

On some Paleogene and Neogene crabs of Kachchh, Western India

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Abstract

Three species of crabs are here reported from the Lower Miocene Khari Nadi Formation at Matanomadh and Lakhpat sections, Western India. *Philyra karkata* new species is included. *Palaeocarpilius* cf. *P. rugifer* Stoliczka, 1871 is first reported from the Middle Eocene Fulra Limestone at Lakhpat section.

Key words: Decapoda, Brachyura, Cenozoic, India

Introduction

Paleogene and Neogene crabs have been recently reported from Western India by several authors (Schweitzer *et al.*, 2004; Ralte *et al.*, 2009; Vega *et al.*, 2010, among others). We report here occurrence of *Palaeocarpilius* cf. *P. rugifer* Stoliczka, 1871 from the Middle Eocene Fulra Limestone at Lakhpat section. *Raninoides* sp., *Philyra karkata* new species and *Hexapinus?* sp. occur in Lower Miocene rocks of the Khari Nadi Formation at Matanomadh and Lakhpat sections. Although preservation of most specimens is not ideal, this report is important to reinforce paleobiogeographic affinities of Miocene brachyuran assemblages with those of the same age for the Indo-Pacific region.

Geology of the Area

The best developed sequence in the Kachchh basin lies in the south-western part and is represented by paralic largely Paleogene/Neogene sequences overlying the Deccan basalts. Palaeocene sediments consist of red lateritic and tuffaceous, trap-wash material which contain plant fossils and represent fluvio-lacustrine conditions (Fig.1). Wynne (1872) informally classified the Paleogene/Neogene sediments of Kachchh into seven “groups”. The time-stratigraphic classification for these rocks was proposed earlier (Biswas, 1965; 1971; 1972) and later the lithostratigraphic classification was designated (Biswas and Raju, 1973; Biswas, 1992) containing eight formations with type sections and details of contacts. The formations in descending order are as follows:

1. Matanomarh Formation = ?Palaeocene
2. Naredi Formation = Lower Eocene
3. Harudi Formation = Late Middle Eocene
4. Fulra Limestone Formation = Late Middle Eocene
5. Maniara Fort Formation = Oligocene
6. Khari Nadi Formation = Lower Miocene
7. Chhasra Formation = Upper Miocene
8. Sandhan Formation = Pliocene

The earliest Paleogene marine transgression is represented by the Naredi Formation. From its basal succession a diversified datable dinoflagellate assemblage assignable to the Lower Ypresian has been recovered (Garg *et al.* 2011). The Harudi and Fulra Limestone formations contain datable calcareous nannofossils, dinoflagellates planktonic and larger foraminifers and a precise Bartonian age is suggested for these formations (Rai, 1997; 2007). Late Eocene (Priabonian) is a hiatus in entire Kachchh Basin. The Maniara Fort and Vinjhan Shale formations also contain datable calcareous nannofossils. The Chhasra Formation is represented by the lower Claystone Member with grey and khaki coloured, laminated gypseous shales with alternating thin hard yellowish highly fossiliferous limestones. The upper Member is mainly represented by siltstone with alternating micaceous siltstone and laminated silty shales of khaki colour. In south-western Kutch, Mesozoic and the Paleogene/Neogene sequences are covered by recent and sub-recent alluvium.

The giant fossil crab *Palaeocarpilius* cf. *P. rugifer* was recovered from the Fulra Limestone Formation present near Lakhpat Fort cliff section (68°46'30.43"E : 23°49'52.57"N), whereas all other small fossil crabs were obtained from the Miocene Maniara Fort Formation exposed on Matanomarh - Denma Road (68°57'E : 23°32'37"N) and near Lakhpat (68°47'E : 23° 49'30"N). Additionally, the Miocene crab bearing horizons are found associated with mainly coastal dwelling vertebrates such as fishes, turtles, crocodiles and sea cows (Sahni and Mishra, 1975) shown in Fig. 2.

Systematic Paleontology

Section Raninoida Ahyong, Lai, Sharkey, Colgan and Ng, 2007

Superfamily Raninoidea De Haan, 1839

Family Raninidae De Haan, 1839

Subfamily Raninoidinae Lörenthey, in Lörenthey and Beurlen, 1929

Genus *Raninoides* H. Milne Edwards, 1837

Type species: *Raninoides laevis* Latreille, 1825, by monotypy.

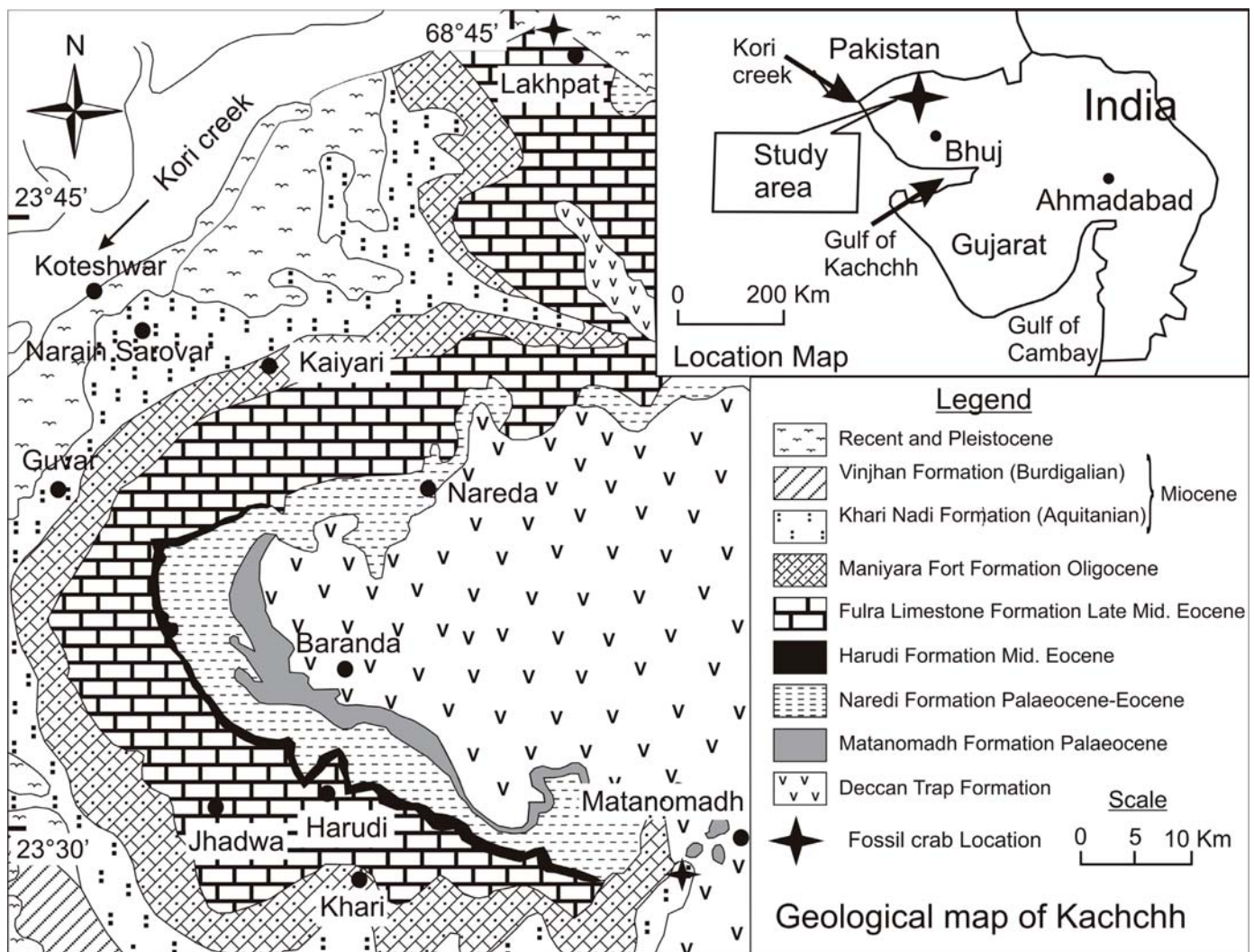


Fig. 1. Geological map of North Western Kachchh indicating formational boundaries and sample locations.

Raninoides sp.

(Pl. 1, Figs. 1, 2)

Description of material: Carapace small, rectangular, elongate, longitudinally nearly flat; orbitofrontal margin about three-fourths the maximum carapace width, small fissure on lateral portion; anterolateral margin short, with small, short spine directed forwards; posterolateral margin long, convex, about four-fifths maximum carapace length; posterior margin curved, two-thirds maximum carapace width; cervical groove sinuous, relatively deep; deep, curved gastrocardiac grooves at midlength of carapace; median ridge extends to anterior margin from middle portion of carapace.

Locality and repository: Lower Miocene Khari Nadi Formation from Lakhpat and Matanomadh Geology Department, Lucknow University, Lucknow. Specimens L.U.V.P 11601; L.U.V.P. 11602.

Measurements (in mm): Specimen L.U.V.P 11601, carapace length = 13.4; width = 8.7; specimen L.U.V.P 11602, carapace length = 15.4, width = 9.8.

Remarks: The two specimens are too incomplete to offer an identification at species level, but are similar to *Raninoides morrissi* Collins, Lee and Noad, 2003, from the Miocene of Sabah. There are also

similarities with the specimen of *Raninoides* sp. figured by Karasawa *et al.* (2008) from the Pleistocene of the Philippines.

Section Eubrachyura de Saint Laurent, 1980

Subsection Heterotremata Guinot, 1977

Superfamily Leucosioidea Samouelle, 1819

Family Leucosiidae Samouelle, 1819

Subfamily Eballiinae Stimpson, 1871

Genus *Philyra* Leach, 1817

Type species: *Leucosia globus* Fabricius, 1775, by subsequent designation of H. Milne-Edwards (1837).

Philyra karkata new species

(Pl. 1, Figs. 3–8)

Diagnosis: Carapace subovate; anterolateral margin inclined; posterolateral margin broadly rounded; posterior margin straight; anterior surface of carapace smooth; dorsal surface covered by granules; fused urogastric and cardiac regions; female abdomen cavity broadly rounded.

Description: Carapace longitudinally subovate; front narrow; anterolateral margin inclined, rimmed with small, evenly-spaced

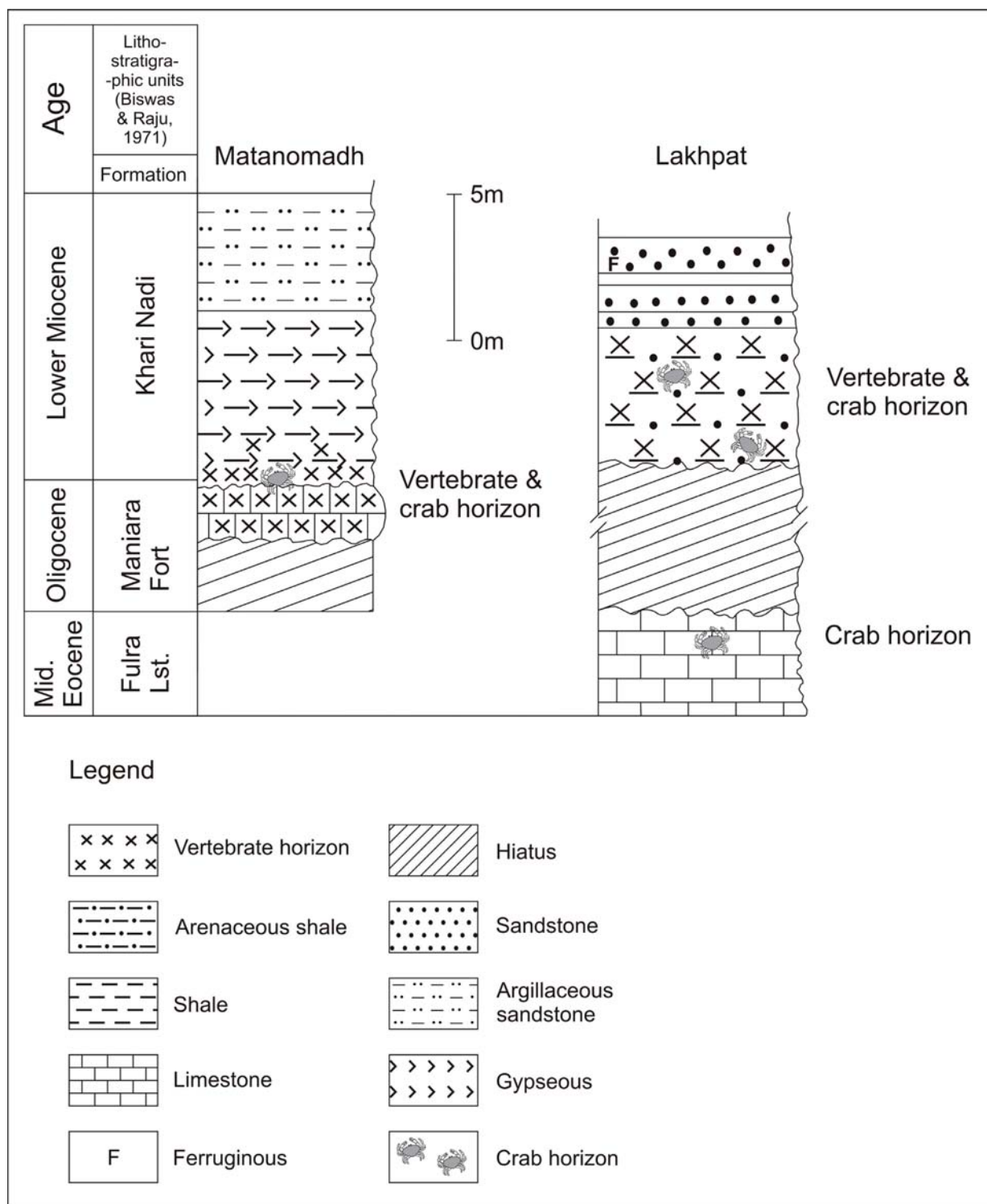


Fig. 2. Stratigraphic sections of study areas indicating occurrence of fossiliferous horizons.

tubercles; posterolateral margin broadly rounded; posterior margin nearly straight, about half the maximum carapace width; anterior surface of carapace smooth; dorsal surface covered by uniformly-sized, evenly-spaced coarse granules; deep, posterolaterally directed groove separates fused urogastric and cardiac regions from branchial areas; base of cardiac region rounded; female abdomen cavity broadly rounded; outer edge of sternites granulose.

Etymology: Species is named after Sanskrit word for crab, karkata.

Locality and repository: Lower Miocene Khari Nadi Formation from Matanomadh Geology Department, Lucknow University, Lucknow. Holotype, L.U.V.P. 11603, paratypes, L.U.V.P. 11606; L.U.V.P. 11607.

Measurements (in mm): Specimen Number 11603, carapace length = 11.8; width = 10.5; Specimen Number 11606, carapace length = 12.0; width = 9.75; Specimen Number 11607, carapace length = 12.0; width = 10.0.

Remarks: Species assigned to the genus *Philyra* were reviewed by

Galil (2009), who suggested that *Philyra sensu stricto* was represented by only two extant species, and present a list of 27 species as *Philyra sensu lato*, pending for further systematic revision. The Indian specimens cannot be placed on any of the seven genera erected by Galil (2009) to contain species previously assigned to *Philyra*, since their morphological features are quite different. Karasawa *et al.* (2008) cited 16 fossil species of *Philyra* from the Miocene to Pleistocene of the Indo-Pacific region. On their systematic list of fossil Decapoda, Schweitzer *et al.* (2010) listed 18 species, also from the Indo-Pacific region. Since no fossil species was considered by Galil (2009) on her review of species of *Philyra*, we follow here the classification presented by Schweitzer *et al.* (2010). Our specimens differ from *Philyra trusanensis* Collins, Lee and Noad, 2003 and *P. granulosa* Morris and Collins, 1991, both from the Miocene of Sarawak, in being more globose, the anterior margin is slightly wider and the posterior margin is narrow and has two posterolateral projections. *Philyra* sp. cf. *P. actidens* Chen, 1987, reported from the Miocene of the Philippines (Karasawa *et al.*, 2008) has weaker granules and straight furrows that separate branchial areas from cardiac and urogastric regions. *Philyra nishimotoi* Karasawa, 1989 and *P. plana* Karasawa, 1989 from the Miocene of Japan, are smaller, have a more rhombic shape of carapace, broader front and weak dorsal granules. *Philyra hayasakai* Karasawa and Inoue, 1992 from the Miocene of Japan, has very deep furrows on the dorsal carapace and granules are weaker. *Philyra miyamotoi* Karasawa and Kishimoto, 1996 from the Miocene of Japan, is more rounded (much wider), has granules on lateral margins and a dorsal surface nearly smooth. *Philyra ferrica* Hu and Tao, 1996, and *P. shihcheni* (Hu and Tao, 1979), both from the Miocene of Taiwan are both more globose and granules of the dorsal carapace are weaker and scarce.

Superfamily Carpioidea Ortmann, 1893

Family Carpioidea Ortmann, 1893

Genus *Palaeocarpilius* A. Milne-Edwards, 1862

Type species: Cancer macrocheilus Desmarest, 1822, by subsequent designation (= *P. macrocheilus* var. *coronata* Bittner, 1886).

***Palaeocarpilius* cf. *P. rugifer* Stoliczka, 1871**

(Pl. 1; Figs. 9, 10)

Description: Carapace of medium size, subovate transversely, one-third wider than long, widest at lower third; transverse ridges on posterior third of carapace reach posterior tubercle of anterolateral margin, anterior margin slightly curved; anterolateral margin curved, three-fourths the maximum carapace length, with seven strong rounded tubercles, the three anterior tubercles more rounded and less prominent, remainder tubercles become longer, most posterior tubercle being stronger; posterolateral margin smooth, one-third the maximum carapace width, inclined 45° respect transversal axis. Female abdomen subovate elongated, telson plus somites 6 to 3 reach half the maximum carapace length, width is one-third the maximum carapace width; telson subtriangular, lateral margins broadly rounded, one fifth the maximum carapace length, one-sixth the maximum carapace width; somite 6 rectangular, slightly wider but shorter than telson; somite 5 rectangular, as wide as somite 6 but half its length; somite 4 similar to somite 5 but slightly shorter; somite 3 very similar in size and shape to somite 4; remainder somites not seen. Chelipeds robust; coxae subrectang 0.5 d from Oligocene and Miocene deposits of India (Stoliczka, 1871; Ralte

et al., 2009; Vega *et al.*, 2010). The specimen here reported is rather small when compared with the mean size of *P. rugifer*, and it was found on Eocene sediments. For this reason, its identification is preliminary until more and more complete specimens are found. This may extend stratigraphic range for *P. rugifer* from the Eocene to the Miocene in India.

Superfamily Hexapodoidea Miers, 1886

Family Hexapodidae Miers, 1886

Genus *Hexapinus* Manning and Holthius, 1981

Type species: Hexapus latipes De Haan, 1835, by original designation.

***Hexapinus?* sp.**

(Pl. 1; Figs. 11–14)

Description: Carapace rectangular, medium-sized, twice wider than long; surface covered with evenly-spaced fine granules; front straight, half the maximum carapace width; anterolateral margin slightly curved; posterolateral margin rimmed; posterior margin straight, two-thirds the maximum carapace width; protogastric region defined by subtle elevation; metagastric region poorly defined; urogastric region narrow and short; cardiac region an inverted triangle with inverted triangular, elongate metabranchial lobes; cervical groove sinuous, clearly impressed; branchiocardiac groove not so evident, extends to anterolateral margins; epi and mesobranchial regions separated by a shallow, tangential groove. Sternum subtrapezoidal, sternite 4 also subtrapezoidal, with notches on anterolateral margins; sternites 5 and 6 rectangular, narrow, slightly wider at lateral margins; male telson triangular, slightly narrow and curve at anterior margin; other sternites and somites not preserved.

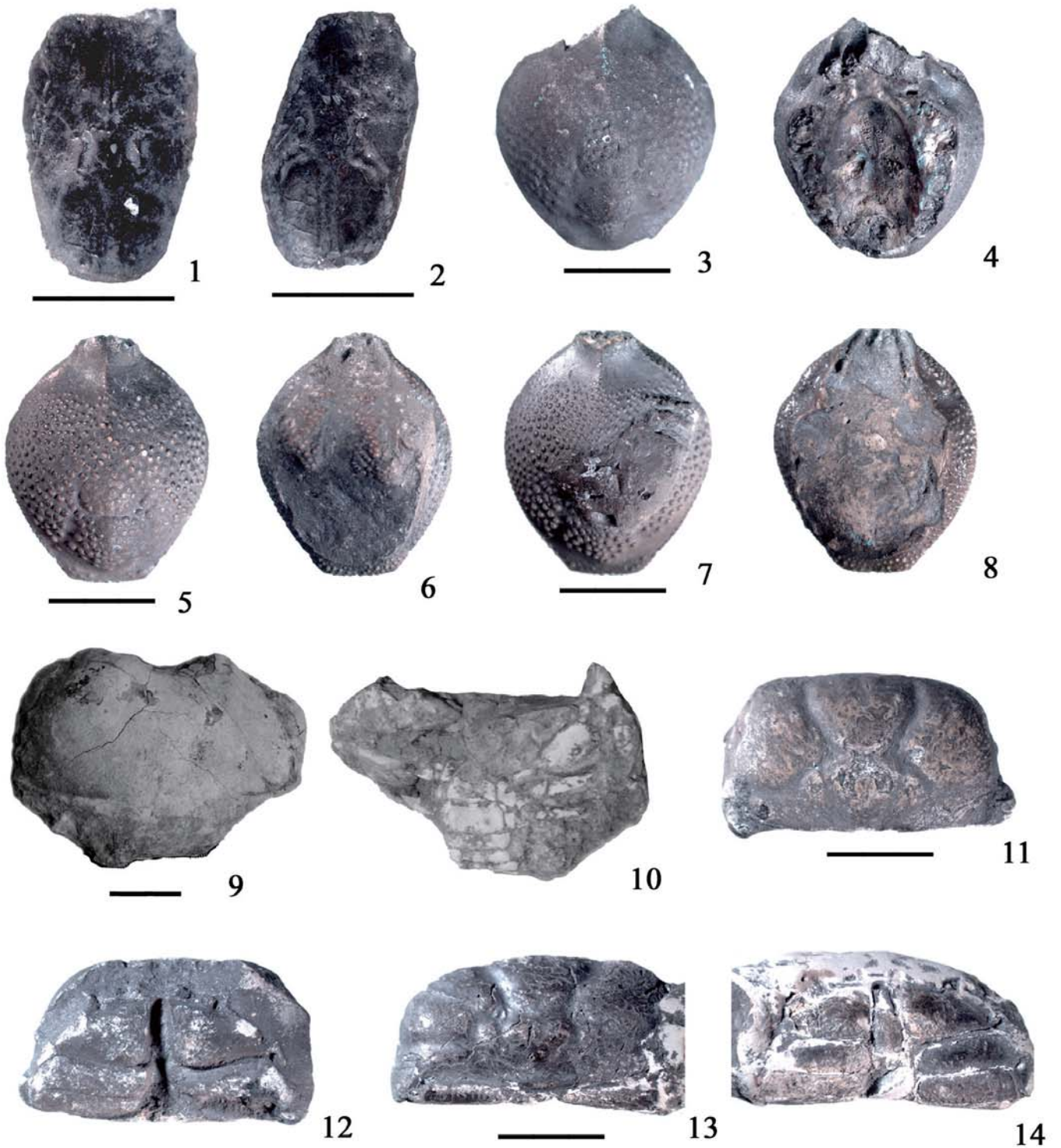
Locality and repository: Lower Miocene Khari Nadi Formation from Lakhpat and Matanomadh Geology Department, Lucknow University, Lucknow. Specimens L.U.V.P. 11604; L.U.V.P. 11605.

Measurements (in mm): Specimen L.U.V.P. 11604, carapace length = 14.8; width = 27.7; specimen L.U.V.P. 11605, carapace length = 11.7, width = 29.1.

Remarks: According to a review of the Hexapodidae (Huang *et al.*, 2002), only three extant species represent the genus *Hexapinus*. Presence of the male abdomen, third maxillipeds and pereopods is extremely important in this family in order to offer a complete diagnosis. Since none of our specimens preserve appendages, we prefer to leave their identification to the generic level, questionably assigned to *Hexapinus*, based on similarities in carapace regions. *Hexapinus* sp. has been reported from the Miocene of Japan (Takeda *et al.*, 1986; Mizuno and Takeda, 1993).

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1, 2. *Raninoides* sp. 1, Dorsal view of specimen L.U.V.P. 11601; 2, Dorsal view of specimen L.U.V.P. 11602. 3–8. *Philyra karkata* new species. 3, Dorsal view of holotype, L.U.V.P. 11603; 4, Ventral view of same specimen; 5, Dorsal view of paratype L.U.V.P. 11606; 6, Ventral view of same specimen; 7, Dorsal view of paratype L.U.V.P. 11607; 8, Ventral view of same specimen; 9, 10. *Palaeocarpilius* cf. *P. rugifer* Stoliczka, 1871. 9, Dorsal view of specimen Number 39991, 10, Ventral view of same specimen. 11–14. *Hexapimus?* sp. 11, Dorsal view of specimen L.U.V.P. 11604; 12, Ventral view of same specimen; 13, Dorsal view of specimen L.U.V.P. 11605; 14, Ventral view of same specimen. Scale bars = 1 cm.

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