

# Late Albian ammonites from the Aitamir Formation (Koppeh Dagh, northeast Iran)



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## ABSTRACT

Late Albian ammonite faunas from the Aitamir Formation of the Koppeh Dagh Basin in northeast Iran are described and illustrated. These comprise 14 taxa, several of which are recorded from Iran for the first time, namely *Anahoplites planus* (formerly recorded from central Iran in open nomenclature only), *Semenoviceras solidus*, *Epihoplites (Metaclavites) iphitus*, *Hysterocheras orbigny* and *Pseudhelicoceras robertianum*. New records of *Placentoceras grossouvrei* extend the stratigraphic range of this species downwards into the Late Albian; previously it was known from the Early and Middle Cenomanian only. The record of the rare *E. (M.) iphitus* fills a palaeobiogeographic gap between Crimea and Tajikistan, and the holotype of Spath is re-illustrated here. Additionally, *Epihoplites trapezoidalis*, from the Late Albian of Tajikistan, is relegated into the synonymy of Spath's species. A large number of taxa typical of the Late Albian (upper part of the Gault Clay Formation) of northwest Europe indicate close palaeobiogeographic affinities with the Koppeh Dagh Basin and faunal exchange across the Russian Platform and Transcaspa. The stratigraphic succession of the ammonite faunas is used for a biostratigraphic subdivision of the upper Aitamir Formation.

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## 1. Introduction

Cretaceous ammonites are well known from Iran (Seyed-Emami, 1988) and Albian–Cenomanian faunas have been recorded from several localities in central (e.g., Seyed-Emami, 1971, 1977, 1982, 1995; Kennedy et al., 1979; Immel and Seyed-Emami, 1985; Seyed-Emami et al., 1993; Seyed-Emami and Immel, 1995, 1996; Wilmsen et al., 2013a) and northeast Iran (Koppeh Dagh: Seyed-Emami and Aryai, 1981; Seyed-Emami et al., 1984; Immel et al., 1997; Raissosadat, 2002, 2006; Mosavinia et al., 2007; Mosavinia, 2008; Mosavinia and Wilmsen, 2011; Wilmsen and Mosavinia, 2011). The rich ammonite faunas of northeast Iran are of Boreal affinity and allow a precise biostratigraphic correlation with mid-Cretaceous biozonations of northwest Europe. Here we document and discuss a well-preserved Late Albian fauna from the middle and upper parts of the Aitamir Formation of the Koppeh Dagh Mountains near Mashad (Fig. 1). Apart from the systematic palaeontology, the

relevance of this work is related to the precise documentation of the stratigraphic succession of the ammonites collected. This results in a detailed biostratigraphic subdivision of the Late Albian segment of the Aitamir Formation. The paper also complements the work of Mosavinia et al. (2007), who focused on the Late Albian mortoniceratines of the Iranian Koppeh Dagh.

## 2. Geological setting

Present-day Iran consists of a complex mosaic of tectonic plates that assembled during the Meso- and Cenozoic (for an overview, see Davoudzadeh, 1997). The main structural elements are the Palaeotethyan suture in the north and the Neotethyan suture in the southwest, delineating (from north to south) the Eurasian, Iranian and Arabian plates. The Palaeotethyan suture, formed by the Late Triassic collision of the Iran Plate with the southern margin of Eurasia, runs from northwest Iran north of the Alborz Mountains into northeast Iran where it roughly separates the Koppeh Dagh from the Binalud Mountains (Alavi, 1991; Wilmsen et al., 2009; Fig. 1). This suture was re-opened during the Middle Jurassic and developed into a strongly subsiding basin (Brunet et al., 2003; Fürsich et al., 2009; Taheri et al., 2009). The Koppeh Dagh Mountains preserve a very

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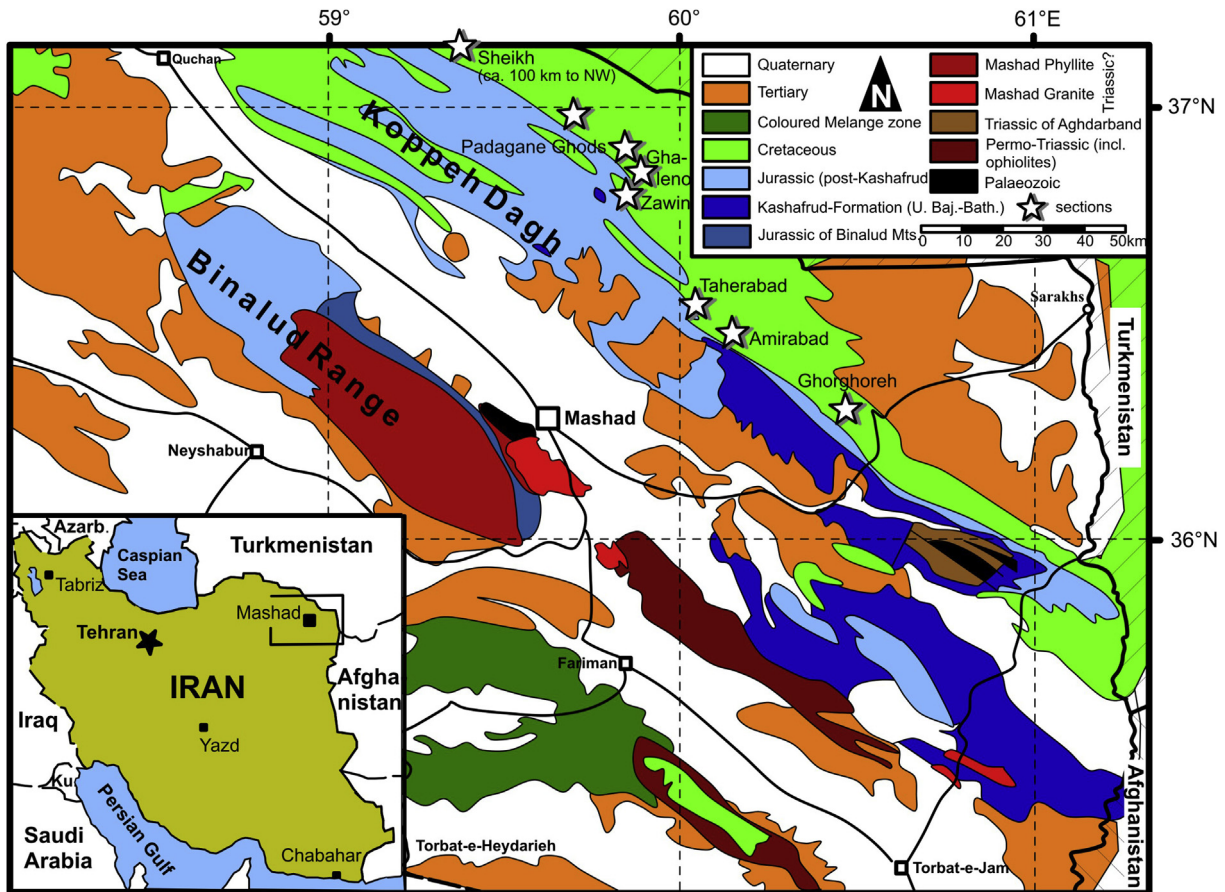


Fig. 1. Geological map of the study area in northeast Iran with indication of the localities and sections studied.

thick succession (7–12 km) of marine strata ranging from the mid-Jurassic up to the Miocene (e.g., Afshab-Harb, 1994; Figs. 1 and 2). The sequences have been deposited on shelves and in deeper-marine basins separating the Iran Plate from Eurasia (Turan Plate, Fig. 2), and fault-controlled subsidence was very important (e.g., Berberian and King, 1981; Taheri et al., 2009). The deposition of the Cretaceous succession (several kilometres thick) started with the non-marine lower Lower Cretaceous ('Neocomian') Shurijeh Formation and ended with the shallow-marine Maastrichtian Kalat Formation (Fig. 2). Marine transgression started with the Late Barremian–Early Aptian Tirgan Formation, consisting of shallow-marine, rudist- and orbitolinid-bearing platform carbonates that are (with different formational names) widespread across the Iran Plate (Schlagintweit et al., 2013; Taherpour Khalil Abad et al., 2013; Wilmsen et al., 2013b). The deepening in the course of the mid-Cretaceous transgression proceeded with the ammonite-bearing shelf and basinal sediments (marls, dark shales) of the Sarchesmeh and Sanganeh formations (Aptian–Early Albian), followed by the Albian–Middle Cenomanian Aitamir Formation (see Immel et al., 1997 for an overview). The depositional setting of the Aitamir Formation comprises a siliciclastic shelf of a passive margin. It represents up to 1000-m-thick succession of fossiliferous, fine- to medium-grained glauconitic and/or bioclastic sandstones of inner-shelf origin and dark-coloured (grey to green), silty to sandy mid- to outer-shelf shales (Mosavinia, 2008; Mosavinia and Wilmsen, 2011). The Aitamir Formation is truncated along a regional unconformity at the base of the overlying Early Turonian–Coniacian Abderaz Formation (Afshab-Harb, 1994; Mosavinia and Wilmsen, 2011).

### 3. Sections

The Aitamir Formation has been investigated at several localities for the present study, all located north, northeast or east of Mashad (Fig. 1):

- Amirabad (co-ordinates: N 36° 34' 50", E 60° 08' 00"; altitude: 720 m);
- Ghaleno (co-ordinates: N 36° 49' 55", E 59° 55' 53"; altitude: 1020 m);
- Ghorghoreh (co-ordinates: N 36° 13' 34", E 60° 24' 18"; altitude: 942 m);
- Padegane Ghods (N 36° 50' 08", E 59° 53' 41"; altitude: 1080 m);
- Sheikh (co-ordinates: N 37° 33' 51", E 57° 32' 46"; altitude: 1210 m);
- Taherabad (co-ordinates: N 36° 37' 05", E 60° 04' 03"; altitude: 982 m);
- Zawin (co-ordinates: N 36° 45' 10", E 59° 54' 49"; altitude: 1128 m).

A simplified Late Albian standard section has been compiled based on the detailed logs from these localities (Fig. 3) in order to show the general lithological development of the Aitamir Formation. However, the Upper Albian segment of the Aitamir Formation is of highly variable thickness in the study area, ranging from 18 m (Amirabad section) to more than 200 m (Ghaleno section). Furthermore, some beds and intervals are pinching out within the limits of the (large-scale) outcrops, thus partly resulting in considerable variation within the individual sections. This local picture is in accordance with the strongly diachronous limits of this formation from E to W in the Koppesh Dagh (Immel et al., 1997).

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