

needed, are to take place without elevation and subsidence of the ground beforehand?

A theory has been lately put forward by Prof. Bischoff, too late for notice in this Memoir, that elevation and depression 'have resulted from an increase or decrease of volume in deeply seated rocks, in consequence of the more or less complete displacement of the silica of their silicates by carbonic acid.*

We cannot forbear quoting a passage from the close of this Appendix:—'A study of the existing state of any portion of the earth's surface will show that denudation is, in fact, more a hill-maker than a hill-destroyer. . . . In what I say here, I, of course, allude to sub-aërial, pluvial denudation, by rain and rivers. Oceanic denudation may perform a greater amount of work in abrading and transporting matter; . . . but, as a rule, and as compared with pluvial denudation, it is purely a levelling agent; it carries away wholesale where the other agency would work out mountain-systems on its own principles.' The relation of the two kinds of denudation has been ably worked out by Prof. Ramsay for the district of the Weald.†

It is not a little strange that the advocates of theories of atmospheric denudation should be chiefly found, of late days, in the ranks of our Geological Surveys,—Ramsay, Jukes, and Logan being followed by Medlicott, Geikie, and others; and we think it not a small thing in favour of these views, that they are upheld by those who, of all men, should know something of that 'form of the ground' by the careful and detailed examination of which they get their living. To Hutton, Playfair, and Scrope belongs the honour of being the earlier advocates.

With the Memoir is a map, on a scale of eight miles to an inch; and there are also three lithographic plates, as indistinct as is usual with that style of illustration, and many woodcut sections. The 'get up' contrasts very favourably with the thin paper and crowded type of our own Geological Survey Memoirs, which, we feel assured, would be thought more of were they printed as they should be, and not sacrificed to a miserable and mistaken notion of Governmental economy.

To conclude, the work, which is a credit both to its author and to the Geological Survey of India, should be read by every philosophical geologist.

ON THE FORMATION AND HISTORY OF THE MALVERN HILLS. By Dr. H. B. HOLL, F.G.S. [Quart. Journ. Geol. Soc., No. 81, February, 1865.]

THE principal object of this valuable paper is to show that the rocks which constitute the axis of the Malvern Range, and which have hitherto been treated of as syenite, &c., are in reality of *Metamorphic* origin, and consist of a variety of gneissic and schistose rocks,

* Quarterly Journal of Science, vol. i. p. 475 (June 1864).

† The Physical Geology and Geography of Great Britain, 2nd edit., 1864.

partly micaceous, but chiefly hornblendic, with occasional sub-crystalline bands, and beds of coarse-grained diorite interstratified; traversed also abundantly by quartzo-felspathic veins, and invaded by dykes and masses of erupted trap (diabase): and Dr. Holl has endeavoured to prove that they form a part of the old Pre-Cambrian continents, of which the metamorphic rocks of British North America, of Scandinavia, Bohemia, Brittany, and the Channel Islands—of the Lewis, the Malverns, Charnwood Forest, Donegal, &c., are uncovered areas, forming what Professor Dana has called a 'Universal Formation,' on which all the other stratified deposits repose.

The presumed great antiquity of the Malvern metamorphic rocks rests upon a variety of evidence. The fact that rocks of Upper Cambrian age rest directly on the flanks of the range shows that the crystalline rocks are by position at least as old as the Lower Cambrian system. But the author has also shown that the Malvern Range was, if not dry land, at least a submarine ridge at the period of the deposition of these Upper Cambrian beds, by the shallow-water conditions they present, and by the fragments of the crystalline rocks of the hills they contain; and that they were laid down on the upturned edges of the metamorphic rocks: and further, that from the oblique direction of the strike of the metamorphic rocks (NW. and SE.) and from other evidence, it is clear that the portion uncovered along the Range of the Malverns is only part of a much larger area. The metamorphism of extensive areas, however, can be due only to some general cause. The production of these changes, therefore, in the Malvern rocks, their subsequent invasion by granitic veins and trap-dykes, and their upheaval and tilting into highly inclined positions, must have occupied an enormous period of time, which could not have been more recent than the Lower Cambrian epoch; and the period of their accumulation (there is a vast thickness of these metamorphic rocks) must have preceded this. The conclusion, therefore, appears a fair one that these rocks must be of Pre-Cambrian age, and their chemical constitution supports this view, inasmuch as, like the rocks of Canada, the Hebrides, Scandinavia, Donegal, &c., which are admitted to be of Laurentian age, they contain an abundance of basic minerals, such as hornblende, epidote, ferro-aluminous mica, &c., and felspars poor in silica.

Dr. Holl then goes on to show the dynamical changes that the range has undergone:—first, that it was probably dry land (or at least high ground) in the Primordial sea, and that it was subsiding during the deposition of the Upper Cambrian series;—that it was again dry land, and had been subjected to denudation, at the period of the deposition of the May Hill Sandstone, as shown by the shallow-water conditions, and successive overlap of the beds; and that the subsidence which accompanied their deposition was continued through the whole of the Upper Silurian period until the close of the Lower Old Red, but that elevation then again took place, as seen by the absence of the Middle Devonian beds, and by the attenuation, in the direction of the Malverns, of the Upper Old Red, the Carboniferous Limestone, and Millstone-grit; the thin deposits of Coal to the North and South of

the Range having been laid down unconformably on the denuded surface of the Lower Old Red and Upper Silurian rocks: also that oscillations of level took place during the Permian and Triassic periods, as shown by the unconformities between the several members of these groups; and that the last great catastrophe, which brought down the Trias on the Eastern side of the Range, was posterior in date to the Lias.

REPORTS AND PROCEEDINGS.

GEOLOGICAL SOCIETY OF LONDON.—June 7, 1865; W. J. Hamilton, Esq., President, in the chair. The following communications were read:—

1. ‘Note on *Ovibos moschatus*, Blainville.’ By M. E. Lartêt, For. Mem. G. S. Translated by the late H. Christy, Esq., F.R.S., F.G.S.—A hoof-phalange found by Mr. Christy and the author in the Gorge d’Enfer was stated to be identical in form and dimensions with the corresponding bone of the existing *Ovibos moschatus*, to which species M. Lartêt therefore referred it. With it were found remains of *Ursus spelæus*, *Felis spelæa*, Wolf, Reindeer, and Aurochs, as well as worked flints differing from those found in any other of the Dordogne caves. The author remarked that the Gorge d’Enfer is the most southern locality at which remains of *Ovibos moschatus* have yet been found, and is 15° south of its most southern limit at the present day; but the Reindeer has been found by Mr. Christy and himself farther south still—on the northern slope of the Pyrenees.

2. ‘On some Additional Fossils from the Lingula-flags.’ By J. W. Salter, Esq., F.G.S. With a Note on the Genus *Anopolenus*; by Henry Hicks, Esq., M.R.C.S.—In a recent paper Mr. Salter described the new genus *Anopolenus* as a blind Trilobite allied to *Paradoxides*, without facial sutures or head-spines, and with truncate body-segments not produced into spinous appendages, as in most of its congeners. The remains of a new species, provided with extraordinary free cheeks, have proved that this conclusion was founded upon a part only of the head and of the body of the animal, which now appears to be more truly intermediate between *Paradoxides* and *Olenus* than was before supposed, while at the same time it presents characters opposed to those of either genus. Mr. Hicks gave a full description of the genus as now known, and of the new species, which he called *Anopolenus Salteri*. From his description, it appears that *Anopolenus* possessed minute eyes, a facial suture, and expanded pleura, but that their arrangement was abnormal. In conclusion, Mr. Salter compared the two species of *Anopolenus* now known, stating that the one first described, without the more anterior of the two segments which compose the head, was to all appearance a perfect Trilobite. He also gave a figure of a new species of *Olenus*—*O. pecten*.

3. ‘On the Discovery of a New Genus of *Cirripedia* in the “Wenlock Shale of Dudley.”’ By Henry Woodward, Esq., F.G.S.—The attention of the author having been called to two species of