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Review of the genus *Neocytheromorpha* GUAN (Crustacea, Ostracoda), with the description of two new species from the Indian Ocean

by Karel WOUTERS

Abstract

Two new species of the genus *Neocytheromorpha* GUAN, 1978, from marine environments in the Maldives and the Comoros (Indian Ocean), are described and compared with other species. The taxonomic position of the genus, the presence of premature specimens and the distribution of the known fossil and recent species of the genus are discussed.

Key words: Ostracoda, taxonomy, Indian Ocean, Maldives, Comoros, zoogeography

Introduction

Marine sediment samples from Grande Comore (Comoro Islands) and South Malé Atoll (Maldives), collected in 1981 and 1984, yielded some interesting new ostracods. Although the ostracod fauna of the Indian Ocean is fairly well know, this is not surprising, because many new species are still to be discovered. Two of those are described in the present paper. The description of both species is based as well on valves as on appendages. This is the first time that the appendages are studied again after the description by HARTMANN (1981) of the genus *Arculacythereis* (= *Neocytheromorpha*). The two species belong to the genus *Neocytheromorpha*, a relatively poorly understood genus of the subfamily Arculacythereidinae. Up to now, this subfamily is monogeneric, and it takes a somewhat isolated position in the family Trachyleberididae. LIEBAU (1975) already emphasized that the subfamilies of the family Trachyleberididae remain difficult to define, mostly because of the very small evolutionary distances among taxa, compared with those among some other cytheroidean families.
All material studied is deposited in the Ostracod Collection (numbers O.C 2854-2890) of the Royal Belgian Institute of Natural Sciences, Brussels (Belgium).

Systematics

Class Ostracoda LATREILLE, 1806
Order Podocopida SARS, 1866
Suborder Cytherocopina BAIRD, 1850
Superfamily Cytheroidea BAIRD, 1850
Family Trachyleberididae SYLVESTER-BRADLEY, 1948
Subfamily Arculacythereidinae HARTMANN, 1981

Genus *Neocytheromorpha* GUAN, 1978

Type-species: *Neocytheromorpha regalis* GUAN, 1978 (by original designation).

Synonym: *Arculacythereis* HARTMANN, 1981 (type-species: *A. vacciformis* HARTMANN, 1981).
? *Casterocythere* HU, 1986 (type-species *Cushmanidea transversa* HU, 1978), see "Discussion".

Neocytheromorpha malensis sp. nov.
(Pl. 1, Figs 1-9, Pl. 3, Figs 1-10)

TYPE LOCALITY

Rihiveli Island (3° 43' N, 73° 16' E), southern part of South Malé Atoll, Maldives. In a sediment sample collected on a sand bank, about 100 m NE of the Island. Leg.: F. FIERS, 4 December 1984 (Station n° 78).

HOLOTYPE

A male with valves stored dry (O.C. 2854a) and dissected limbs preserved in a sealed glycerine preparation (O.C. 2854b).

PARATYPES

Two males, one female and one A-1 instar with valves stored dry and dissected limbs preserved in sealed glycerine preparations (O.C. 2955-2858), 14 male and female loose valves and carapaces (O.C. 2859-2865).

OTHER MATERIAL

Two empty carapaces and two loose valves (O.C. 2866) from Embudhu Island (4° 01'N, 73° 25' E), northeastern part of South Malé Atoll, Maldives; in a sediment sample collected at a depth of 20 cm. Leg.: F. FIERS, 12 December 1984 (Station n° 114).

DERIVATION OF NAME

Named after the type-locality, South Malé Atoll.

DIAGNOSIS

Valves with fine reticulate pattern of polygonal meshes, with small subcircular pits within the meshes; one muscle platform; weakly crenulated hinge teeth; mandibular palp with very long and curved terminal segment; hemipenis with triangular distal shield, long coiled copulatory tube and small furcae.

DESCRIPTION

Valves (Pl. 1, figs 1-2, Pl. 3, figs 1-10,) oblong, with straight dorsal margin and nearly straight ventral margin. Dorsal and ventral margins parallel in males, and slightly tapering in females. Anterior margin obliquely rounded, posterior margin weakly truncate, more so in the right than in the left valve. Anterior margin and posterior margin set with large, blunt denticles. Carapace in dorsal view with beak-like anterior and protruded posterior extremity; lateral margins nearly parallel in females; wedge-shaped in males; subcentral tubercle well developed and clearly visible in dorsal view, with a concavity in front of and behind the tubercle. Ornamentation consisting of a fine but disctinct reticulate pattern of polygonal meshes, each mesh being subdivided into a number of small meshes surrounded by fine subcircular muri (Pl. 3, figs 9-10); distinct oblique posterior rib. Muscle scar pattern visible on the external side of the valve as darker spots. No clear ocular structure. Deep sulcus between dorsal margin and muscle scars. Hinge merodont with weakly crenulated teeth. Inner lamella wide in mature specimens; long, mostly simple, but sometimes bifurcated marginal pore canals. Muscle scar pattern consisting of a V-shaped frontal scar, and four adductor scars, the dorso-median one obliquely oriented and elongate. Large antero-dorsal muscle platform, visible on the external side as a sulcus.
Antennule (Pl. 1, fig. 4) six-segmented with short setae and spines. Antenna (Pl. 1, fig. 5) with well developed exopod, consisting of two articles, reaching to the tip of the terminal claw in females, and to the distal margin of the terminal segment in males; exopod in juveniles also consisting of two articles. Mandibular palp (Pl. 1, fig. 3) with very long and curved terminal segment; epipod with five short strahlen, one of them mouthwardly directed. Maxillula (not figured): palp two-segmentend, with elongate first and subquadrate second segment; branchial plate with 16 hirsute strahlen. Legs (Pl. 1, figs 6-8) long and slender, with simple chitinous knee supports. Hemipenis large and complex, with triangular distal shield and curved hook-like proximal ventrally oriented process, long coiled copulatory tube, and relatively small furca. Brush-like organ (not figured) with a simple shaft, distally set with hairs of approximately the same length as the shaft.

Measurements
Holotype: L 0.72 mm, H 0.32 mm.
Paratypes : L 0.72-0.77 mm, H 0.32-0.37 mm.

COMMENTS

The species is most similar to *N. knoxi* (SCOTT, 1905) (comb. nov.) in aspects of outline, hinge, inner lamella and muscle platform. The main difference between the two species is that *N. knoxi* has a much coarser reticulate ornamentation pattern with broad dorso-ventrally oriented ribs. *N. regalis* GUAN, 1978 has a distinct marginal groove posteriorly. *N. ovalis* (Brady, 1880) has a heavily reticulated surface, with transverse ribs dominant in the posterior region. Furthermore the latter species has a blunt triangular distal shield and a long and straight proximal process (HARTMANN, 1981, fig. 20). Finally, *N. indoarabica* (KHOSLA, 1989) is characterized by a weak reticulation, and a nearly smooth antero-dorsal valve surface.

Neocytheromorpha carlae sp. nov.
(Pl. 2, Figs 1-11, Pl. 4, Figs 1-9)

TYPE LOCALITY

Mohoro (11° 49' S, 43° 28' E), Grande Comore, Comoros. In a sediment sample collected at a depth of 20 m, consisting of fine black lava sand. Leg.: J.-L. KENNES, 16 August 1981 (station n° 121).

HOLOTYPE

A male with valves stored dry (O.C. 2867a) and dissected limbs preserved in a sealed glycerine preparation (O.C. 2827b).

PARATYPES

Five males, ten females and four instars with valves stored dry and dissected limbs preserved in sealed glycerine preparations (O.C. 2868-2886), 83 male and female loose valves and empty carapaces (O.C. 2887-2890).

DERIVATION OF NAME

Named after my wife, Carla HEYLEN.

DIAGNOSIS

Valves with a delicate pattern of mostly obliquely oriented longitudinal ridges, with intermediate subcircular pits; ventral margin with angular concavity; two muscle platforms; smooth hinge teeth; mandibular palp with relatively short and weakly curved terminal segment; hemipenis with semi-oval distal shield, short coiled copulatory tube and large and hairy furcae.

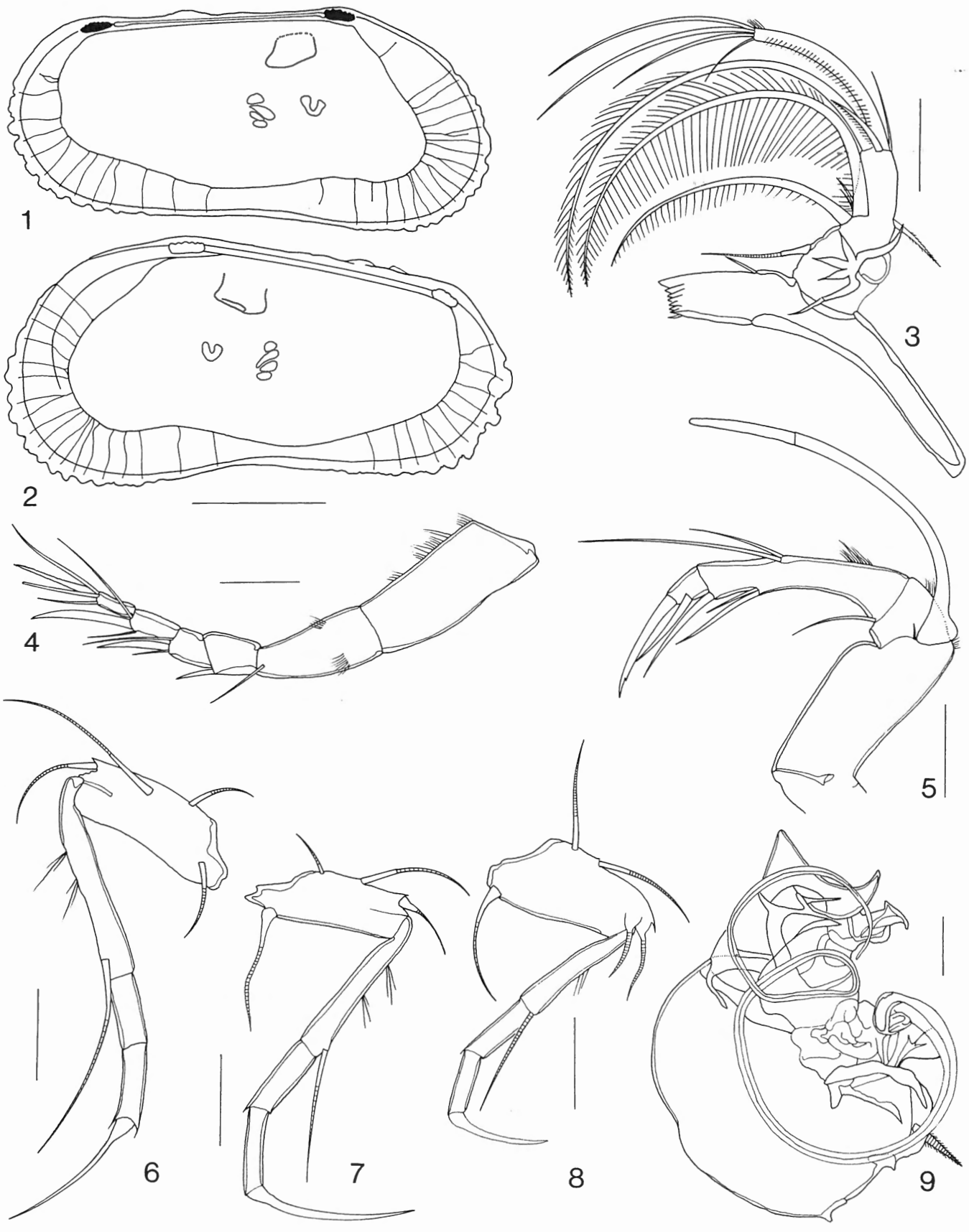

Plate 1. *Neocytheromorpha malensis* sp. nov., Rihiveli Island, Maldives. Fig. 1. Left valve, male, internal view, paratype (O.C. 2855). Fig. 2. Right valve, female, internal view, paratype (O.C. 2864). Fig. 3. Mandible, female, paratype (O.C. 2857). Fig. 4. Antennule, male, holotype (O.C. 2854). Fig. 5. Antenna, male, holotype. Fig. 6. Third leg, male, holotype. Fig. 7. Second leg, male, holotype. Fig. 8. First leg, male, holotype. Fig. 9. Hemipenis, male, holotype. Scales: figs 1-2: 200 μm: figs 3-9: 50 μm.

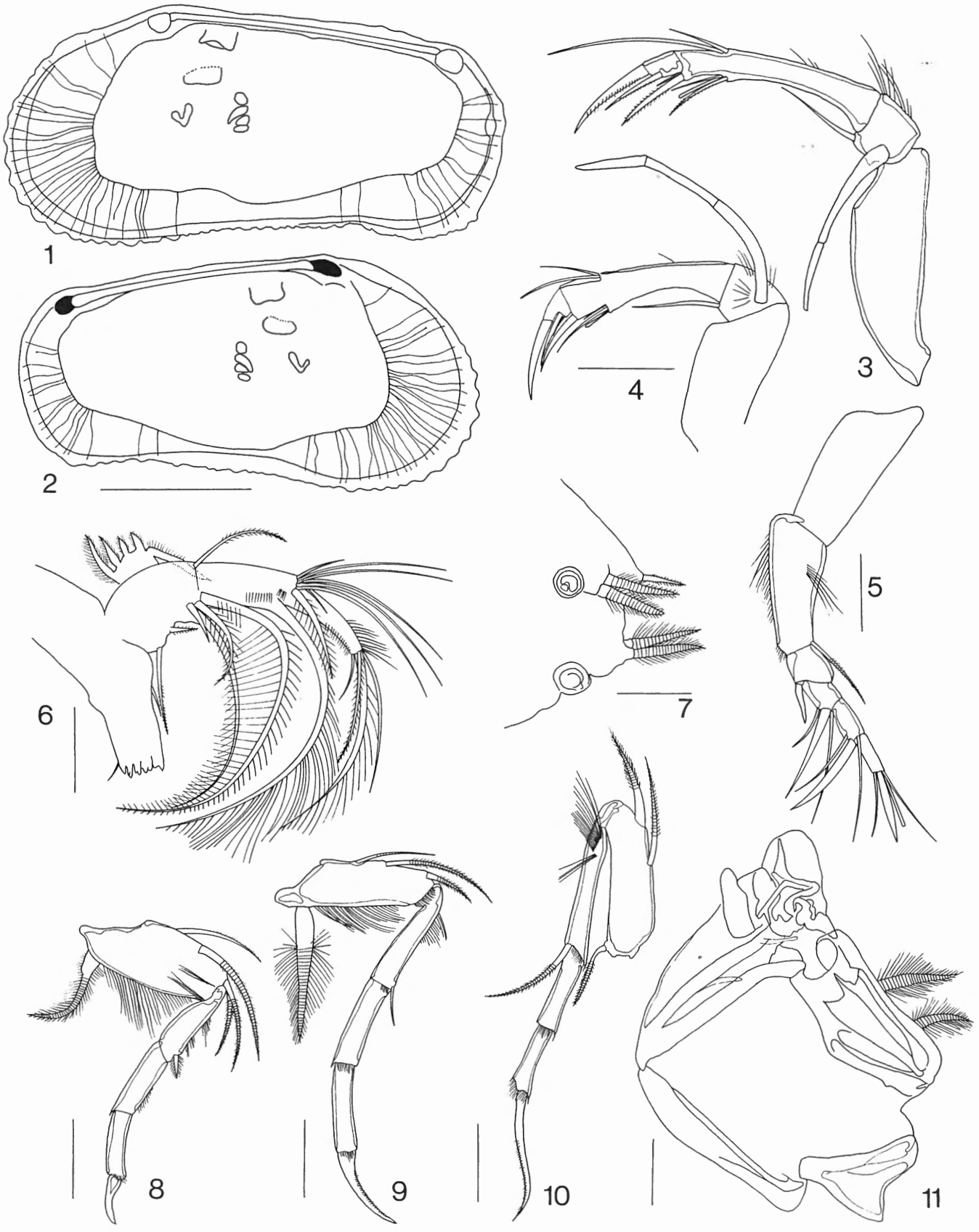

Plate 2. *Neocytheromorpha carlae* sp. nov., Mohoni, Grande Comore, Comoros. Fig. 1. Right valve, internal view, male, holotype (O.C. 2867). Fig. 2. Left valve, internal view, female, paratype (O.C. 2869). Fig. 3. Antenna, male, holotype. Fig. 4. Antenna, A-1 instar, paratype (O.C. 2883). Fig. 5. Antennule, male, holotype. Fig. 6. Mandible, male, paratype (O.C. 2868). Fig. 7. Abdominal extremity, female, paratype (O.C. 2876). 8. First leg, male, holotype. 9. Second leg, male, holotype. 10. Third leg, male, holotype. Fig. 11. Hemipenis, male, holotype. Scales: figs 1-2: 200 µm; figs 3-11: 50 µm.

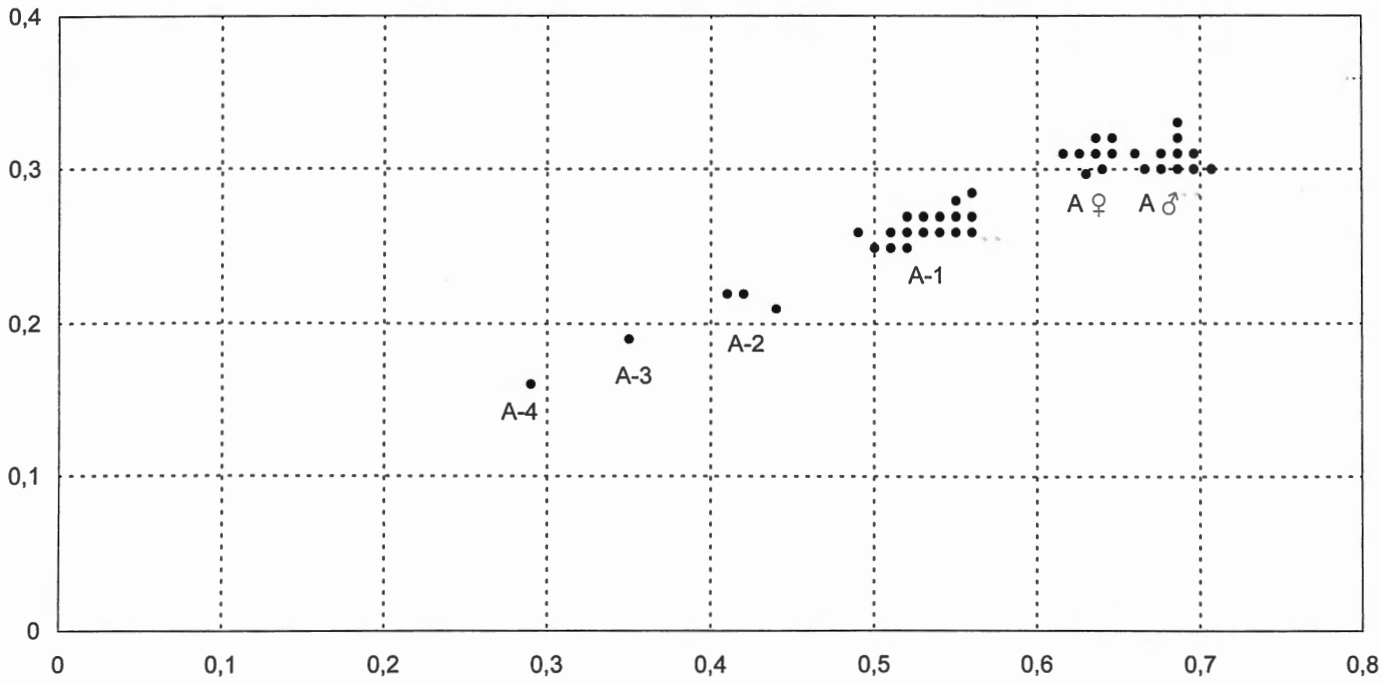

Fig. 1. Length/height scatter diagram of *Neocytheromorpha carlae* sp. nov. (in mm).

DESCRIPTION

Valves (Pl. 2, figs 1-2, Pl. 4, figs 1-9) oblong, with straight dorsal margin with distinct anterior and posterior cardinal angles. Dorsal and ventral margins slightly tapering as well in males as in females. Anterior margin broadly rounded; small concavity in front of anterior cardinal angle in right valves. Posterior margin truncate. Ventral margin concave to angular in the postero-ventral area. Postero-ventral region depressed. Anterior margin set with large, blunt denticles. Carapace in dorsal view spindle-shaped, with beak-like anterior and blunt posterior extremity; lateral margins nearly parallel. Ornamentation consisting of a delicate pattern of mostly obliquely oriented longitudinal ridges, with interjacent subcircular pits. Row of submarginal tubercles along the anterior margin, and submarginal fossae along the posterior one. Two sulci present; the largest one between the dorsal margin and the muscle scars, and a smaller one very close to the dorsal margin. Hinge merodont with smooth teeth. Inner lamella wide in mature specimens, with irregular line of concrescence and long and sinuous marginal pore canals. Muscle scar pattern consisting of a V-shaped frontal scar, and four adductor scars, the dorso-median one obliquely oriented and elongate. Two antero-dorsal muscle platforms, situated between the muscle scar pattern and the dorsal margin. Both platforms are visible on the external side as a sulcus.

Antennule (Pl. 2, fig. 5) six-segmented with short setae and stout spines. Antenna (Pl. 2, fig. 3) with relatively short exopod in males. Exopod longer in females, and reaching to the distal margin of the penultimate segment. In both males and females the exopod consists of two articles. In juvenile specimens, however, the exopod consists of three articles (Pl. 2, fig. 4). Mandibular palp (Pl. 2, fig. 6) with long and weakly curved terminal segment; epipod with five short strahlen, one of them mouthwardly directed. Maxillula (not figured): palp two-segmentend, with elongate first and small subquadrate second segment; branchial plate with 16 hirsute strahlen. Legs (Pl. 2, figs 8-10) hairy, with simple chitinous knee supports. First leg with short terminal claw. Hemipenis large and complex, with semi-oval distal shield, short coiled copulatory tube, and large and hairy furcae. Brush-like organ (not figured) with a wedge-shaped shaft, distally set with hairs twice as long as the shaft.

Measurements (Fig. 1)
Holotype: L 0,69 mm, H 0,31 mm.
Paratypes: L 0,62-0,71 mm, H 0,30-0,33 mm.

COMMENTS

By its unique set of characters, the present species can be easily distinguished from other *Neocytheromorpha* species: longitudinal, mostly obliquely oriented fine ribs, and interjacent small subcircular pits, distinct anterior and posterior cardinal angles, truncate posterior margin, angular postero-ventral concavity, postero-ventral zone depressed, semi-oval distal shield. There is a vague resemblance with *N. chalmersi* (SCOTT, 1905) (comb. nov.). The latter species is also characterized by the presence of submarginal fossae along the posterior margin, but they are markedly larger than in *N. carlae* sp. nov.

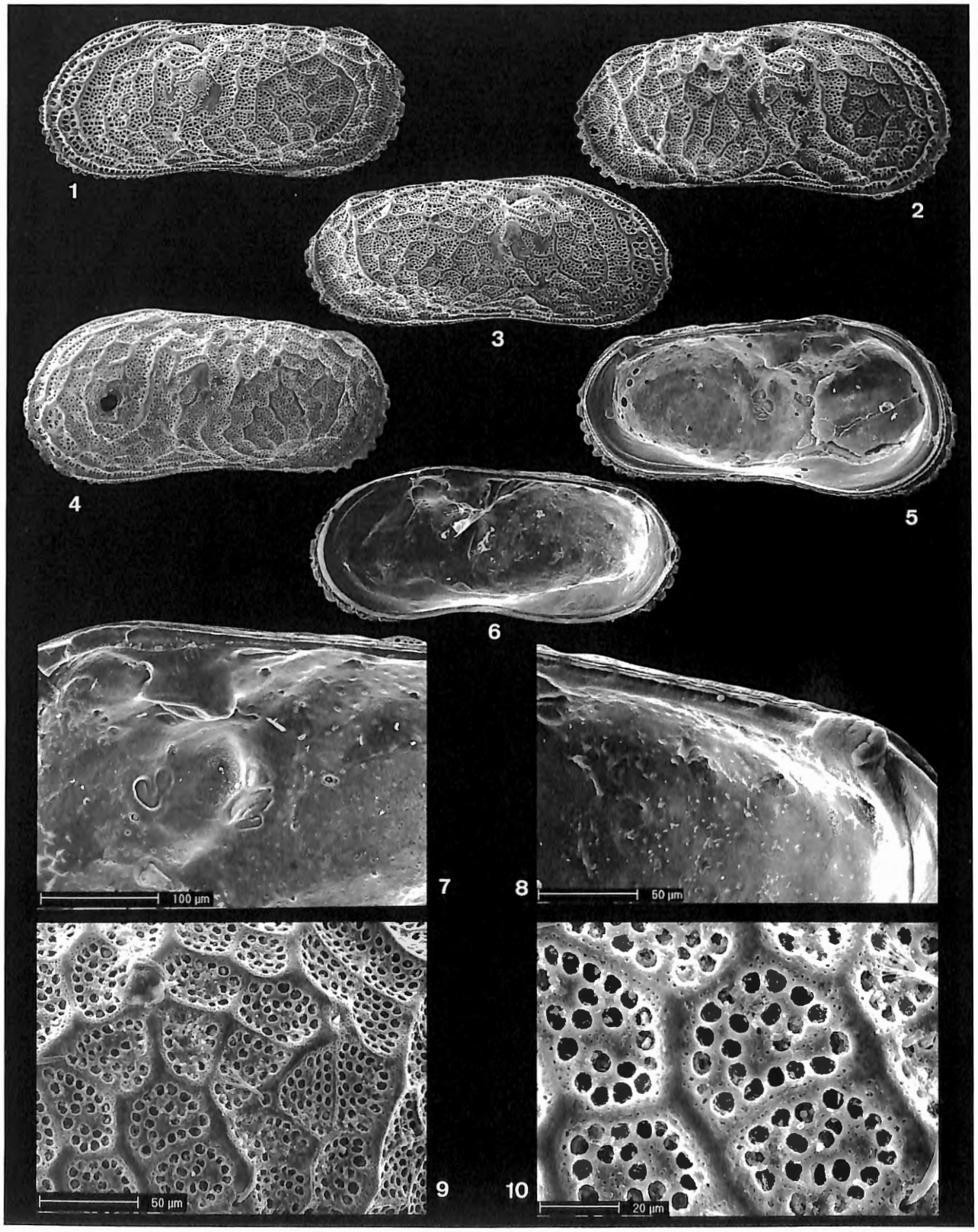

Plate 3. Plate 1. *Neocytheromorpha malensis* sp. nov., Rihiveli Island, Maldives. Fig. 1. Left valve, male, paratype (O.C. 2856). Fig. 2. Right valve, female, paratype (O.C. 2857). Fig. 3. Right valve, male, paratype (O.C. 2855). Fig. 4. Left valve, female, paratype (O.C. 2857). Fig. 5. Left valve, internal view, female, paratype (O.C. 2861). Fig. 6. Right valve, internal view, male, holotype (O.C. 2854). Fig. 7. Right valve, male, antero-dorsal internal view, paratype (O.C. 2860). Fig. 8. Right valve, male, postero-dorsal internal view, paratype (O.C. 2860). Fig 9. Left valve female, detail of ornamentation, paratype (O.C. 2857). Fig. 10. Left valve female, detail of ornamentation, paratype (O.C. 2857). Figs 1-6: X 90.

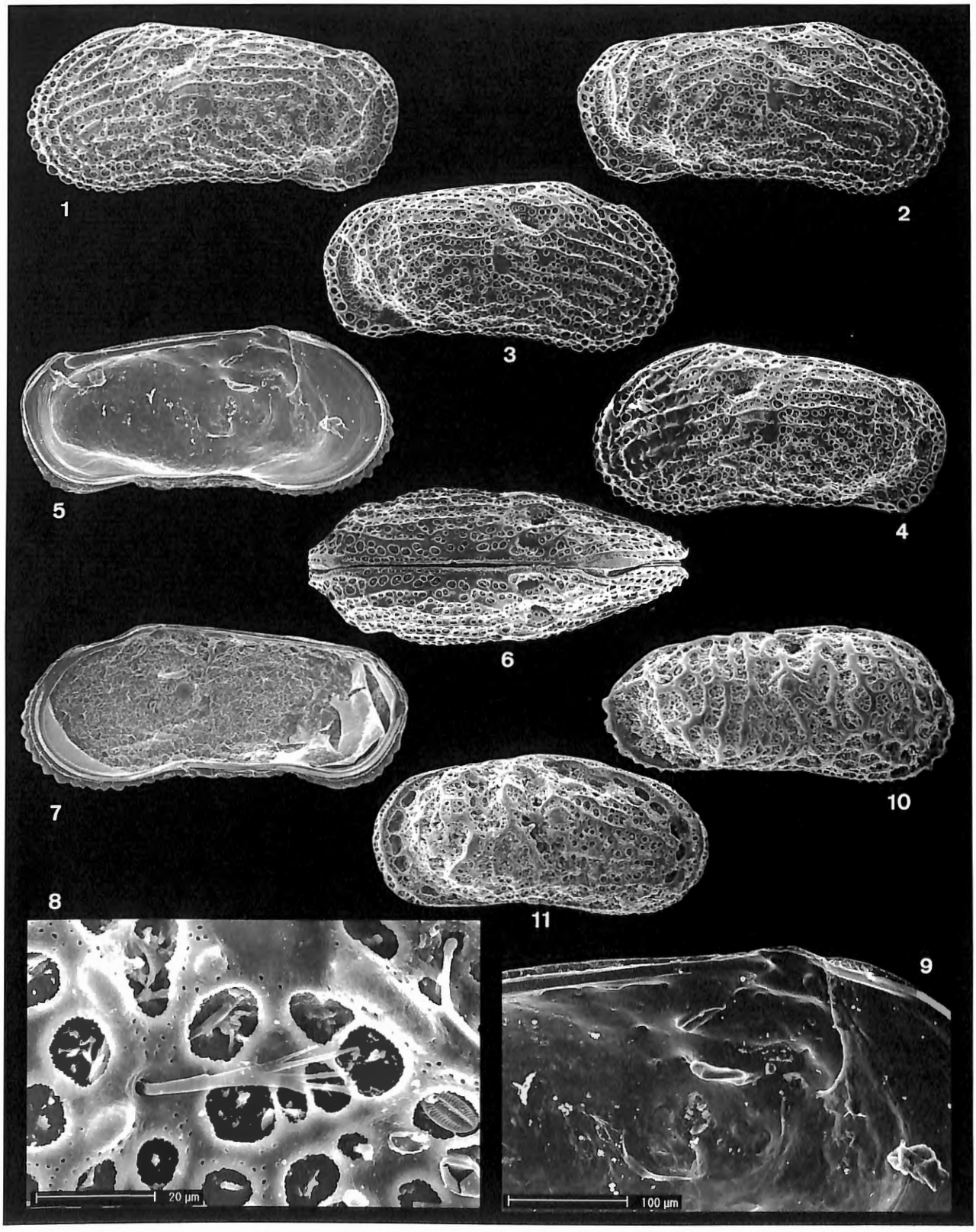

Plate 4. Figs 1-9. *Neocytheromorpha carlae* sp. nov., Mohoni, Grande Comore, Comoros. Fig. 1. Left valve, male, holotype (O.C. 2867). Fig. 2. Right valve, male, paratype (O.C. 2871). Fig. 3. Right valve, female, paratype (O.C. 2868). Fig. 4. Left valve, female, paratype (O.C. 2868). Fig. 5. Left valve, internal view, male, paratype (O.C. 2871). Fig. 6. Carapace, dorsal view, male, paratype (O.C. 2888). Fig. 7. Right valve, internal view, premature male, paratype (O.C. 2871). Fig. 8. Left valve, detail of ornamentation, male, holotype. Fig. 9. Left valve, antero-dorsal internal view, male, paratype (O.C. 2871). Fig. 10. *Neocytheromorpha knoxi* (SCOTT, 1905), Colombo, Sri Lanka, right valve (O.C. 29891). Fig. 11. *Neocytheromorpha chalmersi* (SCOTT, 1905), Colombo, Sri Lanka, right valve (O.C. 2892). Figs 1-7 and 10-11: 95 X.

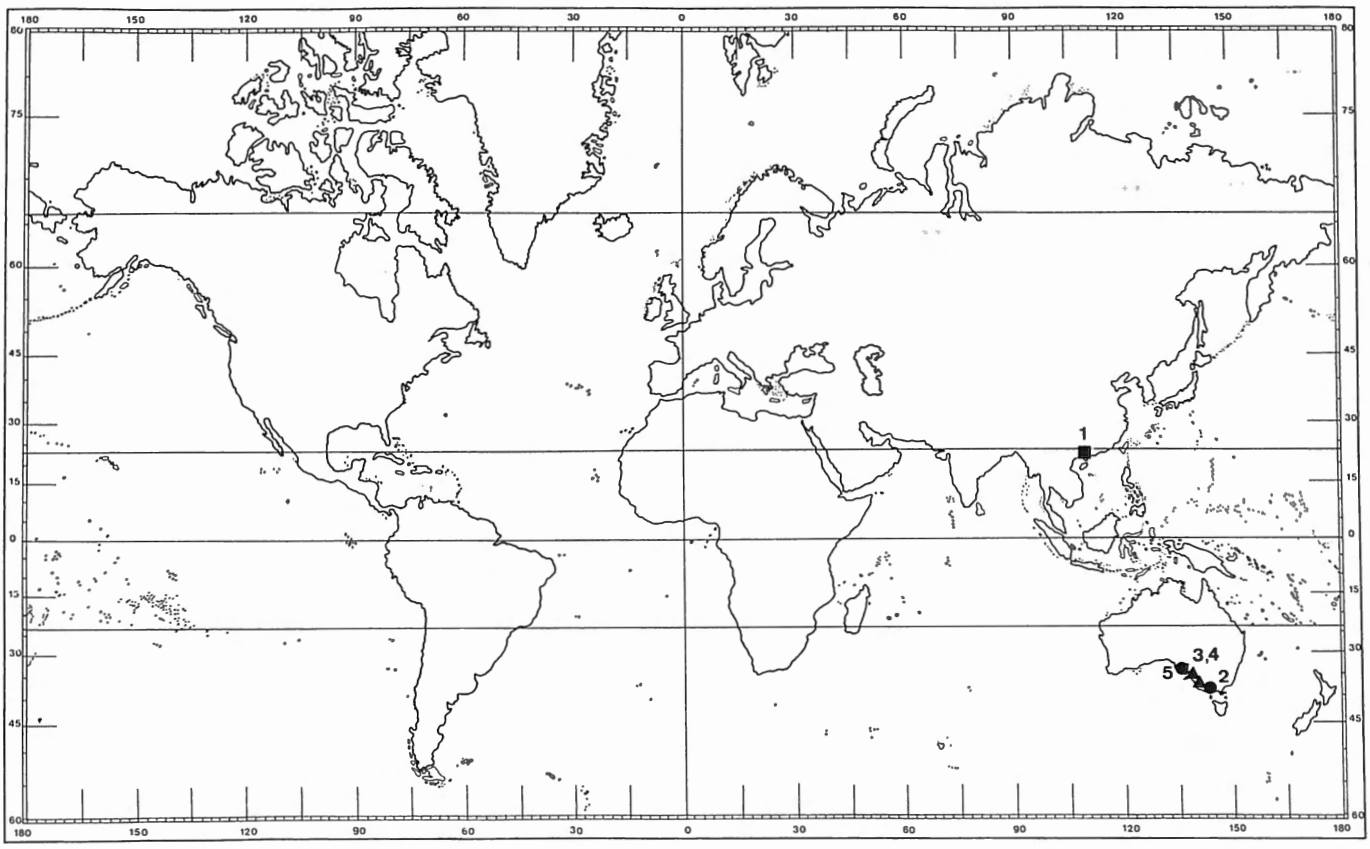

Fig. 2. Distribution of fossil *Neocytheromorpha*-species. 1. *N. regalis* (Pliocene). 2. *N. thomasi* (Late Oligocene and Middle Miocene). 3. *N. tatei* (Early Middle Miocene). 4. *N.* cf. *thomasi sensu* NEIL (Middle Miocene). 5. *N.* sp. *sensu* MAJORAN (Early Oligocene). Circles: Oligocene; triangles: Miocene; square: Pliocene.

Discussion

TAXONOMY

In 1981 HARTMANN (p. 106) introduced the Arculacythereidinae (originally spelled as Arculacythereinae) as a subfamily of the Trachyleberididae. Type-genus of the subfamily is *Arculacythereis* HARTMANN, 1981, sunk into synonymy with *Neocytheromorpha* GUAN, 1978 by WHATLEY & ZHAO (1988), followed herein by later authors (CAI, 1988, RUAN & HAO, 1989, ZHAO & WHATLEY, 1989, TABUKI & NOHARA, 1990, EAGAR, 1998, and the present author, this paper). This synonomy, however, does not affect the validity of the subfamily Arculacythereidinae.

In a reappraisal of trachyleberidid (and hemicytherid) clasification, MCKENZIE & BONADUCE (1993) emphasize that relationships between the component subfamilies are very close, and that diversity of taxa in the family is enormous, a point of view already stressed by previous authors as HAZEL (1967), HARTMANN & PURI (1974) and LIEBAU (1975).

MCKENZIE & BONADUCE (1993) reconfirm the position of Arculacythereidinae as a subfamily of the Trachyleberididae. The subfamily contains the tribes Arculacythereidinae HARTMANN, 1981 and perhaps Australimoosellini HOWE & MCKENZIE, 1989. In this case, Arculacythereidinae is a monogeneric subfamily. Diagnostic characteres are: broad inner lamella, irregular line of concrescence, six-segmented antennule, mandible epipod with five Strahlen, slender elongate curved terminal segment, and large antero-dorsal muscle scar platform. In 1991 JELLINEK (p. 129) introduced the tribe Strobilocytherini (in the subfamily Phacorhabdotinae), containing the genus *Strobilocythere* JELLINEK, 1990 and *Neocytheromorpha* GUAN, 1978. If the genus *Neocytheromorpha* is retained in this tribe, then it falls into synonymy with Arculacythereidinae. The present author, however, is convinced that *Neocytheromorpha* and *Strobilocythere* are sufficiently different genera to warrant a different taxonomical position. On the other hand, this example illustrates how difficult it is to produce a comprehensive classification of a complex family such as the Trachyleberididae. More research is needed before this goal can be achieved. It is hoped that the description of valves and appendages of the two new species in the present paper, and the questions raised, will be useful for further study.

THE GENUS *CASTEROCYTHERE* HU

In 1986 HU introduced the genus *Casterocythere*, with as type species *Cushmanidea transversa* HU, 1978 from the Pleistocene of Taiwan. In the original description of the type species HU (1978, p. 152-153, fig. 27) mentions a number of

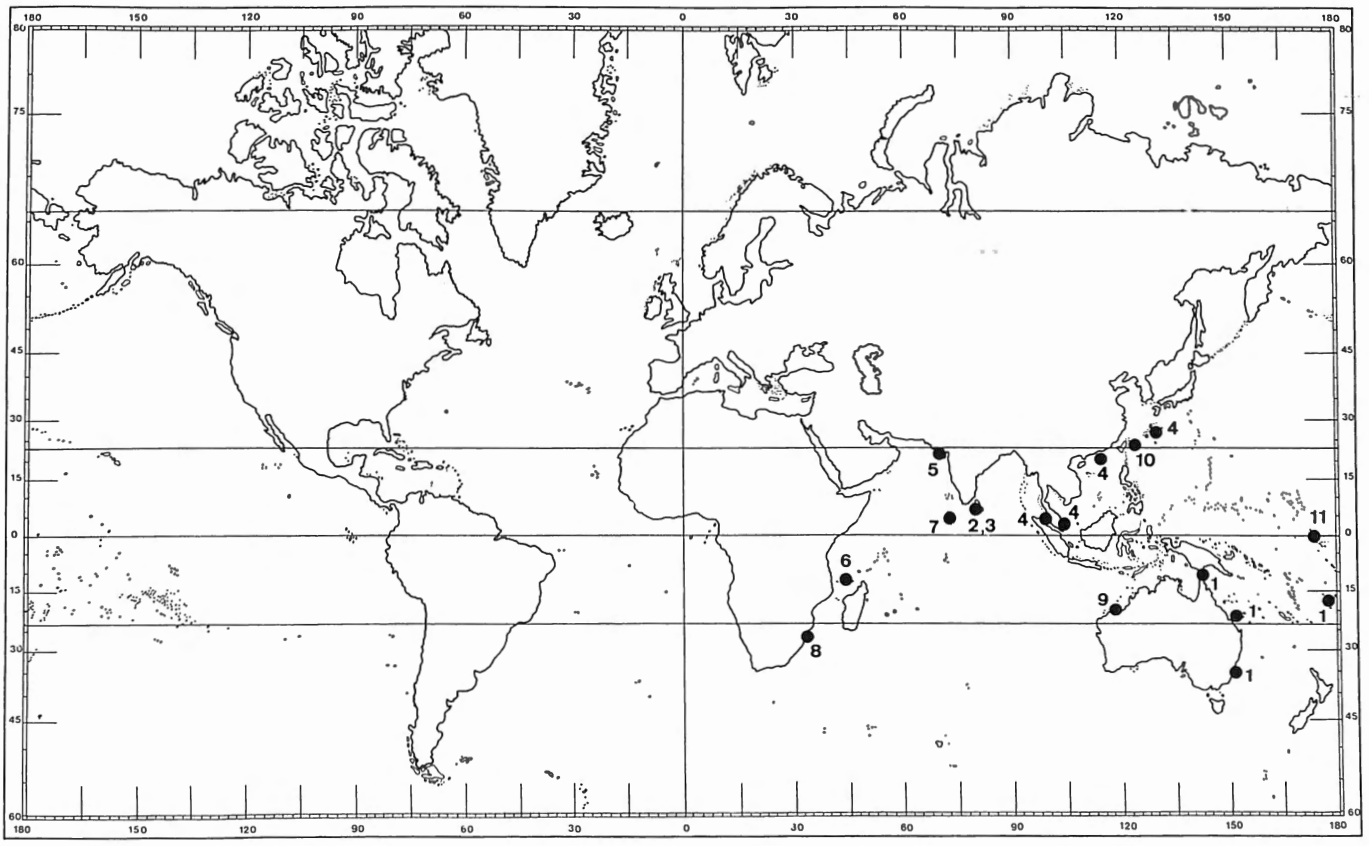

Fig. 3. Distribution of Recent *Neocytheromorpha*-species. 1. *N. ovalis*. 2. *N. knoxi*. 3. *N. chalmersi*. 4. *N. regalis*. 5. *N. indoarabica*. 6. *N. carlae*. 7. *N. malensis*. 8. *N.* sp. *sensu* SYLVESTER-BRADLEY & BENSON. 9. *N.* sp. *sensu* HOWE & MCKENZIE. 10. *N.* sp. *sensu* TABUKI & NOHARA. 11. *N.* sp. *sensu* EAGAR.

characters that are reminiscent of *Neocytheromorpha*, such as "worm-like pore canals", a muscle platform (not described as such, but visible on fig. 27 c). In his 1984 paper HU (p. 108-109) describes more interesting characters, such as: "surface covered with reticulation, posterior caudal process marked by a narrow depressed peripheral border, both anterior and posterior margins bear short stout marginal spines". The new genus is tentatively assigned by HU to the family Cytherideidae, where it most certainly does not belong. It is very likely that *Casterocythere* is either a junior synonym of *Neocytheromorpha*, or a closely related genus. However, the present author has not seen the original material of HU, and therefore is not in a position to give a more conclusive opinion on this taxonomical problem.

PREMATURE VALVES

A small number of valves of *N. carlae* sp. nov., as well males as females, with adult dimensions, and in males with not fully chitinized hemipenes, the inner lamella is remarkably narrow (Pl. 4, fig. 7). This means that after the final molt the chitinization of the hemipenes is not fully completed, but also that the calcification of the inner lamella is not yet complete, and that calcification, widening of the inner lamella and elongation of the marginal pore canals continues until the fully mature state is achieved. This has as a consequence that in a population consisiting of loose adult valves, there can be a marked variability in the width of the inner lamella. The presence of premature specimens was already described by MARTENS (1992) in *Namibcypris costata*, by WOUTERS (1998) in *Mangalocypria* species and by WOUTERS (1999) in *Phlyctenophora* species.

Distribution of the genus *Neocytheromorpha*

Until now ten species have been named and described (one sunk into synonymy), and six have been reported in open nomenclature.

NAMED SPECIES

Neocytheromorpha ovalis (BRADY, 1880)

1880 *Cythere ovalis*, n. sp. – BRADY, p. 66-67, pl. 14, figs 4 a-d. Recent, dredged off Booby Island, N. Australia.
1890 *Cythere ovalis* BRADY – BRADY, p. 499, pl. 2, fig. 12. Recent, Mango Island, Fiji Islands.
1981 *Arculacytheris vacciformis* n. sp. – HARTMANN, p. 106-107, Figs 13-20, Pl. 5, Figs 4-14 (synonymized with *N. ovalis* by YASSINI & JONES, 1995). Recent, Curtis Channel

(Gladstone Harbour, North Queensland) and Heron Island, Australia.
1995 *Arculacythereis ovalis* – YASSINI *et al.*, Table 1 (p. 1184). Recent, Windang Island, New South Wales, Australia.
1995 *Arculacythereis ovalis* (BRADY, 1890) – YASSINI & JONES, p. 356-357, Figs 259-261, 263. Recent, southeastern Australia.

Neocytheromorpha knoxi (SCOTT, 1905)
(Pl. 4, Fig. 10)

1905 *Cythere knoxi*, n. sp. – SCOTT, p. 377-378, Pl. 2, Figs 9, 10. Recent, in general washings from pearl oysters, Sri Lanka (Ceylon).
Material: one right valve from Colombo, Sri Lanka (O.C. 2891)

Neocytheromorpha chalmersi (SCOTT, 1905)
(Pl. 4, Fig. 11)

1905 *Cythere chalmersi*, n. sp. – SCOTT, p. 378, Pl. 2, Figs 11, 12. Recent, in the general washings and in washings of the Gulf of Manaar sponges, Sri Lanka (Ceylon).
Material: one right valve from Colombo, Sri Lanka (O.C. 2892).

Neocytheromorpha regalis Guan, 1978

1978 *Neocytheromorpha regalis* sp. n. – GUAN, p. 281, pl. 74, figs 1-3, text-figure 73. Pliocene of Haikang County, Guangdong Province, China.
1983 *Neocytheromorpha regalis* GUAN – GOU *et al.*, p. 108, pl. 22, figs 1-5, text-fig. 38. Pliocene of Leizhou Peninsula and Hainan Island, Guangdong Province, China.
1988 *Neocytheromorpha regalis* GUAN, 1978 – WHATLEY & ZHAO, p. 23-24, pl. 10, Figs 3-4. Recent, Malacca Straits.
1988 *Neocytheromorpha regalis* GUAN – CAI, Pl. 3, fig. 1. Recent, continental shelf South China Sea.
1989 *Neocytheromorpha regalis* GUAN – RUAN & HAO, Table 2 (p. 6). Recent, Okinawa Through.
1989 *Neocytheromorpha regalis* GUAN – ZHAO & WHATLEY, Table 2 (p. 172). Recent, Sedili River and Jason Bay, southeastern Malay Peninsula.

Neocytheromorpha indoarabica KHOSLA, 1989

1989 *Arculacythereis indoarabica* n. sp. – KHOSLA, p. 329-332, Fig. 2 a-c. Recent, Miani Creek, Saurashtra Coast, N.W. India.

Neocytheromorpha thomasi MCKENZIE *et al.*, 1991

1991 *Arculacythereis thomasi* sp. nov. - MCKENZIE, REYMENT & REYMENT, p. 173, Pl. 9, Figs 10, 15, 16. Late Oligocene, Bells Headland, Victoria and Middle Miocene, Hamilton District, Victoria, Australia.

Neocytheromorpha tatei NEIL, 1994

1994 *Arculacythereis tatei* sp. nov. – NEIL, p. 11-12, Pl. 3, Figs 11, 12. Early Middle Miocene, Muddy Creek Area, South-Western Victoria, Australia.

Neocytheromorpha malensis sp. nov

2004 *Neocytheromorpha malensis sp. nov.* – This paper. Recent, Rihiveli Island, South Malé Atoll, Maldives.

Neocytheromorpha carlae sp. nov.

2004 *Neocytheromorpha carlae* sp. nov. – This paper. Recent, Mohoro, eastern coast of Grande Comore, Comoros.

SPECIES REPORTED IN OPEN NOMENCLATURE

***Neocytheromorpha* sp.** *sensu* SYLVESTER-BRADLEY & BENSON, 1971

1971 *Urocythereis* sp. – SYLVESTER-BRADLEY & BENSON, Fig. 7 (p. 255). Recent, False Bay, KwaZulu-Natal, South Africa.

***Neocytheromorpha* sp.** *sensu* HOWE & MCKENZIE, 1989

1989 *Arculacythereis* sp. – HOWE & MCKENZIE, p. 45, Figs 140-141. Recent, Port Hedland, Western Australia.

***Neocytheromorpha* sp.** *sensu* TABUKI & NOHARA, 1990

1990 *Neocytheromorpha* sp. - TABUKI & NOHARA, Pl. 2, Fig. 1. Recent, Sekisei-sho area, Ryukyu Islands, Japan.

Neocytheromorpha* sp.** aff. ***N. thomasi *sensu* NEIL 1994

1994 *Arculacythereis* sp. aff. *A. thomasi* MCKENZIE *et al.* 1991 – NEIL, p. 12, Pl. 4, Figs 1, 2. Early Middle Miocene Clifton Bank, near Hamilton, South-Western Victoria, Australia.

***Neocytheromorpha* sp.** *sensu* MAJORAN, 1997

1997 *Arculacythereis* sp. – MAJORAN, Fig. 3 (p. 425), only listed, neither figured nor described. Early Oligocene, Port Willunga, South Australia.

***Neocytheromorpha* sp.** *sensu* EAGAR, 1998

1998 *Neocytheromorpha* sp. – EAGAR, p. 59, Pl. 2, Figs 14, 15. Recent, Tarawa Atoll, Kiribati, Pacific Ocean.

COMMENTS

The oldest known record of the genus *Neocytheromorpha* is *Arculacythereis* sp., mentioned by MAJORAN (1997) from the Early Oligocene of Port Willunga, South Australia. Unfortunately, this species is only listed, and not described. It therefore remains doubtful whether this species really belongs to *Neocytheromorpha*. If the Early Oligocene record of MAJORAN would prove to be invalid, then *Arculacythereis thomasi* MCKENZIE *et al.*, 1991, described from the Late

Oligocene of Bells Headland (Victoria) becomes the oldest known record. Furthermore, three species are reported from the Miocene of Australia, and one from the Pliocene of S. China. A second species, *N. longa* (GUAN, 1978), also mentioned by GOU *et al.* (1983, p. 109) from the Pliocene of S. China, probably does not belong to *Neocytheromorpha*. The information up to now available on the distribution of *Neocytheromorpha* species points towards an Australian origin of the genus, most probably in the Oligocene. After a slow evolutionary start in the Oligocene, Miocene and Pliocene, the number of species must have increased rapidly, as can be inferred from the numerous species occurring today in the Pacific, but especially in the Indian Ocean, with not less than eight extant species. It can be concluded that *Neocytheromorpha* is a relatively young genus, that probably originated in the Oligocene, in the southern Hemisphere (Australia), and spread rapidly in post-Pliocene times in the Indian Ocean and to a lesser extent in the Pacific.

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