

ORBITOLINIDS AND OTHER LARGER BENTHIC FORAMINIFERA FROM THE APTIAN-ALBIAN OF TIBET: CRITICAL DISCUSSION OF SOME RECENTLY PUBLISHED DATA

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Abstract Orbitolinidae together with other larger benthic foraminifera are particularly important in Lower Cretaceous shallow-water biostratigraphy provided that they are correctly identified. Especially in the case of the Orbitolininae (with complex embryo), their biostratigraphic range with overlapping ranges corresponds to different lineages displaying ancestor-descendant relationship (e.g., *Praeorbitolina-Mesorbitolina*). In the last fifty years well established and repeatedly confirmed taxon ranges have been largely extended thereby diluting or negating any biostratigraphic value to individual species. Some biostratigraphic data provided by BouDagher-Fadel et al. (2017) from the Aptian-Albian of Tibet that are contradicting previous results are reviewed herein. This publication mostly refers to the stratigraphic ranges of *Praeorbitolina cormyi* Schroeder and *Pseudochoffatella cuvillieri* Deloffre towards the top of the Albian, and that of *Palorbitolina lenticularis* (Blumenbach) into the late Aptian, as well as some misidentifications.

Keywords: Lower Cretaceous, Orbitolinidae, taxonomy, biostratigraphy

INTRODUCTION

Orbitolinidae together with other larger benthic foraminifera are particularly important in the Lower Cretaceous shallow-water limestones microbiostratigraphy. The biostratigraphical distribution framework of the representatives of this foraminiferal group and especially the Orbitolininae that present a complex embryo is well-established since several decades (Schroeder, 1975; Moullade et al., 1985; Schroeder et al., 2010; Cherchi and Schroeder, 2013). In contrast, the stratigraphical ranges of Dictyoconinae that have a morphologically simple embryo is less accurately known. This setting is probably due to the fact that a considerable number of taxa of the Dictyoconinae display a distinct provincialism whereas those of the Orbitolininae have a much wider distribution, cosmopolitan in some cases, and are therefore much more useful for stratigraphic dating and correlations. However, the biostratigraphical value of individual taxa is significantly reduced when incorrect taxonomic determinations are used to extend the known ranges on charts. Such data are often used in formulating new hypotheses on phylogeny, resulting in expanding and refining the existing concepts. Therefore, it is considered important for scientific practical purposes to critically review these data, as exemplified by the numerous reply or comment papers published recently (Consorti & Schlagintweit, 2020; Granier 2020a, b; Simmons, 2020; Schlagintweit, 2020, 2021; Benedetti, 2021; Schlagintweit & Bucur, 2021). The following review focuses on some orbitolinids and other larger benthic foraminifera from the Aptian-Albian of Tibet provided by BouDagher-Fadel et al. (2017) in the paper “Foraminiferal biostratigraphy and palaeoenvironmental analysis of the Mid-Cretaceous limestones in the Southern Tibetan Plateau” published in Journal of

Foraminiferal Research vol. 47, no. 2, pages 188-207. The extension of the lower Aptian *Praeorbitolina wienandsi* Schroeder and the upper Aptian-lower Albian *Pseudochoffatella cuvillieri* Deloffre to the top of the Albian in the Tibet region is critically discussed thereafter. These assumed incorrect “data” could be simply ignored, but the circumstance that they are used to “enabling and refinement of the eastern Tethyan carbonate biostratigraphy” necessitates a wider discussion especially when it also scratches the legacy of highly regarded micropaleontologists.

DISCUSSION

The orbitolinids recorded by BouDagher-Fadel et al. (2017) are from the Langshan and other formations of the Lhasa Block or terrane that was located “on the northern margin of eastern Tethys Ocean in mid-Cretaceous times” (Rao et al., 2015, p. 401). This information is of importance as many Dictyoconinae display a distinct bioprovincialism (“European” vs. “African” margins of the Neotethys; Cherchi et al., 1981). The orbitolinid fauna of the Lhasa Block have been studied in the past by Zhang (1982, 1986, 1991). The numerous taxa (genera and species) established therein and their assumed junior synonyms have been partly summarized by Schroeder et al. (2010), Rao et al. (2015, tables. 1-2), and BouDagher-Fadel et al. (2017). The new data critically discussed here include: A) the records of *Mesorbitolina parva* and *Praeorbitolina cormyi*, B) the extension of *Praeorbitolina cormyi* and *Pseudochoffatella cuvillieri* to the top of the Albian, and C) the extension of *Palorbitolina lenticularis* into the late Aptian. As BouDagher-Fadel et al. (2017, p. 188) correctly stated these ranges are “not compatible

with the now widely accepted description of orbitolinids (see Schroeder et al., 2010)”.

Record of *Mesorbitolina parva* (Douglass, 1960)
(Fig. 1A)

Referred illustrations: *Mesorbitolina parva*, part of figure 8 in BouDagher-Fadel et al. (2017).

Mesorbitolina parva (Douglass, 1960) has been described as *Orbitolina (Columnorbitolina) absidata* by Zhang (1986) from the Langshan Formation of the Lhasa Block. Here we make reference to a tiny image of “*Mesorbitolina parva*” included in Fig. 8 of BouDagher-Fadel et al. (2017) therein showing the stratigraphic ranges and assumed phylogenetic relationships (Fig. 1A). The specimen is here interpreted as an axial section of *Praeorbitolina cormyi* perpendicular to the median plane comparable to those illustrated by Bosselini et al. (1999, fig. 5a and 5g) from the early Aptian of Ethiopia (Fig. 1B-C), or own material from Iran (Fig. 1D-E). It shows a subdivided subembryonic zone overlain by protoconch and deuterconch; a supraembryonic zone is seemingly lacking. The regular presence of short partitions at the top of the deuterconch (not well discernible) would indicate *Praeorbitolina claveli* Schlagintweit et al. This example and the following ones give evidence that the established ranges partly include incorrect determinations too.

Record of *Praeorbitolina cormyi* Schroeder, 1964 and *Praeorbitolina wienandsi* Schroeder, 1964
(Fig. 2A-B, E)

Referred illustrations: *Praeorbitolina cormyi*, figures 9.3 to 9.7 in BouDagher-Fadel et al. (2017). *Praeorbitolina* cf. *wienandsi*, figure 12.1 in BouDagher-Fadel et al. (2017).

The specimens of *P. cormyi* illustrated by BouDagher-Fadel et al. (2017) are low-conical with test diameter of up to 2.3 mm (Fig. 2A-B). Although no detail of the embryo is provided, in my opinion, it is well discernible that a subapical simple embryo of one or two chambers (= protoconch and deuterconch or first postembryonic chamber) that lacks a subembryonic zone is present. Such an embryo type is reported from the dictyoconid *Paleodictyoconus actinostoma* Arnaud-Vanneau & Schroeder. Examples of comparable specimens from the early Aptian of Iran are shown in Figure 2C-D. The adult specimens illustrated by BouDagher-Fadel et al. (2017, fig. 9.5 and 9.6) show a low conico-concave test morphology (e.g., Henson, 1948, fig. 12i) typical for *P. actinostoma*. This morphology results from sigmoidoseptal (in cases annular) adult chambers leading to a striking central depression at the cone base (Arnaud-Vanneau & Schroeder, 1976; Clavel in Granier et al., 2013, 2017). The principal occurrence of *Praeorbitolina cormyi* in lower Aptian limestones of the Tibetan area is well rec-

orded (e.g., Zhang, 1991) but, in my opinion the specimens illustrated by BouDagher-Fadel et al. (2017) do not belong to this species. The specimen of *Praeorbitolina* cf. *wienandsi* (BouDagher-Fadel et al., 2017, fig. 12.1) shows a biloculine embryo (protoconch and deuterconch) lacking a subembryonic zone in my opinion (Fig. 2E). The specimen from Tibet might belong to *Paleodictyoconus* sp. (see Fig. 2F-G for comparison). This conclusion provides a revised basis interpretation for the provided biostratigraphic framework therein.

Record of *Palorbitolinoides orbiculata* Zhang, 1986 and *Palorbitolinoides hedini* Cherchi & Schroeder, 1980

Referred illustration: *Palorbitolinoides orbiculata* Zhang, figure 8.8, *Palorbitolinoides hedini* Cherchi & Schroeder, 1980, figure 8.9 in BouDagher-Fadel et al. (2017).

Both species have been described from Aptian-Albian limestones of Tibet (Cherchi & Schroeder, 1980; Zhang, 1986). A third species, *Palorbitolinoides tenuis* Zhang, 1986, is considered a junior synonym of the type-species *P. hedini* by Schroeder et al. (2010). The differences of both species refer to the size and complexity of the embryo. The diameter of the central embryonic chamber is 0.21-0.4 mm in *P. orbiculata* (see Zhang, 1986, table page 207) against 0.45-0.7 mm in *P. hedini* (see Schroeder et al., 2010, p. 60). The embryo of *P. hedini* is much larger as in *P. orbiculata*, flattened, and with a well developed and inflated peri-embryonic zone. In addition, the partitions at the top of the embryonic chamber produce a system of small alveoli of different lengths. Both specimens illustrated by BouDagher-Fadel et al. (2017) display a hemi-spherical embryonic chamber (diameter ~0.31-~0.39 mm) with rather short partitions of seemingly equal length. They are interpreted as belonging to *P. orbiculata*. The stratigraphy of the two species *P. orbiculata* and *P. hedini* appears not as well fixed as other Orbitolininae (Cherchi & Schroeder, 1980, 2013; Zhang, 1986; Marcoux et al., 1987; BouDagher-Fadel et al., 2017). Transitional types between *P. orbiculata* and *P. hedini* have been illustrated by Marcoux et al. (1987, pl. 2, figs. 2-4) from the late Aptian of Tibet. It is worth noting that representatives of *Palorbitolinoides* co-occurring with *Mesorbitolina aperta* (Erman) in the upper Albian of the Kazhdumi Formation in SW Iran are currently under study. Also with respect to the palaeobiogeographic distribution there seems to be some kind of dissensus as Cherchi & Schroeder (2013) considered *Palorbitolinoides* cf. *orbiculata* as a typical taxon of the southern Neotethysian margin.

Extension of *Praeorbitolina* to the top of the Albian
(Fig 2E)

Referred illustration: *Praeorbitolina* cf. *wienandsi*, figure 12.1 in BouDagher-Fadel et al. (2017).

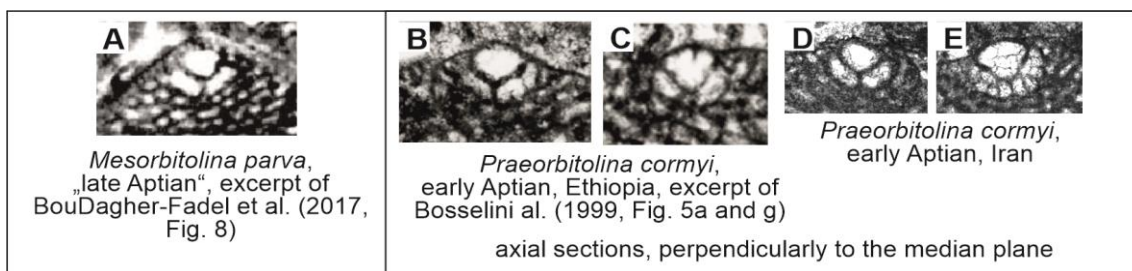


Fig. 1. **A**, *Mesorbitolina parva* (Douglass) fide BouDagher-Fadel et al. (2017, excerpt of fig. 8), Lower Cretaceous of Tibet. **B-E**, *Praeorbitolina cormyi* Schroeder, axial sections perpendicular to the median plane (**B-C**: excerpt of Bosselini et al., 1999, fig. 5a and 5g, early Aptian of Ethiopia; **D-E**: early Aptian of Iran). Figures without scale.

The comparably short range of *Praeorbitolina* in the upper lower Aptian (upper Bedoulian) has been recorded from all over the Tethysian realm since the description of the species in the sixties (e.g., Schroeder, 1964; Moullade et al. 1985; Cherchi et al., 1999; Schroeder et al., 2010; Schlagintweit et al., 2013). Its stratigraphic distribution has been questioned by BouDagher-Fadel et al. (2017) extending its range to the top of the Albian in the “Tibetan Platform”. This assumption is based on an axial section of an orbitolinid showing the megalospheric embryo at the beginning of a small eccentric spire. It shows a spherical embryo and one smaller chamber (deuteroconch or first post-embryonic chamber) partly enclosing the former; a subembryonic zone as typical for the genus is lacking. Comparable sections from the lower Aptian of Iran refer to juvenile specimens of *Paleodictyoconus* sp. (probably *P. actinostoma*) (Fig. 2F-G). Thus, there is in my opinion no evidence that *Praeorbitolina* extends to the top of the Albian, thereby reinstating the lineage *Praeorbitolina* (late early Aptian)-*Mesorbitolina* (late Aptian-Albian) (e.g., Schroeder et al., 2010). Only recently the extension of *Praeorbitolina* into the top of the Aptian has been proposed (Gheiasvand et al., 2020) based on incorrect species identification of associated taxa (see Schlagintweit, 2022 for details). Last but not least, mention should be made that the presence of *Paleodictyoconus actinostoma* in Tibet fits with the northern Neotethysian orbitolinid assemblages. From the former southern margin of the Neotethys, *P. actinostoma* has far not been recorded.

Extension of *Pseudochhoffatella cuvillieri* to the top of the Albian

Fig. 2H

Referred illustrations: *Pseudochhoffatella cuvillieri*, figures 12.7 and 12.8, figure 9.9 (cf.) in BouDagher-Fadel et al. (2017).

P. cuvillieri Deloffreis typically recorded from the upper Aptian (Busnardo et al., 1968: “biozone à *Pseudochhoffatella cuvillieri*; Fourcade, 1970; Moullade and Peybernès, 1975; Peybernès, 1976; Schlagintweit et al., 2016). In other areas, however, *P. cuvillieri* is recorded also throughout the lower Albian (Granier, 1987; Betic Cordillera, Spain).

With the exception of one record in Switzerland (Schroeder et al., 2007), *Pseudochhoffatella cuvillieri* has only been recorded from Iberia. The three specimens of *P. cuvillieri* illustrated by BouDagher-Fadel (2017) are here considered as belonging to three discrete taxa. The specimen shown in fig. 12.7 therein (here re-illustrated exemplarily in Fig. 2H) represents an uncoiling lituolid with alveolar wall structure, and a single central foramen. Note that *Pseudochhoffatella* possesses reniform to annular chambers, a shallow subepidermal network of beams and rafters and cribrate foramina (Deloffre, 1961, 1976; Cherchi & Schroeder, 1982; Loeblich & Tappan, 1987). Comparable specimens have been observed in the early Aptian Taft Formation of Iran (Fig. 2I-K). The specimen illustrated in Fig. 12.8 by BouDagher-Fadel et al. (2017) corresponds to an oblique section of an unknown coarsely agglutinated foraminifera with short coiled portion, then uncoiling, and chambers with coarse subepidermal network (ultimate chamber above). The specimen illustrated in fig. 9.9 by BouDagher-Fadel et al. (2017) corresponds to an oblique equatorial section of a planispirally coiled agglutinated taxon with coarse-alveolar wall. It might belong to *Pseudocyclammina* (e.g., compare with BouDagher-Fadel et al., 2017, fig. 9.8) but the illustration quality and the uncertainty about the foramina features do not allow a precise identification.

Extension of *Palorbitolina lenticularis* into the latest late Aptian

An axial section of *P. lenticularis* with well developed peri-embryonic ring has been illustrated by BouDagher-Fadel et al. (2017) in fig. 9.1 therein from the upper lower Aptian. The specimen on the basis of which the extension into the latest Aptian and the resulting overlapping range with *Mesorbitolina texana* (see range chart, fig. 13 therein) has not been illustrated. In the orbitolinid biostratigraphic chart of Schroeder et al. (2010, Fig. 3) *P. lenticularis* has its LAD at the early-late Aptian (= Bedoulian-Gargasian boundary) while *M. texana* has its FAD in the late Gargasian. In the absence of illustration and reproducible data such as those of Granier et al. (2013, 2017) extending the FAD of *P. lenticularis* into the late early Barremian, the occurrence of *Palorbitolina* in the upper Aptian in Tibet is doubted herein. During the early

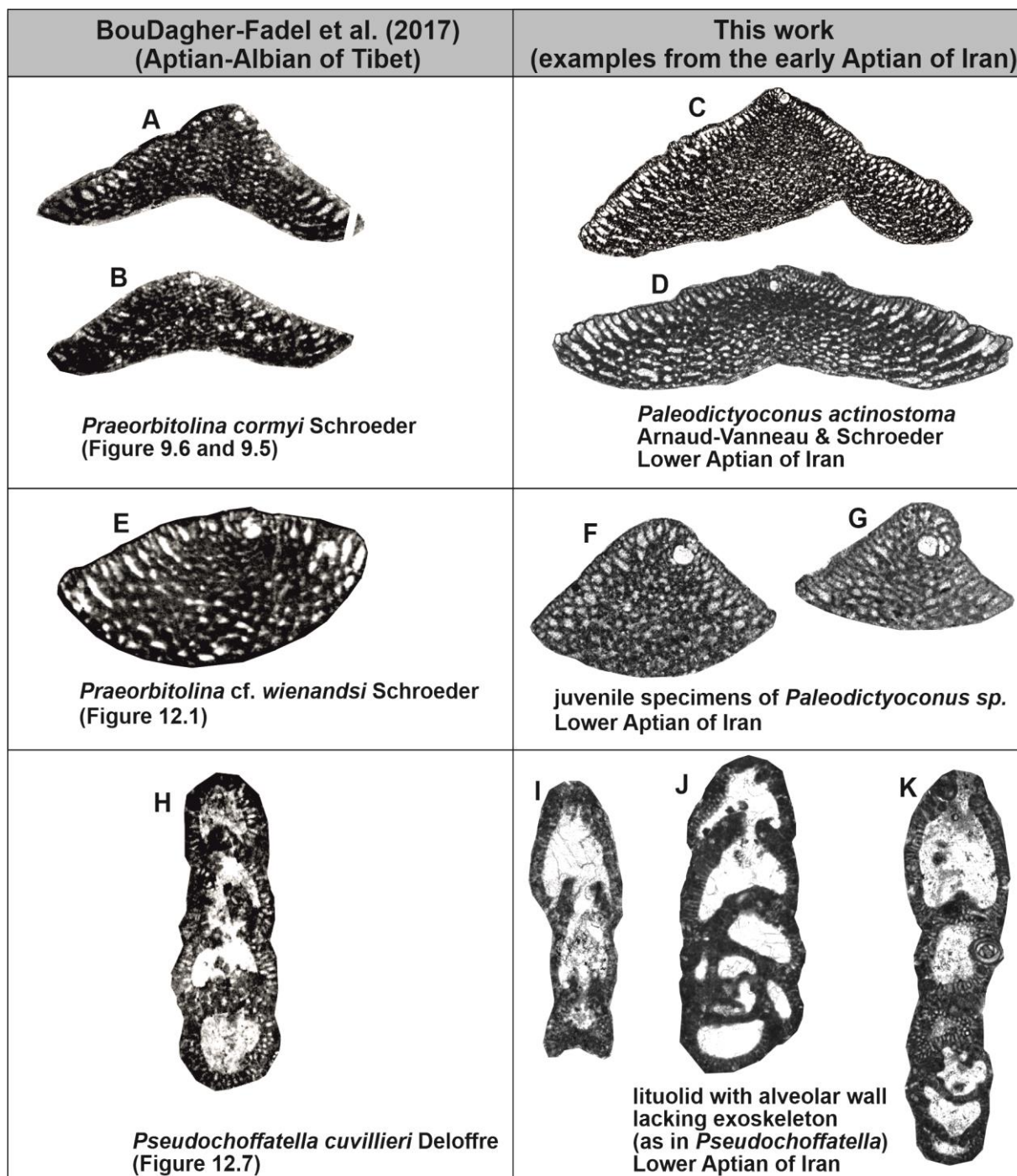


Fig. 2. **A-B**, *Praeorbitolina cormyi* Schroeder fide BouDagher-Fadel et al. (2017, fig. 9.6 and 9.5), Lower Cretaceous of Tibet. **C-D**, *Paleodictyoconus actinostoma* Arnaud-Vanneau & Schroeder, early Aptian of Central Iran. **E**, *Praeorbitolina cf. wienandsi* Schroeder fide BouDagher-Fadel et al. (2017, fig. 12.1). **F-G**, juvenile specimens of *Paleodictyoconus* sp., (?*P. actinostoma* Arnaud-Vanneau & Schroeder), early Aptian of Central Iran. **H**, *Pseudochoffatella cuvillieri* Deloffre fide BouDagher-Fadel et al. (2017, fig. 12.7). **I-K**, unknown lituolid, early Aptian Taft Formation of Central Iran. Figures without scale.

Aptian the peri-embryonic ring of *Palorbitolina lenticularis* shifted more and more towards the base of the proloculus (> *Palorbitolina ultima*) giving rise to the genus *Palorbitolinoides* with a subembryonic zone completely enveloping the former in the late early Aptian (Cherchi & Schroeder, 1980; Schroeder et al., 2010). An occurrence of *Palorbitolina* in the late Aptian would counteract the phylogenetic lineages (see Schroeder et al., 2010, fig. 3).

CONCLUSIONS

The Orbitolinidae represent a complex group of larger benthic foraminifera studied in the past by few specialists who dedicated almost their whole focus on deciphering the phylogenetic, taxonomic, and biostratigraphic aspects of this group. Especially, the stratigraphic ranges of the Orbitolininae with complex embryo appear as a rather

consolidated framework used by researchers world-wide. Small corrections of the ranges of individual taxa appear possible as it has been shown for the FAD of *Palorbitolina*. Such corrections need well founded data (e.g., ammonite data or other anchors to the chronostratigraphy), and should in any case be discussed in detail against the background of previous data. The extension of both *Praeorbitolina* and *Pseudochoffatella* to the top of the Albian in the Tibet region is here rejected because it is not based on solid and reproducible evidences. In addition, the range charts of other taxa (*Praeorbitolina wienandsi*, *Mesorbitolina parva*) are at least in part based on seemingly incorrect determinations. There is no evidence that the stratigraphic ranges of *Palorbitolina lenticularis* and *Praeorbitolina cormyi* as indicated in the biostratigraphic scheme of Schroeder et al. (2010) need correction. It is hoped that, in the future, especially the “data” resulting in revision of classically biostratigraphic framework will be illustrated with adequate details (magnification, high quality images) allowing verification (or falsification) for subsequent researchers.

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