicken (Lord WALSINGHAM.)

,, *ochraceella.* Cur. Cambridge; Wicken (Lord WALSINGHAM); West Dereham (Mr. WARREN.)

,, *phragmitella.* Bent. Whittlesford (Mr. WARREN); Cambridge; Wicken (Mr. FARN); Yaxley, common (Mr. BOND.)

,, *decorella.* Ste. Cambridge.

,, *atra.* Haw. In gardens round Cambridge (Mr. BOND.)

,, *hellerella.* Dup. This insect, usually accepted as a variety of the above, Mr. BOND considers distinct, the larvæ being quite different. *Atra* is a pretty annulated larva and feeds upon apple buds, while the larva of *hellerella* is nearly unicolorous and feeds in whitethorn berries. In localities where Mr. BOND has seen *hellerella* in swarms he has not been able to find a specimen of *atra*, and *hellerella* does not occur in the localities for *atra*.

,, *rhamniella.* Zell. Wicken (Mr. WARREN.)

Chrysoclista linneella. Stn. Mr. FARREN believes he has taken this at Cambridge.

,, *schrankella.* Hüb. Cambridge (Mr. WARREN.)

,, *flavicaput.* Haw. Cambridge; Chatteris; March; Monkswood; Brandon.

Asychna modestella. Dup. Devil's Ditch (Mr. BOND.)

Chrysocorys festaliella. Hüb. Wicken (Lord WALSINGHAM.)

Stephensia brunnichella. Linn. Madingley and Fulbourn (Mr. WARREN); Brandon (Mr. BARRETT.)

Elachista gleichenella. Fab. Fulbourn; Cambridge; Monkswood.
,, *apicipunctella.* Stn. Round Cambridge (Mr. BOND.)
,, *albifrontella.* Hüb. Cambridge (Mr. BOND.)
,, *atricomella.* Stn. Cambridge; Monkswood.
,, *luticomella.* Zell. Cambridge, common (Mr. BOND.)
,, *cineropunctella.* Haw. Fulbourn; Cambridge.
,, *stabilella.* Stn. Fulbourn (Mr. WARREN.)
,, *gregsoni.* Stn. Cherry Hinton (Mr. WARREN.)
,, *nigrella.* Hüb. Fulbourn; Cambridge; Monkswood; Chatteris; Wisbech.
,, *subnigrella.* Dgl. Fulbourn (Mr. WARREN.)
,, *humilis.* Zell. Cambridge; Monkswood.
,, *bedellella.* Sir. Fulbourn (Mr. WARREN.)
,, *obscurella.* Stn. [*subobscurella.* Dbl.] Cambridge; Monkswood.
,, *paludum.* Fre. Cambridge (Mr. WARREN); Wicken (LORD WALSINGHAM); Brandon (Mr. BARRETT).
,, *zonariella.* Tengs. Whittlesford (Mr. WARREN.)
,, *gangabella.* Fisch. Cambridge.
,, *megerlella.* Zell. Cambridge.
,, *cerussella.* Hüb. Cambridge; Wicken; Brandon Fen.
,, *rhyncosporella.* Stn. Wicken, common.
,, *eleochariella.* Stn. Wicken (Mr. BOND.)
,, *biatomella.* Stn. Fulbourn (Mr. WARREN); Cambridge.
,, *triatomella.* Haw. Fulbourn (Mr. WARREN); Cambridge.
,, *rufocinerea.* Haw. Cambridge; Horningsea Fen (Mr. BOND); Chatteris; Monkswood.
,, *cygnipennella.* Hüb. Cambridge, common; Monkswood; Wicken; Wisbech.

Tischeria complanella. Hüb. Cambridge, abundant (Mr. BOND); Monkswood.
,, *marginea.* Haw. [*emyella*] Cambridge; Monkswood.

Lithocolletis roboris. Zell. Madingley (Mr. WARREN.)
,, *hortella.* Fab. Madingley; Cambridge; Monkswood; Chatteris; Warboys Wood; Brandon.
,, *lantanella.* Schr. Cambridge; Monkswood.
,, *quinqueguttella.* Stn. Wicken.
,, *pomifoliella.* Zell. Cambridge; Monkswood; Chatteris.
,, *spinicolella.* Zell. Cambridge.
,, *faginella.* Mann. Cambridge; Chatteris.
,, *salicicolella.* Sir. Cambridge.
,, *viminetella.* Stn. Banks of the Cam (Mr. WARREN.)
,, *carpinicolella.* Stn. Cambridge.
,, *ulmifoliella.* Hüb. Cambridge; Monkswood.
,, *spinolella.* Dup. Cambridge; Monkswood; Wicken.
,, *quercifoliella.* Fisch. Cambridge; Chatteris; Doddington Wood; Warboys Wood; Monkswood; Wisbech.
,, *messaniella.* Zell. Cambridge.
,, *corylifoliella.* Haw. Cambridge; Monkswood; Wisbech.
,, *viminiella.* Sir. Cambridge.
,, *scopariella.* Tisch. Brandon.

Lithocolletis alnifoliella. Hüb. Cambridge.
,, *heegeriella.* Zell. Cambridge.
,, *cramerella.* Fab. Cambridge; Chatteris; Doddington Wood; Warboys Wood; Monkswood.
,, *tenella.* Zell. Cambridge, on hornbeam (Mr. FARREN.)
,, *sylvella.* Haw. [*acerifoliella*] Cambridge.
,, *nicellii.* Zell. Cambridge; Monkswood.
,, *schreberella.* Fab. Cambridge.
,, *tristrigella.* Haw. Cambridge; Monkswood; Chatteris.
Lyonetia clerkella. Linn. Fulbourn and Cambridge (Mr. WARREN); Wicken (Mr. FARN.)
Phyllocnistis suffusella. Zell. Fulbourn (Mr. WARREN); Cambridge; Chatteris; Brandon.
,, *saligna.* Zell. Cambridge.
Cemiostoma spartifoliella. Hüb. Cambridge (Mr. BOND.)
,, *laburnella.* Heyd. Cambridge; Monkswood.
,, *scitella.* Zell. Cambridge (Mr. WARREN.)
,, *lotella.* Stn. Wicken (LORD WALSINGHAM.)
Opostega salaciella. Tr. Cambridge (Mr. FARREN); Brandon (Mr. BARRETT.)
,, *auritella.* Hüb. Wicken (Mr. BOND.)
,, *crepusculella.* Fisch. Wicken.
Bucculatrix aurimaculella. Stn. Cambridge.
,, *ulmella.* Mann. Cambridge.
,, *cratægi.* Dup. Cambridge; Monkswood.
,, *boyerella.* Dup. Cambridge; Wicken (Lord WALSINGHAM.)
,, *frangulella.* Goe. Cambridge; Wicken (Mr. FARN.)
,, *cristatella.* Fisch. Cambridge; Wicken (Mr. WARREN.)
Nepticula atricapitella. Haw. Cambridge.
,, *ruficapitella.* Haw. Cambridge.
; *anomalella.* Goe. Cambridge.
,, *pygmæella.* Haw. Cambridge.
,, *oxyacanthella.* Stn. Cambridge.
,, *viscerella.* Dgl. Cambridge.
,, *catharticella.* Stn. Cambridge.
,, *septembrella.* Stn. Cambridge; Horningsea Fen (Mr. WARREN); Monkswood.
,, *subbimaculella.* Haw. Cambridge; Monkswood.
,, *trimaculella.* Haw. Cambridge.
,, *quinquella.* Bed. Madingley (Mr. WARREN); Cambridge.
,, *serricopeza.* Zell. Cherry Hinton and Madingley (Mr. WARREN); Cambridge.
,, *floslactella.* Haw. Cambridge.
,, *salicis.* Stn. Cambridge.
,, *microtheriella.* Wing. Cambridge.
,, *ignobilella.* Stn. Cambridge (Mr. WARREN.)
,, *plagicolella.* Stn. Cambridge; Wicken; Monkswood.
,, *prunetorum.* Stn. Cambridge.
,, *minusculella.* H.S. Cambridge (Mr. WARREN.)
,, *tityrella.* Dgl. Cambridge.

Nepticula angulifasiella. Stn. Cambridge.

,, *gratiosella.* Stn. Cherry Hinton (Mr. WARREN); Cambridge; Monkswood.

,, *marginecolella.* Stn. Cambridge.

,, *aurella.* Fab. Cambridge; Monkswood.

Trifurcula immundella. Zell. Brandon (Mr. BARRETT.)

Platyptilia bertrami. Roess. Wicken (Mr. BOND); Wisbech; Brandon (Mr. BARRETT.)

,, *ochrodactyla.* Hüb. Wicken and Burwell (Mr. BOND); Brandon (Lord WALSINGHAM.)

,, *gonodactyla.* W.V. [*trigonodactyla.* Haw.] Cambridge (Mr. BOND); Chatteris; Wisbech,

Amblyptilia acanthodactyla. Hüb. Whittlesford (Mr. BOND); Cambridge.

Oxyptilus parvidactyla. Haw. Cambridge.

,, *lætus.* Zell. Brandon. Was first discovered on the Breck sand district in 1868 by Lord WALSINGHAM.

,, *teucrii.* Greening. Brandon (Mr. BARRETT.)

,, *pilosellæ.* Zell. Devil's Ditch (Mr. BOND.)

Mimæscioptilus phæodactyla. Hüb. Whittlesford, and Six Miles Bottom, near Newmarket (Mr. BOND); Cambridge.

,, *serotinus.* Zell. [*bipuntidactylus.*] Cambridge (Mr. BOND); Wicken, common; Brandon (Mr. BARRETT.)

,, *plagiodactylus.* Fisch. Brandon (Mr. BARRETT.)

,, *pterodactyla.* Linn. [*fuscus.*] Whittlesford (Mr. BOND); Warboys Wood; Wisbech.

Œdematophorus lithodactyla. Tr. Whittlesford, common (Mr. BOND.)

Pterophorus monodactylus. Linn. [*pterodactylus.* Hub.] Common throughout the district.

Aciptilia microdactyla. Hüb. Wicken, common.

,, *paludum.* Zell. Wicken; used to be abundant near Yaxley where it was first found by Mr. BOND.

,, *galactodactylus.* Hüb. Hardwick Wood, near Cambridge (Mr. BOND); Cambridge; Warboys Wood; Monkswood.

,, *spilodactylus.* Cur. Bred by Mr. MEYRICK from larvæ taken at Brandon.

,, *tetradactyla.* Linn. Meadows round Cambridge (Mr. BOND.)

,, *pentadactyla.* Linn. Common throughout the district.

Alucita polydactyla. Hüb. Common throughout the district.

Although the above list contains upwards of 1300 species, instead of the number mentioned in the Section in Lepidoptera, there is no doubt but that it is still capable of considerable extension. Rich as the district is in existing species, many being of great rarity, and not found elsewhere, the novelties are probably far from being exhausted, as is evidenced by the discovery, as will be seen, of several new species during the last year or two.

For kindly assistance in the earlier preparation of the list of species, acknowledgment is due to Mr. FRYER and Mr. H. RUSTON, of Chatteris. The list has also the greatly enhanced value of having passed under the revision of Mr. FRED. BOND and Mr. C. G. BARRETT, whose kindness in that respect cannot be too warmly acknowledged, while the services of the latter in the determination of species, have been invaluable.

CORRECTIONS AND ADDENDA TO CHAPTER XI.

Page 322—For DENTALIUM DENTALIS read D. ENTALIS.
,, ,, NATICA ISLANDICA ,, N. ALDERI.
,, ,, PLEUROTOMARIA ,, PLEUROTOMA.
,, Delete MACTRA OVALIS.
,, ? after TELLINA PROXIMA.

Page 323—The species headed Estuarine, are actually land, fresh water and marine. The term estuarine is here used merely to indicate the conditions under which the gravel was formed.

Page 325—Messrs. WOOD and HARMER consider their Bure Valley Beds to constitute a wide-spread deposit: but it appears more probable that several beds have been classed under this term.

Page 226—The *Mastodon* does not belong to the Forest Bed, or even, in all probability to the Norwich Crag at all. The specimens on which these determinations were made are all derived from older deposits.

Page 338—Line 18 for "not British" read "not known to live on this coast."

It has recently been pointed out that *C. fluminalis*, and *H. marginata*, cannot be claimed as warmth-loving forms, as the former still lives in cold streams in Thibet, and the latter in cold mountain streams flowing into the Loire. We must therefore cut out the "southern group" of marine shells. This in nowise effects my argument, but adds weight to the views of Messrs. WOOD and HARMER, that no water communication was open to the south at the period of formation of the March gravels. Mr. HARMER suggested to me the propriety of grouping these species into *Temperate*, or such as belong to our latitudes; *Boreal*, such as range from hence northward; and *Arctic*, such as are now confined to the polar regions. It is singular that *T. terebra*, the commonest March shell, is not now living in the Wash, or on the neighbouring coasts. The groups will be:—

Temperate.	*Boreal.*	*Arctic.*
A. PES-PELICANI.	B. UNDATUM.	P. PYRAMIDALIS.
D. ENTALIS.	L. CRASSIOR.	T. CLATHRATUS.
F. ANTIQUUS.	L. DIVARICATA.	A. BOREALIS.
L. LITTOREA.	P. RUFA.	T. PROXIMA.
L. RUDIS.	P. TURRICULA.	
L. OBTUSATA.	C. ISLANDICA.	
	M. MODIOLUS.	

Notes on Palæolithic Implements.

In addition to the localities mentioned on p. 536, I am able to add three not previously published. Cringleford, near Norwich, a fragment of a fine ovate implement found by Mr. HARMER on his estate; Barnwell, an implement was found in the gravels by Mr. A. GRIFFITHS of C. C. Cambridge; and Orton Longville, on the Nene, an implement found in the gravel by LADY HUNTLEY. I have not seen the two last. I have seen specimens said to have been found at Little Downham near Ely.

[S. B. J. S.]

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D.

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M.

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THE END.

LEACH AND SON, PRINTERS, WISBECH.