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Short communication

Orbitolinid biostratigraphy of the top Taft Formation (Lower Cretaceous of the Yazd Block, Central Iran)

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ABSTRACT

The top parts of the Taft Formation of Central Iran in its type area southwest of Yazd (Central Iran) contain an orbitolinid assemblage consisting of *Dictyoconus*? *pachymarginalis* Schroeder, 1965, *Mesorbitolina birmanica* (Sahni, 1937), and *Mesorbitolina* ex gr. *texana* (Roemer, 1849), assigned to the late Gargasian (mid-late Aptian). *M. birmanica* belongs to a group of mesorbitolinids (e.g., *M. pervia*, *M. ovalis*) exhibiting a rather large and complex embryo with a plano-convex protoconch. It has been largely overlooked in the literature and its integration into the early Aptian (Bedoulian) to early Cenomanian *Mesorbitolina* lineage (*M. lotzei*–*M. aperta*) is discussed. The occurrence of mesorbitolinids with a comparatively large and complex embryonic apparatus exhibiting a plano-convex protoconch already in the Gargasian is in conflict to the current phylogenetic concept of the genus *Mesorbitolina*. Further studies and emendation of this concept are needed. The new biostratigraphic data from the top of the Taft Formation indicate a stratigraphic hiatus of ca. 5 myr at the contact to the overlying, ammonite-dated Darreh-Zanjir Formation, comprising the latest Aptian to earliest Albian.

1. Introduction

Lower Cretaceous orbitolinids have been reported from different structural parts of Iran, e.g., from the Zagros Zone in the south, from Central Iran and from the northern part (Koppeh Dagh, Alborz) (e.g. Henson, 1948; Schroeder, 1965; Sampò, 1969; Mehrnusch, 1973; Simmons et al., 2000; Schroeder et al., 2010; Babazadeh et al., 2010; Yazdi-Moghadam and Amiri, 2010; Taherpour Khalil Abad et al., 2013; Shirazi and Abedi, 2013; Afghah and Haghighi, 2013; Schlagintweit et al., 2013a,b,c). Associated with other shallow- and warm-water biota (e.g., rudists, calcareous algae) they characterize widespread platform carbonates ("*Orbitolina* Limestones") of Barremian–Albian age that are known under different formational names from all parts of Iran, e.g., Dariyan Formation (Zagros Mountains), Tirgan Formation (Koppeh Dagh), Shah Kuh Formation (Khur area), or Taft Formation (Yazd area). The lithostratigraphic formalization (in many areas these strata are mapped as "*Orbitolina* Limestones"), including the establishment of a biostratigraphic framework, of these orbitolinid-bearing strata in Iran is still in progress.

The present paper contributes to this ongoing progress and reports the occurrence of an assemblage of orbitolinids recovered from the top parts of the Taft Formation in its type area on the Yazd Block, Central Iran. The stratigraphic and taxonomic implications of this association are of importance for a) dating the end of shallow-water conditions in that area (platform drowning) and b) the phylogeny of the late early Aptian to early Cenomanian *Mesorbitolina* lineage.

2. Geological and geographical setting

The Mesozoic geology of Central Iran is characterized by a complex array of structural blocks and microplates (Fig. 1A). After accretion of the Iran Plate to the Turan Plate during the Early Cimmerian orogeny in the Late Triassic and the southward shift of the subduction zone, a renewed separation from Eurasia started in the Jurassic (Brunet et al., 2003; Fürsich et al., 2009; Wilmsen et al., 2009). The opening of the (oceanic) South Caspian Basin started in the west during the Early Jurassic and proceeded zip-like into NE Iran during the remainder of the period (Fürsich et al., 2005; Taheri et al., 2009). NW and Central Iran were a structural entity at this time, albeit block-bounding faults appeared in the stratigraphic record, defining individual tectono-sedimentary domains (blocks) and indicating considerable synsedimentary tectonic activity in

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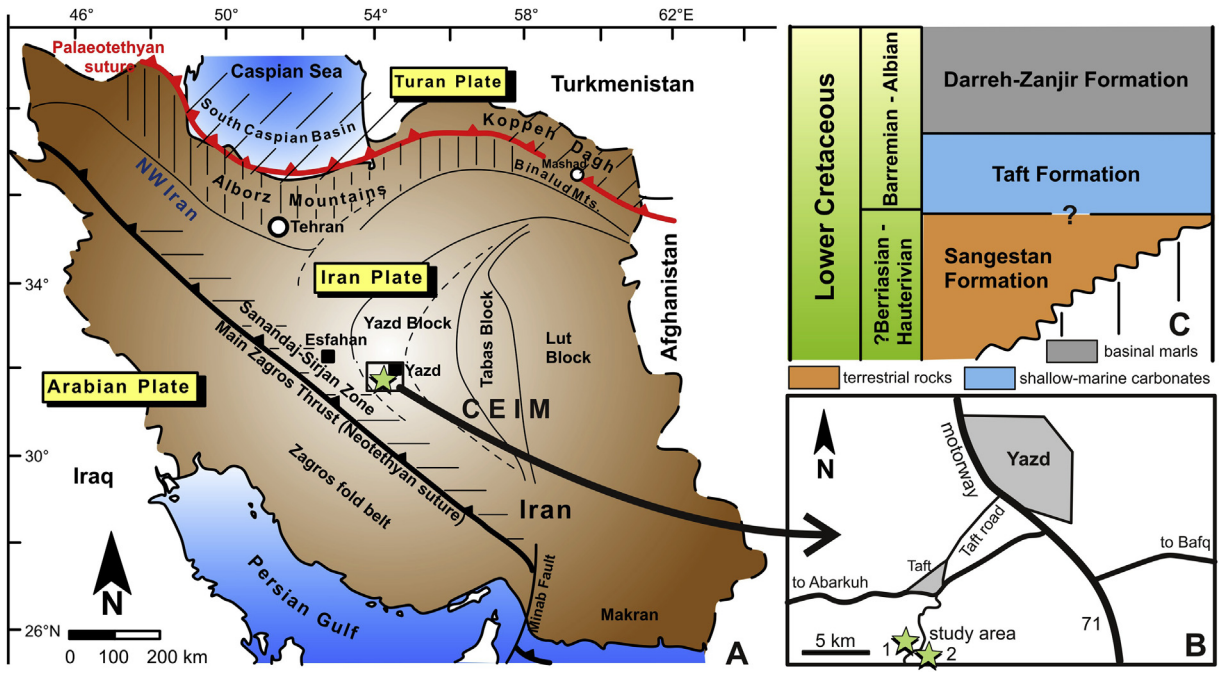

Fig. 1. A, topographic map of Iran showing the main structural elements and sutures (modified from Wilmsen et al., 2013). The study area is indicated by a rectangle. B, topographic sketch map showing the position of the two studied outcrops (see text for coordinates). C, lithostratigraphy of the Lower Cretaceous in the Yazd area.

that time (e.g., Fürsich et al., 2003a,b; Seyed-Emami et al., 2004; Wilmsen et al., 2010). During the Cretaceous, small oceanic basins formed around the Central-East Iranian Microcontinent (CEIM; Takin, 1972, see Fig. 1A), and the Yazd Block, the western block of the CEIM, became the major site of sedimentation in Central Iran. Its thick sedimentary record is of utmost importance for the understanding of the Mesozoic geodynamic evolution of the larger area.

In the Taft area, to the southwest of Yazd (Fig. 1B), a thick Lower Cretaceous sedimentary sequence is exposed, resting unconformably on the Jurassic Shir-Kuh granite (see Yazd geological quadrangle map of Nabavi, 1972a,b; Majidifard, 1996). Deposition started with terrestrial sediments (reddish conglomerates, sand- and siltstones) of the lower to mid-Lower Cretaceous Sangestan Formation (Fig. 1C) burying a considerable palaeo-relief. Regarding the carbonates from the upper Sangestan Formation, a possible Hauterivian age was suggested by Bucur et al. (2003). In its upper part, marine influences are indicated by evaporites and carbonates, in part bearing restricted marine biota (calcareous algae, agglutinating foraminifera). The Sangestan Formation is conformably overlain by thick-bedded carbonates of the Barremian–Aptian Taft Formation (Nabavi, 1972a), consisting of thick-bedded to massive rudist-, algae- and orbitolinid-bearing shallow-water limestones (e.g., Bucur et al., 2012; Schlagintweit et al., 2013a; see Fig. 2). The Taft Formation reaches up to 1 km in thickness and is part of a large-scale carbonate platform system that characterized wide parts of the Yazd Block at that time (Wilmsen et al., 2013). Based on the occurrence of age-diagnostic benthic foraminifera, Schlagintweit et al. (2013a) concluded for an early Aptian (Bedoulian) age of the lower Taft Formation in an outcrop near Aliabad, some 20 km to the west-southwest of the study area. Along a sharp unconformity surface, the Taft Formation is overlain by deep-water marls and spiculitic limestones of the Darreh-Zanjir Formation (Fig. 2A, C). Ammonites from the lower part of the formation indicate a late early to middle Albian age, and the Darreh-Zanjir Formation ranges into the late Albian (Seyed-Emami and Immel, 1995).

The precise age of the top of the Taft Formation is unknown so far and can only be grossly inferred from the superposition of the Darreh-Zanjir Formation. However, given the clear unconformity between both formations, the age range (late Aptian–earliest Albian) is fairly large. Furthermore, the significance of the unconformity between the Taft and the Darreh-Zanjir Formation can only meaningfully be evaluated within an accurate temporal framework. Therefore, the top of the Taft Formation has been sampled at two localities for micropalaeontological investigations (Fig. 1B), ca. 5 km south of Taft, 1) west (samples 080406-1a and -1b) and 2) east (samples 120417-8 and 120417-10) of the road to Deh Bala (31° 41′ 32″ N, 54° 11′ 21″ E and 31° 39′ 13″ N, 54° 11′ 29″ E, respectively). The studied orbitolinid association occurs in wackestones with other benthic foraminifera such as *Sabaudia minuta* Hofker, *Mayncina bulgarica* Laug, Peybernès & Rey and *Cuneolina/Vercorsella* sp. In addition, some thallus fragments of the dasycladale *Morelletpora turgida* (Radoičić) have been observed.

3. Micropalaeontology

The suprageneric classification of agglutinated foraminifera follows Kaminski and Mikhalevich, 2004 (in Kaminski, 2004). Remarks about species characteristics and systematics are provided. For *M. birmanica*, that is almost unknown in European literature, a historical review is supplied additionally to a detailed description of the species, especially its embryonic apparatus.

The studied thin-sections (nos. 080406-1a and 1b, 120417-8 and 120417-10) are housed in the palaeozoological collection of the Senckenberg Naturhistorische Sammlungen Dresden (repository AsK).

Class: Foraminiferida d'Orbigny, 1826
Order: Loftusiida Kaminski & Mikhalevich, 2004 (in Kaminski, 2004)
Suborder: Orbitolinina Kaminski & Mikhalevich, 2004 (in Kaminski, 2004)