Bulletin of the Mizunami Fossil Museum, no. 38 (2012), p. 1–7, 7 figs.

Miocene decapod crustacean from the Guri Member of the Mishan Formation, Bandar-Abbas, Southern Iran

Akbar Heidari*, Rodney M. Feldmann, Reza Moussavi-Harami***

*Department of Geology, Faculty of Science, Ferdowsi University of Mashhad, Mashhad, Iran
**Department of Geology, Kent State University, Kent, Ohio 44242, USA,
<rfeldman@kent.edu> Corresponding Author

Abstract

One decapod crustacean species, *Portunus withersi* (Glaessner, 1933), from Guri Member (early Miocene) from the Mishan Formation of Hormozgan Province, Southern Iran is reported. This species previously was described in the Fars area, but this is the first report from this area. This species confirms the early Miocene age; the lower boundary of the Guri Member is coincident with the lower Miocene. Recognition of the age of this member is very important because the lower boundary of the Guri member ranges from early to middle Miocene from the west to east in the Zagros Basin. This member north of Bandar-Abbas is older than it is in the west of the Basin. This paper introduces only the second report of Cenozoic crustaceans from the Zagros Basin. Thin sections of the carbonate unit have been studied in order to interpret the sedimentary environment. Studied allochems confirmed an open lagoon and some patch reefs with high flow of sea water

Key words: Decapoda, Brachyura, Miocene, Iran

Introduction

The Fossil decapod crustaceans from Iran are scarce. Fortunately, recently some studies focused on them and several papers have been published (Toraby and Yazdi, 2002; Feldmann *et al*., 2007; McCobb and Hairapetian, 2009; Yazdi *et al*., 2009, 2010; Vega *et al*., 2010). But

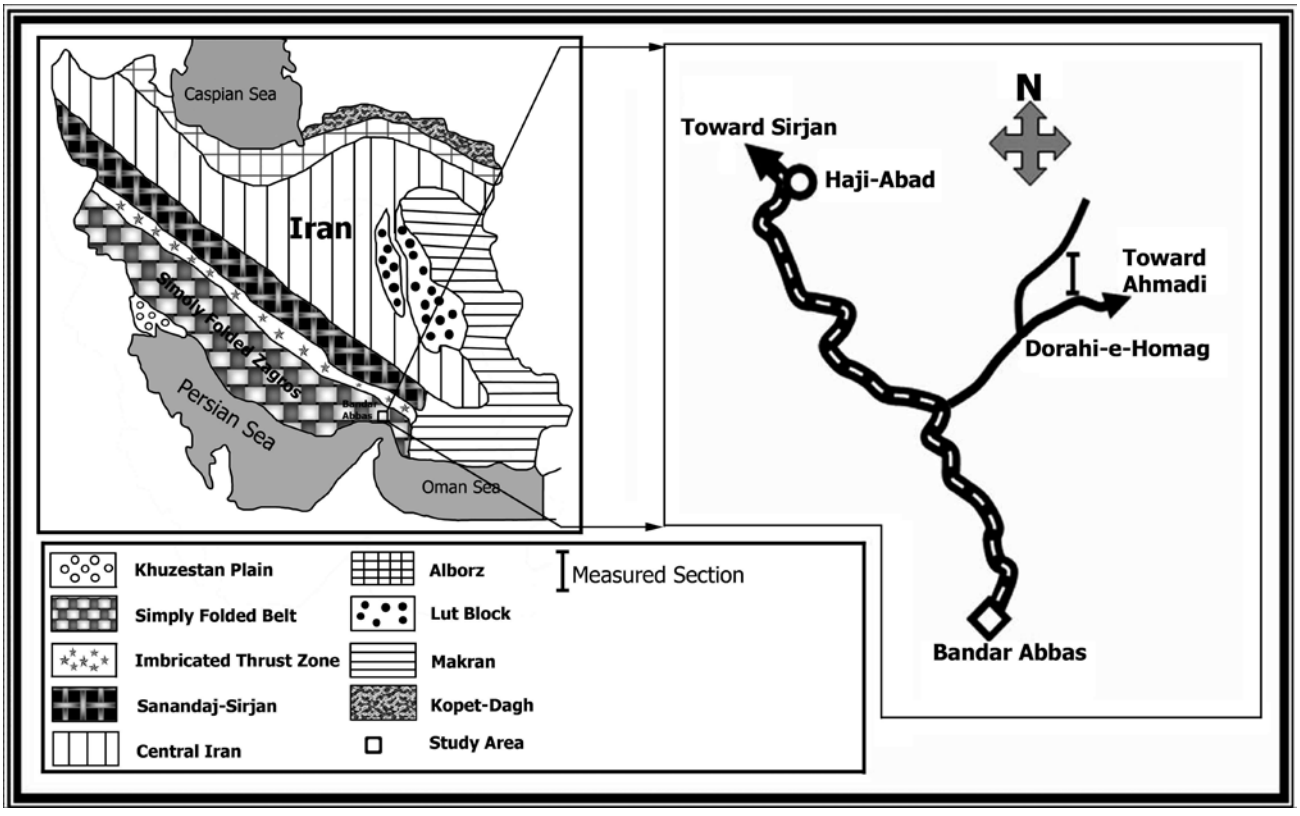

Fig. 1. Generalized map of Iran (modified from Stocklin, 1968) that shows the location of the measured section.

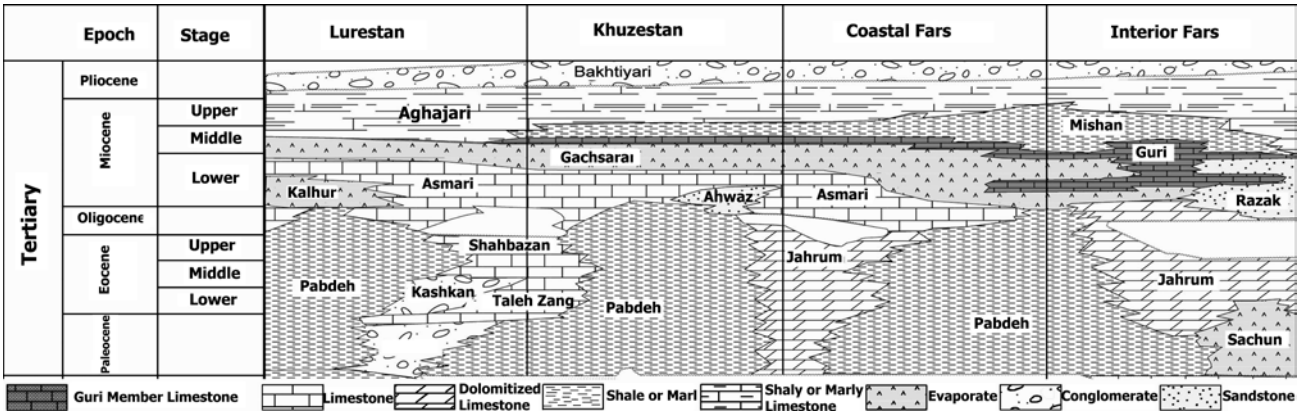

Fig. 2. Lithostratigraphic units of the Cenozoic of Zagros Fold-Thrust (modified from Gulf Petrolink, 1998).

except for Toraby and Yazdi (2002) who described a Miocene portunid crab from the Esfahan area in Central Iran, and Vega *et al*. (2010) who considered four decapod crustacean species from the middle Miocene Mishan Formation, the rest of studies are confined to Jurassic and Cretaceous taxa. This study is the second description of a crab from the Zagros Basin. The species which we report in this study was first described by Glaessner (1933) from the Fars Group near Sulabadar, Iran. Two well preserved samples were collected from a stratigraphic section north of Bandar-Abbas, Hormozgan Province, which is located at the southeastern-most part of the Zagros Mountains, in the south of Iran (Fig. 1). The locality where crabs in this study were found is at Dorahi-e-Homag (N 27°49′54″, E 56°26′45″) northeast from Siahoo, north of Bandar-Abbas. In spite of the economic importance of the Guri Member of the Mishan Formation – the presence of hydrocarbon reservoirs – there is no comprehensive study on the Guri Member. Therefore, it is necessary to characterize the Guri Member in this area. In this study, in addition to recognition of crabs, thin sections of the carbonate unit which encompassed crabs, were studied in order to interpret the sedimentary environment.

Regional geology

Bandar-Abbas Hinterland is located in the southeastern part of the Zagros Mountains. This hinterland is bounded by the Minab Fault on the east, the Zagros fold belt which crosses the Persian Gulf on the south, and the Razak Fault on the north (Barzgar, 1981). Most of structures are anticlines exposing Fars Group successions, which are thicker than the Fars Zone in the study area (Aghanabati, 2004).

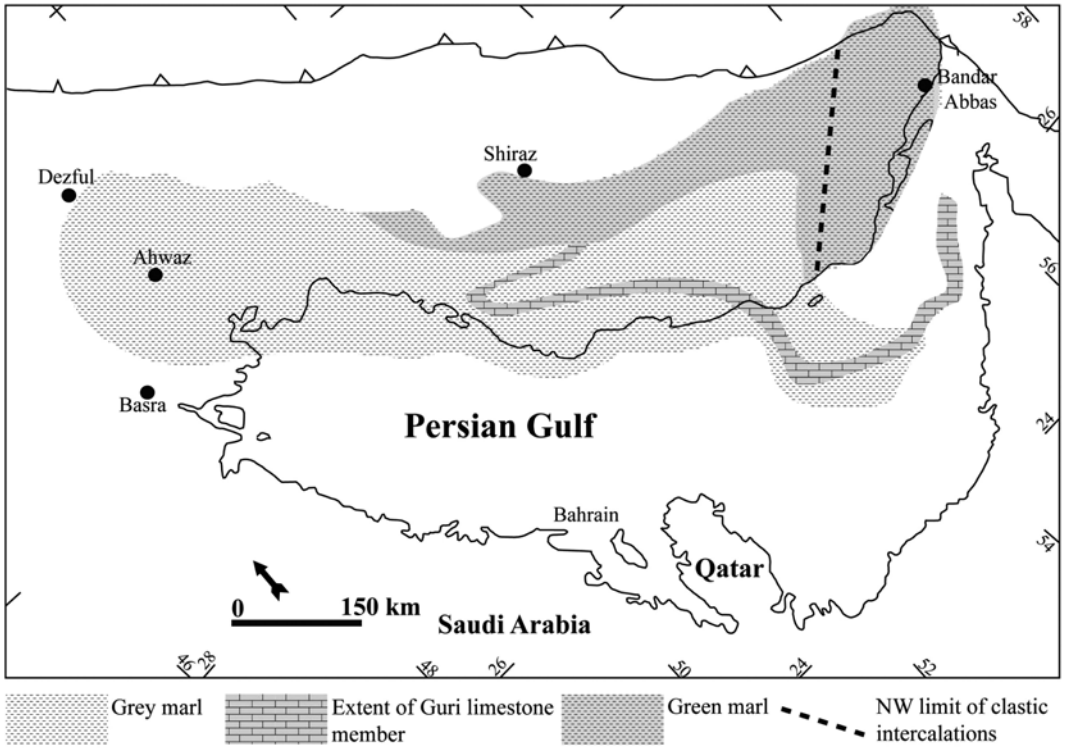

Fig. 3. Map showing the extent of the Guri Member (modified from Motiei, 1993).

The Miocene Epoch was contemporaneous with the Burdigalian phase of the European Alpine Orogeny. The Gulf of Aden opened up and the Red Sea rift began to separate the Arabian Plate from the African Plate (Ziegler, 2001). The thrusting complex of the Sanandaj-Sirjan zone in Iran documents continental collision of the Arabian Plate with Asia. After this collision, a massive volume of non-marine to deltaic and shallow marine siliciclastic sediments were accumulated in the rapidly subsiding foredeep part of the Zagros Foreland basin. Sediments ranging in age

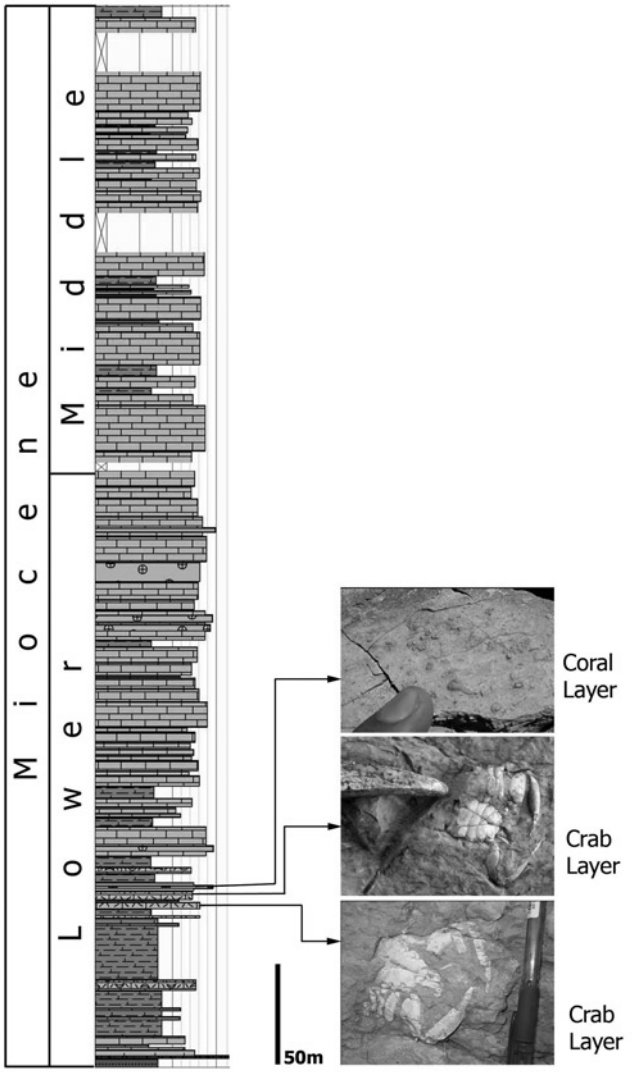

Fig. 4. Stratigraphic section of the Guri member in the Dorahi-e-Homag.

from post-Asmari Miocene deposits to Holocene form a more than 5,000 m thick succession of sediments that were deposited in the Dezful Embayment of the Zagros Basin (Koop and Stoneley, 1982).

The Hormoz Series contains the oldest exposed sedimentary rocks in the study area. This series is composed of Late Precambrian to Middle Cambrian evaporite deposits and volcanic rocks (Stocklin and Setudehnia, 1991; Aghanabati, 2004). There are several salt domes which deformed younger successions and are known as Hormoz Series (Vega *et al*., 2010). Most of the Mesozoic successions of the Zagros basin are not exposed in the study area. Some formations such as Pabdeh, Jahrum, and Asmari (Paleocene to early Miocene) make up the cores of anticlines in the study area. Younger units within the anticlines are composed of early Miocene to Pleistocene deposits which are known as the Fars Group (Gachsaran, Mishan, Aghajari, and Bakhtiari formations) (Vega *et al*., 2010).

Carbonate rocks of the Guri Member, early to middle Miocene, form the youngest reservoir in southeast Zagros Mountains (Kashfi, 1982). This member, named by James and Wynd (1965), is the basal carbonate unit of the Mishan Formation (Fig. 2).

The Bandar-Abbas hinterland is located in southeastern Zagros Mountains and has a different orientation than other parts of the sedimentary Basin (Haynes and McQuilan, 1974). Anticlines and synclines of this zone have mostly an E - W trend, which is different from other zones in the Zagros Basin (Molinaro *et al*., 2004). The thickness of the Guri Member has two different trends including north-south and east-west (Motiei, 1993). The first trend has a range in thickness between 100 m, in the west and southwest, to 1000 m in the north-south zone, and the second trend has a range between 1000 m north of Bandar-Abbas, to 100 m south of Bandar-Abbas (Movahed, 1995). This member extends from south of Shiraz to the Bandar-Abbas area (Fig. 3) (Motiei, 1993); some studies recently reported the Guri Member around the Dezful area (Homaiun-Zadeh, 2002).

The crabs were collected from a 6-meter-thick grey limestone interval in the lower part of the Guri Member in the Dorahi-e-Homag section (Fig. 4). The section is mostly composed of interbedded limestone and marl. This member is overlain and underlain by the Razak Formation and the Mishan marls, respectively. The lower boundary with the Razak Formation is sharp and commences with a conglomerate layer. The last limestone layer is assumed to be the upper boundary of this member. Some studies (Stocklin and Setudehnia, 1991; Kalantari, 1992) stated the Guri Member to be Burdigalian in age. Foreland margin platforms are arrayed in elongate, narrow bands in distal parts in front of foreland basins (Bosence, 2005). The Mishan Formation was deposited in an elongate narrow band, NW–SE trending sedimentary basin contemporaneous with orogenic activities in the Zagros Mountains (Mouthereau *et al*., 2006). The crabs are associated with large benthic foraminiferans, corals, echinoids, bivalves, and gastropods.

Systematics

Order Decapoda Latreille, 1802
Infraorder Brachyura Linnaeus, 1758
Family Portunidae Rafinesque, 1815
Genus *Portunus* Weber, 1795

***Portunus withersi* (Glaessner, 1933)**

(Fig. 5)

Neptunus (*Achelous*) *withersi* Glaessner, 1933, p. 8, pl. 2, figs. 1–3.

Portunus (*Achelous*) *withersi* (Glaessner, 1933); Glaessner, 1969, p. R510, fig. 319.2.

Portunus withersi (Glaessner, 1933); Karasawa *et al*., 2008, p. 127.

Description: "Carapace broader than long (1.5:1). Front with four nearly equal median teeth and two small fronto-orbital teeth; two median teeth project only a part of a millimeter beyond the lateral. Orbits large, extraorbital tooth small. Antero-lateral spines triangular, apparently alternation in size with very small differences. The line connecting the last pair of marginal spines crosses the median line about 5 mm. behind its centre. Postero-lateral and posterior margins straight, without any thickened ridge. Gastral region not clearly marked, mesogastric lobe extremely narrow, gastrocardiac and lateral cardiac

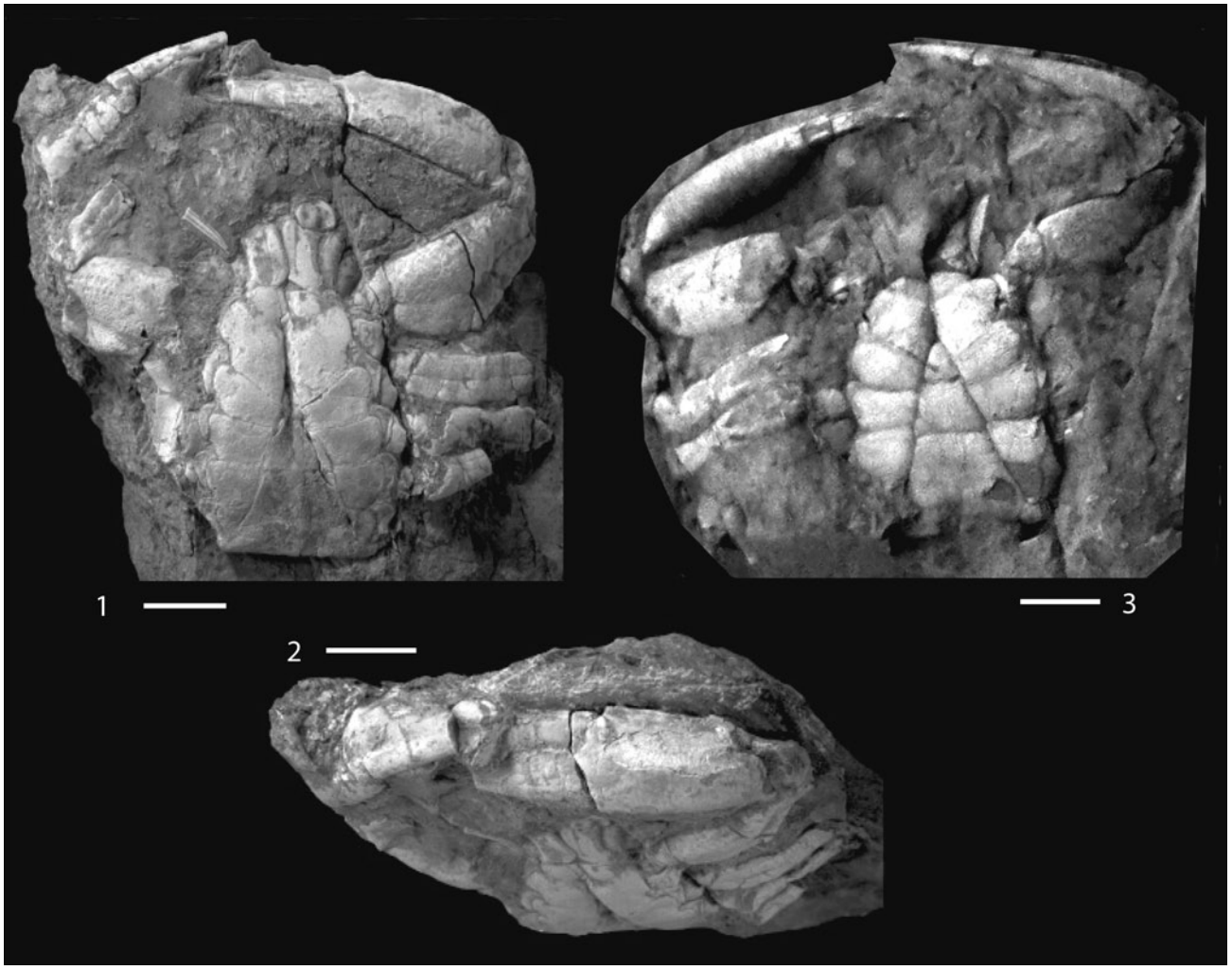

Fig. 5. *Portunus withersi* (Glaessner, 1933). 1, Ventral view of specimen showing operculiform third maxillipeds, sternum, and male pleon. 2, View of outer surface of keeled left chela of same specimen. 3, Ventral view of second male specimen. Scale bars equal 1 cm.

grooves distinct. Surface of carapace covered with coarse granules. A similar granulation on the first sternal segment, the pterygostomian region, the third maxillipeds, and the chelipeds. The lower surface of the cephalothorax shows no feature of specific value. The propodus of the chela has a blunt upper edge, three strong ridges on the outer surface, and two less prominent ridges on the inner side." (Glaessner, 1933, p. 9).

Measurements; "Holotype, In. 24479: length of carapace 55 mm., width of carapace 82 mm., width of front 14 mm. Chela: height 31 mm., length above 34 mm." (Glaessner, 1933, p. 9).

Additional description: The sternum is elongate, relatively slender, widest at sternite 6, bears rounded margins on sternites, and appears to have distinct sutures between the visible sternites, at least laterally. The male pleon is elongate, triangular, with fusion of somites 3–4 and 5–6, and bears a small triangular telson that extends to the posterior part of sternite 4.

Material studied: Two specimens of which one (Fig. 5.1, 5.2), NHM IC 583, is deposited in the Natural History, London. The second specimen (Fig. 5.3) was photographed *in situ* and could not be extracted from the exposure.

Discussion: This species was previously reported from lower Miocene beds of the Fars Group near Sulabadar (Glaessner, 1933). The basis for his description was that of dorsal carapaces, a pleon, and various appendages including the proximal elements of the fifth pereiopod. His comment in the description that there was nothing of diagnostic value on the ventral surface belies the fact that the sternum is exposed surrounding the male pleon.

Placement of the specimens from Bandar-Abbas is based upon characteristics of the sternum, male pleon, and cheliped. Accordingly, the additional description is able to include a description of the sternum and male pleon. The general form of the cheliped is elongate, slender, and keeled which is not particularly diagnostic of the species, but is certainly similar to that seen on many portunids. Unfortunately, attempts to expose the dorsal carapace were not successful as the specimens seem to be limited to the ventral surfaces and pleon. Thus, the placement in *Portunus withersi* is done with some caution, but until better and more complete material is found this seems to be the best assignment.

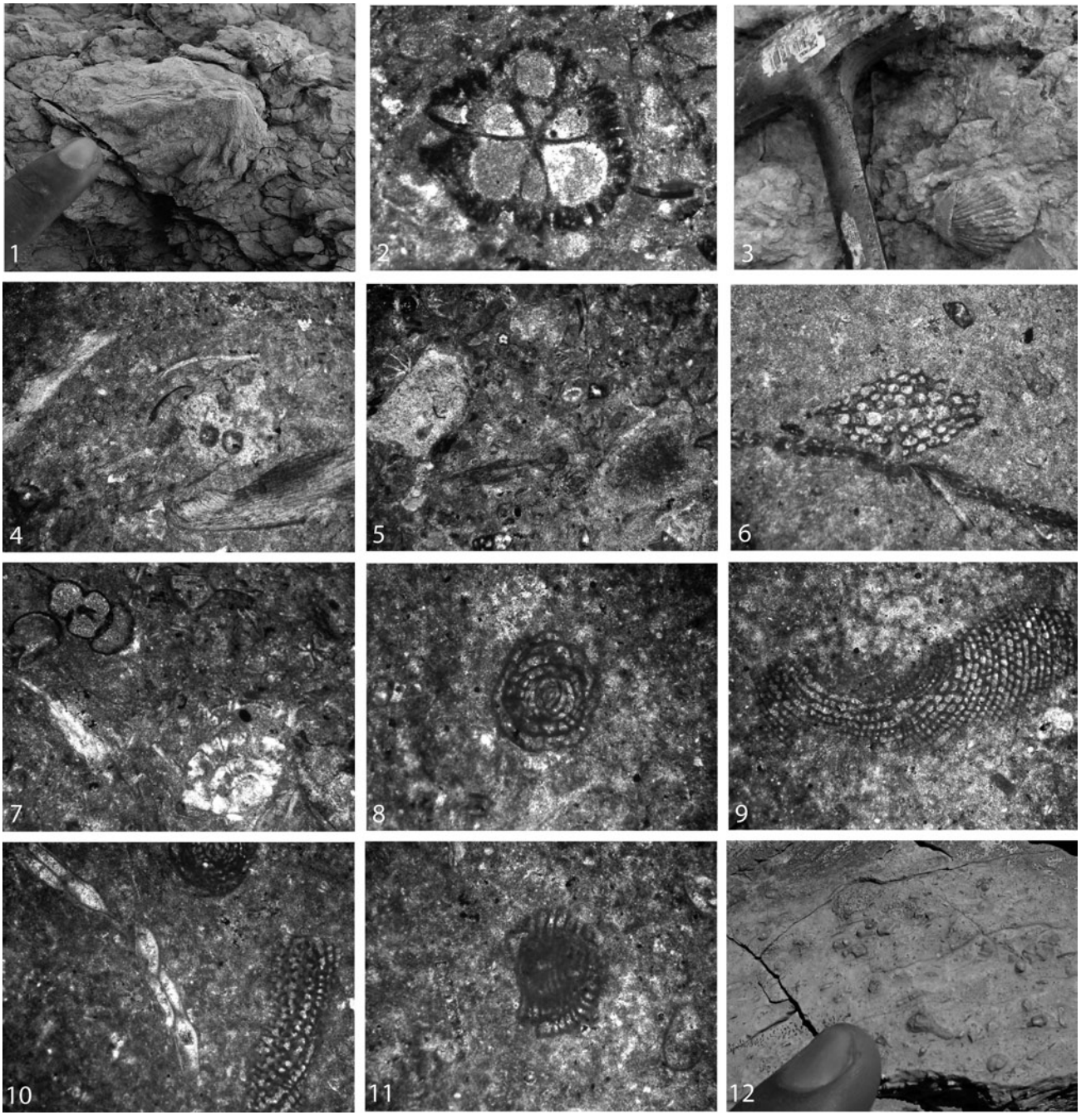

Fig. 6. Biotic allochems associated with Portunites withersi. 1, A large colony of bryozoans. 2, Transverse section of a bryozoan. 3, A large bivalve. 4, Cross-sections of brachiopod shells. 5, Sections through echinoid plates. 6–11, Sections through large benthic foraminiferans. 12, Bedding surface preserving coral specimens.

Discussion of the fauna

Glaessner (1933) observed that the crabs from Iran were generally unlike the Miocene faunas of Europe and suggested Indo-Pacific affinities. Vega *et al*. (2010) recognized several crabs in the Mishan Formation (Miocene in age) in Hormozgan Province, and also believed that the recognized crabs exhibited Indo-Pacific affinities.

Sedimentary environment

Interpretation of the sedimentary environment represented by the rocks in which the crabs were preserved can help us interpret the paleoecology and paleogeography of the study area. Therefore, to interpret the paleoenvironment, it is necessary to recognize the allochems that are associated with the crabs.

The limestone layers that contain crabs are often associated with allochems including about 5% large colonies of bryozoans (Fig. 6.1, 2),

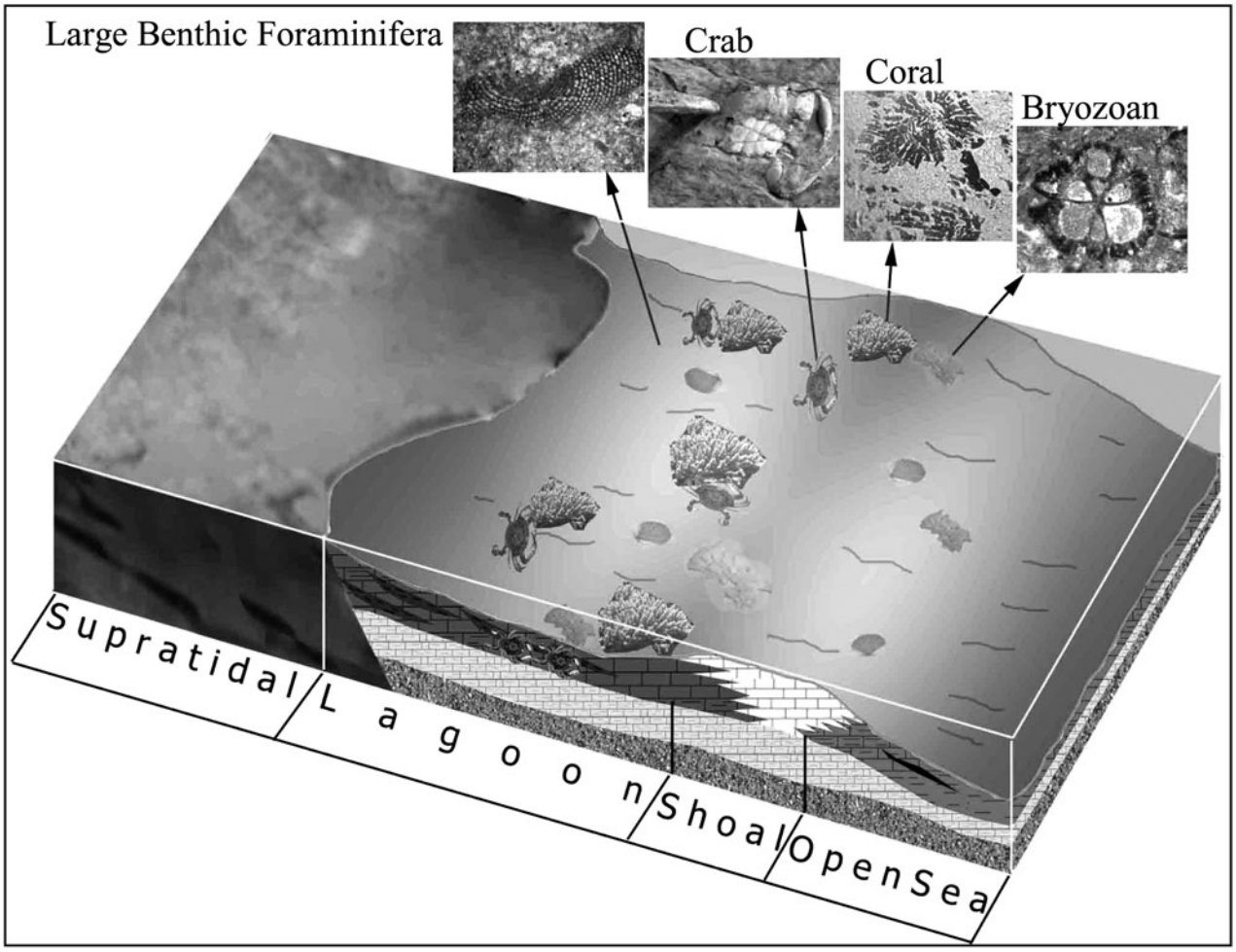

Fig. 7. Three dimensional model of the sedimentary environment from which crabs were collected.

4% bivalves (Fig. 6.3), 3% brachiopods (Fig. 6.4), 3% echinoids (Fig. 6.5), and 10% large benthic foraminiferans (Fig. 6.6–11). The limestone layer which covered the crabs layer is composed of more than 60% corals (Fig. 6.12), which disappeared laterally. The coral accumulations probably formed as patch reefs.

Large benthic foraminiferans which have porcellaneous walls (Fig. 6.6 –11) often are eurihaline and can live in a wide range of salinities (Flugel, 2004, Shahin, 2001); however, the rest of the allochems are stenohaline and are sensitive to changes of salinity (Flugel, 2004; Bachmann and Hirsch, 2006). Based on the mentioned allochems in the crab layers and corals which overlie them, we suggest an open lagoon with high flow of sea water which contained some patch reefs for the sedimentary environment of crabs (Fig. 7).

References

Aghanabati, A. (2004), Geology of Iran. 586 pp., Geological Survey of Iran, Tehran. (in Iranian)

Bachmann, M. and F. Hirsch (2006), Lower Cretaceous carbonate platform of the eastern Levant (Galilee and the Golan Heights), stratigraphy and second-order sea-level change. Cretaceous Research, 27, 487–512.

Barzgar, P. (1981), Razak fault. Third Geology of Iran Symposium, Iranian Petroleum Society, Abstract Volume (in Iranian).

Boscence, D. (2005), A genetic classification of carbonate platforms based on their basinal and tectonic settings in the Cenozoic. Sedimentary Geology, 175, 49–72.

Feldmann, R. M., A. Kolahdouz, B. Biranvand, and G. Schweigert (2007), A new family, genus, and species of lobster (Decapoda: Achelata) from the Gadvan Formation (Early Cretaceous) of Iran. Journal of Paleontology, 81, 405–407.

Flugel, E. (2004), Microfacies of Carbonate Rocks Analysis Interpretation and Application. 976 p., Springer-Verlag, Amsterdam.

Glaessner, M. F. (1933), New Tertiary crabs in the collection of the British Museum. Annals and Magazine of Natural History, (10), 12, 1–28, pls. 1–6.

Glaessner, M. F. (1969), Decapoda, pp. R400–R533, R626–R628. In R. C. Moore (ed.), Treatise on Invertebrate Paleontology, R (4)(2). Geological Society of America, Boulder, Colorado, and University of Kansas Press, Lawrence, Kansas.

Gulf Petrolink (1998), Exploration and production features United Arab Emirates and Iran. Geo Arabia, 3, 427–455.

Haynes, S. J. and H. McQuillan (1974), Evolution of the Zagros Suture Zone, Southern Iran. Geological Society of America Bulletin, 85, 739–744.

Homaiun-Zadeh, S. (2002), Lithostratigraphy and biostratigraphy of Mishan Formation in central part of Dezful Embayment. 94 p., M.Sc. Thesis, Tarbiat-Moalem University, Tehran, Iran.

James, G. A. and J. G. Wynd (1965), Stratigraphic nomenclature of Iranian

Oil Consortium Agreement Area. American Association of Petroleum Geologists Bulletin, 49, 2182–2245.

Kalantari, A. (1992), Lithostratigraphy and microfacies of Zagros orogenic area South-West Iran. National Iranian Oil Company, Exploration and Production, Geological Laboratories Publication, 12, 1–421.

Karasawa, H., C. E. Schweitzer, and R. M. Feldmann (2008), Revision of Portunoidea Rafinesque, 1815 (Decapoda: Brachyura) with emphasis on the fossil genera and families. Journal of Crustacean Biology, 28, 82–127.

Kashfi, M. S. (1982), Guri Limestone, a new hydrocarbon reservoir in south Iran. Journal of Petroleum Geology, 5, 161–171.

Koop, W. J. and R. Stoneley (1982), Subsidence history of the Middle East Zagros Basin, Permian to Recent. Philosophical Transactions of the Royal Society, London, Series A, 305, 149–168.

Latreille, P. A. (1802-1803), Histoire naturelle, générale et particulière, des Crustacés et des Insectes, 3, 1–468. F. Dufart, Paris.

Linnaeus, C. [von] (1758), Systema Naturae per Regna tria Naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis (ed. 10), 1, 1–824. Laurentii Salvii, Holmiae [= Stockholm].

McCobb, L. M. E. and V. Hairapetian (2009), A new lobster *Paraclytia valashtensis* (Crustacea, Decapoda, Nephropidae) from the Late Cretaceous of the central Alborz Range, Iran. Paläontologische Zeitschrift, 83, 419–430.

Molinaro, M., J. C. Guezou, P. Leturmy, S. A. Eshraghi, and D. F. de Lamotte (2004), The origin of changes in structural style across the Bandar-Abbas syntaxis, SE Zagros (Iran). Marine and Petroleum Geology, 21, 735–752.

Motiei, H. (1993), Treatise on Geology of Iran, Stratigraphy of Zagros. 536 p. Geological Survey of Iran, Tehran. (in Iranian)

Mouthereau, F., O. Lacombe, and B. Meyer (2006), The Zagros folded belt (Fars, Iran): Constraints from topolgraphy and critical wedge modeling. Geophysical Journal International, 165, 336–356.

Movahed, B. (1995), Petrology, microfacies, and sedimentary environment of Guri Member from Mishan Formation in North of Bandar-Abbas region. 75 p. M.Sc. Thesis, University of Tarbiat Moalem of Tehran. (in Iranian)

Rafinesque, C. S. (1815), Analyse de la nature, ou tableau de l'univers et des corps organisées. 1–224. L'Imprimerie de Jean Barravecchia, Palermo.

Shahin, A. M. (2001), Mass extinction and bioevents across the Paleocene Eocene boundary in the western Sinai, Egypt. Neues Jahrbuch für Geologie und Paläontologie, Monatscheft, 1, 1–20.

Stocklin, J. (1968), Structural history and tectonics of Iran: a review. American Association of Petroleum Geologists Bulletin, 52, 1229–1258.

Stocklin, J. and A. Setudehnia (1991), Stratigraphic lexicon of Iran. Geological Survey of Iran., Report, 18, 1–376.

Toraby, H. and M. Yazdi (2002), First report on Miocene decapod fauna (Crustacea) from central Iran, a preliminary study on their environmental and ecological factors. Geological Society of Australia Abstracts, 68, 156.

Vega, F. J., H. Gholamalian, and A. Bahrami (2010), First record of Miocene crustaceans from Hormozgan Province, Southern Iran, Paläontologische Zeitschrift, 84, 485–493.

Weber, F. (1975), Nomenclator entomologicus secundum entomologiam systematicum ill. Fabricii, adjectis specibus recens detectis et varietatibus. viii + 172 pp. Chilonii [Kiel] & Hamburgi.

Yazdi, M., A. Bahrami, and F. J. Vega (2009), Albian decapod Crustacea from Southeast Esfahan, Central Iran-Kolah-Qazi area. Bulletin of the Mizunami Fossil Museum, 35, 71–77.

Yazdi, M., A. Bahrami, and F. J. Vega (2010), Additions to Albian (Cretaceous) Crustacea from Iran. Boletín de la Sociedad Geológica Mexicana, 62, 207–211.

Ziegler, M. A. (2001), Late Permian to Holocene paleofacies evolution of the Arabian Plate and its hydrocarbon occurrences. GeoArabia, 6, 445–504.

Manuscript accepted on June 13, 2011