

REPORT ON THE GENUS *TRITONOTURRIS* S. L., (GASTROPODA: CONOIDEA) FROM THE SOUTH CHINA SEA

BAOQUAN LI¹, XINZHENG LI² & RICHARD N. KILBURN³

¹Yantai Coastal Zone Institute, Chinese Academy of Sciences Yantai, 264003, P. R. China

²Institute of Oceanology, Chinese Academy of Sciences, Qingdao 266071, P. R. China

³Honorary Research Associate, Natal Museum and University of KwaZulu-Natal, School of Botany and Zoology, Pietermaritzburg 3201, South Africa.

Abstract Three species of the genus *Tritonoturris* Dall 1924, s. l. (Conidae, subfamily Raphitomininae) are reported from the South China Sea. These are *Tritonoturris scalaris* (Hinds 1843), new synonym *Tritonoturris concinnus* B. Li & X. Li; *T. oxyclathrus* (Martens 1880) (the first record since its description); *T. macandrewi* (E. A. Smith 1882). The holotype of *Defrancia secta* Sowerby 1870, is figured here for the first time. *Pleurotoma oxyclathrus*, *Defrancia secta* and *Clavatula scalaris* are referred to *Tritonoturris* for the first time.

Key words *Tritonoturris* s. l., *Conoidea*, *Raphitomininae*, new synonymy, China

INTRODUCTION

The genus *Tritonoturris* Dall 1924 s. l., is one of the more poorly known turrid genera. Powell (1966) reported the range of this genus as South Africa and Indo-Pacific, from Mauritius to Hawaii, and listed eight species. Approximately 20 species are regarded as belonging to this genus. Chang (2000) reported five species of *Tritonoturris* from Taiwan, China; of these, his Figs 22, 23 and 24 are correctly identified as *Tritonoturris cumingii* (Powys in Powys & Sowerby 1835), *T. amabilis* (Hinds 1843) and *T. menecharmes* (Melvill 1923), respectively. However Chang's (2000) fig. 26 is certainly not *Tritonoturris subrissoides* (Hervier 1897), which does not have such a strong shoulder (syntypes and topotypes examined by R. K. in MNHN), and the shell in his fig. 25 ("*Tritonoturris* sp."), is too worn to be recognizable from the photograph. Other turrid Conoidea from China Seas have been reported previously (Li and Li, 2007a; 2007b; 2008a; 2008b). The present paper deals with three species of *Tritonoturris* s. l.; one is reported for the first time since its description, and one new synonymy is proposed. Type material of all species is figured.

MATERIALS AND METHODS

The material was collected during investigations carried out since the 1950s, including the "National Comprehensive Oceanography

Survey" (NCOS, 1958–1960), "China-Vietnam Marine Resource Investigation Cooperative of the Beibu Gulf (=Gulf of Tonkin)" (1959–1962), "China-Germany Marine Biota Cooperative Investigations of Hainan Island, China" (1990–1992), from the China Seas.

All of the Chinese material examined is deposited in the MBMCAS in the IOCAS.

The taxonomic system is based on the proposals of Taylor *et al.* (1993).

INSTITUTIONAL ABBREVIATIONS

BMNH	The Natural History Museum, London
IOCAS	Institute of Oceanology, Chinese Academy of Science, Qingdao
MBMCAS	Marine Biological Museum of the Chinese Academy of Sciences in the IOCAS
MNHN	Muséum National d'Histoire Naturelle, Paris
ZMHB	Zoologisches Museum, Humboldt University, Berlin
ZMUC	Zoological Museum, University of Copenhagen, Copenhagen

SHELL AND OTHER ABBREVIATIONS

AT	Agassiz trawl
CN	preliminary registration number of collection
RN	museum registration number

- SCS the South China Sea
 a/l ratio of aperture length (measured along main shell axis) to total shell length
 b/l ratio of breadth to total length

SYSTEMATICS

Family Conidae Fleming 1822
 Subfamily Raphitominae Bellardi 1875
 Genus *Tritonoturris* Dall 1924

Tritonoturris Dall 1924: 88. Type species (o.d.)
Clathurella robillardi H. Adams 1869.

Remarks The genus *Tritonoturris* s. l. has been rather loosely applied to a group of relatively large Indo-Pacific raphitomines, all with a high protoconch (2–3.5 whorls), the later whorls of which bear fine, diagonal cancellations. It is possible that *Tritonoturris* may prove synonymous with the earlier *Raphitoma* Bellardi 1847, type species (designated Monterosato 1872) *Raphitoma histrix* Bellardi 1847, of the Italian Pliocene. Evidence from foregut anatomy and particularly the radula (where present) are however required. Dr Donn Tippett (pers. comm.) has found on these grounds that several distinct genera are to be recognized within *Tritonoturris* auctt. Van Aartsen *et al.* (1984: 88) refer six Mediterranean species to *Raphitoma* s.s., encompassing a range of species, from coarsely and spinosely cancellate forms to species with spirals of even strength and with rounded, non-angulate, whorls. A somewhat similar range of teleoconch characters is found in *Tritonoturris* s.l., with spiral sculpture varying from strong, prickly cords to fine threads. Of the species dealt with here, *T. oxyclathrus* (Martens 1880) and *T. secta* (Sowerby 1870) are atypical in their slot-shaped anal sinus, very deep in the former and less so in the latter; however the taxonomic significance of this needs to be evaluated, as in *T. menecharmes* (Melvill 1923) the sinus varies in depth, as to a lesser extent in *T. subrissooides* (Hervier 1897). *T. oxyclathrus* (and *T. subrissooides*) are also atypical in the non-constricted base, another character of uncertain significance.

Species here tentatively referred to *Tritonoturris* s. l. (on shell characters only) are: *Clavatula amabilis* Hinds 1843 (synonyms *Clathurella elegans* Pease 1860, *Clathurella robillardi* H. Adams 1869);

Tritonoturris buccinoides Shuto 1983; *Buccinum cumingii* Powys in Powys & Sowerby 1835 (synonym *Clathurella harpa* Pease 1860); *Pleurotoma eximia* Reeve 1843; *Pleurotoma (Daphnella) macandrewi* E. A. Smith 1882; *Vepracula menecharmes* Melvill 1923; *Philbertia natalensis* Barnard 1958; *Tritonoturris obesa* Kilburn 1977; *Pleurotoma oxyclathrus* Martens 1880; *Clavatula scalaris* Hinds 1843; *Defrancia secta* Sowerby 1870; *Clathurella spreta* Thiele 1925; *Daphnella varicosa* var. *subrissooides* Hervier 1897; *Mangilia (Cithara) vanhoeffeni* Martens 1904 (emended from *M. vanhoeffeni* by Martens, 1904).

Doubtful members of *Tritonoturris* s.l. include: *Daphnella evergestis* Melvill & Standen 1901; *Clathurella omaleyi* Melvill 1899; *Clathurella paucicostata* Pease 1860; *Pleurotoma pessulata* Reeve 1843.

Tritonoturris oxyclathrus (Martens 1880) nov.
 comb.
 (Figs 1–2, 9, 10)

Pleurotoma oxyclathrus Martens 1880: 41, pl. 9, figs 1a–d. Type locality: New Guinea, 46 m, “MacCluer Golf” [f. label] [= Teluk MacCluer], Seram coast of W. Papua].

Clathurella oxyclathrus – Tryon, 1884: 283, pl. 16, fig. 19 (after Martens).

Material Examined 1 sh, CN L67B-8, SCS, 19°30'N, 111°15'E, 86 m, sandy mud, AT, coll. Ma Xiutong, 25 Apr. 1959, MBMCAS; Holotype, ZMHB, Gazelle Expedition.

Measurements

CN	Length	Breadth	Aperture	b/l	a/l
L67B-8	30.2	10.1	14.5	0.334	0.48
Holotype	25.4	8.5	10.6	0.34	0.42

Description (based on holotype, additional data from the Chinese specimen in square brackets): Narrowly fusiform, siphonal canal relatively short [to moderately produced], tapering, end barely truncate, inclined to left; whorls convex, shallowly concave below suture, suture shallow, undulating. Aperture narrowly and arcuately elliptical; outer lip evenly curved, straight in side-view; anal sinus very deep, narrow slot, situated immediately below suture, its lower edge being parallel to this; no lip denticles.



Figures 1–8 1, 2, *Tritonoturris oxyclathrus* (CN L67B-8); 3, 4, *T. scalaris* (CN S79B-50); 5–8, *T. macandrewi* (5, 6, CN Q283B-22); (7, 8, CN X200B-63).

Sculpture cancellate, with small, compressed, angular nodules at intersections. Axial ribs in apical view thin (about 0.3×breadth of intervals), low, angularly rounded, intervals flattened, about 18 ribs on first teleoconch whorl, 13[–14] on penultimate one. Spiral ridges thinner than axial ribs, [4–]5 main ridges on penultimate whorl; base of last whorl with about 14 ridges, the upper three stronger than the rest, concave part of base with six weaker ridges, rostrum with 5[–6] stronger cords. Interstices with close, spiral threads of uneven strength, 7–10 per main interval. Subsutural region with weak spiral threads and lunulate growth lines.

Colour uniform pale buff or yellowish.

Distribution Papua to southern China.

Habitat Sandy mud, 86 m depth.

Remarks This species is easily recognized by its crisp, delicately reticular and prickly sculpture. The only other species in the genus with similar sculpture are the widely distributed *Tritonoturris menecharmes* (Melvill 1923), which has strongly shouldered whorls and fewer, coarser ridges, and the markedly more fusiform *Tritonoturris secta* (Sowerby 1870), which has a strongly constricted, curved siphonal canal. The holotype of *Defrancia secta* Sowerby (1870: 254), figured here for the first time (Fig. 13), was described as coming from China, but has not been reported subsequently.

Tritonoturris scalaris (Hinds 1843)
(Figs 3, 4, 12)

Clavatula scalaris Hinds 1843: 39; Hinds, 1844: 18, pl. 6, fig. 2. Type locality: Straits of Macassar [Makassar], Ujung Pandang, Sulawesi, Indonesia, 12 fath. (22 m).

Pleurotoma scalaris – Reeve, 1845: pl. 26, sp. 233.

Clathurella scalaris – Tryon, 1884: 287, pl. 16, fig. 78.

Tritonoturris concinnus Li and Li 2007b: 79. Type locality: SCS, 21°00'N, 114° 00'E, 78 m. Syn. nov.

Material Examined *Clavatula scalaris*: Holotype BMNH 1879.2.26.95, ex Lombe Taylor coll., slightly chalky. *Tritonoturris concinnus*: Holotype MBMCAS, RN MBM081112, SCS, 114° 00'E, 21°00'N, 78 m, Apr. 10 1959, AT, coll. Shaozong WU; paratype MBMCAS, RN MBM081113, SCS,

116° 00'E, 22°00'N, silty mud, 84 m, Apr. 22, 1960, AT, coll. Jingzuo QU

Measurements

RN	Length	Breadth	Aperture	b/l	a/l
MBM081112	16.9	6.9	8.1	0.41	0.48
MBM081113	12.2	6.1	6.5	0.5	0.53

The original description of *Tritonoturris scalaris* from Hinds (1843) is very simple (see following). We reproduce it here.

“CLAVATULA SCALARIS. *Clav. testâ fusiformi, acuminatâ; anfractibus septenis, rotundatis, scalariformibus, transversim striatis; costulis rotundatis, distantibus, suturam incurrentibus; suturâ simplici; labro arcuato, intus lævi; sinus laterali propè suturam; aperturâ ovali; canali brevi. Axis 7 lin. Hab. Straits of Macassar. In twelve fathoms; coarse sand*”.

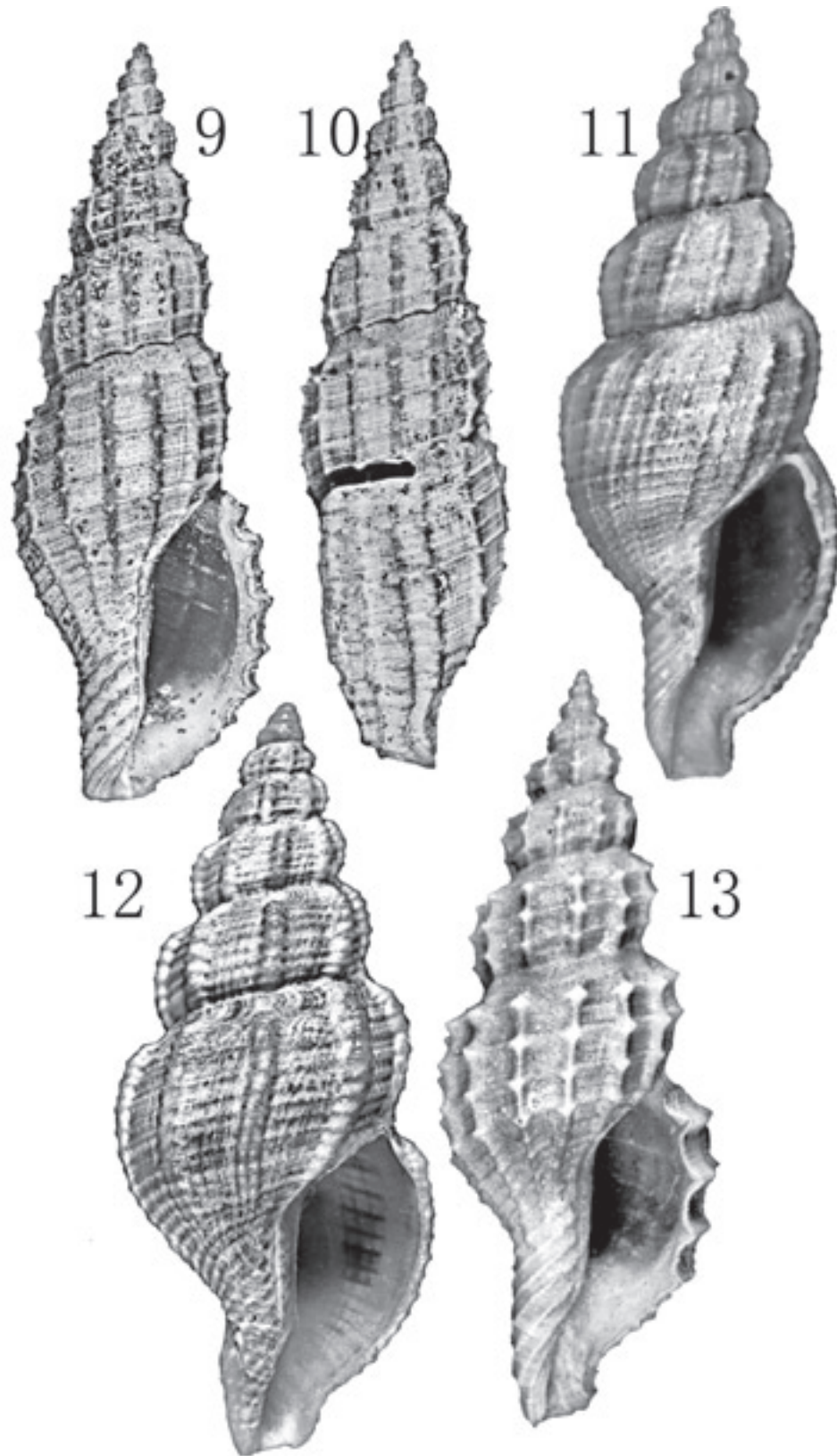
Description (based on holotype of *Clavatula scalaris*; data from other specimens in square brackets): Fusiform, siphonal canal strongly constricted; whorls strongly convex, subsutural region shallowly concave, with coarsely arcuate sculpture crossed by spiral threads; anal sinus deep, linguiform, slot-like.

Axial ribs slightly arcuate, opisthocline, thin (half breadth intervals or less), in apical view rounded with steep sides, with wide, flattened intervals, [7]–8–[10] per whorl; ribs forming slight shoulder immediately below subsutural concavity. Spiral ridges in transverse section compressed, rounded, much narrower than their intervals, three equal ridges on first teleoconch whorl, [9–10]–12 ridges on penultimate whorl (where these cross axials), often with a weak intermediary in each interval, interstices pitted, about 19 ridges on base of body whorl. Minute collabral threads in rib intervals, crenulating the spiral ridges. Terminal varix somewhat thicker than ribs, close to lip.

[Protoconch conical, about 2.6 convex whorls, first depressed, sculpture diagonally cancellated, breadth 0.42 mm.]

Colouration whitish with brown spiral bands of varying breadths.

Distribution South China Sea; West Thailand to Indonesia, 22–84 m (Kilburn MS).



Figures 9–13 9, 10, *Tritonoturris oxyclathrus* (Martens 1880): Holotype, ZMHB, MacCluer Golf [Teluk MacCluer], Seram coast of W. Papua, 25 fath. [46 m.]; 25.4×8.5 mm; 11, *Tritonoturris macandrewi* (E. A. Smith 1882): Holotype, BMNH 1874.5.26.9.17, Persian Gulf, 17.5×6.3 mm; 12, *Tritonoturris scalaris* (Hinds 1843): Holotype, BMNH 1879.2.26.95, Straits of Macassar, 12 fath., 8.0×3.5 mm; 13, *Tritonoturris secta* (Sowerby 1870): Holotype, BMNH 79.2.26.33, "China"; 19.2×6.9 mm.

Remarks The species resembles *Tritonoturris macandrewi* but its axial ribs are stronger, more widely-spaced and more varicoid, the spiral ridges are more sharply defined, the subsutural region is wider with coarser lunulate riblets, and the spiral bands are brown instead of golden. *Tritonoturris scalaris* also resembles *T. amabilis* (Hinds 1843), but its sculptural intersections are not prickly as in the latter.

Hinds' (1843) and Reeve's (1845) small figures and very brief descriptions of *Clavatula scalaris* are inadequate for the recognition of the species. Comparison with a photograph and description of the actual holotype of *C. scalaris* (Kilburn MS) has demonstrated *Tritonoturris concinnus* Li & Li 2007b to be a synonym of *Tritonoturris scalaris*.

The description given above is based on the holotype, a specimen in ZMUC from Bucas Grande Is., Philippines, 50 m, mud, and the holotype of *Tritonoturris concinnus* from the South China Sea.

Tritonoturris macandrewi (Smith 1882)
(Figs 5–8, 11)

Pleurotoma (Daphnella) macandrewi E. A. Smith 1882: 302. Type locality: Persian Gulf.

Daphnella macandrewi – Tryon, 1884: 307.

Daphnella macandrewi – Melvill, 1917: 192, pl. 9, fig. 11.

Tritonoturris macandrewi – Springsteen & Leobrera, 1986: 279, text fig., pl. 80, fig. 7; Higo *et al.*, 1999: 325; 2001: 109, fig. G3830 (holotype).

Material examined Holotype, BMNH 1874.5.26. 9.17; other specimens: (1). 1 sh, CN Q295B-19, SCS, 108°30'E, 20°45'N, silty mud, 45 m, A. T., coll. ZHANG, Nov. 11 1960; (2). 1 sh, CN X147B-39, SCS, 106°35'E, 18°00'N, Beibu Gulf, fine sandy mud, A. T., coll. SUN, Jan. 7 1962; (3). 1 sh, CN Q283B-22, SCS, 108°00'E, 20°15'N, Beibu Gulf, muddy sand, 51 m, Nov. 17 1960; (4). 1 sh, SCS, 111°30'E, 20°15'N, silty mud & fine sand, 71 m, coll. MA Xiutong, Jan. 26 1959; (5). 1 sh, CN X200B-63, SCS, 108°30'E, 19°30'N, silty mud, 51 m, A. T., coll. SUN, Apr. 13 1962; (6). 1 sh, CN N161B-86, SCS, 108°30'E, 17°45'N, mud & coarse sand, 80 m, A. T., coll. SHEN, Mar. 13 1960; (7). 1 sh, CN 10–23, SCS, 116°00'E, 22°00'N, silty mud, 93 m, A. T., coll. QU, Jan. 25, 1959.

Measurements

CN	Length	Breadth	Aperture	b/1	a/1
Holotype	17.5	5.0	7.9	0.36	0.45
Q283B-22	18.0	6.7	8.2	0.37	0.46
Q295B-19	18.3	6.9	8.5	0.38	0.46
X147B-39	23.2	8.5	10.4	0.37	0.45
–	23.5	8.8	11.0	0.37	0.47
X200B-63	23.2	9.2	10.8	0.40	0.47
N161B-86	21.6	7.7	9.5	0.36	0.44
10–23	25.5	9.7	12.3	0.38	0.48

Distribution East China Sea, South China Sea; Persian Gulf, Philippines, 45–51 m.

Description (based on holotype, data from other material in square brackets): Fusiform, a/1 0.36[–0.40], b/1 0.45[–0.48]; whorls evenly convex, with slight subsutural concavity; siphonal canal strongly constricted, widening towards end, not notched; outer lip convex in side view, inner edge with a slight rounded denticle at each end; anal sinus rounded V-shaped or U-shaped, almost in suture, stromboid notch shallow.

Axial ribs stronger on spire whorls, finer and more irregular on last whorl, opisthocline, obsolete slightly below suture (where there is a zone of fine lunulate riblets) and at rostrum, almost straight, feebly sinuous; in apical view low, rounded, narrower than their intervals, about 10 ribs on first whorl, *circa* [13]–17 on penultimate one. Spiral ridges mostly wide-set with weaker intermediaries, low and rounded, slightly granular, four in number on first whorl, [9]–12 main ridges on penultimate one, with finer ones posteriorly; base of last whorl with 11 wide-set, granose ridges, plus [8]–10 stronger ridges on rostrum, which are smooth and equal to their intervals [Protoconch conical, *circa* 2.5 whorls, first whorl swollen; fresh sculpture unknown].

Colouration pale buff, with faint darker and lighter spiral bands.

ACKNOWLEDGEMENTS

This research was supported by the National Natural Science Foundation of China (NSFC No. 40976086), Innovation Programs of the Chinese Academy of Sciences (KSCX2-YW-Z-0915 and IOCAS O72715). Thanks are due to Miss

Xiaochen Wang and Dr. Qingxi Han for preparing the figures. We thank the managers of the MBMCAS, Shaoqing Wang, Yongqiang Wang, Lianmei Shuai, Shiling Li, for helping to sort the material in the MBMCAS. We are grateful to Ms. Kathie Way (BMNH) and Dr. Ole Tendal (ZMUC) for giving access to their respective turrid collections.

REFERENCES

- AARTSEN JJ VAN, MENKHORST HPM & GITTEBERGER E 1984 The marine Mollusca of the Bay of Algeciras, Spain, with general notes on *Mitrella*, Marginellidae and Turridae. *Basteria Supplement 2*: 1–135.
- CHANG CK 2000 Small shells of the classic Turridae from Taiwan IV. Daphnellinae and Philibertinae [sic]. *Bulletin of Malacology, Taiwan, ROC 24*: 53–70.
- DALL WH 1924 Notes on molluscan nomenclature. *Proceedings of the Biological Society of Washington 37*: 87–90.
- HIGO S, CALLOMON P & GOTO Y 1999 *Catalogue and bibliography of the marine shell-bearing Mollusca of Japan*. Elle Scientific Publications, Osaka. 749 pp., 5 maps.
- HIGO S, CALLOMON P & GOTO Y 2001 *Catalogue and bibliography of the marine shell-bearing Mollusca of Japan. Type figures*. Elle Scientific Publications, Osaka. 208 pp.
- HINDS RB 1843 On new species of *Pleurotoma*, *Clavatula*, and *Mangelia*. *Proceedings of the Zoological Society of London 1843*: 36–46.
- HINDS RB 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*. Smith, Elder and Co., London. Vol. 2. 72 pp., 21 pls.
- LI BQ & LI XZ 2007a An account of the Genus *Turris* species (Mollusca: Gastropoda: Turridae) from the East and South China Seas. *Zootaxa 1397*: 63–68.
- LI BQ & LI XZ 2007b Two new species of conoidean gastropods (Gastropoda: Conoidea) from China seas. *The Veliger 49* (2): 79–83.
- LI BQ & LI XZ 2008a Report on the turrid genera *Gemmula*, *Lophiotoma* and *Ptychosyrinx* (Gastropod: Turridae: Turrinae) from the China seas. *Zootaxa 1778*: 1–25.
- LI BQ & LI XZ 2008b Report on the two subfamilies Clavatulinae and Cochlespirinae (Mollusca: Neogastropoda: Turridae) from the China seas. *Zootaxa 1771*: 31–42.
- MARTENS E VON 1880 *Conchologische Mittheilungen als Fortsetzung der Novitates Conchologicae*. Vol. 1. Theodor Fischer, Cassel.
- MELVILL JC 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.
- POWELL AWB 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, 23 pls.
- REEVE LA 1845 *Monograph of the Genus Pleurotoma. Conchologia Iconica, or Illustrations of the shells of molluscos animals*. Reeve Brothers, London. Vol. 1: pls. 20–33, species 166–305.
- SMITH EA 1882 Diagnoses of new species of Pleurotomidae in the British Museum. *Annals and Magazine of Natural History, [series 5] 10*: 296–306.
- SOWERBY GB 1870 Descriptions of forty-eight new species of shells. *Proceedings of the Zoological Society of London 1870*: 249–259, pls 21–22.
- SPRINGSTEEN FJ & LEOBRERA FM 1986 *Shells of the Philippines*. Carfel Seashell Museum, Manila. 377 pp., 27 figs., 100 pls., 1 map.
- TAYLOR JD, KANTOR YI & SYSOEV AV 1993 Foregut anatomy, feeding mechanisms, relationships and classification of the Conoidea (=Toxoglossa) (Gastropoda). *Bulletin of the Natural History Museum of London, Zoology 59*: 125–170.
- TRYON GW JR 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).

