

REPORTS AND PROCEEDINGS.

GEOLOGICAL SOCIETY OF LONDON.

June 19th, 1895.—Dr. Henry Woodward, F.R.S., President, in the Chair.

Mr. Whitaker called attention to the two new Survey maps of the Bournemouth district. In the map without Drift it would be observed that the boundary-lines were more detailed. In the map with Drift much new work had been incorporated—in fact, the Drift-lines were wholly new. The work had been done by Mr. C. Reid.

The following communications were read:—

1. "On the Occurrence of Radiolaria in Chalk." By W. Hill, Esq., F.G.S., and A. J. Jukes-Browne, Esq., B.A., F.G.S.¹

The authors notice the rarity of records of Cretaceous Radiolaria, and allude to those which have been made, including those by Rüst and Sollas. They have recently discovered spherical bodies resembling in form and general appearance certain calcified and partially destroyed radiolarian tests from some of the Barbadian rocks; microscopic examination of these has proved that many of them, at any rate, are Radiolaria. They occur in the nodules of the lower beds of the Melbourn Rock, at Melbourn, Royston, near Hitchin, Leagrave near Luton, Pitstone and Tring, Watlington, the Richmond boring, the lower part of the "Grit Bed" at Dover, Sutton Waldron and Burcombe (Dorset), and in a nodular chalk which may be considered as the equivalent of the Melbourn Rock from Bindon Cliffs, near Axmouth, Devon. Similar organisms have recently been found in the Chalk Marl of Lincolnshire, Yorkshire, and Norfolk, but have not been noticed in any other parts of the Chalk. It is suggested that they occurred in many portions of the Chalk-ooze, but were usually rapidly and completely dissolved, and contributed to that solution of silica which furnished the substance of flint-nodules; and the authors conclude that the preservation of traces of the Radiolaria in the nodules of the Melbourn Rock is due to some specially favourable conditions.

A description of the changes undergone by Barbadian Radiolaria is given to illustrate the instability of radiolarian tests. Here all stages are traceable, from the perfect siliceous test to a structureless ball or disc filled with calcareous matter, or a mere patch of clear crystalline material.

A description of forms recognized in the nodules of the Melbourn Rock is given.

2. "The Crush-Conglomerates of the Isle of Man." By G. W. Lamplugh, Esq., F.G.S.; with an Appendix by W. W. Watts, Esq., M.A., F.G.S. (Communicated by permission of the Director-General of the Geological Survey.)

The Skiddaw Slates of the Isle of Man have everywhere undergone intense shearing, and on the north-west side of the main stratigraphical axis actual disruption of the bedding with the resultant formation of breccia or crush-conglomerate on a large

¹ See also paper by Mr. G. E. Grimes on Radiolarians in the English Chalk, *ante*, p. 345.

scale has taken place. This structure attains its widest development on the north side of the central valley, though it is noted on a more limited scale in a few localities farther south. It is well exposed in the cliffs three miles north of Peel, but the finest sections are in the interior in Sulby Glen, where the structure has a thickness of some hundreds of feet, and runs continuously about north-north-east for five miles, with a probable extension southward for three miles farther, and also eastward for other four miles. It is usually flanked by gritty flags on one side, and by dark clay-slates on the other. It is affected by a strain-slip cleavage later than the brecciation, and several igneous dykes which intersect it are affected by the same cleavage, though not by the brecciation-movement.

East of Sulby Glen the structure extends towards Ramsey, at first in a horizontal spread over a mile in width, and afterwards in a series of comparatively narrow subparallel bands; and it is suggested that we are dealing here with the emergence of a deformed plane. The structure is continued eastward into the hill overlooking Ramsey, beyond which it is cut off by the sea. In this locality, as elsewhere, the sections show the gradual smashing into fragments of highly contorted strata until every trace of the original bedding is lost, and a "crush-conglomerate" with lenticular and partly rounded inclusions is formed.

The rocks described in Mr. Watts' Appendix are grouped in four classes. Firstly, the grits and slates which have been crushed but have not been converted into crush-conglomerates; secondly, the crush-conglomerates themselves, and the fragments which they contain; thirdly, the dykes of decomposed dolerite (greenstone) and fresh later dolerite which penetrate the conglomerate; fourthly, a portion of the crush-conglomerate metamorphosed by these intrusions.

The chief point of interest is brought out by the examination of the fragments in the conglomerate. All stages of crushing may be traced, until the grit-fragments have a structure which is a mere miniature of the crush-conglomerate itself; that is to say, if the crush-conglomerate be regarded as made of "fragments" of hard rocks enclosed in crushed "matrix" of soft rocks, a host of intermediate varieties with varying resistances will occur. Whether any particular one of these varieties shall pass into "fragments" or "matrix" under the crushing will depend upon the amount of the crushing force and upon the association (paragenesis) of the material brought together to be crushed.

3. "The Chalky Clay of the Fenland and its Borders: its Constitution, Origin, Distribution, and Age." By Sir Henry H. Howorth, K.C.I.E., M.P., F.R.S., F.G.S.

The distribution of the Clay (so often termed Chalky *Boulder-clay*) is noticed, and it is stated that it is surrounded on all sides by country occupied by different deposits, being mainly separated from the sea on the east and north-east by sandy and pebbly materials, while on every other side it is clearly and sharply defined. The paucity of foreign stones is noted as compared with natives, and

the similarity of the matrix of the Chalky Clay to the material of the older deposits of the neighbourhood. The author maintains that the contents of the Clay indicate movement of material from west to east in some places, as shown by Jurassic fossils in the East Anglian Chalky Clay, and from east to west in others: in fact, that movement took place in sporadic lines diverging from the Wash and the Fens. He appeals to the amount of disintegration that has taken place to furnish the material for the Clay, the shape of the stones in the Clay, and the distribution of the Clay itself, as evidence against the action of land-ice or icebergs, maintaining that there is no evidence of submergence at the time the Clay was formed; and criticizes the attempts made to explain the formation of the Clay by water produced by the melting of ice.

The author believes that the denudation of the Fen country which produced the great mass of the Chalk Clay with most of its boulders was coincident with and caused by the bending and folding of the Chalk of Eastern England, which took place after the deposition of the Crag beds, and that during the period of folding a great depression was formed round the Wash, into which the water rushed from the North carrying débris and mixing it with clays; this, rushing into what was virtually a *cul-de-sac*, dispersed and scattered its load in all directions.

4. "On the Occurrence of *Spirorbis*-Limestone and thin Coals in the so-called Permian Rocks of Wyre Forest; with considerations as to the Systematic Position of the 'Permians' of Salopian type." By T. Crosbee Cantrill, Esq., B.Sc. Lond. (Communicated by Walcot Gibson, Esq., F.G.S.)

In South Staffordshire a thick series of red rocks—the so-called Lower Permian—overlies the ordinary yellow and gray Coal-measures, and underlies the Triassic rocks. They consist of sandstones, marls, calcareous conglomerates, and breccias, having a general red or purplish-red colour.

Since Jukes' work was published, fresh sinkings have shown that these red rocks must be regarded as of Upper Coal-measure age, because their included fossils have an Upper Coal-measure *facies*. The rocks contain bands of limestone characterized by the presence of *Spirorbis pusillus*: those parts of the series which have not yielded Coal-measure fossils are apparently similar lithologically to those which have yielded them; there is no stratigraphical break between the fossiliferous and unfossiliferous parts of the red series, and the only marked breaks are at the base and summit of the series, the break at the base being locally great but elsewhere practically imperceptible.

The evidence furnished by the deposits of the Forest of Wyre (= Enville) district also leads the author to regard the red rocks associated with *Spirorbis*-limestone and coals as Upper Coal-measures, exhibiting a gradual passing away of Coal-measure conditions and the in-coming of those of New Red Sandstone times; and these passage-beds must be regarded as much nearer the Coal-measure than the Permian-Triassic end of the transitional period.

So far as our present knowledge goes, the so-called Permian rocks of Anglesey, Denbighshire, Lebotwood, Shrewsbury, Coalbrookdale, Wyre Forest, South Staffordshire, Warwickshire, Leicestershire, and North Staffordshire are all essentially similar; and observers are urged to look out for Coal-seams, plant-remains, and *Spirorbis*-limestones.

[The next Meeting of the Society will be held on Wednesday, November 6th, 1895.]

CORRESPONDENCE.

NATURE AND ART.

SIR,—It has been suggested (and the belief is held by many) that the asserted flint implements of the Chalk Plateau of Kent may be divided into two groups—one (A) in which the presumed work is referred to the *agency of nature*, and is therefore non-existent so far as human agency is concerned; and the other (B) of which the work is admitted, but is asserted to be that of Palæolithic Man, and not therefore belonging to a still older race of Man, to which on geological grounds I have assigned them.

B.—It may be admitted as not improbable that some of the more highly finished implements found on the plateau (if not made by the more skilful workman of Eolithic Man) may have been the work of Palæolithic Man. But the mere circumstance of their being found on the same surface with the plateau implements proves nothing, as flint implements of undoubted Neolithic age are likewise found frequently associated with the older plateau as well as with Palæolithic implements on the same surfaces. Further, in a pit dug for the Committee of the British Association by Mr. Harrison, several plateau implements were found in a bed of clay and flints at the depth of six feet from the surface, but no implements of the Palæolithic type were met with there. We may presume, therefore, that the association of implements of different ages on the surface is accidental, and does not always prove that they are contemporaneous.

With respect to the other question (A), I am at forced issue with those who would ascribe any of the forms of the rude plateau flints to any natural agency, such as, for example, as has been suggested in explanation of one form—that of the action of the waves on the shore, or of river-action; and there can be no other. Angular pieces of limestone put into a mill come out rounded marbles. In like manner the sharp angular fragments of flint exposed to the beating of the waves soon lose their sharp angles and become gradually more and more worn, until eventually they are transformed into rounded shingle, such as that which may be seen on Blackheath Common and at Bickley station. No other result is possible. This fact must have been brought home to many who have lounged pleasantly on the sea-beach at Brighton or Dover, but who would not find a bank of plateau flints with their sharp angles and many points, so well fitted for that purpose. Had it been possible for sea- or river-action to have produced such forms as those I have