

but useful method we hope to teach some really practical ideas of geological phenomena.

Impracticable in the present state of knowledge, it would take years to construct such an entire map of the first dry lands, and we have, therefore, selected a portion containing the typical district, and which is certainly correct in its great features, though still wanting in some details; and in the primitive lands there portrayed, the long ridge extending along the western margin of the whole American continent, from the northernmost point of Russian America through the Isthmus of Panama to Cape Horn, the lunulate mass on the north side of the lakes encircling Hudson Bay, with the outlying islands and patches, appear at a glance as the framework upon which the existing territory has been elaborated and expanded in the great geological ages which have passed away, and in these remnants the primitive lands are probably very nearly represented, for, as the rock-masses were elevated, it would naturally follow that the more newly-raised and outer or marginal portions would be degraded by the action of the waves, and form the source of the materials of the subsequent deposits during successive geological periods.

(To be continued.)

CONTRIBUTIONS TO THE GEOLOGY OF GLOUCESTERSHIRE. THE LIAS.

BY THE REV. P. B. BRODIE, M.A., F.G.S., &c., &c.

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The beds immediately below the Marlstone, which consist of laminated shales and clays often micaceous and sandy, were well exposed at the latter place during the formation of the reservoirs, and at Robinswood Hill, near Gloucester, and at Chipping Campden, on the north-eastern extremity of the county, a locality which deserves a special visit. In this part of the series, at the base of the Marlstone, a good deal of ironstone prevails, which, it is said, was in ancient times worked near Gloucester; it is of some thickness and of excellent quality at Campden. These beds are no where destitute of fossils, among which, at the last-named place, we may especially notice the fine *Ophioderma Gaveyi* (one of the brittle-stars,* some species of which are so frequent in our

* Some of the recent Ophiuridæ have a singular habit of shaking off their tender arms when touched, as if in defiance of their captor, and owing to this, it is almost impossible to obtain specimens in perfection.—P. B. B.

present seas) and a new species of Pentacrinites (*P. robustus*, Wright). Here, too, at the base of the Marlstone, Mr. Gavey found two previously undescribed forms of star-fish, the *Uraster Gaveyi* and the *Tropidaster pectinatus*, both of which were figured and described by the late lamented Professor Edward Forbes, in the 3rd Decade of the Geological Survey. With them he obtained an entire and beautiful large *Cidaris Edwardsii* (Wright), with the attached spines, a rarity in this condition in any formation, and especially in the Lias, where Echinoderms are very scarce; although we have met with specimens of some small species, with the spines attached, in the upper, middle, and lower Lias.

These fossil star-fish are often obtained grouped together, as living ones are now, with their short spines adhering to the rays. Indeed, they seem to have been more than usually abundant at this spot—at least, such is the case with the *Tropidaster pectinatus*. Two or three species of small Crustacea, chiefly belonging to the genus *Astacus*, were also procured there in the argillaceous nodules, irregularly distributed throughout the clay. The most interesting we have seen is one in our possession, nearly allied to the recent genus *Æga*, belonging to the order Isopoda, and which, like others of this group, was probably parasitic upon fish. There were also a great number and variety of marine shells in a remarkably good state of preservation, and these were equally abundant at Hewlett's Hill, some of them retaining the actual shell. Although the railway at Campden has been long since finished, and the excavations for the reservoirs at Hewlett completed, the spoil-banks are well worth a careful search, and many pretty specimens may still be obtained. This portion of the Lias is particularly rich in fossils wherever it occurs; only, from its position in Gloucestershire, it is seldom exposed, and therefore cannot be so often searched as the Marlstone and the lower Lias. Similar beds were laid open in Northamptonshire during the construction of the famous Kilsby tunnel; and the organic remains there detected were nearly identical, and equally abundant. Among the most characteristic shells at all these localities, the following may be mentioned—*Pholadomya Murchisoniæ*, *Cardium truncatum*, *Plicatula spinosa*, *Modiola scalprum*, *Arca Buckmani* and *A. pulchra*, *Pecten æquivalvis*, *Perna* (*Crenatula*) *ventricosa*, *Leda rostralis*, *Hippopodium n.s.*, *Nucula*, showing cast of the intestinal canal; *Trochus imbricatus*, *Ammonites Henleyi*, *A. planicostatus*, and a small grooved Belemnite. Many of these are grouped together in clusters, especially *Cardium*

truncatum, whole blocks being nearly entirely composed of them; and several beds of oysters were also obtained *in situ* at different depths. It is to be observed further, that the bivalves preponderate over the gasteropodous univalves in the Lias generally, and in this particular zone are several species which are limited to it. The Cephalopoda (Ammonites, Belemnites, and Nautilus) are not in this division represented by so many species as in others; although individuals are numerous, and indicate a considerable depth of water. Remains of Saurians are scarce, only a few bones and detached vertebræ of Plesiosaurs having been met with; presenting thus a wide contrast with the abundance of those marine monsters in the lower part of this formation.

In our next article, when describing the underlying beds, which, in fact, compose the main mass of the Lias in Gloucestershire, we hope to dwell somewhat longer on the habits and structure of the remarkable marine reptiles which played so prominent a part in the zoological history of the earlier stages of the deposit. Indeed, there is only one other geological period during which such creatures swarmed in equal profusion, and in such numbers that they must have been the tyrants of the deep, so that the eras of the Lias and Wealden have been not inaptly termed the "age of reptiles." And, although these remains are few and far between in the upper and middle part of the series in this county, in other places they are much more frequent, as in the upper Lias at Ilminster, in Somersetshire, and at Whitby, in Yorkshire. Most people are probably aware of the general form and appearance of these saurians: a fine collection of them may be seen at the British Museum, and in various local collections, both public and private, so that ample facilities are not wanting for making acquaintance with these extinct animals,* even to those who have little or no knowledge of Geology.

* The gardens of the Crystal Palace are enriched with noble models of these creatures.—ED. GEOLOGIST.