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New Alveolinoidea (Foraminifera) from the Cenomanian of Oman

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ABSTRACT

The first alveolinoidean appearing in the Cenomanian Natih Formation of Oman (Adam foothills and southern edge of Jabal Akhdar) are studied in detail. Morphological analysis results in the creation of one new family, Myriastylidae, two new genera, *Myriastyla* and *Alveocella*, and four new species, *M. omanensis*, *M. grelaudae*, *A. wernliana*, and *Cisalveolina nakharensis*. These four new taxa have a short stratigraphic extension restricted to the uppermost part of Natih E unit and are dated early middle Cenomanian by neighboring foraminifers and ammonite levels.

1. Introduction

During middle Cretaceous, wide shallow-water carbonate platform systems developed on the Arabian plate. In Oman, this succession was described as the Natih Formation and is classically attributed to the upper Albian to lower Turonian (Simmons and Hart, 1987; Smith et al., 1990; Scott, 1990; Kennedy and Simmons, 1991; Philip et al., 1995; Van Buchem et al., 2002; Homewood et al., 2008). The Natih Fm. shows rich associations of large foraminifera that changes through time and characterizes different lithostratigraphical units in which that formation is subdivided.

One of the most abundant and important group of larger foraminifera in the Natih Fm. is the Alveolinoidea (superfamily Alveolinoidea Ehrenberg, 1839). The Late Cretaceous alveolinoids of the Caribbean and western Tethys paleobioprovinces are well known (see Reichel, 1933, 1937, 1941, 1947; Colalongo, 1963; Pêcheux, 1984, 2002; Schroeder and Neumann, 1985; Hottinger et al., 1989; Fleury and Fourcade, 1990; Calonge et al., 2002; Vicedo et al., 2009, 2011, 2013; Vicedo and Serra-Kiel, 2011 among others), but the representative of this group in the south and southwest margin of the Tethys call for detailed architectural studies.

Numerous specimens of alveolinoids appearing in the Omani Natih Fm. series have been analyzed and revealed notable differences with other Cenomanian genera and species. The aims of this paper are to describe the new taxa of alveolinoids found in the studied material of Oman, and give a tentative age and distribution considering the biostratigraphical and paleobiogeographical context.

2. Material and methods

The material of this study was collected in two field trips in Oman, which were carried out in 2009 and 2012. The Omani Natih Fm. is very well exposed in extensive outcrops in the northern part of the country, particularly in the southern side of Jabal Akhdar and in the Adam Foothills (Béchennec et al., 1992a,b). Fig. 1 gives the geographic location of studied field sections (Fig. 2). They are located in Jabal Madar, Jabal Madmar, Jabal Khaydalah and Jabal Qusaybah or Fitri (Adam foothills), plus Wadi Mi'Aidin and Wadi Nakhr (southern side of Jabal Akhdar).

Larger foraminifera were found in hard limestone mainly made up of muddy microfacies (Fig. 3). Several thin sections were made in order to develop the detailed architectural analysis (nomenclature follows Hottinger, 2006). More than a thousand sections of alveolinoids have been photographed and compared, coming from thin section as well as polished rock samples. The material figured in this paper (Table 1) is housed in the micropaleontological

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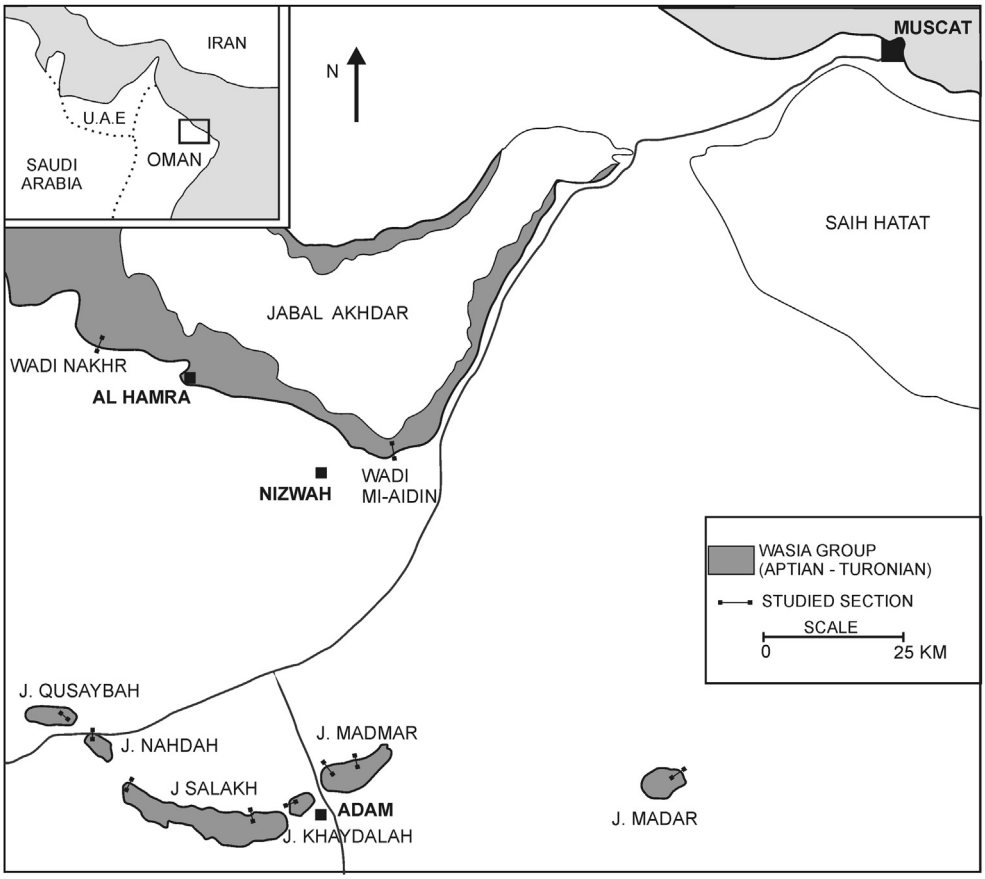

Fig. 1. Geographical and geological setting of the studied localities.

collections of the "Muséum d'histoire naturelle de Genève" (MHNG numbers) and "Museu de Ciències Naturals de Barcelona" (MGB numbers). Ammonites (Meister and Piuz, in prep.) are housed in the "Muséum d'histoire naturelle de Genève".

3. Geological settings

During the Cretaceous, the Sultanate of Oman was part of an extensive carbonate platform complex of 1000 km wide and 1200 m thick (Droste and Van Steenwinkel, 2004). The Aptian (Granier, 2008) to Turonian Wasia group (defined by Steineke and Bramkamp, 1952) consist of the Nahr Umr Formation (defined by Owen and Nasr, 1958) at the base, and the Natih Formation (introduced by Glennie et al., 1974 as substitute to the "Wasia Limestone Formation" used formerly, e.g. Tschopp, 1967) at the top. The Natih Fm. rests conformably on the Nahr Umr Fm. and is overlain in regional unconformity by the Muti Fm. (Béchennec et al., 1992a). Intense erosion has removed the Natih Fm. in the northeast of Jabal Akhdar and Saih Hatat (Béchennec et al., 1992a). The upper Albian/Turonian Natih Formation consists of mainly mud-supported and some grain-supported limestone (with local rudist development) alternating with intraplatform basin organic rich calcareous shales. Deposition was interrupted several times by subaerial exposure with emersion and incision (Immenhauser et al., 2000; Droste and Van Steenwinkel, 2004; Grélaud et al., 2006, 2010; Homewood et al., 2008). Outcrop sedimentology of the Natih Fm. is detailed by Homewood et al. (2008) with an extensive list of references.

3.1. Lithostratigraphy

For the geological maps of the studied area, Béchennec et al. (1992a,b) separated the Natih Formation into a lower (thick-bedded shallow-marine limestone) and an upper (clayey and foetid limestone with planktonic foraminifera) mappable member. The upper one corresponded to the Fitri Formation of Rabu (1988), a term now abandoned. On their side, based on subsurface log signature, petroleum geologists subdivided the Natih Fm. into seven informal "members" (reservoir units) designated by the lowercase letters "a" to "g" from top to base (Hughes Clarke, 1988; Scott, 1990). Although labeled in a reverse stratigraphical order, the recombination of these subsurface informal units into outcropping lithostratigraphic "members" got soon extensively used (e.g. Philip et al., 1995; Van Buchem et al., 1996, 2002, 2011; Homewood et al., 2008). Even if lithological properties and boundaries can locally be confusing (see below), for evident practical reasons we use them here as informal units, in upper-case letters "A" to "G" (as in many previous publications), with reservations due to their informal status and lack of rock outcrop comprehensive description. Well recognizable in the north (southern side of Jabal Akhdar) and in the west of the Adam foothills (Jabal Qusaybah, J. Nadah, J. Salakh, J. Khaydalah, J. Madmar), they gradually lose their distinctive character eastward.

Various hard grounds mark disconformities along the Natih Fm., some being easily recognizable in the field (5a, 6a, 7a, 8a in Fig. 2) and commonly used for correlation between sections in the Adam foothills (see Van Buchem et al., 1996, 2002, 2011;