

On the Cretaceous occurrences of *Ammogloborotalia* ZHENG, 2001 (Foraminifera)

Michael A. KAMINSKI^{1*}, Claudia G. CETEAN², Andrew HENDERSON³
Sorin FILIPESCU²

¹ Department of Earth Sciences, University College London, Gower Street, London WC1E 6BT, U.K.

² Department of Geology and Paleontology, „Babeş-Bolyai“ University, Kogălniceanu 1, 400084 Cluj Napoca, Romania

³ Natural History Museum, Department of Palaeontology, Cromwell Road, London SW7 5BD, U.K.

Received May 2006; accepted December 2007

Available online 14 December 2007



Abstract. Three species of agglutinated foraminifera from Cretaceous deep-water deposits that have been described as trochamminids are here transferred to the genus *Ammogloborotalia* ZHENG, 2001. These species are *Trochammina abrupta* GEROCH, 1959; *Trochammina quinqueloba* GEROCH, 1959, and *Ammonoanite globorotaliaeformis* Gradstein and Kaminski, 1999. A fourth species, *Ammogloborotalia* sp.1, which is probably a new species from the Turonian of the southern East Carpathians of Romania is reported here for the first time. We hereby extend the known stratigraphic range of the genus *Ammogloborotalia* to the Late Jurassic (Tithonian).

Key words: Foraminifera, Cretaceous, *Ammogloborotalia*, East Carpathians, Romania.

INTRODUCTION

The trochamminaceans comprise a diverse superfamily of trochospirally-coiled agglutinated foraminifera that occur in all marine environments. Detailed systematic work by Paul Brönnimann, John Whittaker and co-workers in the 1980s and early 1990s demonstrated that the trochamminid group comprises forms with diverse morphologies. In a series of studies published over the span of about 15 years, Brönnimann and co-workers introduced 21 new generic names and emended many of the previously described genera (Kaminski, 2004). As part of their work on the revision of the trochamminaceans, the definition of the genus "*Trochammina*" was more precisely and narrowly defined (Brönnimann and Whittaker, 1984, 1988). A consequence of the revision of the trochamminacean genera is the fact that numerous species originally described as "*Trochammina*" can now be placed in any of a number of different genera that are defined based on test shape and apertural characteristics.

Species of "*Trochammina*" have been known from the Cretaceous deep-water deposits in the Polish Carpathians for the past half-century. In 1959, Prof. Stanislaw Geroch described a species of "*Trochammina*" from the Lower Cretaceous of the Polish Carpathians that he named *Trochammina quinqueloba*, and in 1966 he named a second species *Trochammina abrupta*. Both species were described as having a flat spiral side, but their apertural characteristics were unknown. In the first studies of Cretaceous agglutinated foraminifera from the Deep-Sea Drilling Project cores, Krasheninnikov (1974) was aware of the fact that some deep-water trochamminids did not conform to the

traditional definition of the genus *Trochammina*. He described a new species (*T. gyroidinaeformis*) with a flat spiral side and a conical shape, and remarked that it "could possibly be regarded as a new independent genus". Sieglie and Baker (1987) introduced the name *Ammonoanite* for a "keeled" biconvex trochamminid from the Upper Cretaceous, and in a more recent study, Gradstein et al. (1999) described a species with similar gross morphology as *Ammonoanite* from the Albian of offshore mid Norway.

Recently Zheng (2001) described the new genus *Ammogloborotalia* (type species: *Ammogloborotalia stellaris* ZHENG, 2001) from Holocene deep-water deposits of the East China Sea. In our opinion, forms that conform to the description of this new genus can also be found in older deposits. In this paper we report the occurrence of a probable new species of *Ammogloborotalia* from the lowermost Turonian of the southern East Carpathians, and we present a review of previously described species that we now assign to the genus *Ammogloborotalia* ZHENG, 2001.

MATERIAL STUDIED

In this study we re-examined material from the ODP Leg 123, Hole 765C which recovered a diverse DWAF fauna from sediments of Tithonian to Hauterivian age. Assemblages from this site were previously described by Kaminski et al. (1992). We also re-examined the type specimens of *Ammonoanite globorotaliaeformis* Gradstein and Kaminski, 1999, which are housed in the Palaeontology Department of The Natural History Museum in London. Additional material was examined from lowermost Turonian

* Correspondence: M.A. Kaminski (m.kaminski@ucl.ac.uk)

deep-water deposits of the southern East Carpathians (see Cetean et al., *in review*). All new material studied is deposited in the collections of the Department of Palaeontology, The Natural History Museum, London.

Systematic paleontology

Subfamily Trochammininae SCHWAGER, 1877

AMMOGLOBOROTALIA ZHENG, 2001

Ammogloborotalia ZHENG, 2001, p. 421.

Type species: *Ammogloborotalia stellaris* ZHENG, 2001, by original designation (monotypic).

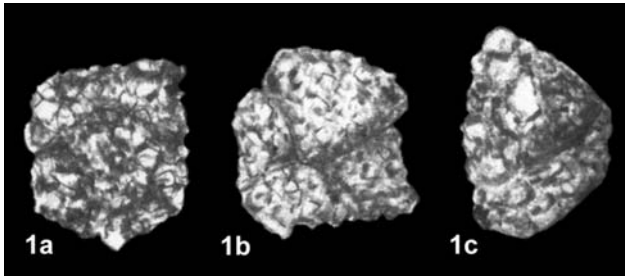


Fig. 1. Holotype of *Ammogloborotalia stellaris* (modified from Zheng, 2001). Holocene, East China Sea, 2100 m; 1a, dorsal view, 1b, ventral view, 1c, edge view, $\times 70$.

Description

Zheng (2001) described the new genus *Ammogloborotalia* as follows: “Test free, trochospiral, conical, dorsal side flattened, evolute, ventral side convex, involute. Periphery truncate, peripheral angle subacute. Chambers increasing rapidly in breadth along a vertical axis. Suture not very distinct, slightly depressed. Wall coarsely agglutinated, surface coarsely finished. Aperture short, arched slit-like, at the ventral side of the final chamber, basal, near the umbilical end”.

Remarks

According to Zheng (2001), the new genus resembles *Adercotryma* in its coiling along a vertical axis, but differs from it in being trochospiral, with the dorsal side evolute. The type specimens of Zheng’s new species were recovered from a 2100 m deep station in the East China Sea.

The generic characteristics that are useful for separating the Cretaceous *Globorotalia*-like trochamminids include the overall shape of the test and the nature of the sutures on the dorsal side (Table 1). *Ammogloborotalia* ZHENG, 2001 has a flat or slightly convex spiral side, sutures that are slightly depressed and radial or only very weakly arched. *Insculptarenula* Loeblich and Tappan, 1985 differs in having a spiral side flattened to concave, with elevated strongly arched spiralling sutures that give the test a sculptured appearance.

The genus *Ammonoanita* Seiglie and Baker, 1987 differs in having a biconvex test and in at least one species (*A. ruthvenmurrayi*), the spiral side is highly convex as in the genus *Contusotruncana*.

Table 1. Generic characteristics of Cretaceous *Globorotalia*-like trochamminids.

| Genus | Dorsal Side | Sutures |
|-------------------------|-------------------------|----------------------------|
| <i>Ammogloborotalia</i> | Flat to slightly convex | Depressed, radial |
| <i>Ammonoanita</i> | Convex to highly convex | Depressed, slightly arched |
| <i>Insculptarenula</i> | Flat to concave | Raised, strongly arched |

Ammogloborotalia abrupta (Geroch, 1966), n.comb. (Pl. I, Figs. 1-6).

Trochammina abrupta GEROCH, 1966 (p. 451, Pl. 5, Figs. 13-17).

Remarks

In the type description of the species *Trochammina abrupta*, Geroch (1966) mentioned that the aperture is not visible. In well-preserved specimens from ODP Hole 765C, the aperture appears as a high narrow extra umbilical arch, midway between the umbilicus and periphery. The spiral side is slightly convex to flat.

Ammogloborotalia quinqueloba (Geroch, 1959), n.comb. (Pl. I, Figs. 7-12).

Trochammina quinqueloba GEROCH, 1959 (p. 118, Pl. 12, Figs. 1-3).

Remarks

In the description of the species by Geroch (1959) there is no mention of an aperture. In the majority of our specimens the aperture is not visible, but in some specimens from Hole 765C, a low and narrow interiomarginal slit is present in an extraumbilical position, about one-third of the way between the umbilicus and the periphery.

Ammogloborotalia globorotaliaeformis (Gradstein and Kaminski, 1999), n.comb., *emend.* (Pl. II, Figs. 1-9).

Ammonoanita globorotaliaeformis Gradstein and Kaminski (in Gradstein et al., 1999; p. 94, Pl. 3, Figs. 6-8).

Remarks

Gradstein and Kaminski (1999) were in error in figuring the holotype and citing the illustration as plate 3, figs. 6-8. Only the illustration of the specimen in figure 8 is of the holotype. This specimen is therefore re-illustrated herein (Pl. II, Figs. 1-4) and two paratypes are also illustrated (Pl. II, Figs. 5-9) to provide a better concept of the species.

After further examination of the type material, it was decided to emend the description of the species to include specimens with seven or more chambers in the final whorl. The aperture on the holotype is a low interiomarginal slit in an extra-umbilical position about one-third of the way between the umbilicus and the periphery. This species has a spiral side that is slightly convex, and has sutures that curve slightly on the ventral side. The types are from the Albian of the Norwegian Sea.

The holotype (PF 66923), the two figured paratypes (PF 66925, PF 66922) and three unfigured paratypes (PF 66924, PF 66926, PF 66927) are all deposited in the micropalaeontology collections of the Department of Palaeontology in the Natural History Museum, London.

Ammogloborotalia sp. 1

Pl. II, Figs. 10-12.

Description

Test medium size, coiled trochospirally, with a flat spiral side and elevated ventral side. Test is comprised of two and

a half whorls with 6 chambers in the last whorl. Periphery is acute, but not keeled. Chambers on the ventral side are triangular, and the final chambers are moderately inflated. Sutures on ventral side are radial and slightly depressed. Sutures on spiral side are radial or only slightly arched, flush or slightly depressed. Wall is comprised of medium to fine grains, with a moderately rough surface. Aperture a low, extraumbilical interiomarginal arch, half way between the umbilicus and the periphery.

Remarks

Differs from *Ammogloborotalia globorotaliaeformis* in possessing fewer chambers in the final whorl and straight sutures on the ventral side. Our species is from the lowermost Turonian deep-water deposits of southern East Carpathians, Romania, situated near Stoenești, west of Dâmbovița Valley. The type-level is the first foraminifera-bearing sample directly above the Cenomanian-Turonian black shale corresponding to Oceanic Anoxic Event 2 (OAE-2) in Romania.

DISCUSSION AND CONCLUSIONS

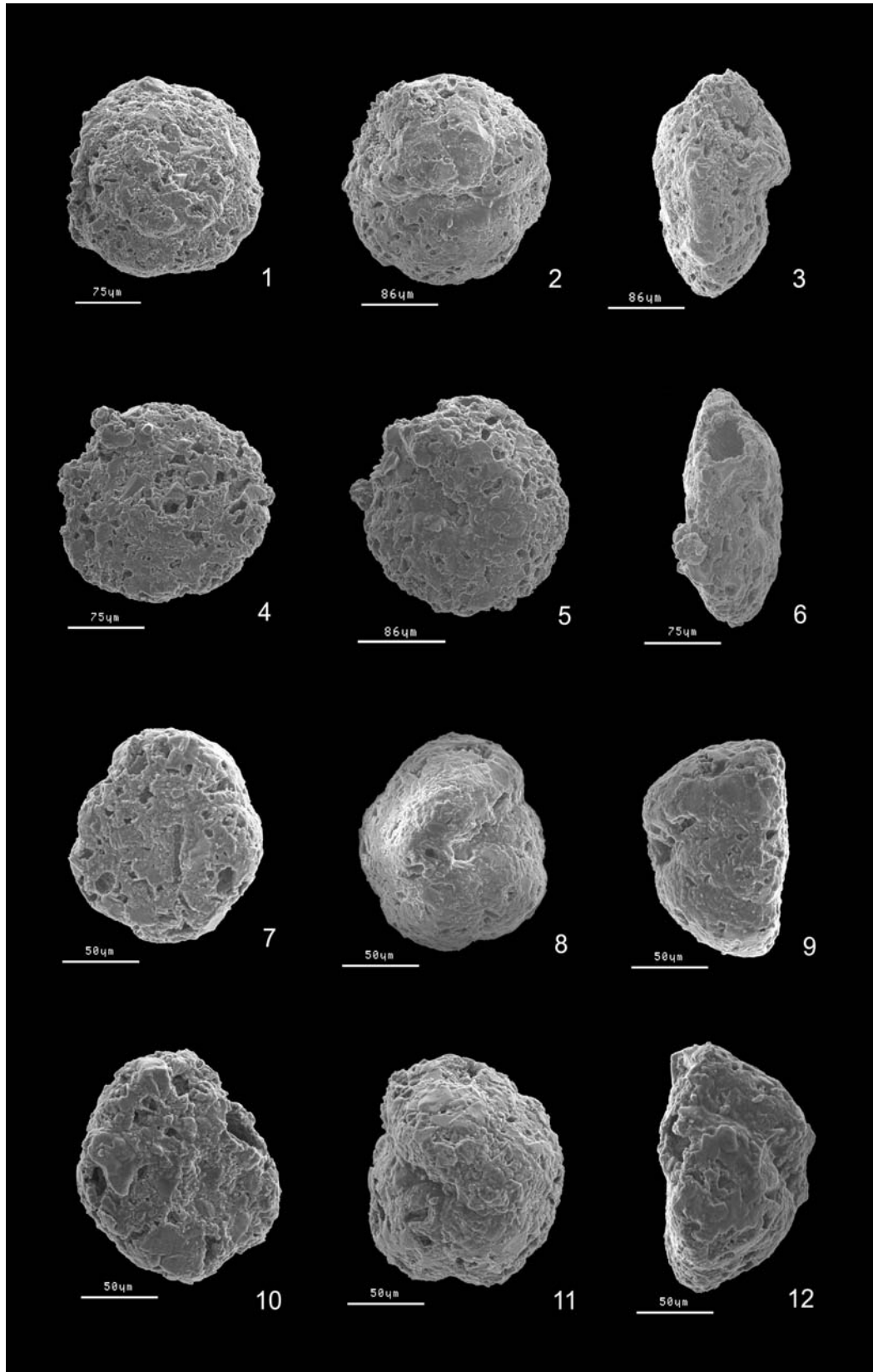
The genus *Ammogloborotalia*, described from the modern East China Sea is not monotypic and restricted to Holocene, but fossil species that can be assigned to this genus can be found in latest Jurassic to Cretaceous deep-water deposits from the North Atlantic and Tethys. We now recognize at least four species of *Ammogloborotalia* in addition to the type species, two of them ranging from the Late Jurassic (Tithonian) (Kaminski et al., 1992). Additionally, the deep-water trochamminid described by Krasheninnikov (1974) from the Upper Cretaceous of the Indian Ocean (*Trochammina gyrodinaeformis*) likely belongs in the genus *Ammogloborotalia*.

Currently, there are three genera of trochamminids known from the Cretaceous that have *Globorotalia*-like morphology: *Insculptarenula* Loeblich and Tappan, 1985; *Ammoanita*, Seiglie and Baker, 1987; and *Ammogloborotalia*, Zheng, 2001. The distinctive character of *Ammogloborotalia* is its flat to slightly convex spiral side with radial sutures that are not raised or strongly arched.

Acknowledgements. This research received support from the SYNTHESYS Project <http://www.synthesys.info/>, which is financed by European Community Research Infrastructure Action under the FP6 "Structuring the European Research Area" Programme. CGC wishes to thank Dr. Alexandru Hosu (Holcim S.A.) for providing well samples from the East Carpathians. We are grateful to Ioan Bucur and Ann Holbourn for their helpful reviews of the manuscript. All new material studied is deposited in the micropalaeontological collections of the Department of Palaeontology, Natural History Museum, London. The revision of agglutinated foraminiferal genera is supported by a consortium of oil companies (BP, Saudi Aramco, Shell, Total, PDVSA, Petronas, RPS Energy, Fugro Robertson). This is contribution nr. 78 of the Deep-Water Agglutinated Foraminiferal Project.

REFERENCES

- Brönnimann, P., Whittaker, J.E. 1984, A neotype for *Trochammina inflata* (Montagu) (Protozoa: Foraminiferida) with notes on the wall structure. *Bulletin of the British Museum (Natural History), Zoology*, 46 (4): 311-315.
- Brönnimann, P., Whittaker, J.E. 1988, The trochammineous test and the taxonomic criteria used in the classification of the superfamily Trochamminacea. *Abhandlungen der Geologischen Bundesanstalt*, 41: 23-39.
- Cetean, C.G., Bălc, R., Kaminski, M.A. & Filipescu, S. (in review), Preliminary biostratigraphical observations on the Cenomanian-Turonian boundary in the Eastern Carpathians (Dâmbovița Valley). *Studia Universitatis Babeș-Bolyai, Geologia*.
- Geroch, S. 1959, Stratigraphic significance of arenaceous foraminifera in the Carpathian flysch. *Paläontologische Zeitschrift*, 33: 113-122.
- Geroch, S. 1966, Lower Cretaceous small Foraminifera of the Silesian Series, Polish Carpathians. *Rocznik Polskiego Towarzystwa Geologicznego*, 36 (4): 413-480.
- Gradstein, F.M., Kaminski, M.A. & Agterberg, F.P. 1999, Biostratigraphy and paleoceanography of the Cretaceous seaway between Norway and Greenland. *Earth Sciences Reviews*, 45: 27-98.
- Kaminski, M.A. 2004, The Year 2000 classification of agglutinated foraminifera. In *Proceedings of the Sixth International Workshop on Agglutinated Foraminifera* (Bubik, M., Kaminski, M.A., Eds.), Grzybowski Foundation Special Publication, 8: 237-255.
- Kaminski, M. A., Gradstein, F.M. & Geroch, S. 1992, Uppermost Jurassic to Lower Cretaceous deep-water benthic foraminiferal assemblages from Site 765 on the Argo Abyssal Plain. *Proceedings of the Ocean Drilling Program, Scientific Results*, 123: 239-269.
- Krasheninnikov, V.A. 1974, Upper Cretaceous benthonic agglutinated foraminifera, Leg 27 of the Deep Sea Drilling Project. *Initial Reports of the Deep Sea Drilling Project*, 27: 631-661.
- Loeblich, A.R., Tappan, H. 1985, Some new and redefined genera and families of agglutinated foraminifera; II. *Journal of Foraminiferal Research*, 15 (3): 175-217.
- Seiglie, G.A., Baker, M.B. 1987, *Ammoanita rosea*, new genus and new species of deep water Trochamminidae, Foraminiferida. *Proceedings of the Biological Society of Washington, D.C.* 100 (3): 490-492.
- Zheng, S., Fu, Z. 2001, *Fauna Sinica, Phylum Granuloreticulosa, Class Foraminifera, Agglutinated Foraminifera*. Science Press, 788 pp + 122 pls, Beijing.



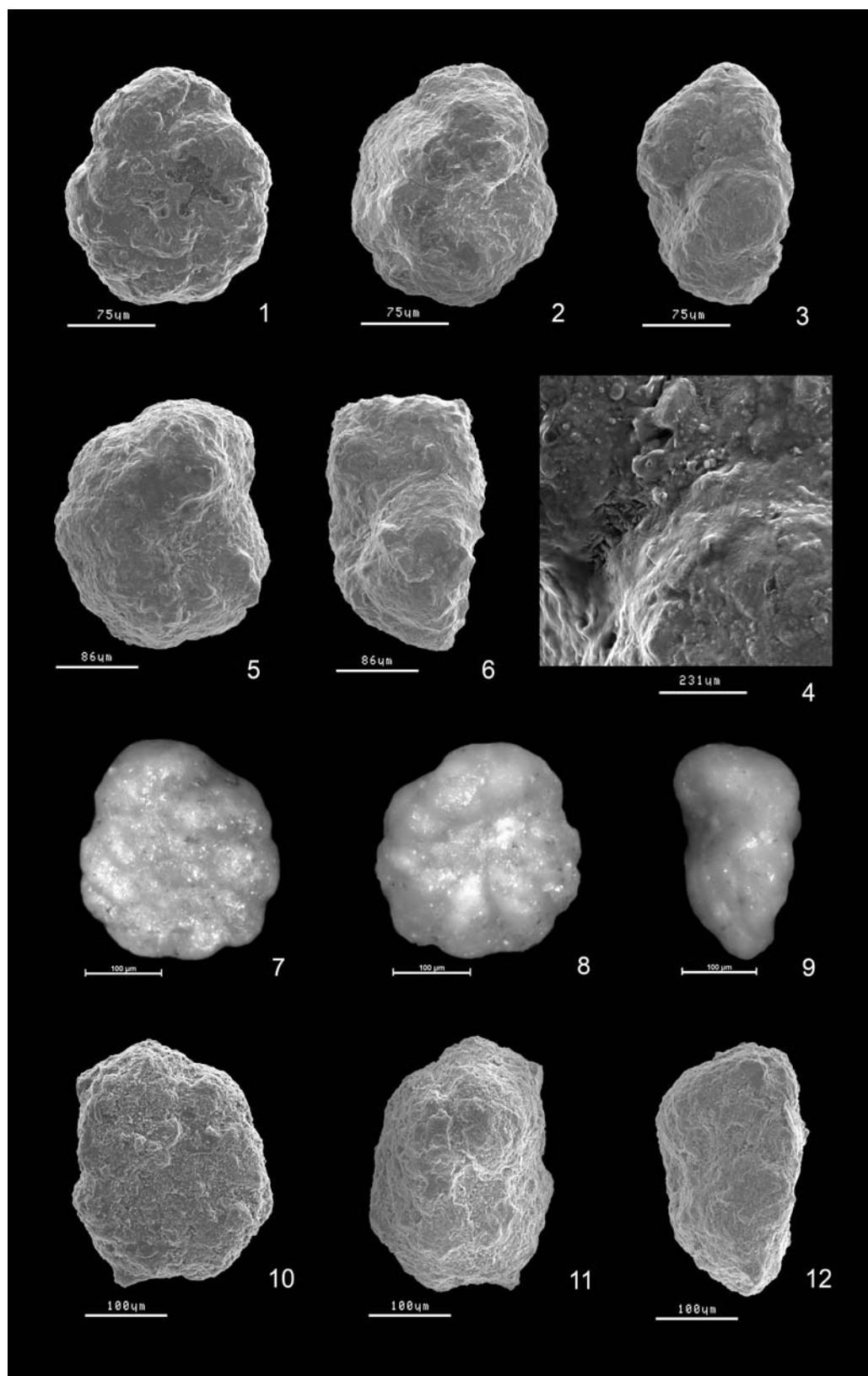
Figs. 1-3. *Ammoglorotalia abrupta* (GEROCH), *n.comb.*, (PF 68299), Tithonian, ODP Site 765, Argo Abyssal Plain, Indian Ocean, figured in spiral view (scale bar = 75 μm), umbilical and edge views (scale bar = 86 μm).

Figs. 4-6. *Ammoglorotalia abrupta* (GEROCH), *n.comb.*, (PF 68300), Tithonian, ODP Site 765, figured in spiral (scale bar = 75 μm), umbilical (scale bar = 86 μm) and edge views (scale bar = 75 μm).

Figs. 7-9. *Ammoglorotalia quinqueloba* (GEROCH), *n.comb.*, (PF 68302), Tithonian, ODP Site 765, figured in spiral, umbilical and edge views (scale bar = 50 μm).

Figs. 10-12. *Ammoglorotalia quinqueloba* (GEROCH), *n.comb.*, (PF 68301), Tithonian, ODP Site 765, figured in spiral, umbilical and edge views (scale bar = 50 μm).

PLATE II



Figs. 1-4. *Ammogloborotalia globorotaliaeformis* (Gradstein and Kaminski, 1999), *n.comb.*, holotype (PF 66923), Albian, 3110 m depth in the 6507/6-2 well, offshore Norway, figured in spiral, umbilical and edge views (scale bar = 75 μ m). Fig. 4. Apertural view (scale bar = 231 μ m).

Figs. 5-6. *Ammogloborotalia globorotaliaeformis* (Gradstein and Kaminski, 1999), *n.comb.*, paratype (PF 66922), Aptian, offshore Norway, figured in umbilical and edge views (scale bar = 86 μ m).

Figs. 7-9. *Ammogloborotalia globorotaliaeformis* (Gradstein and Kaminski, 1999), *n.comb.*, paratype (PF 66925), Aptian, offshore Norway, photograph in reflected light (taken using the PalaeoVision System) figured in spiral, umbilical and edge views (scale bar = 100 μ m).

Figs. 10-12. *Ammogloborotalia* sp. 1 (PF 68303), Turonian, near Stoenești, west of Dâmbovița Valley, Romania, figured in spiral, umbilical and edge views (scale bar = 100 μ m).