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Six new species of pyramidellids (Mollusca, Gastropoda, Pyramidelloidea) from West Africa, introducing the new genus *Kongsrudia*

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Abstract

During an ongoing project investigating the benthic fauna of the Gulf of Guinea several new species of Pyramidellidae were identified. In spite of several recent investigations of the pyramidellid fauna of the area, a great portion of the fauna is obviously still un-described. This paper introduces five new species of *Turbonilla* sensu lato (*T. krakstadi, T. anselmopenasi, T. iseborae, T. korantengi, T. alvheimi*). A new Chrysallininae genus, *Kongsrudia,* is introduced with *Actaeopyramis gruveli* as type species. A new species, *K. rolani* is described, and *Pyrgulina approximans, Chrysallida ersei, and Pyrgulina mutata* (an existing nom. nov. pro *P. lamyi*) are transferred to the genus *Kongsrudia.*

Key words: Odostomidae, Chrysallidinae, *Chrysallida*, Heterostropha, distribution, Pyramidellidae, Turbonillidae, Turbonillinae, *Turbonilla*

Introduction

Pyramidellidae is a speciose group of parasitic gastropods, comprising more than 6000 species divided into more than 350 genera (Schander *et al.* 1999). In recent years the pyramidellid fauna of Europe and West Africa has been intensively studied (e.g. Schander 1994; Peñas & Rolan 1997, 1998, 2002; Peñas *et al.* 1999; van Aartsen *et al.* 1998, 2000). Numerous new species have been described from the area, but still a large number remains to be described. New studies also indicate that present knowledge about distribution range is incomplete. The present paper describes six new species from the West African coast.

The Gulf of Guinea, with its humid tropical climate (Vallée & Margat 2003) and complex hydrographic dynamics (McGlade *et al.* 2002; Verstraete 1992) is dominated by seasonal upwelling, warm and low saline surface water and surface and subsurface zonal currents (Hardman-Mountford & McGlade 2003). The eastward flowing Guinea Current is a dominant feature, transporting low-salinity warm water (Binet & Marchal 1993) and favoring upwelling during its summer intensification (Philander 1979). The major upwelling season extends from July to September along northern coast (the Ivory Coast, Ghana, Togo and Benin) and June to September on the east coast (off southern Gabon to Angola). A minor upwelling season occurs in December-January (Longhurst 1962; Philander 1979).

Material and methods

Material was collected in Nigeria, Gabon and the Republic of Congo during a cruise with R/V Fridtjof Nansen in July 2005. Thirty-five stations were sampled using a 0.1 m^2 van Veen grab between 20 and 217 meters depth. The localities here referred to are listed in Table 1 and shown in Figure 1. Four replicates were taken at

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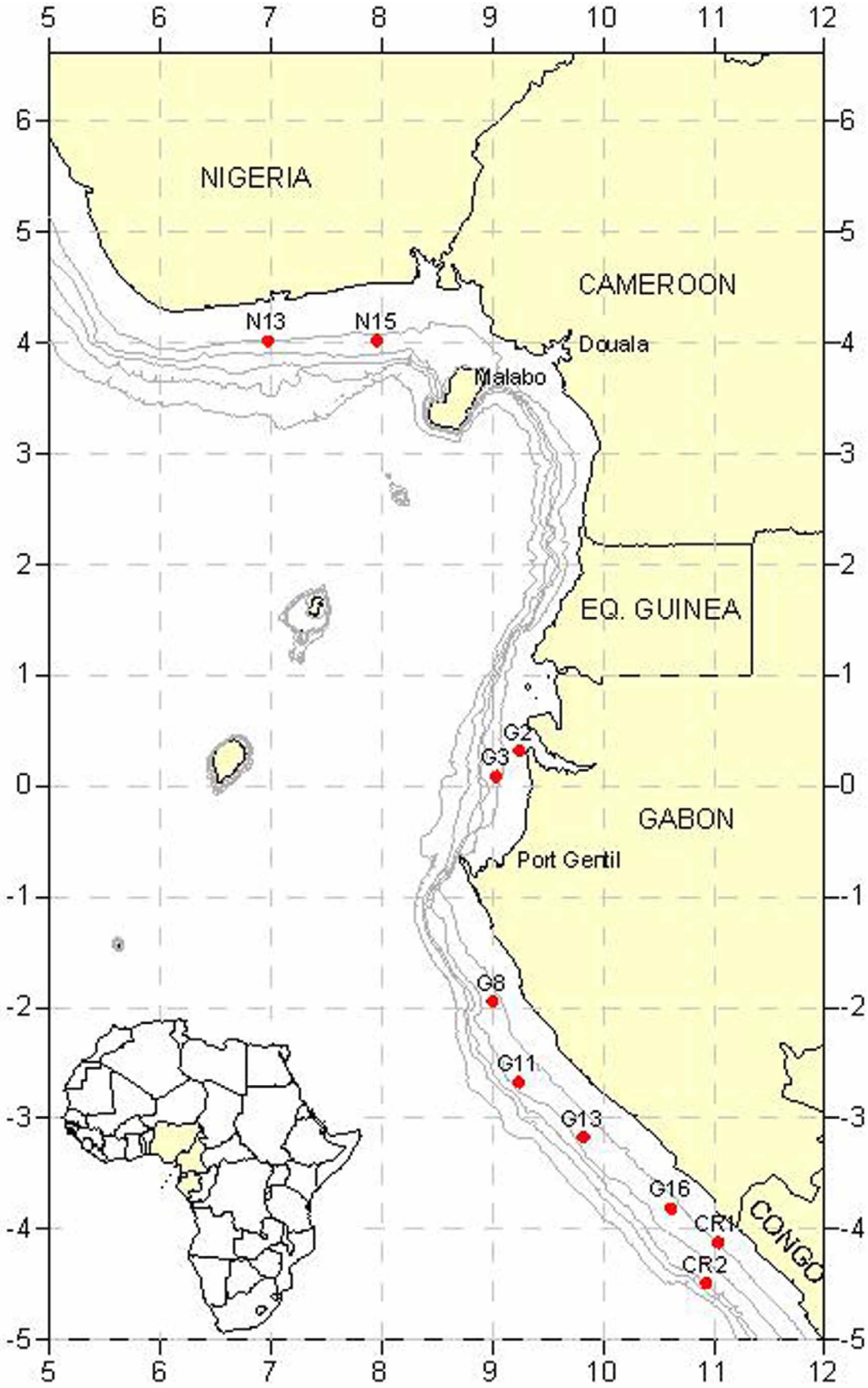

FIGURE 1. Map of the stations from which the specimens used in this paper were collected. Se also Table 1.

each station. Samples were screened through sieves of mesh size 0.5 or 1 mm. Samples were fixed in 96% alcohol or in 10% borax buffered formaldehyde. Samples were subsequently sorted under a stereo microscope at the Natural History museum, University of Bergen.

For Scanning Electron Microscopy (SEM) images, the shells were being cleaned and dried and mounted onto aluminum stubs with conductive carbon cement, and subsequently sputtered with gold-palladium alloy using a Bio-Rad SEM Coating System. Images were obtained using a Zeiss Supra VP55 microscope and edited in Adobe Photoshop CS4 Extended.

All specimens, with the exception of some paratypes, are deposited at the Natural History Collections, Bergen Museum, University of Bergen.

TABLE 1. Sampling stations for material here reported.

Station number	Country	Date	Latitude	Longitude	Depth (m)
5N13	Nigeria	14 June 2005	04º 01'N	06º 58'E	65
5N15	Nigeria	20 June 2005	04º 01'N	07º 58'E	64
5G2	Gabon	01 July 2005	00º 19'N	09º 19'E	24
5G3	Gabon	01 July 2005	00º 05'N	09º 02'E	61
5G11	Gabon	08 July 2005	02º 40'S	09º 14'E	90
5G16	Gabon	11 July 2005	03º 49'S	10º 37'E	69
5CR1	Republic of Congo	12 July 2005	04º 07'S	11º 02'E	49
5CR2	Republic of Congo	13 July 2005	04º 29'S	10º 56'E	162

Results

Family Odostomiidae Pelseneer, 1928

Informal taxon Liostomini Schander, Halanych, Dahlgren & Sundberg, 2003

Subfamily Chrysallidinae Saurin, 1958

Genus *Kongsrudia* new genus

Diagnosis: Shell tall, solid, slender, conical, white with pointed apex. Protoconch of type B, sometimes tending to C (van Aartsen 1977, 1981; van der Linden & Eikenboom 1992). Whorls slightly convex. Suture distinct, shallow- moderately deep, noticeably oblique. Axial ribs elevated, shouldered straight and orthocline to slightly prosocline. Interspaces much broader than ribs. Ribs continue more or less clearly down to base. Spiral sculpture of distinct ridges, distinct also crossing axial ribs, giving a grid-like appearance. Interspaces are equally broad or broader than ridges. Spirals continue to the base. Aperture oval, with distinct columellar tooth. Inner side of outer lip often with several prominent ridges. Umbilicus distinct. The combination of characters is not present in any other pyramidellid genus.

Type species: *Actaeopyramis gruveli* Dautzenberg, 1910

Etymology: The genus is named in honor of Jon Anders Kongsrud, Bergen Museum, who has been instrumental in getting the material collected during the GCLME project worked up and put to scientific use.

Comments: There are several West African species that belong in this genus and are here formally transferred to the genus *Kongsrudia*: *Pyrgulina approximans* Dautzenberg, 1913a; *Chrysallida ersei* Schander, 1994; *Pyrgulina mutata* Dautzenberg, 1913b (nom. nov. pro *P. lamyi* Dautzenberg 1913a non *P. lamyi* Dautzenberg & Fischer, 1906). *Pyrgulina jullieni* Dautzenberg, 1913a is similar, but have a very marked shoulder on the whorls, and until further information is available, we refrain from including this species in *Kongsrudia*. According to Schander et al. 1999, Chrysallidinae comprises close to 50 genera. After comparing

the species with available descriptions and illustrations of type species we have not been able to comfortably fit the above mentioned species in to any of those genera. The genus *Kongsrudia* shows some similarities to the genus *Pyrgulina* A. Adams, 1863 with the type species *Chrysallida casta* A. Adams, 1861 (Subsequent designation Dall & Bartsch, 1904), but the spiral sculpture in this genus is far less prominent, and the species of *Pyrgulina* also tends to be broader in outline. The genus *Trabecula* Monterosato, 1884 with the type species *Trabecula jeffreysiana* Monterosato, 1884 is similar in outline, but lack the marked striations and the axial sculpture does not reach the base of the shells.

***Kongsrudia gruveli* (Dautzenberg, 1910) comb. nov.**
(Fig. 2 A–F)

Actaeopyramis gruveli Dautzenberg, 1910. Act. S. Linn. Bordeaux 64: 93-94. Pl. 3. Figs 6–7.
Pyrgulina bavayi Dautzenberg, 1913. Ann. Inst. Oceanogr. 5: 69–70, pl. 3, figs 23–24
Chrysallida gruveli Auct.

Type locality: Pointe Cansado, Mauritania, Mission Gruvel.

Material examined: Station N15, 7 shells; G2, 1 shell; G 16, 1 shell, CR 1, 1 shell

Description: Shell tall, solid, slender, conical, white with pointed apex. Protoconch of type B, tending to C. Whorls almost straight, turreted. Suture distinct but not deep, noticeably oblique. Axial ribs thin, very elevated, shouldered, straight and orthocline in initial whorls, slightly prosocline later. Interspaces much broader than ribs. Ribs continue to base. Spiral ridges distinct and numerous, covering axial ribs giving a grid-like appearance. Interspaces equally broad or broader than ridges. Space between apical ridge and suture broader than interspaces. Ridges continue to base. Aperture oval, almost kidney-shaped because of prominent tooth. Inner side of outer lip with 7-9 riblets. Distinct columellar tooth. Umbilicus deep and narrow.

Distribution: From Mauritania to Angola. Infralitoral and circalitoral (Peñas & Rolan 2002)

Remarks: *Kongsrudia approximans* (Dautzenberg 1913a) show a sculpture similar to *K. gruveli*, but whorls are more convex and not turreted. The axial ribs and spiral ridges have narrower interspaces and the ridges are broader and continue all the way to the upper suture. The riblets seen on the inner side of the outer lip are not as prominent in *K. approximans*. *Kongsrudia rolani* **n. sp.** is similar to *K. gruveli*, for comparison, see this species.

***Kongsrudia rolani* new species**
(Fig. 3 A–F)

Type locality: Gabon, station G16, 03º 49'S, 10º 37'E**,** 69 m.

Type material: Holotype deposited in Bergen Museum ZMBN 86655; 6 Paratypes from Type locality in Bergen Museum ZMBN 86656 2 Paratypes Gothenburg Natural History Museum GNM Gen. kat. 2010-22.252 and Gen. kat. 2010-22.253.

Material examined: Station N15 20 shells; G2, 11 shells; G16, 10 shells; CR2, 13 shells.

Etymology: The species is named after Emilio Rolán, Vigo, Spain who has worked extensively on West African Pyramidellids, and is a dear friend.

Description: Shell tall, slender, conical, milky white and shiny with a blunt, pointed apex. Protoconch of type B. Whorls convex, turreted. Suture distinct and moderately deep, noticeably oblique. Narrow subsutural shelf. Axial ribs elevated, continuing down to base. Spiral sculpture consisting of numerous ribs, about equidistant, equally broad as interspaces. Covering axial ribs giving a grid-like appearance. Spiral ribs equally broad or broader than interspaces continuing to the base. Microsculpture of spine-like projections from upper and lower side of spiral ribs ad vertical striae on spiral ridges within interspaces of axial ribs. Aperture oval, almost kidney-shaped because of a distinct columellar tooth. Umbilical fissure can be deep or shallow.

Distribution: Nigeria, Gabon and Congo, 24-162 m.

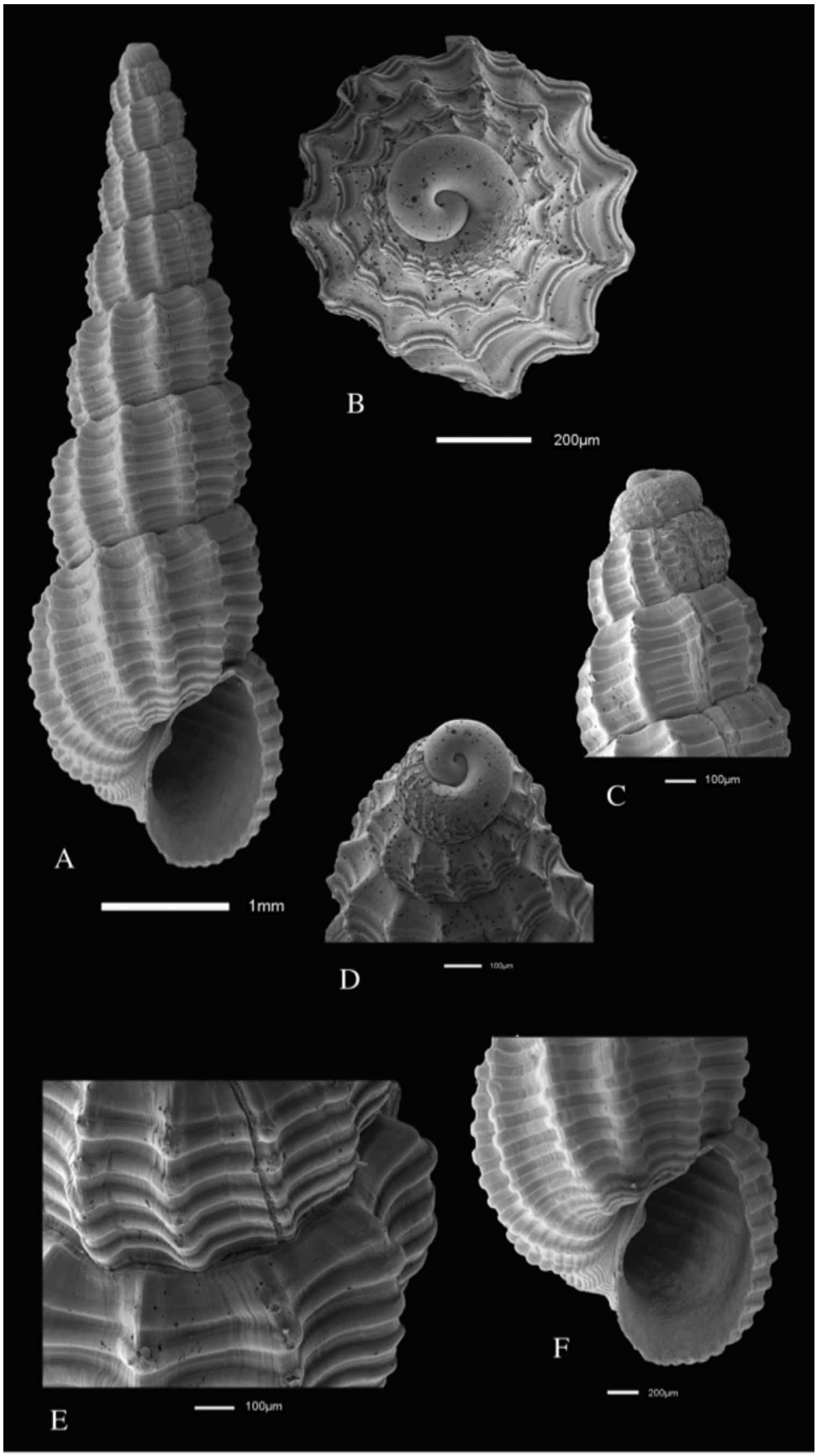

FIGURE 2 A–F. *Kongsrudia gruveli*. A: Teleoconch, station G2, Gabon, 00º19'N 09º15'E; B & D: Protoconch, station CR1, Republic of Congo, 04º07'S 11º02'E; C: Protoconch, station G2; E: Suture and details of the sculpture; F: Aperture and riblets on the inside of the outer lip.

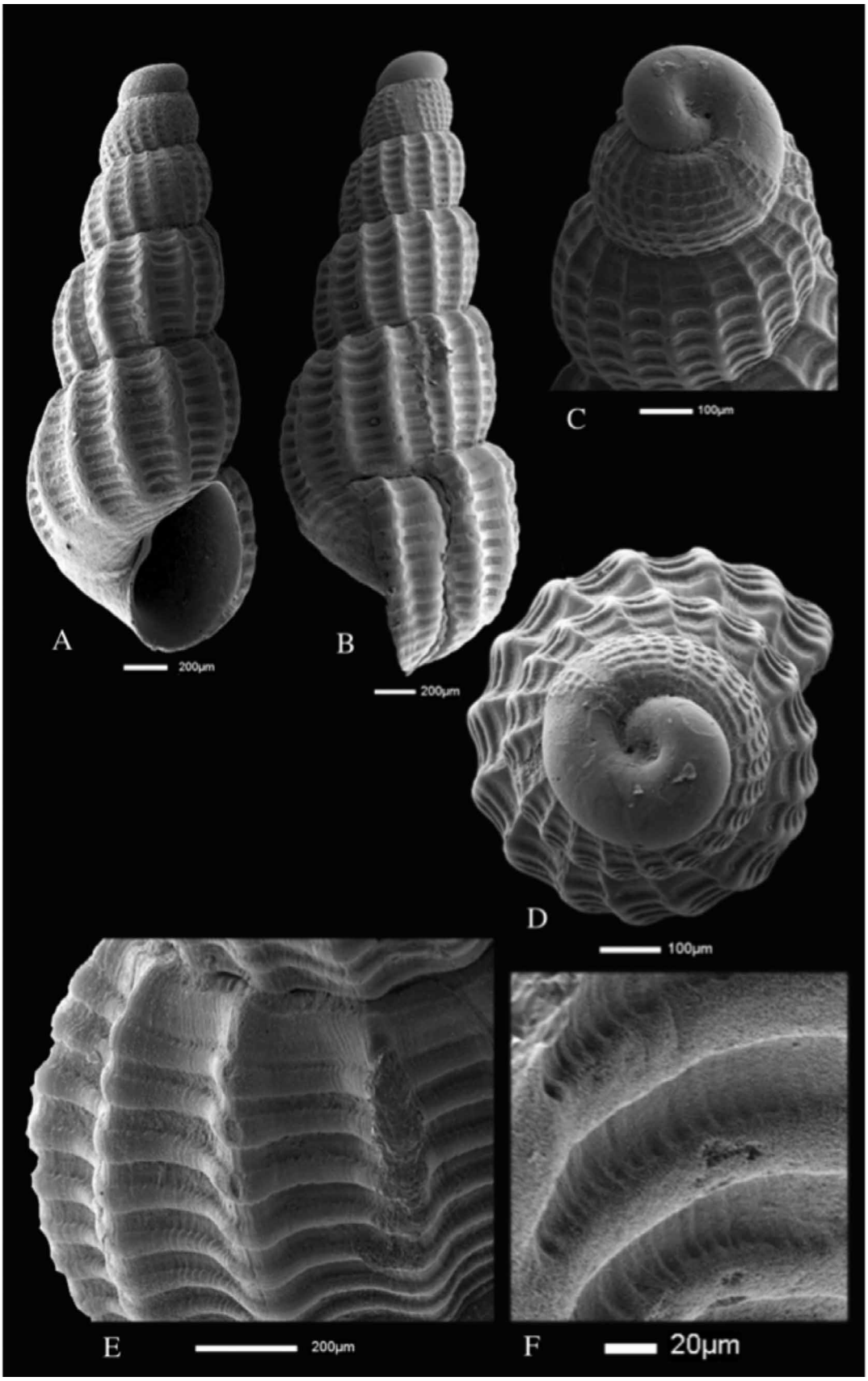

FIGURE 3 A–F. *Kongsrudia rolani* **n. sp.** A: Paratype, teleoconch, station G16, Gabon, 03º49'S, 10º37'E; B: Holotype, teleoconch, station G16, Gabon, 03º49'S, 10º37'E; C-D: Paratype, protoconch, station G16, Gabon, 03º49'S, 10º37'E; E-F: Paratype, details of the sculpture and microstructure, station N15, Nigeria, 04º01'N, 07º58'E.

Remarks: The shape and sculpture is similar to *Kongsrudia gruveli* (Dautzenberg, 1910), but the whorls are more convex and *K. gruveli* lacks the microsculpture. The axial sculpture of *K. gruveli* is more prominent, especially on the base. *Kongsrudia approxiamans* (Dauzenberg, 1912) and *K. ersei* (Schander, 1994) are similar, but they both have more convex whorls, lack the subsutural shelf and have broader spiral ribs that are more tightly spaced. Like the genus *Afroturbonilla* Peñas, Rolán & Schander, 1999, *Kongsrudia* is so far only known from off West Africa.

Family Turbonillidae Bronn, 1849

Subfamily Turbonillinae Bronn, 1849

Genus *Turbonilla* Risso, 1826

The Genus *Turbonilla* as commonly used is doubtless a polyphyletic assemblage. Schander *et al*. (1999) listed more than 40 genera in Turbonillinae. The knowledge of most of these genera are however scarce, and we therefore feel that we currently can not divide the West African species in a proper phylogenetic way, but are forced to place the new species in *Turbonilla* sensu latu. A proper revision of the family Turbonillidae is urgently needed.

***Turbonilla krakstadi* new species**
(Fig. 4 A–E)

Type locality: Gabon station G11, 02º 40’S, 09º 14’E, 90 m.

Type specimens: Holotype, Bergen Museum ZMBN 86657. One paratype Bergen Museum ZMBN 86658. One paratype Gothenburg Natural History Museum GNM Gen. kat. 2010-22.254.

Material examined: Type material.

Etymology: The species is named in honor of Jens Otto Krakstad, who has lead many of the expeditions where the material included in this study was collected, and was fundamental in the initiative of getting a benthic part of the surveys.

Description: Shell small, slender, conical, milky white and shiny with blunt apex. Protoconch of type A-II, small and protruding. Whorls almost straight, bending slightly towards the lower suture, turetted. Suture distinct but not deep, noticeably oblique. Subsutural shelf present and distinct. Axial ribs elevated, strong and shouldered, irregular, almost straight and opisthocline. Interspaces equally broad or broader than ribs. Ribs ending abruptly at the periphery of the ultimate whorl or continuing to the base. If continuing to the base, they are more diffuse below the ultimate whorl. No spiral sculpture present. Aperture subrectangular. No collumellar tooth and no umbilicus.

Distribution: Gabon, 61-90 m.

Remarks: The size of the protoconch differ slightly in the two shells from station G11. The interspaces between the ribs also differ slightly and one shell has ribs closer together. *Turbonilla perezdionisi* Peñas & Rolan, 1997 resembles this species, but has straighter whorls and lacks the subsutural shelf and shouldered axial ribs. The ribs of *T. perezdionisi* are also more sinuous and less opistocline than in *T. krakstadi*. *Turbonilla melvilli* Dautzenberg, 1912 shows some resemblance to *T. krakstadi*, but only the initial whorls are turreted in this species and the axial ribs are more tightly spaced. *Turbonilla gradata* Bucquoy, Dautzenberg & Dollfus, 1883 has more regular axial ribs and is less turreted than *T. krakstadi.*

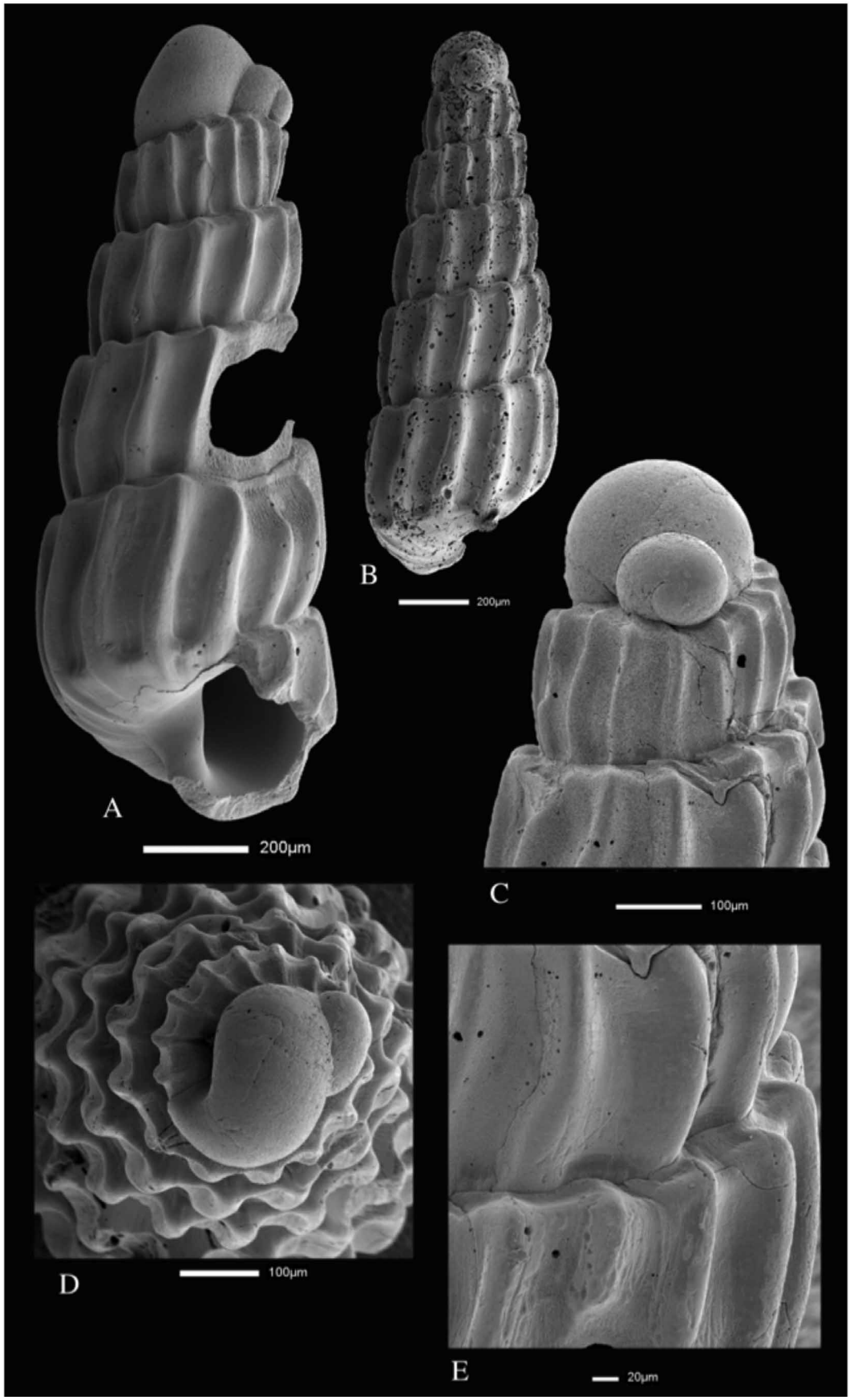

FIGURE 4 A–E. *Turbonilla krakstadi* **n. sp.** A: Holotype, teleoconch, station G11, Gabon, 02º40'S, 09º14'E; B: Paratype, teleoconch, station G3, Gabon, 00º05'N, 09º02'E; C-D: Paratype, protoconch, station G11, Gabon, 02º40'S, 09º14'E; E: Paratype, details of the subsutural shelf, station G11, Gabon, 02º40'S, 09º14'E.

***Turbonilla anselmopenasi* new species**
(Fig 5 A–D)

Type material: Holotype, Bergen Museum ZMBN 86659.

Type locality: Gabon station G11, 02º 40'S, 09º 14'E, 90 m.

Material examined: Type material.

Etymology: The species is named after Anselmo Peñas, Barcelona, Spain who has worked extensively on West African Pyramidellids, and is a dear friend.

Description: Shell small, slender, conical towards subcylindrical, white and shiny with rounded apex. Protoconch of type A-II. Whorls slightly convex. Suture shallow. Axial ribs elevated, straight and opisthocline. Axial ribs equally broad as interspaces, disappearing at the periphery of the ultimate whorl. The base is smooth. Sculpture seen in interspaces consists of both fine macrostructure and microstructure, the sculpture is strongest abapically and consists of spiral striae and vertical grooves. Interspaces between spiral striae are broader in the middle of the whorl and more tightly spaced apically than abapically. Vertical grooves more tightly spaced apically gives finer sculpture there. Aperture subrectangular. No columellar tooth. No umbilicus.

Distribution: Gabon, 90 m.

Remarks: The combination of shape and the very fine sculpture makes this species fairly easy to distinguish from other species of *Turbonilla* s. l. *Turbonilla bedoyai* Peñas & Rolan, 1997 has a similar sculpture between the axial ribs, but in this species the sculpture is evenly spaced.

***Turbonilla iseborae* new species**
(Fig. 6 A–D)

Type material: Holotype, Bergen Museum ZMBN 86660 One paratype, type locality, Bergen Museum 86661. One paratype Gothenburg Natural History Museum, GNM Gen. kat. 2010-22.255.

Type locality: Gabon station G2, 00º 19'N, 09º 19'E, 24 m.

Material examined: Type material.

Etymology: The species is named after the late Catherine Ekaete Isebor from the Nigerian Institute for Oceanography and Marine research, Lagos Nigeria, who was local cruise leader and GCLME-representative during the cruises with R/V Dr. Fridtjof Nansen from 2004-2006 where some of the material used here was collected. Catherine was an outstanding scientist and a future leader from the region who died unexpectedly only months from finalizing her PhD in 2006.

Description: Shell small, delicate, conical, milky white with blunt apex. Protoconch of type A-II, small and semi-submerged. Whorls convex. Suture distinct, but not deep. Axial sculpture consisting of numerous, shallow and sinuous grooves, not equal or equidistant. Axial sculpture ending abruptly at the periphery of the ultimate whorl. The base is smooth. Spiral sculpture consisting of fine spiral striae on the initial whorl, and the upper third of the second whorl. Aperture oval. No columellar tooth, and no umbilicus.

Distribution: Gabon, 24 m.

Remarks: This species has a protoconch similar to *Turbonilla oliverioi* Peñas & Rolán, 1997. The sculpture is also similar to this species, but is more sinuous in *Turbonilla iseborae*. The fine spiral striae seen in *Turbonilla iseborae* are also seen in the initial whorl of some specimens of *T. oliverioi*, but not on the second whorl. *Turbonilla syrtensis* van Aartsen, 1981 has a similar shape and protoconch, but the axial sculpture consists of straight ribs that are much broader than the interspaces.

***Turbonilla korantengi* new species**
(Fig 7 A–E)

Type material: Holotype, Bergen Museum ZMBN 86662.

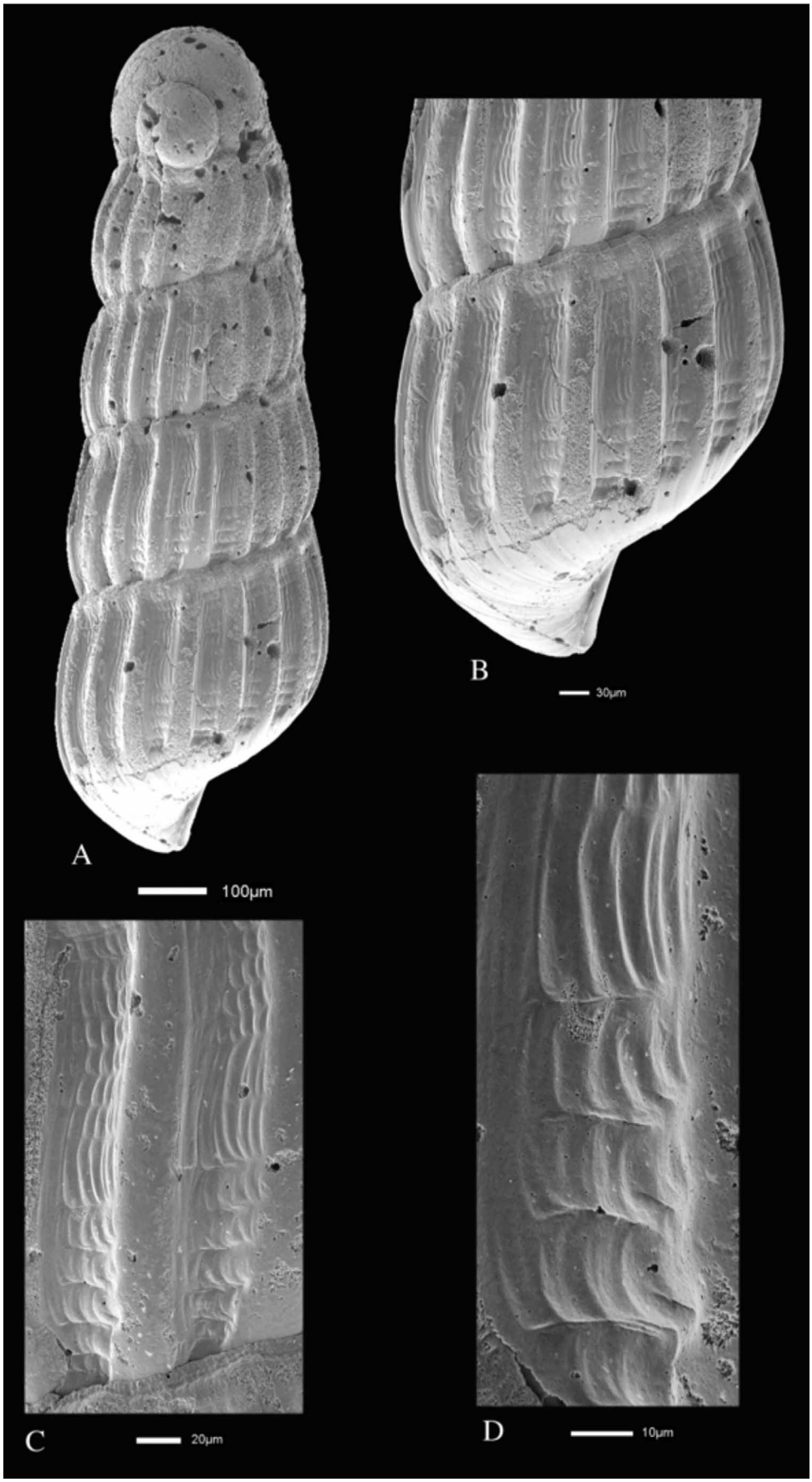

FIGURE 5 A–D. *Turbonilla anselmopenasi* **n. sp.** A: Holotype, teleoconch, station G11, Gabon, 02º40'S 09º14'E; B-D: Holotype, details of the sculpture and microstructure.

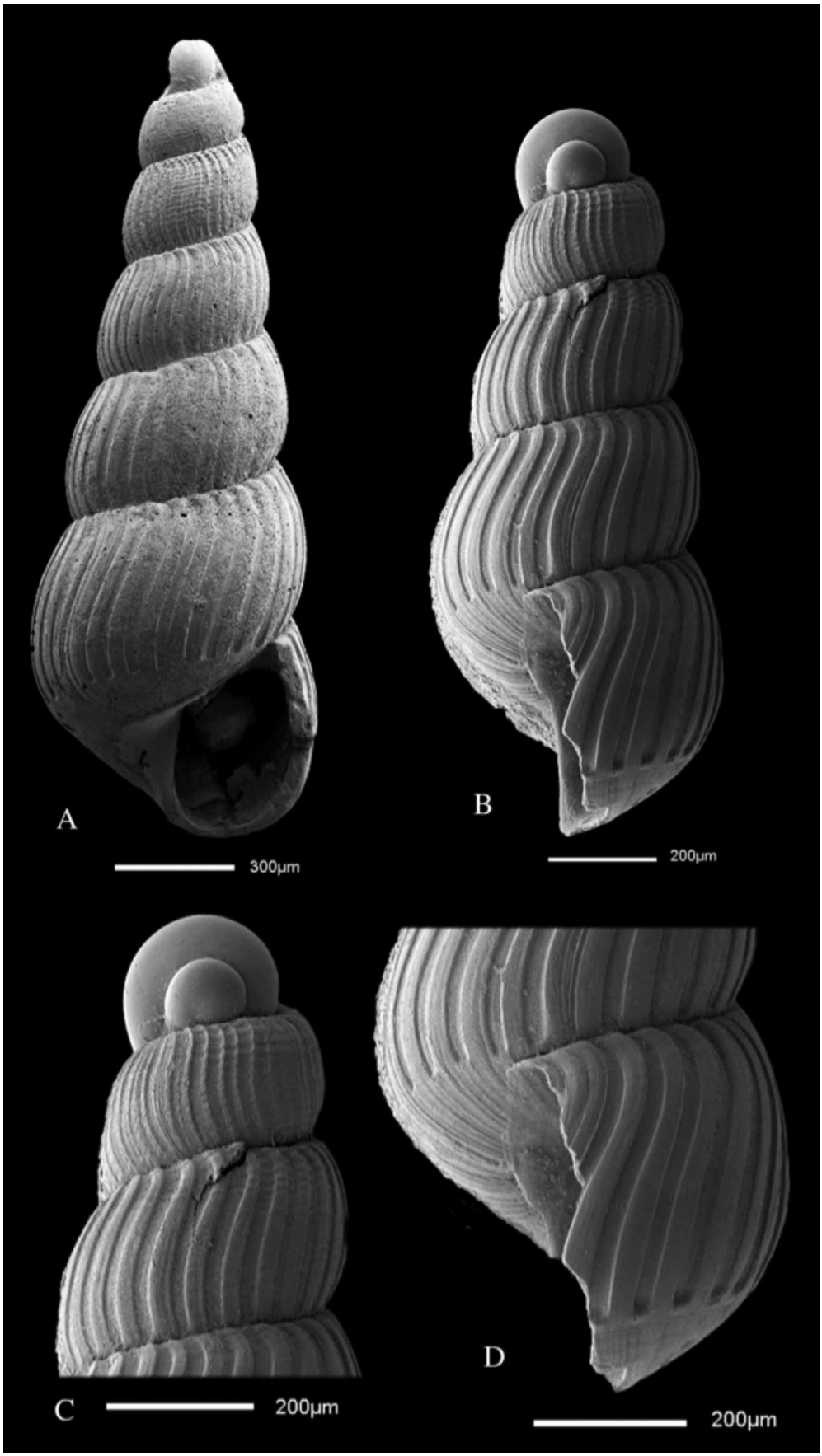

FIGURE 6 A–D. *Turbonilla iseborae* **n. sp.** A: Holotype, teleoconch, station G2, Gabon, 00º19'N 09º15'E; B: Paratype, station G2, Gabon, 00º19'N 09º15'E; C: Holotype, protoconch; D: Paratype, details of the base.

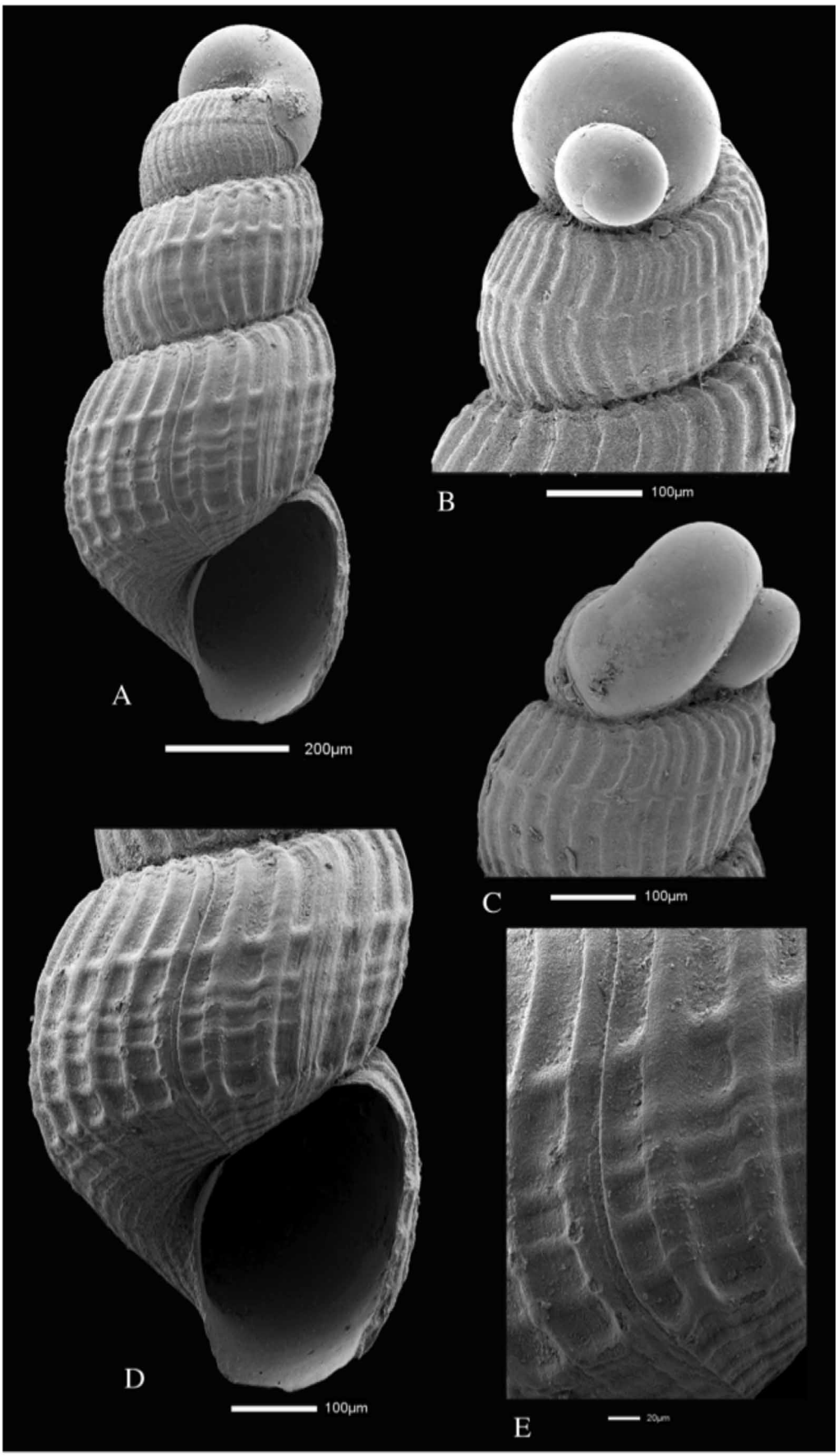

FIGURE 7 A–E. *Turbonilla korantengi* **n. sp.** A: Holotype teleoconch, station CR2, Republic of Congo, 04º29'S 10º56'E; B-C: Holotype protoconch; D: Holotype details of the sculpture and base; E: Holotype details of the sculpture.

Type locality: Republic of Congo station CR2, 04º 29'S, 10º 56'E, 162 m.

Material examined: Type material.

Etymology: The species is named in honor of Dr. Kwame Koranteng who is the present EAF coordinator of FAO-FIMF. He is a past chairman of the GOOS-AFRICA coordinating committee and a former director of the Marine Fisheries Division (MFRD) at the ministry of Food and Agriculture in Ghana. His work has been for the good of marine biology and fisheries research in the area.

Description: Shell very small, delicate, conical, milky white and semitransparent with rounded apex. Protoconch of type A-II, small. Whorls convex, turreted. Suture distinct, rather deep. Axial ribs slightly elevated, not equal or equidistant, sinuous and orthocline. Ribs equally broad or broader than interspaces, ending abruptly at the periphery of the ultimate whorl. Spiral sculpture consisting of ten ridges, very fine and thin, unequal, not equidistant. The uppermost and four lowermost ridges crossing axial ribs, the others only seen in interspaces. The ridge above the middle of the whorl is stronger and more prominent than the ridges below the middle. Seven spiral ridges are present on the base. Aperture oval. No columellar tooth. Narrow umbilical fissure.

Distribution: Congo, 162 m.

Remarks: *Turbonilla korantengi* is easily distinguished from all other *Turbonilla* species from West Africa. *Turbonilla franciscoi* Peñas & Rolán, 1997 has a similar protoconch and to some degree shape, but is easily distinguished by a different sculpture. *Turbonilla hattenbergeri* Peñas & Rolán, 1997 resembles this species to a certain degree, but the protoconch is more protruding, the whorls more convex and the spiral sculpture is more equally distributed.

***Turbonilla alvheimi* new species**
(Fig 8 A–E)

Type material: Holotype, Bergen Museum ZMBN 86663. One paratype, type locality, Bergen Museum ZMBN 86664.

Type locality: Gabon station G3, 00º 05'N, 09º 02'E, 61 m.

Material examined: Type material.

Etymology: The species is named in honor of Oddgeir Alvheim who is a senior technician of the Nansen program. Alvheim have had a long career as a senior research technician at the Institute of Marine Research. He has participated in cruises connected with the Nansen program since the beginning of the 1980's and was the cruise leader on one of the GCLME surveys that provided material for this study. He has devoted his life to field work off the coast of Africa and is among those people with the best general knowledge of the marine fauna in Africa.

Description: Shell tall, solid, conical, milky white and shiny with pointed apex. A very diffuse colored broad band is seen in middle/lower half of whorls. Protoconch of type A-I, small and semi-submerged. Whorl almost straight, slightly turreted. Suture distinct, broad and channeled. Axial ribs elevated, strong almost straight, shouldered and orthocline or slightly opisthocline. Ribs and interspaces about equally broad. Ribs disappear at the periphery of the ultimate whorl or continue as diffuse and thin extensions on base. Spiral sculpture consisting of rectangular grooves, not equal or equidistant. Bands between grooves not equal, for the most part broader than grooves. Spiral grooves present on base. Aperture rhomboid. Inner lip slightly folded. No columellar tooth. No umbilicus.

Distribution: Gabon 61 m.

Remarks: This species shows a certain resemblance to *Turbonilla abrardi* Fischer-Piette & Nicklés, 1946, but the protoconch is less submerged and the suture is broader and deeper in *Turbonilla alvheimi*. The whorls are more convex and the axial ribs not as strong and not shouldered in *Turbonilla abrardi*. *Turbonilla jeffreysi* (Thompson, 1850) is more turreted and has a less pronounced suture, the axial ribs are narrower, not as tightly spaced and less strong. The grooves are also more narrow in *T. jeffreysi*. *Turbonilla rufescens* (Forbes, 1846) have slightly more convex whorls. The suture and sculpture differs in the same manner as *T. jeffreysi*.

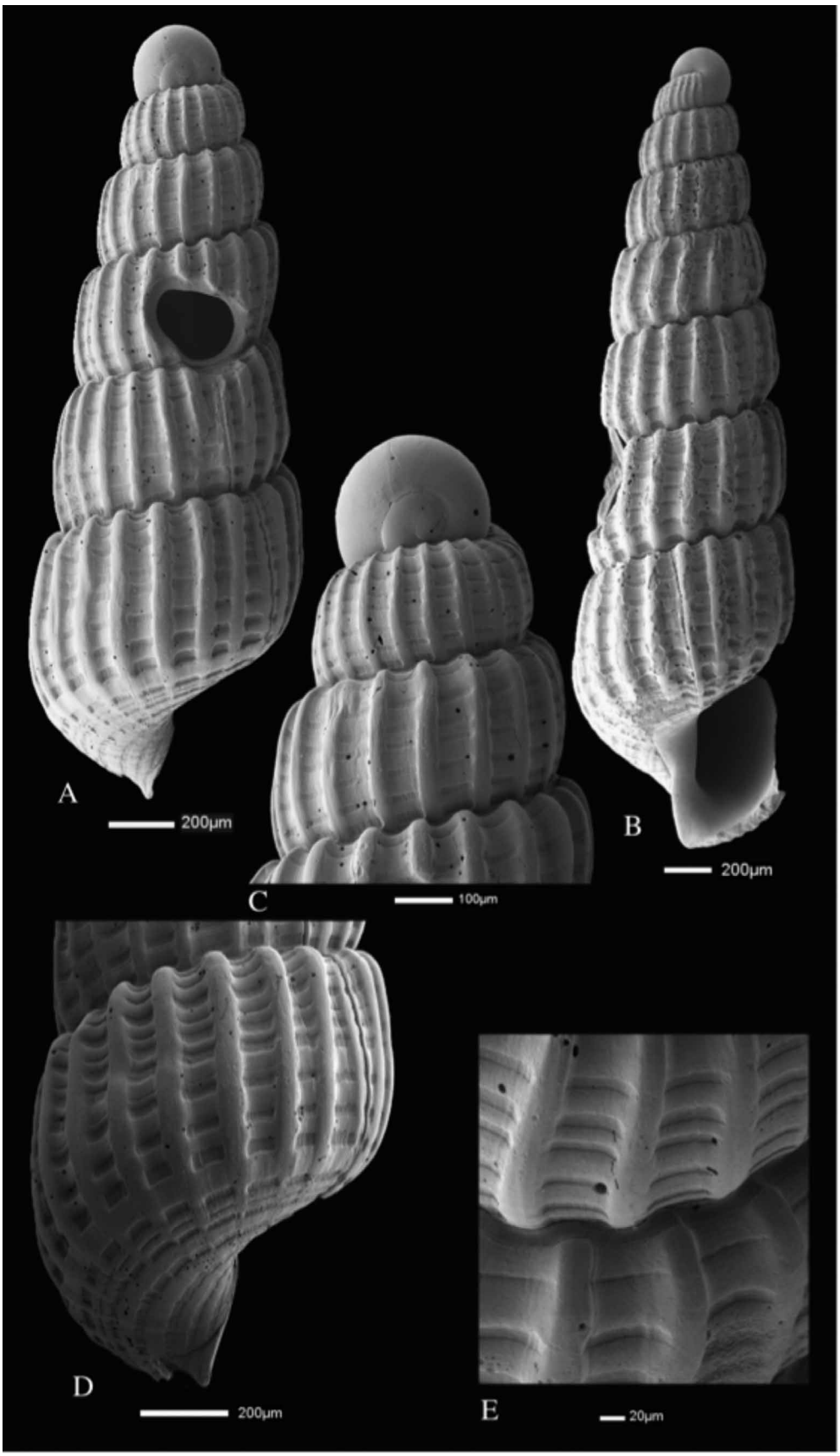

FIGURE 8 A–E. *Turbonilla alvheimi* **n. sp.** A: Holotype teleoconch, station G3, Gabon, 00º05'N 09º02'E; B: Paratype teleoconch, station G3, Gabon, 00º05'N 09º02'E; C: Holotype protoconch; D: Holotype details of the sculpture and base; E: Holotype details of the suture.

Discussion

The results from the present study clearly shows that our knowledge of the pyramidellid fauna of West Africa is still incomplete. Not only is our knowledge of the species composition and the distribution of the species incomplete, but even more acute is our lack of knowledge of the biology of the species present (Schander *et al.* 1999). Our results shows that there are still a great number of un-described species of pyramidellids in the area.

The nomenclature and phylogenetic position of the Pyramidellidae is confused. Pimenta & Absalão (2004) and Pimenta et al. (2009) points out that most of the over 300 supraspecific taxa of the Pyramidellidae (Schander *et al.* 1999, Schander *et al.* 2003) are poorly defined, and that an absence of general consensus about the definitions and boundaries of the genera and subgenera contributes to a much confused taxonomy. A great number of authors shoehorn species into the "supertaxa" *Odostomia*, *Chrysallida*, and *Turbonilla* without any consideration of phylogenetic context. Our placement of species in *Turbonilla*, should be considered provisional, awaiting a revision of the taxon.

Dinapoli & Klussmann-Kolb (2010) have shown that the taxon Pyramidelloidea as used in the traditional sense (including Murchisonellidae = Ebalidae) is polyphyletic since Murchisonellidae is not the sister group to Pyramidellidae. We here keep the name in a restricted sense including Odostomiidae, Pyramidellidae, Syrnolidae and Turbonillidae.

It is not ideal to describe new taxa from shells alone. But this is the most common practice since in most cases only the shells are known. It has been shown that shell characters in gastropod phylogeny reconstructions are no more prone to homoplasies than other types of morphological characters (Schander & Sundberg 2001). For identification purposes it would have been ideal to been able to provide DNA barcodes (e.g. Schander & Willassen 2005) for the species described here. But none of them has so far been found alive. Also, it would have been clearly advantageous if a phylogenetic definition could be given to the taxon *Kongsrudia* that is described here (e.g. Schander & Thollesson 1995, Schander 1998a,b), but so far only few phylogenetic studies including pyramidellids have been performed (Wise 1996, Schander *et al.* 1999, Schander *et al.* 2003, Dinapoli & Klussmann-Kolb 2010), and we refrain to perform a phylogenetic analysis including representatives of *Kongsrudia* without soft parts for anatomy and DNA sequencing.

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