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

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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, *Rennensisimilia oldhami* (Duncan), *Cunnolites (Paracunnolites) minima* de Fromentel, *C. (P.) discoidea* Goldfuss, and the molluscs *'Lopha' dichotoma* Bayle and *Bournonita 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. (Asierorbis) rooki* Vaughan & Cole and

![Fig. 1. Outcrop map of the Aruma Formation (Late Cretaceous), central Saudi Arabia, with sampling locations.](image-url)
subsequent 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 transverse 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 heterogeneous 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. morganii* Douville (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.

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**Explanation of Plate I**

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.
Table 1.

| Species                  | Length in mm | Diameter in mm | Length/diameter ratio | No. of chambers (average) | Thickness of adult whorls in equatorial section (in mm) | No. of chambers in large specimens (in mm) | Width of chambers in large specimens (in mm) |
|--------------------------|--------------|----------------|-----------------------|---------------------------|--------------------------------------------------------|-------------------------------------------|---------------------------------------------|
| *Loftusia morgani*       | 44.5         | 5.8            | 7.2                   | 2                         | 0.25-0.55                                              | 15-20                                     | ?                                           |
| Douville                 | 27           | 3              | 4.6                   | 16                        |                                                        |                                           |                                             |
| *Loftusia elongata*      | 118          | 12.3           | 5.6                   | 3                         | 0.25-0.82                                              | 15-20                                     | 2.5                                         |
| Cox                      | 55.5         | 12.3           | 4.5                   | 18                        |                                                        |                                           |                                             |
| *Loftusia arabica*       | 58           | 3.9            | 2.1                   | 10                        | 0.25-0.35                                              | 22-25                                     | 0.55-0.85                                  |
| sp. nov.                 | 33.9         | 6              | 7.8                   | 4                         |                                                        |                                           |                                             |
|                          | 16.5         | 10.3           | 4.8                   | 10                        |                                                        |                                           |                                             |

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 (Douville, 1904, 1910; Lees, 1928; Cox, 1937; Henson, 1948 and Merič, 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).

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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 labyrinthic 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.
Loftusia arabica sp. nov. from the Maastrichtian of central Saudi Arabia
Loftusia arabica sp. nov.
L. morgani Douvillé
L. elongata Cox

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

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