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GLOBOTRUNCANA FALSOCALCARATA KERDANY — ABDELSALAM, 1969, FROM THE UPPER MAASTRICHTIAN OF ENFIDAVILLE, NORTHEASTERN TUNISIA

(Figs. 3, Pls. 2)

Abstract: The Upper Maastrichtian planktic foraminiferal species *Globotruncana falsocalcarata* KERDANY — ABDELSALAM, 1969, is described and discussed. In this population from Tunisia specimens that resemble the holotype are juvenile forms while those that resemble the paratype are adult forms. It is thus suggested that the specimens resembling the paratype should be regarded as typical representatives of the species. These adult specimens which differ from paratype only in the presence of spines or chamber extensions in the periphery of the test or both, are considered part of the main variation of the species.

Резюме: В статье описан и обсужден вид планктонной фораминиферы верхнего мастрихта *Globotruncana falsocalcarata* KERDANY — ABDELSALAM, 1969. В этой популяции из Туниса экземпляры похожие на голотип редставляют ювенильные формы, в то время как экземпляры похожие на паратип являются взрослыми формами. Таким образом предлагается, что экземпляры похожие на паратип должно считать типичными представителями вида. Эти взрослые экземпляры отличающиеся от паратипа только наличием игол или протяжениями камер на периферии раковины или в обеих считаем частью основной вариации вида.

Introduction

Globotruncana falsocalcarata KERDANY—ABDELSALAM, 1969, is a rare little known, but stratigraphically very useful *Globotruncana* species from the Upper Maastrichtian.

Globotruncana falsocalcarata was described by KERDANY—ABDELSALAM (1969) as a group of forms "which retain the peripheral spine in the early chambers of the final whorl and forms which do not exhibit peripheral spine in the last whorl". These two authors further stated that "the latter forms are usually larger in size. They are not described as a separate species since we had only very few specimens". Thus, they intimated that the holotype and paratype of *Globotruncana falsocalcarata* might prove to belong to two different species.

An exmination of the *Globotruncana falsocalcarata* population from the Upper Maastrichtian samples of Kef en Nsoura and Ain Mdeker (Fig. 1), showed me that the specimens that resemble the holotype are juvenile forms while those that the resemble the paratype are adults. Both forms clearly belong to the same species. In my material I have found a series of forms ranging from juvenile specimens to adult specimens.

This ontogenetic development can also be observed in the specimens of *Globotruncana falsocalcarata* from Egypt illustrated by Kerdany—Abdel-

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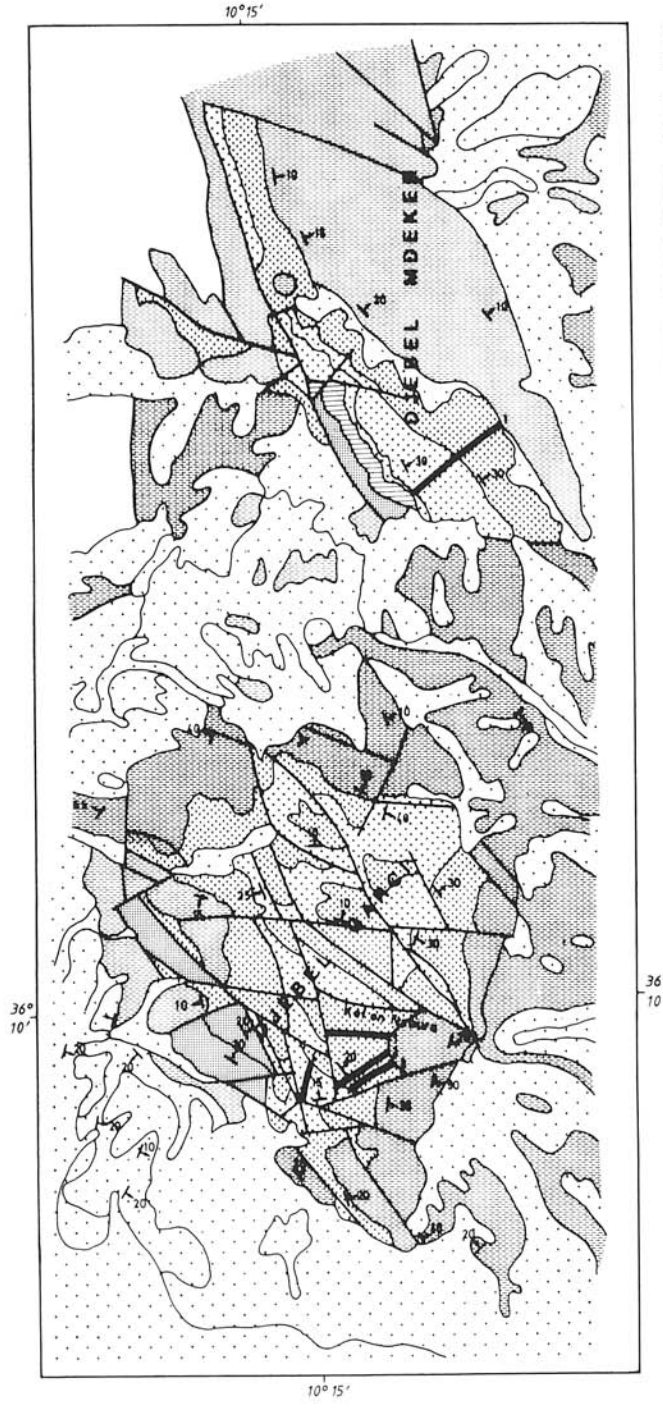
10°15'
DJEBEL MDEKEL
36° 10'
10° 15'
Holocene – Miocene
Eocene
Paleocene – Upper Maastrichtian
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N
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s a l a m (1969). The holotype corresponds in size and shape to the first and second whorl of the paratype which is an adult specimen (Fig. 2). The spines of the holotype will not reach the periphery of the test when the organism reach the adult stage but they can be seen on the spiral side.

On the basis of these observations it is suggested that the specimens that resemble the paratype should be regarded as typical representatives of *Globotruncana falsocalcarata* (1) because the paratype represents the adult stage of the test and (2) because the shape, size and position of the spines and the shape and size of the test vary considerably in the juvenile specimens.

Apart from the typical representatives of *Globotruncana falsocalcarata,* there are specimens in the Tunisian material which although closely resembling typical representatives of the species differ in the size and position of the spines or in possessing radial chamber extensions in the periphery. These specimens are regarded as variaties of *Globotruncana falsocalcarata* and are included in the main variation of the species.

Systematic description

Family *G l o b o t r u n c a n i d a e* BROTZEN, 1942

Genus: *Globotruncana* CUSHMAN, 1927

T y p e s p e c i e s: *Pulvinulina arca* CUSHMAN, 1926

Globotruncana falsocalcarata KERDANY–ABDELSALAM, 1969

1969 *Globotruncana falsocalcarata* KERDANY–ABDELSALAM: pp. 261–263, pl. 1, figs. 1–4, pl. 2, figs. 1 a–c, 2 a–c.
1974 *Globotruncana falsocalcarata* KERDANY–ABDELSALAM; D o r e e n: pl. 1, fig. 3e.
1975 *Globotruncana falsocalcarata* KERDANY–ABDELSALAM; K a s s a b: pp. 346–351, pl. 1, figs. 1–7, pl. 2, figs. 1–4.
1978 *Globotruncana falsocalcarata* KERDANY–ABDELSALAM; K a s s a b: p. 320, pl. 2, fig. 4.
1979 *Globotruncana falsocalcarata* KERDANY–ABDELSALAM; K a s s a b: pp. 50–51, pl. 4, fig. 12, pl. 5, figs. 1–2, pl. 21, fig. 3, pl. 22, figs. 1–2, pl. 23, figs. 1–7, pl. 26, fig. 5.
1980 *Plummerita hantkeninoides* (BRÖNNIMANN); S a l a j: pl. 17, fig. 1–2.

D e s c r i p t i o n. Test medium-sized to large, planoconvex, umbilico-convex coiled into 2.5–3 whorls. Spiral side flat to slightly concave, umbilical side strongly convex and protruding. Initial chambers small and globular followed by larger triangular chambers with peripheral spines. These spines occur in typical representatives of the species on the periphery of the test in its juvenile stage (chamber arrangement 1.5–2 whorls) and in the adult stage on the spiral side of the chambers of the last whorl which is composed of 6–8 chambers. Ultimate chamber often inclined or vertical. Some specimens have peripheral spines, others have chamber extensions or both at the beginning of the last

Fig. 1. Geological map of the Kef en Nsoura and Ain Mdeker areas (after B a j a n í k – B i e l y, 1974) showing the location of the studied sections.

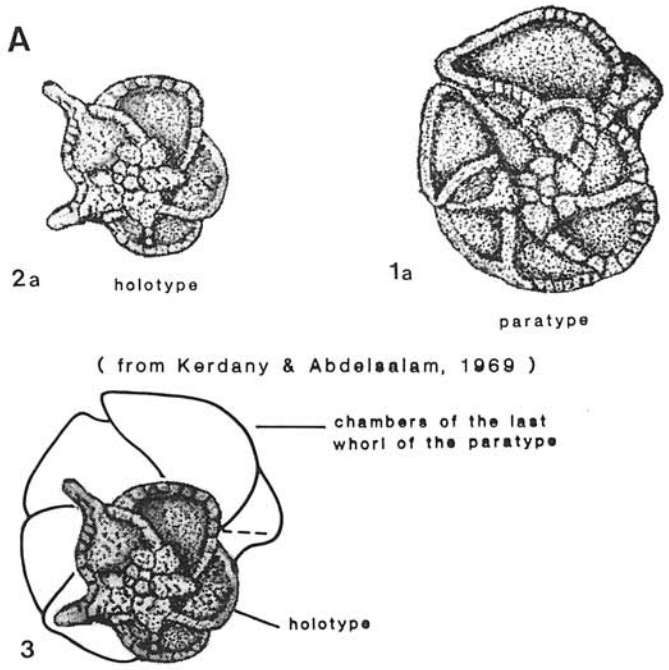


Fig. 2 A. 2 a, 1 a — spiral side of the holotype and paratype of *Globotruncana falsocalcarata* as illustrated by Kerdany and Abdelsalam (1969); 3 — shows that the holotype is a juvenile specimen corresponding to the early whorls of the paratype which is an adult specimen.

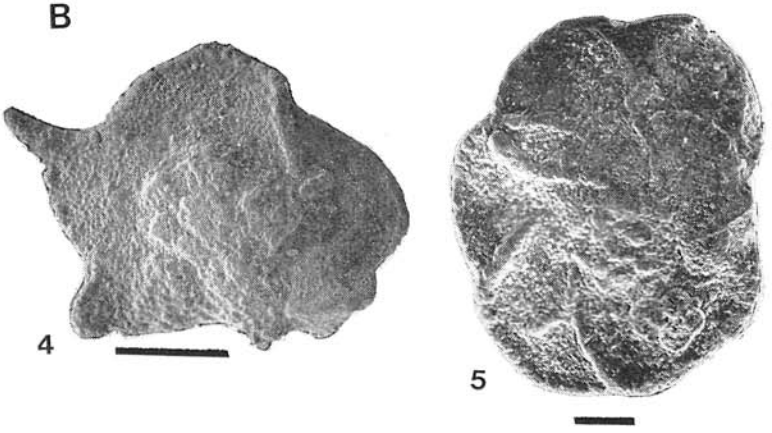


Fig. 2 B. 4, 5 — Tunisian specimens of *Globotruncana falsocalcarata* resembling the holotype and paratype (4 — NS 19, sample AD-16 of Ain Mdeker; 5 — NS 20, sample AD-16 of Ain Mdeker). Each bar equivalent to 100 μm.

whorl in their adult stage. The equatorial periphery of the test is subcircular or ovoid and spinose and it has a single keel. The sutures on the spiral side are oblique and depressed in the initial part, raised and baeded in the latter part. On the umbilical side they are curved and depressed. Umbilicus wide, deep and surrounded by periumbilical ridges. The primary aperture is interiomarginal umbilical and is covered by the complex tegilla.

Main variation: Adult specimens with peripheral spines. Adult specimens with chamber extensions and spines. Adult specimens with chamber extensions only.

Discussion

There is direct evidence that typical representatives of *Globotruncana falsocalcarata* developed peripheral spines in the juvenile stage (chamber arrangement 1.5–2 whorls) and that these spines were preserved on the spiral side of the test in adult stage. In addition to these typical representatives specimens which show peripheral spines or chamber extensions in the juvenile and adult stage have been found. These forms are included in the main variation of *Globotruncana falsocalcarata*.

Development of spines or chamber extensions in the test is usual in Globigerinacea. Haynes (1981, p. 310) connected the development of spines and chamber extensions in the planktic foraminifera which he calls "Globigerinida" with the lowering of the sinking rate of the test. The development of long spines which penetrate the chambers of the last whorl have according to Haynes, also another function, namely to strengthen the test (e. g. *Hastigerina*). A horizontal flattening of the test is often associated with radial chamber extensions possessing spines at the periphery or at the end of the chambers (e. g. *Hastigerinopsis)* (Haynes, 1981). The test of *Globotruncana falsocalcarata* resembles neither *Hastigerina* nor *Hastigerinopsis* in shape but it possesses spines and radial chamber extensions, the function of which can probably be interpreted in the same way as the spines of the above species. That the peripheral spines of *Globotruncana falsocalcarata* in the juvenile stage have an architectural strengthening function is obvious. The test is flattened in the horizontal plane with the spiral side flat or slightly concave. The hollow spines or chamber extensions were necessary at this stage for balance and buoyancy.

In the adult stage the typical representatives of *Globotruncana falsocalcarata* had completed the architecture of their test firstly by developing additional chambers in the last whorl which are slightly concave on the spiral side and strongly convex on the umbilical side and secondly by orienting the ultimate chamber so that it was inclined or vertical. These adult forms must have been able to cope with buoyancy problems in the same way as other planispiral non-spinose *Globotruncana* species such as *Globotruncana elevata*, *G. concavata*, *G. insignis*, etc . . .

Other adult specimens within the *Globotruncana falsocalcarata* population had retained spines at the early part of the last whorl. These specimens generally have flat to sligthly concave spiral side and a convex umbilical side. In these cases a long spine has developed at the outside end of the first chamber of the last whorl, and spines have also developed as extensions of

sutures. These spines probably have the same function as in the juvenile stage.

All the forms of *Globotruncana falsocalcarata* discussed here resemble one another except for slight differences in size and position of the spines or the presence of chamber extensions and hence are all treated as members of the same species.

Remarks. *Globotruncana falsocalcarata* is easily distinguished from other Globotruncanas on the presence of spines and/or chamber extensions in the periphery of the test. It recalls *Globotruncana calcarata* CUSHMAN but differs in being smaller, in having spines on the spiral side of the test, in the peripheral spines at the outside ends of the chambers of the beginning of the last whorl, and in the chamber extensions at the periphery of the test. The two species also occurred in different stratigraphic intervals.

There is very little information to indicate which species was the ancestor of *Globotruncana falsocalcarata*. Kerdany–Abdelsalam (1969) have suggested a *Plummerita* species and Kassab (1975) believes that it may have evolved from *Globotruncana gansseri* BOLLI, because, as he noted, juvenile forms of *Globotruncana falsocalcarata* show some similarities to specimens of *Globotruncana gansseri* group. Although I myself have suggested *Globotruncana insignis* GANDOLFI as the possible ancestor of *Globotruncana falsocalcarata* (Solakius in press) no direct evidence such as the occurrence of transitional forms has been found in the Tunisian material to support this.

Occurrence. *Globotruncana falsocalcarata* was originally recorded from the uppermost part of the *Globotruncana gansseri* Zone of the *Abathomphalus mayaroensis* Zone of the Upper Maastrichtian of Gebel Duwi, the Eastern Desert, Egypt (Kerdany–Abdelsalam, 1969). Kassab (1975, 1978, 1979) reported this species from the Upper Maastrichtian *Globotruncana falsocalcarata* Zone of the Tanjero Formation, northern Iraq, and Doreen (1974) found it in the Upper Maastrichtian *Globotruncana falsocalcarata* Zone of the Gaj River Formation of southern Pakistan.

In Tunisia this species was originally reported by Salaj (1980) from the upper part of the *Abathomphalus mayaroensis* Zone of the Maastrichtian of El Kef but he did not illustrate any specimens. The specimens illustrated by Salaj (1980, pl. 17, figs. 1 and 2) under the name of *Plummerita hantkeninoides* (BRÖNNIMANN) agree with my specimens of *Globotruncana falsocalcarata* from the same area. My specimens of *Globotruncana falsocalcarata* are from the uppermost part of the Upper Maastrichtian of sections 1–3 of Kef en Nsoura and from the same level in the Maastrichtian of section of Ain Mdeker. Thus I could identify the *Globotruncana falsocalcarata* Zone in these sections. This zone is preceded by the *Abathomphalus mayaroensis* Zone and succeded by the Danian.

Material. Over 150 specimens.

Stratigraphical range. Uppermost Maastrichtian to the top of the Maastrichtian.

Acknowledgements

The writer wishes to express his gratitude to Dr. Anita Löfgren of the Department of Historical Geology and Palaeontology, University of Lund for reading the manuscript.

Depository. All the illustrated specimens are deposited in the type collection of the Service Geologique de Tunisie, sous-Direction de la Geologie, Tunis, Tunisia.

Plate 1

Figs. 1–12. *Globotruncana falsocalcarata* KERDANY–ABDELSALAM, 1969.
Fig. 1. Spiral side, NS 1:, from the original sample E-61 (Salaj, 1969) of Kef en Nsoura.
Fig. 2. Umbilical side, NS 2; sample E-61 of Kef en Nsoura.
Fig. 3. Side view, NS 3; sample E-61 of Kef en Nsoura.
Fig. 4. Spiral side, NS 4; sample AD-17 of Ain Mdeker.
Fig. 5. Umbilical side, NS 5; sample AD-17 of Ain Mdeker.
Fig. 6. Side view, NS 6; sample AD-16 of Ain Mdeker.
Fig. 7, 8. Spiral and umbilical side of the same specimen, NS 7; sample AD-16 of Ain Mdeker.
Fig. 9. Spiral side, NS 8; sample AD-17 of Ain Mdeker.
Figs. 10, 11, 12. Spiral, umbilical and side view of the same specimen, NS 9; sample KN-16 of Kef en Nsoura.
(Each bar = 100 μm).

Plate 2

Figs. 1–10. *Globotruncana falsocalcarata* KERDANY–ABDELSALAM, 1969.
Figs. 1, 2, 3. Spiral, umbilical and side view of the same specimen, NS 10; sample E-61 of Kef en Nsoura.
Figs. 4, 5. Spiral and umbilical side of an juvenile specimen, NS 11; sample E-61 of Kef en Nsoura.
Fig. 6. Spiral side of an juvenile specimen, NS 12; sample AD-16 of Ain Mdeker.
Fig. 7. Spiral side, NS 13; sample KN-16 of Kef en Nsoura.
Fig. 8. Spiral side, NS 14; sample KN-16 of Kef en Nsoura.
Fig. 9. Spiral side, NS 15; sample AD-16 of Ain Mdeker.
Fig. 10. Spiral side of an juvenile specimen, NS 16; sample AD-16 of Ain Mdeker.
Fig. 11. *Plummerita hantkeninoides* (BRÖNNIMANN, 1952). Spiral side, NS 18; sample KN-12 of Kef en Nsoura.
Fig. 12. *Globotruncana calcarata* CUSHMAN, 1927. Spiral side, NS 18; pont du Fahs.
(Each bar = 100 μm).

Plate 1

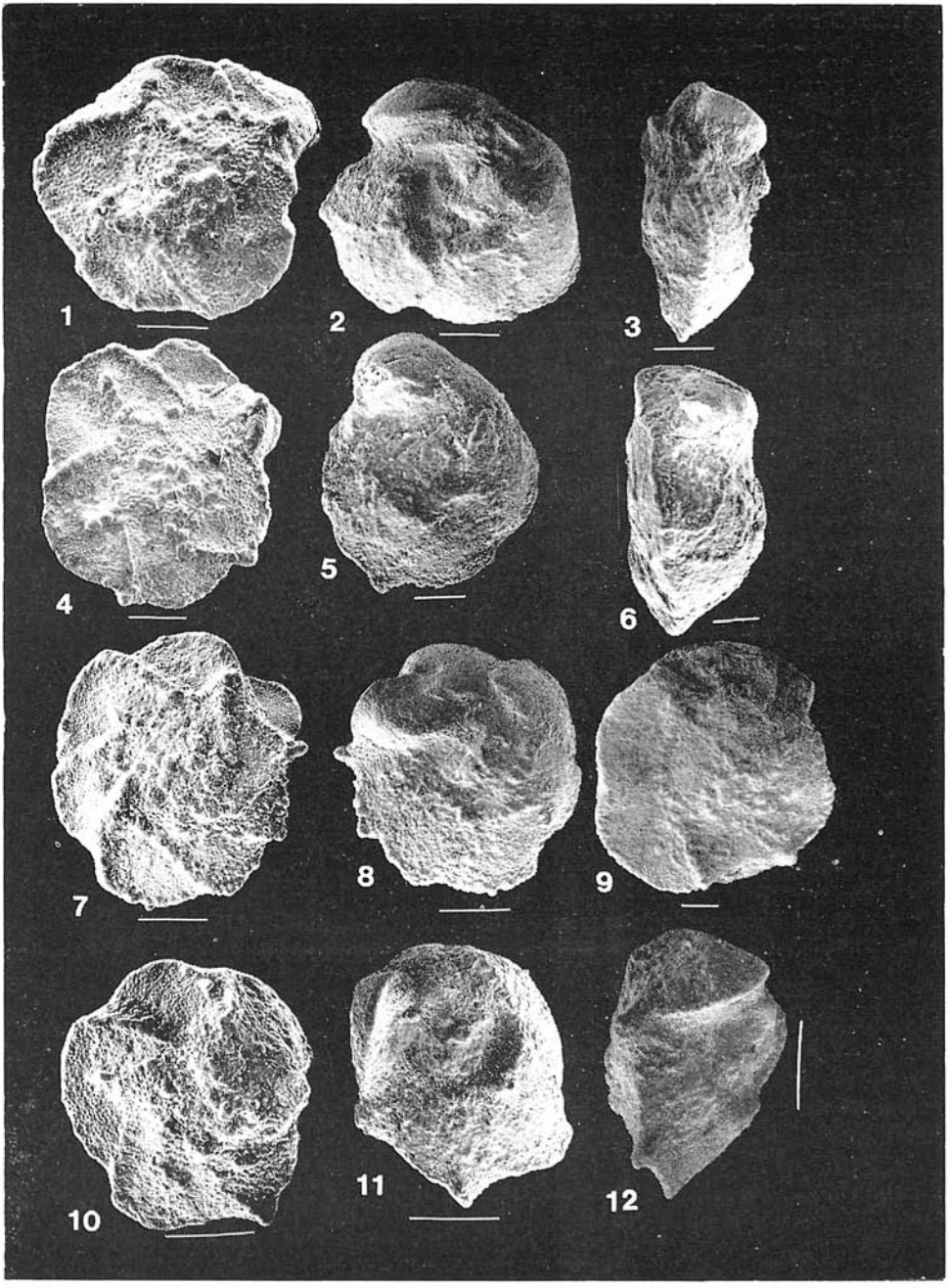
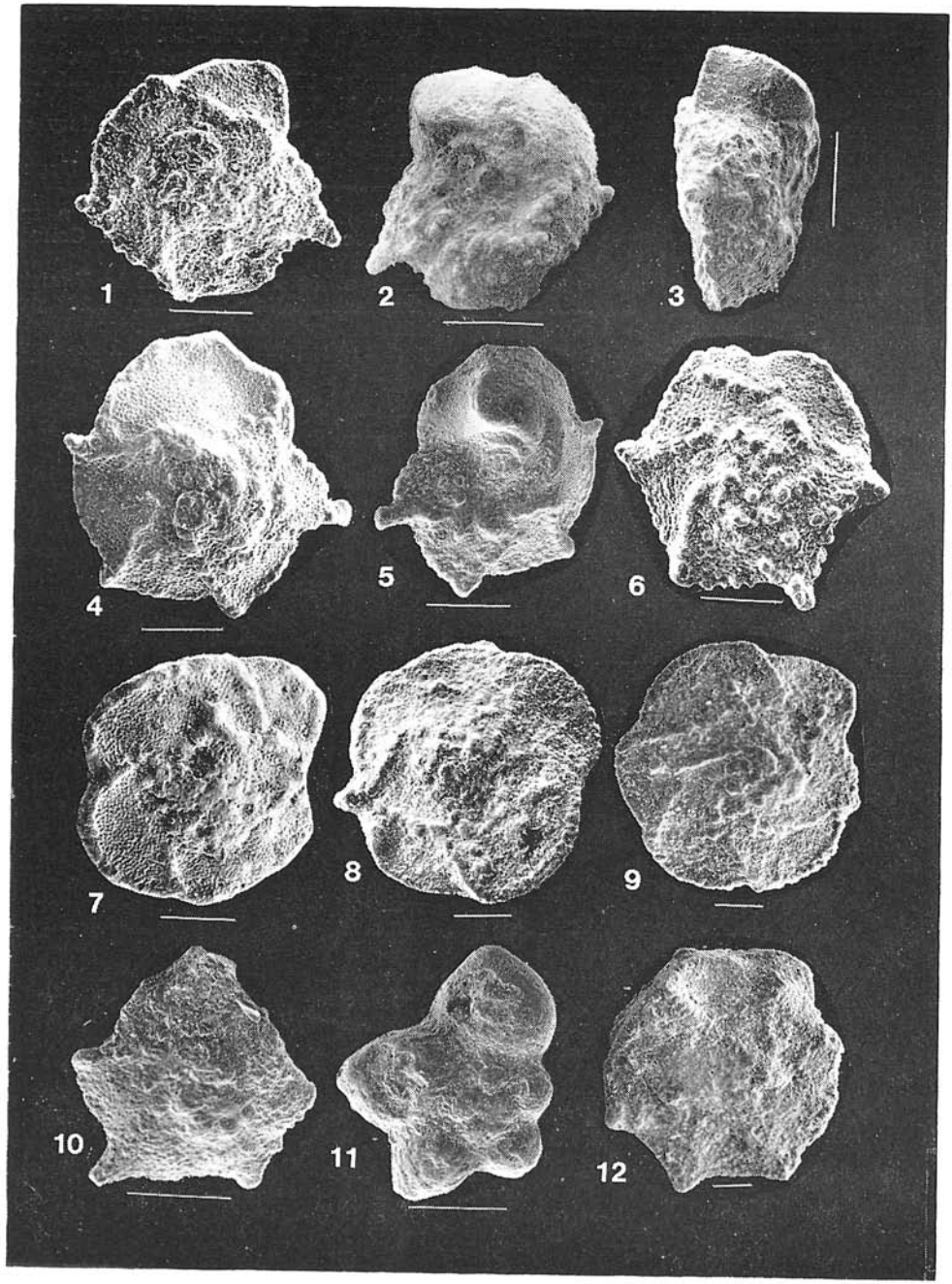


Plate 2



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Review J. SALAJ

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