Riv. It. Paleont. Strat.	v. 100	n. 1	pp. 71-102	tav. 1-7	Giugno 1994

NOTES ON SOME PLIOCENE GASTROPODS FROM RIO TORSERO, WESTERN LIGURIA, ITALY

MARIA PIA BERNASCONI* & ELIO ROBBA**

Key-words: Taxonomy, Gastropods, Pliocene, Liguria.

Riassunto. Il presente lavoro è il secondo di una serie dedicata ai Molluschi pliocenici della Liguria. Esso riguarda 13 specie di Gasteropodi appartenenti alle superfamiglie *Rissoacea*, *Rissoinacea*, *Cerithiopsacea* e *Triphoracea*. Di ciascun taxon viene rivista l'attribuzione generica sulla base dei caratteri della protoconca, e di quelli meno conosciuti si fornisce la descrizione dei giri apicali e della teleoconca. Sono segnalati per la prima volta nel Pliocene mediterraneo i taxa *Cerithiopsidella*, *Retilaskeya*, *Rissoina (Rissoina) varicosa* Boettger e *Metaxia abrupta* (Watson); viene formalizzata la specie *Alvania (Alvania) obliquistoma*, nuova per la scienza.

Abstract. The present paper is the second of a series dedicated to Pliocene molluscs of Liguria. It deals with 13 gastropods species belonging to the superfamilies *Rissoacea*, *Rissoinacea*, *Cerithiopsacea* and *Triphoracea*. The generic assignment of each taxon is reviewed on the basis of the protoconch characters, and the description is provided for less known species. The genera *Cerithiopsidella* and *Retilaskeya* are quoted for the first time in Mediterranean area as well as *Rissoina (Rissoina) varicosa* Boettger and *Metaxia abrupta* (Watson). The new species *Alvania (Alvania) obliquistoma* is proposed.

Introduction.

The present paper is the second of a series dedicated to Pliocene molluscs of Liguria. A first contribution on turrids has been already published (Bernasconi & Robba, 1984), and a further one on nassariids and epitoniids is being prepared. The study aims to describe and discuss some poorly known or previously unrecorded gastropods. A total of 13 rissoid, rissoinid, cerithiopsid and triphorid species are considered herein.

The whole shell material was recovered from the Pliocene Ortovero Clay (Argille di Ortovero) exposed in the locality of Rio Torsero, western Liguria (Fig. 1). The specimens were obtained from 4 bulk-samples (TOR1 to TOR4, 30 dm3 each) collected during field work in 1979.

* Dipartimento di Scienze della Terra, Università della Calabria, 87036 Arcavacata di Rende (Cs).

** Dipartimento di Scienze della Terra, Università degli Studi di Milano, Via Mangiagalli 34, 20133 Milano.

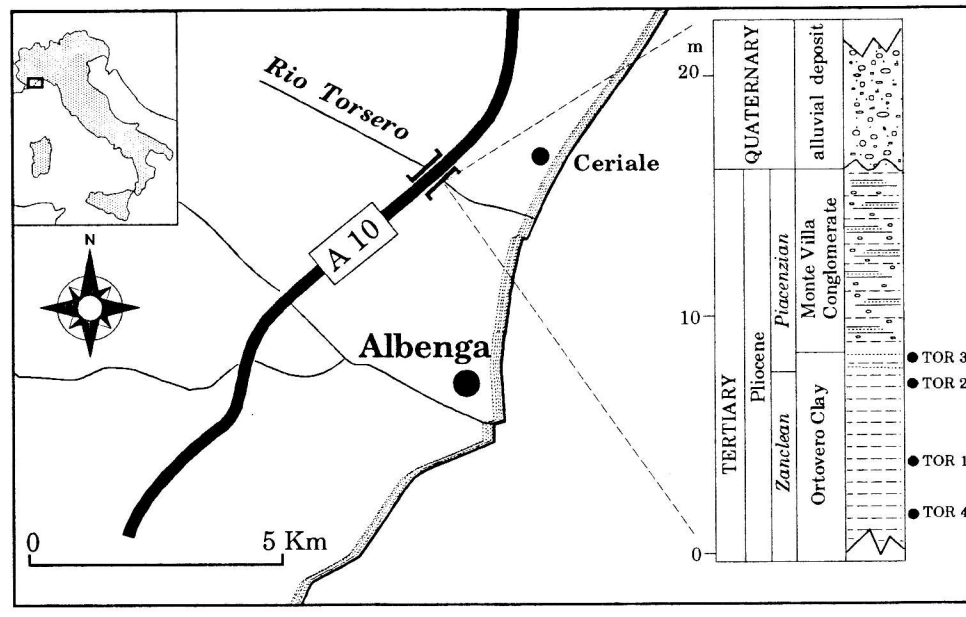


Fig. 1 - Location map of Rio Torsero outcrop (left) and columnar section of the Pliocene sediments exposed along the stream (right); black dots indicate the collecting points of the four bulk-samples.

The Pliocene deposits of western Liguria are observable at several exposures, from Borzoli near Genoa westward to the state border near Ventimiglia. The various outcrops were more or less extensively dealt with by the authors (cf. Sasso, 1827; Pareto, 1846; Issel, 1877; Squinabol, 1877; Della Campana, 1890; Mastrorilli, 1969; Boni P. & Peloso, 1973; Giammarino & Tedeschi, 1970, 1975, 1976, 1980, 1982, 1983; Boni P. et al., 1976; Robba, 1981; Boni A. et al., 1983; Giammarino et al., 1984; Bernasconi, 1989). Rio Torsero, on account of its very rich mollusc fauna, is well known since the last century. It has been considered by Arduini (1895), Hornung (1920), Bernasconi (1981), Bernasconi & Robba (1984), and Violanti (1987) who studied the foraminiferal assemblages.

The locality of Rio Torsero.

The Pliocene deposits crop out on both banks of Rio Torsero, just where the A 10 highway bridges the stream, southwest of the village of Ceriale (Fig. 1). They consist of the Ortovero Clay (base not exposed) which is overlain by Monte Villa Conglomerate (Conglomerati di Monte Villa) here represented by a sandy facies. The sequence from bottom to top is as follows:

- 8.50 m of clayey silt very sandy, light grey, with abundant fossil molluscs (Ortovero Clay); bulk-samples TOR1-TOR4 were collected from different levels (see Fig. 1);

- 7.50 m of very sandy clay, yellowish-brown, laminated, with thin interbeds of calcareous sandstone; in the upper part the sand fraction increases and discontinuous indurated layers are observable (Monte Villa Conglomerate);
- erosional surface;
- 2.00-2.50 m of coarse gravel, strongly weathered, reddish-brown (Quaternary alluvial deposits).

The study of the planktonic foraminifera (Violanti, 1987) has shown that the mid-lower part of the Ortovero Clay (TOR4, TOR1, TOR2) has a MPL3, i.e. a Zanclean age. The uppermost part (TOR3) yielded a MPL4 association, pointing toward a Piacenzian age.

Both foraminiferal and molluscan assemblages contain a great number of allochthonous specimens, transported in from shallower depths. Violanti (1987), focussing on autochthonous benthic foraminifera, suggested that the Ortovero Clay was deposited in the deep circalittoral zone, close to the shelf edge. This inference is consistent with the paleoecological interpretation, based on molluscs, given by Bernasconi (1981). In fact, the author recognized a fossil community that compares to the modern *Auchenoplax crinita* Community of the Mediterranean. This latter has a deep circalittoral location and is possibly to be regarded as a peculiar aspect of the Biocoenosis of Muddy Detritic Bottoms (DE) (Picard, 1972).

Systematic paleontology

The classification adopted in this account draws on those of Wenz (1938-44) and Taylor & Sohl (1962), with modifications according to more recently proposed changes (cf. Marshall, 1977, 1978, 1983; Bouchet, 1984; Ponder, 1985).

The studied material is housed in the Museo di Paleontologia dell'Università, Milan, Italy (MPUM in the following).

Symbols for shell dimensions are: NW, number of whorls; PD, diameter of the protoconch; H, height of the shell; hs, height of the spire; hw, height of the body whorl; D, maximum diameter; ha, height of the aperture; wa, width of the aperture; MSA, mean spire angle; SS, sutural slope.

Class Gastropoda Cuvier, 1797
Subclass Prosobranchia Milne Edwards, 1848
Order **Mesogastropoda** Thiele, 1925
Family *Rissoidae* Gray, 1847
Genus *Pusillina* Monterosato, 1884
Subgenus *Pusillina* s.s.

Pusillina (Pusillina) sulzeriana (Risso, 1826)

Pl. 1, fig. 1-5

1895 *Apicularia sulzeriana* var. *villalvernensis, sublaevis, perlaevis* Sacco, pp. 20, 21, pl. 1, fig. 46-48.
1895 *Rissoia lineolata* - Sacco, p. 19.
1895 *Rissoia lineolata* var. *rotunduloides, laevirotunda* Sacco, p. 19, pl. 1, fig. 39, 39bis.
?1914 *Rissoia (Turbella) inconspicua* - Cerulli Irelli, p. 192, pl. 15, fig. 35-42.
?1974 *Apicularia sulzeriana* - Malatesta, p. 176, pl. 13, fig. 18.
1975 *Apicularia sulzeriana* - Pavia, p. 130, pl. 3, fig. 11, 17-23.

Occurrence. TOR1, 8 spms., MPUM 7081, 7084, 7086; TOR2, 22 spms., MPUM 7082, 7083, 7087; TOR4, 4 spms, MPUM 7080, 7085. The shell material is more or less worn but all characters, protoconch included, are observable.

Remarks. *Apicularia* Monterosato, 1884 has been regarded as a synonym of *Rissoa* Desmarest, 1814 by Ponder (1985). The present species does not fit in satisfactorily with the protoconch and teleoconch characters of neither *Apicularia* nor *Rissoa*. Instead, the broadly conical, 2.5 whorled protoconch bearing 2 abapical threads, the general shell shape and apertural features strongly suggest its assignment to the nominotypical subgenus of *Pusillina* Monterosato, 1884.

Our specimens have been thoroughly compared with the shells determined as *Rissoia lineolata* Michaud by Sacco (1895) and proved to be identical. Pavia (1975) examined the same Sacco's shells and concluded that they are to be included in the synonymy of *Apicularia sulzeriana* (Risso). This opinion is regarded as correct and followed herein. The perfect resemblance of our specimens to those figured as *Apicularia sulzeriana* by Pavia (1975) is also to be noticed.

The shell published by Malatesta (1974) and assigned to Risso's species exhibits a typical *Rissoa*-like habit. Accordingly, its identification with *Pusillina (Pusillina) sulzeriana* appears to be rather doubtful. The specimens referred to as *Rissoia (Turbella) inconspicua* (Alder) by Cerulli Irelli (1914), according to the description and figures given by the author, seem to be strikingly similar to those from Rio Torsero and quite possibly belong to the present species. It is of note that the illustrations of *Pusillina (Pusillina) inconspicua* provided by Sars (1878), Fretter & Graham (1978) and Ponder (1985) show that Alder's species has a relatively smooth shell; ribs, when present, are weaker and more numerous. However, a definitive statement must await direct examination of Cerulli Irelli's material.

Distribution. *P. (Pusillina) sulzeriana* (Risso) has been recorded from Tortonian deposits of Piedmont and Emilia, and from several Pliocene localities of peninsular Italy.

Pusillina (Pusillina) sp.

Pl. 2, fig. 1, 2

Occurrence. TOR1, 2 spms., MPUM 7066; TOR 2, 8 spms., MPUM 7063-7065. The shell material is more or less worn.

Description. Shell ovately conical, rather thin walled, with a slightly coeloconoid spire which is 57 to 61% of shell height. Protoconch not clearly demarcated from

teleoconch, obtusely conical, apparently of 2.25-2.50 convex whorls and with a globular, somewhat tilted nucleus. Some faint spiral lines are observed on the abapical one half of the first 1.5 whorls. Teleoconch whorls convex, the 2 youngest much more tumid, meeting at deep, impressed sutures. Body whorl rather inflated, about 63% of the shell height, regularly tapering at the base. Aperture comparatively large although somewhat constricted, oval-rhomboid, narrowed adapically and bounded by a thin peristome lying in an orthocline to slightly opisthocline plane. The outer lip arises well below the periphery of body whorl and follows a regularly curved course to join the columella. The inner lip is more or less angulated in the middle, somewhat everted abapically over a narrow umbilical chink. Columella straight, slightly oblique.

The shell appears to be smooth. Remnants of original colouring are observed in some shells, and consist of pale brown streaks having a zig zag pattern.

Dimensions (in mm):

NW	PD	H	hs	hw	D	ha	wa	MSA	SS
5.20	0.55	2.45	1.50	1.55	1.25	0.95	0.60	40°	14°
5.00	0.50	2.25	1.30	1.45	1.30	0.90	0.65	45°	15°
5.00	0.55	2.20	1.30	1.40	1.15	0.90	0.60	40°	15°
4.75	0.55	2.10	1.20	1.40	1.20	0.90	0.60	44°	16°
---	---	2.65	1.55	1.60	1.35	1.05	0.70	39°	13°

Remarks. The smooth shells from Rio Torsero are featured by their markedly convex low whorls and somewhat constricted abapical part. They are herein assigned to the nominotypical subgenus of *Pusillina* Monterosato, 1884 on the basis of protoconch characters, shell shape and apertural features (cf. Ponder, 1985). The present material does not compare satisfactorily to any species of *Pusillina* figured in the literature and quite possibly belongs to a new taxon. However, additional, well preserved specimens are needed in order to reach a definitive conclusion in this respect. It is not unlikely that identical Pliocene shells have been so far referred by authors to superficially similar species of *Pusillina* or *Setia* H. & A. Adams, 1852 because of smooth teleoconch surface. The Middle Miocene *Rissoa (Turboella) dilemma* Boettger appears to be the most closely related species. According to the figure of the holotype given by Zilch (1934), it differs in that has less tumid teleoconch whorls and does not show any basal constriction at the aperture level.

Genus *Alvania* Risso, 1826

Subgenus *Alvania* s.s.

Alvania (Alvania) testae (Aradas & Maggiore, 1844)

Pl. 2, fig. 3, 4; Pl. 3, fig. 1

1973 *Alvania testae* - Di Geronimo & Panetta, p. 77, pl. 1, fig. 4.
1980 *Rissoa abyssicola* var. *conformis* - Waren, p. 22, pl. 4, fig. 2,3.

1985 *Alvania (Alvania) testae* - Ponder, p. 41, fig. 88, A-B.
1991 *Alvania testae* - Poppe & Goto, p. 102, pl. 12, fig. 18.
1992 *Alvania (Alvania) testae* - T. Cossignani, V. Cossignani, Di Nisio & Passamonti, p. 20, fig. 073.
1993 *Alvania testae* - Oliverio, Amati & Nofroni, p. 251, pl. 1, fig. 1-3.
1993 *Alvania testae* - Bouchet & Waren, p. 628, fig. 1386, 1387, 1400-1405.

Occurrence. TOR1, 57 spms., MPUM 7067-7069, 7071; TOR2, 14 spms., MPUM 7073; TOR 3, 9 spms., MPUM 7070; TOR4, 19 spms., MPUM 7072. Almost all the shells in hand are well preserved.

Description. Shell slender, ovately conic, with a rather tall spire which is 61 to 66 % of shell height. Protoconch conical of 2-2.5 convex whorls, with a deviated nucleus. The embryonic shell consists of 1 whorl and exhibits a somewhat irregular reticulated pattern. It is distinctly demarcated from the larval shell. The latter bears 2 spiral threads close to the abapical suture, small granules grouped adapically, and short, oblique threads lying in between. The transition to teleoconch is marked by an abrupt change of the ornamentation. Teleoconch whorls convex, with a low increase in diameter from one to the next. Sutures straight, impressed. Body whorl ovate, about 60 % of shell height, rather rapidly tapering at the base. Aperture oval, somewhat pinched adapically, a little higher than broad, and with a thick peristome. The markedly opisthocline outer lip arises from below the periphery of body whorl and follows a nearly semicircular course to the base of columella which is very short. A strong, prominent labial varix is observed. The inner lip is gently arched and inconspicuously turned out. A very narrow umbilical chinck is seen in some shells.

The teleoconch ornamentation starts with collabral ribs and 2 spiral ridges. The collabral ribs, 16 per whorl, are opisthocline, narrow and prominent, separated by wide interspaces. The spiral ridges are 2 on the first whorl, lying adapically and abapically at some distance from sutures. At the end of the first whorl a third spiral ridge develops close to adapical suture, soon followed by another ridge in between the first two. By the middle of the second whorl the 4 spiral ridges are of equal strenght and equally spaced. A fifth spiral ridge marginating the abapical suture is occasionally observed. The collabral and spiral ornaments are of similar strenght and intersect giving the surface an oblong reticulate pattern. The spirals form raised knobs on crossing ribs. The body whorl has 16 to 18 collabral ribs which die out just below the periphery, at level of spiral 5. Ridges, 8 in number, extend to the outer lip and cross the labial varix. The three most abapical are stronger and more widely spaced. Growth lines are very delicate, crossed by a faint spiral striation observable all over except for ridges.

Dimensions (in mm):

NW	PD	H	hs	hw	D	ha	wa	MSA	SS
5.50	0.40	2.70	1.80	1.60	1.45	0.90	0.65	40°	12°
5.30	0.40	2.80	1.85	1.65	1.55	0.95	0.70	42°	12°
5.20	0.40	2.60	1.70	1.55	1.35	0.90	0.60	40°	13°
5.20	0.40	2.45	1.55	1.50	1.30	0.90	0.60	40°	13°
5.10	0.40	2.50	1.60	1.50	1.40	0.90	0.60	41°	14°

5.00	0.42	2.40	1.50	1.45	1.35	0.90	0.60	42°	13°
5.00	0.40	2.30	1.50	1.50	1.30	0.80	0.65	42°	12°
4.90	0.40	2.35	1.55	1.45	1.30	0.80	0.60	41°	13°
4.80	0.38	2.30	1.50	1.45	1.30	0.80	0.60	42°	11°
4.50	0.40	2.20	1.35	1.45	1.20	0.85	0.60	42°	10°

Remarks. The present form was selected for the type of *Actonia* Monterosato, 1884. According to Ponder (1985), *Actonia* is to be regarded as a synonym of the nominotypical subgenus of *Alvania* Risso, 1826.

The specimens considered herein fully match the basic characters of *Alvania (Alvania) testae* (Aradas & Maggiore), in particular, the protoconch is identical (cf. Ponder, 1985 and Oliverio et al., 1993). However, they exhibit some subtle differences in respect to the typical form: 1) the spire whorls are comparatively lower, 2) the spiral ridges are constantly 4 instead of 5 or more, and 3) the spiral striation in between ridges is coarser. We regard these differences as no more than intraspecific variability. The Middle-Upper Miocene *Alvania partschi* (Hoernes) and *Alvania pseudopartschi* Anderson exhibit a quite similar shape and sculpture and appear to be related. According to Sorgenfrei (1958), *Alvania partschi* has the protoconch with "1-2 fine spiral striae exposed immediately above the anterior suture" and otherwise smooth, thus different from that of the present taxon. As regards *Alvania pseudopartschi*, we have no information on its protoconch and, for that reason, cannot reach any conclusion about the relationships between this species and the form described here. It is of note, however, that Janssen (1984) regarded *Alvania pseudopartschi* as identical with *Alvania partschi*.

Distribution. *A. (Alvania) testae* (Aradas & Maggiore) has been recorded from Plio-Pleistocene deposits of Italy. The species has a modern distribution in the Mediterranean and the North Atlantic Ocean, being a deep circalittoral and bathyal element.

Alvania (Alvania) thalia De Stefani & Pantanelli, 1880

Pl. 3, fig. 2-4

1880 *Alvania thalia* De Stefani & Pantanelli, p. 167 (non vidimus).
1888 *Alvania thalia* - De Stefani, pl. 11, fig. 36,37 (non vidimus).
1895 *Alvania (Alvaniella) thalia* - Sacco, p. 25.
1895 *Alvania (Alvaniella) thalia* var. *exbrevis* and *subacingulata* Sacco, pp. 25,26, pl. 1, fig. 59,60.

Occurrence. TOR1, 16 spms, MPUM 7059; TOR2, 110 spms., MPUM 7056-7058; TOR4, 6 spms., MPUM 7055, 7060. The available shells are mostly well preserved.

Description. Shell ovoid conical with a rather tall spire which is 60 to 66 % of shell height and has a blunt apex. Protoconch bulbous of 1.75 convex whorls, with a large, slightly deviated nucleus. It is covered by dense granules which tend to be aligned in spiral rows. The transition to teleoconch is abruptly marked by a change of ornamentation and enhanced by the presence of a faint, slightly prosocline varix. Tele-

oconch whorls convex, with some adapical flattening, and with the periphery a little below the middle of the height. Sutures straight, somewhat impressed. Body whorl almost globular, 63 % of shell height, rather rapidly tapering at the base. Aperture oval, relatively small, angulated adapically and rounded abapically. The thin edged outer lip arises well below the periphery of body whorl, at level of spiral 4-5. It is slightly opisthocyrt adapically and follows a semicircular course to the end of columella which is short. There is a broad, somewhat flattened varix. The inner side bears, a little deep in the aperture, about ten irregular ridges which are subobsolete or missing in some shells. The inner lip is gently arched, slightly disjoined abapically and slightly everted over a quite narrow umbilical chink. The latter can be completely hidden in some specimens.

The teleoconch ornamentation starts with 2 spiral ridges followed almost immediately by faint collabral ribs. The collabral ribs, 18-20 on the first whorl, reduce the number during growth, being 13-15 on the penultimate. They increase in strenght, are straight and as wide as one half of the intervening spaces. The first appeared spiral ridges respectively lie in the middle of the whorl and close to abapical suture. A third ridge develops in between after nearly 1 whorl and quickly reaches the same size of the others two. At the same stage, a very faint cord appears close to adapical suture and persists on all whorls. An additional ridge rises from abapical suture on the penultimate whorl. The body whorl bears 6-7 spirals and 10-12 ribs which die out at level of spiral 5. The abapical half of the base is generally smooth. Both spiral and collabral ornaments usually fade away on the youngest part of the whorl. Low nodosities are observed where spiral ridges cross ribs. The whole shell, except for the abapical half of the base, is covered with an obscure spiral striation intersected by growth lines.

Dimensions (in mm):

NW	DP	H	hs	hw	D	ha	wa	MSA	SS
4.80	0.43	3.00	1.90	1.85	1.65	1.05	0.85	43°	12°
4.70	0.40	2.70	1.80	1.70	1.50	0.90	0.70	43°	11°
4.70	0.40	2.65	1.60	1.70	1.55	1.05	0.80	41°	13°
4.60	0.40	2.70	1.65	1.75	1.55	1.00	0.70	46°	11°
4.60	0.40	2.65	1.60	1.70	1.65	1.05	0.80	48°	10°
4.60	0.40	2.65	1.65	1.75	1.50	1.00	0.75	46°	10°
4.50	0.40	2.55	1.65	1.60	1.45	0.90	0.70	44°	12°
4.30	0.40	2.55	1.55	1.70	1.60	1.00	0.75	48°	12°
4.20	0.40	2.35	1.45	1.50	1.35	0.90	0.60	46°	12°
4.10	0.43	2.25	1.35	1.50	1.35	0.90	0.60	48°	12°

Remarks. *Alvaniella* Sacco, 1895 is regarded as a synonym of the nominotypical subgenus of *Alvania* Risso, 1826 (cf. Ponder, 1985).

The identification of our specimens is made on the authority of Sacco (1895). In fact, we have compared the shells from Rio Torsero with those referred to as *Alvania (Alvaniella) thalia* by Sacco and can state that they are indistinguishable. *Alvania (Al-*

vania) thalia is rather variable as regards number and strenght of spirals. In particular, the occasional absence of the faint adapical cord is to be noticed. These variations, however, are extremely gradual and do not support the separation of subspecies. The strikingly similar protoconch suggests a close relation with *Alvania (A.) lineata* Risso (cf. Thiriot-Quiévreux, 1980; Ponder, 1985). The present species differs from *A. (A.) lineata* basically in that has the adapical one third of whorls devoid of spirals and the abapical part of base nearly smooth.

Distribution. *A. (Alvania) thalia* De Stefani & Pantanelli is so far known from the Pliocene of Piedmont and Tuscany.

Alvania (Alvania) tiberiana (Coppi, 1876)

Pl. 4, fig. 1,2

1876 *Rissoa tiberiana* Coppi, p. 201 (non vidimus).
1895 *Alvania (Galeodinopsis) tiberiana* - Sacco, p. 28, pl. 1, fig. 67.
1921 *Alvania (Galeodinopsis) tiberiana* - Cossmann, p. 23, pl. 1, fig. 55, 56.

Occurrence. TOR1, 7 spms., MPUM 7051, 7053; TOR2, 2 spms., MPUM 7052, 7054. The shells in hand are well preserved.

Description. Shell oval-conic, with a rather tall, straight sided spire which is 49 to 52 % of total height. Protoconch conic, made of 2.25 gently convex whorls and with a strongly tilted nucleus. The embryonic shell consists of 1 whorl and exhibits an irregular reticulated pattern; it is distinctly demarcated from the larval shell. The latter has 2 spiral threads running on the abapical half of the whorls. Small scattered granules are observed close to the end of the protoconch. The transition to teleoconch is abrupt, marked by the sudden appearance of 3 spiral ridges. Teleoconch whorls tumid, quickly increasing in diameter, and meeting at impressed sutures placed somewhat below the periphery of whorls. Body whorl globular, 72 % of shell height, rather rapidly tapering at the base. Aperture drop-shaped, angulated adapically, rounded abapically. It lies in a slightly prosocline plane and is bounded by a thick, but not duplicated peristome. The outer lip arises abapical to the periphery of body whorl at level of spiral 5 and follows a semicircular course to the base of columella which is short. It is somewhat reflected and bears a strong varix on its outer side. The inner lip is gently arched, just a little everted over a very narrow umbilical groove.

The teleoconch ornamentation starts with 3 spiral ridges, soon followed by collabral ribs. The collabral ribs, 14-16 per whorl, are prominent, slightly opisthocline and conspicuously narrower than the intervening spaces. The spiral ridges are of equal strenght and run over the abapical 2/3 of the whorls. A quarter of a whorl after their appearance, a fourth faint spiral develops adapically and remains definitely thinner than the others. The body whorl bears 9 to 11 spiral ridges which cross the labial varix. The most abapical 7 to 11 spirals are somewhat stronger. The ridges bear rows of small pits, and are about half the breadth of ribs. These latter die out below the

periphery, at level of spiral 6. Ribs and ridges intersect to give a square reticulation. A second varix is occasionally seen on body whorl, approximately opposite the labial one. Growth lines fine, more evident on the abapical part of the base. The whole shell exhibits minute and regular threads between main spirals.

Dimensions (in mm):

NW	PD	H	hs	hw	D	ha	wa	MSA	SS
4.70	0.40	2.90	1.45	2.15	2.10	1.45	0.95	64°	10°
4.70	0.46	2.80	1.45	2.00	2.05	1.35	0.80	60°	13°
4.70	0.40	2.60	1.35	1.90	1.95	1.25	0.80	59°	11°
4.30	0.40	2.30	1.20	1.70	1.65	1.10	0.70	58°	10°
4.20	0.40	2.15	1.05	1.60	1.65	1.10	0.70	64°	8°
---	0.40	2.20	1.15	1.60	1.70	1.05	0.70	64°	8°
---	---	2.80	1.40	1.95	1.95	1.40	0.85	55°	10°

Remarks. Our specimens have been compared with the material referred to as *Alvania (Galeodinopsis) tiberiana* (Coppi) by Sacco (1895) and proved to be perfectly akin. We follow Ponder (1985) who assigned the present species to the nominotypical subgenus of *Alvania* Risso, 1826. Coppi's taxon is easily recognizable on account of its globular and variced body whorl, wide aperture and thickened peristome.

Distribution. *A. (Alvania) tiberiana* (Coppi) is so far known from Lower Pliocene of Liguria, Emilia and Algeria.

Alvania (Alvania) obliquistoma sp. n.

Pl. 4, fig. 3, 4; Pl. 5, fig. 1, 2

Derivation of name. From Latin *obliquus*, oblique plus Greek *stoma*, mouth, with reference to the oblique aperture.

Holotype. Rio Torsero Section: TOR 2, MPUM 7094 (Pl. 5, fig. 1).

Paratypes. Rio Torsero Section: TOR1, 105 spms., MPUM 7097, 7100; TOR2, 256 spms., MPUM 7095, 7096, 7099; TOR4, 2 spms., MPUM 7098.

Type-locality. Rio Torsero near Albenga, Province of Savona (Liguria).

Horizon. Ortovero Clay (Zanclean).

Preservation. Most specimens are fragmentary and/or eroded, but some are well preserved and show all features.

Diagnosis. Shell conic-ovate with a rather tall spire. Protoconch paucispiral with raised spiral lines. Teleoconch whorls convex, with the periphery lying abapically. Base obconical. Youngest whorls ornamented by 10-11 collabral ribs which fade away at the level of spiral 8. Fine spiral threads on whole surface, except for ridges.

Description. Shell conic-ovate with a rather tall, straight sided spire which is 57 to 65 % of shell height. Protoconch paucispiral, made of 1.5 convex whorl, and with a large somewhat flattened and slightly tilted nucleus. The embryonic shell is not clearly demarcated from larval one. This latter bears a pattern of raised, slightly ondulating spiral lines, sometimes with rows of irregular small tubercles in between. The transi-

tion to the teleoconch is abruptly marked by a very faint varix and by the appearance of teleoconch ornamentation. Teleoconch whorls rather convex with the periphery lying abapically. They meet at straight, deeply impressed sutures. Body whorl 62% of shell height, somewhat expanded and angulated at the periphery. It rapidly tapers at the base which has straight, steep sides resulting in a nearly conical shape. Aperture oval, relatively small, markedly oblique, narrowed adapically, rounded abapically, and lying in an almost orthocline plane. The outer lip arises well below the periphery of body whorl, at the level of spiral 8-9 and follows a semicircular course to the end of columella. It is thin edged, somewhat everted medially and abapically. There is, just behind, a prominent, rather wide varix. The inner side generally bears 10-12 ridges which die out a little distance from peristome; ridges are occasionally obsolescent or totally missing. The inner lip is slightly arched. An inconspicuous umbilical chink is observed in few shells.

The teleoconch ornamentation starts with 2 spiral ridges and collabral ribs which are of equal strenght. The collabral ribs gradually increase in size, are orthocline to slightly prosocline and as broad as the intervening furrows or a little less. They are prominent, with a rather narrow top and widen abapically, being somewhat nodose at the periphery of whorls. The ribs are 14-15 on the first whorl, whereas 10-11 occur on the following ones. The spirals first appeared lie medially and close to abapical suture respectively. A third faint ridge develops in between, about at the end of first whorl, and soon reaches the same strenght. Two adapical thin cords follow almost immediately; another one intervenes after 1-1.25 whorl. An additional cord may occur on the 2 last whorls, close to adapical suture. The cords running adapically are in comparison thinner than the 3 abapical ones. The spirals do not give nodosities on crossing the ribs. The body whorl bears 13-14 spirals, the basal ones (7) equal and equally spaced. The collabral ribs (10-11) die away a little abapical of the periphery, at level of spiral 8. The whole shell, except for spiral ridges, is covered by fine spiral threads crossed by growth lines.

Dimensions (in mm):

NW	PD	H	hs	hw	D	ha	wa	MSA	SS
6.40	---	3.85	2.50	2.25	2.10	1.35	0.90	43°	12°
6.25	0.60	3.50	2.20	2.10	2.00	1.30	1.00	45°	11°
6.20	0.55	3.50	2.15	2.15	2.05	1.35	0.90	47°	11°
6.10	0.60	3.35	2.10	2.30	2.25	1.50	1.00	51°	11°
6.00	0.60	3.45	2.15	2.10	1.85	1.30	0.90	42°	13°
6.00	0.60	3.45	2.10	2.10	1.90	1.35	0.90	43°	10°
6.00	0.55	3.40	2.15	2.05	1.90	1.25	0.85	46°	10°
6.00	0.60	3.40	2.10	2.10	2.05	1.30	0.85	47°	12°
6.00	0.60	3.40	2.05	2.05	2.00	1.35	0.80	46°	9°
6.00	0.60	3.40	2.10	2.05	2.15	1.30	0.80	50°	8°
6.00	0.60	3.40	2.10	2.10	2.00	1.30	0.85	48°	10°
6.00	0.55	3.35	2.10	2.00	1.95	1.25	0.80	47°	9°
6.00	0.55	3.35	2.00	2.15	2.10	1.35	0.85	50°	12°
5.90	---	3.35	2.00	2.15	2.10	1.35	0.90	49°	11°

NW	PD	H	hs	hw	D	ha	wa	MSA	SS
5.90	0.55	3.35	2.05	2.05	1.90	1.30	0.90	44°	10°
5.90	0.60	3.30	2.00	2.05	2.00	1.30	0.90	46°	12°
5.80	0.60	3.25	1.95	2.10	1.90	1.30	0.85	49°	13°
5.80	0.55	3.20	1.85	2.05	1.95	1.30	0.80	48°	13°
5.80	0.60	3.15	1.80	2.05	1.90	1.35	0.80	48°	12°
5.80	0.60	3.10	2.00	1.90	1.80	1.10	0.85	45°	13°
5.80	0.60	3.05	1.90	1.95	1.85	1.15	0.90	45°	12°
5.80	0.55	3.05	1.75	2.00	1.95	1.30	0.80	50°	9°
5.80	0.60	3.00	1.85	1.90	1.80	1.15	0.70	48°	11°
5.80	0.55	3.00	1.80	1.90	1.75	1.20	0.70	45°	12°
5.80	0.55	2.80	1.80	1.70	1.65	1.00	0.70	45°	11°
5.70	0.60	3.00	1.85	1.85	1.65	1.15	0.75	46°	13°
5.70	0.60	2.95	1.75	1.85	1.90	1.20	0.80	52°	13°
5.60	0.60	3.05	1.80	2.00	1.95	1.25	0.75	53°	12°
5.60	0.60	2.85	1.80	1.80	1.70	1.05	0.70	45°	11°
5.60	0.55	2.80	1.70	1.75	1.70	1.10	0.80	46°	12°

Remarks. The present new species is featured mainly by its oblique, small, strongly variced aperture. The bulk of the characters are consistent with the assignment to the nominotypical subgenus of *Alvania* Risso, 1826. The most obvious comparison is with the Pliocene *Alvania (Alvania)* sp. figured from the Pliocene of Sicily by Greco (1970, pl. 2, fig. 7,9). The author neither gave a description nor discussed possible relationships with other taxa, but provided a quite good illustration. On the basis of this latter, we can state that the material dealt with by Greco is very similar to our specimens in shell shape and ornamentation, but has a clearly less oblique aperture and, possibly, somewhat different apical part.

Alvania (Alvania) montagui (Payraudeau) has similar shape and sculptural features. Payraudeau's species, however, differs in having the protoconch (cf. Thiriot-Quiévreux, 1980) made at least of two whorls, bearing few spiral rows of exceedingly fine granules. Its shell is stouter, with less convex whorls meeting at clearly grooved sutures. Finally, the collabral ribs are stronger, round-topped and the spirals are somewhat less numerous.

Family *Rissoinidae* Stimpson, 1865

Genus *Rissoina* D'Orbigny, 1840

Subgenus *Rissoina* s.s.

Rissoina (Rissoina) varicosa Boettger, 1906

Pl. 5, fig. 3; Pl. 6, fig. 1

1906 *Rissoina (Zebinella) varicosa* Boettger, p. 164, n. 567.
1934 *Rissoina (Zebinella) varicosa* - Zilch, p. 215, pl. 6, fig. 99.
1975 *Rissoina (Zebinella) varicosa* - Baluk, p. 92, pl. 10, fig. 3.

Occurrence. TOR2, 2 spms., MPUM 7074, 7075. The shells in hand are rather well preserved, but have the protoconch partly broken.

Description. Shell turret-like, relatively thin walled, with a cyrtoconoidal spire which is 60 % of shell height. The transition from the protoconch to teleoconch is marked by a distinct opisthocline varix having the strongest curvature just adapical to periphery. Teleoconch whorls slightly convex, with some adapical flattening, except for the first one which is feebly angulated in the middle. They meet at straight, adpressed sutures. Body whorl oval, about 56 % of shell height, very gently tapering at the base. Aperture D-shaped, relatively high, acutely angulated adapically where a distinct channel is observed. The outer lip arises just below the periphery of body whorl, has a somewhat thickened edge and is reinforced outside by a low, rather broad varix. The inner lip is slightly convex at both ends, somewhat concave in the middle, and follows a straight course as a whole. It makes an angle of about 35° with shell axis. The parietal callus is somewhat thickened and extends just a little outside the aperture. The outer and inner lips are connected abapically by a wide, shallow notch.

The teleoconch ornamentation starts with collabral ribs and more or less delicate spiral threads. The collabral ornaments are opisthocline, as broad as one half of intervening spaces. They consist of flattened ribs on older whorls and change into riblets on the youngest ones. Their number gradually increases during growth: 20 occur on the first whorl, whereas 50 are present on the penultimate. The spirals lie in the furrows between ribs, are irregularly spaced, 2 abapical more prominent on youngest whorls. The body whorl bears 60 riblets which are obsolescent toward the abapical end of shell. About 50 spirals are counted, somewhat stronger on the base, intersecting the riblets to give a reticulate pattern. A varix is observed nearly at the beginning of body whorl.

Dimensions (mm, preserved part):

NW	PD	H	hs	hw	D	ha	wa	MSA	SS
5.75	---	4.91	2.95	2.74	2.04	1.78	1.00	24°	9°

Remarks. Our specimens perfectly agree with the illustration of the lectotype of *Rissoina (Zebinella) varicosa* Boettger given by Zilch (1934). *Zebinella* Moerch, 1876 is regarded by Ponder (1985) as a synonym of the nominotypical subgenus of *Rissoina* D'Orbigny, 1840.

Rissoina (Rissoina) decussata (Montagu) is the most closely related taxon but differs in having a more coarsely ornamented shell. Moreover, Montagu's species exhibits a somewhat different transition from protoconch to teleoconch (Pl. 6, fig. 2; MPUM 7076): the varix is more markedly opisthocline, more arched, and has its strongest curvature placed in the adapical one third of the whorl. Finally, in *Rissoina (Rissoina) decussata* a spiral ridge appears just at the beginning of teleoconch, halfway from sutures.

Distribution. *R. (Rissoina) varicosa* Boettger is so far known from Middle-Upper Miocene of Paratethys.

Order **Heterogastropoda** Kosuge, 1966
Family *Cerithiopsidae* H. & A. Adams, 1854
Subfamily *Aliptinae* Marshall, 1978
Genus *Cerithiopsidella* Bartsch, 1911

Cerithiopsidella sp.

Pl. 6, fig. 3

Occurrence. Sample TOR1, 2 spms., MPUM 7049, 7050. A perfectly preserved shell and a broken one are at hand.

Description. Shell turret-shaped with a rather high, gently cyrtoconoid spire which is 80% of shell height. Protoconch mammillated, having a blunt nucleus, made of 3.8 slightly convex whorls except for the last one which is obtusely angulated. The embryonic shell consists of 1.5 whorls bearing granulations roughly organized into spiral rows. The larval shell exhibits a daphnelloid sculpture of opisthocline axial riblets, extended from suture to suture, intersected with thinner, markedly prosocline threads which do not reach the adapical suture. The transition to the teleoconch is abruptly marked by a change of the ornamentation pattern. Teleoconch whorls nearly flat, as high as about one half of the diameter, and with a very low increase rate during growth. They meet at linear, somewhat ondulating, shallow sutures. Body whorl 32% of shell height. Base slightly convex, having a very short, somewhat twisted neck. Aperture quadrangular in outline. The outer lip arises below the periphery of body whorl, at the level of spiral 4. Its adapical part is straight and follows the outline of the spire to the base where it turns at right angle toward the shell axis. The inner lip exhibits a strong parietal concavity and has a thin callus. Columella straight. Siphonal canal bent, very short.

The teleoconch ornamentation starts with 3 spiral ridges and few collabral riblets which change into ribs after a small fraction of the whorl. The ribs are straight, with a rounded top and somewhat less broad than the intervening furrows. They show some abapical narrowing, between the lower spiral ridge and the suture. There are 14 ribs on the first whorl, whereas 19 occur on the penultimate. The spiral lying abapically continues the peripheral angulation of the protoconch and is the strongest. The intermediate and the adapical ones reach the same strenght after 2.5 and 5 whorls respectively. The body whorl bears 21 ribs which die out at the level of spiral 4, not intersecting it. There are 5 spiral ridges. The lowermost 2, running a little abapical of the periphery, are smooth and bound the base which is smooth as well. Rounded knobs develop where the spiral and the collabral ornaments intersect. A faint spiral striation is observed in the furrows between ridges, crossed by fine growth lines which are more easily seen on the base.

Dimensions (in mm):

NW	PD	H	hs	hw	D	ha	wa	MSA	SS
12	0.55	3.90	3.15	1.25	1.20	0.75	0.50	21°	11°

Remarks. The multispiral protoconch bearing daphnelloid sculpture is consistent with the assignment of the present material to an undetermined species of the genus *Cerithiopsidella* Bartsch, 1911 (cf. Marshall, 1978). It is of note that this is the first record of *Cerithiopsidella* in the Mediterranean Pliocene, the genus being otherwise represented by Recent Pacific species.

Subfamily *Eumetulinae* Golikov & Starobogatov, 1972

Genus *Retilaskeya* Marshall, 1978

Retilaskeya sp.

Pl. 6, fig. 4

Occurrence. TOR1, 1 spm., MPUM 7048; TOR2, 2 spms., MPUM 7045, 7046; TOR4, 5 spms., MPUM 7047. The shell material is partly worn but all the shell features are observable.

Description. Shell slenderly turriculate, with a quite high, straight sided spire which is about 84% of shell height. Protoconch mammillated; the 3.5 preserved whorls are rather convex, and bear orthocline axial riblets aligned across successive whorls. The riblets are crossed by two faint spiral threads on the periphery of whorls. The transition to the teleoconch is abrupt, marked by a sudden change of the ornamentation. Teleoconch whorls nearly flat, as high as one half of the diameter whose increase rate during growth is rather low. They meet at linear, very gently undulating, shallowly impressed sutures. Body whorl about 30% of shell height. A sharp angulation lying a little abapical of the periphery bounds the base which is gently concave and has a short, twisted neck. Aperture quadrangular, prolongated in a short, bent canal. The outer lip arises normal to the surface of body whorl, at the level of spiral 4. Its adapical part is almost straight and follows the outline of the spire to the base where it abruptly turns toward the shell axis. Inner lip thin callused, with deep parietal concavity. Columella straight.

The teleoconch ornamentation starts with collabral ribs and 2 spiral ridges. The collabral ribs are straight, round-topped, and as broad as 2/3 of the intervening furrows. They are in partial alignment across successive whorls. The first whorl has 13 ribs, 15 occur on the last but one. The spiral ridges are of the same strenght, lie on the periphery and close to the abapical suture respectively. A feeble ridge develops adapically, about at the transition from the first to the second teleoconch whorl. It reaches the same strenght of the others on the fourth whorl. The body whorl has 16 collabral ribs which die out at the level of spiral 4 which is the most abapical and bounds the base. A thin spiral cord encircles the adapical end of the neck. The spirals are broad,

flattened, gently sloping downward, with a low but sharp adapical step. This latter is emphasized where spirals override ribs which seem to be made of axially elongated, embricated tubercles.

Dimensions (in mm, preserved part):

NW	PD	H	hs	hw	D	ha	wa	MSA	SS
11.8	---	5.69	4.87	1.49	1.79	0.82	0.66	16°	8°
11.5	0.31	3.92	3.26	1.30	1.30	0.66	---	---	8°

Remarks. The planktotrophic protoconch bearing axial riblets crossed by 2 spiral threads, and the reticulating teleoconch ornamentation are consistent with the assignment of the present shells to the genus *Retilaskeya* Marshall, 1978. The specimens from Rio Torsero, featured by rough aspect of the teleoconch surface, do not agree with the characters of any European cerithiopsid species described so far. They quite possibly belong to an undescribed taxon, but the material in hand is not considered to be adequate to denominate a species.

Subfamily *Cerithiopsinae* H. & A. Adams, 1853

Genus *Cerithiopsis* Forbes & Hanley, 1850

Marshall (1978) noted that a great deal of confusion does exist as regards *Cerithiopsis tubercularis* (Montagu), the type species of the genus *Cerithiopsis* Forbes & Hanley, 1850. In order to avoid any doubt, he selected a syntype to be designated for the lectotype of *Cerithiopsis tubercularis* and provided a detailed description of it. The author pointed out that the multispiral protoconch of the lectotype is "exactly like those figured and described by Rodriguez Babio & Thiriot-Quiévreux (1974) and Richter & Thorson (1975) as *C. barleei* Jeffreys, 1867", i.e. sculptured with axial riblets.

Aartsen et al. (1984) remarked that the lectotype selected by Marshall "most probably belongs to the species so far known as *C. barleei* Jeffreys". The authors concluded that the species "known for many years as *Cerithiopsis tubercularis* should change its name, whereas the much more rare *Cerithiopsis barleei* should be called *Cerithiopsis tubercularis*". They, however, did not propose a new name for *Cerithiopsis tubercularis* Auctorum.

From the above it results that 1) it must be decided which species is eligible for the type of the genus *Cerithiopsis*, and 2) the characters of *Cerithiopsis* remain unclear and are still to be fixed. The present authors provisionally follow the interpretation of the genus presented by Marshall (p. 82), involving a relatively wide range of protoconch features.

Cerithiopsis cf. **fayalensis** Watson, 1885

Pl. 7, fig. 1

cf. 1885 *Cerithiopsis fayalensis* Watson, p. 92, pl. 4, fig. 5, 5a.
cf. 1968 *Cerithiopsis (Cerithiopsina) fayalensis* - Nordsieck, p. 70, pl. 11, fig. 43.21

Occurrence. Sample TOR2, 14 spms., MPUM 7088, 7089. The shell material is somewhat worn but the bulk of shell features is preserved.

Remarks. The reference of the above shells to *Cerithiopsis fayalensis* Watson is made with much reservation, no exaustive illustration of the larval shell of that species being available in the literature. The multispiral protoconch of our specimens lacks the tip. The 3 preserved whorls bear 22-24 prosocline riblets over the abapical two thirds. The teleoconch agrees in several respects with the original description of *Cerithiopsis fayalensis* given by Watson (1885). In particular, the base is nearly flat, bounded by a relatively strong, fretted spiral like in Watson's species.

Cerithiopsis sp. 1

Pl. 7, fig. 2

Occurrence. TOR1, 2 spms., MPUM 7090, 7092; TOR2, 1 spm., MPUM 7091; TOR4, 2 spms., MPUM 7093. The available specimens are more or less fragmentary. However, it is possible to get a complete picture of shell features.

Description. Shell slenderly turriculate, with a quite high, rather pointed spire which is about 80% of shell height. Protoconch mammillated of 4.75 slightly convex whorls, the last half-whorl with a prominent peripheral angulation. Embryonic shell globular, slightly tilted, made of about 1.50 papillose whorls. The transition to the larval shell is marked by the disappearance of granulations. The discontinuity between protoconch and teleoconch is abrupt, marked by the sudden co-occurrence of spiral ridges and collabral ribs. Teleoconch whorls gently convex, each as high as about one half of the diameter which exhibits a very low and regular increase rate during growth. They meet at somewhat undulating, shallowly impressed sutures.

Body whorl about 30% of shell height. A rather sharp angulation, a little abapical of the periphery, gives an abrupt transition to the base which is almost flattened and has a very short, somewhat twisted neck. Aperture damaged in all specimens, apparently quadrangular in outline. The outer lip arises normal to the surface of the body whorl, at the level of spiral 4 and follows an angulated course to a short, bent canal. Inner lip strongly concave, with a very thin callus.

The teleoconch ornamentation starts with 3 spiral ridges and collabral ribs. The collabral ribs are straight, slightly opisthocline, have a rounded top and are as broad as one half of intervening spaces. Their number increases during growth: 13-14 occur on the first whorl, 19 on the penultimate (eighth). The spiral ridges are equally spaced. The adapical ridge is very close to the suture, the abapical one lies on the periphery, at about one third of the breadth of the whorl. The upper ridge is the thinnest on earlier whorls, but reaches the same strenght of the others at the level of the fifth or sixth whorl. The body whorl (ninth in our largest specimen) bears 20 collabral ribs and 4

spirals. The ribs die out at the level of spiral 4. The base is completely smooth except for a faint cord which encircles the adapical end of the neck. The collabral and spiral ornaments are of the same strenght and intersect giving the surface a square reticulate pattern. Rounded knobs are observed where ribs and spiral ridges intersect.

Remarks. The multispiral protoconch having a papillose tip and the last half-whorl peripherally angulated points toward the assignment of the present material to the genus *Cerithiopsis* Forbes & Hanley, 1850 (cf. Marshall, 1978). Our specimens do not agree satisfactorily with the characters of any described species of *Cerithiopsis*. Their small number and preservation, however, are considered not suitable to propose a new species. *Cerithiopsis (Cerithiopsis) vandermarki* Janssen and *Cerithiopsis (Cerithiopsis) andersoni* Janssen are allied species, in having similar shell shape and ornamentation. Both differ from *Cerithiopsis* sp. 1 mainly by their protoconch which has distinctly convex whorls and lacks the peripheral angulation of the last half-whorl.

Cerithiopsis sp. 2

Pl. 7, fig. 3

1972 *Cerithiopsis tubercularis* - Richter, fig. 6c.
?1975 *Cerithiopsis* sp. E Jung, p. 117, fig. 37,38.

Occurrence. TOR4, 1 spm., MPUM 7062. The specimen is rather well preserved.

Description. Shell slenderly turriculate with a quite high, very slightly cyrtoconoid spire which is 78 % of shell height. Protoconch conical, multispiral with the latest 3.5 whorls preserved. They are slightly convex, smooth except for two ornamented narrow belts close to the sutures. The adapical suture is marginated by very short, regularly spaced axial denticulations, whereas irregularly distributed granulations are observed in a shallow furrow along the abapical suture. The transition to teleoconch is abrupt, marked by the sudden appearance of teleoconch ornamentation. Teleoconch whorls are almost flat, as high as one half of the diameter which shows a definitely low increase rate during growth. Each whorl abuts against the preceeding one at slightly undulating shallow sutures. Body whorl 22% of shell height; a sharp curvature, just below the periphery, makes the transition to a slightly convex base. Siphonal fasciole with dense growth striation, bounded adapically by a faint, shallow furrow. Aperture ovately quadrangular; the outer lip arises at the level of spiral 4 and follows a rather straight course to the base where it rapidly turns toward the shell axis. The inner lip is regularly arched and has a thin callus somewhat thicker abapically. A deep and relatively narrow siphonal notch is observed.

The teleoconch ornamentation starts with 3 spiral cords soon followed by collabral riblets. The riblets are gently prosocline on earlier whorls and change into distinct opisthocyrt on later whorls. They have a rather sharp top and are as wide as one

third of the intervening furrows. Their number increases from 15 on the first whorl to 20 on the penultimate. The spiral cords are of about the same strenght and equally spaced, being the intervening furrows as broad as the bands themselves. The body whorl bears 21 collabral riblets and 4 spirals, the abapical one somewhat wider and smooth bounding the base. The riblets die away against spiral 4. The spiral ornaments are comparatively strong, clearly prevailing in respect to the riblets. Knobs are formed where spiral and collabral ornaments intersect.

Remarks. The larval shell bearing an adapical row of axially elongated denticulations and an abapical belt of granules suggests the assignment of the specimen in hand to the genus *Cerithiopsis* Forbes & Hanley, 1850 (cf. Marshall, 1978). The protoconch of the present shell is basically similar to those illustrated by Richter (1972) and Grecchi (1984) as *Cerithiopsis tubercularis* (Montagu), and by Jung (1975) as *Cerithiopsis* sp. E. According to the remarks of Aartsen et al. (1984) reported on in the discussion of the genus *Cerithiopsis* (see above), neither our specimen nor those dealt with by Richter, Grecchi and by Jung can be confidently referred to Montagu's taxon whose protoconch characters are still to be defined.

Family *Triphoridae* Gray, 1847
Subfamily *Metaxiinae* Marshall, 1977
Genus *Metaxia* Monterosato, 1884

Metaxia abrupta (Watson, 1880)

Pl. 7, fig. 4

1880 *Cerithium abrupta* Watson, p. 119 (non vidimus).
1886 *Cerithium abrupta* - Watson, p. 551, pl. 41, fig. 4.
1984 *Metaxia abrupta* - Bouchet, p. 18, fig. 19.

Occurrence. TOR1, 1 spm., MPUM 7061. The single broken shell exhibits well preserved sculptural features.

Remarks. The identification is made with some caution since the shell in hand lacks the protoconch. It is of note, however, that the outline and sculpture of the teleoconch whorls of our specimen perfectly agree with the figure of *Metaxia abrupta* (Watson) published by Bouchet (1984).

The Miocene *Newtoniella* (?) *degrangei* Cossmann & Peyrot seems to be a strictly related species, having quite similar teleoconch shape and ornamentation. Once more the absence of information on the protoconch characters hinders any decision about its relationships with the present taxon. We notice that Janssen (1967) has pointed out that the shell features are very similar to those of *Metaxia* Monterosato, 1884. The Recent deep-water variation *excavata* Locard (cf. Bouchet, 1984) of *Metaxia metaxae* (Delle Chiaje) is very similar too, but has a somewhat different outline of the whorls.

Distribution. *M. abrupta* (Watson) has never been recorded as fossil. It is reported to be endemic of the Azores Islands where it occurs in the deep circalittoral and bathyal zones.

Acknowledgements.

This paper benefited the critical reading by Prof. C. Rossi Ronchetti, Milan. We are very grateful to Prof. G. Pavia, University of Turin, for granting access to the Bellardi-Sacco Collection. The scanning electron micrographs were made by A. Rizzi and G. Chiodi, University of Milan. The research was granted by Ministero della Ricerca Scientifica e Tecnologica (MURST 40%).

REFERENCES

Aartsen J.J.v., Menkhorst H.P.G.M. & Gittenberger E. (1984) - The marine Mollusca of the Bay of Algeciras, Spain, with general notes on *Mitrella*, Marginellidae and Turridae. *Basteria*, v. 2, pp. 1-135, Leiden.

Arduini V. (1895) - Conchiglie plioceniche del bacino d'Albenga. *Atti Soc. Ligust. Sc. Nat. Geogr.*, v. 6, pp. 150-220, Genova.

Baluk W. (1975) - Lower Tortonian Gastropods from Korytnica, Poland. Part I. *Palaeont. Polonica*, v. 32, pp. 1-186, Warszawa.

Bernasconi M.P. (1981) - Paleoecologia delle associazioni plioceniche a molluschi della provincia di Savona. Unp. Thesis, Università degli Studi di Milano, 256 pp., Milano.

Bernasconi M.P. (1989) - Studi paleoecologici sul Pliocene ligure. V. Il Pliocene di Savona. *Boll. Mus. Reg. Sc. Nat. Torino*, v. 7, pp. 49-116, Torino.

Bernasconi M.P. & Robba E. (1984) - The Pliocene Turridae from Western Liguria. I. Clavinae, Turrinae, Turriculinae, Crassispirinae, Borsoniinae, Clathurellinae. *Boll. Mus. Reg. Sc. Nat. Torino*, v. 2, pp. 257-358, Torino.

Boettger O. (1901-1906) - Zur Kenntnis der Fauna der mittelmiocänen Schichten von Kostej im Krassó-Szörényer Komitat, 2-3. *Verhandl. Mitt. Siebenb. Ver. Natur-Wissensch. Hermannstadt*, v. 54/55, pp. 1-244 (1906), Hermannstadt.

Boni A., Boni P., Mosna S. & Peloso G.F. (1983) - Rinvenimento del Pliocene superiore (e del Pleistocene marino basale?) nelle colline tra Ventimiglia e Bordighera (Liguria occidentale). *Atti Ist. Geol. Univ. Pavia*, v. 30, pp. 182-188, Pavia.

Boni P. & Peloso G.F. (1973) - I lembi pliocenici della Liguria occidentale da Terzorio al confine italo-francese. *Atti Ist. Geol. Univ. Pavia*, v. 23, pp. 170-201, Pavia.

Boni P., Peloso G.F. & Vercesi P.L. (1976) - I lembi pliocenici della Liguria occidentale da S. Lorenzo al Mare (Imperia) ad Andora (Savona). *Atti Ist. Geol. Univ. Pavia*, v. 25, pp. 112-142, Pavia.

Bouchet P. (1984) - Les Triphoridae de Méditerranée et du proche Atlantique (Mollusca, Gastropoda). *Lavori S.I.M.* Atti Simp. Sistematica dei Prosobranchi del Mediterraneo, v. 21, pp. 5-58, Milano.

Bouchet P. & Waren A. (1993) - Revision of the Northeast Atlantic bathyal and abyssal Mesogastropoda. *Boll. Malac.*, v. 3, pp. 579-840, Milano.

Cerulli-Irelli S. (1914) - Fauna malacologica mariana. Parte settima. *Palaeont. Ital.*, v. 20, pp. 183-277, Pisa.

Cossignani T., Cossignani V., Di Nisio A. & Passamonti M. (1992) - Atlante delle conchiglie del Medio Adriatico. V. of 40 pp., L'Informatore Piceno, Ancona.

Cossmann M. (1921) - Essais de paléoconchologie comparée. Douzième livraison. V. of 348 pp., Cossmann, Paris.

Della Campana C. (1890) - Cenni paleontologici sul Pliocene antico di Borzoli. *Atti Soc. Ligust. Sc. Nat. Geogr.*, v. 1, pp. 128-165, Genova.

De Stefani C. (1888) - Iconografia dei nuovi Molluschi pliocenici d'intorno Siena. *Bull. Soc. Malac. It.*, v. 13, pp. 181-235, Pisa (*non vidimus*).

De Stefani C. & Pantanelli D. (1880) - Molluschi pliocenici dei dintorni di Siena. *Bull. Soc. Malac., It.*, v. 4, pp. 1-215, Siena (*non vidimus*).

Di Geronimo I. & Panetta P. (1973) - La malacofauna batiale del golfo di Taranto. *Conchiglie*, v. 9, pp. 62-122, Milano.

Fretter V. & Graham A. (1978) - The Prosobranch Molluscs of Britain and Denmark. Part 4. Marine Rissoacea. *J. Moll. Stud.*, v. 6, pp. 153-241, Reading.

Fretter V. & Graham A. (1982) - The Prosobranch Molluscs of Britain and Denmark. Part 7. 'Heterogastropoda' (Cerithiopsacea, Triforacea, Epitoniacea, Eulimacea). *J. Moll. Stud.*, v. 2, pp. 363-434, Reading.

Giammarino S., Sprovieri R. & Di Stefano I. (1984) - La sezione pliocenica di Castel d'Appio (Ventimiglia). *Atti Soc. Tosc. Sc. Nat. Mem.*, v. 91 (s.A), pp. 1-26, Pisa.

Giammarino S. & Tedeschi D. (1970) - A proposito dell'età degli affioramenti di Ventimiglia e Pompeiana (Liguria occidentale). *Atti Ist. Geol. Univ. Genova*, v. 8, pp. 1-11, Genova.

Giammarino S. & Tedeschi D. (1975) - Prima segnalazione di Pliocene medio nella Liguria occidentale (Monte Bauso). *Boll. Soc. Geol. Ital.*, v. 94, pp. 281-289, Roma.

Giammarino S. & Tedeschi D. (1976) - Osservazioni biostratigrafiche sul Pliocene di Ventimiglia (Liguria occidentale). *Boll. Soc. Geol. Ital.*, v. 95, pp. 1509-1520, Roma.

Giammarino S. & Tedeschi D. (1980) - Le microfaune a foraminiferi del Pliocene di Borzoli (Genova) e il loro significato paleoambientale. *Ann. Univ. Ferrara*, s. 9, v. 6, pp. 73-92, Ferrara.

Giammarino S. & Tedeschi D. (1982) - Ricerche paleoecologiche sul Pliocene della Liguria occidentale. Le microfaune a foraminiferi di Brunetti (Ventimiglia). *Geol. Rom.*, v. 21, pp. 723-731, Roma.

Giammarino S. & Tedeschi D. (1983) - Considerazioni geologico-stratigrafiche sul Pliocene di Albisola (Savona). *Atti Soc. Tosc. Sc. Nat. Mem.*, v. 90 (s.A), pp. 1-16, Pisa.

Grecchi G. (1984) - Molluschi planctonici e bentonici in sedimenti sapropelitici del Quaternario della dorsale mediterranea. *Boll. Malac.*, v. 20, pp. 1-34, Milano.

Greco A. (1970) - La malacofauna pliocenica di Contrada Cerausi presso Serradifalco (Caltanisetta). *Geol. Rom.*, v. 9, pp. 275-314, Roma.

Hornung A. (1920) - Gastéropodes fossiles du Rio Torsero (Ceriale). Pliocène inférieur de la Ligurie. *Ann. Mus. Civ. St. Nat. Doria*, s. 3, v. 9, pp. 70-92, Genova.

Issel A. (1877) - Appunti paleontologici. I Fossili delle Marne di Genova. *Ann. Mus. Civ. St. Nat. Genova*, v. 9, pp. 209-264, Genova.

Janssen A.W. (1967) - Beiträge zur Kenntnis des Miocäns von Dingden und seiner Molluskenfauna 1. *Geol. Palaeont.*, v. 1, pp. 115-173, Marburg.

Janssen A.W. (1984) - Mollusken uit het Mioceen van Winterswijk-Miste. V. of 451 pp., *K. Nederl. Natuurhist. Ver., Nederl. Geol. Ver.*, Rijksmus. Geol. Min., Amsterdam.

Jung P. (1975) - Quaternary Larval Gastropods from Leg 15, Site 147, Deep Sea Drilling Project. Preliminary Report. *Veliger*, v. 18, pp. 109-126, Berkeley.

Malatesta A. (1974) - Malacofauna pliocenica umbra. *Mem. Serv. Geol. Ital.*, v. 13, pp. 1-498, Roma.

Marshall B.A. (1977) - The dextral triforid genus *Metaxia* (Mollusca: Gastropoda) in the south-west Pacific. *New Zealand Journ. Zool.*, v. 4, pp. 111-117, Wellington.

Marshall B.A. (1978) - Cerithiopsidae (Mollusca: Gastropoda) of New Zealand, and a provisional classification of the family. *New Zealand Journ. Zool.*, v. 5, pp. 47-120, Wellington.

Marshall B.A. (1983) - A Revision of the Recent Triphoridae of Southern Australia (Mollusca: Gastropoda). *Rec. Austral. Mus.*, v. 2, pp. 1-119, Sidney.

Mastrorilli V.I. (1969) - I Molluschi del Pliocene ligure nella Collezione dell'Istituto di Geologia dell'Università di Genova, e i microfossili delle formazioni che li ricettavano. 1) I reperti provenienti dalle marne di Genova. *Atti Ist. Geol. Univ. Genova*, v. 7, pp. 85-228, Genova.

Nordsieck F. (1968) - Die europäischen Meeres-Gehäuseschnecken (Prosobranchia). V. of 273 pp., Gustav Fischer Verlag, Stuttgart.

Oliverio M., Amati B. & Nofroni I. (1993) - Revision of the *Alvania testae* group of species (Gastropoda, Prosobranchia, Truncatelloidea = Rissoidea). *Lavori S.I.M.*, Atti Congr. Parma 11-13 ottobre 1990, v. 24 (1992), pp. 249-259, Parma.

Pareto L. (1846) - Descrizione di Genova e del Genovesato. V. of 141 pp., Genova.

Pavia G. (1975) - I Molluschi del Pliocene inferiore di Monteu Roero (Alba, Italia NW). *Boll. Soc. Paleont. Ital.*, v. 14, pp. 99-175, Modena.

Picard C. (1972) - Les peuplements de vase au large du Golfe de Fos. *Téthys*, v. 3(1971), pp. 569-681, Marseille.

Ponder W.F. (1985) - A review of the Genera of the Rissoidae (Mollusca: Mesogastropoda: Rissoacea). *Rec. Austral. Mus.*, v. 4 (1984), pp. 1-221, Canberra.

Poppe G. T. & Goto Y. (1991) - European Seashells. V. 1. V. of 352 pp., Verlag Christa Hemmen, Wiesbaden.

Richter G. (1972) - Marine Planktonforschung im Binnenland. *Natur. Museum*, v. 107, pp. 255-264, Frankfurt a. M.

Richter G. & Thorson G. (1975) - Pelagische Prosobranchienlarven des Golfes von Neapel. *Ophelia*, v. 13, pp. 109-185, Helsingor.

Robba E. (1981) - Studi paleoecologici sul Pliocene ligure. IV. Malacofaune batiali della Liguria occidentale. *Riv. Ital. Paleont. Strat.*, v. 87, n. 1, pp. 93-164, Milano.

Rodriguez Babio C. & Thiriot-Quiévreux C. (1974) - Gastropodes de la région de Roscoff. Etude particulière de la protoconque. *Cahiers Biol. Marine*, v. 15, pp. 531-549, Paris.

Sacco F. (1895) - I Molluschi dei terreni terziari del Piemonte e della Liguria. V. 18, pp. 1-51, Torino.

Sars G.O. (1878) - Mollusca regionis arcticae Norvegiae. V. of 466 pp., Brögger, Christiania.

Sasso A. (1827) - Saggio geologico sopra il bacino terziario di Albenga. *Giorn. Ligust. Sc. Lett. Arti*, v. 5, pp. 467-484, Genova.

Sorgenfrei T. (1958) - Molluscan Assemblages from the Marine Middle Miocene of South Jutland and their Environments. *Dan. Geol. Unders., II Raekke*, v. 79, pp. 1-503, Kobenhavn.

Squinabol S. (1877) - Sui fossili pliocenici di Savona (comunicazione preliminare). *Boll. Soc. Geol. Ital.*, v. 6, pp. 454-456, Roma.

Taylor D.W. & Sohl N.F. (1962) - An outline of gastropod classification. *Malacologia*, v. 1, pp. 7-32, Michigan Ann Arbor.

Thiriot-Quiévreux C. (1980) - Identification of Some Planktonic Prosobranch larvae present off Beaufort, North Carolina. *Veliger*, v. 23, pp. 1-9, Berkeley.

Violanti D. (1987) - Analisi paleoambientali e tassonomiche di associazioni a Foraminiferi del Pliocene ligure (Rio Torsero). *Boll. Mus. Reg. Sc. Nat. Torino*, v. 5, pp. 239-293, Torino.

Waren A. (1980) - Marine Mollusca described by John Gwyn Jeffreys, with the location of the type material. *Conchol. Soc. Great Britain and Ireland*, spec. publ. n. 1, 60 pp., London.

Watson R. B. (1880) - Mollusca of H.M.S. "Challenger" expedition. Pt. 5. *Journ. Linn. Soc.*, v. 15, pp. 87-126, London (non vidimus).

Watson R.B. (1885) - On the Cerithiopsides from the Eastern Side of the North Atlantic, with three new Species from Madeira. *Journ. Linn. Soc.*, v. 19 (1885-1886), pp. 89-95, London.

Watson R.B. (1886) - Report on the Scaphopoda and Gasteropoda collected by H.M.S. "Challanger" during the years 1873-76. *Rep. Scient. Res. Challenger Exp., Zool.*, v. 42, pp. 1-756, Edinburgh.

Wenz W. (1938-44) - Gastropoda. Handbuch der Paläozoologie. V. of 1639 pp., Gebrüder Borntraeger, Berlin.

Zilch A. (1934) - Zur Fauna des Mittel-Miocäns von Kostej (Banat). Typus-Bestimmung und Tafeln zu O. Boettger's Bearbeitungen. *Senckenbergiana*, v. 16, pp. 193-302, Frankfurt a.M.

Received January 1, 1994; accepted February 22, 1994

PLATE 1

Fig. 1 - *Pusillina (Pusillina) sulzeriana* (Risso, 1826). TOR4. MPUM 7080; apertural view.
Fig. 2 - *Pusillina (Pusillina) sulzeriana* (Risso, 1826). TOR1. MPUM 7084; a) apertural view, b) labial view.
Fig. 3 - *Pusillina (Pusillina) sulzeriana* (Risso, 1826). TOR2. MPUM 7083; a) apertural view, b) protoconch, c) top view.
Fig. 4 - *Pusillina (Pusillina) sulzeriana* (Risso, 1826). TOR1. MPUM 7081; a) apertural view, b) labial view.
Fig. 5 - *Pusillina (Pusillina) sulzeriana* (Risso, 1826). TOR2. MPUM 7082; a) apertural view, b) protoconch, c) top view.

Scale bar for shells on top left

PLATE 2

Fig. 1 - *Pusillina (Pusillina)* sp. TOR2. MPUM 7063; a) apertural view, b) labial view, c) protoconch, d) top view, e) detail of the protoconch.
Fig. 2 - *Pusillina (Pusillina)* sp. TOR2. MPUM 7064; apertural view.
Fig. 3 - *Alvania (Alvania) testae* (Aradas & Maggiore, 1844). TOR1. MPUM 7067; apertural view.
Fig. 4 - *Alvania (Alvania) testae* (Aradas & Maggiore, 1844). TOR1. MPUM 7068; a) apertural view, b) labial view.

Scale bar for shells on top left

PLATE 3

Fig. 1 - *Alvania (Alvania) testae* (Aradas & Maggiore, 1844). TOR1. MPUM 7069; a) apertural view, b) labial view, c) protoconch, d) top view.
Fig. 2 - *Alvania (Alvania) thalia* De Stefani & Pantanelli, 1880. TOR2. MPUM 7057; a) apertural view, b) labial view.
Fig. 3 - *Alvania (Alvania) thalia* De Stefani & Pantanelli, 1880. TOR4. MPUM 7055; top view.
Fig. 4 - *Alvania (Alvania) thalia* De Stefani & Pantanelli, 1880. TOR2. MPUM 7056; a) apertural view, b) protoconch.

Scale bar for shells on top left

PLATE 4

Fig. 1 - *Alvania (Alvania) tiberiana* (Coppi, 1876). TOR2. MPUM 7052; a) apertural view, b) labial view, c) detail of the teleoconch, d) micro-ornamentation of the spirals.
Fig. 2 - *Alvania (Alvania) tiberiana* (Coppi, 1876). TOR1. MPUM 7051; a) protoconch, b) top view.
Fig. 3 - *Alvania (Alvania) obliquistoma* sp. n. Paratype. TOR2. MPUM 7096; apertural view of specimen with ridges on the inner side of the outer lip.
Fig. 4 - *Alvania (Alvania) obliquistoma* sp. n. Paratype. TOR2. MPUM 7095; apertural view of specimen with the inner side of the outer lip devoid of ridges.

Scale bar for shells on top left

PLATE 5

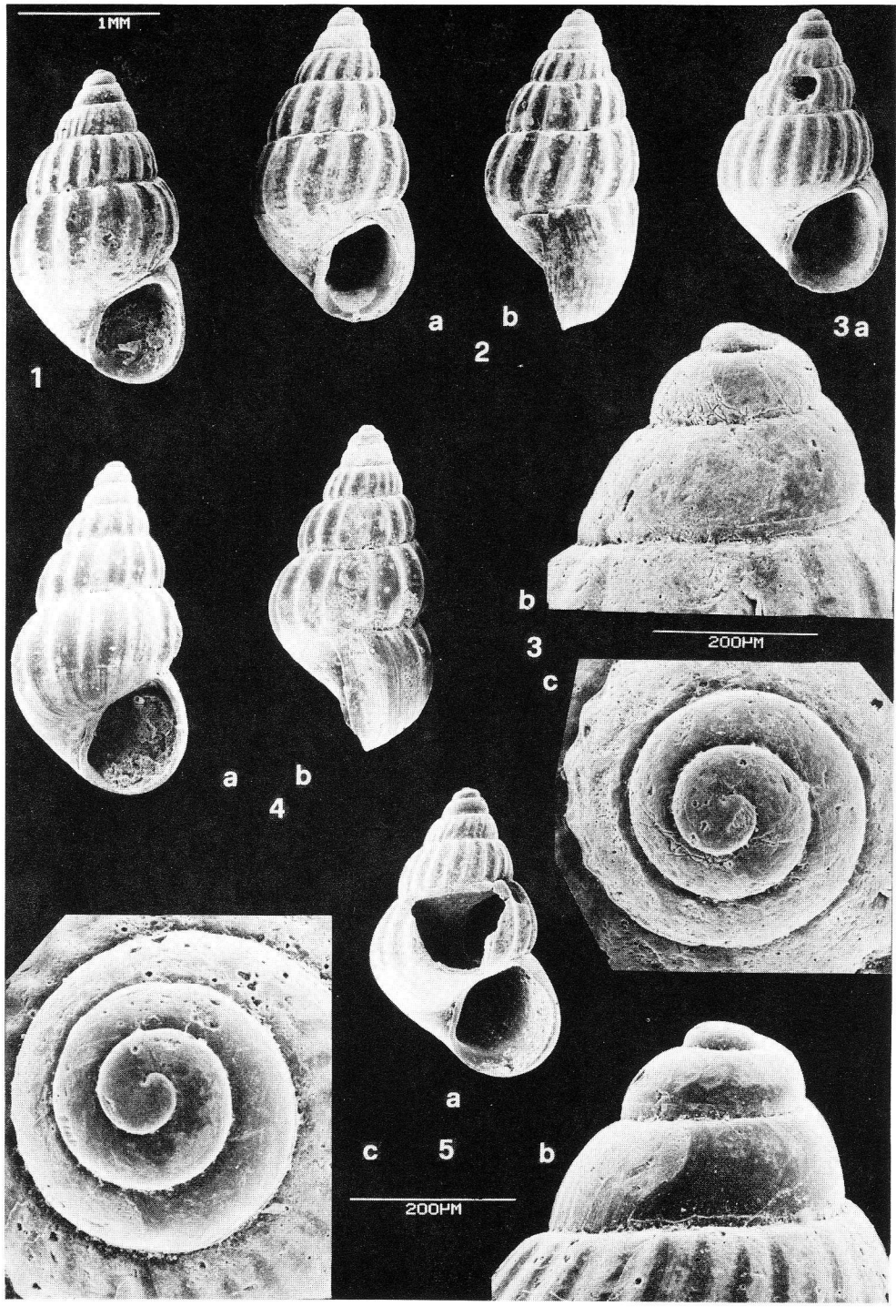
Fig. 1 - *Alvania (Alvania) obliquistoma* sp. n. Holotype. TOR2. MPUM 7094; a) apertural view, b) labial view, c) protoconch, d) top view.
Fig. 2 - *Alvania (Alvania) obliquistoma* sp. n. Paratype. TOR1. MPUM 7097; protoconch.
Fig. 3 - *Rissoina (Rissoina) varicosa* Boettger, 1906. TOR2. MPUM 7074; a) apertural view, b) labial view.

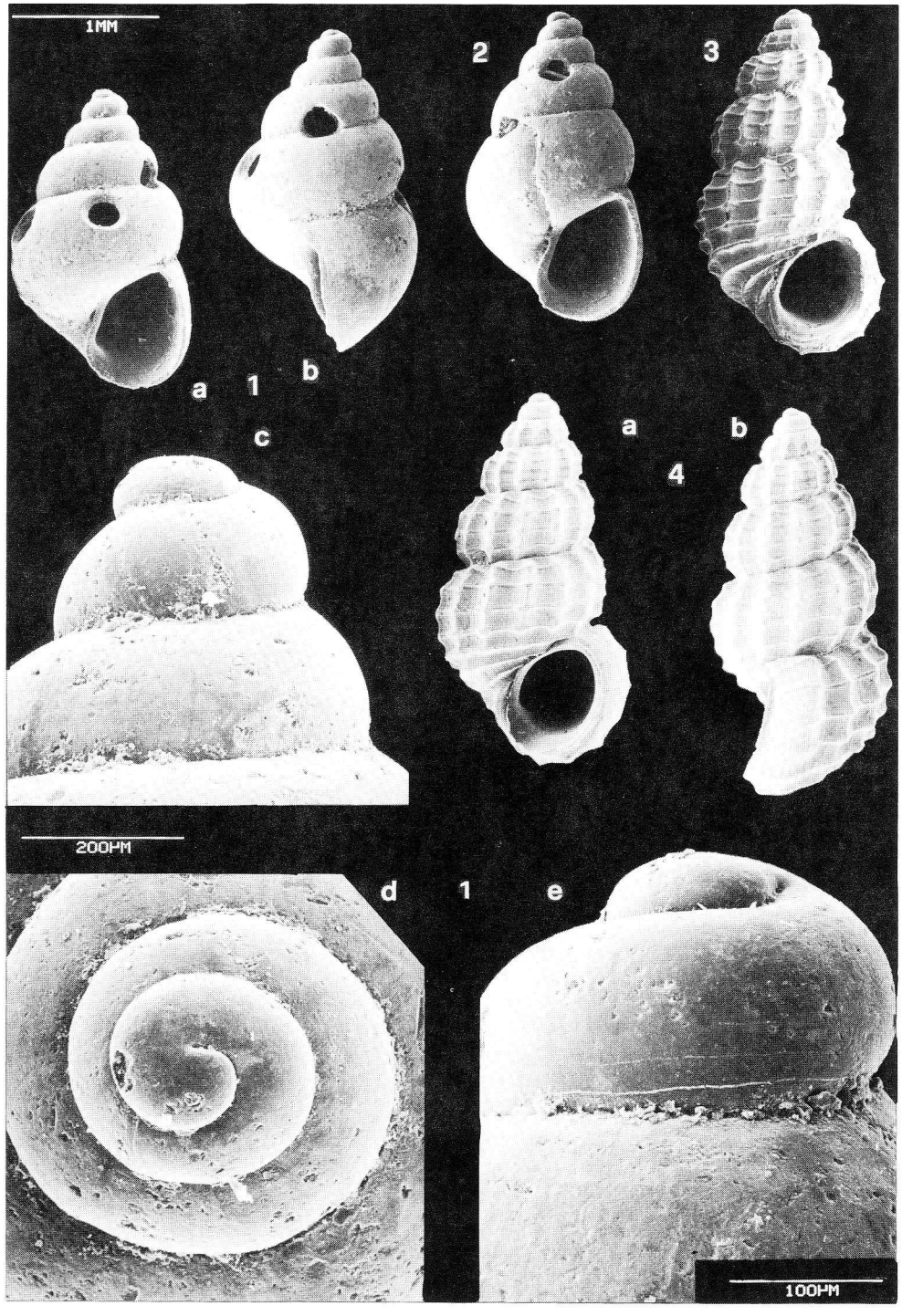
PLATE 6

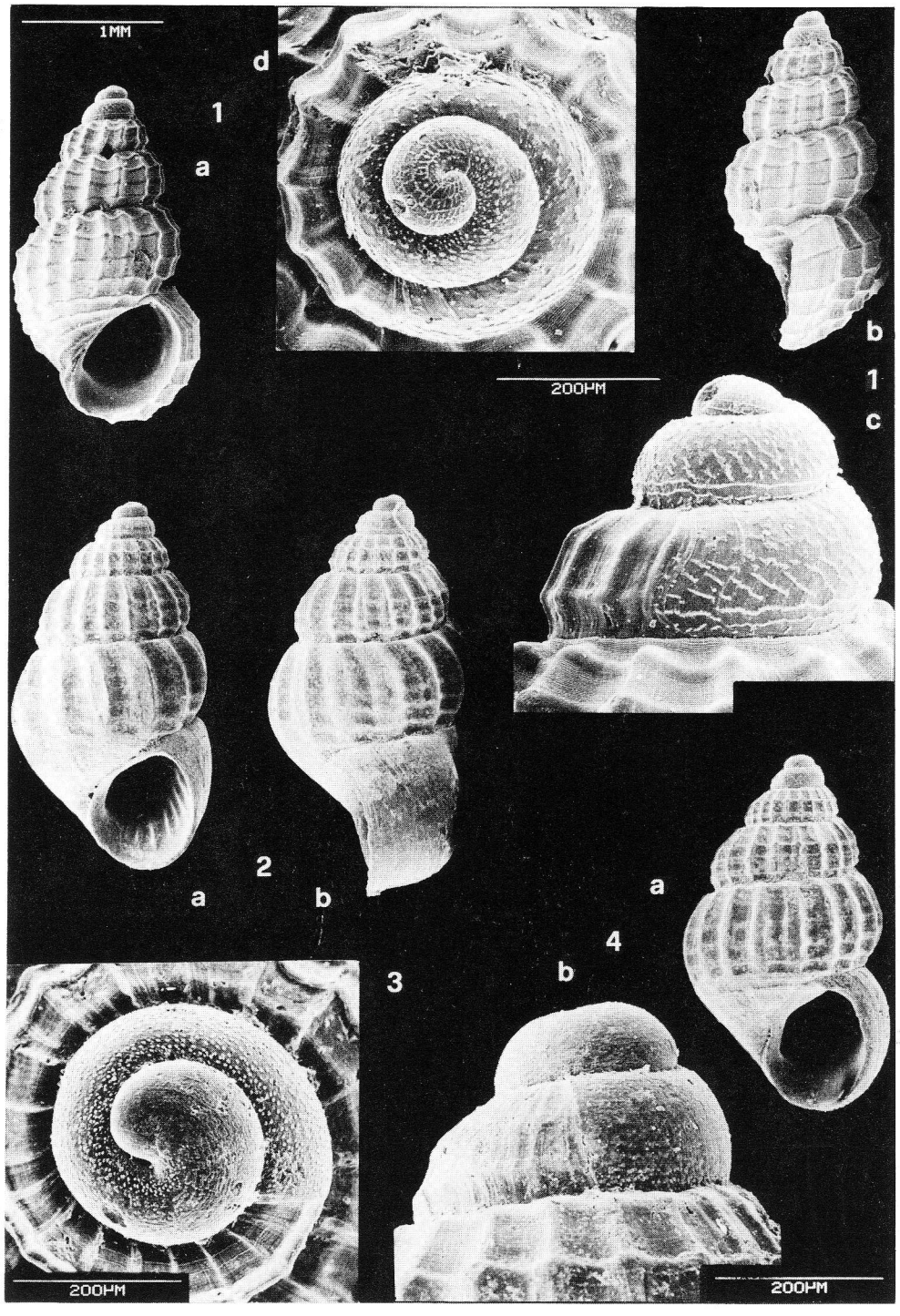
Fig. 1 - *Rissoina (Rissoina) varicosa* Boettger, 1906. TOR2. MPUM 7074; protoconch of specimen in pl. 5, fig. 3.
Fig. 2 - *Rissoina (Rissoina) decussata* (Montagu, 1803). TOR4. MPUM 7076; protoconch.
Fig. 3 - *Cerithiopsidella* sp. TOR1. MPUM 7049; a) apertural view, b) protoconch.
Fig. 4 - *Retilaskeya* sp. TOR2. MPUM 7045; a) apertural view, b) protoconch, c) detail of teleoconch sculpture.

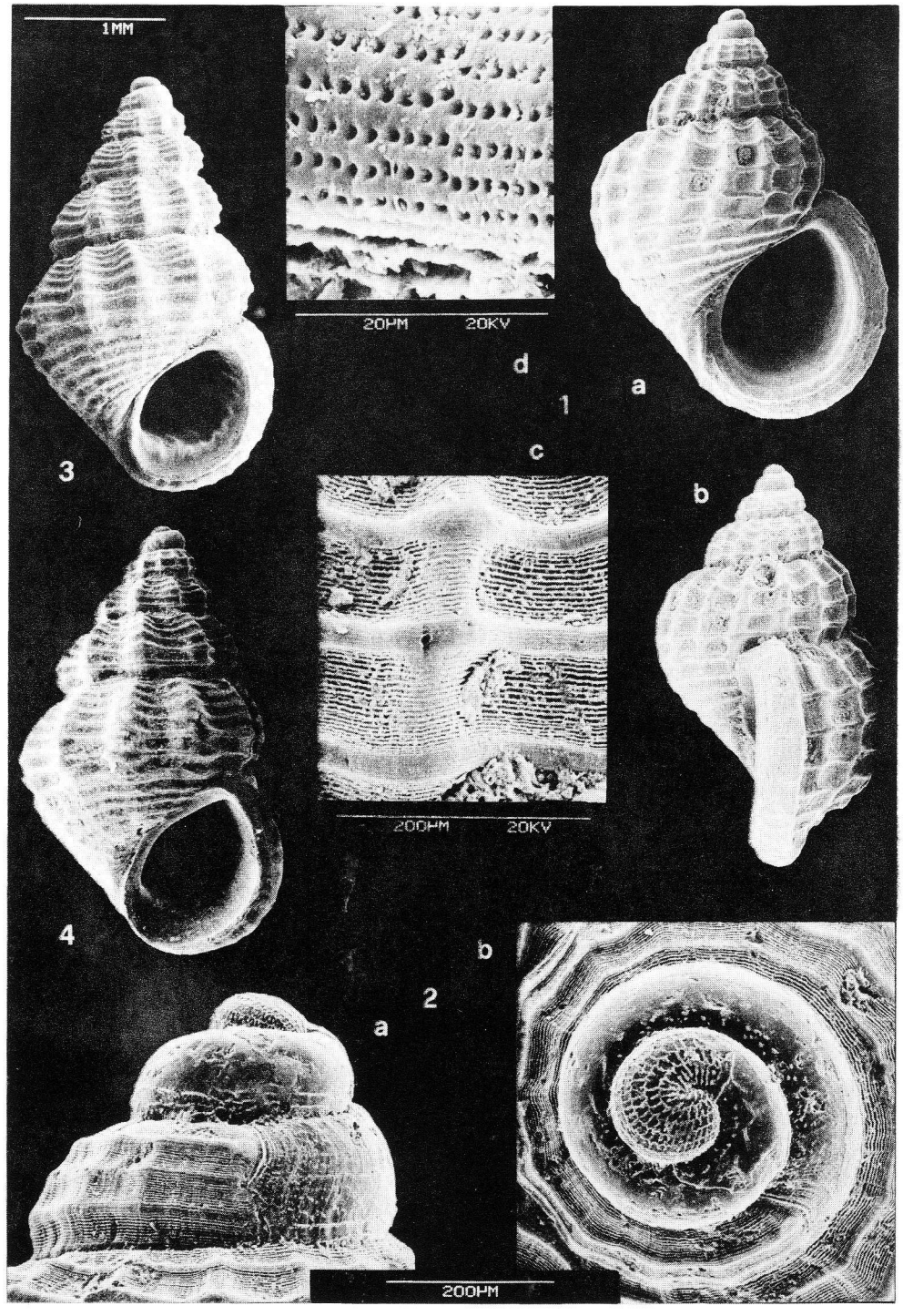
PLATE 7

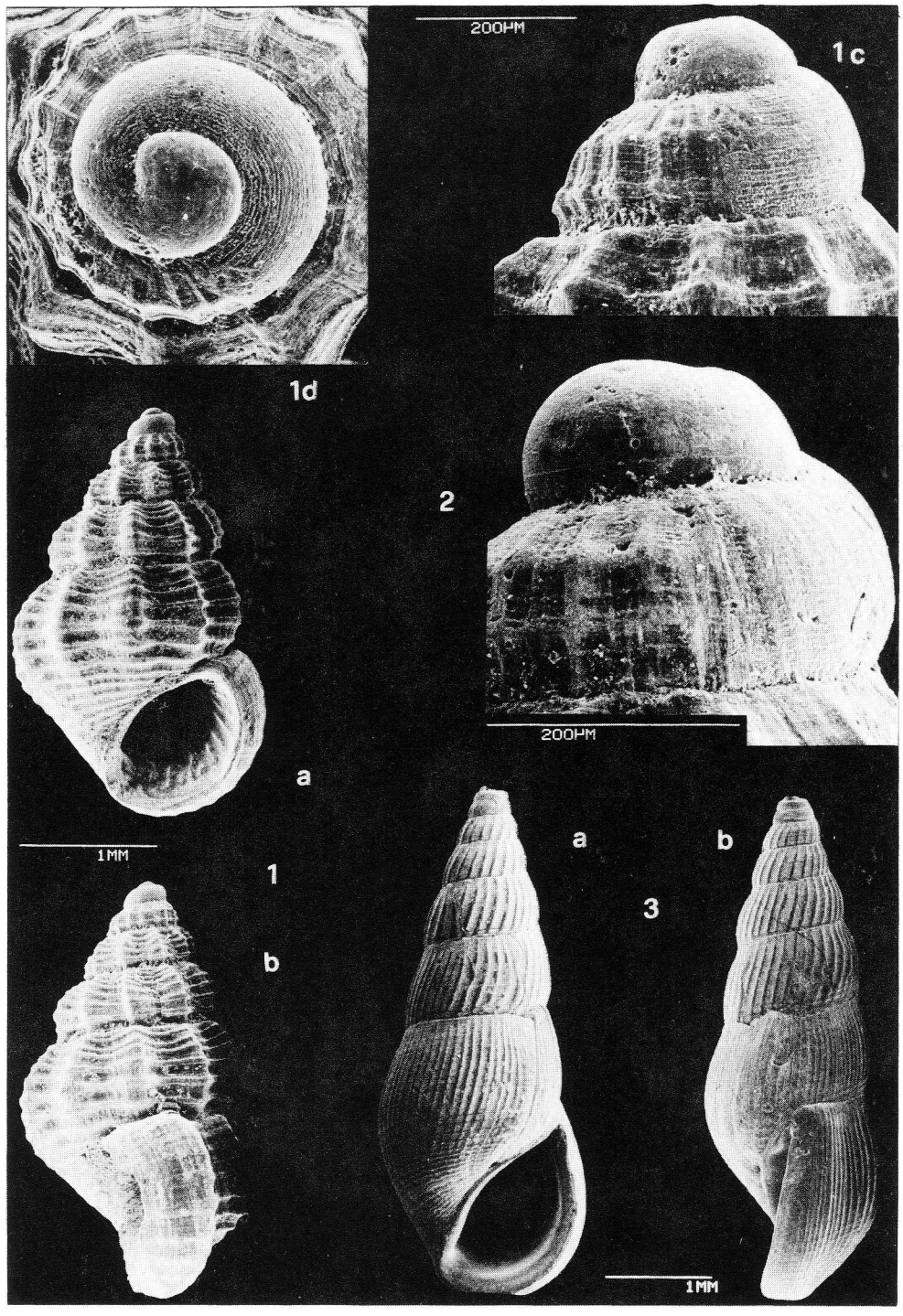
Fig. 1 - *Cerithiopsis* cf. *fayalensis* Watson, 1885. TOR2. MPUM 7088; a) apertural view, b) protoconch.
Fig. 2 - *Cerithiopsis* sp. 1. TOR1. MPUM 7090; a) apertural view, b) protoconch, c) top view.
Fig. 3 - *Cerithiopsis* sp. 2. TOR4. MPUM 7062; a) apertural view, b) protoconch.
Fig. 4 - *Metaxia abrupta* (Watson, 1880). TOR1. MPUM 7061; sculptural features.

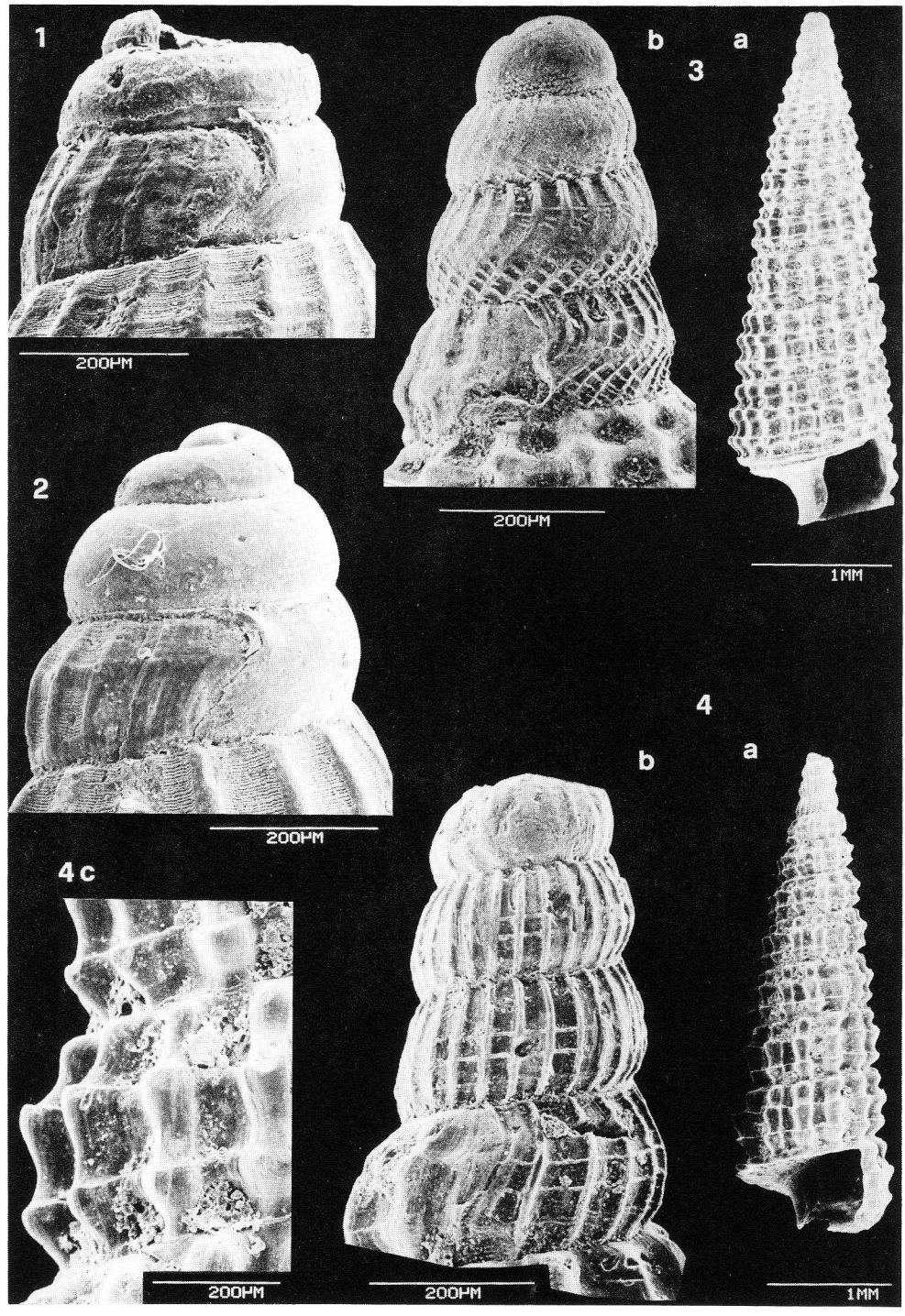

1MM
1
a
b
2
3a
b
200PM
3
c
a
b
4
a
c
5
200PM
b

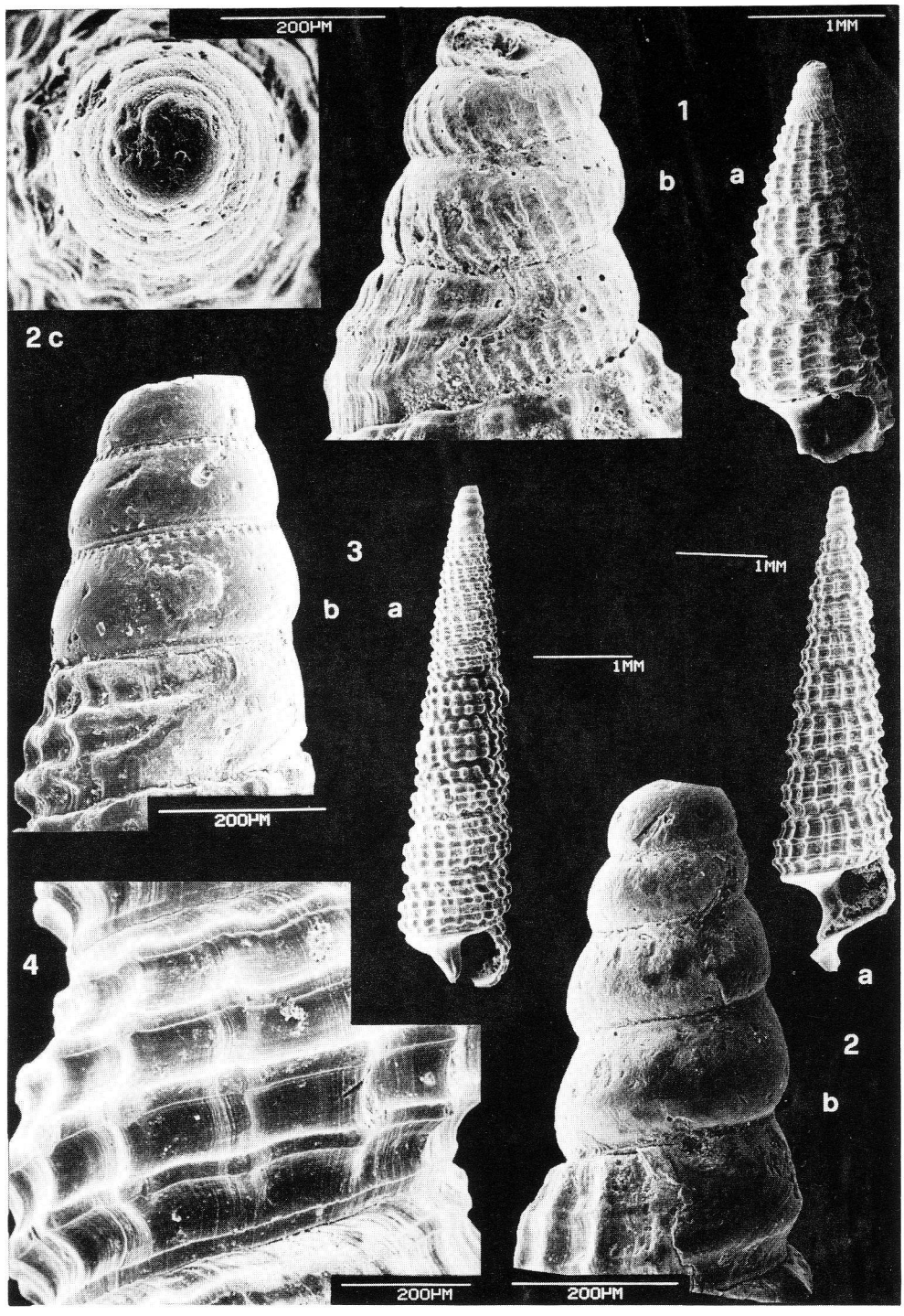

1MM
2
3
a 1 b
c
a b
4
200µM
d 1 e
100µM


1MM
d
1
a
200µM
b
1
c
2
a
b
3
200µM
a
4
b
200µM


1MM
20PM 20KV
d
1
a
c
3
b
200PM 20KV
4
b
2
a
200PM


200µM
1c
1d
2
200µM
a
1MM
1
b
a
b
3
1MM


1
200µM
b
a
3
200µM
1MM
2
200µM
4
b
a
4c
200µM
200µM
1MM


200µM
1MM
1
b
a
2 c
3
b
a
1MM
1MM
200µM
4
200µM
200µM
a
2
b