

Genus *Kermia* (Mollusca: Gastropoda: Conoidea: Conidae: Raphitominae) in South African waters, with observations on the identities of related extralimital species

Richard Neil Kilburn

Natal Museum, P. Bag 9070, Pietermaritzburg, 3200 South Africa, and School of Biological & Conservation Sciences, University of KwaZulu-Natal, P. Bag X01, Scottsville, 3209 South Africa; dickkilburn@sai.co.za

ABSTRACT

The genus *Kermia* Oliver, 1915, is recorded for the first time from South Africa. New species described are: *Kermia geraldsmithi* sp. n., *K. clathurelloides* sp. n., *K. drupelloides* sp. n. and *K. eugenei* sp. n. New records for southern Africa are: *Kermia melanoxytum* (Hervier, 1896), *K. edychroa* (Hervier, 1897), *K. pumila* (Mighels, 1845), *K. daedalea* (Garrett, 1873) and *K. producta* (Pease, 1860). New synonymies established are: *Clathurella birtsi* Preston, 1908 and *Mangelia chrysolitha* Melvill & Standen, 1896 under *Kermia punctifera* Garrett, 1873; *Pleurotoma gracilis* Folin, 1871 and *Mangelia anxia* Hedley, 1909 under *Kermia edychroa* (Hervier, 1897); *Pseudodaphnella punicea* Hedley, 1922 under *Clathurella blanfordi pullula* Hervier, 1897 = *Pseudodaphnella pullula*; *Defrancia mauritiana* Sowerby, 1893 and *Clathurina foraminata pyrgodea* Melvill, 1917 under *Clathurella producta* Pease, 1860; *Clathurella spelaeodea* Hervier, 1897 under *Clathurella infrasulcata* Garrett, 1873 (currently *Pseudodaphnella* subgenus *Qii*). Type specimens of the following species are also illustrated: *Pleurotoma apicalis* Montrouzier in Souverbie, 1861; *Pleurotoma cavernosa* Reeve, 1845; *Pleurotoma margaritifera* Reeve, 1846; *Glyphostoma melanoxytum* Hervier, 1896; *Clavatulula tessellata* Hinds, 1843. New combinations are established: *Clathurella blanfordi* G. & H. Nevill, 1875 transferred to the genus *Paramontana* Laseron, 1954, and *Clathurella martensi* G. & H. Nevill, 1875 to *Pseudodaphnella* Boettger, 1895. *Pleurotoma pustulosa* Folin, 1867 and *Pleurotoma foraminata* Reeve, 1845 are considered *nomina dubia*. A lectotype is designated for *Clathurella daedalea* Garrett, 1873.

KEY WORDS: Conidae, Raphitominae, *Kermia*, South Africa, Indo-West Pacific, new species, new synonymy.

INTRODUCTION

The Indo-Pacific genus *Kermia* Oliver, 1915, has not previously been reported from South Africa. However, at least nine species occur, four of them here described as new.

Like most raphitomine genera, *Kermia* has been very inadequately studied, and its limits are unclear. Characteristics include the presence of cancellate teleoconch sculpture, one or more diagonally cancellate protoconch whorls (initially smooth or spirally striate), and a linguiform to lacrimiform anal sinus, its upper margin drawn forward at suture by a callous node; outer lip with a strong varix, denticulate to dentate within.

The Mediterranean genus *Philbertia* Monterosato, 1884, sometimes used for Indo-Pacific taxa, is more applicable to species with a shallow, reversed L-shaped anal sinus. Using this definition, *Kermia* is a large genus of approximately 36 described species in the Indo-West Pacific. However, observed variation in protoconch characters is probably indicative of polyphyly. Borderline cases include the type species, *Kermia benhami*, which is atypical in its protoconch possessing arcuate axial riblets, with only their bases diagonally cancellated. The only Western Hemisphere species referred by authors to *Kermia* is *K. informis* McLean & Poorman, 1971, from Ecuador; however, this taxon evidently lacks diagonally cancellate protoconch sculpture.

A number of similar species with terminal protoconch sculpture of orthocone or arcuate axial riblets, with or without spiral threads, are provisionally referred to the

genus *Pseudodaphnella* Boettger, 1895. As noted above, in *Kermia* the protoconch is initially smooth or spirally striated, but later whorls are diagonally cancellate. Nevertheless, it is possible that the two taxa may intergrade, as diagonally cancellate sculpture may only develop towards the termination of the protoconch. It should also be noted that specimens of some *Pseudodaphnella* species in which obliquely arcuate axial riblets cross spiral threads may confusingly resemble *Kermia* species, particularly when slightly eroded.

Pseudodaphnella auct. is probably polyphyletic, and contains several mostly unnamed (sub)groups. In the group containing the type species (*Pleurotoma philippinensis* Reeve, 1843) the aperture is wide and the outer lip is strongly arched and bears relatively numerous small pleats or denticles. However, although Hedley (1922: 349) described the last whorl of the protoconch as bearing fine axial threads in *P. philippinensis*, Shuto (1971: 18) claimed that the sculpture was diagonally cancellate. Species resembling *P. philippinensis* (at least in teleoconch characters) include *Pleurotoma nexa* Reeve, 1845, *Clathurella pulchella* Pease, 1860, and *Pleurotoma granicostata* Reeve, 1846. A second, larger, group, which includes species such as *Pleurotoma tincta* Reeve, 1846, *Clathurella rubroguttata* H. Adams, 1872, *Pleurotoma lemniscata* G. & H. Nevill, 1869, *Clathurella cnephaea* Melvill & Standen, 1896, and *Clathurella ramsayi* Brazier, 1876, differs from the *philippinensis* complex in its constricted base and in the presence of four or five strong labral denticles. However, several species, such as *Pleurotoma (Drillia) hadfieldi* Melvill & Standen, 1895 (= *Clathurella ephela* Hervier, 1897) and *Clathurella rufolirata* Hervier, 1897, are somewhat intermediate.

Reference may also be made to *Pseudodaphnella* subgenus *Qii* Zhang, 1995, whose type species (o.d.) *Clathurella spelaeodea* Hervier, 1897, is a synonym of *Clathurella infrasulcata* Garrett, 1873, according to comparison of their syntypes in the MNHN and ANSP respectively. Zhang (1995) characterised *Qii* by its strong basal furrow (waist) which is demarcated apically by a somewhat strengthened spiral ridge. According to fresh examples of this species (*P. infrasulcata* occurs as far south as Durban), the protoconch bears cancellate sculpture of fine axial ribs crossed by subequal spiral threads (Fig. 56). Other species presumably referable to *Qii* are *Pseudodaphnella oligoina* Hedley, 1922, *Pleurotoma (Defrancia?) alternans* E.A. Smith, 1882, and perhaps *Clathurella spyridula* Melvill & Standen, 1896. However, some other species with a similar sunken waist and bordering ridge have a *Kermia*-type protoconch, so these characters presumably cannot be regarded as apomorphic.

Figures of radulae given by Orr-Maes (1967) appear to show no obvious differences between the two genera (figs 4G, H and I, representing respectively *Pseudodaphnella granicostata* (Reeve, 1846) (as *Philbertia (Pseudodaphnella) granicostata*, *Pseudodaphnella rubroguttata* (H. Adams, 1872), as *Philbertia (Pseudodaphnella) tincta* (non Reeve, 1846), and *Kermia barnardi* (Brazier, 1876), as *Philbertia (Kermia) barnardi*). However, no radula was present in material of *P. granicostata* examined by Kantor and Taylor (2002).

Melvill (1917) proposed the name *Clathurina* for a polyphyletic group of *Kermia*-like species, with *Pleurotoma foraminata* Reeve, 1845, as the type species. *Clathurina* was synonymised with *Kermia* by Powell (1966: 134), but its type species should be regarded as a *nomen dubium*, as no types of *P. foraminata* are present in the BMNH, and Reeve's tiny figure and brief description (1845, pl. 33, sp. 301) are of little value in

positive recognition of the species. However, specimens labelled as *P. foraminata* in the Melvill-Tomlin collection (NMWC) are actually *Kermia margaritifera* (Reeve, 1846) from India and the Arabian Gulf. When compared with Reeve's figure of *foraminata*, *K. margaritifera* (Fig. 49) has a shorter, more truncate base, a wider aperture and stronger, more numerous spiral ridges. The protoconch sculpture of Indian examples (Fig. 55) appears to be atypical for *Kermia* in having oblique axial riblets crossed by interrupted spiral threads.

MATERIAL AND METHODS

The studied material is kept in the following institutions:

- AMSA – The Australian Museum, Sydney, Australia;
- ANSP – Academy of Natural Sciences, Philadelphia, USA;
- BMNH – The Natural History Museum, London, UK;
- MCZH – Museum of Comparative Zoology, Harvard, USA;
- MHNB – Muséum d'Histoire Naturelle, Bordeaux, France;
- MMUE – Manchester Museum University, Manchester, UK;
- MNHN – Muséum National d'Histoire Naturelle, Paris, France;
- NMSA – Natal Museum, Pietermaritzburg, South Africa;
- NMWC – National Museum of Wales, Cardiff, UK;
- SML – Société de Marie, Lyon, France;
- USNM – National Museum of Natural History, Washington DC, USA;
- ZSIC – Zoological Survey of India, Kolkata (Calcutta), India.

The following abbreviations and acronyms are used in this paper:

- a/l – ratio of aperture length (measured along main shell axis) to total shell length;
- b/l – ratio of breadth to total length;
- ESEM – environmental scanning electron microscope;
- loc. – locality;
- KZN – KwaZulu-Natal;
- t/s – transverse section (i.e. as seen in apical view).

TAXONOMY

Family Conidae Fleming, 1822
 Subfamily Raphitominae Bellardi, 1875
 Genus *Kermia* Oliver, 1915

Kermia: Oliver 1915: 539. Type species: *Kermia benhami* Oliver, 1915, by original designation.

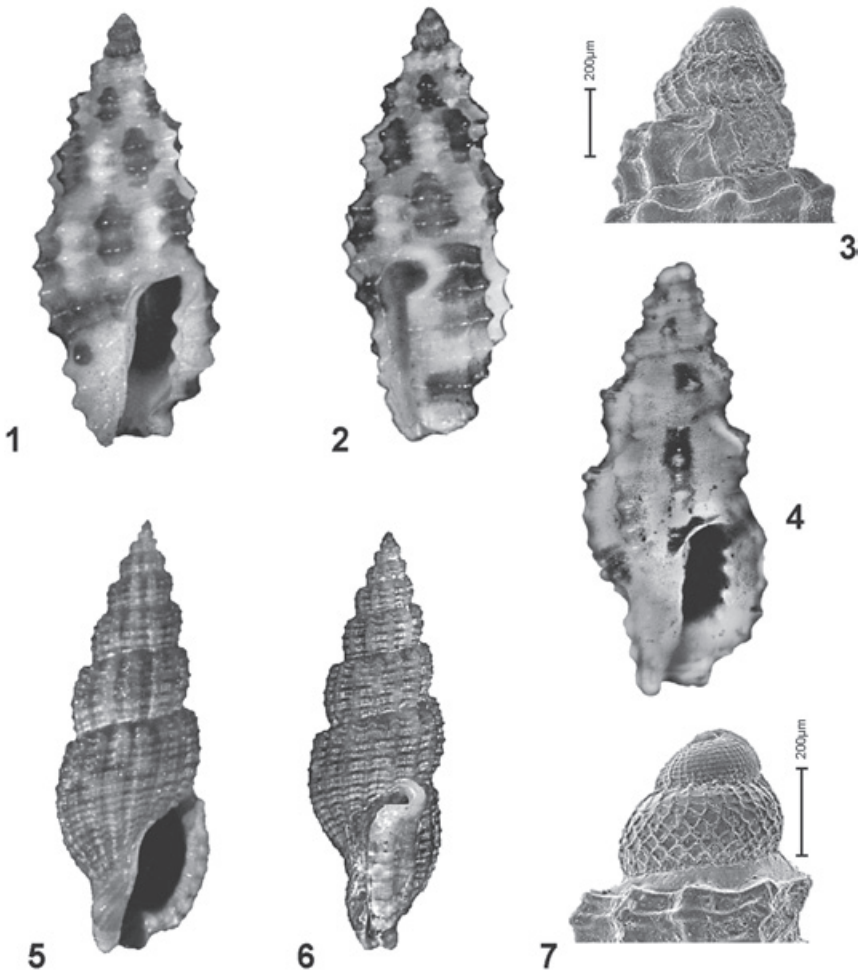
***Kermia geraldsmithi* sp. n.**

Figs 1–3

?*Philbertia* (*Pseudodaphnella*) sp.: Oyama & Takemura 1957: *Philbertia* (2), figs 7, 8.

Etymology: Named in honour of its collector, Mr Gerald Smith of Durban.

Description: Shell fusiform with truncated base; b/l 0.40–0.46, a/l 0.36–0.46; whorls slightly convex with angular, sloping shoulder, subsutural region wide and concave, suture undulating, base of body whorl constricted above rostrum into a slight but distinct



Figs 1–7. *Kermia geraldsmithi* sp. n., *Pseudodaphnella* (?) *excellens* (Sowerby, 1913), and *Kermia clathurelloides* sp. n.: (1–3) *K. geraldsmithi*, holotype NMSA W6533/T2354, 4.6×2.1 mm, apertural (1) and side (2) views, and ESEM of protoconch (3); (4) *Pseudodaphnella* (?) *excellens*, holotype of *Clathurella excellens*, BMNH 1914.1.7.267, Osumi, Japan; 9.6×4.2 mm; (5–7) *K. clathurelloides*, holotype NMSA W6533/T2360, 11.3×4.0 mm, apertural (5) and side (6) views, and ESEM of protoconch (7).

waist; rostrum thick and convex; siphonal canal strongly contracted but expanded terminally, end truncate, level, in dorsal view medially convex, not notched. Outer lip flat in side view, with 4 serrations, caused by ridge terminations; inner edge with 3 equal-sized teeth and sometimes a weak 4th; inner lip smooth and flattened, posterior end of aperture with a parietal pad. Anal sinus shallow, U-shaped.

Axial ribs slightly prosocline, fairly straight, weaker below suture, on base extending onto rostrum as rounded nodules; in *t/s* high, asymmetrically rounded, with steeply sloping sides, ribs wider than their intervals, 9 or 10 per whorl. Spiral ridges thinner than axials in intervals, expanding on ribs to form angular nodules, ridges nearly equal in strength, adapical row slightly the stronger, abapical one slightly weaker; first two

whorls with two rows of nodules plus a third usually beginning to develop above suture, later whorls with three main rows of nodules, plus a weak ridge immediately below suture; last whorl with a shallow waist-like furrow at base of rostrum containing a thin ridge, strengthening and bearing angular nodules on dorsum; rostrum forming a moderate fasciole, which bears 3 ridges weakening anteriorly, the upper 2 with angular nodules. Interstices with extremely fine and close collabral striae.

Protoconch (Fig. 3) bluntly conical, of 3.3 whorls, last two whorls with prosocyt axial riblets, crossed diagonally by oblique threads; 1st whorl with a few minutely pliculate spiral threads above its suture; dark brown; breadth 0.46 mm.

White, alternate ribs with axially elongated orange-brown blotches, basal constriction dark to medium orange-brown; protoconch dark orange-brown.

Dimensions: 4.6×2.1 mm (holotype), largest paratype 5.5×2.3 mm.

Comparison and remarks: This appears to be the species figured by Oyama and Takemura (1957) as '*Philbertia* (*Pseudodaphnella*) sp.', based on a specimen from southern Japan (Amami–Oshima Is). The most similar described species is the Japanese *Clathurella excellens* Sowerby, 1913. The holotype of that (Fig. 4) differs from *K. geraldsmithi* in its angular shoulder, darker brown blotches, fewer axial ribs (8 per whorl) and more numerous spiral ridges (5 on penultimate whorl). Japanese authors (e.g. Oyama & Takemura (1957: *Philbertia* (3), figs 7, 8); Fukuda (1995: 24, pl. 67, fig. 986); Higo *et al.* (2001: 109, fig. G3809, holotype); Hasegawa *et al.* (2000: 659, pl. 328, fig. 194) cite *excellens* as *Philbertia* (*Pseudodaphnella*) *excellens*. Unfortunately, the holotype of that species lacks its protoconch, and no details of it are available to me, so that its generic position remains to be confirmed.

Holotype: NMSA W6533/T2354. SOUTH AFRICA: *KwaZulu-Natal*: off Park Rynie (30°19'S:30°44'E), depth ca -35 m, in shell grit, dived G. Smith, 1996.

Paratype 1: same data as holotype, to be deposited in BMNH. Paratypes 2–9: NMSA S2999/T 2377, between Bhangana Neck and Kosi Bay, depth ca -13 m, D. Herbert.

Other material examined: SOUTH AFRICA: *KwaZulu-Natal*: Kosi Bay, 14 km S of estuary mouth, ca -20 m (D. Herbert, R. Broker; NMSA S2579), 1–4 km S of estuary mouth, ca -18 m (D. Herbert, K. Bloem; NMSA S2311) and -23–24 m (D. Herbert, K. Bloem; NMSA S2900); Park Rynie, ca -16 m, in shell grit (D. Herbert; NMSA S5920); Aliwal Shoal, off Scottburgh, ca -16 m, sand (D. Herbert; NMSA S5920).

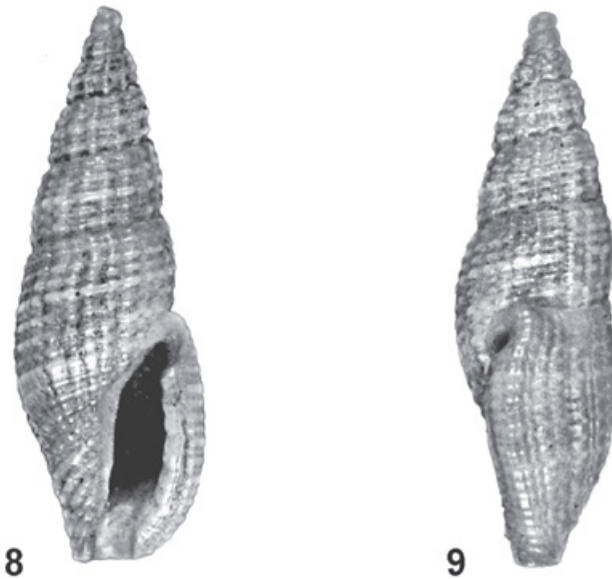
Distribution: Inner continental shelf of KZN and probably southern Japan, in -13–35 m.

***Kermia clathurelloides* sp. n.**

Figs 5–7

Etymology: From the genus name *Clathurella* Carpenter, 1857; it refers to the teleoconch being superficially similar to some species of latter genus.

Description: Shell fusiform with truncated base; b/l 0.35–0.38, a/l 0.38–0.41; whorls strongly convex with narrow angular shoulder, and undulant, fairly deep suture, base of last whorl without a waist-like constriction; rostrum narrow, without a fasciole; aperture narrowly elliptical; siphonal canal strongly contracted but slightly expanded terminally, end truncate, oblique in dorsal view, not notched. Outer lip evenly convex in side view, not serrated, anal sinus moderately deep, linguiform, its opening constricted, margin raised; inner edge of lip with 9–11 weak, ridge-like teeth, one at each end stronger than others, but in some specimens very irregular; inner lip smooth, shallowly sinuous, thinly calloused, parietal pad weak.



Figs 8, 9. *Clathurella exilis* Pease, 1860, apertural and side views, lectotype BMNH 1962766, Sandwich Is., Hawaii, 5.7×2.1 mm.

Sculpture cancellate, with spiral ridges finer than axial ribs, forming weak compressed nodules where they cross them. Axial ribs slightly opisthocline, almost straight, weakly sigmoid on last whorl, terminating (or weakening) above, slightly short of suture, on base extending to top of rostrum; on last whorl continuing to outer lip; in t/s constricted, steep-sided, sharply rounded, equal to or slightly narrower than their flattened intervals, 10 or 11 on 1st teleoconch whorl (first few ribs weak), 15 or 16 on penultimate whorl. Spiral ridges narrower than their intervals, nearly equal in strength, except for those on base of last whorl which are uneven; 1st whorl with 3 spiral ridges, the upper two close together; penultimate whorl with 8–12 ridges, base with 6–8, plus 4–7 smooth, slightly angular ridges on rostrum (which may become obsolete distally). Interstices with fine, close axial striae.

Protoconch (Fig. 7) bluntly conical, of ca 3.0 whorls, beginning of 1st whorl strongly tilted, next whorl finely cancellate, last whorls with obliquely cancellate sculpture, of sigmoid, opisthocyrt riblets, crossed diagonally by oblique threads; golden brown; breadth 0.41 mm.

Slightly glossy, medium or golden brown, with obscure darker and lighter bands, spiral ridges more or less darker than intervals, last whorl with a terminal brown band basally; interior of outer lip white, protoconch orange-brown.

Dimensions: 11.3×4.0 mm (holotype); 12.0×4.3 mm (paratype).

Comparison and remarks: Within the genus *Kermia*, the new species shows some resemblance to *K. producta* (Pease, 1860), but that species is only about half the size of *K. clathurelloides* (adults of both species having a maximum of about six teleoconch whorls), axial ribs are much finer in *producta* (20–22 on the penultimate whorl against 15 or 16) and markedly straighter, and the suture is crenulated by the rib terminations in *clathurelloides*, but not in *producta*. There also appears to be some resemblance to

K. thorssoni Chang, 2001, from Taiwan (types not seen), but *K. clathurelloides* differs in its later whorls being distinctly shouldered, the last whorl lacking a submedian angle and the spiral ridges are much finer (in *thorssoni* these are subequal in strength to the axial ribs and fewer on the penultimate whorl (five according to Chang), whereas these number 8–12 in *K. clathurelloides*).

A relationship with *Clathurella exilis* Pease, 1860, from Hawaii is also possible. Unfortunately, the lectotype of that (BMNH 1962766, designated by Kay (1965: 21, pl. 2, figs 17, 18)) lacks its protoconch. Kay (1979: 356, fig. 116J) referred *exilis* to the genus *Paramontana* (a probable clathurelline group with smooth protoconch), but her illustration appears to show finer sculpture and a more elliptical aperture than the lectotype (Figs 8, 9), so that confirmation of the identity of her material is needed. Compared with the lectotype of *exilis*, *K. clathurelloides* has weaker lip denticles, a distinct shoulder angle to the ribs, and a much more constricted base.

K. clathurelloides shows a superficial resemblance to several species generally referred to the genus *Lienardia* Jousseaume, 1884. Of these, the most similar species (apart from colouration) appear to be *L. roseotincta* (Montrouzier in Souverbie & Montrouzier, 1872), which also occurs in KZN, and *L. montrouzieri* (Souverbie, 1860). However, these two species are typical *Lienardia* in possessing a keeled protoconch, whereas that of *K. clathurelloides* not only lacks a keel but has the typical diagonally cancellate sculpture of *Kermia*.

Holotype: NMSA W6533/T2360. SOUTH AFRICA: *KwaZulu-Natal*: off Reunion Rocks, Durban (29°58'S: 30°56'E), ca -130 m, sand and rubble bottom, dredged G. Smith.

Paratype 1: same data as holotype, to be deposited in BMNH. Paratype 2: *KwaZulu-Natal*: Leadsman Shoal, -24–26 m, stone washings (D. Herbert; NMSA E2634/T2343). *Eastern Cape*: Off Port Grosvenor, -80 m, calcareous nodules (R. Kilburn *et al.*; NMSA C7367/T2342).

Other material examined comes from the type locality and is in G. Smith's collection.

Distribution: Eastern South Africa, from northern KZN to Eastern Cape, inner continental shelf.

***Kermia drupelloides* sp. n.**

Figs 10–12

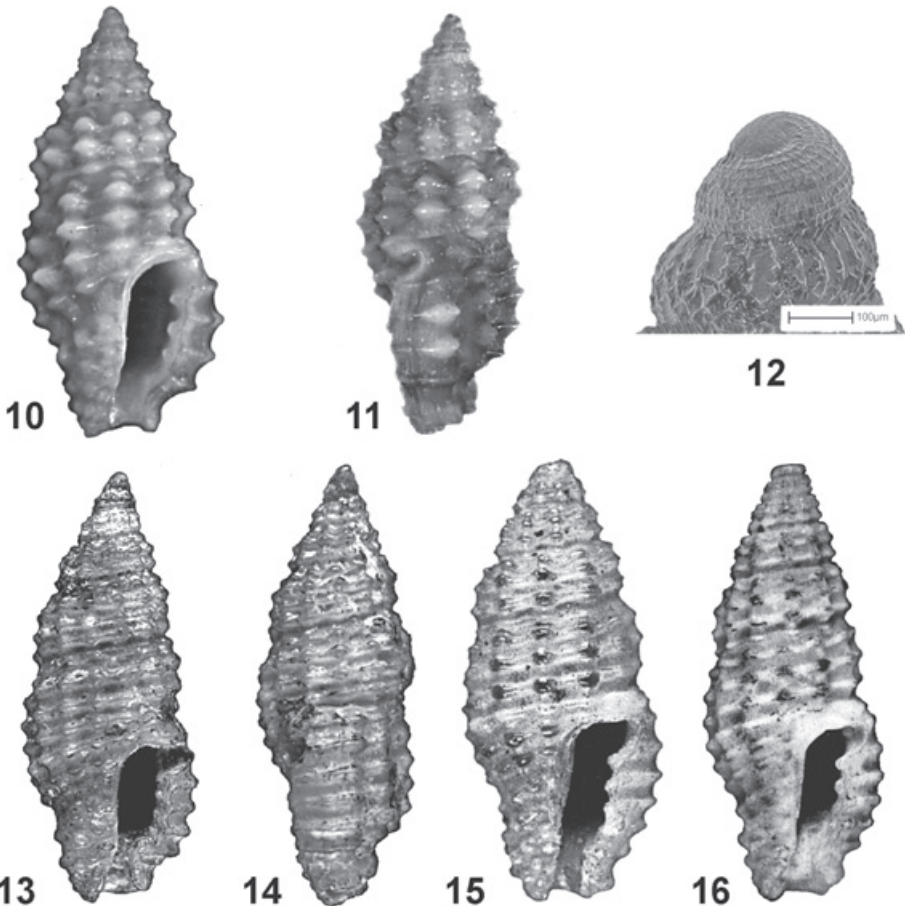
Etymology: From the genus name *Drupella* Thiele, 1925.

Description: Shell fusiform with high, orthoconoid spire and truncated base; b/l 0.38–0.43, a/l 0.33–0.39; whorls convex, not shouldered, subsutural region concave and sloping, suture not undulating, base of last whorl constricted above rostrum into a deeply concave “waist”; rostrum forming a strongly convex fasciole; aperture narrowly elliptical; siphonal canal strongly contracted but expanded terminally, end truncate, in dorsal view concave, with a slight projection medially. Outer lip almost flat in side view, with 4 slight, rounded serrations at terminations of spiral ridges; inner edge with 3 equal-sized, rounded teeth and sometimes a weak 4th; inner lip sigmoid, with a flattened callus deposit with slightly free edge, sometimes with a few feeble plicae, posterior end of aperture with a parietal pad. Anal sinus shallowly linguiform, directed slightly posteriorly, situated on subsutural ridge.

Sculptured by spiral cords that are narrower than the axial ridges, but expand to form angular nodules where they cross them. Axial ribs straight, slightly prosocline, moderately weak below suture, evanescent below “waist”, fasciole with strong nodules; ribs

in t/s more or less angularly rounded, with sloping sides, ribs wider than their intervals, 8 per whorl; bases of ribs narrowing where they cross basal "waist", where they are separated by foveolate interstices. First teleoconch whorl cancellate, with 2 spiral ridges, increasing to 4 from 2nd whorl, that below suture remaining weak, that above suture sometimes as strong as the median two (i.e. with three main rows of nodules); last whorl with 5 rows of nodules, of which subsutural one is weak, fasciole bearing 3–5 rows of strongly rounded tubercles, progressively weakening towards base. Interstices with extremely fine and close collabral striae.

Protoconch bluntly conical, of about 2.7 whorls, 1st whorl depressed and tilted, 2nd whorl with cancellate sculpture (about 9 spiral threads, crossed by orthocline axial threads); last whorls with arcuate axial riblets, crossed by short, opisthocline axial threads, interrupted in the intervals; breadth 0.43 mm.

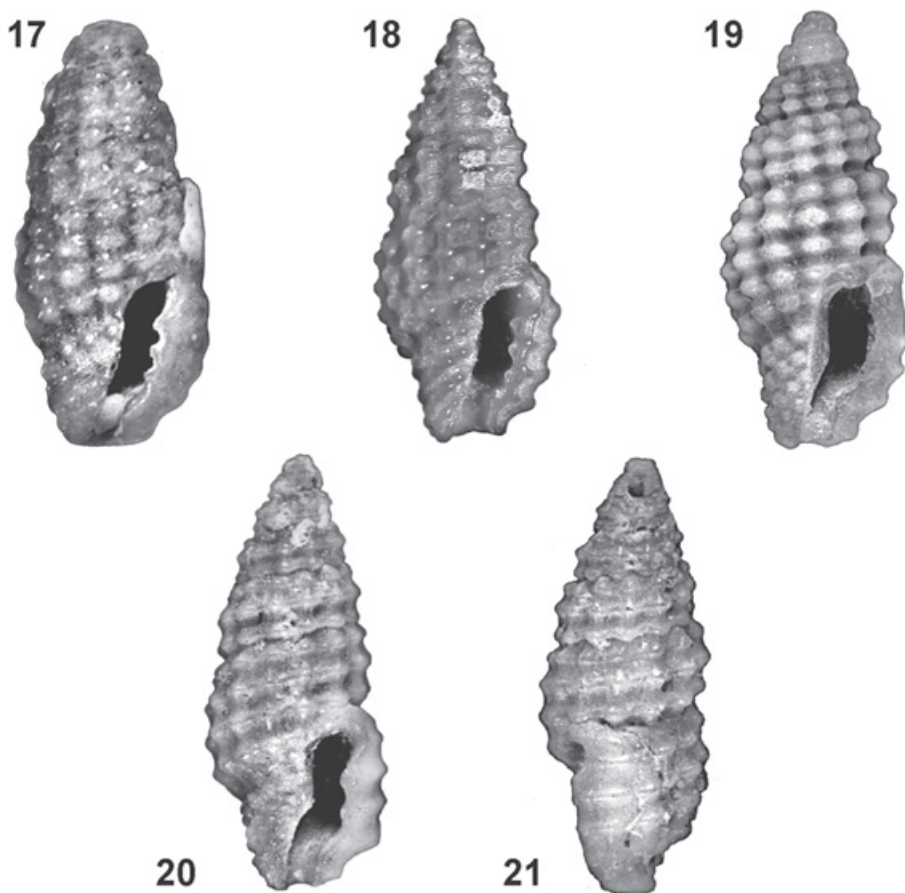


Figs 10–16. New and earlier described species of *Kermia*: (10–12) *K. drupelloides* sp. n., holotype NMSA W6532/T2358, 4.4×1.9 mm, apertural (10) and side (11) views, and ESEM of protoconch (12); (13, 14) *K. punctifera*, syntype of *Clathurella punctifera*, ANSP15687, Viti Is [Fiji], 4.9×2.0 mm, apertural and side views; (15, 16) *K. chrysolitha* [? = *C. punctifera*]: (15) holotype of *Mangilia* (*Glyphostoma*) *chrysolitha*, MMUE EE 3718, Loyalty Is, apertural view, 5.1×2.3 mm, (16) syntype of *Clathurella birtsi* Preston, 1908, BMNH 1912.8.7.1, "Ceylon?", apertural view, 6.3×2.3 mm.

Light brown, nodules, rostrum and early teleoconch whorls paler, aperture and its margin white; protoconch light brown.

Dimensions: 4.4×1.9 mm (holotype), 6.3×2.4 mm (paratype).

Comparison and remarks: This distinctive species shows some resemblance to the widely distributed Indo-Pacific *K. punctifera* (Garrett, 1873). The new species differs from *K. punctifera* in lacking characteristic brown marks on its tubercles, which are also markedly stronger and more angular, and its proportions are broader. Based on their types in the MMUE, BMNH and ANSP collections respectively (Figs 13–16), it is probable that *Mangelia chrysolitha* Melvill & Standen, 1896, and *Clathurella birtsi* Preston, 1908, are synonyms of *K. punctifera*, although they have fewer spiral cords and lip denticles. *K. drupelloides* also appears to show some resemblance to the figure of *Pleurotoma*



Figs 17–21. *Pseudodaphnella pullula* (Hervier, 1897), *P. martensi* (G. & H. Nevill, 1875) and *Paramontana blanfordi* (G. & H. Nevill, 1875): (17, 18) *P. pullula*, apertural views: (17) probable syntype of *Clathurella blanfordi* var. *pullula*, MNHN, Lifou; (18) holotype of *Pseudodaphnella punicea* Hedley, 1922, AMSA C.9520, Palm Is, Queensland, 5.5×2.5 mm, photo courtesy of Des Beechey; (19) *P. martensi*, syntype of *Clathurella martensi*, BMNH 1904.9.26.10–11, Balapiti, Sri Lanka, apertural view, 4.8×2.1 mm; (20, 21) *P. blanfordi*, probable holotype of *Clathurella blanfordi*, ZSIC, Annesley Bay [Zula Bahir Selate], Eritrea, apertural and side views, 5.5×2.4 mm.

microcerata type (Folin 1879: 248, pl. 8, fig. 2), described from the Andaman Islands, but that shows sharper nodules, which are spinose on the base, interstices that appear foveolate, an internally smooth outer lip, and its colour is white. Unfortunately, the holotype of *P. microcerata* is absent from the Folin turrid types preserved in the BMNH, and must be considered lost.

Sometimes the name *Pleurotoma pustulosa* Folin, 1867, has been used for specimens of *Kermia punctifera*, particularly in the Japanese and Chinese literature. However the figure of the *P. pustulosa* type (Folin 1867, pl. 5, fig. 14) illustrates finer, more numerous nodules, particularly so on the base; furthermore, the type material, which is evidently lost, might have originated from either the Philippines or the Bay of Panama. For the present I regard *P. pustulosa* as a *nomen dubium*.

Several species of *Pseudodaphnella* Boettger, 1895, and *Paramontana* Laseron, 1954, are essentially similar to *K. drupelloides*, but have a different protoconch. In the genus *Pseudodaphnella* this is generally paucispiral and papilliform with more or less ortho-cline axial riblets and weak spiral threads. A superficially comparable species of *Pseudodaphnella* is *P. pullula* (Hervier, 1897) from New Caledonia, which has a narrower indentation (waist) on the base and a narrower aperture than *K. drupelloides*. A synonym of *Clathurella blanfordi* var. *pullula* is *Pseudodaphnella punicea* Hedley, 1922 (Figs 17, 18). Another somewhat similar species is *Clathurella martensi* G. & H. Nevill, 1875 (Fig. 19), distributed from Sri Lanka to New Caledonia and southern Japan, which appears to have a *Pseudodaphnella*-type protoconch, similar to that of *P. pullula*.

Confusingly, *Clathurella blanfordi* G. & H. Nevill, 1875, of the Red Sea, has similar teleoconch sculpture to *P. pullula* and *P. martensi* comb. n. (Figs 20, 21), but the protoconch (in fresh condition) appears smooth, indicating a position in the genus *Paramontana*. This genus has been referred to the Mangeliinae (Sysoev 1993: 167), presumably on account of the smooth protoconch, but teleoconch characters are perhaps suggestive of the Clathurellinae or even Raphitominae. The teleoconch in *Paramontana blanfordi* comb. n. differs from that of *K. drupelloides* and *P. martensi* in its flattened lip profile, with a distinctive angle anteriorly.

Apart from its raphitome protoconch and small adult size, *K. drupelloides* shows superficial resemblance to some members of genus *Drupella* (Muricidae).

Holotype: NMSA W6532/T2358. SOUTH AFRICA: *KwaZulu-Natal*: off Scottburgh (30°17'S:30°45'E), ca -35 m, in shell grit, 1995. Donated by G. Smith.

Paratype 1: same data, to be lodged in BMNH. Paratype 2: *KwaZulu-Natal*: Park Rynie, -35–45 m, dived (NMSA S9826/T2350).

Other material in G. Smith collection.

Distribution: KZN, in Park Rynie – Scottburgh area, inner continental shelf.

***Kermia eugenei* sp. n.**

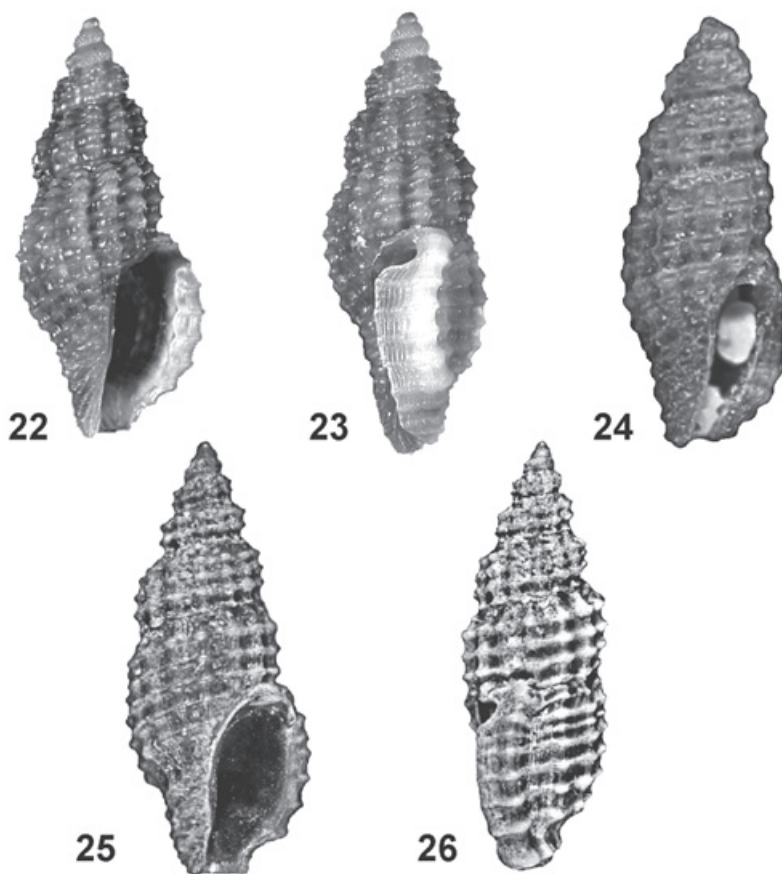
Figs 22, 23

Etymology: Named in honour of my son, Eugene, for his help and encouragement.

Description: Shell globose-fusiform with a tapering base; b/l 0.43–0.47, a/l 0.47–0.56; whorls strongly convex with a slight indentation below suture, and a fairly deep suture, crenulated by rib terminations, base of last whorl only slightly constricted at top of rostrum; rostrum narrow, flat-sided, without a fasciole; aperture narrowly elliptical,

more or less linear, constricted at siphonal canal, which is more or less parallel-sided, its termination oblique, shallowly indented in dorsal view; columella straight. Outer lip flattened in side view, slightly serrated at ridge terminations, edge incurved; anal sinus moderately deep, linguiform, abapically directed, its opening constricted, its margin not raised; interior of lip with 7 ridges or small teeth, the strongest one at entrance to siphonal canal; inner lip smooth, with a flattened callus, parietal pad weak.

Sculpture nodose-cancellate, of axial ribs crossed by narrower spiral ridges, forming compressed nodules, interstices rather deep and quadrate, a slightly deeper interval demarcating rostrum. Axial ribs somewhat arcuate, slightly opisthocyrton on last whorl, reaching and crenulating suture, evanescent on upper part of rostrum, fasciole with strong nodules; ribs in *t/s* strongly rounded and slightly compressed on spire whorls, lower with sloping sides on last whorl, ribs slightly wider than their intervals, one behind lip high and varicoid, 12 or 13 axials per whorl. Spiral ridges more or less evenly sized,



Figs 22–26. *Kermia eugenei* sp. n. and similar species: (22, 23) *K. eugenei*, holotype NMSA V23411/T2331, apertural and side views, 3.5×1.4 mm; (24) *K. aniani* Kay, 1979, paratype USNM 806725, Nanakuli beach, Oahu, Hawaii, apertural view, 3.1×1.2 mm; (25, 26) *K. cavernosa* (Reeve, 1845), syntype of *Pleurotoma cavernosa*, BMNH 1963801, Philippine Is, apertural and side views, 5.9×2.5 mm.

first teleoconch whorl with 2, increasing to 3, spiral ridges, 2nd whorl with 4; penultimate whorl with 5–7 ridges, subsutural one or two usually weaker than others; base of last whorl with an additional 2 ridges, rostrum bearing 7 or 8 close, angular spiral ridges, upper 2 or 3 somewhat crenulate, progressively weakening towards base. Prelabral varix crossed by 8–10 ridges. Interstices with extremely fine and close collabral striae (coarsest behind lip).

Protoconch conical, of *ca* 3.3 convex whorls, 1st one tilted, last one very finely diagonally cancellate, penultimate one punctate; breadth of last whorl 0.37 mm.

Uniform pale to medium brown, early spire whorls sometimes faintly tinted with orange, protoconch pale brown; columella and inner edge of outer lip orange-brown.

Dimensions: 3.5×1.4 mm (holotype); 4.2×1.8 mm (largest paratype).

Comparisons and remarks: *K. eugenei* appears closely comparable only with *K. cavernosa* (Reeve, 1845) from the Philippines. The freshest of five syntypes of *Pleurotoma cavernosa* (BMNH 1963801), which retains its protoconch, is here illustrated (Figs 25, 26). Compared with *K. eugenei*, *K. cavernosa* has flatter whorls, only two spiral ridges on the early teleoconch whorls, a distinct waist-like basal furrow demarcating four or five nodular cords on the rostrum, and lacks an orange inner margin to the aperture. *K. aniani* Kay, 1979, of Hawaii, is markedly more cylindrical in shape, with a narrower aperture, stronger labral denticles and more numerous spiral ridges (Fig. 24).

Holotype: NMSA V23411/T2331. SOUTH AFRICA: *KwaZulu-Natal*: 1–4 km S of Kosi Bay (26°54'S; 32°52'E), -20–22 m, reef, D. Herbert & K. Bloem.

Paratypes: SOUTH AFRICA: *KwaZulu-Natal*: between Bhanga Neck and Kosi Bay, reef near pinnacles, -10–12 m, hand-dredged sand (D. Herbert; NMSA S2371/T2334); Leadsman Shoal, coral reef, -7–11 m, 1 specimen (D. Herbert & Natal Parks Board; NMSA E6778/T2332); off Durban Bluff, -20–22 m, sand (reclamation dump), 5 specimens (R. Kilburn & R. Fregona; NMSA B5467/T2333).

Distribution: From northern KZN to Durban, in *ca* -10–22 m.

Kermia melanoxytum (Hervier, 1896)

Figs 27–29

Glyphostoma melanoxytum: Hervier 1896a: 150; 1896b: 78, pl. 3, fig. 19. Type locality: Lifou.

Kermia melanoxytum (Hervier): Kay 1979: 361, figs 117F (protoconch), 118J; Zhang 1995: 290, pl. 4, figs 23–24; Chang 2001: 72, figs 65, 65b, and p. 212, figs 19–16a, b.

Type material: Originally ten syntypes from Hervier collection in SML; three probable syntypes now in MNHN, one labelled by Fischer-Piette as “Type” 4.6×2.0 mm, early part of protoconch missing; unconfirmed syntypes AMSA C.7019.

Regional locality data: SOUTH AFRICA: *KwaZulu-Natal*: E of Kosi Bay, -50 m, fine sand (Kilburn *et al.*; NMSA E5348); Kosi Bay, 1–4 km S of mouth, -20–22 m (D. Herbert & K. Bloem; NMSA S775); off Island Rock, -62 m, sandstone, coral (Kilburn *et al.*; NMSA E5551); Leadsman Shoal, 1–2 km N of Leven Point, -9–14 m, mixed algal and coral reef (D. Herbert; NMSA E5375); off Sodwana Bay, talus slope, -46 m (Marine Geoscience Unit, University of KwaZulu-Natal, Durban; NMSA V5072); Aliwal Shoal, off Scottburgh, -10 m, reef debris (D. Herbert; NMSA S9237); same data but -25–27 m (D. Herbert; NMSA S7131); off Park Rynie, -35–40 m, offshore reef (G. Smith; NMSA S9857). Beach-worn shells also seen in private collection from Mzamba, Eastern Cape.

Distribution: New Caledonia to Hawaii, and west to south-eastern Africa, as far south as Eastern Cape.

Remarks: Specimen NMSA S775 (Fig. 29) has been compared with one of the “syntypes” (Figs 27, 28) in the MNHN.

Kermia edychroa (Hervier, 1897)

Figs 30–33

Clathurella edychroa: Hervier 1897a: 146; 1897b: 109, pl. 3, fig. 2; Bouge & Dautzenberg 1914: 195. Type locality: Lifou.

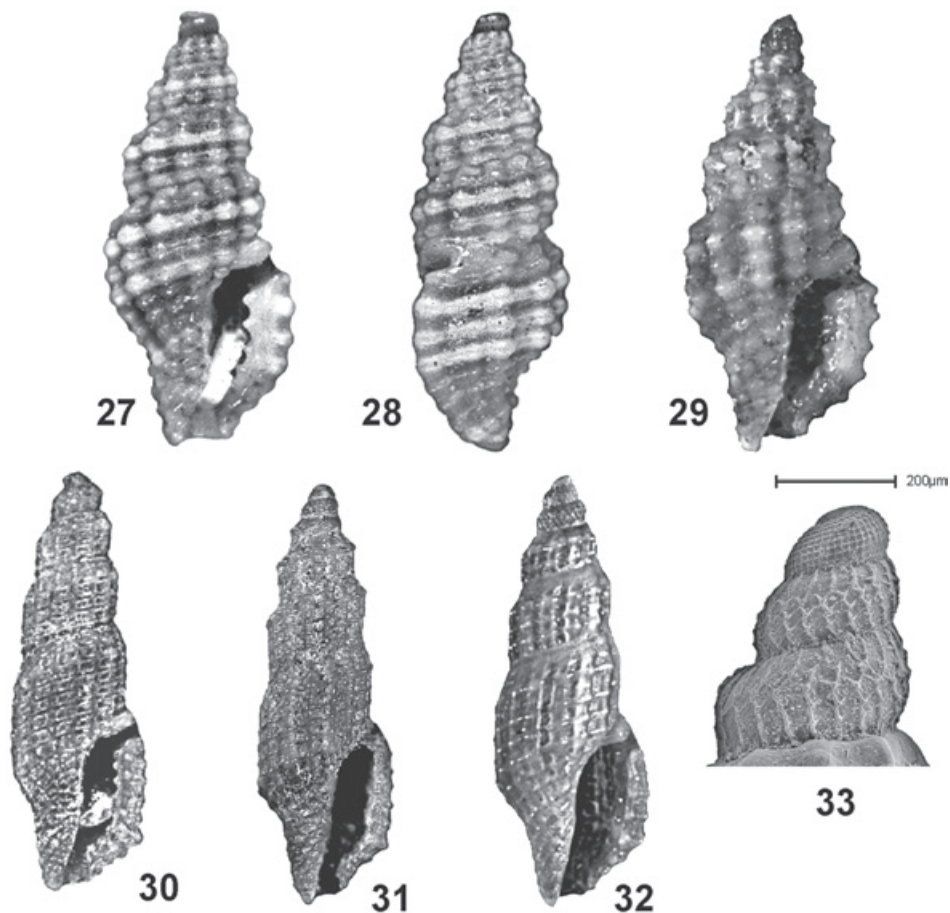
Clathurella edychroa var. *violacea* Hervier, 1897b (*non* Bucquoy, Dautzenberg & Dollfus, 1883): 110. Type locality: Lifou.

Kermia edychroa (Hervier): Kay & S. Johnson 1987: 122, fig. 4U.

Pleurotoma gracilis Folin, 1879 (*non* Conrad, 1830, *nec* Scacchi, 1836): 251, pl. 8, fig. 6. **Syn. n.** Type locality: Andaman Is.

Mangelia anxia Hedley, 1909: 455, pl. 43, fig. 89. **Syn. n.** Type locality: Hope I., Great Barrier Reef, Queensland, 5–10 fath. [9–18 m].

Exomilus anxius (Hedley): Hedley 1922: 333; Powell 1966: 137.



Figs 27–33. *Kermia melanoxytium* (Hervier, 1896) and *Kermia edychroa* (Hervier, 1897): (27–29) *K. melanoxytium*: (27, 28) syntype of *Glyphostoma melanoxytium*, MNHN, Lifou, apertural and side views, 4.6×2.0 mm; (29) specimen NMSA S775 from Kosi Bay, 4.0×1.9 mm; (30–33) *K. edychroa*: (30) probable syntype of *Clathurella edychroa*, MNHN, Lifou, apertural view, 4.1×1.3 mm; (31) syntype of *Mangelia anxia* Hedley, 1909, AMSA C.27446, Hope Is., Queensland, 5–10 fath. [9–18 m], apertural view, 3.3×1.1 mm (photo courtesy of Des Beechey); (32) specimen NMSA V2284 from Kosi Bay, apertural view, 3.2×1.3 mm; (33) ESEM of protoconch, specimen from Réunion I.

Type material: *C. edychroa*: originally two syntypes in SML, one possible syntype now in MNHN (labelled "Holotype"), worn and lacking its apex (Fig. 30); very doubtful syntypes AMSA C.6988 (not seen). *C. edychroa* var. *violacea*: not located. *P. gracilis*: Holotype in BMNH (ex Macandrew coll.), 3.0×1.1 mm. *M. anxia*: syntypes AMSA C.27446, 1 syntype NMWC 1955.158.912 (not seen).

Regional locality data: SOUTH AFRICA: *KwaZulu-Natal*: Kosi Bay, 1–4 km S of estuary, -20–22 m (D. Herbert & K. Bloem; NMSA V2284); off Kosi Bay, -23–24 m (D. Herbert & K. Bloem; NMSA S2936); SE of Kosi Bay, -50 m, fine sand (Kilburn *et al.*; NMSA E5349); off Kosi Bay, -9–17 m, stone washings (D. Herbert; NMSA D9928); between Kosi Bay and Bhanga Neck, -13 m, sand (D. Herbert; NMSA S2995); same data but -10–12 m, sand (D. Herbert; NMSA S2373); off Boteler Point, -70 m, coral rubble (Kilburn *et al.*; NMSA E1574); off Island Rock, -62 m, sand and coral debris (Kilburn *et al.*; NMSA E5562); off Leadsman Shoal, -24–26 m, stone washings (D. Herbert & Natal Parks Board; NMSA E2636); Sodwana Bay, Two-Mile Reef, -10–15 m, stone washings (D. Herbert & R. Broker; NMSA E734); off Richards Bay, -50 m, fine sand, broken shell (CSIR Water Research; NMSA A6102); off Cape St Lucia, -76–80 m, coarse sand (Kilburn *et al.*; NMSA E5692); SE of Mission Rocks, -50 m, old coral rubble (Kilburn *et al.*; NMSA E6297); off Durban Bluff, -20–22 m, sand (R. Kilburn & R. Fregona; NMSA B5468); Aliwal Shoal, off Umkomaas, -27 m, silt between rocks (G. Smith; NMSA E1677). *Eastern Cape*: Port Grosvenor, -82 m, worn coral nodules (Kilburn *et al.*; NMSA S9578); off Cape Morgan Lighthouse, east of East London, approx. -100 m, broken coral and shell (A. Connell; NMSA B7122).

Distribution: New Caledonia to Queensland, west to Réunion I. and south-eastern Africa, south as far as the East London area, in shallow water to about -100 m.

Remarks: The types listed above have been examined, except for *M. anxia*, photographs of a syntype of which (Fig. 31) were kindly provided by D. Beechey. The protoconch of a fresh Réunion I. specimen, donated by Dr Maurice Jay, is illustrated here (Fig. 33).

K. edychroa shows some resemblance in teleoconch form to *Mangelia lutaria* Hedley, 1907, of New South Wales, type species of *Exomilus* Hedley, 1918. In fact, *M. anxia*, here synonymised with *K. edychroa*, was included in *Exomilus* by Powell (1966). However, the protoconch in *Exomilus lutarius*, as figured by Laseron (1954: figs 251, 252), has a distinctive, cylindrical, truncate shape, without trace of diagonally cancellate sculpture.

Kermia pumila (Mighels, 1845)

Figs 34–38

Pleurotoma pumila: Mighels 1845: 23; Johnson 1949: 228, pl. 27, fig. 11 ('neoholotype' = lectotype). Type locality: Oahu [= Kauai, *vide* Johnson 1949: 217], Hawaii.

Philbertia (Kermia) pumila: Cernohorsky 1978: 162, pl. 57, fig. 14.

Kermia pumila (Mighels): Kay 1979: 362, fig. 118L.

Mangelia digitale Reeve, 1846: pl. 8, sp. 70. Type locality: unknown.

Pleurotoma (Mangelia) reticulata Garrett, 1857: 102 (*non* T. Brown, 1827, *nec* Bronn, 1831). Type locality: Hilo Bay, Hawaii. [= *Pleurotoma pumila fide* Pease 1868; Tryon 1884; Kay 1979]

Pleurotoma clandestina Deshayes, 1863: 110, pl. 12, figs 15, 16. Type locality: Réunion I.

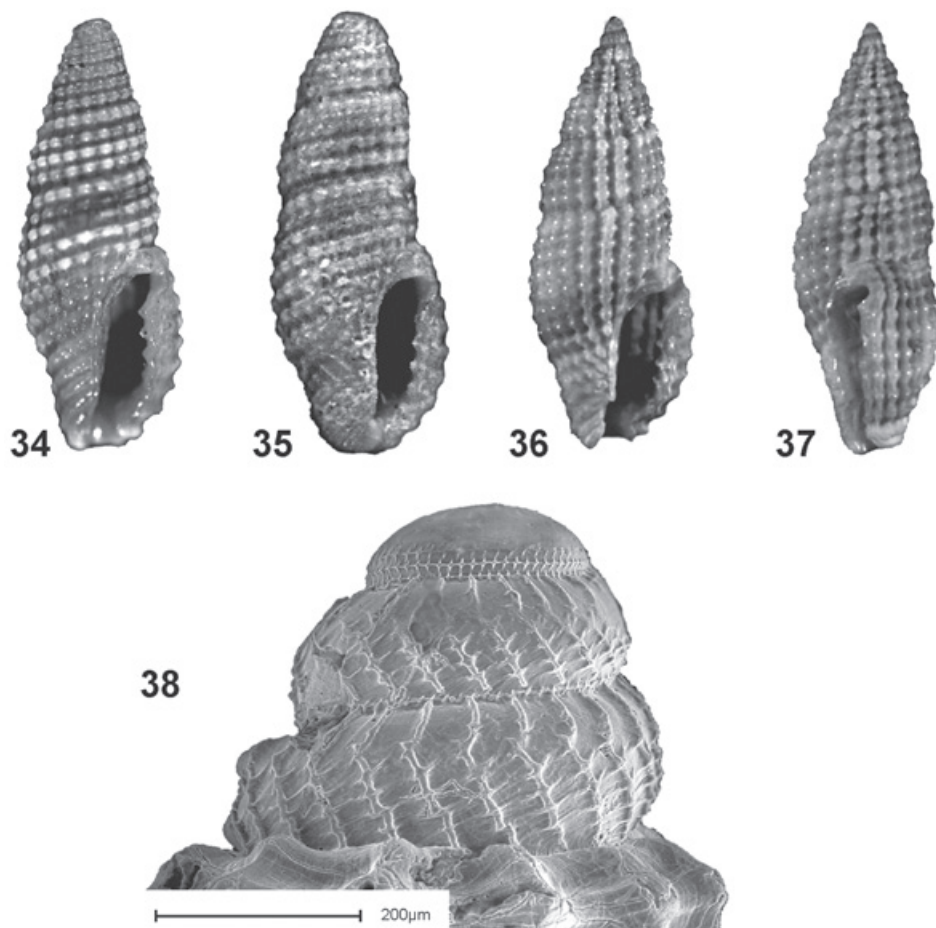
Clathurella violacea Pease, 1868: 218, pl. 15, fig. 15; Johnson 1994: 27, pl. 6, fig. 15 (lectotype). Type locality: Paumotu [Tuamotu], Polynesia.

Type material (examined unless otherwise indicated): *P. pumila*: lectotype (designated by Johnson 1949) MCZH 176993 (Fig. 34). *M. digitale*: types probably lost (originally in Stainforth coll.). *P. reticulata*: not seen. *P. clandestina*: one syntype in MNHN (a juvenile, badly encrusted by "Byne's disease"). *C. violacea*: lectotype (Fig. 35), worn (designated by Johnson 1994) MCZH 231971, 4.6×1.8 mm, paralectotypes MCZH 231971 (not seen).

Regional locality data: SOUTH AFRICA: *KwaZulu-Natal*: between Bhanga Neck and Kosi Bay, near pinnacles of reef, -10–12 m, hand-dredged sand (D. Herbert; NMSA S2391).

Distribution: Polynesia, Hawaii, Fiji and Okinawa to the Mascarenes, Seychelles, and northern KZN, intertidal to about -20 m, under coral and stones.

Remarks: The single South African specimen, in fresh (probably live-collected) condition, appears to be the first record of *K. pumila* from the African mainland. Only the



Figs 34–38. *Kermia pumila* (Mighels, 1845): (34) lectotype of *Pleurotoma pumila* (designated by Johnson 1949), MCZH 176993; (35) lectotype of *Clathurella violacea* Pease, 1868, MCZ 231971, 4.6×1.8 mm; (36, 37) specimen NMSA S2391 from between Bhanga Neck and Kosi Bay, 5.0×1.9 mm; (38) ESEM of protoconch, specimen from Réunion I.

most important references are cited above. The protoconch of a specimen from Réunion I., collected by Dr M. Jay, is illustrated here (Fig. 38).

Kermia producta (Pease, 1860)

Figs 39–45

Clathurella producta: Pease 1860: 143; Von Martens & Langkavel 1871: 2, pl. 1, fig. 3; Tryon 1884: 298, pl. 19, fig. 63; Kay 1965: 19, pl. 2, figs 3, 4 (lectotype). Type locality: Sandwich Is [Hawaii].

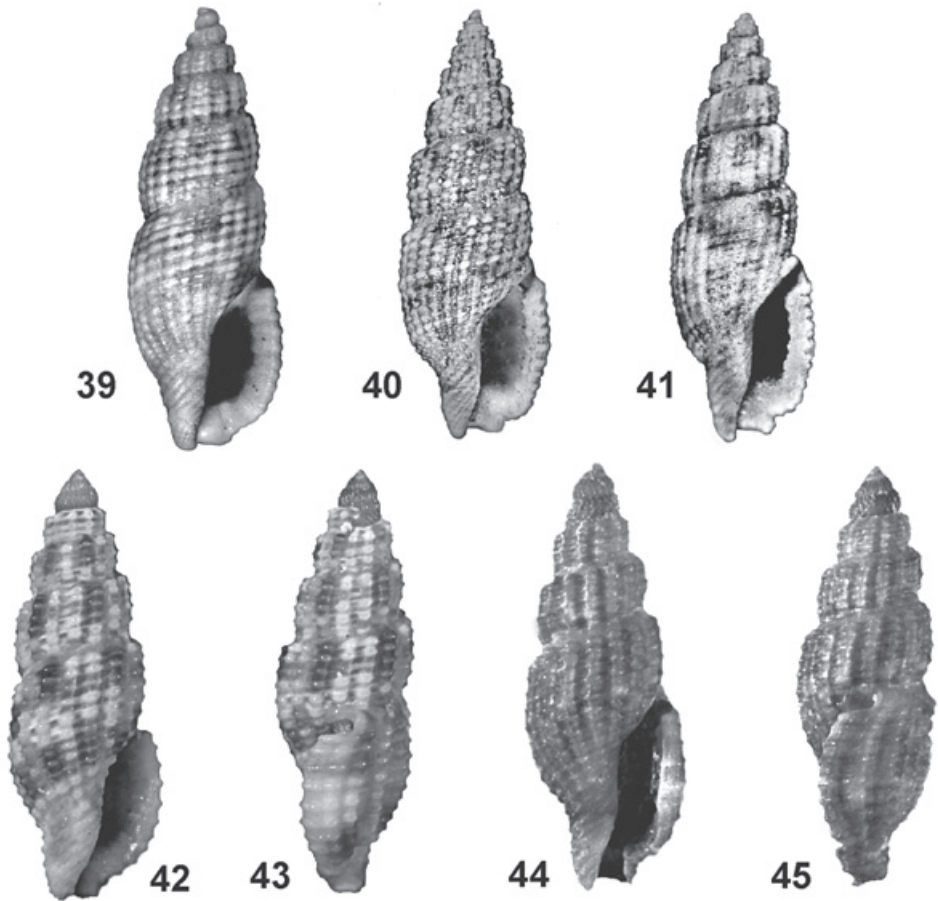
Kermia producta (Pease): Kay 1979: 361, fig. 118M.

Defracia mauritiana Sowerby, 1893: 491, pl. 38, figs 23, 24. Type locality: Mauritius. **Syn. n.**

Clathurina foraminata pyrgodea Melvill, 1917: 186, pl. 10, fig. 13; Trew 1987: 60. Type locality: Mussandam, Persian Gulf, 55 fath. [-101 m]. **Syn. n.**

Kermia foraminata pyrgodea (Melvill): Powell 1966, pl. 22, fig. 2 (after Melvill 1917).

Type material: *Clathurella producta*: lectotype (designated by Kay 1965) BMNH 1962761. *D. mauritiana*: holotype BMNH 1893.8.18.10, don. G.B. Sowerby. *C. foraminata pyrgodea*: holotype BMNH 1925.3.12.5.



Figs 39–45. *Kermia producta* (Pease, 1860): (39) lectotype of *Clathurella producta*, BMNH 1962761, 7.2×2.6 mm; (40) holotype of *Defrancia mauritiana* Sowerby, 1893, BMNH 1893.8.18.10, 10.5×3.8 mm; (41) holotype of *Clathurina foraminata pyrgodea* Melvill, 1917, BMNH 1925.3.12.5, 11.8×3.9 mm; (42, 43) specimen NMSA S771 from between Banga Neck and Kosi Bay, apertural and side views, 4.2×1.7 mm; (44, 45) specimen NMSA E5727 from off Boteler Point, apertural and side views, 4.2×1.4 mm.

Regional locality data: SOUTH AFRICA: *KwaZulu-Natal*: between Kosi Bay and Bhanga Neck, -13 m, sand (D. Herbert; NMSA S3006), same locality, ca -8 m (D. Herbert & K. Bloem; NMSA S771); off Boteler Point, -70 m, coral rubble (R. Kilburn *et al.*; NMSA E5727); Aliwal Shoal, off Umkomaas, -25–28 m (D. Herbert; NMSA S9894). *Eastern Cape*: Mzamba, beach drift (J.P. Marais; NMSA A5295).

Distribution: Hawaii and Polynesia to Red Sea, Mauritius, Mozambique and eastern South Africa.

Remarks: *K. producta* belongs to a highly problematic complex of taxa, much confused in the literature. Examination of the relevant types and fresher samples from various localities leads me to propose the synonymy given above. Comparison of types of *D. mauritiana* (Fig. 40) and *C. foraminata* var. *pyrgodea* (Fig. 41) shows them to be conspecific, and *Clathurella producta* (Fig. 39) to have been based on a slightly worn specimen of the same species. Although *D. mauritiana* was synonymised with *Kermia*

tessellata (Hinds, 1843) by Hedley (1922), Powell (1966) and Cernohorsky (1978), the extant types differ as follows: those of *D. mauritiana* (and *C. foraminata pyrgodea*) differ from *K. tessellata* (*Clavatulula tessellata* Hinds, 1843: 44, syntype BMNH 1879.2.26.82 ex Lombe Taylor coll.—presumably not the figured type (Hinds 1844: 23, pl. 7, fig. 11) as it is worn and broken) in their shouldered whorls, finer sculpture, flatter outer lip and strongly contracted base (Fig. 48). Two similar but evidently distinct species are *Kermia apicalis* (Montrouzier in Souverbie, 1861) and *Kermia daedalea* (Garrett, 1873). Of these, the former, according to the holotype of *Pleurotoma apicalis* in MHNH (Figs 46, 47), has non-shouldered whorls and a less contracted base than *K. producta*. *K. daedalea* is discussed below.

Kermia daedalea (Garrett, 1873)

Figs 50–54

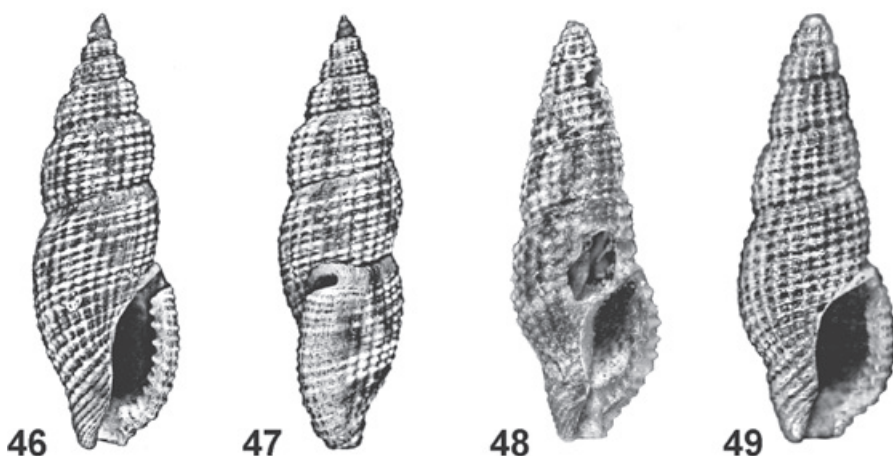
Clathurella daedalea: Garrett 1873: 219, pl. 2, fig. 33; Tryon 1884: 294, pl. 19, fig. 66. Type locality: Viti Is [= Fiji].

Clathurella phaedra Hervier, 1897a: 141; 1897c: 96, pl. 2, fig. 3. Type locality: Lifou.

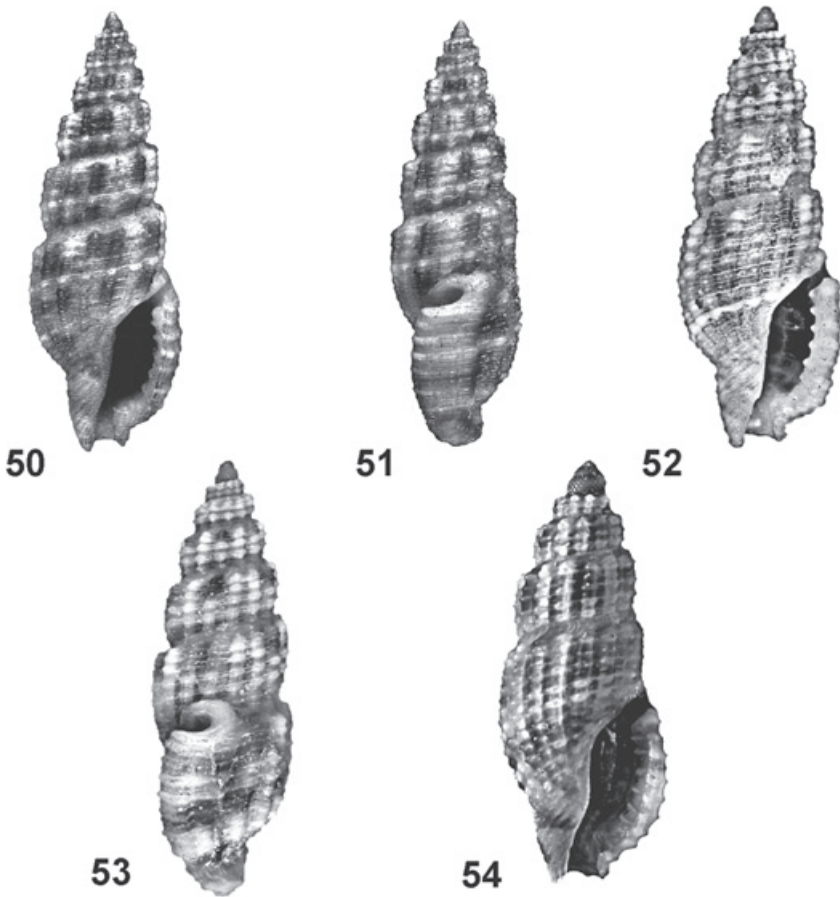
Philbertia phaedra (Hervier): Oyama & Takemura 1957: *Philbertia* (2), figs 13, 14.

Type material: *C. daedalea*: 3 syntypes from Viti [Fiji] Is in ANSP; of these, ANSP 15821 (Figs 50, 51) resembles the type figure and is here designated as lectotype; it is evidently a specimen of the species later described as *C. phaedra*; ANSP 15820 comprises two syntypes, one a chalky example of *C. phaedra*, the other a specimen of *Kermia felina* (Reeve, 1843). *C. phaedra*: originally 6 syntypes in SML; one presumed syntype (labelled “paratype”, although it does not agree well with the type figure) now in MNHN (Figs 53, 54); another possible syntype AMSA C.7081 (not seen).

Regional locality data: SOUTH AFRICA: *KwaZulu-Natal*: 1–4 km S of Kosi Bay, ca -20 m (D. Herbert & R. Broker; NMSA S2580); between Bhanga Neck and Kosi Bay, -13 m (D. Herbert; NMSA S3006); Leadsman Shoal, Raggie Reef, -8–14 m, mixed algal and coral reef (D. Herbert & Natal Parks Board; NMSA E5397); off Durban Bluff, -20–22 m, reclamation sand (R. Kilburn & R. Fregona; NMSA B5471); Aliwal Shoal, off Scottburgh, -10 m, sand and reef debris (D. Herbert; NMSA S8227) and off Umkomaas, -25–28 m (D. Herbert; NMSA S9894).



Figs 46–49. Some *Kermia* species: (46, 47) *K. apicalis* (Montrouzier in Souverbie, 1861), holotype of *Pleurotoma apicalis*, MHNH, Art I., New Caledonia, apertural and side views, length 8.9 mm (negative courtesy of D. Herbert); (48) *K. tessellata* (Hinds, 1843), syntype of *Clavatulula tessellata*, BMNH 1879.2.26.82, Strait of Macassar (Makassar), 10 fath. [-18 m], apertural view, 6.9×2.3 mm; (49) *K. margaritifera* (Reeve, 1846), syntype of *Pleurotoma margaritifera*, BMNH 74.10.31.8, loc. unknown, apertural view, 6.8×2.5 mm.



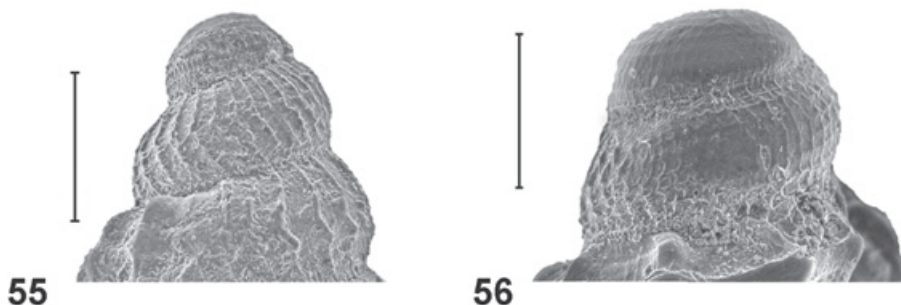
Figs 50–54. *Kermia daedalea* (Garrett, 1873): (50, 51) lectotype of *Clathurella daedalea*, ANSP 15821, Viti Is [Fiji], apertural and side views, 8.1×2.8 mm; (52) specimen NMSA E5397 from Leadsman Shoal, apertural view, 4.6×1.7 mm; (53, 54) possible syntype of *Clathurella phaedra* Hervier, 1897, MNHN, Lifou, apertural and side views, 7.1×2.6 mm.

Distribution: New Caledonia to the Gulf of Suez and south to southern KZN.

Remarks: The status of *K. daedalea* remains to be finally resolved and it may prove to be an extreme variant of *K. producta*, from which it appears to differ only in its coarser sculpture and sharper lip denticles.

ACKNOWLEDGEMENTS

I am indebted to the following curators for providing access to turritid type and other material in their care, or for supplying photographs of these: Dr D.G. Herbert (NMSA); Ms K. Way and Dr D. Reid (BMNH); Dr Ph. Bouchet and Ms V. Heros (MNHN); D. Beechey and I. Loch (digital photographs of types in the AMSA); C.W. Pettit (MMUE); Dr H. Subba Rao (ZSIC); P. Callomon (ANSP), Dr M.G. Harasewych (USNM); A. Baldinger (MCZH). I also thank Mr Tony Bruton of the Electron Microscope Unit, University of KwaZulu-Natal, for the use of the ESEM and Automontage system. Mr



Figs 55, 56. ESEM micrographs of protoconchs: (55) *Kermia margaritifera* (Reeve, 1846), Bombay; (56) *Pseudodaphnella infrasulcata* (Garrett, 1873), MNHN, Lifou. Scale bars = 200 μ m.

Gerald Smith provided material of small turrids dived off KZN. The late Dr Maurice Jay of Réunion Island kindly provided an extensive series of fresh specimens from that island. Finally, I thank referees for useful comments on the manuscript.

REFERENCES

- BOUGE, L.J. & DAUTZENBERG, P. 1914. Les Pleurotomés de la Nouvelle-Calédonie et de dépendances. *Journal de Conchyliologie* **61**: 123–214.
- CERNOHORSKY, W.O. 1978. *Tropical Pacific Marine Shells*. Sydney and New York: Pacific Publications.
- CHANG, C.-K. [ZHANG ZH.-g.]. 2001. New turrid taxa and three new species. *Bulletin of Malacology* **25**: 1–4.
- DESHAYES, G.P. 1863. Catalogue des mollusques de l’Ile de la Réunion (Bourbon). In: Maillard, L. *Notes sur l’Ile de la Réunion (Bourbon)*. Mollusques. Paris: Dentu.
- FOLIN, A.G.L. DE. 1867. In: Folin, A.G.L. de & Périer, L. 1867–69. *Les fonds de la mer études internationale sur les particularités nouvelles des régions sous-marines*. Paris: Folin, pp. 1–256, 32 pls.
- 1879. Mollusques des Iles Andaman. In: Folin, A.G.L. de & Périer, L. 1867–87: *Les fonds de la mer études internationale sur les particularités nouvelles des régions sous-marines*. Paris: Folin, (Pleurotoma in livres 58–60, pp. 248–251, pl. 6.)
- FUKUDA, H. 1995. *Marine Gastropoda (Mollusca) of the Ogasawara (Bonin Islands)*. Part 3. Additional records. *Ogasawara Research* **21**: 1–142, 75 pls.
- GARRETT, A. 1857. [... on new species of marine shells of the Sandwich Islands]. *Proceedings of the California Academy of Sciences* **1** (2D): 102–103; 114–115.
- 1873. Descriptions of new species of marine shells inhabiting the South Sea Islands. *Proceedings of the Academy of Natural Science of Philadelphia* **25**: 209–231, pls 2–3.
- HASEGAWA, K., OKUTANI, T. & TSUCHIDA, E. 2000. Family Turridae. In: Okutani, T., ed., *Marine mollusks in Japan*. Tokyo: Tokai University Press, pp. 619–667, pls. 308 (in part) – 332 (in part), 2 figs.
- HEDLEY, C. 1909. Mollusca from the Hope Islands, North Queensland. *Proceedings of the Linnean Society of New South Wales* **34**: 420–466, pls 36–44.
- 1922. A revision of the Australian Turridae. *Records of the Australian Museum* **13** (6): 213–359, pls 42–56.
- HERVIER, J. 1896a. Descriptions d’espèces nouvelles de l’Archipel Néo-Calédonien. *Journal de Conchyliologie* **43** (3): 141–152.
- 1896b. Descriptions d’espèces nouvelles de l’Archipel de la Nouvelle-Calédonie. *Journal de Conchyliologie* **44** (1): 51–95, pls 1–3.
- 1897a. Descriptions d’espèces nouvelles de l’Archipel de la Nouvelle-Calédonie. *Journal de Conchyliologie* **44** (2): 138–151.
- 1897b. Descriptions d’espèces nouvelles de l’Archipel de la Nouvelle-Calédonie. *Journal de Conchyliologie* **45** (2): 89–121, pls 2, 3.
- HIGO, S., CALLOMON, P. & GOTO, Y. 1999. *Catalogue and bibliography of the marine shell-bearing Mollusca of Japan*. Osaka, Japan: Elle Scientific Publications.
- 2001. *Catalogue and bibliography of the marine shell-bearing Mollusca of Japan*. Type figures. Osaka, Japan: Elle Scientific Publications.
- HINDS, R.B. 1843. On new species of *Pleurotoma*, *Clavatula*, and *Mangelia*. *Proceedings of the Zoological Society of London* **1843**: 36–46.

- 1844. *The zoology of the voyage of H. M. S. "Sulphur", under the command of Captain Sir Edward Belcher, R.N., C.B., F.R.G.S., etc., during the years 1836–42*. Vol. 2. London: Smith, Elder and Co., pp. 1–24 (July, 1844), 25–48 (October, 1844).
- JOHNSON, R.I. 1949. Jesse Wedgwood Mighels with a bibliography and a catalogue of his species. *Occasional Papers on Mollusks* **1** (14): 213–231, pl. 27.
- 1994. Types of shelled Indo-Pacific mollusks described by W.H. Pease. *Bulletin of the Museum of Comparative Zoology* **154** (1): 1–61, pls 1–10.
- KANTOR, Y.I. & TAYLOR, J.D. 2002. Foregut anatomy and relationships of raphitomine gastropods (Gastropoda: Conoidea: Raphitominae). *Bolletino Malacologico, Supplemento* **4**: 83–110.
- KAY, E.A. 1965. Marine molluscs in the Cuming collection, British Museum (Natural History) described by William Harper Pease. *Bulletin of the British Museum (Natural History) Zoology, Supplement* **1**: 1–96, pls 1–14.
- 1979. Hawaiian marine shells. Reef and shore fauna of Hawaii. Section 4: Mollusca. *Bernice P. Bishop Museum Special Publications* **64** (4): 1–653.
- KAY, E.A. & JOHNSON, S. 1987. Mollusca of Enewetak Atoll. In: Devaney, D.M., Reese, E.S., Burch, B.L. & Helfrich, P. *The natural history of Enewetak Atoll*. Vol. 1. Washington, DC: US Department of Energy, pp. 105–148.
- MELVILL, J.C. 1917. A revision of the Turridae (Pleurotomidae) occurring in the Persian Gulf, Gulf of Oman, and north Arabian Sea, as evidenced mostly through the results of dredgings carried out by Mr. F.W. Townsend, 1893–1914. *Proceedings of the Malacological Society of London* **12**: 140–201, pls 8–10.
- MIGHELS, J.W. 1845. Descriptions of shells from the Sandwich Islands and other localities. *Proceedings of the Boston Society of Natural History* **2**: 18–25.
- OLIVER, W.R.B. 1915. The Mollusca of the Kermadec Islands. *Transactions of the New Zealand Institute* **47**: 509–568, pls. 9–12.
- ORR-MAES, V. 1967. The littoral marine mollusks of Cocos-Keeling Islands (Indian Ocean). *Proceedings of the Academy of Natural Sciences of Philadelphia* **119**: 93–217.
- OYAMA, K. & TAKEMURA, Y. 1957. *The Molluscan Shells*. Resources Exploitation Institute, Tokyo. [No pagination or text]. Pt 1. *Lienardia* (1); *Philbertia* (1); *Philbertia* (2); *Philbertia* (3); *Philbertia* (4) – *Asperdaphne*; and *Daphnella* (1); 1, pls 6 plus captions.
- PEASE, W.H. 1860. Descriptions of new species of Mollusca from the Sandwich Islands (Part II). *Proceedings of the Zoological Society of London* **1860**: 141–148.
- 1868. Descriptions of marine Gasteropoda, inhabiting Polynesia. *American Journal of Conchology* **3**: 211–222.
- POWELL, A.W.B. 1966. The molluscan families Speightiidae and Turridae, an evaluation of the valid taxa, both Recent and fossil, with lists of characteristic species. *Bulletin of the Auckland Institute and Museum* **5**: 1–184, text-figs. A1–A3, B–F, pls 1–23.
- REEVE, L.A. 1843–1846. Monograph of the Genus *Pleurotoma*. *Conchologia Iconica, or Illustrations of the shells of molluscous animals*. Vol. 1. London: Reeve Brothers, pls 1–18 (1843), pl. 19 (1844), pls 20–33 (1845), pls 34–40 + index and errata (1846).
- 1846. Monograph of the Genus *Mangelia*. *Conchologia Iconica, or Illustrations of the shells of molluscous animals*. Vol. 3. London: Reeve Brothers, pls 1–8 + index and errata.
- SHUTO, T. 1971. Taxonomical notes on the turrids of the Siboga-Collection originally described by M. N. Schepman, 1913 (Part 3). *Venus* **30** (1): 5–22, pls 1–2.
- SOWERBY, G.B. III. 1893. Descriptions of fifteen new species of shells of the family Pleurotomidae. *Proceedings of the Zoological Society of London* **1893**: 487–492, pl. 38.
- 1913. Description of new species of Mollusca. *Annals and Magazine of Natural History, Series 8* **12**: 233–239, pl. 3.
- SYSOEV, A.V. 1993. In: Taylor, J.D., Kantor, Yu.I. & Sysoev, A.V. 1993. Foregut anatomy, feeding mechanisms, relationships and classification of the Conoidea (= Toxoglossa) (Gastropoda). *Bulletin of the Natural History Museum of London, Zoology* **59** (2): 125–170, figs 1–27.
- TREW, A. 1987. James Cosmo Melvill's new molluscan names. Cardiff: National Museum of Wales, pp 1–84.
- TRYON, G.W. 1884. Conidae, Pleurotomidae. *Manual of conchology, structural and systematic, with illustrations of the species*. **6**: 1–150, pls 1–31 (Conidae); 151–413, pls 1–34 (Pleurotomidae).
- VON MARTENS, E. & LANGKAVEL, B. 1871. *Donum Bismarkianum. Ein Sammlung von Südsee Conchylum*. [i–vi] Berlin.
- ZHANG, ZH.-G. [CHANG, CH.-K.] 1995. Studies on micromolluscan Turridae of Ludao Islet, Taiwan. *Studia Marina Sinica* **36**: 273–296.