

IV.—ON SOME FOSSILS FROM CENTRAL AFRICA.

By Professor T. RUPERT JONES, F.R.S., F.G.S., etc.

IN Professor Henry Drummond's "Tropical Africa," 8vo. London, 1888, pp. 183–199 are occupied with an interesting "Geological Sketch" of the country between the Zambesi River (about 18° S. Lat.) and the Tanganyika plateau (about 3° S. Lat.), his own observations having been made along a route from Kilimane on the coast, to the Shiré, and up that river, by Lake Shirwa and Lake Nyassa, to Karonga (or Karonga's village) on the north west shore near the end of the lake; and thence through the Uchungu district, for about 70 miles, in a part of the Tanganyika plateau. This region, like most of the country bordering the lake, is composed of "granite and gneiss." There are igneous rocks on the north-eastern shore at the lake's head; and a stretch of sedimentary strata for about twenty miles south of Karonga on the shore, and further south inland away from the lake (as indicated on the map in Prof. Drummond's book). These strata are referred to as "red and grey sandstones, fine conglomerate, limestone, shale, and coal," and are shown on the map as the same as some west of the Lake Tanganyika,—some about six degrees to the East, towards Zanzibar,—and some on and below the Zambesi, including Livingstone's coal-beds at Teté on that river.¹ Indeed these beds are correlated (at p. 185) with the series in Cape Colony and Natal known as the Karoo Formation,—at all events as having "a somewhat similar relation" to the gneissic plateau.

COAL.—At page 187, Prof. Drummond refers to a locality where coal was found some years ago by Mr. Cecil Rhodes, examined subsequently by Mr. James Stewart, and revisited by himself—namely, "on the western shore of Lake Nyassa, about 10° South Latitude." He does not report so favourably of this coal-seam as Mr. J. Stewart did in the "Proceed. R. Geograph. Soc." new series, vol. iii. 1881, p. 264. The latter observer noticed that in the valley of the Rikuru, running northward across 10° 45' S. Lat., there is a great change from "the granite and quartz, which prevail throughout the whole country from the Murchison Cataracts on the Shiré River to Lake Tanganyika," to argillaceous rocks and shales, hard and soft, with sandstone, dipping 1 in 2½ west and by north. Reaching the mouth of the Rikuru on Lake Nyassa, in south latitude 10° 45' 15", and going northward along the coast, after three miles he came to "the stream in which is the coal discovered by Mr. Rhodes. The coal lies in a clay bank tilted up at an angle of 45°, dip west. It is laid bare over only some 30 feet, and is about seven feet thick. It hardly looks as if it were in its original bed. The coal is broken and thrown about, as if it had been brought down by a landslip, and traces of clay are found in the interstices. Yet the bed is compact and full of good coal. I traced it along the hillside for some 200 yards, and found it cropping out on the surface here and there. It

¹ It is mentioned at p. 186 that the black rock on the western border of the Shiré valley, at about 17° S. lat. thought by Livingstone to be coal, probably is a "very dark diorite," which is present among the igneous rocks there.

is 500 feet above the lake-level, and about a mile and a half from the shore. I lit a good fire with it, which burned up strongly. The coal softened and threw out gas bubbles, but gave no gas jets. It caked slightly, but not so as to impede its burning. It is found in the main gorge of the Chisindiré valley," about six miles S. by E. of Mount Waller.

Visiting Mount Waller (*op. cit.* p. 265), Mr. J. Stewart found it to consist of horizontal argillaceous and sandy beds, hard and soft, for 900 feet upwards; then three bands of coarse grit, standing out along the mountain-side, form a ledge, at 1200 feet, 300 or 400 yards wide; a precipitous mass of soft shales succeeds up to 2630 feet above the lake; and then a cliff of hard compact argillaceous rock, of a dull straw-colour, in beds 10 or more feet thick, with intervening crumbling shales, reaches 3100 feet above the lake (4700 feet above sea-level).

Respecting the coal mentioned above, a footnote at p. 264 adds:—"Having submitted a specimen of this coal to Mr. Carruthers, F.R.S., Keeper of the Botanical Department, British Museum, this eminent authority has sent me the following note of the results of his examination of it:—"The coal has the appearance of a good specimen of English coal. The lines of stratification are indicated by films of . . . mother-coal. The general form of the minute tissues are preserved in the mother-coal,—I have observed fragments of scalariform vessels; and in sections of the coal prepared for the microscope I have found the macrospores of Lycopodiaceous plants, which I cannot distinguish from similar bodies in the coal of England. After combustion only 1·8 per cent. of ash remains. I have no doubt that the specimen from Lake Nyassa is of the same age as the coal of England.'"

The hand-specimen of coal examined by Mr. Carruthers is labelled—"Coal from Mt. Waller, Lake Nyassa. Livingstonia, 22 May, 1880, Jas. Stewart." Presumably the locality is not exactly Mount Waller, but in its neighbourhood as defined above. It has an irregular oblong shape, about 6 inches long, 3½ wide, and 3 thick; and consists of close-set parallel laminae, some of dull, compact, cannel-like coal, and some of bright, crackled glance-coal, all irregular in their relative thicknesses, and seldom more than a quarter of an inch thick. Mother-coal (dull, fibrous, black wood-carbon) lies on an outer (uppermost) layer of the glance-coal, and probably is present at intervals in the mass.

Slices taken from the same block and prepared for the microscope were sent to Mr. R. Kidston, F.G.S., of Stirling, and he favoured me with the following letter (dated January 27, 1890):—

"I have examined carefully the two slides of Coal from near Lake Nyassa. . . . The slides sent would be classed under the descriptive term of 'Spore-Coal,' in so far as spores (macrospores) enter largely into the composition of the Nyassa specimen.

"Spore-coal generally occurs as bands of greater or less thickness in the structureless bituminous matter. Not having seen the block of coal from which the slides were taken, I cannot, of course, say

whether all the specimen had a similar composition, or whether the slides represent portions of a spore-band.

"The spores are much smaller than the macrospores usually entering into the composition of British 'Spore-coal,' but seem to be composed of an identical substance. The spores are of a reddish-amber colour. In certain parts of the slides bands of similarly coloured material occur. Although all structure is effaced in these bands, I have no doubt that they are derived from similar macrospores. The more numerous the spores in coal, the better is the quality, on account of their highly inflammable resinous quality."

Alluding to the above-mentioned coal near the mouth of the Rikuru (see p. 553), Prof. Drummond states at page 188 of his "Tropical Africa,"—"I examined this section pretty carefully, and fear I must differ slightly from Mr. Stewart in his geological and economical view of the formation. The 7-foot seam described by Stewart is certainly a deception, the seam being really composed of a series of thin beds of alternately carbonaceous and argillaceous matter, few of the layers of coal being more than an inch in thickness. With some of the most carefully selected specimens I lit a fire, but with disappointing results. Combustion was slow and without flame. Although there were what can be called *films* of really good coal here and there, the mineral, on the whole, seemed of inferior quality, and useless as a steam-coal. From the general indications of the locality I should judge that the coal existed only in limited quantity; while the position of the bed at the top of a rocky gorge renders the deposit all but inaccessible. On the whole, therefore, the Lake-Nyassa coal, so far as opened up at present, can scarcely be regarded as having any great economical importance, although the geological interest of such a mineral in this region is considerable. Sections of the coal have already been prepared for the microscope, and Mr. Carruthers, of the British Museum, has identified the macrospores of Lycopodiaceous plants, which are identical with similar organisms found in the coal-fields of England."

The specimen of coal from the neighbourhood of Mount Waller, described above, lent to Mr. Carruthers, and kindly submitted for examination, certainly seems to agree better with Mr. Stewart's description, above quoted (p. 554), than with Prof. Drummond's foregoing note on the character of his specimens. The variation of a seam, both as to structure and composition, within a limited area, may possibly account for the difference.

Fossils.—At about 60 miles N. by W. from the locality where the above-mentioned coal was obtained, Prof. Drummond discovered, at Maramura (as by label), not far from Karonga, on Lake Nyassa (and about 20 miles along the "Stevenson Road" to Lake Tanganyika), some interesting fossils, as mentioned at pages 191–195 of his book—"About a dozen miles from the north-western lake shore on the route to Tanganyika, after following the Rukuru River through a defile of granite rocks, I came, to my great surprise, upon a well-marked series of stratified beds. At a bend in the river a

fine section is exposed. They lie thrown against the granitic rocks, which here show signs of disturbance; and consist of thin beds of very fine light-grey sandstone, and blue and grey shales, with an occasional band of grey limestone. By camping on the spot for some days, and working patiently, I was rewarded with the discovery of fossils. . . . The shale naturally yields the most results, one layer especially being one mass of small *Lamellibranchiata*. . . . Vegetable remains are feebly represented by a few reeds and grasses. Fish-scales abound; but I was only able, and that after much labour, to unearth two or three imperfect specimens of the fishes themselves. These have been put into the accomplished hands of Dr. Traquair, of Edinburgh, who has been kind enough to furnish the following account of them" (in letter, dated 23rd April, 1888).

Dr. Traquair refers to and describes (pp. 193–195) six specimens of fossil Fish-remains: No. 1. *Acrolepis* (?) *Drummondi*, sp. nov. No. 2. In a piece of cream-coloured limestone, besides numerous minute scales and a fragment of a small jaw and teeth, some larger scales and bones, provisionally referred to *Acrolepis* (?) *Africanus*, sp. nov. Nos. 3 and 4. Small pieces of similar limestone with minute scales, like those mentioned above. No. 5. Grey micaceous shale with scales of another, but indeterminable, species of Fish. No. 6. The clavicle of a small Fish, in shale similar to the foregoing. All these are remains of Palæoniscid Fish.

We may remark that Fish of this kind and order are such as are found also in the great Karoo Formation of the Orange-Free-State and Cape Colony, incidentally referred to above.

Prof. Drummond writes at p. 195, with reference to the fossiliferous strata which he so fortunately met with, that they "seem to occupy a comparatively limited area, and have a very high dip in a south-easterly direction. At the spot where my observations were taken they did not extend over more than half a mile of country, but it is possible that the formation may persist for a long distance in other directions. Indeed, I traced it for some miles in the direction in which, some fifty or sixty miles off, lay the coal already described, and to which it may possibly be related."

The fossil shells collected by Professor Henry Drummond, F.R.S.E., F.G.S., etc., at Maramura, near the north-west shore of Lake Nyassa, in Central Africa, occur in a piece of greenish-grey shale, somewhat micaceous, numerous casts of small Bivalves, on two bed-planes, forming its upper and lower surfaces. On one face the casts are convex; on the other, only hollow impressions. Similar casts, in the same relative position, are inclosed in the shale; and small fragments of Fish-remains are sparsely scattered throughout. The convex casts are brown, and on them here and there dark-brown films partially represent the original shells. The concave impressions have brown-black iron stains.

The shells are oval-oblong, or suboblong, rounded at the ends unequally; the posterior being somewhat truncate, and the anterior obliquely-truncate, with an ogee curve below the umbo. Hinge-line long and straight; ventral margin slightly curved. Various

degrees of imbedment affect the visible shape; some individuals showing only a triangular outline. The surface is moderately convex, and bears rather strong concentric lines of growth.

These fossils have a general resemblance to the *Iridina* described and figured by D. Sharpe in the "Transact. Geol. Soc." ser. 2, vol. vii. pp. 225, 226, pl. xxviii. figs. 2-4. These were from the Karoo Formation at Graaff-Reynet in the Cape Colony. The concentric markings in the specimens from Maramura are stronger than those in fig. 4; and the shell is more oblong, more nearly vertical at the anterior end, rather fuller on the ventral, and straighter on the dorsal margin. It is not so truncate anteriorly as fig. 2, and not so square behind, nor is its umbo so near the middle of the back. The dimensions are—length 20 mm. (hinge-line 15 mm.); height 10 mm. We have nothing to add as to its generic relationship; and, as it differs specifically from *Iridina*? *rhomboidalis* and *I.*? *ovata*, it may be distinguished as *Iridina*? *oblonga*, sp. nov.



A portion of the piece of fossiliferous shale, with *Iridina* (?) *oblonga*, sp. nov., from Maramura, north-west of Lake Nyassa, Central Africa. Natural size.

The *Iridina* may be regarded as of Mesozoic age, as well as the associated reed-like and grass-like plant-remains, and the palæoniscid Fishes; for all these are represented in the same series of strata with the Mesozoic *Dicynodon* and other Reptiles, *Cyrenæ*, plant-remains, and coal of apparently the same period. The wide extension northward of the Karoo Formation, as probably represented by these Maramura beds, is an important addition to our knowledge of African geology.

Prof. Dr. W. C. Williamson, F.R.S., informs me that he has not found in South-African coals "decided evidence of spores, especially macrospores, such as we get in so many of the British splint-coals. The nearest approaches have been in the Cyphergat, the bottom and middle Molteno, the Wynberg on the Sand River, and Slater's coal.

In each of these a vertical section of the coal exhibits numerous very thin horizontal yellow lines, not unlike what we see in our English spore-bearing coals; but I have no proof that these lines were due to spores."

Mr. E. T. Newton, F.G.S., some years ago examined microscopically a piece of compact coal from Andreas's (or Andries's) Nek, a spur of the Stormberg, sent by the late Dr. G. Grey, see Quart. Journ. Geol. Soc. vol. xxvii. 1871, p. 51; and he says that "the coal is bright and bituminous, with partings of dull material, apparently 'mother-coal,' but there are no traces of spores. The section shows the bituminous part as dark-brown laminae, similar to the bright parts of Wallsend coal; but there are no spores to be distinguished. The 'mother-coal' remains black and opaque in section."¹

CORRIGENDA.—At page 410 (September Number of *GEOL. MAG.*) for the woodcut and the description substitute the following:—



A portion of one of the blocks from the Kat River, Eastern Province, South Africa, showing four of the small shells (*Cyrena ? neglecta*) and parts and sections of others. Natural size.

At p. 410, line 7 from bottom, for "*Cyrenæ*" (?) read "*Cyrenæ ?*"

V.—THE EFFECTS PRODUCED BY EARTH-MOVEMENTS ON PRE-CAMBRIAN AND LOWER PALEOZOIC ROCKS IN SOME SECTIONS IN WALES AND SHROPSHIRE.

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(Read at British Association, 1890.)

IN this paper I purpose giving a few examples to show the powerful influences which have been exerted by Earth-movements in producing changes in the rocks, and in obliterating the evidences of succession in some of the disturbed areas in Wales and Shropshire. For a long time past it has been well known that certain changes such as cleavage, etc., have been induced in the rocks in Wales and elsewhere by pressure, but only of late years has the magnitude of the results due to Earth-movements been

¹ See also the "Mining Journal," Decemb. 4, 1886, for a paper on the Coals of South Africa.