ABSTRACTS OF THE PROCEEDINGS

OF THE

GEOLOGICAL SOCIETY OF LONDON.

No. 535.] [Session 1888–89.

February 20, 1889.—W. T. Blanford, LL.D., F.R.S., President, in the Chair.

Upfield Green, Esq., Liebenheim, Watford, Hertfordshire; Wintour Frederick Gwinnell Esq., Argyle Villas, White Hill, Gravesend; John Charles Mackay, Esq., Assoc. M. Inst. C. E., Stow Park, Newport, Monmouthshire; and George Synge, Esq., 3, Harrington Mansions, Queen's Gate, S.W., were elected Fellows of the Society.

Peregrine O. Wilson, Esq., Barberton, Transvaal, South Africa, was proposed as a Fellow of the Society.

The List of Donations to the Library was read; it included, among others, the following works:—Géologie régionale de la France, par Stanislas Meunier; Geological Survey of Pennsylvania, A. A., Atlas, Eastern Middle Anthracite Field, Part 2; and Hazell's Annual for 1889, edited by E. D. Price.

The Secretary announced that the following works ordered by the Council to be purchased were on the table:—Manuel Pratique de Cristallographie, par G. Wyrouboff; Lehrbuch der Mineralogie, von G. Tschermak, 2e Aufl.; and the American Geologist.

Visitors having withdrawn, the President, in accordance with Section XI. Art. 8 of the Bye-Laws, read, for the second time, the notices of motion relating to the proposed alterations in the Bye-Laws, signed by Mr. T. V. Holmes and twelve other Fellows, and by Dr. G. J. Hinde and nine other Fellows; and also, for the first time, some proposed emendations to the motion of the Council drafted by the Council and signed by the Chairman, a notice signed by Mr. J. Hopkinson and five other Fellows of the Society, and one signed by Mr. R. Lydekker and sixteen other Fellows of the Society.

The President further announced that a Special General Meeting, for the consideration of the Bye-Laws, would be called for Friday, March 15, 1889, at 4.30 P.M.

The following communications were read :—

1. "On the Cotteswold, Midford, and Yeovil Sands, and the division between Lias and Oolite." By S. S. Buckman, Esq., F.G.S.

After giving a short sketch of the work and opinions of other writers, the Author proceeded with the evidence on which his own views are based. He described a series of sections of the typical exposures of "Sands" and contiguous strata, commencing near Stroud and terminating on the Dorset coast. Dividing the series into *seven* horizons, characterized by their distinctive Ammonites, viz., *Amm. communis*, *variabilis*, *striatulus*, *dispansus*, the genus *Dumortieria*, *Amm. Moorei*, and *opalinus*, and taking the *Striatulus*-beds as a fixed starting-point, the Author demonstrated how the strata varied in regard to that horizon. The Cotteswold Sands, containing the *Variabilis*- and part of the *communis*-horizons, were below the *Striatulus*-beds; the Midford Sands, containing the *Dispansus*-horizon, were above, *Gramm. striatulum* occupying a thin bed at the base; the Yeovil Sands, containing the *Moorei*- and *Dumortieria*-horizons, overlay a bed containing Ammonites of the *Dispansus*-horizon, and were consequently still later deposits.

Since the different sands were deposited not on a horizontal plane, in point of time, but, as it were, obliquely, the deposit of Cotteswold Sands having ceased before that of Yeovil Sands commenced, it was incorrect to lump all the "Sands" from the Cotteswolds to the Dorset coast under the single local name "Midford Sands," thereby implying a contemporaneity which did not exist, while the use of the present restricted local names was defended.

The Ammonites were apparently uninfluenced by changes in the character of the deposit, since the same species are found in Limestone in the Cotteswolds, in Sands at Midford, and in argillaceous Marl at Ilminster. The change from argillaceous to arenaceous or calcareous deposits has been looked upon as so distinct a feature, that it has been utilized as a great argument in favour of drawing the line between Lias and Oolite at that point; but if this be done, the line is always drawn at different horizons in different districts.

If lithology furnishes no reason for a dividing-line at this point, it was shown that neither did palæontology. It was also shown that the Ammonite family Hildoceratidæ dominated the period from the *Falcifer*- to the *Concavus*-zones, and that with the close of the latter zone they died out with singular abruptness, and that, furthermore, there exists, both in England and upon the continent, a marked hiatus at the same point due to the absence of a zone or a number of zones.

On account of these facts the proposal was put forward that d'Or-

bigny's term "Toarcien" should be employed to designate the strata from the *Falcifer*-zone to the *Concavus*-zone inclusive, that this term should not be used in the sense of merely an extended "Upper Lias," but to mark an entirely distinct transition-formation,—a definite part of the Jurassic period,—separating the typical Lias from the mass of thoroughly Oolitic strata.

Discussion.

The President said that the paper showed a large amount of field-work in conjunction with palæontological research, and helped to prove that much yet had to be done in the stratigraphy of England. He commented on the interest attaching to the Jurassic system, where the zonal divisions were so well marked. Neumayr had enumerated 33 zones. In the International Geological Map of Europe, the base of the *Opalinum*-zone had been adopted as the lower boundary of Middle Jurassic. He doubted the advantage of admitting intermediate subdivisions like "Toarcien," and would prefer a conventional arbitrary limit.

Mr. H. B. Woodward commented on the biological character of the paper. In England the entire Jurassic series (locally) was conformable, and the question was whether our divisional lines should be drawn on palæontological or stratigraphical evidence. A zone might be regarded as a particular assemblage of species; but when traced for any distance these zones were found running into each other. He instanced especially the inosculation of the zones of the Lias, as showing there were no rigid planes of division. He had adopted the term "Midford Sands" because it met an acknowledged difficulty; and so long as people knew what it meant, he could not see any valid objection to its use. The lower portion of the "Sands" in the Bridport Cliffs was inaccessible; but the beds passed downwards into the Upper Lias, while the upper parts were more nearly allied to the Inferior Oolite. He referred to the difficulties in connexion with the naming of Ammonites, and concluded that, taking the Cephalopoda-beds and the "Cotteswold Sands" together, and as stratigraphically equivalent to the "Yeovil and Bridport Sands," the term "Midford Sands" ought not to be changed.

Prof. Blake considered that the Author had thoroughly proved his case, in so far as showing that the different "Sands" were not on the same horizon. With respect to the "Toarcien," he thought the suggestion by no means new. As regards the dividing-line between Lias and Oolite, he observed that in South Europe limestones were more abundant in the Jurassic rocks. We ought to pay some attention to lithological distinction as indicating physical changes. A new fauna, and that by no means Liassic, made its appearance in the Cephalopoda-bed, although the same Ammonite-groups remained. In Yorkshire, the *Striatulus*-beds were in Liassic shales. No doubt the family Hildoceratidæ constituted a bond of union between Lias and Oolite; but if this principle were

generally adopted, this would help to divide the Trias also. Hence his objection to the proposed "Toarcien."

Rev. H. H. Winwood declared that lithology was cast to the winds if we accepted the conclusions of Mr. Buckman's paper. However, he was glad that the Author had done away with the misleading name "Cephalopoda-bed." In addition to *Amm. striatulus*, found in the Midford Sands in a cutting near Bath, he had found portions of another Ammonite, apparently too imperfect for Mr. Buckman to define, and also portions of a Brachiopod defined by Chas. Moore as *Rhynchonella spinosa*. He did not fully recognize Mr. Buckman's section at Lyncombe.

Mr. Hudleston was glad to hear a confirmation of the first part of Mr. Buckman's contention from so good a palæontologist as Prof. Blake. Lately, whilst examining the Inferior Oolite of the south-west for a particular purpose, he had come to the conclusion that the Yeovil Sands were on a different horizon from those of the Cotteswolds; hence he could not think it was advisable to describe them by the same name, except on very general grounds. When Phillips selected the term "Midford" for the "Sands" generally, it was probable that he had not an intimate knowledge of any of them. As regards the real Midford Sands the only thing clear about them was that they lay above the *striatulus*-beds, and were consequently more allied to the Yeovil than to the Cotteswold Sands. If *Rhynchonella spinosa* had really been found the Midford Sands would belong to the uppermost zone of the Inferior Oolite. It was suggested that this might have been *Rhynch. cynocephala*. In the section near Midford the beds of the *Parkinsoni*-zone rested directly on the Sands, showing the absence of the *Murchisonæ*- and *Humphriesianus*-zones; hence there could be no question of passage where such a break existed.

Mr. Buckman's proposal to establish the "Toarcien" at the expense of the Upper Lias and the Lower Division of the Inferior Oolite was scarcely practicable, though we were indebted to the Author for specifying the particular genera of the Hildoceratidæ which characterized the several series. In Dorsetshire the palæontological hiatus between the Lower and Upper Divisions of the Inferior Oolite was undoubtedly very great, and by no means confined to the Cephalopoda. But this could not outweigh the many considerations on the other side. If Mr. Buckman's views on this point were accepted the Inferior Oolite would disappear, the Upper Division being thrown to the Bathonian.

2. "On some Nodular Felstones of the Lleyn Peninsula." By Miss Catherine A. Raisin, B.Sc. Communicated by Prof. T. G. Bonney, D.Sc., LL.D., F.R.S., F.G.S.

This paper dealt with two small masses of rock forming the headlands of Pen-y-chain and Careg-y-defaid, a few miles from Pwllheli. They consist of old lava-flows, once glassy, now devitrified and, at the former place, associated with interbedded agglomeratic and ashy strata. The lithological characters, as well as other slight evidence

obtained, would fully support the identification by the Survey of the surrounding beds as of Bala age.

The rocks exhibit evidence of alteration and of silicification, suggesting that the district may have passed through a Solfatara stage, and that its condition may have been not far removed from that of a geyser region. Perlitic structure is common, and is often found in connexion with spherulitic growth, of which there are many gradations, and specially marked and large examples are presented in the agate nodules.

Some nodules seem to result from spheroidal fracture, others to be masses of flow-brecciation; but the majority have a spherulitic crust, often surrounding an interior occupied by secondary quartz or chalcedony. Similar specimens were described and compared, which had been received from Boulay Bay, through the kindness of Professor Bonney. The evidence of these and of the Lleyn examples appears to be strongly in favour of the view that the spherulite is the least altered and most durable part of the mass. Other considerations were brought forward by the Author, which would offer some further difficulties in accepting the decomposition-theory to account for the origin of the interior of the nodules. Some of the specimens described present certain special characteristics, and, at one locality in the Lleyn, what seem to be quartzose amygdaloids occur, in close relation to agate nodules. On the whole, although the mode of origin is difficult or impossible definitely to prove, the evidence appears to suggest that in these nodules a spherulitic crust has formed around an originally vesicular nucleus.

Discussion.

Mr. Cole remarked that some features connected with the spherulites appeared to bear out his views. A complete illustration of the phenomena of the Lleyn felsites is furnished by the Permian pitchstone of Zwickau.

In one of Miss Raisin's specimens a small film with beautiful spherulitic structure projected into the central quartz-mass, apparently pointing to the destruction of the central portion. In Mr. Iddings's specimens the cavity, when existent, is comparatively small, and the typical hollow spherulites of Wales cannot be explained even by comparison with lithophysæ.

Dr. Hicks believed that the hollows in the nodules had been subsequently filled in with secondary silica, but that the cavities, in the majority of cases, originally existed in the rock.

Prof. Bonney commented on the too close comparison between small things and great. He still remained sceptical as to Mr. Cole's explanation. The vesicles became more irregular in outline in the more acid rocks, and the proposed interpretation of sections might thus be erroneous. The Boulay Bay specimens seemed to show that the spherulites were the least decomposed part of the rock, and there was evidence that, in a non-spherulitic part of the mass, the

cavities had existed from the first. He had not gathered from Mr. Iddings's description that either the spherulites or the cavities in the Yellowstone rocks were so small. These rocks were beautifully fresh, so that Mr. Cole's explanation could not be applied to them.

3. "On the Action of Pure Water, and of Water saturated with Carbonic-acid Gas, on the Minerals of the Mica family." By Alexander Johnstone, Esq., F.G.S.

Two muscovite fragments were suspended for a year, one in distilled water, the other in water saturated with carbonic anhydride. A good deal of mica-dust was detached from each, but no material had been dissolved, the only chemical change being hydration, accompanied by physical alteration, producing a mineral chemically and physically similar to a natural hydromuscovite.

When biotite was similarly treated, the mineral suspended in the distilled water became a hydrobiotite, whilst that in the water saturated with carbonic anhydride underwent chemical change, and was converted into hydromuscovite by loss of magnesia and iron, which were dissolved in the water.

Lepidomelane in pure water became hydrated, but in carbonated water also sustained a loss of iron.

The Author has ascertained that when anhydrous micas become hydrated, or lower hydrated ones more highly hydrated, they increase in bulk.

Discussion.

The President called attention to the analyses given by the Author.

The following specimens were exhibited:—

Specimens from South Caernarvon, with microscopic sections, exhibited by Miss C. A. Raisin, B.Sc., in illustration of her paper on Nodular Felstones.

Specimens of Pyromerides and other allied rocks, from Boulay Bay, Jersey, exhibited by Prof. T. G. Bonney, D.Sc., F.R.S., F.G.S.

Photograph of a group of Members of the International Geological Congress taken during the visit to North Wales, September 1888, exhibited by Dr. H. Hicks, F.R.S., F.G.S.

The next Ordinary Meeting of the Society will be held on Wednesday, March 6th, 1889, when the following communications will be read:—

1. "On the Subdivisions of the Speeton Clay." By G. W. Lamplugh, Esq. Communicated by Clement Reid, Esq., F.G.S.

2. "Notes on the Geology of Madagascar." By the Rev. R. Baron. Communicated by the Director-General of the Geological Survey.

3. "Notes on the Petrographical Characters of some rocks collected in Madagascar by the Rev. R. Baron." By F. H. Hatch, Ph.D., F.G.S.

David Yewdall Cliff, Esq., Nesbit Hall, Fulneck, near Leeds; Edward Aurelian Ridsdale, Esq., Assoc. Roy. School of Mines, Rottingdean, Sussex, and 3 Montague Street, W.C.; and Bernard Henry Woodward, Esq., 80 Petherton Road, Highbury New Park, N., will be balloted for as Fellows of the Society.