

CANGROID CRABS FROM THE QUILON BEDS (LOWER MIOCENE) OF KERALA, INDIA

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ABSTRACT

Two cancroid crabs, *Palaeocarpilius rugifer* Stoliczka and *Callinectes quilonensis* n. sp., discovered by the author from the Quilon Beds (Lower Miocene) of Kerala, India, are systematically described. This is the first record of the occurrence of crabs in this formation. The genus *Callinectes* is recorded for the first time from India. A brief summary of the geology of the collecting localities is given. The crabs were found associated with a rich assemblage of micro- and mega-foraminifera and other invertebrates. The age relationship of the crab fauna is discussed. The fossils indicate a Lower Miocene (Aquitanian-Burdigalian) age for the Quilon Beds.

INTRODUCTION

Two fairly complete crabs were discovered by the author during 1965 from the Quilon Beds exposed at Edavai (8° 46': 76° 41'; Survey of India sheet 58 D/9) and Paravur (8° 49': 76° 40'; Survey of India sheet 58 D/9), south of Quilon (8° 53': 76° 35'; Survey of India sheet 58 D/9), in the Kerala State, India (Text fig. 1). These beds form a part of the marine Tertiary formations of the west coast of India. The Quilon Beds crop out at a very few places along the Kerala coast and our knowledge of these beds is mainly inferred from well sections and boreholes.

The Quilon Beds of Kerala coast (Fig. 1) occupy an important place in Indian stratigraphy as they afford an evidence of a marine transgression along the south-west coast of India during Miocene times and are comparable to similar marine deposits along north-western and western parts of Indian subcontinent.

PREVIOUS WORK

Quilon Beds were first referred to by Carter (1854) in connection with the discovery of fossils by General Cullen in 1853 from the grey fossiliferous and argillaceous limestone near Quilon on the Kerala coast. Subsequently King (1882), who examined the coastal Tertiaries of Kerala, could not locate this fossiliferous limestone. The Quilon limestone was rediscovered by Logan (in Medicott, 1884; p. 9). A summary of the previous palaeontological work done on these beds is given by Eames (1950; p. 235). The fauna, age and affinities of these beds is further discussed by a number of workers (Jacob and Sastri, 1951 and 1952; Sahni and Sastry,

1958; Dey, 1962; Poullose and Narayanaswami, 1968). The writer found no reference to the occurrence of fossil crabs in the Quilon Beds. However, a similar crab fauna has been reported from a few other localities in the Tertiaries of the Indian sub-continent, namely, Sind and Baluchistan (Pakistan), Kutch, Kathiawar and Bombay (India) (Stoliczka, 1871; Das Gupta, 1925; Withers, 1932; Glaessner, 1933; Mathur, 1963, 1968 a, b).

STRATIGRAPHY

King (1882), who was first to map the Tertiary deposits of Kerala coast, could not locate the Quilon Beds, but he described fresh-water Warkalli Beds containing lignite seams from this area, and assigned Upper Tertiary age to the latter. The Warkalli Beds are now generally considered to be slightly younger than Quilon Beds. Carter (1857) suggested Eocene age for the Quilon Beds on the basis of the fossils collected by General Cullen.

The stratigraphic position of the Quilon Beds is given in the following table:

Rock unit	Geological age
Soils and Alluvium	Recent to Sub-recent
Warkalli Beds (fresh-water)	Mio-Pliocene
.....Overlap.....	
Quilon Beds (marine)	Lower Miocene
.....Unconformity.....	
Metamorphics	Archaean

GEOLOGICAL MAP OF KERALA BETWEEN TRIVANDRUM AND QUILON, SHOWING FOSSIL LOCATION.

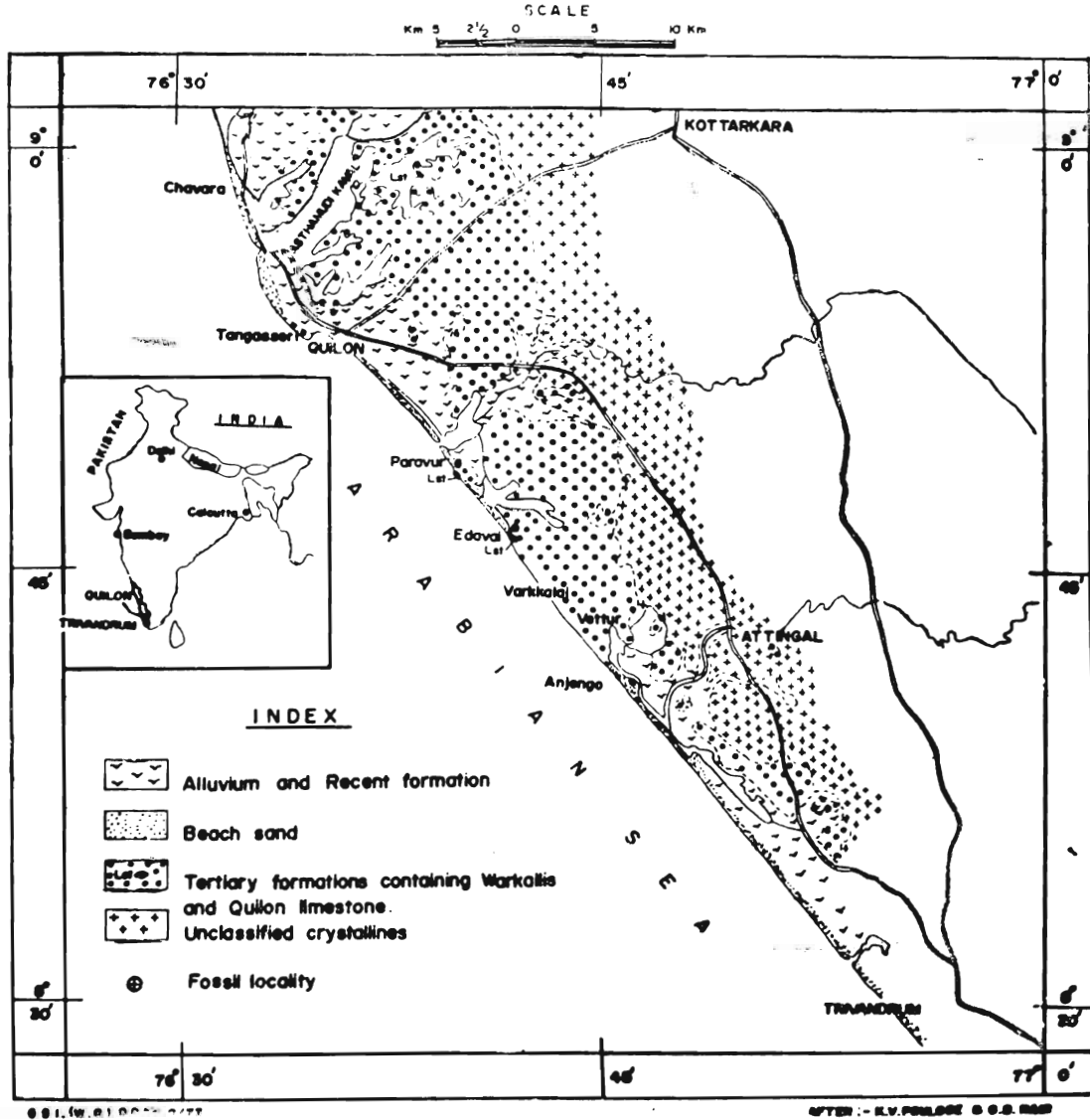


Fig. 1—Geological Map of Kerala between Trivandrum and Quilon, showing Fossil Location.

The outcrop of the Quilon Beds at Paravur is small; the base of the section is not visible, being covered by beach sand; and the succession is as follows:

The following sequence was observed at Edavai, where also the base is not seen, being covered by beach sand:

Rock unit	Bed no.	Lithology	Thick-ness
Warkalli Beds	6	Laterite 2.5 m
	5	White clay, sand and gravel 1.5 m
	4	Lateritised sandstone 1.0 m
	3	Carbonaceous clay 0.8 m
.....Overlap			
Quilon Beds	2	Soft fossiliferous clayey limestone..	.. 0.5 m
	1	Hard grey fossiliferous limestone..	.. 0.5 m
Base covered			

Rock unit	Bed no.	Lithology	Thick-ness
Warkalli Beds ..	5	Laterite 3.0 m
	4	Lateritised sandstone 4.0 m
	3	Variegated clays 1.0 m
.....Overlap			
Quilon Beds ..	2	Soft fossiliferous clayey limestone..	.. 0.7 m
	1	Hard compact bluish grey highly fossiliferous limestone..	.. 0.4 m
Base covered			

In both the sections mentioned above the hard fossiliferous limestone is exposed at the sea level. During high tide the outcrops of the Quilon Beds are completely covered by water.

MATERIAL

The material described in this paper consists of two specimens of fossil crabs which are fairly complete. The specimen of *Callinectes quilonensis*, collected at Paravur, is deeply embedded in the hard matrix of fossiliferous limestone (bed no. 1) and only the weathered ventral surface is exposed. A part of the dorsal surface of the carapace could, however, be extracted from the matrix. Its ventral surface shows almost the entire carapace with merus, carpus and manus of both chelipeds. The dactylus and cutting teeth are well preserved on each manus. No other appendage is preserved.

The specimen of *Palaeocarpilius rugifer*, collected at Edavai, was recovered from the rather soft fossiliferous clayey limestone (bed no. 2). The specimen shows both dorsal as well as ventral surfaces. The ventral surface exhibits the partially preserved exoskeleton; both chelipeds with marus, carpus and manus with dactylus and propodus; one abdominal segment and two thoracic segments. The carapace on the dorsal side is not preserved.

Both these specimens are preserved in the Type Collection of the Geological Survey of India and are illustrated by means of photographs as well as drawings.

SYSTEMATIC DESCRIPTION

- Phylum* Arthropoda
- Class* Crustacea
- Sub Class* Malacostraca
- Order* Decapoda
- Family* Xanthidae
- Genus* *Palaeocarpilius* Milne-Edwards 1862
- Palaeocarpilius rugifer* Stoliczka 1871

(Table I and Figs. 2, 3, 4, 5, and 6)

Type No.—Geological Survey of India Type Number 18352. Almost complete specimen.

DESCRIPTION

Carapace.—Carapace transversally ovate, very convex, the front almost perpendicularly deflected. Ventral surface and postero-lateral margins smooth.

Merus.—Very strong, anteriorly ridged, surface smooth with a large tubercle near its articulation with the carpus.

Carpus.—Surface smooth, three prominent rounded tubercles on upper surface, one near the articulation

Table I

Principal features of the crabs from the Quilon Beds of Kerala, India

	<i>Palaeocarpilius rugifer</i> Stol.	<i>Callinectes quilonensis</i> n. sp.
Carapace:		
Length ..	Incomplete ..	61 mm (estimated)
Width ..	140 mm ..	94 mm (estimated)
Texture ..	Smooth ..	Densely granular, coarse on elevated portions
Fronto-orbital region:		
Width ..	Incomplete ..	46 mm (estimated)
Position of orbits ..	Indeterminate..	Lower margin of the orbit at level of antero-lateral margins.
Antero-lateral teeth:	Not preserved..	Eight teeth, triangular, tips acute, both margins concave, Lateral spine stout, one and half times the length of the preceding tooth.
Chelipeds:		
Merus width..	27 mm ..	Incomplete
length ..	30 mm ..	Incomplete
Carpus width ..	28 mm ..	Incomplete
length ..	27 mm ..	Incomplete
Manus width ..	41 mm ..	20 mm
length ..	40 mm ..	40 mm
Dactylus length ..	26 mm ..	24 mm
	No cutting teeth.	Prominent cutting teeth.

with merus and the other near the articulation with carpus, and the third one in between the above two.

Manus.—Very strong and robust; right one slightly longer, wider and more compressed laterally than the left; each ridged on inner surface; chela strongly rugose with large obtuse tubercles at the base of the fingers. The upper side of both chelipeds crowned with four to seven large obtuse tubercles. Inner surface of manus with evenly distributed granulations.

Dactylus.—Incomplete, distal ends missing; one strong tubercle on upper side near the base; cutting teeth missing; outer and inner surfaces equally granulated; right finger broadly flattened as compared to the left one which is thinner and perhaps longer.

Propodus.—Incomplete, broken off distally, teeth missing.

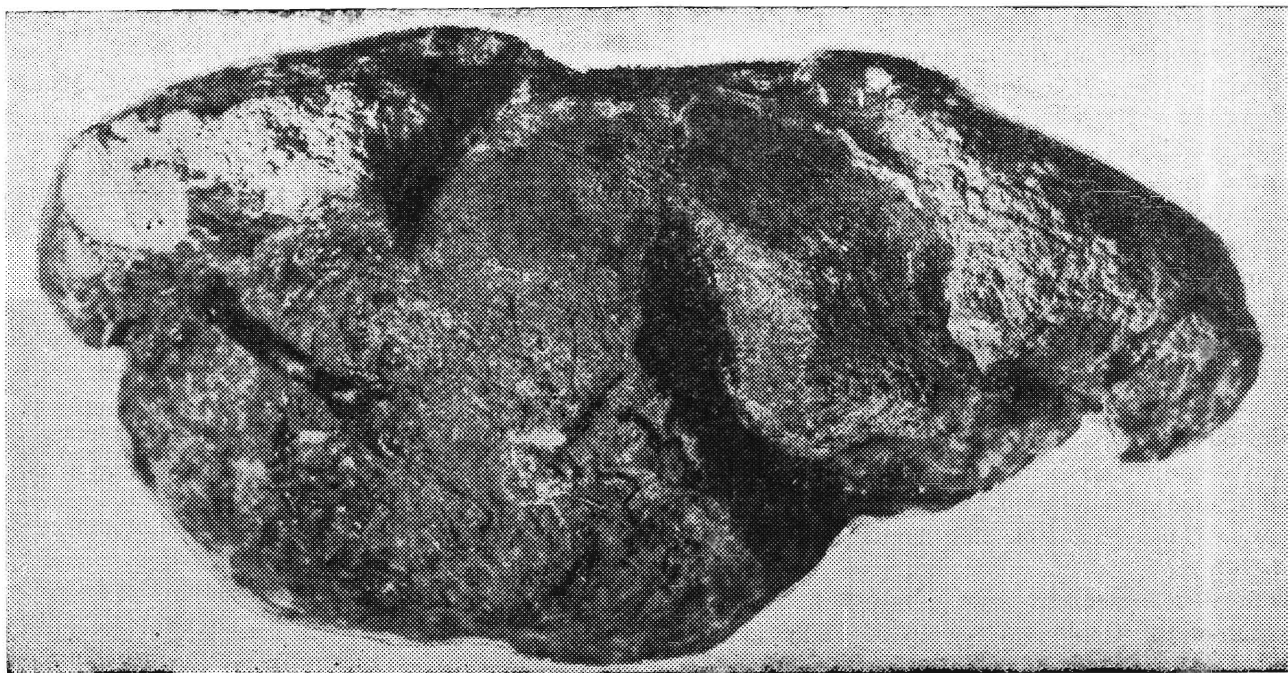


Fig. 2—*Palaeocarpilius rugifer* Stol. $\times 1.25$ GSI 18352; dorsal view.

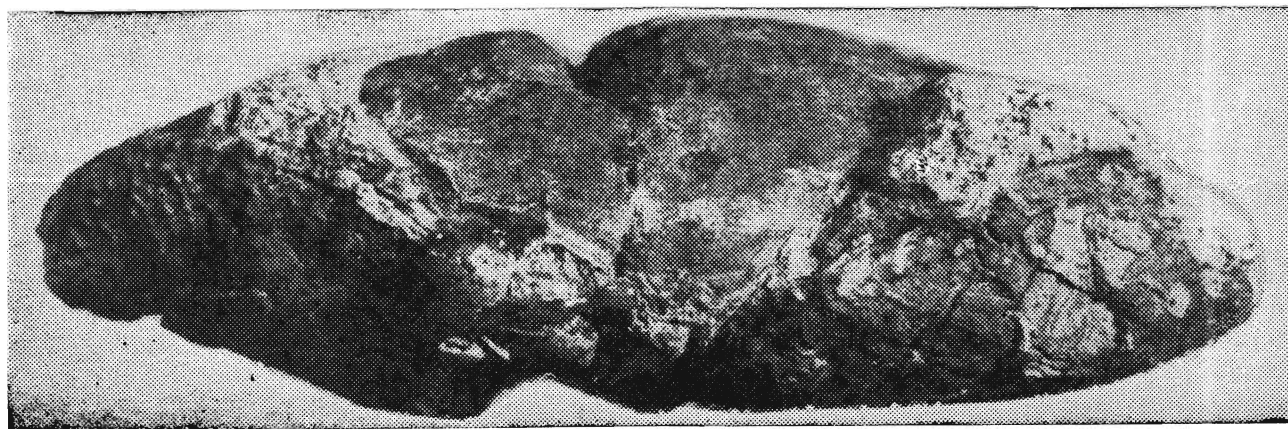


Fig. 3—*Palaeocarpilius rugifer* Stol. $\times 1.25$ GSI 18352; frontal view.

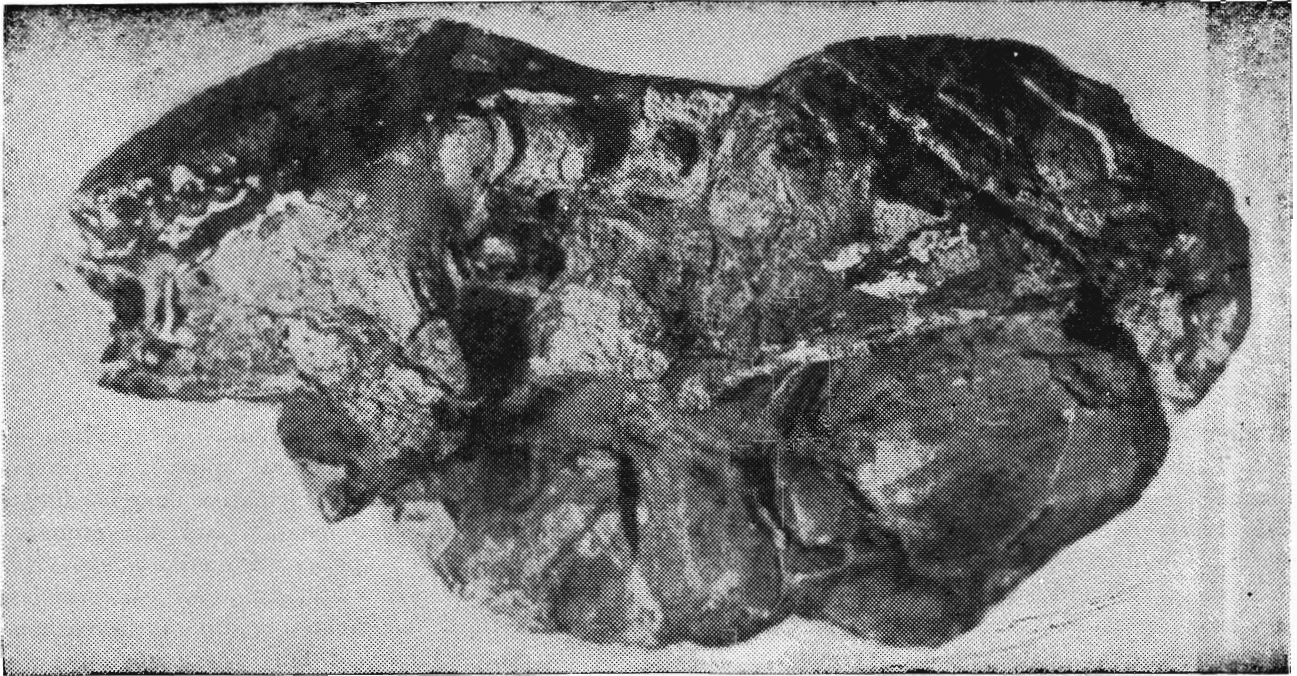


Fig. 4—*Palaeocarpilius rugifer* Stol. $\times 1.25$ GSI 18352; ventral view.

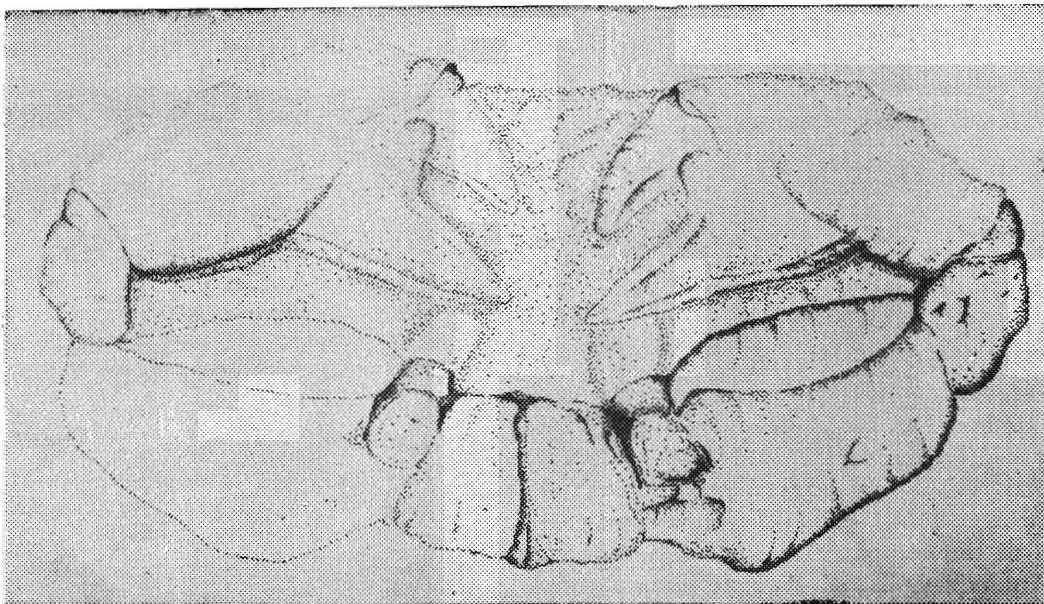


Fig. 5—*Palaeocarpilius rugifer* Stol. $\times 1.00$ GSI 18352; reconstruction in outline of ventral view.

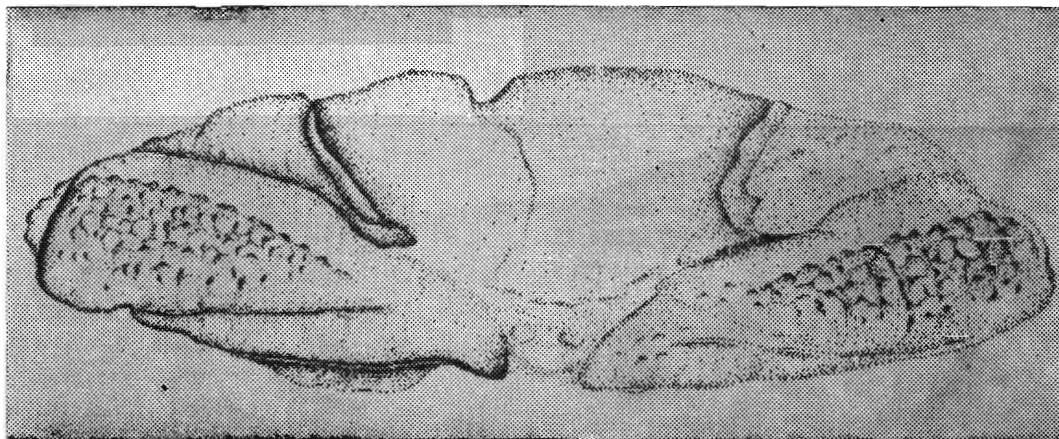


Fig. 6—*Palaeocarpilius rugifer* Stol. $\times 1.00$ GSI 18352; reconstruction in outline of frontal view.

Abdomen.—Only the first segment is preserved, the shape and size of which suggest that the specimen is of a female.

Discussions.—Such features as the shape of the carapace, character of the fronto-orbital region, the shape and size of the merus, carpus and manus suggest that the specimen belongs to the genus *Palaeocarpilius* Milne-Edwards. The conspicuous rugosities on the upper and outer side of the chelipeds and the nature of the tubercles at the upper edge of the propodus on both the chelipeds are characteristic of the species *P. rugifer* Stoliczka. This species has been reported from the Tertiary deposits of Sind (Pakistan) and Kutch (India) (Stoliczka, 1871).

Locality.—At the base of the sea-cliff near Edavai. Specimen collected from bed number 2 of the cliff section.

Family Portunidae
Genus *Callinectes* Stimpson 1860
Callinectes quilonensis sp. nov.

(Table I and Figs. 7, 8, 9)

Holotype.—Geological Survey of India Type Number 18353. Almost complete crab embedded in hard fossiliferous limestone.

Description:

Carapace.—Broadly oval, moderately convex, one and half times as broad as long. Granules of moderate size, densely spaced on the cardiac and inner branchial regions, scattered and faintly marked on the anterior half of the carapace. Fronto-orbital border almost one-fifth the width of the carapace; frontal teeth missing; orbits fairly large, well separated, their posterior margin slightly longer than the anterior one. Antero-lateral teeth eight in number, triangular, tips acute, more or

less concave on both the margins, slightly directed upwards and forwards. Lateral spine very prominent, about one and half times the length of the preceding tooth. All antero-lateral teeth smooth and non-granulated.

Carpus.—Poorly preserved; surface smooth with faint, evenly distributed granulations; short and stout, about one-third the greatest width of the carapace.

Dactylus.—Preserved fairly complete on both the chelipeds, very slender, thick at the base; inner margins of the fingers contain stout conical cutting teeth which differ in shape and size. Only six cutting teeth could be made out on the right dactylus, the proximal one is strong and the rest are comparatively small; the second and third are almost of the same size, the fourth is slightly larger than the preceding one, the fifth again slightly larger than the former. The proximal tooth of the left dactylus is very strong and outstanding. The cutting



Fig. 7—*Callinectes quilonensis* n. sp. $\times 0.60$ GSI 18353; ventral view.

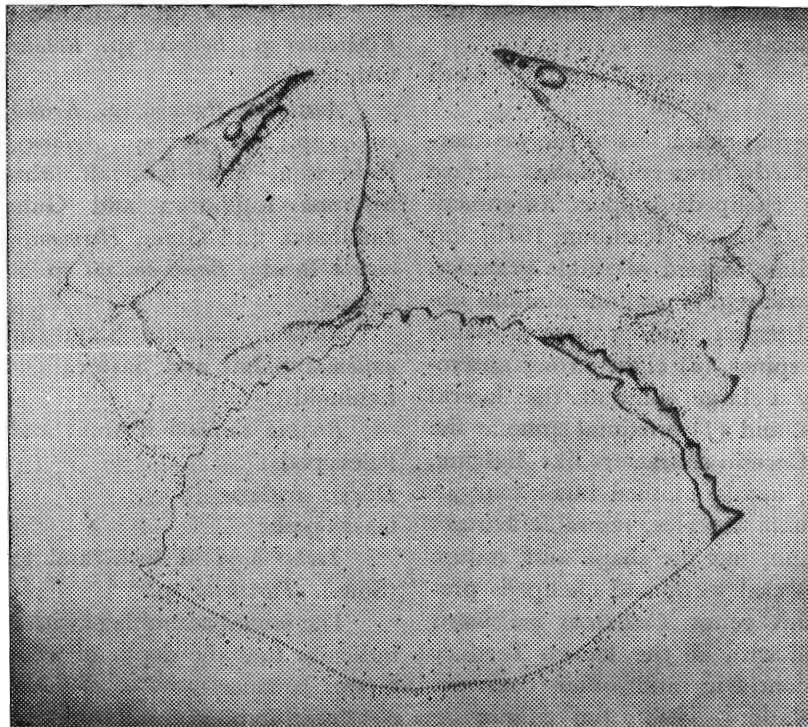


Fig. 8—*Callinectes quilonensis* n. sp. $\times 0.85$ GSI 18353; reconstruction in outline of ventral view.

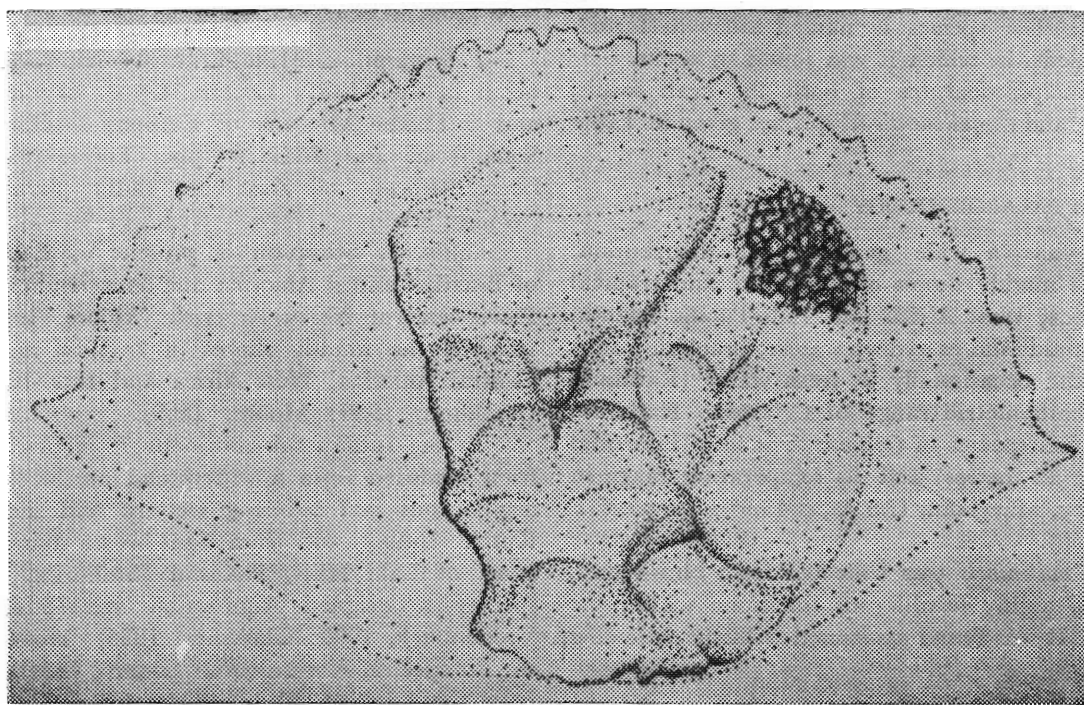


Fig. 9—*Callinectes quilonensis* n. sp. $\times 1.50$ GSI 18353; reconstruction in outline of a part of dorsal view showing carapace sculpture.

teeth are dark brown in colour and appear to be more dense than the skeletal material. The surface of the finger is uniformly granulate.

Propodus.—Imperfectly preserved, cutting teeth missing.

Discussions.—The following characters of the weathered ventral surface and partly preserved dorsal surface of the carapace and the chelipeds support assignment of the specimen to the genus *Callinectes* (Rathbun, 1930): (a) large size, (b) dorsal carinae formed of single granules, (c) transverse lines on gastric region and one sinuous oblique line on the branchial region, leading most probably inward from the lateral spines, (d) eight strong antero-lateral teeth followed by a large spine at the lateral angle, (e) strong chelipeds, and (f) proximal spine at the articulation with carpus. Certain characters like bulging, smooth and robust claws, highly toothed inner margins of the fingers and the arcuate dactylus, resemble features of the genus *Scylla* de Hann, but the shape and nature of the carapace, antero-lateral teeth and chelipeds precludes its reference to this genus. *Callinectes quilonensis* n. sp., has been compared with all the known Tertiary crabs from Indian sub-continent and other countries (Rathbun, 1930, 1937; Nations, 1968), but cannot be assigned to any. Based on its characteristic features the fossil is designated as the new species *Callinectes quilonensis* and is the first ever report of this genus from India.

Type Locality.—At the base of the sea-cliff near Paravur. Specimen collected from bed number 1.

Etymology.—The species is named after the formation, Quilon Beds, in which it was found to occur.

Some principal features of both the crab fossils, *P. rugifer* Stol., and *C. quilonensis* n. sp., are given in Table no. 1.

ECOLOGY AND PALAEOECOLOGY

Callinectes has a wide geographical distribution. It inhabits the muddy shores of temperate and tropical Central America, West Africa and Indo-Pacific Islands. Its habitat is muddy shores to deep waters; brackish waters of estuaries, and occasionally in fresh water (Rathbun, 1930). The bathymetric range of *C. sapidus* Rathbun, the most common species of *Callinectes*, is from intertidal to 23 fathoms (42 metres) and its temperature range in Chesapeake Bay, Maryland, U.S.A., is 43.9° F. to 65.5° F (Rathbun, 1930).

Callinectes quilonensis was collected from bluish-grey, hard compact, highly fossiliferous limestone within the Quilon Beds. It was found associated with the following taxa:

Larger foraminifers:

Archaias malabarica (Carter), *Operculina bartschi* Cushman.

Smaller foraminifers:

Austrotrillina sp., *Clavulina* sp., *Pyrgo* sp., *Nonion* sp., *Elphidium* sp., *Bolivina* sp., *Rotalia* sp.,

Ostracodes:

Aurila sp., *Puriana* sp., *Krithe* sp., *Parakrithe* sp., *Loxiconcha* sp., *Paracypris* sp., *Aglaicypris complanata* Brady and Robertson, *Xestoleberis* aff. *margaritea* Brady, *Cytheretta trifurcata* Lubimova and Guha, *Cytheropteron confirmis* Lubimova and Guha, *Hermanits reticulata* (Puri), *Bairdia victrix* Brady, *Bairdoppilata* sp

Corals:

Antillia miocenica Sahni and Sastry, *Calamophyllia quilonica* Sahni and Sastry.

Echinoids:

Breynia carinata d'Arch. and Haime.

Pelecypods:

Discors triforme (Sow.).

Gastropods:

Tectus loryi (d'Arch. and Haime), *Cernina* cf. *callasa* (Sow.), *Turritella* sp.

The faunal assemblage with *P. rugifer* and *C. quilonensis* indicates that the depth of water was not more than 40 metres because most of the forms mentioned above are not found to be generally present below that depth. The fauna as a whole is characteristic of near-shore environment with a temperature range of 25-30° C., salinity range of 27-40 ppm and bathymetric range of surface to 20 m because all the genera and species mentioned above are capable of ranging into this zone.

AGE RELATIONSHIP

Palaeocarpilius Milne-Edwards has been found to occur in the Middle Eocene, Upper Eocene, Oligocene and ? Lower Miocene of Europe; Middle Eocene of Somaliland and India; Upper Eocene of Egypt and Lower Miocene of Zanzibar, India, Java and Saipan (Moore, 1969).

Callinectes Stimpson is present in Eocene-Miocene of Brazil, Central America and West Indies, and in the Pleistocene of North America (Moore, 1969). It still inhabits the muddy shores of tropical and temperate Central America, West Africa and Indo-Pacific Islands (Rathbun, 1930; Moore, 1969).

In the Indian sub-continent *P. rugifer* Stoliczka has been recorded from a widespread fossiliferous yellowish argillaceous bed covering western and central part of Kutch (India) and from light brown nummulitic limestone of Laki Hills, Pakistan (Stoliczka, 1871). This species is assigned Aquitanian age (Stoliczka, 1871; Vredenburg, 1907; Glaessner, 1933). However, a very similar species, *P. macrochelius* (Desm.) has been recorded from the Kirthar (Middle Eocene) of Kutch (Mathur, 1963). Mathur (1968 b) revised his opinion and assigned Oligocene age to *P. macrochelius* (Desm.). Glaessner

(1933), who reviewed the Indian Tertiary crab fauna, made a clear distinction between the Eocene and Oligocene (including Aquitanian) faunas and assigned the latter age to *P. rugifer* Stol. The other invertebrate fossils found associated with the crabs are typical of Gaj Beds and are assigned Lower Miocene age (Sahni and Sastry, 1958; Jacob and Sastri, 1951 and 1952).

The author, therefore, has little hesitation in assigning Lower Miocene (Aquitanian-Burdigalian) age to the crab fauna from the Quilon Beds.

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