

tering at any length into an explanation of his method of illuminating microscopic objects. Considering a perfect microscope as consisting of two parts, viz. an illuminating apparatus, and a magnifying apparatus, he stated, that it was of more consequence that the illuminating apparatus should be perfect, than that the magnifying apparatus should be so; and that the essential part of his method consisted in this, that the rays which form the illuminating image or disc shall have their foci exactly on the part of the microscopic object to be observed, so that the illuminating rays may radiate as it were from the object, as if it were self-luminous. Now, this can only be well obtained, by illuminating with a single lens, or a system of lenses, without spherical or chromatic aberration, whose focal length, either real or equivalent, is less than the focal length of the object-glass of the microscope. The smaller the focal length of the illuminating lens or system of lenses, the more completely do we secure the condition that the illuminating rays shall not come to a focus either before they reach the object, or after they have passed it. When Dr. Wollaston recommended for an illuminating lens, one of three-fourths of an inch in focal length, in which the microscopic object was placed in a vertex of foci, where the rays crossed in a thousand points both before and after they fell upon the object, he could have had no idea of the new method of illumination. In the construction of a perfect microscope, Sir David Brewster recommended that the illuminating and magnifying apparatus should have separate and similar movements along the same rod or bar, and that the stage for the objects should be unconnected with both, and should have also a motion independent of both.

The improvement which he communicated on the Polarizing Microscope, was one which he had used for several years, and which consists in placing the analyzing prism or simple rhomb immediately behind the object-glass, that is, on the side of the object-glass next the eye. The great inconvenience of placing it between the eye-glass and the eye, had induced several skilful observers to reject the prism altogether as an analyser, or to substitute for it a plate of tourmaline, which is quite unfit for any observations in which colour is to be considered. The analyzing prism may remain constantly on the microscope behind the object-glass, without in the least injuring the performance of the microscope, and it should have a motion of rotation independent of the body of the microscope.

WEDNESDAY.

SECTION B.—CHEMISTRY AND MINERALOGY.

'On a New Method of ascertaining the Refractive Powers of Minute Bodies, and its application to Mineralogy,' by Alexander Bryson.

The means at present employed in ascertaining the refractive powers of crystalline substances, rendered it necessary to procure pieces not less than a quarter of an inch in size, which were then to be ground into prisms, before any idea of their refractive powers could be obtained. The microscope is well suited, with a slight alteration, to give minute differences in refractive powers. On the stage of the microscope is placed a piece of crown glass, with fine lines drawn on its first surface. If a piece of beryl, or any other mineral with parallel sides, is now placed on the glass, the lines will no longer be visible through the microscope, until it is raised above the crystal three hundredths of an inch. The difference of focus becomes an index of the difference of refractive power, between the glass plate and the crystal. The means adopted to ascertain minute changes in focal length, is a scale of hundredths of an inch, with a vernier dividing it into thousandth parts.

Mr. ESPY gave a summary of his views with respect to the causes of the Diurnal Fluctuations of the Barometer, for which see Section A. Saturday, p. 794.

'On the Preparation of Alloxan, Alloxantine, Thionurate of Ammonia, Uramile, and Murexide,' by Prof. Gregory.

To prepare alloxan from uric acid, Liebig and Wöhler used nitric acid sp. g. 1.42, and separated the acid liquid from the crystals by means of a porous brick, thus losing the whole mother liquid. The author uses nitric acid of sp. g. 1.35. The action of this acid on uric acid must be kept moderate. When crystals of alloxan are formed, the whole is

thrown on a filter, the throat of which is stopped with asbestos. That portion of the acid liquid which remains in the crystals is displaced by a few drops of cold water, and the crystals are purified by recrystallization. The liquid is again employed in the same way, and the crystals collected as before. Five such operations may be performed with the same liquid, each yielding a large crop of crystals; while the mother liquid is preserved, and yields a large quantity of parabanic acid, or oxalurate of ammonia. By this process the author obtains from 100 parts of uric acid, 65 of anhydrous alloxan, or 90 of alloxan + 6 aq. From alloxan, alloxantine is easily obtained by the action of sulphuretted hydrogen. Thionurate of ammonia is easily formed, by boiling a solution of alloxan with sulphite of ammonia and free ammonia. Uramile is also easily obtained, by boiling a solution of thionurate of ammonia, with an excess of diluted sulphuric acid. Murexide is obtained, as described by Prof. Gregory on the Thursday (p. 742). He now exhibited the last three processes. He also stated, that the theory of the formation of murexide was of great importance in reference to organic colouring matters.

Prof. JACOBI made some observations respecting his discovery of Galvanoplastics, or electrotypes, from which, and from printed documents, it appeared that he had communicated a notice of the discovery to the Petersburg Academy on the 5th of October 1838. In his pamphlet, 'Die Galvanoplastik,' the date of this communication is 5th of October 1839; but it was stated that this was a typographical error. The first published account of the discovery appeared, according to Prof. Jacobi, in a Petersburg journal of the 30th October, 1838—(der St. Petersburger deutschen Zeitung). The attention of Mr. Spencer, the latter stated, was attracted to the subject as early as 1837, and in 1838 he communicated the result of some of his experiments to several persons in Liverpool. He did not, however, publish an account of them till 1839; so that Prof. Jacobi is undoubtedly entitled to the claim of priority of discovery, as far as publication is concerned, which usually determines the question.

SECTION C.—GEOLOGY AND PHYSICAL GEOGRAPHY.

Mr. MURCHISON exhibited several new geological maps of different parts of Germany, and especially directed attention to two inedited maps which the authors had prepared for his use, and of which he proposed to avail himself in subsequent researches. Amongst them was a map of parts of Silesia, Moravia, and Bohemia, by Leopold Von Buch; and the second a very large unpublished map of Germany, by M. H. Von Dechen, which contained a greater mass of important detail, as regards geological and mineral distinctions, than any map of the present period.

Mr. Murchison next called attention to the subject of the 'Old Red Sandstone of the Northern Counties of Scotland,' the general relations of which had been pointed out, and some of its fossil fishes described by Prof. Sedgwick and himself. On this occasion his object was, to mark distinctly the progress which had since been made in our knowledge of the structure and contents of this formation, in the same tract of country. In doing this, he referred to Mr. Hugh Miller, of Cromarty, who unaided had unravelled the complicated relations of the older stratified deposits around his native place, and had first endeavoured to describe a singularly formed animal with lateral wing-like processes, which has been found recently in considerable quantities on both sides of the Murray Firth. Mr. Murchison then adverted to the general views of Dr. Malcolmson, of Forres, who had re-examined all the fish deposits lying between the Orkneys and Aberdeenshire, and divided the old red sandstone of these parts into three measures, the middle and lower of which are distinguished by forms of fish peculiar to each. This work, illustrated by drawings, is now in the course of publication in the Geological Society's Transactions, and will form a subject of comparison with the work preparing by Prof. Asmus, of Dörpat, upon similar ichthyolites, and to which Mr. Murchison adverted in his communication, on the Geology of Russia (p. 800).

Prof. AGASSIZ was then called on to give his opinion on the winged fish, which, after a high encomium on the preparatory labours of Mr. Miller,

he named *Pterichthys Milleri*.—Mr. KEEN, of Elgin, stated, that he had found some years ago the same form, now named *Pterichthys Milleri*.—Mr. DE LA BECHE remarked, that in rocks so much pervaded by peroxide of iron as old red sandstone, which peroxide was adverse to the growth of shells, it was reasonable to expect that fish would prove the more important organic remains, as they had the power of locomotion, and could move about in the water, where the peroxide fell to the bottom, and rendered it unfit for mollusca.

Mr. J. E. BOWMAN read a memoir 'On the Geology of Ceará, North Brazil,' and exhibited a series of specimens of fossil fishes, both of which were forwarded to him by Mr. Geo. Gardner, a native of Glasgow, who has been for several years, and still is exploring the botanical treasures of the interior of Brazil. The province of Ceará, which forms a portion of North Brazil, is situated between the 3rd and 8th degrees of south lat., and the 37th and 41st of west long. It is of an oblong form, its greatest length being about 100 leagues from north to south, and its width varying from 50 to 70 leagues. It is bounded on the north by the Atlantic Ocean, and on the west by a low mountain range, which separates it from the great inland province of Pianhy, and consists for the most part of sandy or gravelly plains, which remind the traveller of the descriptions of the Pampas of Buenos Ayres. Boulders of granite, gneiss, and quartz, sometimes of four feet diameter, and more or less rounded, occasionally occur; and here and there a low ridge of gneiss rock crops out, dipping at a very high angle to the N.W. For many leagues from the coast, the characteristic and prevailing vegetation of the plains is a beautiful species of palm, called Carnahuba by the Brazilians, (*Corypha cerifera* of Martius,) while that of the ridge of gneiss consists of various Cactæ (of the genus *Cereus*), and a large Bromelia. At a distance of about 80 leagues from the north coast, and 10 leagues below the Villa de Icó, the nearly monotonous level of the country is broken by a mountain range, which makes its appearance to the eastward. This is the Serra de Pereira, which runs S.W. and N.E., and is 16 leagues in length, and its greatest height about 1000 feet above the surrounding plain. Its S.W. extremity is entirely of gneiss, but at its base is a coarse red conglomerate, containing rounded fragments of both primitive and secondary rocks. The country between Icó and the small Villa de Crato, 34 leagues to the S.W., is of a more hilly undulating character; more abundantly wooded, and only occasionally opening into the large campos or plains of the north. In this tract gold has been found in small particles, interspersed in a dark coloured diluvial soil, near the Rio Jaguaribe, but not in sufficient abundance to repay the speculators. At about 18 leagues south of Crato, the gneiss rocks are replaced by a grey-coloured primitive clay slate, and at the termination of this the secondary stratified series begins, the few rocks occurring from thence to Crato consisting of a white coarse-grained sandstone. Crato stands in the middle of a large undulating valley, among hills which are the flanks or lateral spurs of the long chain which separates the provinces of the coast from that of Pianhy to the west, and which here receives the name of Serra de Araripe. The highest parts of this range do not rise more than from 1,200 to 1,500 feet above the town of Crato; their tops are perfectly level, and continue so many leagues to the west and south, forming what the Brazilians call Taboelas, or table lands. In all directions these hills consist of a light-coloured sandstone, which has sometimes a reddish tinge. In the bed of one of the largest streams, a section of the strata to a considerable depth, exposes a bed of limestone three feet thick beneath the sandstone, and resting upon a seam of impure coal two feet thick, which in its turn is placed upon another and lower bed of limestone. In these limestones no fossil remains could be found; the strata are all perfectly horizontal; and the level appearance of the whole Serra makes it probable they are so throughout. About 14 leagues to the south from Crato, is a branch or spur of this Serra, which projects 10 leagues to the eastward, on the south side of which is a small villa called Barra de Jardine, situated in a small valley upwards of a league in length, and about half a league across in its widest part. The deposit of fossil fishes (from which

those now exhibited were chiefly obtained,) is in an open place of the gently sloping ridge north of the villa; there the ground is covered with great abundance of rounded stones of various sizes, from that of an egg to blocks of several feet in circumference, consisting of a light-coloured, rather impure limestone, in which lines of bedding may often be perceived, and sometimes minute shells. They split very easily, and contain portions of fishes in a more or less perfect state; by far the greatest number, however, being so much broken, that it is with considerable difficulty that tolerably perfect specimens can be obtained. The space to which these limestone nodules are confined, is not more than 100 yards square, and scarcely any other kind of stones is to be found among them; but on every side of it the ground is covered with other rounded pebbles of sandstone, similar to the rock of which the Serra is composed. Three other deposits of fishes occur in the neighbourhood; one about half a league to the south, a second at Macapé, five leagues to the east of Jardine, and a third at Mundo Novo, three leagues to the west. These are all on the declivity of the low hills, between the valley and the Serra, and perfectly resemble the one described, in consisting only of the rounded fossiliferous limestone nodules. On breaking these nodules, many of them exhibit abundance of a minute bivalve shell. At Mundo Novo, Mr. Gardner found in the same nodule a very perfect specimen, of what he believes is a species of Turritites, about an inch and a half long, and a single valve of a Venus, about half an inch in length, and in very excellent preservation. He was told by a person at Jardine, that a few years ago he found a small serpent coiled up in a stone which he had split, but this no doubt was a species of Ammonites. In the several hundred stones, however, which he broke in search of fish, he met with nothing of this description. These specimens Mr. Gardner had not sent over; neither had he accompanied those submitted to the Section, by any of the sandstone of the Serra de Araripe; but, from the fact communicated to me by M. Agassiz, that he has not yet met with Cycloid fishes in any older formation than the chalk, and as far as can be inferred from the minute bivalves, it is probable that the sandstone hills in which the deposits occur, belong to that geological epoch. He states, that he could nowhere find in the neighbourhood of Barra de Jardine, any limestone in situ. This circumstance, taken in conjunction with the fact, that the fossiliferous nodules show indications of stratification, and are found in detached localities, and not intermixed with those of the sandstone which surrounds them on every side, leads to the conclusion that they occur as a bed or layer of detached concretions in the sandstone, each fish or portion of one (for many seem to have been imbedded after being broken,) having attracted round it a sufficient quantity of the lime disseminated through the mass to form a nodule.

[We have been informed by Mr. Bowman, that M. Agassiz examined the whole collection of these fossils, and pronounced them to be from rocks the equivalent of the chalk formation, and to be entirely new to science, not only as to species, but genera. Mr. Bowman has placed the whole series, consisting of 150 to 200 specimens, at the disposal of M. Agassiz, in order that they may be figured and described in the 'Histoire des Poissons Fossiles.']

Lord GREENOCK announced the discovery of lead, on the estate of his brother, Colonel Cathcart, on the borders of Galloway and Ayrshire; the vein runs N.N.E. and S.S.W., and is not far distant from granite: the contained silver averages five ounces to the ton. Hæmatitic iron ore is in the vicinity.

Mr. FEATHERSTONHAUGH made a communication 'On the Geography of New Brunswick.'—He alluded to the ignorance which prevailed on this subject, at the time of making the boundary treaty; but as there was an unwillingness on the part of the meeting to enter on the political view of the question, Mr. Featherstonhaugh said, it was difficult to explain the subject satisfactorily. As it is one of extreme delicacy, and the report of the commissioners was some time since laid before Parliament, we think it better to refer all who are interested to the published Report.

Dr. HANNAY exhibited a section of the bed of the Clyde, made by the late Mr. Logan. In the survey

a number of borings had been made, and different phenomena occurred. Skulls had been found twenty-eight feet in the silt, also armour, but no fossil remains.

The last paper brought before the Section was from Mr. KNIPE, 'On the Vale of Solway, and Closeburn Basin.'—Mr. Knipe stated, that the new red sandstone occurs both on the north and south of the Solway river; the subjacent limestone occasionally occurs. At Aiket Muir, and at Ecclefechan are coal measures. New red sandstone extends up the river Annan to Moffat; in this is situated the famous Corncockle Muir quarry, where footmarks in the sandstone were discovered some years ago. These marks are also to be seen at the Craigs Quarry, some of which were shown at the Birmingham meeting. In the Closeburn Basin are new red sandstone and carboniferous limestone; a basaltic dyke cuts through it.

TUESDAY.

SECTION D.—ZOOLOGY AND BOTANY.

Prof. Graham (of Edinburgh) in the chair.

Mr. SMITH, of Deanston, exhibited a model and gave a description of a Salmon Stair.—The object of this construction was to allow of the passage of salmon up streams where mills or other impediments existed. After various efforts, Mr. Smith succeeded in erecting one near his own residence, which answered the purpose. The salmon, by means of a dyke constructed by the side of the mill-stream, were enabled to pass up the stream whilst a wire defence kept them from falling into the mill-stream.

Dr. M'DONALD suggested that the dam should be larger than that proposed by Mr. Smith, as the larger the dam the less would be its inclination, and the fish would have less difficulty in ascending.—Mr. SMITH stated that the steps were six feet asunder, and it was equally applicable to steep places or rivers. The fry were never injured in passing down the stream, although they came in contact with the mill-wheel. The fish are not deterred in their journeys by this apparatus, as they had been counted, and in one instance 180 were found above and 182 below.

Prof. AGASSIZ gave an account of his researches on the development of the embryo in the ova of fishes, more especially of the family Salmonidæ. He detailed at great length the successive changes undergone by the various systems of organs. The object he had in view in these investigations was to ascertain if there existed any relation between the forms of fish of the present day, during the successive stages of their development, and the permanent forms of fish found in the older strata of the earth. The details of the Professor's views were illustrated by drawings.

Sir W. JARDINE observed that, in the structure of the Salmonidæ, as in most other animals, the anatomical details were in accordance with the habits of the animal. The nerves of taste were small, and this sense was dull. There was also a want of nerves in the skin, and the sense was not acute, as the animal might be touched without its knowing it. The organ of sight was highly developed, and the power of this sense was very great. The organ of hearing, though largely developed, was not adapted for collecting the vibrations of the air, as a gun might be fired over salmon and they would not move; he believed the ear of the salmon adapted to perceive the vibrations of the water, for, if the water they were in was moved at a great distance, they became aware of it.—Mr. FORBES thought the bifurcation of the cilia must have been an optical illusion; the existence of cilia at all in such a position, he thought, extraordinary.—Dr. LIZARS was quite certain of the existence of the cilia in the nasal membrane, as he employed only low powers, and could then see them very distinctly, and they were also seen by the artist who executed the drawings. He had not seen the metallic scales referred to by Prof. Agassiz, and this gentleman had also traced the epidermis on the scales, further than he had done himself.—Prof. AGASSIZ had not seen the cilia on the nasal membrane.

Messrs. FORBES and GOODSIR on a new genus of Ascidians.—They had lately discovered two species; one of them was found in the mud-filled cavity of a bivalve, dredged from thirty fathoms water, at the mouth of the Frith of Forth; two specimens of the other were found near Rosyth. The appearance of these animals was so peculiar that they were unable to determine their position in the system till dissec-

tion displayed their relation to the Tunicata, and revealed their interesting character. The animals of this genus are—free, elongated, dilated posteriorly, respiratory and excretory orifices exerted, the first being at the anterior extremity and in the axis of the animal. As both the species were found in muddy ground, the genus was named *Pelonaia*. The species from the Frith of Forth, *P. corrugata*, is characterized by transverse somewhat irregular rugæ, a dark brown colour, and a length of two inches and a half. The Rosyth species, *P. glabra*, is smooth, with a slight villosity, greyish white, length one inch. The following anatomical peculiarities distinguish these from other Ascidians:—1, The respiratory opening has no radiated folds or papillary fringes. 2, The respiratory sac is elongated, radiated, exhibits transverse folds, which contain the primary branches of the branchial artery and vein, and are tied to the internal surface of the muscular sac and to the respiratory tubes by a longitudinal row of thread-like bands, on each side. It gradually contracts posteriorly into the oesophagus. 3, The digestive tube floats free in the capacious cavity of the muscular sac, except where it is tied down by muscular bands, and it terminates in a free floating and radiating extremity in the anterior, and half the length of the animal from the posterior opening of the sac just mentioned. 4, The vascular system exhibits no heart, and in consequence of the peculiar relative position of the respiratory sac and the other viscera, the system is symmetrical, the blood flowing backwards in the branchial vein and systemic artery, and forwards in the systemic vein and branchial artery; these two systems forming a dorsal and ventral vascular trunk. 5, The reproductive organs consist of two elongated sipunculated tubes, shut at one extremity, opening at the other into the cavity of the muscular sac, and closely attached to its inner surface. The orifices of these tubes are situated at the anterior third of the animal. 6, The principal peculiarities of the muscular cloaca is its firm adhesion to the internal surface of the tunic. In consequence also of the attachment of the viscera to its internal surface along the lateral line only, its cavity is much more capacious, resembling in this respect the water-filled cavities of the bodies of certain Echinodermata. A strong transverse band is placed behind the excretory orifice. External and internal symmetry is the leading peculiarity of *Pelonaia*. It is this symmetry which renders the genus valuable, as it reveals the structure and relations of the different organs in the unsymmetrical ascidians. We may now state with certainty that the branchial vein, heart and systemic artery of the typical ascidians correspond to the dorsal vascular system of the annulose animals, and the systemic veins and branchial artery to the ventral vascular system in some of the latter. The genus is also interesting as it indicates the relations of the Mollusca to the Annulosa, and to the Echinodermata.

Mr. PATTERSON read a paper on Medusæ.—After briefly noticing some of the specific distinctions of two species of Medusæ common on the Irish coast (*Cyanea Lamarckii* and *Aurelia aurita*), Mr. Patterson stated, that his object was chiefly to direct the attention of the members to the Acalepha of the British shores—a portion of our Fauna hitherto uninvestigated. With this view he described at some length their habits and appearance. He next proceeded to detail some of their peculiarities of organization, especially the difference observable in their filamentary appendages, and the varying number of the mouths and arms. Our ignorance of their physiology was exemplified by a series of questions relative to the organs of sensation which they possess, and the origin and uses of their luminosity, their stinging powers, their means of defence and propagation, their length of life and their peculiar parasites. It was stated that we are ignorant, not only of the structure of the acalepha, but even of the species which frequent our shores—an ignorance arising from the necessity of studying these animals in a living state, and also from the want of proper descriptions and figures. Those which may be confided in are given by Müller, Sars, Mertens, and Escholtz, in comparatively scarce works; and, as two are written in German and one in Danish, they are sealed books to those who are ignorant of these languages. In consequence, we are in continual danger, if we venture to name one that appears unknown, of adding to the existing con-