

Calcareous nannofossil biostratigraphy of Campanian strata (Abtalkh Formation) from the eastern Koppeh-Dagh Basin, NE Iran



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ABSTRACT

The Campanian of the eastern Koppeh-Dagh Basin (NE Iran) is generally considered to be represented by the upper part of the Abderaz and the Abtalkh formations. The Abtalkh Formation, which is studied here, reaches thicknesses of up to 1750 m in the area. The formation is characterized by abundant, diverse, and poor to moderately well preserved calcareous nannofossil assemblages of Tethyan affinity. The assemblages were studied in detail in two sections in eastern Koppeh-Dagh, allowing construction of a precise biozonation for this stage. The Abtalkh Formation at sections in Abtalkh village and Padeha spans biozones CC20 to CC23a (UC15b^{TP} to UC16). The results of this study indicate a late early to late Campanian age for the formation in the area. The most complete Campanian sequence is in the southeast, where the Padeha section is located. Nannofossil abundance and diversity decreases upwards, showing a trend from the base to top of the formation. Dominance of warm water taxa, and low abundance of high latitude taxa, confirm placement of the basin in low to mid palaeolatitudes during deposition of the formation.

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1. Introduction and basin history

The Koppeh-Dagh Basin stretches NW–SE from east of the Caspian Sea, NE Iran, to SW Turkmenistan and NW Afghanistan (Fig. 1). The basin formed after the middle Triassic orogeny as a result of Hercynian Ocean closure in northeast Iran, an area in which sedimentation was nearly continuous from the middle Jurassic through the Neogene (Berberian and King, 1981; Afshar-Harb, 1994). The base of the Cretaceous succession is only exposed in the eastern part of the Koppeh-Dagh Basin, within Iran (Davodzadeh and Schmidt, 1982). The Iranian part of the basin is located between 36° 00′–38° 16′ N and 54° 00′–61° 41′ E.

As important hydrocarbon oil fields have been discovered within the Koppeh-Dagh Basin, the National Iranian Oil Company as always considered it as a target for a number of comprehensive

palaeontological, sedimentological and structural–geological studies to lead the oil and gas exploration projects (e.g. Kalantari, 1969; Afshar-Harb, 1969, 1979, 1994). The Koppeh-Dagh Basin has also been of interest to many academic research projects (e.g. Seyed-Emami and Aryai, 1981; Raisossadat and Moussavi-Harami, 2000; Hadavi, 2004; Hadavi and Notghi Moghadam, 2010; Vahidinia and Sadeghi, 2011; Mahanipour et al., 2011; Notghi Moghadam et al., 2013; Foroughi et al., 2014).

Many of the studies focussing on the age and correlation of Cretaceous sedimentary deposits in the area have highlighted discrepancies in the age assignment of the formations. The Abtalkh Formation (=Fm.) is the thickest Cretaceous rock unit (up to 1700 m) in the Koppeh-Dagh Basin (Stocklin and Setudehnia, 1971), and its reported age varies depending on the locality and fossil group employed (Table 1). Most of the micropalaeontological studies based on foraminifera (from Afshar-Harb, 1994 to; Ahmadi, 2011) have assigned a Santonian to Maastrichtian age, from the base to the top of the formation in the eastern Koppeh-Dagh. In contrast, recent calcareous nannofossil investigations (Hadavi and Khodadadi, 2002; Notghi Moghadam, 2002; Hadavi, 2004; Hadavi and Notghi Moghadam, 2010), have pointed to an early

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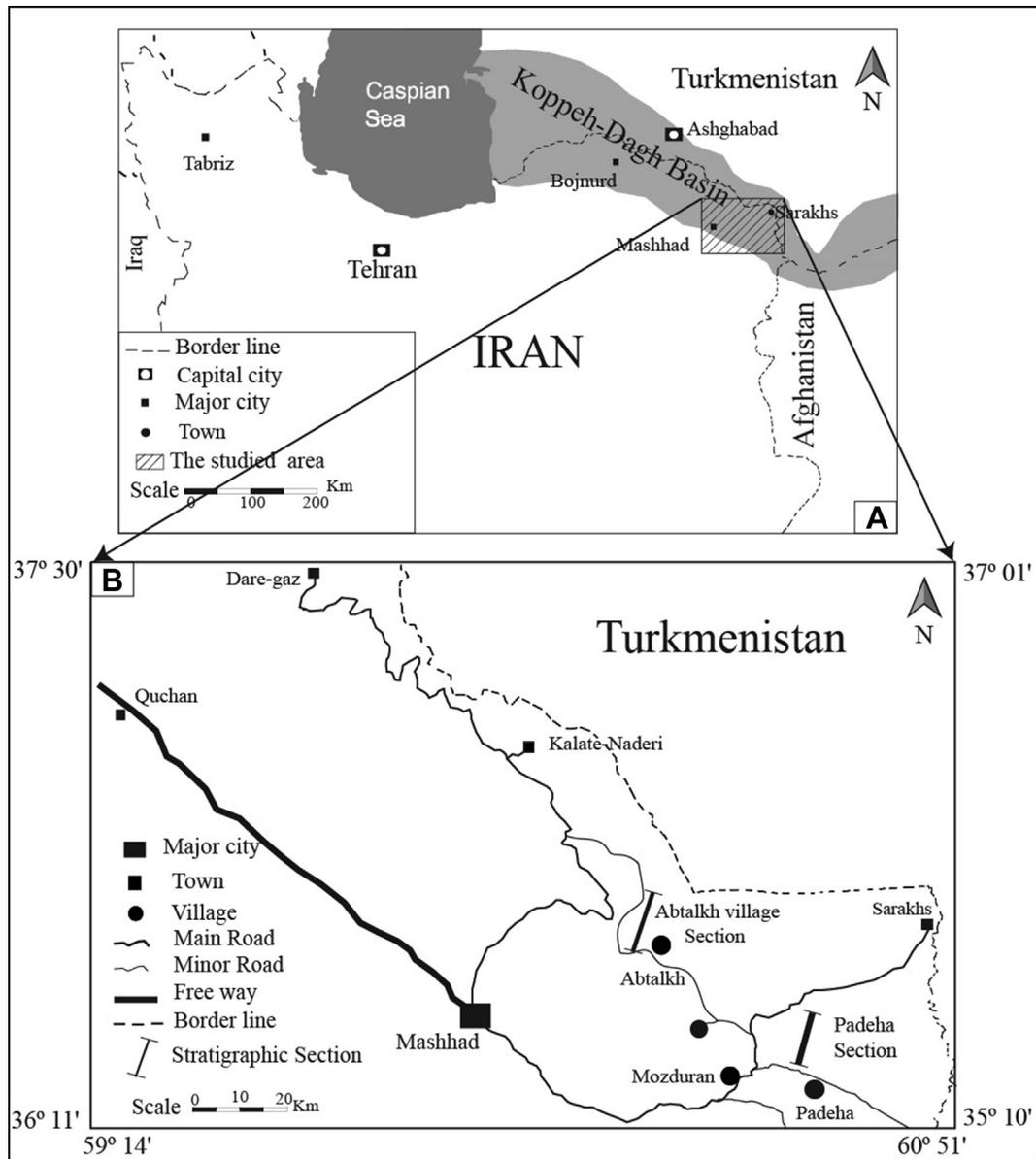


Fig. 1. (A). Extension of the Koppeh-Dagh Basin and studied area (modified after Berberian and King (1981)); (B). Road map of the studied area [modified after Afshar-Harb (1982)]. The Iranian part of the basin is located between $36^{\circ} 00' - 38^{\circ} 16' N$ and $54^{\circ} 00' - 61^{\circ} 41' E$.

Campanian to early Maastrichtian age. An age of early to late Campanian ascribed to the formation at Jalilabad section, located west of the eastern Koppeh-Dagh section, by Foroughi et al. (2014), who deserve credit for highlighting the potential of calcareous nannofossil biostratigraphy in the area.

The discrepant ages call for better stratigraphic constraints for the Cretaceous sedimentary successions, and the potential of rich and abundant calcareous nannofossil assemblages has promoted a detailed reinvestigation of the Abtalkh Fm. in the eastern Koppeh-Dagh Basin. In this work we present a new biostratigraphic study based on a high resolution calcareous nannofossil investigation performed on two expanded sections, Padeha (southeast of Mashhad) and Abtalkh village (northeast of Mashhad).

The aim of this study was to date the Abtalkh Fm. from base to top by comparing our results with previous investigations in the same area for which the age assignment of the formation has been reviewed and revised.

2. The Abtalkh Formation: geological setting and previous biostratigraphic studies

The Abtalkh Fm. is composed of light grey, green to blue marls and silty marls. The formation conformably overlies the latest chalky limestone of the Abderaz Fm. which is composed of light grey to greyish white shale, topped by three to four white chalky limestone beds (Stocklin and Setudehnia, 1971; Afshar-Harb, 1994). Although the contact between the Abderaz and Abtalkh formations has been previously described as a sharp one, between the uppermost chalky limestone of the Abderaz and marls of the Abtalkh formations (e.g. Stocklin and Setudehnia, 1971; Afshar-Harb, 1994), our field work shows that the contact is rather gradual in the two sections. The upper part of the Abderaz Fm. grades into intercalations of chalky limestones and marls with a thickness of about 5–7 m, overlain by the monotonous bluish to grey marls of the Abtalkh Fm (Fig. 2).

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