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ORIGINAL ARTICLES.

I.—A NOTE ON THE GEOLOGY OF SOMALI-LAND, BASED ON COLLECTIONS MADE BY MRS. E. LORT-PHILLIPS, MISS EDITH COLE, AND MR. G. P. V. AYLMER.

By J. W. GREGORY, D.Sc., F.G.S.

SINCE the famous expedition<sup>1</sup> of the late F. L. and W. James, of E. Lort-Phillips and G. P. V. Aylmer, in 1884-5, opened the Somali plateau to European exploration, the country has been repeatedly traversed. A valuable series of geographical memoirs, hunting journals, and bluebooks has described the main features in the topography of the country, and given many suggestions as to its geological structure. The collections of Dr. Révoil<sup>2</sup> and Prof. Keller<sup>3</sup> have proved that Neocomian beds occur there, and thus have shown that it is of greater interest than most of the monotonous unfossiliferous wastes of East Africa.

In the winter of 1894-5 Messrs. E. Lort-Phillips and G. P. V. Aylmer, two members of the James' expedition, returned to the country, accompanied by Mrs. Lort-Phillips and Miss Edith Cole. Their expedition made some very important botanical and zoological collections, which have been already described.<sup>4</sup> Shortly after their return Mrs. Lort-Phillips kindly entrusted me with the examination of the geological collection which she had made. Subsequently Miss Edith Cole and Mr. Aylmer were also so kind as to lend me their collections. These together enable an outline geological section to be drawn from the coast at Berbera on the main Somali plateau; while, moreover, by the proof of the occurrence of marine Jurassic rocks in this country, they make an important addition to our knowledge of the geological history of Somali-land.

The specimens all came either from the district of Guban, the tract of country between Berbera and the foot of the inland plateau,

<sup>1</sup> F. L. James, "The Unknown Horn of Africa," 1888.

<sup>2</sup> Described by T. de Rochebrune in Geo. Révoil, "Faune et flore des pays Comalis," p. 39, pls. i-iv. Paris, 1882.

<sup>3</sup> Described by C. Mayer-Eymar. "Ueber Neocomian: Versteinerungen aus dem Somali-land": Vierteljahrsschrift Naturfors. Gesells. Zürich, Jahrg. xxxviii, 1893, pp. 249-65, pls. i, ii.

<sup>4</sup> "Diagnoses Africanæ," pt. vii: Bull. Misc. Inform. Kew, No. 105, 1895, pp. 211-30. E. Lort-Phillips, *ibid.*, 1895, pp. 211-30.

or from the Golis Range, on the northern edge of the plateau. The general physical geology of the country has been well described by Captain Swayne.<sup>1</sup>

## II. LIST OF THE COLLECTIONS.

Mrs. Lort-Phillips' collection consists of a series of rocks and fossils, of which the following is the list:—

FOSSILS. <sup>2</sup>	LOCALITY.
<i>Belemnites subhastatus</i> , Zieten ... ..	Bihin, in river-bed, 15 miles from Berbera.
<i>Parallelodon Egertonianus</i> , Stoliczka ... ..	Do.
<i>Rhynchonella Edwardsi</i> , Chapuis and Dewalque ... ..	Do.
<i>Rhynchonella subtetrahedra</i> , Davidson ... ..	Do.
Coral (gen. et sp. indet.) ... ..	Fara-Daro.
<i>Cryptocœnia Lort-Phillipsiæ</i> , n.sp.... ..	Duba.
Rocks.	
1. Sedimentary.	
Compact, hard, light-grey limestone ... ..	Duba, eight miles from Berbera.
Quartzose, coarse-grained, red hæmatite, passing into a loose, coarse grit, stained by hæmatite.	Loc. ? No doubt from summit of plateau.
Purple, roughly-bedded, quartzose grit ... ..	Daar-Ass, Golis Range. Alt. 5000 ft.
Hard nodules of brown hæmatite; sometimes show crystalline form; they generally show structure, and are apparently concretionary in origin ... ..	From summit of plateau; weathered out of sands.
Chert; sometimes chalcedonic, sometimes transparent, and at others opaque, milky-white ... ..	Summit of plateau.
Jasper concretions ... ..	Do.
2. Igneous.	
Coarse, quartzo-orthoclase pegmatite ... ..	Golis Range.
Thin-bedded, very quartzose muscovite - biotite gneiss ... ..	Do.
Pebbles of hornblendic gneiss, with numerous veins and crystals of epidote. <sup>3</sup>	

Miss Edith Cole's collection contains similar rocks, including pegmatite, chalcedonic chert, hæmatite nodules, calcareous tufa, wind-polished limestone from Bihin, and some fragments of roughly-chipped chert flakes.

Mr. Aylmer's specimens contain much the same, with several interesting additions. There is a large specimen of very coarse pegmatite from the face of the Golis, which contains large flesh-coloured crystals of orthoclase, broad tabular crystals of muscovite, aggregates of red garnets, and some long acicular crystals of apatite.

<sup>1</sup> H. G. C. Swayne, "Seventeen Trips through Somali-land," 1895, pp. 361-7.

<sup>2</sup> The Belemnite, the Lamellibranch, and the two Brachiopods have been determined respectively by Messrs. G. C. Crick, R. B. Newton, and F. A. Bather. Notes by Mr. Newton and Mr. Crick are published herewith, and a selection of the specimens has been presented by Mrs. Lort-Phillips to the Geological Department of the British Museum (Natural History).

<sup>3</sup> To determine the character of the mineral in this rock, as it throws light on the nature of some rocks collected by Dr. Donaldson Smith much further to the south, Mr. L. J. Spencer has kindly measured one of the crystals, and has determined them as epidote.

He has also brought back some large mica crystals, which are sufficiently large and clear to suggest that a supply may be obtained of economic value.

His last addition to the series is a lump of an intensely altered hornblendic gneiss from the summit of Wein Deimoleh (or Deymole). This is of interest as proving that outcrops of the Archean series occur in the Maritime Mountains.

### III. DESCRIPTION OF A NEW SPECIES OF CORAL.

#### *Cryptocœnia Lort-Phillipsii*, n.sp.

DIAGNOSIS.—*Corallum* massive, hemispherical.

*Calices* circular, deep.

*Septa* hexamerall; of two orders. The primary septa are thin, and in length are equal to a third the width of the calix. Secondary little more than rudimentary.

*Costæ* conspicuous. The confluence of the costæ of different calices is well marked.

*Intercalicular areas* very narrow.

DIMENSIONS.—Diameter of calices, 2 mm.; distance of calicular centres, 3 mm.; number of septa, 6 large and 6 rudimentary; length of primary septa,  $\frac{2}{3}$  mm.; height of corallum, 45 mm.; diameter of corallum, 55 mm.

DISTRIBUTION.—Limestone of Maritime Mountains at Duba, 8 miles south of Berbera, Somali-land.—Presented to the Geological Department by Mrs. E. Lort-Phillips.

AFFINITIES.—This species belongs to the group of *Cryptocœniæ*, in which the septa are hexamerall. Of known species it is most allied to *Cryptocœnia Neocomiensis* (E. de F.).<sup>1</sup> From this, however, it clearly differs by having only two orders of septa, and by having thinner intercalicular areas. Of Jurassic *Hexacryptocœniæ*, it is nearest to *Cryptocœnia Thiessingi*, Koby,<sup>2</sup> from the Swiss Sequanian; but from this it differs owing to the greater amount of coenenchyma and greater size of the secondary septa in the Swiss species.

There is some doubt as to the age of the Duba limestone. From stratigraphical considerations one would be inclined to regard it as part of the same series as the limestones at Bihin. But it may be Neocomian. The single fossil found does not afford ground for an opinion, though it resembles the Lower Cretaceous and Upper Jurassic *Cryptocœniæ* rather than the Bathonian species.

It is to be hoped that the next traveller along the road to the Sheikh Pass will endeavour to collect more fossils from the Duba limestone.

### IV. SECTION ACROSS THE GUBAN AND THE GOLIS.

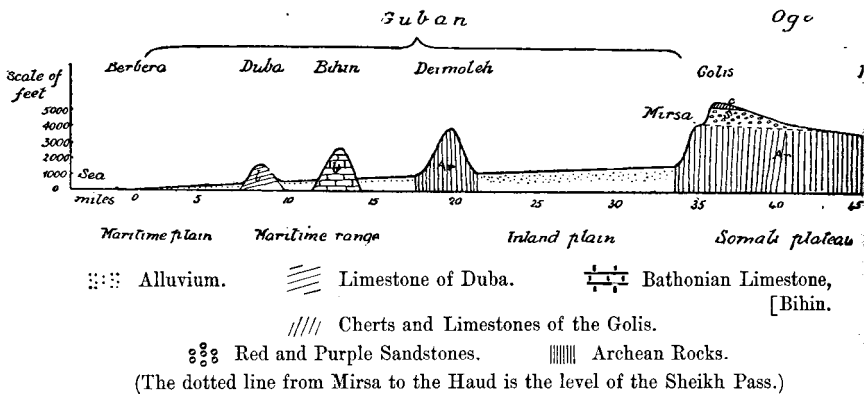
After having thus enumerated the specimens contained in the collection, we may proceed to consider what light they show on

<sup>1</sup> *Cyathophora Neocomiensis*, E. de Fromentel, "Description des polypiers fossiles de l'Étage néocomien," p. 41, pl. v, figs 11, 12. Paris, 1857.

<sup>2</sup> F. Koby, "Monographie des Polypiers Jurassiques de la Suisse," pt. 2, p. 86, pl. xxix, fig. 2: Mém. Soc. pal. Suisse, vol. viii, 1882 (1881).

the general geological structure of the country. The accompanying section shows the topographical features, according to Capt. Swayne's map and some notes given me by Mr. Aylmer.

South of Berbera there is a low plain composed of recent marine deposits, mostly covered by blown sand and soil. Eight miles inland is the first of a series of east and west ridges which form the "Maritime Mountains." These extend for about twelve miles. Then follows the "Inland Plain," which is a continuation of the coast plain: it ends abruptly at the height of 1800 feet, at the foot of the north scarp of the Somali plateau. A steep track leads up the face of this scarp to the Sheikh Pass, at the height of 4000 feet, which leads on to the plateau. East and west of the pass the north edge of the plateau is much higher, rising at one point to 6819 feet. As a rule this northern edge is from 5000-5500 feet in height, while a terrace a mile or two in breadth, known as Mirsa, runs along its northern face at the height of about 4000 feet. The northern edge of the plateau is jagged, and, seen from the north, looks like a mountain range, and is therefore known as the Golis Range. The whole of the low country to the north, consisting of the Maritime Plain, Maritime Mountains, and Inland Plain, is known to the Somalis as the "Guban." To the south of the Golis the plateau descends gradually across the Haud to the valley of the Webi Shebeyli. These topographical features may easily be explained by the collections described.



SECTION ACROSS NORTHERN SOMALI-LAND.

The Maritime and Inland Plains are both occupied by alluvium, marine and subaerial. Through these rise three ridges. The first two are formed of limestone. That at Bihin is unquestionably Lower Oolitic, and no doubt Bathonian. That at Duba may be a part of the same limestone, or a later one, possibly Neocomian in age.

The highest and furthest inland of the three ridges consists of Archean gneisses, and is an outlier from the main Somali plateau.

Whether it has been separated by denudation or earth-movements, there is not at present sufficient evidence to show.

The Somali plateau itself consists in the main of a mass of gneiss and rocks of the Archean series. As usual, this gives rise to the sandy scrub-covered plains, with many mimosa and Sansevieria. The Archean series is penetrated by pegmatite dykes of the same type, but coarser in grain than those of British East Africa. It is capped by rocks of two series—(1) red and purple unfossiliferous sandstones, often passing into impure hæmatite; (2) some limestones associated with beds of chert, probably of Neocomian age. These form the cap of the plateau and the summits of the Golis Range. The ledge of Mirsa and the summit of the Sheikh Pass are both on the upper surface of the Archean series (4000 feet).

The Somali-land sequence therefore consists of the following:—

1. Marine and subaerial recent deposits.
2. Neocomian limestones and cherts.
3. Duba limestone of uncertain age.
4. Bathonian limestones of Bihin.
5. Red and purple sandstones—unfossiliferous.
6. Archean series. (Gneisses penetrated by pegmatite dykes, etc.)

#### V. THE ORIGIN OF THE SOMALI-LAND FAUNA AND FLORA.

The discovery of the Bathonian fossils is of great interest. Bathonian rocks are known in Abyssinia from the work of Blanford,<sup>1</sup> Ferret and Galinier,<sup>2</sup> Aubry and Douvillé.<sup>3</sup> They are also well known from the west coast of India in Cutch. They occur in Northern Somali-land, exactly on the line joining these two localities. Mrs. Lort-Phillips' fossils are especially of value, as Rochebrune,<sup>4</sup> on the basis of Révoil's collections from Somali-land, has disputed the accuracy of the determination of the Jurassic age of the Abyssinian limestones. The presence of Bathonian fossils in Somali-land, however, shows that, apart from the Abyssinian limestones, there are fossiliferous marine deposits of both Lower Jurassic and Neocomian age in this region of East Africa.

The occurrence of one species (*Parallelodon Egertonianus*, Stoliczka) in Somali-land and in India helps to strengthen the idea of the former connection of the Bathonian rocks of India and Somali-land, which is suggested by the apparent extension of these rocks along an east and west line, from Cutch to Shoa. This is of interest, as it throws light on the origin of the interesting fauna and flora of the Golis Range. The report on the collection of plants made in the Golis Range, published in the Kew Bulletin of Miscellaneous Information (No. 105, September 1895, pp. 211–30), shows that the flora of this district contains a very

<sup>1</sup> W. T. Blanford, "Observations on the Geology and Zoology of Abyssinia," 1870, pp. 176–80, 199–203, pl. viii.

<sup>2</sup> Ferret and Galinier, "Description géologique du Tigré et du Samen Voyage en Abyssinie," t. iii, 1847, pp. 54–6.

<sup>3</sup> H. Douvillé, "Examen des fossiles rapportés du Choa par M. Aubry": Bull. Soc. géol. France, sér. 3, t. xiv, 1886, pp. 223–41, pl. xii.

<sup>4</sup> Rochebrune, in Révoil, *op. cit.*, p. 26.

high proportion of endemic species (69 species out of 350 were new). This appears to be due to two reasons. In the first case, the Golis hills appear to contain limestones, which support a more varied flora than the soil formed by the weathering of the gneiss and schist. As travellers generally cross from the lowlands to the plateau by the Sheikh Pass, which has been cut down to the Archean series, they had previously missed this interesting flora.

In the second place, the high proportion of endemic species and the fauna and flora of these hills may be explained by their being inhabited by a group of species which entered the country from land which formerly extended to the east. In the discussion at the Geographical Society on Dr. Donaldson Smith's paper on his journey to Lake Rudolf, Dr. Bowdler Sharpe remarked that some of the Somali-land birds were allied to those of the Cape, and were unlike the representative species that live in the intervening parts of East Africa. It is most probable that the Jurassic rocks of Somali-land are part of a band which once extended eastward into the Indian Ocean, and may have been part of the hypothetical continent of Gondwana-land or Lemuria. This continent was probably separated from Equatorial East Africa, but was connected with the Cape. Thus it is quite possible that some species may have reached both the Cape and Somali-land without entering Equatorial Africa. Hence one of the constituents of the fauna and flora of Somali-land may be a remnant from those of the lost continent of Gondwana-land and Lemuria.

#### VI. POINTS FOR FURTHER INQUIRY.

Considering how many travellers are now visiting Somali-land, it may be advisable to refer to some of the principal points in reference to the geology of Somali-land on which material is especially desired.

1st. Collection of fossils from Duba; from any cherts or limestone on the Golis Range; and from Fara-Daro.

2nd. Information as to the dip of the limestones at Duba, Bihin, or Fara-Daro.

3rd. A sketch-map, on the scale of one or two inches to the mile, of any part of the Golis Range which includes the ends of river-valleys running northward to the coast and southward to the Haud. The information especially desired is the course of the valleys, and their relations to the watershed.

4th. A comparison of the succession of rocks seen in the ascent of Wein Deimoleh with those seen in the ascent of the plateau scarp at the nearest point.

#### II.—ON THE OCCURRENCE OF AN INDIAN JURASSIC SHELL, *PARALLELON EGERTONIANUS*, IN SOMALI-LAND, EASTERN AFRICA.

By R. BULLEN NEWTON, F.G.S.

**M**R. E. LORT-PHILLIPS, during her journey in Africa, collected some well-preserved *Arca*-like shells from a river-bed at Bihin, in Somali-land, which have been entrusted to me