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Albian decapod Crustacea from Southeast Isfahan, Central Iran-Kolah-Qazi area

Mehdi Yazdi[1], Ali Bahrami[1], and Francisco J. Vega[2]

[1]Department of Geology, Faculty of Science, University of Isfahan, 81746, Iran
<yazdimehdi@yahoo.com, bahrami_geo@yahoo.com>
[2]Instituto de Geología, UNAM, Ciudad Universitaria, Coyoacán, México, DF 04510, Mexico
<vegver@servidor.unam.mx>

Abstract

The first record for Cretaceous (Albian) crustaceans from Southeast Isfahan, Central Iran-Kolah-Qazi area is provided based on presence of the raninid crab *Notopocorystes xizangensis* Wang, 1981, as well as callianassoid remains and articles of ?*Hoploparia* sp. Details of the stratigraphic section were material was collected are provied, as well as a brief review on the previous geologic reports of the study area.

Key words: Albian, Crustacea, Central Iran-Kolah-Qazi

Resumen

El primer registro de crustáceos del Certácico (Albiano) del sureste de Ifahan, en el área de Irán Central-Kolah-Qazi, es documentado con base en la presencia del cangrejo ranínido *Notopocorystes xizangens*is Wang, 1981, así como en restos de calianasoideos y artejos de ?*Hoploparia* sp. Se ofrecen detalles de la sección estratigráfica de donde procede el material colectado, así como una breve descripción de los reportes geológicos previos para el área de estudio.

Palabras clave: Albiano, Crustacea, Irán Central-Kolah-Qaz

Introduction

The oldest rocks exposed in the Kolah-Qazi area consist of dark–gray shale, siltstone and sandstone, including only rare fossil traces and few plant remains. On the base of lithology, the bulk of these sediments can be attribiuted to the Shemshak Group, which in the type area is Lower and Middle Jurassic in age, but this age must be attributed tentatively. For example, a few small ammonites were collected from north of Isfahan, 10 m below the base of Cretaceous deposits (Davoudzadeh and Tatevossian, 1966), which belong to the upper Triassic. This suggests that the clastic sediments of Isfahan are equivalent of the Nayband Formation in east-central-Iran, as a result of the late Kimmerigian orogenic movements. Lower Cretaceous sediments transgressed with angular unconformity upon the above mentioned deposits. A true sharp angular unconformity can be seen in most places. The Cretaceous rocks are widespread in many localities in the Isfahan region, but a fairly complete section (Barremian–Campanian/Maastrichtian?) can be seen in the Kolah-Qazi area, southeast of Isfahan.

The present work describes for the first time the assemblage of decapod crustaceans recently collected from the Albian stage of the Kolah-Qazi area.

Previous work

Stahl (1897) was the first geologist to mention presence of Cretaceous rocks in the Isfahan area. Böckh et al. (1929) reported a Cenomanian ammonite, 17 miles southeast of Isfahan (in Kolah-Qazi area). Kühn (1933) recorded and described the Cretaceous deposits from the eastern part of Isfahan. Clapp (1940) described an incomplete Cretaceous section, 8 miles east of Isfahan (Shahrestanak section), in which Lower *Orbitolina* limestones overlie Liassic beds. Furon (1941) reported the basal conglomerates and sandstones overlying the *Orbitolina* limestone (Aptian or younger stage) from many localities north and east of Isfahan. Soder (1954) was the first to map the area of Isfahan in detail. Stöcklin (1954) mapped and described the geology of the area north of Isfahan (Dizlu area, 60 km northeast of Isfahan); he placed the reddish sandstone and conglomerates at the base of the Cretaceous, followed by the *Orbitolina* limestone in the upper part of the section, and reported Albian ammonites from green marls, 8 km east of Baqerabad (near Dizlu section). Davoudzadeh and Tatevossian (1966) subdivided the Cretaceous of the Gardaneh Shir area (north of Zefreh) in four units. Mehrnush and Tehrani (1970) studied the three Cretaceous sections at different places in the Isfahan area; they covered the whole Cretaceous

sequence in the Isfahan area (Roshandasht, Kolah-Qazi and Kuh-Shidan sections). Seyed-Emami et al. (1971) studied the fairly complete Cretaceous section in Kolah-Qazi area, and distinguished 11 biostratigaphic units, ranging from Barremian to Campanian –?Maastrichtian. They found that the Cretaceous section in Kolah-Qazi area southeast of Isfahan, is more complete than in other localities in the vicinity of Isfahan. Zahedi (1976) prepared the quadrangle map of the Isfahan area and provided detailed informative evidence about the geology of Isfahan and neighboring areas. Based on foraminiferal biostratiraphy, Seyrafian (1988) attributed the Upper Cretaceous deposits in Shidan Montain (Kolah-Qazi area) to the informal Shidan Group, subdivided in the Lashotor, Miankuh and Gharneh formations. Amirshahkarami (1998) studied the biostratigraphy and paleogeography of the Albian–Turonian stages in the Kolah-Qazi area. Amirshahkarami and Vaziri-moghadam (2000) made a detailed biostratigraphic study based on *Inoceramus* limestone beds of the Kolah-Qazi area. Habibi et al. (2005), subdivided the Upper Cretaceous deposits in Kolah-Qazi area in four planktonic foraminiferal biozones.

Geological settings

The Kolah-Qazi section is located in Central Iran, 25 km Southeast of Isfahhan, near Baharestan new town, and 2 km south of Isfahan-Shiraz road, at the entrance of Kolah-Qazi valley (lat. N 51°46′32″, long. E 32° 26′50″ GPS-WGS84 coordinates). Kolah- Qazi area structurally belongs to West-Central Iran, which is limited by main Zagros Fault to the southwest, and by the Great Kavir Fault to the east (Figs. 1 and 2).

Lithostratigraphy of the Kolah-Qazi section

From top to bottom, the succession is as follows (Fig. 3):

Total thickness: 365.5 m

Top: continuation of the sequence described in unit 9, but covered by alluvial deposits.

9 - Calcareous marl, bluish-gray, light weathering, containing limestone intercalations with few inoceramids, echinoids and planaktonic foraminifera: *Micraster coravium, Echinocorys* sp., *Isomicraster gibbus, Pithonella ovalis, Calcisphaerula* sp., *Globotruncana fornicata, G. concavata* (Seyed-Emami et al., 1971). 80 m.

Age: Santonian–Campanian (Echinoid marls).

8 - Bright-gray limestone, clearly bedded (10–100 cm), glauconitic at the base and marly to the top, frequently containing *Inoceramus*, *I. lamarcki, I. labiatus, Globotruncana helvetica, G. imbricada, G.*

Fig. 1. Map showing localities mentioned in text, around Isfahan area.

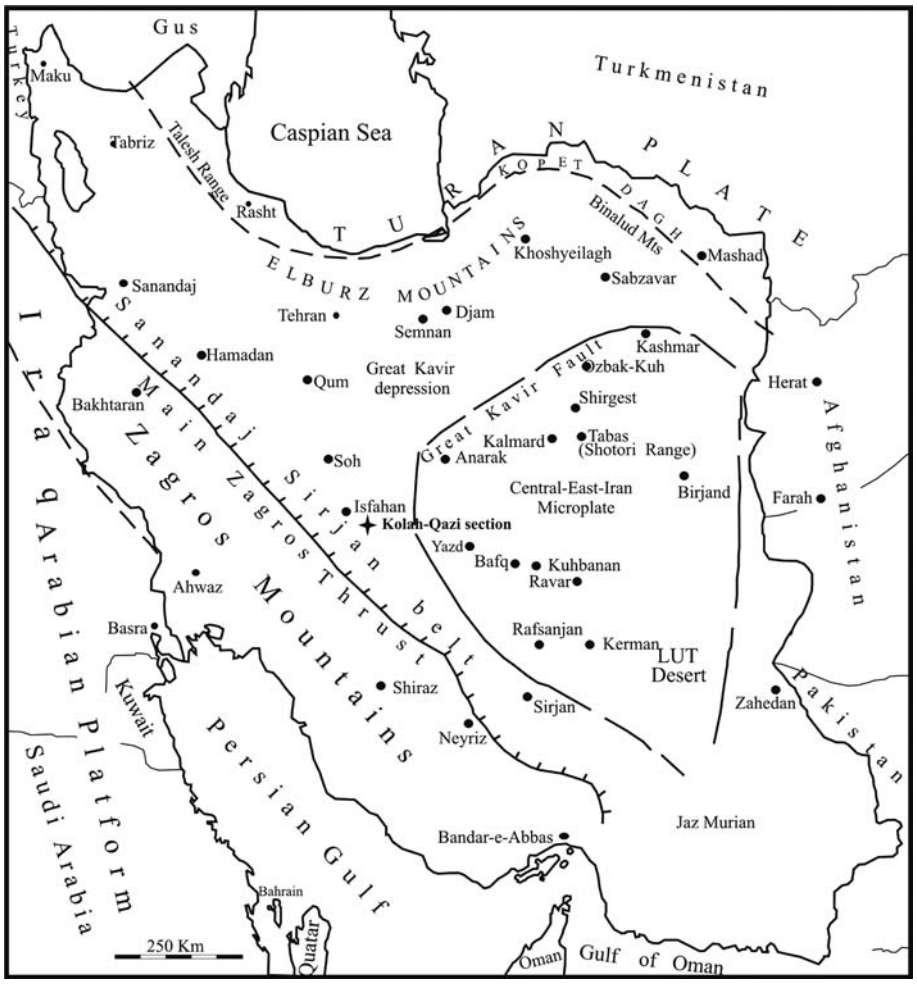

Fig. 2. Structural zones of Iran (after Wendt et al., 2005).

coronata, G. lapparenti. (Seyed-Emami et al., 1971). 102 m.

Age: Turonian–Coniacian (*Inoceramus* limestone) (Pl. 1, Fig. 1).

7 - Sandy-glauconitic limestone, olive-green to grayish, dark-brown weathering, with few centimeters of glauconitic sandstone at the base, containing abundant brachiopods, echinoids and ammonites. *Pithonella ovalis, Stomiosphaera sphaerica, Calcisphaerula innominada, Terebratula dutempleana, Scaphites simples, S. obliquus, Turrilites costatus* (Seyed-Emami et al., 1971). 2.0 m.

Age: upper Albian–Cenomanian (Glauconitic limestone) (Pl. 1, Fig. 1).

6 - Olive-green to grayish shale, with concretions and cone-in-cone structures and intercalations of thin-bedded, lense forming, dark-gray limestone (5–30 cm), filled with small turritellid gastropods and nuculids. *Trigonia* and ammonites can be found throughout the unit. *Tetragonites* sp., *Beudanticeras* sp., *Beudanticeras beudanti*, *Douvilleiceras* sp., *Puzosia* sp. (Seyed-Emami et al., 1971, Amirshahkarami, 1998). 120 m.

Age: Albian (*Beudanticeras* Shale) (Pl. 1, Fig. 2).

5 - Limestone, organic - detritic, thick bedded to massive, grayish, bituminous, crowded with orbitolinids and containing big, thick-shelled oysters. *Orbitolina texana texana, O. discoidea*, *Orbitolina* cf., *O. texana parva*. 26.0 m.

Age: upper Aptian (Upper *Orbitolina* limestone) (Pl. 1, Fig. 3).

4 - Marly limestone, thin-bedded, with marly intercalations. 16.5 m.

3 - Sandy, nodular limestone, with few orbitolinids, bryozoans and oysters. 2.0 m.

2 - Shale, calcareous, dark-gray, yellow weathering, with orbitolinids and bryozoans. 16 m.

1 - Grayish sandy limestone with orbitolinids and bryozoans, underlied by 0.5 m calcareous shale. 0.8 m.

Age of units 1–4: Lower Aptian.

Base: Massive limestone of the Lower *Orbitolina* limestone, with dolomitic intercalations (Pl. 1, Fig. 4).

Seyed-Emami et al. (1971) traced a slight disconformity between the *Beudanticeras* shale and the Glauconitic limestone. The ammonites present in the Glauconitic limestone indicate a condensed section from the upper Albian to upper Cenomanian. In the Kuh-e-Shidan (Pl. 1, Fig. 5), at the northeast corner of Kolah-Qazi mountains, the uppermost part of the Cretaceous deposits are more clearly exposed, and represent the organic-detritic limestone, mainly composed of rudist fragments, of Campanian –?Maastrichtian age.

Specimens are deposited in the Department of Geology, Faculty of Science, University of Isfahan, 81746, Iran, under acronym EUIC.

Systematic paleontology

Order Decapoda Latreille, 1802

Infraorder Brachyura Latreille, 1802

Section Podotremata Guinot, 1977

Subsection Archaeobrachyura Guinot, 1977

Superfamily Raninoidea De Haan, 1839

Family Raninidae De Haan, 1839

Subfamily Palaeocorystinae Lőrenthey *in* Lőrenthey and Beurlen, 1929

Genus *Notopocorystes* M´Coy, 1849

Type species: *Corystes stokesii* Mantell, 1844, by subsequent designation of Withers, 1928.

Notopocorystes xizangensis Wang, 1981

(Pl. 2, Figs. 6–11)

Notopocorystes xizangensis Wang, 1981, p. 352, pl. II, figs. 1a–1c.

Description: Carapace small, elongate oval in outline, constricted posteriorly, vaulted transversely, less so longitudinally, deflected near

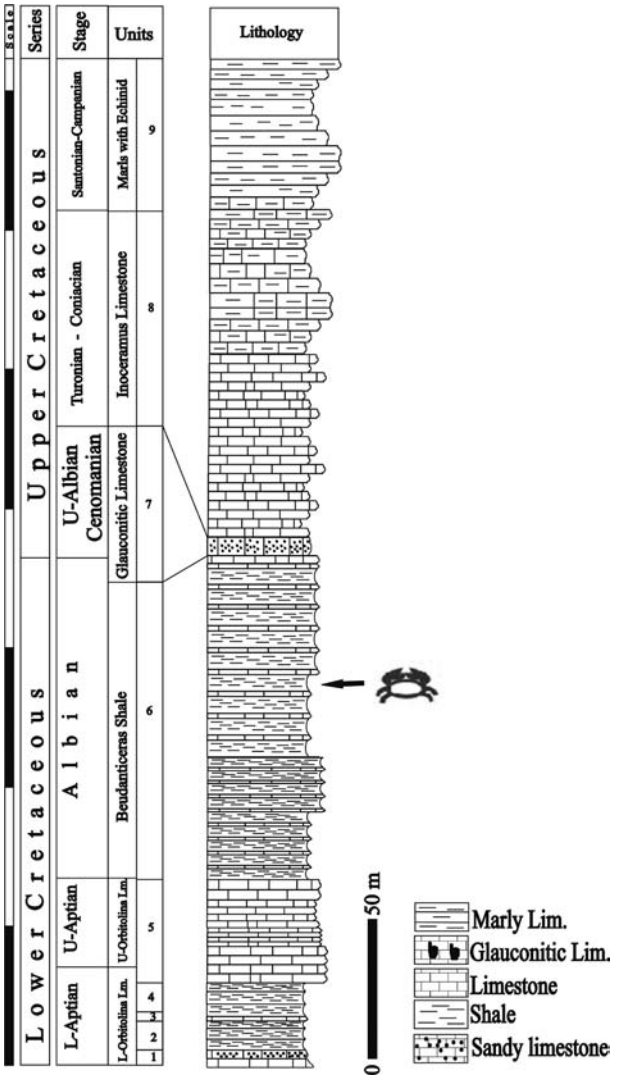

Fig. 3. Stratigraphic column of Kolah-Qazi section to show detailed lithology.

fronto-orbital margin; carapace widest at anterior third, near level of mesogastric region. Fronto-orbital margin two-thirds of maximum carapace width, delimited by sharp, outer orbital spines, inclined anterolaterally; margins inclined posterolaterally from projected bifid rostrum; supraorbital ridges with two relatively wide fissures. Anterolateral margin inclined, smooth, one-fourth maximum carapace length. Sharp, short spine directed anterolaterally at anterior potion of smooth, slightly concave posterolateral margin, nearly three-fourths of maximum carapace length. Posterior margin slightly concave, half of maximum carapace width. Dorsal surface of carapace smooth; longitudinal, smooth median keel on entire length of carapace; cervical groove deeply impressed, inclined posterolaterally near hepatic areas; hepatic area triangular, with two small tubercles, aligned subparallel to inclined cervical groove; protogastric process equivalent to anterior extension of median keel; mesogastric lobe subpentagonal, widest at level of angular flexion of cervical groove; urogastric region inverted-subtrapezoidal, much wider on its anterior margin, bounded laterally by short but relatively deep grooves, part of the branchiocardiac groove; cardiac region inverted-subtrapezoidal; intestinal region ovate; branchial areas indistinct. Possible articles of pereiopods were preserved in a concretion (Pl. 2, Fig. 12).

Material examined: Five carapaces, hypotypes EUIC 3752 to EUIC 3756.

Occurrence: Kolah Qazi section-*Beudanticeras* shale, Albian.

Measurements: Hypotypes EUIC 3752, length = 11 mm, width = 13 mm; EUIC 3753, length = 14 mm, width = 13 mm; EUIC 3754, length = 13 mm, width = 10 mm; EUIC 3755, length = 14 mm, width = 10 mm; EUIC 3756, length = 17 mm, width = 11 mm.

Discussion: *Notopocorystes xizangensis* was described from Aptian–Albian beds of the Tackna Formation of the Lhsa region, Xizang (Wang, 1981). It was described along with the mecochirid *Meyeria magna* M´Coy, 1849, typical of Aptian beds of Europe and America (Vega et al., 2008). Specimens from the Kolah-Qazi section are similar to *N. xizangensis* in their small size, lack of dorsal carapace ornamentation and shape and distribution of dorsal regions. Tucker (1998) listed seven species of *Notopocorystes*, five of them from Albian beds: *N. stokesii* (Mantell, 1844), England; *N. praecox* Wright and Collins, 1972, England; *N. serotinus* Wright and Collins, 1972, England; *N. bituberculatus* (Secretan, 1964), Madagascar, and *N. xizangensis* (incorrectly spelled by that author as *N. xizangemsos*). The other two species were described from the Cenomanian of England and Germany and the late Turonian or early Coniacian of Japan: *N. normani* (Bell, 1863) and *N. japonicus* (Jimbô, 1894), respectively. *N. xizangensis* differ from all of the above mentioned species in being the smallest representative of *Notopocorystes*, and lacking the tuberculate ornament of the dorsal carapace. Additionally, most of the species from Europe have wider fronto-orbital margins and have spines on anterolateral margins.

Specimens from the Kolah-Qazi section were found associated with cheliped palms of callianassoids (Pl. 2, Figs. 1 to 3), as well as ?*Hoploparia* sp. remains (Pl. 2, Figs. 4, 5).

Occurrence of *N. xizangensis* in Albian beds of Iran confirm the wide distribution that certain species of crustaceans had during Aptian and Albian times, and represent important information for the understanding of the paleobiogeographic distribution patterns of the Cretaceous decapod crustaceans.

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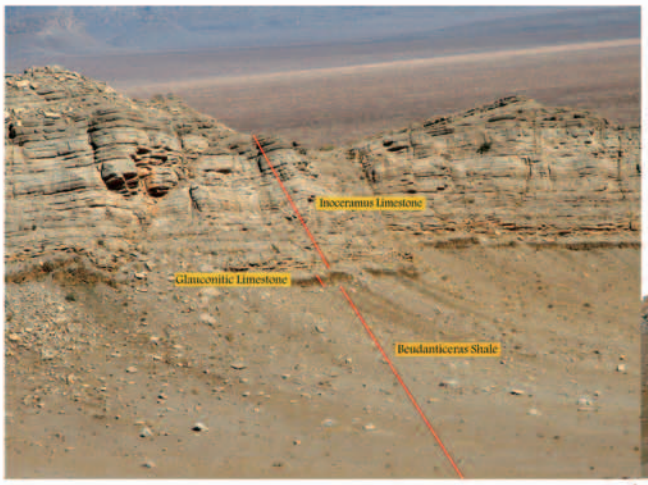
→Plate 1

1. Kolah-Qazi area-Beudanticeras shale with Glauconitic limestone and *Inoceramus* limestone at topmost. **2**. Kolah-Qazi area-*Beudanticeras* shale. Note layer that includes crustacean remains. **3**. Kolah-Qazi area-Upper *Orbitolina* limestone. SW view. **4**. Kolah-Qazi area-map showing the base of Cretaceous (Shemshak Group), overlied by Lower *Orbitolina* limestones. **5**. Kuh-e-Shidan Campanian–Maastrichtian? a: Alternation of marl and marly limestones. b: Rudist limestones.

Plate 1



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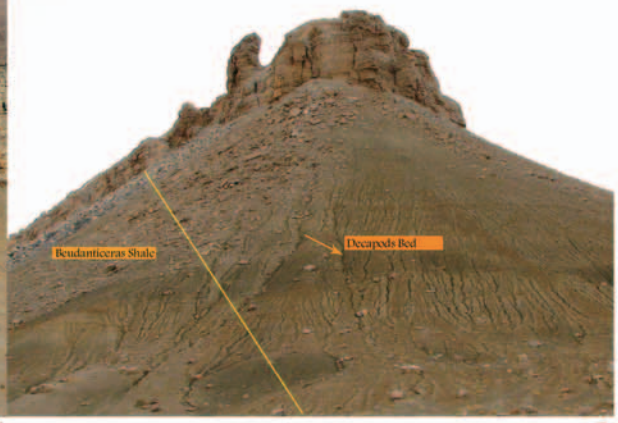

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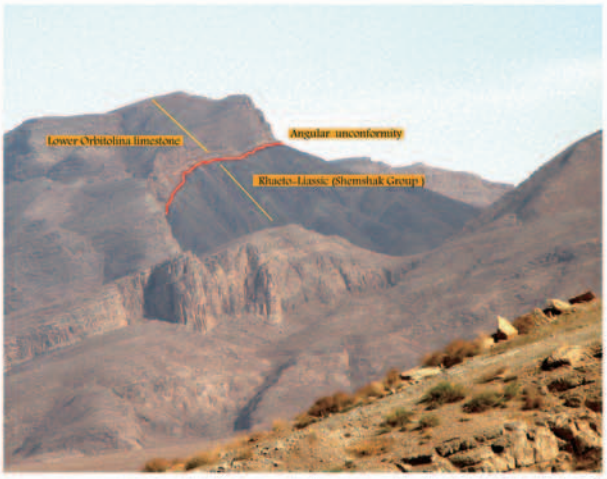

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→Plate 2

1–3. Callianassoidea palm remains, Kolah Qazi section-*Beudanticeras* shale, Albian, ×8. **4, 5**. ?*Hoploparia* sp. articles, Kolah Qazi section-*Beudanticeras* shale, Albian, ×8. **6–11**. *Notopocorystes xizangensis* Wang, 1981, Kolah Qazi section-*Beudanticeras* shale, Albian. 6, Hypotype EUIC 3754, ×5; 7, Hypotype EUIC 3755, ×5; 8, Hypotype EUIC 3752, ×5; 9, Hypotype EUIC 3753, ×5; 10, Hypotype EUIC 3756, ×5; 11, Line drawing based on hypotype EUIC 3755. 12. Possible articles of pereiopods of *Notopocorystes xizangensis*, Kolah Qazi section-*Beudanticeras* shale, Albian, ×3.

Plate 2