J. micropalaeontol., **8**(1): 49–54, June 1989

Loftusia arabica sp. nov. (*Foraminiferida*) from the Maastrichtian of central Saudi Arabia

GHALIB M.A. EL-ASA'AD
Department of Geology, College of Science, King Saud University,
P.O. Box 2455, Riyadh 11451, Saudi Arabia

ABSTRACT–Microfauna from the lower part of the Hajajah Limestone Member (Early Maastrichtian) in central Saudi Arabia has been found to include a new species of *Loftusia*, *L. arabica*. The description, illustration, age and localized distribution of this species and a comparison with similar species are presented.

INTRODUCTION

The present study is based on specimens collected from the lower part of the Hajajah Limestone Member of the Aruma Formation in central Saudi Arabia.

The outcropping belt of the Aruma Formation in central Saudi Arabia has been subdivided by El-Asa'ad (1983a, b) into three members: the Khanasir Limestone Member overlain by the Hajajah Limestone Member and the Lina Shale Member. El-Asa'ad recognized nine faunal zones representing the Senonian to Maastrichtian stages in these rock units. The Hajajah Limestone Member (77 m thick) is composed of olive green shale (6 m thick) overlain by a slightly dolomitic, chalky limestone (51 m thick), followed upwards by a highly dolomitic limestone (20 m thick)

Specimens of *Loftusia arabica* sp.nov. were found in a localized calcareous facies within the basal olive green shale unit of the Hajajah Limestone Member. This facies is only known from two localities along the strike of the Aruma Formation which extends for about 400 km in central Saudi Arabia; these localities are Khashm Buwaibiyat — Rumhiyah, and to the west of Artawi (see location map, Fig. 1).

Associated macrofossils with *Loftusia arabica* sp.nov. from the shale unit were the echinoderms *Iraniaster affinidouvillei* Kier, I. *bowersi* Kier and *Proraster buwaibiyatensis* El-Asa'ad, the solitary corals *Aulosmilia vidali* Mallada, *Conicosmilotrochus parkinsoni* (Edwards & Haime, *C. imbricata* Matheron, *Rennensismilia oldhami* (Duncan), *Cunnolites (Paracunnolites) minima* de Fromentel, *C. (P.) discoidea* Goldfuss, and the molluscs '*Lopha*' *dichotoma* Bayle and *Bournonia excavata* (d'Orbigny). These fossils are typically Maastrichtian and have a shallow water aspect.

Just above the basal shale unit the following larger foraminifera were recorded: *Monolepidorbis douvillei* (Silvestri), *Orbitoides gensacicus* (Leymerie), *O. apiculatus* Schlumberger, *Lepidorbitoides macgillavryi* Thiadens, *L. (Asterorbis) rooki* Vaughan & Cole and *Omphalocyclus macroporus* (Lamarck) (El-Asa'ad, 1983b). Of these, *O. macroporus* has the most restricted range, occurring for the first time within the Maastrichtian (not the earliest part) (Van Gorsel, 1978); therefore, *Loftusia arabica* must be Maastrichtian in age and is almost certainly referable to the early part of that stage.

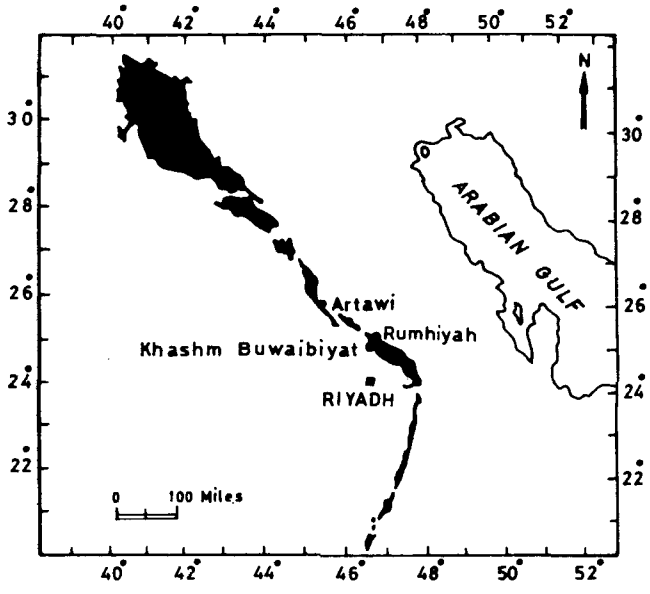


Fig. 1. Outcrop map of the Aruma Formation (Late Cretaceous), central Saudi Arabia, with sampling locations.

SYSTEMATIC DESCRIPTION

Loftusia arabica sp.nov. has been compared with similar *Loftusia* species, especially those from the Middle East, which are deposited in the Micropalaeontology Section, Department of Palaeontology, British Museum (Nat. Hist.), London.

The holotype and paratypes of the new species are

deposited in the collections of the Geological Museum, Geology Department, King Saud University, Riyadh, Saudi Arabia. Their numbers are prefixed by the letters K.S.U.G.F.

Suprageneric classification follows Loeblich & Tappan (1988).

Order: Foraminiferida Eichwald, 1830
Suborder: Textulariina Delage & Hérouard, 1896
Superfamily: Loftusiacea Brady, 1884
Family: Loftusiidae Brady, 1884
Genus: *Loftusia* Brady (*in* Carpenter & Brady, 1870)
Type species: *Loftusia persica* Brady (*in* Carpenter & Brady, 1870).

Loftusia arabica sp.nov.
(Pl. 1, figs. 1–5, Pl. 2, figs. 1–5)

Derivation of name. In honour of Saudi Arabia.

Diagnosis. A species of *Loftusia* characterized by its small diameter, by its successive whorls being greatly increased in length along the horizontal axis and by its proportionally few and narrow whorls and proportionally narrow chambers. This gives a high length/diameter ratio and an elongated, thin and fusiform test.

Holotype. K.S.U.G.F. 10, an axial longitudinal thin-section (Pl. 1, fig. 2).

Paratypes. K.S.U.G.F. 12–24, complete tests (Pl. 1, figs. 3, 4); K.S.U.G.F. 26, an equatorial thin-section (Pl. 1, fig. 5) and K.S.U.G.F. 11, an axial longitudinal thin-section (Pl. 1, fig. 1).

Other material. Forty complete tests and about one hundred incomplete tests were also collected.

Locality and horizon. All specimens were collected from a localized calcareous facies within the basal shale unit of the Hajajah Limestone Member, Aruma Formation at Khashm Buwaibiyat — Rumhiyah and to the west of Artawi, central Saudi Arabia. Early Maastrichtian.

Description. Test elongated, thin, fusiform, constricted and pointed at both ends. The test shows considerable variation in size: the length ranges from 16.5 mm to 58 mm and the diameter from 2.1 mm to 6.2 mm. The average length of 100 specimens is 33.9 mm and the average diameter is 3.9 mm. The ratio of length to diameter varies between 4.8:1 to 10.3:1, with an average of 7.8:1. The spiral wall is made up of an outer, thin and imperforate layer and an alveolar supporting structure beneath it; minute cells of the alveolar layer are polygonal, their size 0.01 × 0.5 mm. Worn surfaces show transvere outer ridges corresponding to internal rows of pillars, the number of outer ridges varying between 18 and 30. There is a faint longitudinal furrow on outer surface of some tests. The endoskeleton is agglutinated, built up of heteregenous accumulations of siliceous, calcareous and iron oxide grains (0.05–0.17 mm) cemented by fine-grained calcareous cement. Whorls are narrow (0.20–0.40 mm thick in equatorial section), their number varying with diameter of specimens (there are 13 whorls in specimens of 5.8 mm diameter and 6 whorls in specimens of 3.5 mm diameter). Successive whorls increase rapidly in length (axial length of whorl/equatorial length of whorl is 2–3:1 in young whorls and 6–10:1 in adult whorls). Whorls are divided into chambers by primary, longitudinal and oblique septa; the average number of chambers in outer whorls is 22. The chambers themselves contain labyrinthic endoskeletal structures (pillars). No convincing external apertures have been seen. Only microspheric forms are known, the initial coil being 0.10–0.20 mm in diameter in centred sections.

Dimension of holotype. Length — 36.7 mm, diameter — 4.3 mm, length/diameter ratio — 8.5, number of whorls — 9, thickness of adult whorls in axial section — 0.30–0.35 mm, breadth of chambers in adult whorls — 0.20–0.30 mm, grain size of agglutinated material of endoskeleton — 0.10 mm.

Remarks. *Loftusia arabica* sp.nov. resembles *L. morgani* Douvillé (see Cox (1937), pl. 33, fig. 3; pl. 34, figs. 1, 2) and *L. elongata* Cox (see Cox (1937), pl. 33, fig. 2; pl. 35, figs. 1, 2). These two species are known from western Iran (Cox, 1937) and are described only from microspheric specimens. *Loftusia arabica* is also known only from microspheric forms and has similar structural characters, nature of spire and wall structure. It differs, however, from both of them by the internal and external dimensions and by the general shape of the test. Table 1 and Fig. 2 summarize these differences.

Every attempt was made to recover megalospheric specimens. It is suggested their absence relates to some stressed palaeoenvironmental conditions, the precise nature of which is not yet known.

Explanation of Plate 1

Figs. 1–5. *Loftusia arabica* sp. nov.
Fig. 1. Axial longitudinal thin-section of paratype (K.S.U.G.F. 11), × 4.
Fig. 2. Axial longitudinal thin-section of holotype (K.S.U.G.F. 10), × 4.
Fig. 3. Paratypes (K.S.U.G.F. 12–19), × 1.
Fig. 4. Paratypes (K.S.U.G.F. 20–24), × 1.
Fig. 5. Equatorial thin-section of paratype (K.S.U.G.F. 25), × 15.

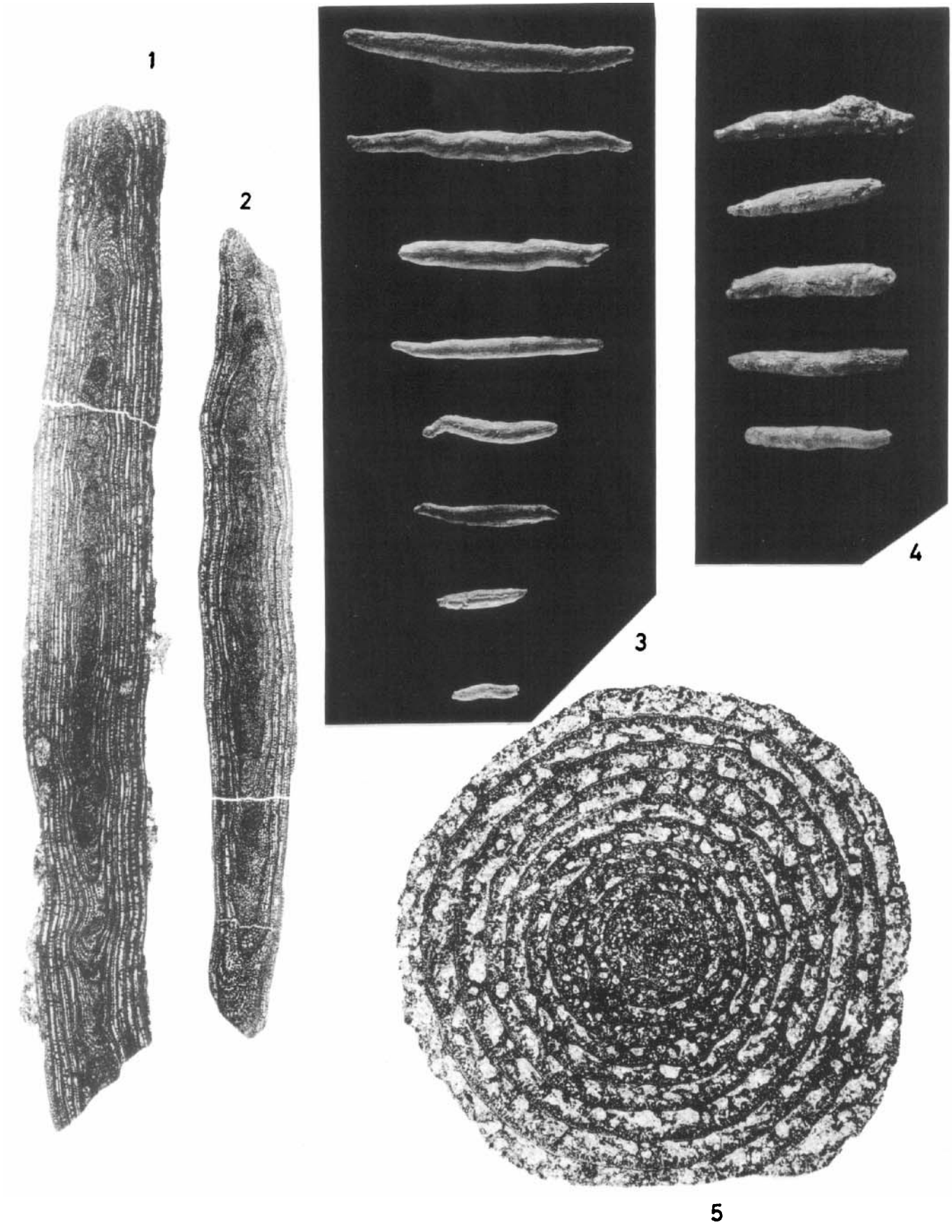

1
2
3
4
5

Table 1.

Species	Length in mm max.	Length in mm ave.	Diameter in mm min.	Diameter in mm max.	Diameter in mm ave.	Length/diameter ratio min.	Length/diameter ratio max.	Length/diameter ratio ave.	No. of whorls (average)	Thickness of adult whorls in equatorial section (in mm)	No. of chambers in outer whorls	Width of chambers in large specimens (in mm)
Loftusia morgani Douvillé	44.5	27	6	8	5.8	3	7.2	4.6	2	16	0.25–0.55	15–20	?
Loftusia elongata Cox	118	55.5	12	33	12.3	5.6	9.2	4.5	3.5	18	0.25–0.82	15–20	2.5
Loftusia arabica sp. nov.	58	33.9	16.5	6	3.9	2.1	10.3	7.8	4.8	10	0.25–0.35	22–25	0.55–0.85

Table 1. External and some internal dimensions of *Loftusia* species. Dimensions of *L. morgani* Douvillé and *L. elongata* Cox are after Cox (1937 p. 435, p. 443) and measurements made by the present author of specimens in the British Museum (Nat. Hist.), viz. *L. morgani* (specimens P 28543–P 28549, from Kermanshah District, Iran; sample WL 5837–39, from Mahra, Hadramaut, Arabia; tube no. P 34382, from Sari-i-Kul, Bakhtiari Country, Iran and slide P 23877, from Jebel el Abaid, Oman) and *L. elongata* (slide P 43935, from Jebel el Abaid, Oman and specimens P 34371–P34375 and P 34364–P 34370 (paratypes), from Kuh-i-Balum, Bakhtiari Country, Iran).

DISCUSSION

According to El-Asa'ad (1983a, b), the associated fossils with *Loftusia arabica* sp.nov. from the basal shale unit of the Hajajah Limestone Member are of early Maastrichtian age; other evidence from larger foraminifera occurring just above this unit (see p. 49) would support this age determination. From adjacent areas such as Iran, Oman, Iraq and Turkey, *Loftusia* species are always found associated with Maastrichtian faunal assemblages (Douvillé, 1904, 1910; Lees, 1928; Cox, 1937; Henson, 1948 and Meriç, 1965).

As the present species was found at only two localities along the strike of the Aruma Formation which extends for more than 400 km in central Saudi Arabia, it seems that *Loftusia arabica* had a highly localized stratigraphical and geographical distribution. It is suggested that conditions were only favourable for the development of this species during the deposition of the areally restricted calcareous facies of the Hajajah Limestone Member; hence the populations are so restricted in their distribution. Such an interpretation would also be consistent with the absence of asexually produced (megalospheric) forms (i.e. that environmental conditions were usually stressed).

ACKNOWLEDGEMENTS

The author wishes to thank King Saud University, Riyadh, Saudi Arabia for their financial support; Drs C. G. Adams and J. E. Whittaker, Department of Palaeontology, British Museum (Nat. Hist.), London, kindly read an early draft of the manuscript and introduced me to the Museum's extensive collections of *Loftusia*, respectively. Finally, the staff of the Institut de Paléontologie, Paris, are acknowledged for allowing me use of their research facilities.

Manuscript received October 1987
Revised manuscript accepted October 1988

Explanation of Plate 2

Figs. 1–5. *Loftusia arabica* sp. nov.

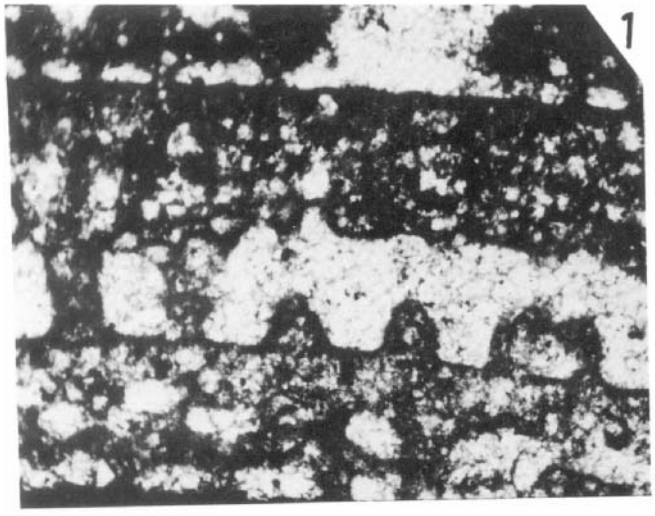
Fig. 1. Part of adult whorl of paratype (K.S.U.G.F. 11, Pl. 1, fig. 1) showing some pillars, × 40.

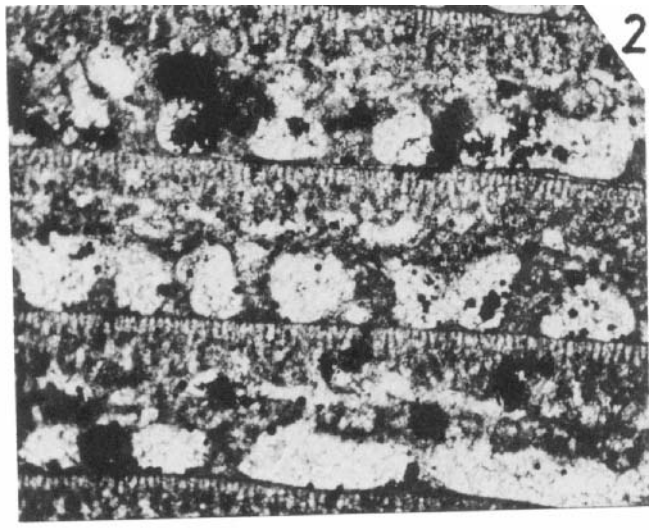
Fig. 2. Part of adult whorls of holotype (K.S.U.G.F. 10, Pl. 1, fig. 2) showing some chambers, pillars and septa, × 40.

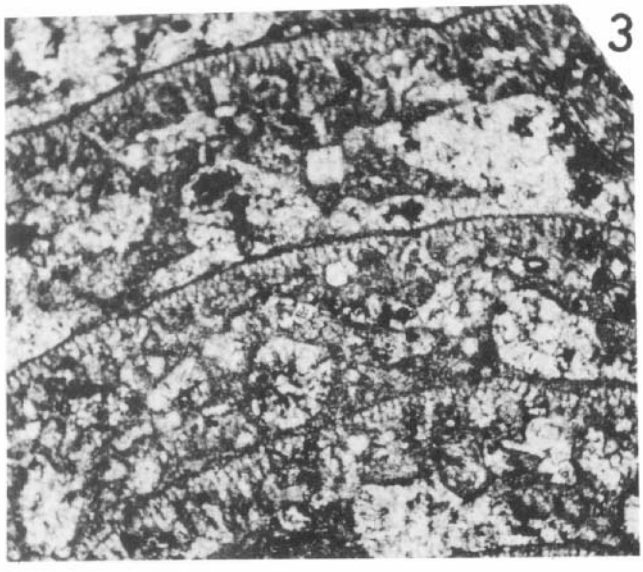
Fig. 3. Part of adult whorls of paratype (K.S.U.G.F. 25, Pl. 1, fig. 5) showing chambers, wall and labrynthic structures, × 45.

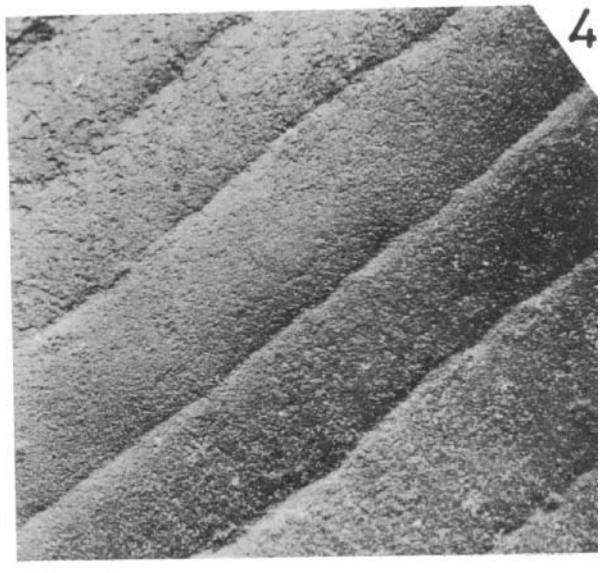
Fig. 4. Scanning electron micrograph of outer surface of paratype showing ridges but no convincing apertures, × 40.

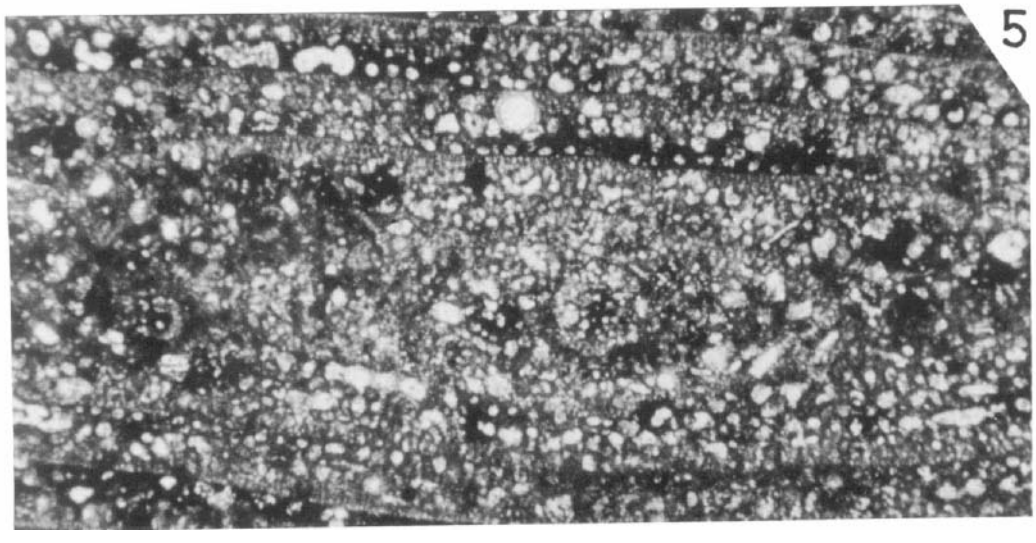
Fig. 5. Part of axial longitudinal section of holotype (K.S.U.G.F. 10, Pl. 1, fig. 2) showing the initial microspheric coil, × 60.


1


2


3


4


5

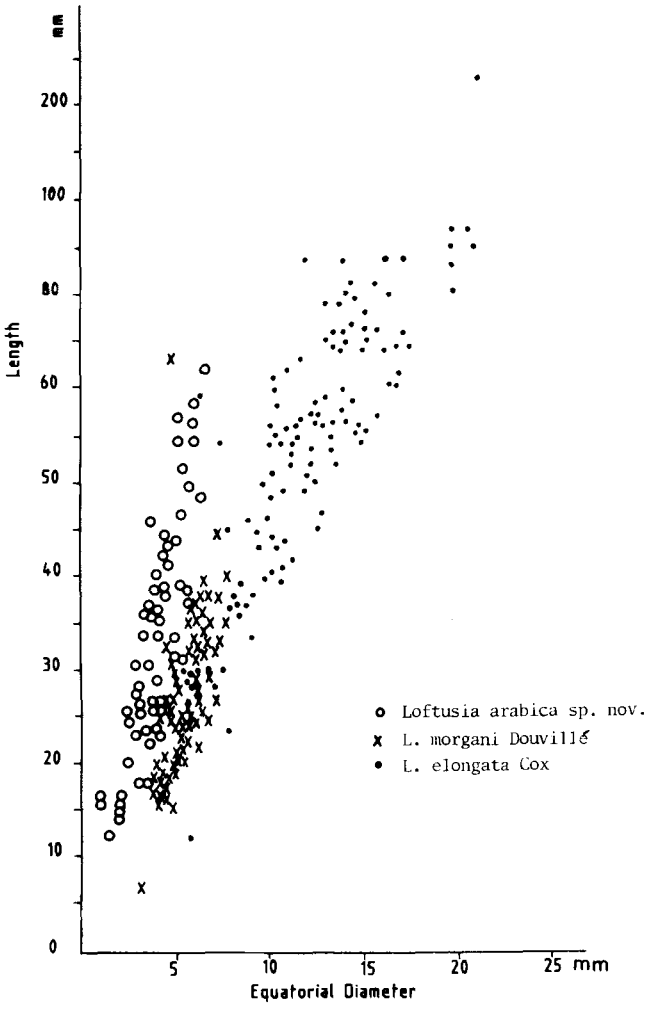


Fig. 2. Graph of equatorial diameter against length for measured specimens of *Loftusia arabica* sp. nov., *L. elongata* Cox and *L. morgani* Douvillé.

REFERENCES

Brady, H. B. 1870. *In* Carpenter, W. B. & Brady, H. B., Description of *Parkeria* and *Loftusia,* two gigantic species of arenaceous foraminifera. *Phil. Trans. R. Soc.*, **159** (for 1869), 721–754.

Cox, T. 1937. The genus *Loftusia* in south western Iran. *Ecol. geol. Helv.*, **30,** 432–443.

Douvillé, H. 1904. Mollusques fossiles. *In* Mission scientifique en Perse par J. de Morgan. *Bull. Soc. géol. Fr.*, ser. 4, **3**, 251–153, 367–368.

Douvillé, H. 1910. Etudes sur les Rudistes: Les Rudistes de Sicile, d'Algérie, d'Egypte, du Liban et de la Perse. *Mém. Soc. géol. Fr.*, **18,** 76–78.

El-Asa'ad, G. M. 1983a. Lithostratigraphy of the Aruma Formation in central Saudi Arabia. *In* Proceedings of the First Jordanian Geological Conference. *Spec. Publs. Jordanian Geol. Ass.*, **1,** 72–86.

El-Asa'ad, G. M. 1983b. Bio- and chronostratigraphy of the Aruma Formation in central Saudi Arabia. *In* Proceedings of the First Jordanian Geological Conference. *Spec. Publs. Jordanian Geol. Ass.*, **1,** 87–111.

Henson, F. R. S. 1948. Larger imperforate foraminifera of southwestern Asia. Families Lituolidae, Orbitolinidae and Meandropsinidae. British Museum (Nat. Hist.), London. xi + 127 pp.

Lees, G. M. 1928. Geology and tectonics of Oman and parts of S.E. Arabia. *Q.Jl geol. Soc. Lond.*, **84,** 585–670.

Loeblich, A. R. Jr. & Tappan, H. 1988. *Foraminiferal genera and their classification.* 2 vols. Van Nostrand Reinhold, New York.

Meriç, E. 1965. Sur deux nouvelles espéces de *Loftusia* en un nouveau genre *Asterosomalina. Revue Micropaléont.*, **8,** 45–52.

Van Gorsel, J. T. 1978. Late Cretaceous orbitoidal foraminifera. *In* Hedley, R. H. & Adams, C. G., *Foraminifera, Volume 3.* Academic Press, London, etc., pp. 1–120.