posed the term "Epi-Silurian" for these formations, which, he observed, could not be called "old red sandstone" in Devon, or "Devonian" in Herefordshire.

Prof. PHILLIPS first discussed the general nature of the problem involved in determining the age of the Devonian strata, and compared them with other systems of strata whose relative position had been fully made out,—showing that, both by mineral character and structure, and sequence of individual rocks, the strata of Devonshire could be confidently ranged among the older assemblages of rocks, but were not referable to their exact age, or place in the general scale of geological time, by characters derived from these considerations. Mr. Phillips next proceeded to examine the value of zoological evidence. Seeing that as the fossils of any series of strata were found in deposits, which have in succession formed the bed of the ancient sea, and are therefore to be received as the monuments of successive combinations of life, the question arose, what was the character of organic life in each of these periods? These remains of life are most plentiful in the upper strata, decrease in number and variety as we proceed downwards, and, by gradual and continual diminution, approach in the lowest to absolute extinction. In the Devonian rocks more than 300 forms are now known; and from the abundance of materials not yet examined we may expect to raise it to 500, a number greater than that yet found in the Silurian system. Turning from the consideration of numbers to another mode of comparison, we may study the prevalent forms of organic life, characteristic of successive periods. Nature is always consistent in the inorganic and living parts of creation, and the combination of organic remains was not the same when the earth was under different conditions from the present. The predominant mollusca of the ancient sea were not of the same type as the present. The Cephalopoda and Brachiopoda, now comparatively rare, were abundant and various in the ancient beds; but Polypiaria abound in all strata where the necessary conditions seem to have existed. Having ascertained the combinations which characterize groups of the older strata, the general result of a comparison between the Devonian rocks and the Silurian and carboniferous systems would give them an intermediate position between the combination of life in the Silurian period and that in the carboniferous; and Mr. Phillips considered the evidence derived from this ground as free from imperfection as any which could be obtained. He next considered the value of particular species in characterizing formations, and observed that in one country a species might spread all over a deposit, but never rise to those above, or have existed in those below; in another country it might range through twenty consecutive beds; no reliance can therefore be placed upon a single case, such as the occurrence of a coral in both the Silurian and Devonian systems. It has been said that not one carboniferous fossil occurs in the Silurian system, nor one Silurian fossil in the carboniferous; but in Devonian strata fossils of both these formations occur mixed, so that it appears that some Silurian fossils continued to exist till after the commencement of the Devonian series, and some of the carboniferous fossils began to exist earlier than its close; and in districts far removed some species of both formations may have commenced their existence at the same point of time. The Polypiaria of the Devonian and Cornish strata resemble those of the Silurian; and the Crinoidea and many Brachiopoda resemble those of the carboniferous system; whilst some forms manifest no analogy to either. Again, there are features in the combination of organic remains peculiar to certain districts. The organic remains so abundant at Petherwin, strongly and specially resemble those of the Fichtelgebirge, described by Count Münster. The fossils of North Devon and Cornwall often resemble those of the carboniferous limestone, whilst the South Devon corals resemble those of the Silurian system. The fossils of North and South Devon differ considerably, and the circumstances under which they existed seem to have differed. The fossils of South Devon seem principally analogous to those of the *lower beds* of North Devon, especially the corals; but from the very nature of coral reefs some species of coral might be prolonged under particular circumstances through long periods of time. With respect to the arrangement of the ancient fossilliferous strata in one grand series, Mr. Phillips was not of opinion that all the terms have yet been obtained. When Mr. Murchison introduced his system of 400 new forms of fossils, the sequence was still incomplete; and now that another system had been introduced, with a probability of 500 more species, there might yet be on the continent more than one series of beds of which we have here no representatives. The Devon and Cornish strata may be one such series, not representing a whole geological interval; still less can it be said to be an exact equivalent of the old red sandstone, which is but a local interruption in the sequence of zoological affinities; and in examining the changes which have taken place upon the globe at large, we may find evidences of many such partial interruptions. Prof. Phillips concluded by recommending the study of stratified rocks, as the individual effects of one great series of changes which had gone on in regular sequence from the first appearance of organic life to the time when existing species first appeared in the tertiary deposits, and through the tertiary to existing conditions, and proposed to group the whole under three great classes, by the names of Palæozoic, Mesozoic, and Cainozoic deposits, a classification depending wholly on general views of the associations of organic life, and yet really capable of being harmoniously compared with mineral characters taken on a large scale, and with a simple series of successively superposed strata, such as that formerly proposed by Mr. Conybeare.

Since the publication of the Report of Prof. Phillips's paper 'On Fossil Crustaceans, &c.' (*ante*, p. 599), we have received the following note:—

Clifton, Bristol, 18th Aug. 1841.

Perhaps it may be interesting to your readers to know, that the little Cypridiform Entomostraca, from the lower limestone shales of Pembrokeshire, to which I called the attention of the Geological Section of the British Association at Plymouth, have a wider geographical range than I then presumed to indicate. I have had the pleasure, to-day, of recognizing them, very distinctly, in the same geological place, below the great mass of mountain limestone, and above the old red sandstone, on the bank of the Avon, about one mile west of the Hotwells. Yours, &c.,

JOHN PHILLIPS.

SECTION D.—ZOOLOGY AND BOTANY.

Prof. OWEN gave an account of a Thylacinus, the great dog-headed opossum, and one of the rarest and largest of the marsupiate family of animals. At the present day it existed only in Van Diemen's Land, though formerly it had a much more extensive geographical distribution. For his knowledge of the anatomy of this animal Mr. Owen stated that he was indebted to Sir John Franklin, who had kindly preserved and sent him a specimen in spirit, and he believed this was the only specimen extant in Europe. In its habits it was carnivorous; holding about the same relation to the other marsupiata that the carnivora did to the whole of the mammalia. It was a great pest to the shepherd in its native districts; and in its low intellectual character, and its craft and cunning, very much resembled the wolf. In destroying sheep, it does not feed on them at once, but proceeds to worry, if possible, the whole flock, first tearing one and then another. Its smell is very powerful. It has a narrow head, a large number of incisor teeth, with the molars all alike. Its bony palate is very defective, thus presenting a lower organization than any of the carnivora of Europe. Its internal organization agrees with that of Dasyurus. Its external organization presents nothing remarkable. It has the pouch so remarkably characteristic of the whole order of these animals. The reason of the existence of this pouch might be to enable the animal to carry its young great distances more easily, as it was obliged to travel far in seasons of drought in search of water. Both male and female possess this pouch in the whole family, in the former less evident. In Thylacinus the pouch is more developed in the male than any other genus.

Mr. J. C. BELLAMY made remarks 'On the Distribution, &c. of the Mammals of Devonshire;' he exhibited a drawing of the palate of an individual of *Balænoptera minor* (Knox), taken off Plymouth, and showed a portion of the baleine, and a part of the ear of that animal. He showed a new species of Vole, taken at Yealmpton. He also displayed a tooth of an extinct species of elephant, from the Yealm Bridge cavern; a species of Asterias unknown to him; a species of Helix new to the British isles; some Helices from the Yealm Bridge cave (proving their modern date); the skull of *Arvicola agrestis*, having teeth with fangs, instead of the common fluted condition; and several curious reliques of arvicolæ, birds, fish, &c. from the cavern of Yealm Bridge, which he discovered.

Dr. RICHARDSON stated, that the new Helix described by Mr. Bellamy, under the name of *H. subvirescens*, had been seen by Mr. Gray, who found it to be the *Helix rivulata* of the continent. It had been found by Mr. Forbes in the Isle of Man, and also described by Turton.—Mr. COUCH observed, with regard to the white varieties of animals, he did not believe it depended, as frequently supposed, on cold. He knew in Cornwall a district in which a white variety of hares existed, and had propagated their race. The various species of Cetacea were not uncommon on the coast of Cornwall. He had seen some fifty or sixty feet long, and had often watched their actions by means of a telescope. The Asterias produced by Mr. Bellamy was new to him.—Mr. BALL believed the Asterias was described in Mr. Forbes's 'History of British Star-fishes.'—Col. SMITH related an instance of a number of specimens of the *Lepus Americanus* being shipped in America quite white, and at the end of twenty days they had turned quite brown. The hairs were not shed, and the change must have taken place in the hairs themselves.—Dr. LANKESTER observed, that unless more specimens of the *Mus intermedius* and *Arvicola hirta* could be procured, it would be very unsafe to admit them into the list of new British animals. A variety of circumstances might occur, producing the amount of difference which these specimens appeared to present.

Mr. P. F. BELLAMY read a paper descriptive of two Peruvian Mummies presented to the Devon and Cornwall Natural History Society by Capt. Blanckley, of the Royal Navy.—They proved to be the remains of children of different ages, one a few months old, the other not much more than one year; they were brought from the mountainous district of Peru, but at a considerable distance from the lake Titicaca. In conjunction with them were found certain envelopes (one of which proved to be an article of dress,) and the model of a raft or catamaran, two small bags containing ears of an undescribed variety of Indian corn, and two small earthen pots. He also exhibited a variety of other models found wrapped up with others examined by Capt. Blanckley. The skulls were found to resemble those adult specimens contained in the Museum of the Royal College of Surgeons in London, and presented the same peculiarities, viz. a short projecting face, square protruding chin, receding forehead, and elongated cranium. He stated, that he considered their formation to be natural, for the following reasons: 1st, that the peculiarities are as great in the child as in the adult, and indeed, more remarkable in the younger individual than in the elder; 2nd, from the great relative length of the large bones of the skull, all of which are elongated in a posterior direction; 3rd, from the position of the occipital bone, which occupies a place in the under part of the cranium; 4th, from the absence of marks of pressure, there being no elevation of the vertex nor projection on either side; and 5th, from there being no instrument, nor mechanical contrivance, suited for the process of compression, found with the remains. He called attention to the peculiar formation of the occipital bone, which consisted of five rudimentary portions; the fifth piece being placed between the occipital portion, commonly so called, and the two parietal bones. He considered the probability of the mummies being the remains of some of the true Titicacan race, deposited after the arrival of the original emigrants, who founded the Incas dynasty, and called on ethnologists to say what Asiatic people they resembled in manners, customs, and attainments; but if no affinity could be found, he considered it fair to attribute to the indigenes a mental capacity equal to the originating of such inventions, as the specimens connected with these mummies would indicate them to have been capable of. The extinction of the race he considered to have been gradual, and occasioned by an intermixture of blood with the followers of Manco Capac. Lastly, he suggested that the adult skulls called Titicacans were of two kinds, one being of the pure stock, the other of a spurious character, resulting from the

and of a saline taste; it has been examined by Professors Faraday and Daniell, and found to contain in the imperial pint 8.100 cubic inches of carbonic acid gas, and 151.66 grains of dry salts, thus:—

Chloride of Sodium....	96.64
Muriate of Magnesia ..	18.68
,, ,, Lime	15.10
Sulphate of Soda	9.55
,, ,, Lime	8.94
Carbonate of Lime	2.06
,, ,, Iron	0.69
	151.66

Its specific gravity at 62° is 1013.3.

Prof. Sedgwick, after reviewing the general principle of artesian wells, described two districts in which these operations were attended with very different results. In the eastern part of Essex the chalk is covered by sandy beds of the plastic clay, and these by several hundred feet of impervious strata of London clay, all dipping together towards the east. The arenaceous beds below the London clay rise higher towards the chalk than the clay does, and absorbs a considerable part of the water from the high grounds. By boring through the clays to this sand, springs of water immediately rise above the surface, and are carried off by natural channels. By this supply of water, the value of the land has been materially increased, since the country, though abounding in peat bogs, and stagnant ponds during winter, suffers much from the summer drought. The other attempts to form artesian wells, referred to by Mr. Sedgwick, were made near Lincoln, which, though surrounded by fens, covered with water in the winter, is not sufficiently supplied during the summer. But the clays supporting the fens of the Bedford Level are below the chalk, and though there are pervious beds beneath them, which rise to the north-west, yet the clays are of such enormous thickness that they have never been penetrated; and even were that accomplished, the high land is so distant that intervening fissures, filled up with impervious materials, might intercept the supply. Expensive sinkings have been made at Lynn, and also at Boston, and after boring through many hundred feet of clay they have utterly failed, and in any future operations in this district the chance of success would be very remote. Mr. Sedgwick then observed with respect to the red colour of rocks mentioned by Dr. Moore, that he considered it simply owing to the red oxide of iron which might be present or not in any bed; sometimes the tinge was only superficial. In Nassau the red colour was owing to vicinity of trap rocks. He also observed, as to the condition of limestone rocks, that although they sometimes appear in masses, presenting a brecciated appearance, shells and broken corals being cemented together, yet generally they occur as regular parts of the series repeated without any regularity, in formations of all ages. In position and inclination they resembled their associated rocks, and partook in all their contortions and dislocations, except so far as their solid masses would resist mechanical movements, better than yielding deposits of sediment and mud. The organic remains found in limestones only differed from those in the other beds of the same age as far as the conditions differed under which each was deposited. At the present day different families of corals grow upon a solid and a soft bottom.—The Rev. W. D. Conybeare pointed out the similarity between artesian wells and mines sunk in the coal measures. Artesian borings had been made with success near the outcrop of certain strata, but at a distance from this, although the combination of strata was the same, they had failed, from the great depth necessary to be penetrated. Now it is certain that the coal exists in many places beneath the new red sandstone and magnesian limestone, but at such depths that it would be hopeless to attempt to reach it. He therefore recommended to the attention of miners the formation of a series of artesian borings in some of the coal districts, beginning where the probability was greatest, and proceeding from that point till the depth became too great. Such a series of experiments would show the nature and depth of the strata below, and over what extent coal might be worked without sinking shafts at enormous expense and with the risk of complete failure.—Mr. Bartlett observed, in confirmation of one of Dr. Moore's remarks, that where limestones abounded in corals, as at Berryhead, their structure was homogeneous, and exhibited little trace of stratification; when the corals were rare, the bedding became distinct.

Dr. Buckland desired to state more explicitly the opinion he had given on Friday, with respect to the construction of breakwaters, &c. of limestone.—Upon further inquiry he was inclined to believe the ravages of the Pholas and Saxicava did not extend to any great depth, but were chiefly confined to the interval between high and low water-marks. The length of time requisite to destroy a work of considerable extent by such means would probably render it still advisable to use limestone where it could be obtained with facility, since it would be better to rebuild once in five hundred or a thousand years than go to the immediate expense of employing granite. Dr. Buckland then exhibited a series of specimens from Lord Morley's granite quarries, in Prince Town, Dartmoor. To the depth of fifty or sixty feet the granite is more or less decomposed, and this *surface granite* has been employed in almost all cases, because it was obtained cheapest; and the result has been, that in all buildings which have stood for any number of years, such as the Dartmoor prison, each block of granite has become a spongy mass, absorbing moisture continually, rusting the iron bars employed in combination with it, and rendering the cells so damp that they can only be used by covering the walls within and without with Roman cement or tiles. This defect is inseparable from all the granite which is not quarried from a depth beyond the influence of decomposition. At the bottom of the Morley works a mass of granite is exposed to a great extent, and entirely free from this influence; it is from this the granite is obtained now being used for Lord Nelson's monument in Trafalgar Square. Dr. Buckland also exhibited specimens of granite containing tin, and a mass of amethystine quartz, from Dartmoor. He next described the quarries and potteries at Shaw, seven miles north of Plymouth. The surface, over hundreds of acres, consists of decomposed feldspar, in a state resembling flour; this is purified by passing streams of water over it, and when baked it forms a fine porcelain, from which ornamental figures, &c. may be made. Specimens of the decomposing feldspar, and the porcelain prepared from it, were exhibited by Dr. Buckland; also fire-bricks made from the refuse of the tin ore, which did not suffer like those ordinarily employed by being used in the furnaces for black bottle-glass; and waterpipes, precisely like those made by the Romans and discovered uninjured at Stonefield and at Palermo, showing they will last two thousand years, combining this advantage, that the water conveyed by them would not be charged with ferruginous matter, as in the iron pipes.

Dr. Moore exhibited a collection of the fossils just discovered in some of the slate rocks.—Mr. S. P. Pratt exhibited specimens, supposed to be from the black slate overlying the limestone of Mount Batten; they were derived from blocks lying on the beach close to the black shales; one piece was in contact with the bed containing encrinites. They contained several species of plants and scales of fish.—Mr. Phillips observed, that the slates of Bovisand and the neighbourhood, where these scales were found, was far removed above the Plymouth limestone: the scales appeared to be those of the Holoptichus and Palæoniscus of carboniferous and old red sandstone deposits. The Palæoniscus occurs chiefly in the upper carboniferous limestone, and extends to higher beds; two forms of its scales, the smooth and ornamented, were in Mr. Pratt's specimens, and both are found in the carboniferous system. The shales were so similar to those of Manchester that actual comparison would not serve to distinguish them.

Mr. Dawson exhibited a model of the Great Landslip of Axmouth, which took place at Christmas, 1840. It was constructed on a scale of 120 feet to the inch, and represented a mile and a quarter. According to Mr. Dawson, the length of the chasm caused by this subsidence was 1,000 yards, the breadth 300 yards, and the depth 130 to 210 feet; 22 acres were sunk in the chasm.

The Rev. W. Conybeare, and afterwards Dr. Buckland, described the general nature and particulars of the landslip (vide *Athenæum*, No. 654). The strata at Axmouth consist of chalk resting upon extremely sandy beds of "foxmould" or upper greensand, and the beds dip towards the sea. The extremely wet winter of 1840 reduced these lower beds to a quicksand, which at length gave way, and let down a part of the cliff above; part settled forward and part downwards, forcing up, by its pressure, a bank of sand in the harbour, twenty or twenty-five feet above sea level; the bedding of this forced up mass was stated to be in a contrary direction to that of the cliffs.—Mr. Whewell stated that apparently no tremor causing a change of level in the land near the landslip had taken place, for a person had been sent to examine the block of granite placed at Axmouth, to register the level of the tides, and had any change, even of the twentieth of an inch, taken place, it would have been observed.—Mr. De la Beche observed that the landslip appeared to have taken place along a small line of fault known before to have existed there.

Major Harding read a notice of the discovery of some fossils on Great Hangman Hill, near Combemartin, North Devon.—They consist of shells in the form of casts, and appear in large detached and ferruginous masses of quartzose rock, ranged on the surface. Major Harding has also observed a similar formation in the Valley of Rocks, near Linton.

Prof. Sedgwick observed that fossils had not before been found in this locality; they were considered the same as the fossils in the upper Ludlow rock. But they were found in the lowest part of the Devonian system, all the old red slates being above them; the fact therefore of finding upper Silurian fossils near the base of the Devonian system only proved that in Devon there was no good line of separation between the systems. When Mr. Sedgwick and Mr. Murchison examined the country, in 1836, they were led, chiefly by mineral structure, to consider the highest groups of North Devon identical with the Caradoc sandstone: the beds further north, which dip under these, were found to contain fossils of the old red sandstone, which led them to suppose it was a grand case of *bouleversement*. In 1838, Mr. Sedgwick again examined the district, and finding there was no reversal, was obliged to relinquish the idea of the identity of the higher groups with the Caradoc sandstone, and refer them to the parallel of the upper old red sandstone. Mr. Lonsdale's examination of the fossils of the Plymouth limestone having determined its intermediate position between the carboniferous and Silurian systems, the whole system of rocks in North and South Devon were regarded, on zoological evidence, as newer than the Silurian system and older than the carboniferous; the exact lines of demarcation between these systems not being finally settled. Mr. Sedgwick then alluded to the difficulty he and Mr. Murchison had experienced in drawing a line between the Cambrian and Silurian systems. The Llandeilo flags would have formed a good basis for the Silurian system, but they were not persistent, yet the want of a good base line does not destroy the value of the details which Mr. Murchison has collected. A similar difficulty occurs in descending below the carboniferous limestone: certain typical forms appear and disappear, one series melting into another, so that no group can be entirely different, from those above and below; but this circumstance, though it makes the divisions of strata more difficult, does not make them less real. One general conclusion becomes very apparent—wherever we meet with rocks admitting of the preservation of organic remains, the number of these decreases as we descend in the series, till we arrive at a period when the physical monuments of the globe bear no trace of organized beings, an abyss which gives no record of life, and sets a bound to our zoological inquiries. But the researches of the geologist do not stay here; it still remains for him to investigate changes connected with great moving forces, with galvanism, and with polarity, manifested in cleavage, and joints, and all the other problems connected with the primary rocks; and these inquiries Prof. Sedgwick believed would in future form one of the most important parts of geological investigation.

Mr. J. C. Bellamy exhibited a collection of Devonian fossils, containing about 150 species, and a printed table of genera, showing the various localities in which they were obtained; he stated the relative abundance of groups of fossils in these rocks, as occurring in the following order: Polypiaria, Crinoidea, Conchifera, Cephalopoda, Gasteropoda, and Crustacea.—The Rev. W. D. Conybeare pro-