beds is due as much to their unfavourable position, as to the percolation of water from only cropping at the escarpment of Cross Fell. Zinc ranges from the Little Limestone down to the base of the Great Limestone. Copper from the top of the Scar to the top of the Tynebottom Limestones, especially in the copper hazles. Lastly, the greater the inward dip, the larger the supply of metal.

NOTICES OF MEMOIRS.

I.—Contributions to the Study of the Errant Annelides of the Older Palæozoic Rocks. By H. Alleyne Nicholson, M.D., D.Sc., M.A., Ph.D., F.R.S.E., Professor of Natural History in University College, Toronto. [Proceedings of the Royal Society, May 8th, 1873.]

In this communication the author endeavours to elucidate the abundant and obscure organic remains which are found so commonly in the Palæozoic rocks, and especially in the Silurian strata of Britain, and which are generally known by the vague and convenient names of "Fucoids," "Annelide-burrows," and "tracks." After expressing his opinion that the first step towards the study of these obscure fossils lies in the provisional grouping and naming of the more marked forms which are already known to exist, the author proceeds to divide the remains under consideration into two great groups. In the first of these groups are those fossils which are truly the *burrows* of marine worms, as distinguished from mere trails and surface-tracks. Some of these burrows (*Scolithus*) are more or less nearly vertical in direction as regards the strata in which they are found; and they are to be looked upon as being true burrows of habitation. In this section are placed the genera *Scolithus*, *Arenicolites*, and *Histioderma*. Other burrows are of a totally different nature from the preceding, and may reasonably be compared to the burrows of the recent lobworms. These burrows run more or less horizontally as compared with the laminæ of deposition, or they penetrate the strata obliquely. They are not burrows of habitation, but are wandering tunnels excavated by the worm in its search after food. The fossils of this group, therefore, as preserved to us, are not the actual burrows themselves, but the burrows filled up with the sand or mud which the worm has passed through its alimentary canal. The burrows of this kind (including many forms previously described under the names of *Chondrites*, *Palæophycus*, etc.), the author groups together under the name of *Planolites*.

The second great group of Annelide-remains comprises genuine surface-trails or "tracks," which of necessity never pass below the surface of the bed on which they occur. Some of these remains, such as *Crossopodia*, are, beyond doubt, due to the operation of marine Annelides; but it may be a matter of question whether we have in these cases the actually petrified body of the worm, or merely the track produced by the passage of the animal over the surface of the mud or sand. The author, however, gives reasons for

believing that the latter explanation is truly the correct one. Other fossils belonging to this group (such as *Myrianites*) are equally, beyond doubt, produced by the operations of marine animals: but it remains quite uncertain whether they have been formed by Annelides, Crustaceans, or Mollusks. Lastly, there are remains which appear to be really *casts* of the surface-trails of Annelides or other marine creatures, and which, therefore, are elevated above the surface of the bed on which they occur. Such remains may readily be confounded with those belonging to the genus *Planolites*, from which they are only distinguishable by the fact that they are strictly confined to a single surface of deposition. To fossils of this nature the author proposes to restrict the generic title of *Nemertites*.

Finally, the author describes some singular tracks apparently produced by Crustaceans belonging to the genus *Ceratiocaris*, and for which he proposes the generic name of *Caridolites*.

The following list comprises the species of fossils described in this communication :—

A. Burrows.

I. Genus Arenicolites, Salter.
1. *Arenicolites sparsus*, Salter.
2. ——— *didymus*, Salter.
3. ——— *robustus*, Nicholson.

II. Genus Scolithus, Haldemand.
4. *Scolithus canadensis*, Billings.
5. ——— *linearis*, Hall.
6. ——— *verticalis*, Hall.

III. Genus Histioderma, Kinahan.
7. *Histioderma hibernicum*, Kinahan.

IV. Genus Planolites, Nicholson.
8. *Planolites vulgaris*, Nicholson.
9. ——— *granosus*, Nicholson.
10. ——— *articulatus*, Nicholson.

B. Trails.

V. Genus Crossopodia, M'Coy.
11. *Crossopodia scotica*, M'Coy.
12. ——— *lata*, M'Coy.

VI. Genus Nemertites, M'Leay.
13. *Nemertites Ollivantii*, Murchison.
14. ——— (*Palæochorda*) *major*, M'Coy.
15. ——— (*Palæochorda*) *minor*, M'Coy.

VII. Genus Myrianites, M'Leay.
16. *Myrianites tenuis*, M'Coy.
17. ——— *Murchisoni*, Emmons.

C. Appendix.

VIII. Genus Caridolites, Nicholson.
18. *Caridolites Wilsoni*, Nicholson.

II.—Reports of the Geological Survey of Indiana, for the Years 1870–71–72. By E. T. Cox, State Geologist. Assisted by Prof. John Collett and Dr. G. M. Levette, etc. (Indianapolis, 1871, 1872. London: Trübner & Co.)

THESE Reports are contained in two volumes of 303 and 488 pages respectively, with accompanying maps, plans, sections, and other illustrations of the districts described, as well as tables

of analyses of coals and other minerals, so as to make known their commercial importance. The Counties surveyed in detail in 1870 were chiefly Sullivan, Daviess, and Martin; and the following were surveyed in detail in 1871 and 1872, viz. Perry, Dubois, Pike, Parke, Ohio, Dearborn, and Switzerland counties, besides a preliminary examination of some ten or twelve others, from which a good general knowledge of their geology has been obtained, as well as the continuance of the Block or iron-smelting coal from the northern limits of the Indiana coal-basin to the Ohio river, a discovery of great advantage to the State, for this coal, which is unequalled for smelting iron, may probably induce the building of blast furnaces along the entire eastern margin of the coal-basin. In Indiana there are two well-defined zones (eastern and western), containing apparently some equivalent seams, yet the quality of the coal is quite distinct in each. The eastern area is about 450 square miles, and includes bituminous coals characterized, as non-caking or free burning; the *Block-coal* belongs to this series, and is so called from the facility with which it can be mined in blocks; it has a laminated structure, and is composed of alternate thin layers of vitreous dull black coal and fibrous mineral coal. The western zone comprises the greatest area, being over 6000 square miles, and contains three or more very thick beds of coal besides a number of thin ones. Its eastern boundary is formed by the zone of block-coal, but cannot at present be well defined; it appears however from the Report that the block-coal beds change in character, and pass into caking coal in going west.

From a general study of the Western and Indiana Coal-measures, Prof. Cox concludes that the Carboniferous rocks of the Appalachian and Western coal-fields were formed in two great depressions that gave rise to large inland seas, which communicated with the ocean on the south and west, and covered most of the southern states, as far north as the 35th parallel. A high ridge of Silurian rocks, capped in places with the Devonian, lying in a north-easterly direction across the states of Tenessee and Kentucky, and along the western border of Ohio, and the eastern of Indiana, separated these two seas from each other, and spreading over portions of the two latter states, extended into Pennsylvania, on the east, and Illinois and Iowa on the west, forming an unbroken chain along their northern shores. In these seas were formed the sub-carboniferous rocks, and, as the water became shallow from accumulated sediments, a barrier was formed, which shut out the ocean, and cut off the source of salt-water supply. By the further drainage of a large surface area, the water of these seas became less and less brackish, and the conditions necessary for the accumulation of the coal vegetation were, in this way, brought about so gradually that many marine forms continued to exist, and, by degrees, accommodated themselves to the new condition of things (p. 164). It is further inferred that these seas were of unequal depth, for the thickness of the strata in the two coal-fields is very different, the Appalachian being estimated at 2500 or 3000 feet, whereas the

Western coal-field will hardly exceed 1000 feet, and in Indiana not more than 700 feet.

The intercalated limestones and shales are replete with marine remains of fish, Cephalopods, Brachiopods, and Gasteropods, many of them even being specifically identical with British Carboniferous forms, an occurrence "which can scarcely be harmonized with the adopted 'bog or swamp' theory for the deposition of Coal and Coal-measure Limestones;" (p. 200) "for they indicate a home in the profound and quiet depths of a central ocean, remote from the influence of waves as well as from rocky or sandy bottoms, until some mighty current of disturbed and muddy waters, impelled by earthquake action, overwhelmed these animals—the impure water putting an end to their life, and burying them in the slimy bed deposited over the coal material." (Report, 1872, p. 201.)

These two volumes, which are chiefly occupied by descriptions of the Carboniferous rocks, contain also some useful and interesting notices of the Quaternary deposits, as well as of the agriculture, botany, and economical substances of the districts surveyed.

REVIEWS.

I.—The Geological Evidences of the Antiquity of Man; with an Outline of Glacial and Post-Tertiary Geology, and Remarks on the Origin of Species, with special reference to Man's First Appearance on the Earth. By Sir Charles Lyell, Bart., M.A., F.R.S. Fourth edition, revised. 8vo. pp. 572. (London: John Murray, 1873.)

NO man, during a long career as a scientific writer, has ever enjoyed a more well-deserved popularity or held a higher position as the exponent of modern geological thought and discovery than Sir Charles Lyell.

His books have been widely circulated and largely read. Even his "Antiquity of Man"—to some extent a diversion from his previous writings, and forming as it were an advanced post in a new region (the Quaternary Period) about to be annexed to Geological Science—met with the same warm and ready reception by the public.

Thus we find that the first edition, which was published in 1863, was followed by the second two months later, and by the third edition before the end of the year! Such a run of popularity required an interval of rest and recuperation; accordingly we find a period of ten years has now elapsed since the publication of the third edition—a period rich in varied and additional proofs of Man's antiquity. These, so far as the author has been able to collect and compress them into the small number of pages added to the fourth edition, will be found duly arranged and enrolled in the present volume.

The author has divided his book into three distinct parts, the first of which, called the "Antiquity of Man," might with more propriety (he thinks) have been distinguished as the "Geological Memorials of Man." The introduction, into the second part, of "the Glacial