

organic peculiarities. Even by placing rock specimens in distilled water, outlines and designs may be brought out which were before invisible; and still more may be learned by the application of hydrochloric acid, or by studying weathered surfaces. As examples of the importance of attending to minute characters, the author mentioned that the red sandstone of Berchtesgaden had been considered the equivalent of the old red schists of Salzburg; but he had detected the existence of green particles in this sandstone, and had traced them to a distance increasing in numbers until the red sandstone became green, and was clearly recognizable as a lower member of the Cretaceous group. In a similar manner he had ascertained that the black, lias-like schist of M. Besele r, in the western Bavarian Alps, was also "greensand." Microscopic fragments of characteristic shells, like the *Caprotina*, had been found by him where entire specimens were wanting; and in some of the lofty Alpine limestones, which are destitute of fossils, he had detected microscopic remains which showed their origin, like that of the chalk formation, to have been intimately connected with "the wide-spread and powerful-working spirit of life developing itself in forms invisible to the unassisted eye."

'On the Geology of a part of the Himalaya and Tibet,' by Capt. STRACHEY.—Capt. Strachey pointed out on a large map the great elevated region of Central Asia, extending from the sources of the Oxus to the Yellow River of China; bounded on the north by the Kouenlun mountains, on the south by the Himalaya, which form the southern face of the elevated region, rather than a separately existing chain. Little is known of the interior and northern part of the region, but it appears to be broken up into a mass of mountains, where valleys as well as the ridges have a very great elevation. The observations of the author relate to the centre of the Himalayan chain, between the river Kalee and the Sutlej, a space of 200 miles, and extending N.W. from the plain to a distance of 120 miles.

'On the Drift and Surfaces of Rocks on the Coast of Scotland,' by Sir R. I. MURCHISON.—The rocks on the coast of Loch Fyne, near Inverary, were described as being worn and striated on their N.E. face and rugged on the opposite side; the striae were in a direction parallel with the Loch, and sometimes ten or fifteen feet long. They were particularly observed near the fishing village of Kenmore, where the rocks of chlorite schist were smoothed and striated on the surfaces away from the sea. Similar observations were made on the coast between Ben Cruachan and Oban. Connecting these with the phenomena formerly observed on the east coast of Scotland, Sir R. Murchison was of opinion that Scotland during the glacial period had formed a narrow rocky tract penetrated by deep fiords; that there might have been glaciers on some points, but that the worn and polished rocks were chiefly to be attributed to the descent of masses of gravel and blocks moving down along with great debacles of ice and snow on the successive upheavals of the region in an icy sea.

Mr. HOPKINS exhibited a map of the lochs and mountains around Ben Cruachan, with the distribution of the trains of granite blocks which he had described last year at the Edinburgh meeting. He had formerly been unable to explain by what means the granite blocks supposed to have been derived from Ben Cruachan had crossed the mountain group between Loch Fyne and Loch Lomond, so as to gain access to the latter, and form a stream extending to the Clyde and Glasgow. Since then, he had discovered in this very mountain group a granitic tract not marked on the geological maps, in the immediate vicinity of Loch Sloy, at a height of from 1,500 to 2,000 feet, and agreeing in mineral character with these travelled blocks, which may therefore have descended Loch Long and Loch Lomond with the same facility that the granite blocks of Ben Cruachan have entered Loch Aure, and those of Loch Etive have reached Oban and Kerrara. Mr. Hopkins then referred to the possible causes of the dispersion of the granite blocks;—if by currents from the sea, then the country must have been depressed nearly 2,000 feet, as Wales is believed to have been about the same period;—if transported by floating ice, independently of glaciers, then also the country must have had a

lower level;—terrestrial glaciers might also have been the agents, if their existence was allowed. The position of the blocks in horizontal streams along the sides of the lochs, at an elevation of four or five hundred feet, and their character—being at first large and angular, but becoming smaller and more rounded, until they were mere water-worn pebbles,—were circumstances opposed to the supposition that floating ice or terrestrial glaciers were the principal agents in their removal. If floating ice had been the cause, then the sphere of dispersion would have been much greater. In Glen Ray he had observed indications of what he considered true moraines. He was still inclined to believe that more than one of these methods had been in operation, and that the whole mass of the Highlands had been the centre of divergence from which the blocks had been dispersed.

The DUKE of ARGYLE referred to Mr. James Smith's observations on the shores of the Gare Loch, in confirmation of the statement that the course of the blocks and striated surfaces was only locally uniform, and that it followed the valleys and arms of the sea whatever might be their direction.

MONDAY.

'On new Fossil Mammalia from the Eocene freshwater formation at Hardwell, Hants,' by Prof. OWEN.—The specimens described were from the collection of the Marchioness of Hastings, and belonged to the genera *Paloplotherium*, *Xiphodon*, *Dichodon*, and *Hyænodon*. The genus *Paloplotherium* (Owen) is the link which connects the tapir, rhinoceros, and palæothere with the hippothere and horse. It differs essentially from the *Anoplotherium* in having a long interval between the molar and canine teeth, and in having the external nostril formed by six bones instead of four. From *Palæotherium* it differs in having only six molars on each side of the upper jaw. The species (*P. annectans*) found at Hardwell also occurs in the lignite formation of Gargas, Vaucluse. The genus *Dichodon* agrees with *Anoplotherium* in having an uninterrupted series of teeth; remains of two species (*D. cuspidatus* and *dorcus*) have been found at Hardwell. Of the genus *Xiphodon* an almost entire lower jaw (distinct from the *X. gracilis* of Cuvier) has been obtained. Also an entire lower jaw of the *Hyænodon*:—a genus "so remarkable amongst the carnivorous order for retaining the normal formula of the dentition of monophyodont placental, and for the truly carnassial form of the three true molars." The Hardwell specimen agrees with the *H. minor* of M. Gervais, from the lacustrine marls of Alais.

'On the probable Dimensions of the great Shark (*Carcharias megalodon*) of the Red Crag,' by Mr. BOWERBANK.—The teeth of this fish are common in the coprolite beds of Suffolk; but although exceedingly hard, they are usually much water-worn, and have nearly always lost the serrated edges which are so well preserved in specimens of the same species from Malta. The teeth of the upper jaw may be known from the lower teeth by their comparative narrowness and thickness; those from the sides of the jaws are progressively smaller and shorter. The largest specimens measure from 4½ to 5 inches in length. In order to give some idea of the magnitude of the creature to which they belonged, Mr. Bowerbank exhibited the jaws of the largest known specimen of the *Carcharias glauca* of Australia; it was killed by a whaling crew, when after having gorged itself on their captain, it seized the boat sent in its pursuit. It measured 37 feet in length; its vertical gape is 25½ inches, its horizontal 20½ inches; the length of its largest teeth 2½ inches. From the measurements it is inferred that the fossil shark must have had a gape of at least 5 feet by 6, and an entire length of not less than 65 feet. This estimate is not at all improbable, as there exists a (comparatively harmless) species—the basking shark—in the British seas, of which one individual, killed off Brighton, measured 36 feet, and one which was stranded in the Orkneys, and described as a "sea-serpent," exceeded 50 feet in length. Looking at the mineral character of these fossils, and their association with the teeth of a second Maltese shark (*Oxyrhina hastalis*), not found either in the London clay or coralline crag, Mr. Bowerbank was inclined to regard them as having been derived from the destruction of some older clay deposit, perhaps an

extension of the great miocene formation of southern Europe.

Sir C. Lyell and the Rev. Barham Zincke exhibited a large irregular and marine chalk flint, and rounded pebbles of flint and phosphate of lime, from the red crag at Wherstead. These specimens, and many others in the same layer of shingle, have their upper surfaces overgrown with small barnacles, showing that, for a time at least, there was not sufficient movement in the sea to overturn the small pebbles, which must have been at a very small depth, if not actually between tide marks.

'On the Echinodermata of the Crag,' by Prof. E. FORBES.—These fossils, amounting to twenty species, are mostly obtained from the coralline crag. They consist of two new Comatulæ, not related to the existing British, but to Indian species; a unique specimen of a star-fish from the Red Crag, identical with the recent *Uraster rubens*; four Echini, of which one is the common British species, *E. sphaera*; three species of *Temnopleurus*,—a genus not now living in the Atlantic, but living in India, where it also occurs fossil; two species of *Echinocyamus*, one identical with the British *E. pusillus*; fragments of an Echinoneus; two species of *Spatangus*, one *S. purpureus*, the other, *S. regina* (Gray), of Malta; a species of *Amphidotus*; and lastly *Brissus Scillæ*, which occurs both living and fossil in the Mediterranean, but is properly a tropical Indian form. In this assemblage there is a mixture of Celtic with Indian types, and an absence of characteristic Lusitanian forms; as if during the crag epoch there had existed a communication with the eastern seas, but a barrier to the south:—a conclusion which would harmonize with Mr. Searles Wood's inferences from the shells of this formation.

'On the Discovery by Dr. Overweg of Devonian Rocks in North Africa,' by Prof. E. FORBES.—This was an announcement of an important discovery made by Dr. Overweg in Fezzan, whence he has sent specimens of true Devonian rocks with fossils identical with those of the Devonians of the Sierra Morena in Spain. No palæozoic rocks have hitherto been discovered in Africa north of the line; and this new fact may probably prove of consequence in explaining the physical and organic peculiarities of Africa,—and, taken in connexion with the fact of the existence of Devonian rocks in the Cape region, may indicate a palæozoic axis running north and south through that continent.

'On the Remains of a Gigantic Bird from the London Clay of Sheppy,' by Mr. J. P. BOWERBANK.—The specimen described is a fragment of one of the bones of the extremities; it is 4 inches long and 1 inch in diameter at the larger end, and is somewhat three sided, with rounded angles. The thickness of its walls is from ⅓ of a line to 1¼ lines; its microscopic structure exhibits the characteristic bone-cells of animals of the bird tribe.

'On the Pterodactyles of the Chalk Formation,' by Mr. BOWERBANK.—The author exhibited drawings and restorations of remains of these winged reptiles, showing that the great species of the chalk (*P. Currieri*) must have had a spread of wing equal to 16 feet 6 inches; whilst a second large species (*P. compressirostris*) was estimated at 15 feet. The largest species previously well known, the *P. macronyx* of Buckland, from the lias, was only computed at 7½ inches from tip to tip of its expanded wings.

'On the age of the Copper-bearing Rocks of Lakes Superior and Huron, and various facts relating to the physical structure of Canada,' by Mr. W. E. LOGAN.

'On the Silurian Fossils of Canada,' by Mr. J. W. SALTER.—Lower Silurian, Allumette Island. These are regarded as forming one group, intermediate between the Potsdam sandstone and the Hudson River series, and agreeing with the Trenton limestone of New York.

Mr. LOGAN exhibited the slab of Potsdam sandstone, with tracks like those of a tortoise, which is regarded by Prof. Owen as proving the existence of an air-breathing four-footed animal at the very earliest period of known animal life.

Prof. E. FORBES exhibited the new species of *Maclurea* referred to by Mr. Salter, and its operculum,—and stated that he regarded it as one of the floating forms which appear to have been common in the Silurian period. The shell, however, is described by Mr. Salter as "strong and massive," and