

MINERALOGICAL SOCIETY.

March 16, 1920.—Sir William P. Beale, Bart., President, in the chair.

Arthur Russell: "On the occurrence of Cotunnite, Anglesite, Leadhillite, and Galena on fused lead from the wreck of the Fire-ship *Firebrand*, Falmouth Harbour, Cornwall." The specimens were obtained in 1846 from the wreck of the fireship *Firebrand*, which was burnt in Falmouth Harbour about the year 1780. They were found under the lead pump, most of which appeared to have been melted and mixed with charcoal, and consist of slag-like masses of lead, which has evidently been fused, and upon the surface and interstices of which are numerous well-defined and brilliant crystals of cotunnite and anglesite, and more rarely small crystals of leadhillite and galena. The cotunnite crystals, which are colourless and transparent with brilliant faces, are nearly always elongated in the direction of the *a* axis, and attain a length of 3 mm. The habit is somewhat variable owing to the very unequal development of the faces. The forms observed were 010, 001, 021, 011, 012, 101, 111, and 112. The anglesite crystals are of rectangular habit, and exhibit the forms 100, 001, 110, 102, 122, and 113. The leadhillite crystals, thin six-sided plates in shape, are of a brown colour and show the forms 101, 201, $\bar{1}01$, 201, 112, 111, 112, and $\bar{1}11$. The galena occurs in minute cubo-octahedra. An occurrence of cotunnite formed under almost exactly similar conditions has been described by A. Lacroix. Similar occurrences of lead oxychlorides at Laurium, and of leadhillite in Roman slags from the Mendip Hills, were referred to.—W. Campbell Smith: "Riebeckite-rhyolite from North Kordofan, Sudan." A rock found by Dr. C. G. Seligman at the base of Jebel Katul, 350 miles south-west of the Bayuda volcanic field was described.—Dr. G. T. Prior: "The Meteoric Iron of Mt. Ayliff, Griqualand East, South Africa." This meteoric iron, found about 1907, is a coarse octahedrite similar in character to Wichita County (Brazos River) and Magura (Arva). On polished and etched surfaces it shows nodules of graphite and triolite, and abundant cohenite crystals arranged parallel to the octahedral bands. It contains about 7 per cent of nickel.

CORRESPONDENCE.

GAULT AND LOWER GREENSAND NEAR LEIGHTON BUZZARD.

SIR,—I know that my colleague, Dr. Kitchin, has always found it difficult to believe that the fossiliferous limestone beneath the Gault at Shenley Hill can be in its original position, and it is well that he and Mr. Pringle should have undertaken an independent investigation of the sections. But I am certain that they have misinterpreted the evidence in supposing that the limestone has been

brought below the Gault by Glacial overturn. This is the only point which it concerns me to discuss at present, as the other issues raised in their recent paper in your pages all depend upon it.

With a much wider knowledge of the sections than I possessed in 1903, when the first account of the fossiliferous band was published by the late J. F. Walker and myself (*Quart. Journ. Geol. Soc.*, vol. lix, pp. 234–65), I shall maintain that the description of the sequence and conditions then given was substantially accurate. Ever since that time I have taken the neighbourhood of Leighton Buzzard as my geological playground, revisiting the sections again and again, often several times a year and rarely missing a year, attracted by the fresh features disclosed in the extension of the great sand-pits and in new excavations. Hence, I have now seen the fossiliferous band at one time or another in a practically continuous section over 300 yards in length and 10 to 50 yards in breadth, from Garside's pit on the south to Chance's pit on the north. Yet I have not found in it the slightest trace of intercalated Glacial material or of Glacial disturbance. Moreover, having made a particular study of glacially transported masses in Yorkshire and other places, I am the less likely to have missed such evidence if it had been present. Also, on reference to my notebook, I find that in April, 1914, I saw patches of pale-pink gritty fossiliferous limestone, somewhat decomposed, associated with the breccia-band at the base of the Gault in the Miletree Farm pit (see Fig. 3 of my critics' paper), which lies outside the area of the supposed overturn; and similar material was lately visible in the same position in another section between this pit and Shenley Hill.

All the new features observed since 1903 have helped to confirm my original view of the sequence. Between 1904 and 1906 the easterly workings of the Garside's pit, now abandoned, disclosed new facts which are absolutely irreconcilable with the hypothesis of Glacial inversion. I mentioned some of these, in brief, in my report on the visit of the Geologists' Association to Shenley Hill in 1908 (*Proc. Geol. Assoc.*, vol. xx, pt. vi, p. 475), and dealt similarly with the Grovebury sections (with which we are not at present concerned) in reporting on a later excursion to Leighton Buzzard in 1915 (*Proc. Geol. Assoc.*, vol. xxvi, pt. v, p. 310); and as Dr. Kitchin knows, I have embodied a further description of them in a paper written just before the War and intended for publication at a convenient season. This paper will afford me an opportunity to deal in detail with the arguments of my critics. Meanwhile, it seems advisable that I should state at once my disagreement with their main conclusion, and show reason for believing it to be wrong.

Last year it chanced that I could not conveniently visit the sections, though I should have contrived to do so if I had been aware that my colleagues' investigation was then in progress. However, I have re-examined the pits twice during the past month, and am satisfied that the features with regard to the fossiliferous band have

remained without essential change, and that my critics and I are discussing the same facts in this particular.

Dr. Kitchin and Mr. Pringle rely for proof of the inversion almost entirely upon inferences drawn directly or indirectly from the fossils of the limestones and its associated strata. They infer that the fossils in question—certain brachiopods, lamellibranchs, crustacea, and echinoderms—cannot occur in place below the Gault. But if the stratigraphical evidence is convincing, as I believe it is, that at this locality they *do* occur below the Gault, the *a priori* inference loses all validity. I presume that no geologist will claim that our present knowledge of the range of these particular fossils is so perfect that it cannot be extended. In strata so sparingly and sporadically fossiliferous as the upper part of the Lower Greensand, we know as yet very little about the life of the period. Now, the Shenley section, as I believe, has slightly extended our knowledge; and, in the paper of 1903, my co-author and myself offered what I still hold to be a reasonable explanation of the unusual elements of the fauna. Our critics naturally lay stress upon their own side of the argument, and dismiss the admixture of Lower Cretaceous forms as ‘derivatives’ and as occurring, perhaps, in a limestone similar to the so-called ‘Cenomanian’ rock, but of different age, and brought into contact with it by the inversion. I hardly need express dissent from these inferences; they merge into the broader question of the supposed Glacial overturn. Let us consider what this hypothesis implies, and how far it runs contrary to probability.

1. The supposed ‘Cenomanian’ limestone, a gritty rock of peculiar aspect and composition (fully described in our paper of 1903), is unlike any other rock known in the district, and shows every indication of having been formed on the floor on which it now rests. My critics have sought for it above the Gault all along the foot of the Chalk escarpment, and acknowledge that they have sought in vain. They fall back upon an assumption that it may have occurred above the Gault in a vanished tract in the neighbourhood of Shenley Hill, and that it may have remained at the surface there until the hypothetical inversion in Glacial times. Yet it is only a few inches thick, and is for the most part quite fresh and unweathered.

2. In the same way the bed of loose glauconitic greensand, up to 5 feet thick, which I saw below the Gault, surrounding an upstanding crag of iron-grit, in the easterly part of Garside’s pit before the working was abandoned in 1906 (see Proc. Geol. Assoc., vol. xx, p. 475), is supposed to have been overturned from the surface; yet it also, though so readily perishable, shows no trace of weathering.

3. The slab of Gault, greensand, and limestone supposed to have been overturned has proved to extend without visible disturbance over an area of not less than 15 acres, and it still has a thickness of about 18 feet in Harris’s pit, which, therefore, must be accepted as the minimum for the whole slab before the overturn. Not a trace

of drift has been found beneath the mass. It is supposed to have been sliced off exactly at the base of the Gault, and, like a pancake, to have been tossed over cleanly back into its bed, without breaking and without entangling any extraneous matter. By this overturn, it is assumed that a thin band of limestone originally at the top of the Gault and a similar thin band of limestone and breccia at its base have been everywhere brought directly into contact within a belt never more than 2 feet thick, and usually less, as shown in Fig. 2 of my critics' paper. Glacialists have been accused at times of expecting too much from ice-sheets, but they have never expected such a feat as this.

4. Reason is shown in our paper of 1903 for believing that the thin irregular layer of iron-grit or ironstone which covers the lenticles of limestone, and to which they appear to owe their preservation, was in existence before the deposition of the Gault. The fresh evidence accumulated during my later investigations has, I think, placed this point beyond doubt. It is, of course, fatal to the hypothesis of my critics, and they are compelled to put forward the argument that the ironstone floors have been formed in Post-Glacial times, after the beds had been overturned, though they tacitly admit that the ironstone fragments between the floors are of pre-Upper Gault age, at least.

But I feel that it is really useless to enter into a lengthy verbal debate in this matter; the evidence speaks for itself in the whole section, and I will ask anyone who is doubtful upon it to make a personal examination of what is to be seen, even though the exposures visible at any particular time can hardly be expected to give the cumulative impression which I have received year by year in seeing one section after another. I feel sure that it will be found easier, on the spot, to believe in an extension of the range of the anomalous fossils than to believe that the bed had been brought into its present position through a gigantic inversion by glacial or other agency.

As regards the Gault, for the present I will only say that my colleagues may possibly be right in claiming that the Upper Gault alone is present under Shenley Hill, though there are several factors which call imperatively for a suspension of judgment in this matter, pending further investigation. I may be permitted to point out that in our paper of 1903 we explicitly stated that the Gault exposed at that time contained no discriminative fossils, and that the presence of the Lower Gault was inferred solely on the evidence of the fossils recorded by Jukes-Browne from a neighbouring pit. But whether Upper or Lower Gault, the statement that it is inverted runs counter to so many points of evidence recently considered in the field, that I have no hesitation in rejecting the supposition as unwarranted.

G. W. LAMPLUGH.

ST. ALBANS.

April 5, 1920.