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NOTES ON SOME
LOWER CAMBRIAN FOSSILS FROM
FRENCH WEST AFRICA

BY

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Synopsis

In 1955 two occurrences of fossiliferous Lower Cambrian were discovered in the Zemmour region of Mauritania (French West Africa). The fossil fauna consists of six species, three of which are established as new, and it appears to be related to that of the *Neobolus* Beds at Fort Kusak in the Salt Range (Pakistan). In the writer's opinion the material at hand is significant as additional evidence of the existence of a *Tethys* already in early Cambrian time.

Preface

The material described and discussed in the present paper was collected in the Zemmour region of northern Mauritania, partly by Dr. J. SOUGY of the DIRECTION FÉDÉRALE DES MINES ET DE LA GÉOLOGIE DE L'AFRIQUE OCCIDENTALE FRANÇAISE, partly by J. BOROCOCCO and R. NYSSEN. At the request of Dr. SOUGY the writer undertook the examination of the material, and the results are presented in the following pages. Geological information and several photographs were placed at the writer's disposal; thanks for this aid are expressed. The figures in the plates are photographs partly furnished by Dr. SOUGY, partly taken by the writer. Several prints were made with great care and ability by Mr. C. HALKIER.

NOTES ON THE GEOLOGY OF THE ZEMMOUR REGION

The fossils, almost exclusively brachiopods, originate from Aghachan el Akhdhar and Gara Bouya Ali, marked on the map (fig. 1) as 1 and 2, respectively, and the geological position of these occurrences appears partly from the map (fig. 1), partly from the stratigraphic table (p. 5), made by Dr. Sougy and kindly placed at the writer's disposal.

In addition to the geological map and the stratigraphic table Dr. SOUGY has kindly sent the following brief information concerning the series of strata:

“La Série d'El Thlethyate a livré des Stromatolithes et la Série de Garat el Hamoueid des empreintes indéterminables de Camarotoechiidae. Deux niveaux de la Série de l'Oumat el Ham *sensu stricto* ont livré des empreintes de Brachiopodes Inarticulés: les Argiles vertes micacées d'Aghachan el Akhdhar (niveau local 6) et les Minerais de fer de Gara Bouya Ali.

La série stratigraphique du Paléozoïque inférieur du Zemmour, définie dans deux notes de J. SOUGY (1956 et 1957) peut se résumer dans le tableau suivant :

Ages		Puissances	Echelle locale	Niveaux
GOTLANDIEN		6 à 50 m	16	Schistes à <i>Monograptus triangulatus</i>
ORDOVICIEN?	Serie de Gara el Hamoud	15 à 150 m	15	Grès-quartzites massifs
			14	Conglomérat de base remaniant les pélites du niveau 8 et à nodules phosphatés
			13	Zone d'altération de la paléosurface d'érosion
Lacune		Discordance de ravinement		
CAMBRIEN	Serie de l'Oumat el Ham sensu stricto	6 m	12	Grès schisteux de l'Oued Ezrayeb
		5 m	11	Grès à <i>Scolithus linearis</i> supérieurs
		0.30 m	10	Grès et conglomérat à nodules phosphatés
		1 m?	9	Argiles supérieures
		120 m	8	Pélites et siltstones micacés à glauconie, à micro-débris de Lingulidés
		0 à 15 m	7	Niveau ferrugineux de Gara Bouya Ali à empreintes de Brachiopodes Inarticulés
		0 à 6 m	6	Argiles micacées vertes d'Aghachan el Akhdhar, à <i>Acrothele</i>
		0 à 40 m	5	Grès à <i>Scolithus linearis</i> inférieurs
		0 à 12 m	4	Grès feldspathiques grossiers roses
0 à 1 m	3	Conglomérat de base transgressif		
Lacune probable				
INFRA-CAMBRIEN	Serie d'el Thlethyate	0 à 600 m	2	Dolomies à <i>Conophyton</i>
			1	Base mal connue de la formation
Lacune		Discordance angulaire		
PRECAMBRIEN				Socle granitique

(a) Les Argiles à *Acrothele* d'Aghachan el Akhdhar :

Cette formation repose directement sur les Grès à *Scolithus* inférieurs. Ce sont des argiles illitiques très micacées de 6 mètres de puissance, qui comportent des passées plus grossières et passent insensiblement vers le haut à la puissante série de pélites micacées à glauconie.

Les empreintes ont été découvertes par J. SOUGY le 31 mars 1955 à Aghachan el Akhdhar. Le gisement, dont la position est précisée par la figure 1, a les coordonnées suivantes :

Latitude: 25°21'15'' N.

Longitude: 11°57'12'' W.

Il se trouve dans un petit rû descendant du piton sud de la colline, et qui a mis à jour les argiles. Ces argiles appartiennent à la base de la Série de l'Oumat et Ham *sensu stricto* définie en 1957.

(b) Les Minerais de fer de Gara Bouya Ali:

Les minerais de fer de Gara Bouya Ali sont un faciès latéral des pélites à glauconie qui se développe vers la base de celle-ci dans le Nord du Zemmour, au NE de la Gara Foug Gara. Ces minerais proviennent de l'altération de niveaux particulièrement riches en glauconie. Ce sont des minerais siliceux à 33 % de fer métal.

La position approximative des empreintes est la suivante:

Latitude: 25°58'30'' N.

Longitude: 11°25' W.

Les empreintes ont été découvertes par J. BOROCCHO et R. NYSSSEN le 10 mars 1955. L'affleurement est très étendu et les empreintes se trouvent sur les débris de roches qui jonchent le sol.

La position stratigraphique des Minerais de Gara Bouya Ali est très légèrement supérieure à celle des Argiles d'Aghachan el Akhdhar."

DESCRIPTIONS AND DISCUSSIONS OF THE FOSSILS

BRACHIOPODA

Order **ATREMATA** BEECHER

Superfamily **OBOLACEA** SCHUCHERT

Family **OBOLIDAE** KING

Subfamily **Neobolinae** WAAGEN

Genus *Neobolus* WAAGEN

Neobolus cf. *warthi* WAAGEN, 1885.

Pl. 1, figs. 1—4.

For synonyms see SCHINDEWOLF & SEILACHER 1955, pp. 325—326.

Material: Two ventral valves and six dorsal valves, all of them more or less fragmentary.

Locality: Aghachan el Akhdhar.

Remarks: The specimens agree fairly well with those from Salt Range (Pakistan) as described by SCHINDEWOLF (1955) with regard to the outline of the valves, which may vary from subcircular to transversely subelliptic. Some of the specimens show the same somewhat coarse surface markings as those figured by SCHINDEWOLF & SEILACHER, but most of them have less coarse and more regular surface markings and are in this respect intermediate between SCHINDEWOLF & SEILACHER's specimens and those figured by WALCOTT (1912, pl. 1, figs. 4-5; pl. 81, figs. 2, 2a-d). One of the African specimens, a natural cast of the interior of a dorsal valve, shows impression of apical plate and median septum; the former is poorly defined when compared with specimens figured by WALCOTT and by SCHINDEWOLF & SEILACHER; it is well-known, however, that in inarticulate brachiopods internal characters of one and the same species may vary to a considerable extent. It deserves notice that the African specimens are much smaller than those from Salt Range; the maximum diameter of the Salt Range specimens is about 10 mm, whereas that of the African specimens hardly exceeds 2 mm; in view of this fact and the poor state of preservation the specific determination is given with reservation.

Subfamily **Lingulellinae** SCHUCHERT

Genus *Lingulella* SALTER

Lingulella cf. *fuchsi* REDLICH, 1899.

Pl. 1, figs. 5-9.

1899. *Lingulella fuchsi* REDLICH, p. 7, Pl. 1, figs. 10a-e.

1905. *Obolus (Lingulella) fuchsi* WALCOTT, p. 332.

1912. *Lingulella fuchsi* WALCOTT, p. 502, Pl. 39, figs. 2, 2a-c, 3.

1955. *Lingulella fuchsi* SCHINDEWOLF in SCHINDEWOLF & SEILACHER, p. 307, Pl. 8, figs. 21-28.

Material: Twenty-three more or less fragmentary specimens most of which appear to be dorsal valves.

Locality: Aghachan el Akhdhar.

Remarks: It appears from SCHINDEWOLF's figures that *Lingulella fuchsi* shows great variation with regard to the outline of the valves so that in many cases it is impossible to distinguish ventral valves from dorsal ones by means of this character only, and the situation is the same as far as the African material is concerned. The specimens having the same almost perfectly oval outline as those figured by WALCOTT 1912 as Pl. 39, figs. 2b-c are supposed

to be dorsal valves, whereas those having acute posterior ends are supposed to be ventral valves. Judging from figures of the holotype (REDLICH 1899, Pl. 1, fig. 10c; WALCOTT 1912, Pl. 39, fig. 3) the external surface may have longitudinal striae radiating from the apex; in the African material such striae are indistinctly shown by the specimen represented in Pl. 1, fig. 8, whereas the other specimens, like those figured by SCHINDEWOLF, fail to show this character; the same specimen also shows indications of the papillae described by SCHINDEWOLF (p. 307) and shown in one of his figures (Pl. 8, fig. 26).

Most of the African specimens are within the variation limits shown by the several specimens from Salt Range as figured by SCHINDEWOLF, although some of the former are larger, measuring up to 6 mm in length, but it deserves notice that ventral valves with very acute posterior ends as shown in REDLICH'S Pl. 1, fig. 10c, and SCHINDEWOLF'S Pl. 8, figs. 25—26, have not been met with, and in view of this fact and the fragmentary state of preservation the specific determination is given with some hesitation.

Order **NEOTREMATA** BEECHER

Superfamily **BOTSFORDIACEA** SCHINDEWOLF

Family **BOTSFORDIIDAE** SCHINDEWOLF

Genus *Botsfordia* MATTHEW

Botsfordia paucigranulata n. sp.

Pl. 2, figs. 1—3.

Material: A dorsal valve and casts of the external surface of two specimens, one of which is a ventral valve, the other possibly a dorsal valve.

Locality: Gara Bouya Ali.

Description: General form subcircular with posterior end of ventral valve very obtusely angular. Ventral valve slightly convex, with overhanging apex situated at a level very close to that of the commissure of the valves and maximum elevation very close to the apex. External surface marked by very few concentric lines of growth and a system of fine, more or less inosculating ridges upon which there are minute rounded to oblong granules that have no extended systematic arrangement; in some places the granules are arranged in diagonal rows that cross each other. Internal characters of the ventral valve unknown. Dorsal valve more perfectly circular than the ventral one, almost flat, and with surface markings similar to that of the

ventral valve, the interior of the dorsal valve shows a low, relatively thick median septum extending to the central part of the valve and becoming increasingly low towards the centre. Main vascular sinuses evenly curved, forming parts of one and the same circle, originating from points remote from the median septum, and terminating at the posterior third line. The length of the specimens represented in Pl. 2, figs. 1–3, is about 3, 2.2, and 2.8 mm, respectively.

Remarks: This species is readily distinguished from the hitherto known members of the genus *Botsfordia* by its more spaced surface granulae and by the short, evenly curved main vascular sinuses.

Superfamily **ACROTRETACEA** SCHUCHERT

Family **ACROTRETIDAE** SCHUCHERT

Subfamily **Acrothelinae** WALCOTT & SCHUCHERT

Genus *Acrothele* LINNARSSON

Acrothele sougyi n. sp.

Pl. 2, figs. 4–7; 8–9?

Material: Eleven ventral valves.

Locality: Aghachan el Akhdhar.

Description: Ventral valve subcircular in outline, low, subconical with the apex a very short distance behind the centre. A pseudo-interarea is very indistinctly defined. An elongate foraminal aperture occurs just behind and beneath the apex. External surface marked by concentric, more or less undulating, partly inosculating ridges; the breadth of the interspaces is equal to that of the ridges; in the central part of the valve the concentric ridges are delicate, more regular, and crossed by numerous extremely fine radiating striae; one specimen (Pl. 2, fig. 7) shows a tendency to formation of coarse radiating ribs at some distance from the apex. Diameter of the valves rarely exceeding 3 mm.

Remarks: The almost central apex and the rather coarse, irregular, partly inosculating concentric ridges are characters which serve to distinguish this species from the hitherto described ones.

Acrothele spinulosa n. sp.

Pl. 3, figs. 1–6.

Material: Twenty-one specimens, mainly ventral valves.

Locality: Aghachan el Akhdhar.

Description: General form subcircular, frequently with a slight triangular or quadrangular tendency, and with numerous slender, closely set spines radiating from the margin. Ventral valve low, subconical, with the apex some distance behind the centre. A pseudo-interarea is very indistinctly defined. An oval foraminal aperture occurs just behind and beneath the apex. Surface markings consisting of concentric ridges, which are delicate, regular, and closely set in the central part of the valve, whereas in the peripheral part they are very coarse, irregularly undulating, and partly inosculating; in the peripheral part of the valve the breadth of the interspaces exceeds that of the ridges; in the central part the concentric ridges are crossed by numerous, delicate, closely set, radiating ribs so as to form a fine reticulate pattern. Dorsal valve perfectly flat, with a pair of tubercles at the marginal apex; marginal spines and surface markings as in the ventral valve. Nothing is known of the interior of the valves. Diameter of the valves rarely exceeding 3.3 mm.

Remarks: *Acrothele spinulosa* appears to be closely related to the preceding species, from which it differs by having a more posteriorly located ventral apex, more spaced concentric ridges, and marginal spines; as far as is known, marginal spines have not been observed in other species of the genus *Acrothele*.

TRILOBITA

Order **REDLICHIIA** RICHTER

Suborder **Redlichiina** HARRINGTON

Superfamily **REDLICHIIACEA** POULSEN

Family **REDLICHIIDAE** POULSEN

Subfamily **Redlichiinae** POULSEN?

Genus *Redlichia* COSSMANN?

Redlichia? sp.

Pl. 1, fig. 10.

The specimen figured is the only representative of the trilobites in the material at hand. Unfortunately, the fragmentary state of preservation prevents a safe reference to subfamily, genus, and species. The specimen in question may be regarded as a fragment of the librigena of an early meraspid individual, showing the genal angle and the proximal part of the genal

spine, and it may be compared with the genal angle region of *Redlichia* as figured by KOBAYASHI & KATO (1957).

Locality: Aghachan el Akhdhar.

CONCLUSIVE REMARKS

The Lower Cambrian age of the material is indicated by the occurrence of sandstone with *Scolithus linearis* below and above the levels from which the above-described fossils originate. This age of the faunule is further corroborated by the fact that the genus *Neobolus* is only known from Lower Cambrian strata.

The faunule is related to that of the *Neobolus* Beds at Fort Kusak in the Salt Range (Pakistan) described by SCHINDEWOLF (1955); this appears from the fact that two species from Aghachan el Akhdhar seem to be identical with or at any rate very closely related to *Neobolus warthi* WAAGEN and *Lingulella fuchsi* REDLICH from the mentioned *Neobolus* Beds, and the affinity is further emphasized by the occurrence of species of *Botsfordia* in both regions. Accordingly, the genera of brachiopods in the *Neobolus* Beds of Salt Range are not "local genera" as maintained by NEAVERSON (1955).

In the writer's opinion the above-described faunule is significant in a palaeogeographical respect as additional evidence of the existence of a Tethys already in early Cambrian time.

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PLATES

PLATE 1.

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Fig. 1—4. <i>Neobolus</i> cf. <i>warthi</i> WAAGEN	6
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- 4. Ventral valve?, × 10.	
- 5—9. <i>Lingulella</i> cf. <i>juchsi</i> REDLICH.	7
- 5. Ventral valve?, × 10.	
- 6. External cast of the same, × 10.	
- 7. Dorsal valve?, × 10.	
- 8. Ventral valve?, × 10, with partly preserved surface markings.	
- 9. Dorsal valve, × 10.	
- 10. <i>Redlichia</i> ? sp., genal angle with proximal part of genal spine, × 10.....	10



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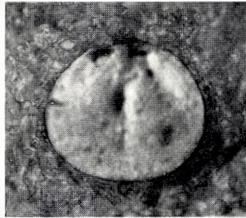
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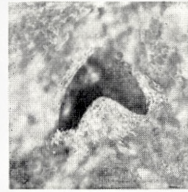
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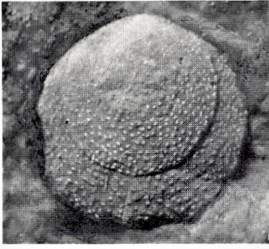
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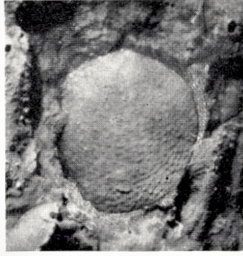
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PLATE 2.

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- 6. External cast of the same, × 10.	
- 8. <i>Acrothele</i> cf. <i>sougyi</i> n. sp., ventral valve, × 10.	
- 9. Lateral view of the same, × 10.	



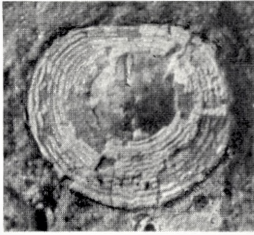
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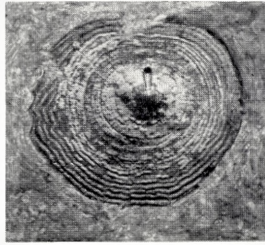
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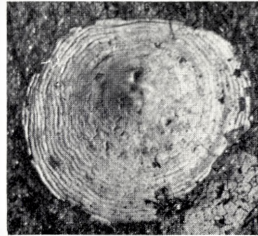
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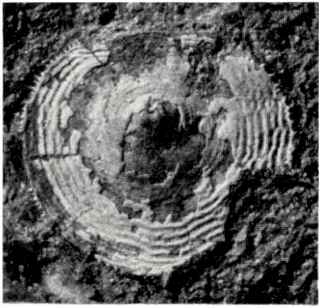
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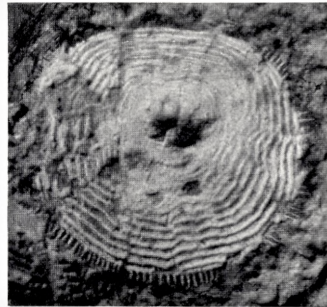
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PLATE 3.

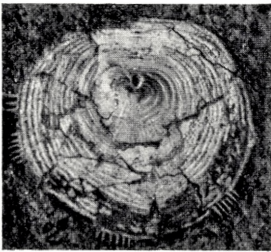
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Fig. 1—6. <i>Acrothele spinulosa</i> n. sp.	9
- 1—4. Ventral valves, $\times 10$; the specimen represented by fig. 2 is the holotype.	
- 5. Dorsal valve, $\times 10$.	
- 6. Fragment of ventral valve, $\times 10$, showing unusually delicate surface markings.	



1



2



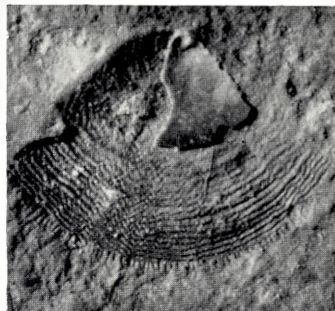
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