



The Oligocene mollusc types of Gaetano ROVERETO from Santa Giustina and Sassello (NW Italy)

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Abstract: The present paper examines the type specimens of the bivalve and gastropod taxa described by Gaetano ROVERETO in the years 1897-1914 coming from the Oligocene rocks of Santa Giustina and Sassello areas (Molare Formation, Tertiary Piedmont Basin, Central Liguria, NW Italy). These taxa are part of the "Collezione BTP" (BTP Collection) housed at the Dipartimento di Scienze della Terra, dell'Ambiente e della Vita - DISTAV - of the Università di Genova. The collecting sites reported in the ROVERETO's papers and indicated on labels have been reinvestigated in the field. 22 taxa (6 gastropods and 16 bivalves) are revised and re-documented; 6 have been recognized as younger synonyms of other species, the others are valid taxa. The majority of this fauna is restricted to the Oligocene time and to the Tertiary Piedmont Basin.

Key-words:

- ROVERETO;
- bivalve and gastropod type-material;
- Oligocene;
- NW Italy

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Résumé : *Les types des mollusques oligocènes de Gaetano ROVERETO provenant de Santa Giustina et Sassello (NW Italie).*- Ce travail examine les spécimens types des taxons de bivalves et de gastéropodes décrits par Gaetano ROVERETO de 1897 à 1914, provenant des roches oligocènes de Santa Giustina et Sassello (Formation de Molare, Bassin Tertiaire du Piémont, Ligurie centrale, Italie du nord-ouest). Ces taxons font partie de la "Collezione BTP" (Collection BTP) hébergée dans le Département des Sciences de la Terre, de l'Environnement et de la Vie - DISTAV - de l'Université de Gênes. Les sites de collecte indiqués dans les publications de ROVERETO et mentionnés sur les étiquettes ont fait l'objet de nouvelles recherches sur le terrain. 22 taxons (6 gastéropodes et 16 bivalves) sont ici révisés et documentés, dont 6 ont été reconnus comme synonymes plus récents d'autres espèces ; les autres sont des taxons valides. La majeure partie de cette faune est restreinte à l'Oligocène et au Bassin Tertiaire du Piémont.

Mots-clefs :

- ROVERETO ;
- matériel-type de bivalves et gastéropodes ;
- Oligocène ;
- Italie du nord-ouest

Introduction

This paper deals with the taxonomic revision of Oligocene mollusc types erected by Gaetano ROVERETO (geologist and palaeontologist of the Genoa University) in the years 1897-1914. These faunas that were collected in the Santa Giustina and Sassello areas have received little attention in recent times, therefore they are scarcely known, if not forgotten, and their

systematic position requires a complete review. These types (Table 1) are part of the Collezione BTP (BTP Collection) housed at the Museo di Paleontologia, Dipartimento di Scienze della Terra, dell'Ambiente e della Vita (DISTAV), Università di Genova. The name of the Collection is the acronym of "Bacino Terziario del Piemonte" (Tertiary Piedmont Basin, the geological unit in which the specimens were collected). The complicated history of this collection has been re-

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cently reconstructed by BONCI *et al.* (2014), who also compiled the complete list of the ROVERETO's molluscan taxa. During the revision of another paleontological collection housed at the

DISTAV the type of *Fusus (Aptyxis) nimbatus* ROVERETO, 1914, deemed lost by BONCI *et al.* (2014), was found (Table 1).

Table 1: List of mollusc taxa described by ROVERETO (1897, 1898, 1900, 1914) coming from Santa Giustina and Sassello areas and preserved in the BTP Collection.

Original name in ROVERETO (1897, 1898, 1900, 1914)	New name	Catalog number
Gastropoda		
<i>Fusus (Aptyxis) nimbatus</i> ROVERETO, 1914	<i>Gourmya nimbata</i> (ROVERETO, 1914)	2976/Sa-II-S 195
<i>Tritonium (Ranularia) semifucosum</i> ROVERETO, 1914	<i>Cymatium (Ranularia) semifucosum</i> (ROVERETO, 1914)	1175/Sa-II-S 12
<i>Melongena laxecarinata</i> MICHTT. var. <i>depromta</i> ROVERETO, 1914	<i>Melongena laxecarinata</i> (MICHELOTTI, 1861)	1158/Sa-V-SG 89
<i>Melongena laxecarinata</i> MICHTT. var. <i>praepilata</i> ROVERETO, 1914	<i>Melongena laxecarinata</i> (MICHELOTTI, 1861)	1178/Sa-II-S 15 178/Sa-II-S 196
<i>Melongena (Myristica) basilica</i> BELL. var. <i>Justinensis</i> ROVERETO, 1900 = <i>Melongena basilica</i> BELL. var. <i>justinensis</i> ROVERETO, 1914	<i>Volema basilica</i> (BELLARDI, 1872)	1177/Sa-II-S 14
<i>Pleurotoma thalassina</i> ROVERETO, 1914	<i>Cryptoconus thalassinus</i> (ROVERETO, 1914)	1176/Sa-II-S 13
Bivalvia		
<i>Limopsis turgida</i> ROVERETO, 1898	<i>Limopsis (Pectunculina) turgida</i> ROVERETO, 1898	1167/Sa-II-S 4
<i>Ostrea (Ostrea) caudata</i> MÜNST. var. <i>meridionalis</i> ROVERETO, 1897 = <i>Ostrea (Ostrea) meridionalis</i> ROVERETO, 1900	<i>Ostrea (Ostrea) meridionalis</i> ROVERETO, 1900	1086/Sa-V-SG 17
<i>Ostrea (Ostrea) statiflorum</i> ROVERETO, 1897	<i>Ostrea (Ostrea) statiflorum</i> ROVERETO, 1897	1088/Sa-V-SG 19a 1088/Sa-V-SG 19b 1088/Sa-V-SG 19c
<i>Ostrea (Ostrea) ventillabrum</i> GOLDF. var. <i>crebricosta</i> ROVERETO, 1897	<i>Crassostrea crebricosta</i> (ROVERETO, 1897)	1089/Sa-V-SG 20
<i>Ostrea (Alectryonia) prestantina</i> ROVERETO, 1897	<i>Hytissa prestantina</i> (ROVERETO, 1897)	2067/Sa-II-S 163 2067/Sa-II-S 163bis
<i>Pecten arcuatus</i> BROCCHI var. <i>stricta</i> ROVERETO, 1898	<i>Pecten arcuatus</i> (BROCCHI, 1814)	1077/Sa-V-SG 8
<i>Chlamys ventillabrum</i> GOLDF. var. <i>oligocenicus</i> ROVERETO, 1898	<i>Aequipecten oligocenicus</i> (ROVERETO, 1898)	1169/Sa-II-S 6
<i>Spondylus ? hastatus</i> ROVERETO, 1897 = <i>Spondylus hastatus</i> ROVERETO, 1900	<i>Spondylus (Spondylus) hastatus</i> ROVERETO, 1900	1170/Sa-II-S 7
<i>Crassatella gigantea</i> ROVERETO, 1898	<i>Crassatella gigantea</i> ROVERETO, 1898	1098/Sa-V-SG 29
<i>Cyprina oncodes</i> ROVERETO, 1898 = <i>Cypriniadea oncodes</i> ROVERETO, 1900	<i>Arctica oncodes</i> (ROVERETO, 1898)	3106/M-III-M 20
<i>Chama tongriana</i> ROVERETO, 1898	<i>Chama tongriana</i> ROVERETO, 1898	792/SM-VI-P 169 907/M-I-S 16 1744/SM-VI-P 75 1745/SM-VI-P 76 2863/M-3-M 101
<i>Cyrena strangulata</i> ROVERETO, 1898	<i>Polymesoda convexa</i> (BRONGNIART, 1822)	1100/Sa-V-SG 34 2874/M-III-M 112
<i>Syndesmya intermedia</i> ROVERETO, 1898	<i>Abra rossii</i> nomen novum	1172/Sa-II-S 9
<i>Diplodonta alepis</i> ROVERETO, 1898	<i>Diplodonta alepis</i> ROVERETO, 1898	1181/Sa-II-S 18
<i>Jouannetia avellanaria</i> ROVERETO, 1914	<i>Jouannetia (Jouannetia) tournoueri</i> LOCARD, 1877	2089bis/Sa-II-S 185 2089/Sa-II-S 185
<i>Thracia stenochora</i> ROVERETO, 1898	<i>Thracia stenochora</i> ROVERETO, 1898	908/OV-III-C 1



The TPB and the collecting sites

The TPB is a late- to post-orogenic basin located in the inner part of the arcuate belt of the Western and Ligurian Alps (GELATI & GNACCOLINI, 1988; MUTTI *et al.*, 1995; GIGLIA *et al.*, 1996; CAPPONI *et al.*, 2001, 2009; FEDERICO *et al.*, 2015, and references therein). The basin deposits unconformably overlie the tectonic pile resulting from the main alpine orogenic deformation phases and include non-marine to marine sediments (upper Eocene? - upper Miocene) (LORENZ, 1969; GELATI & GNACCOLINI, 1988; MUTTI *et al.*, 1995; BONCI *et al.*, 2011, 2014, 2017; QUARANTA *et al.*, 2009a, 2009b; GELATI *et al.*, 2010; CAPPONI *et al.*, 2013, FEDERICO *et al.*, 2015, and reference therein). In the Sassello and Santa Giustina areas, the sedimentation starts with slope and scree (Fig. 1, CRA) and fine to very coarse siliciclastic alluvial fan and river plain deposits, which grade upward to fan-delta/shallow marine sandstone and conglomerate (Fig. 1, MOR). These bodies are overlain by marine shallow-water fine to coarse grained siliciclastic sediments and local reef limestones (Fig. 1, MORT). Fine to medium sandstone followed by siltstone and marly siltstone (Fig. 1, MORm) overlie the MORT facies. MORm deposits record a deepening phase that reached its maximum with the deposition of silty sandstone, siltstone and marl, in which sandstone and conglomerate lenticular bodies are interbedded (Fig. 1, RTM). For more detailed information about the geology of the Santa Giustina and Sassello areas refer to LORENZ (1969), FRAVEGA *et al.* (1987); QUARANTA *et al.* (2009a, 2009b), BONCI *et al.* (2011, 2014, 2017), CAPPONI *et al.* (2013), FEDERICO *et al.* (2015), and reference therein.

The survey performed by the present authors in the Santa Giustina and Sassello areas (Fig. 1) allowed us to rediscover the majority of the historical sites, that are described below. These sites exhibit stratigraphic features that perfectly fit with those of the Molare Formation (MOR, MORT, MORm, Oligocene) as summarized above and recently reported on by CAPPONI *et al.* (2013) and FEDERICO *et al.* (2015).

SANTA GIUSTINA

As stated by ROVERETO's original handwritten labels and papers (1897, 1898, 1900, 1914), the mollusc types of the Santa Giustina area are from four collecting sites (Fig. 1): G1) Salita a M. Prà lungo, G2) Monte Prà lungo, G3) Forte del Giovo o Forte Moglie, and G4) Le Ciappe, for which the geologic information obtained from the field trips undertaken by the present authors or from the literature are summarized below.

G1) Salita a M. Prà lungo - southern slope of Bric Ciasu (N 44°25'16", E 8°29'38.8", 410 m a.s.l.). Poorly exposed fossiliferous coarse sandstones in which pluridecimeteric marly sandstone and conglomerate lenses are interbedded; the fossil content includes molluscan fragments; no age-diagnostic fossils are present.

G2) M. Prà lungo - unnamed crest close to Bric Ciasu (N 44°25'21.9", E 8°28'33", 462 m a.s.l.). Poorly exposed fossiliferous coarse sandstone and fine to medium conglomerate lenses; the fossil content includes molluscs but no other age diagnostic fossils.

G3) Forte del Giovo or Forte Moglie - Fort Giovo aka Fort Moglie (N 44°25'54", E 8°28'38", 540 m a.s.l.). This outcrop, briefly described by LORENZ (1969), is composed of sandstones with interbedded conglomerate lenses, grading upward to silty and marly sandstones. The fossil content includes molluscs and larger foraminifera, among which abundant *Operculina complanata* (DEFRANCE, 1822) and rare *Nummulites fichteli* MICHELOTTI, 1841, and *Eulepidina* sp.; LORENZ (1969) recorded the presence of *Eulepidina dilatata* (MICHELOTTI, 1861). The larger foraminifera assemblage points to a SB22 - lower SB23 Zone assignment, *i.e.*, a late Rupelian - early Chattian age (according to CAHUZAC & POIGNANT, 1997).

G4) Le Ciappe (N 44°25'40", E 8°28'48", 420 m a.s.l.). This is a well-known section, already described by ISSEL (1885, 1892), ROVERETO (1914), LORENZ (1969), QUARANTA *et al.* (2009a), QUARANTA *et al.* (2009b), and BONCI *et al.* (2011). According to these authors, this section is Rupelian in age. It demonstrates the Oligocene pretransgressive and transgressive phase of the TPB, including alluvial fan, river plain and lacustrine very fine to very coarse grained siliciclastic deposits grading upwards to fan-delta and brackish water sandstone and conglomerate. The latter are overlain by beach to shallow sublittoral siltstone, sandstone and conglomerate interbedded by rare small branching coral reefal deposits.

SASSELLO

According to ROVERETO's original handwritten labels and papers (1897, 1898, 1900, 1914), the mollusc types of the Sassello basin are from six localities (Fig. 1): S1) Battella, S2) Case Cappelletta, S3) Case Bergiura, S4) Case Gei, S5) Rio Zunini, and S6) Case Sacchetta, for which the geologic information obtained from the field trips performed by the present authors or from the literature are summarized below.

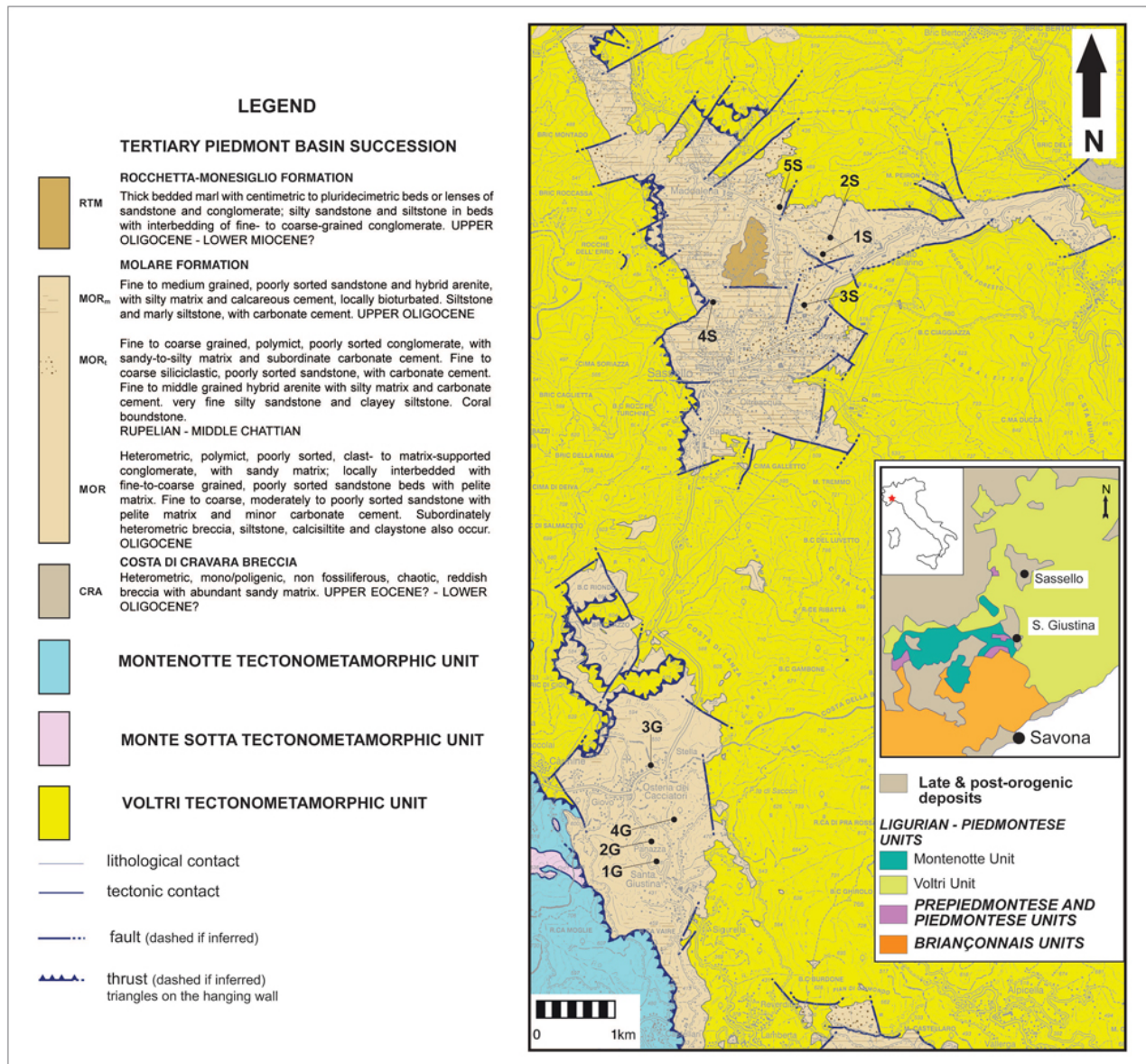


Figure 1: Simplified geologic map of Santa Giustina and Sassello areas, modified from CAPPONI *et al.* (2013) and FEDERICO *et al.* (2015), with location of rediscovered collecting sites (G1= Salita a M. Prà lungo, G2= Monte Prà lungo, G3= Forte del Giovo o Forte Moglie, G4= Le Ciappe, S1= Battella, S2= Case Cappelletta, S3= Case Bergiura, S4= Case Gei, S5= Rio Zunini).

S1) Battella (N 44°29'31", E 8°30'18", 384 m a.s.l.): the section has a total thickness of 140 cm and is made of medium bedded, well sorted, slightly bioturbated, fine sandstone with silty clayey matrix and carbonate cement. The individual beds exhibit a wavy discontinuous lamination. The fossil content includes echinoid spines, coral fragments, bivalve and gastropod shells and moulds (pectinids, glycymerids, turritellids), larger foraminifera, and coalified plant remains. These rocks have yielded a large number of specimens of *Nummulites fichteli*, supporting the SB21 Zone assignment, *i.e.*, an early-middle Rupelian age (CAHUZAC & POIGNANT, 1997).

S2) Case Cappelletta: this toponym is probably a writing error of ROVERETO due to the misunderstanding of the dialectal name of the locality. The real name might be Case Capè, a group of old cottages where few small outcrops of terrestrial to shallow marine deposits are present (N 44°29'36", E 8°30'29", 432 m a.s.l.).

S3) Case Bergiura, nowadays named Case Bergera (N 44°29'11", E 8°30'05", 430 m a.s.l.): the lithostratigraphic section (total thickness about 240 cm) is made of medium bedded, polymict, coarse conglomerate followed by poorly stratified, medium sorted, medium to coarse sandstone with silty matrix and carbonate ce-



ment. These rocks have yielded bivalve and gastropod shells together with moulds and coalified leaf remains, without biostratigraphic value.

S4) Case Gei, now named Case Moglie di Gè (N 44°29'15", E 8°29'07", 420 m a.s.l.): the section (thickness about 13 m) is made of poorly bedded, strongly burrowed marly-sandy siltstone with wavy discontinuous lamination. The fossil content includes abundant bryozoans, very abundant bivalve shells and moulds (pholadomyids, pectinids, cardiids, veneriids, teredinids), and coalified plant remains.

S5) Rio Zunini, also known as Ponte Prina (N 44°29'54", E 8°29'53", 370 m a.s.l.): this is a classical fossiliferous locality of the Sassello area. According to LORENZ (1969), FRAVEGA *et al.* (1987), QUARANTA *et al.* (2009a, 2009b) the section (total thickness of about 13 m) is late Rupelian - early Chattian in age and represents the base of the Molare Formation. It unconformably overlies the serpentinites of the Voltri Unit. The succession is made of coarse conglomerate interbedded with sandy lenses and coral buildups followed by coarse sandstone and fine conglomerate with scattered coral colonies. Upwards it grades to rhythmic alternation of thin to medium thick strata of calcarenite/hybrid arenite and coral/coralline algal limestone. The fossil content includes corals, mollusc shells and moulds, bryozoans, larger foraminifera (*Nummulites fichteli* and *Eulepidina*), and coralline algae.

S6) Case Sacchetta is not reported on the maps. A rural house with a very similar name, *i.e.*, Case Sacchetto, is located close to the NW limit of the Sassello basin, but only metamorphic rocks are exposed. Therefore, it can be supposed that Case Sacchetta apparently represents a different, but unknown locality.

The gastropod and bivalve types from Santa Giustina and Sassello

The classification scheme here adopted is that proposed by BOUCHET *et al.* (2005, 2010). Additional sources were COX (1960), COX *et al.* (1969a, 1969b), STENZEL (1971), HARRY (1985), CLEMAM, Fossilworks, and WoRMS that also provide useful taxonomic and nomenclatural information.

Measurements on gastropod shells are according to PEDRIALI and ROBBA (2005): H = shell height, D = maximum diameter, SH = spire height, AH = aperture height, AW = aperture width, SA = spire angle. Measurements on bivalve shells according to BEREZOVSKY (2015a) are: L = valve length, H = valve height, C = valve convexity, EE = elongation extent (= H/L), CE = convexity extent (= C/H), A = apical angle.

Class Gastropoda CUVIER, 1795

Subclass Caenogastropoda Cox, 1960

Unassigned order

Superfamily Cerithioidea FLEMING, 1822

Family Cerithiidae FLEMING, 1822

Subfamily Cerithiinae FLEMING, 1822

Genus *Gourmya* FISCHER, 1884

Gourmya nimbata (ROVERETO, 1914)

(Fig. 2.A-B)

1914 *Fusus* (*Aptyxis*) *nimbatus* ROVERETO, p. 128, Pl. III, fig. 1.

Type material: One partially preserved shell, the original label has been lost, holotype (by monotypy) 2976/Sa-II-S 195.

Type locality: Sassello (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Fusiform, dextral, stocky shell; three whorls counting spire. Apical whorls, aperture, and neck lacking; partially abraded. Body whorl covering 1/3 of the entire shell. Sculpture: evenly spaced, fine, irregular, close-packed spiral riblets; one spiral of prominent, evenly spaced, rounded nodes on the middle part of the whorl and a second one spiral of faint nodes on the body whorl. Suture undulated and impressed. Size: H= about 42.61 mm; D= about 28.36 mm; SH= 24.48 mm; AH= not measurable; AW= not measurable; SA= about 43°.

Remarks: We assigned this species to the genus *Gourmya* FISCHER, 1884, because the observable morpho-dimensional characters are very similar to those of the stout, moderately ornamented members of *Gourmya* discussed by COSSMANN and PEYROT (1921), LOZOUET *et al.* (2001) and HARZHAUSER (2007). In this regard, it should be

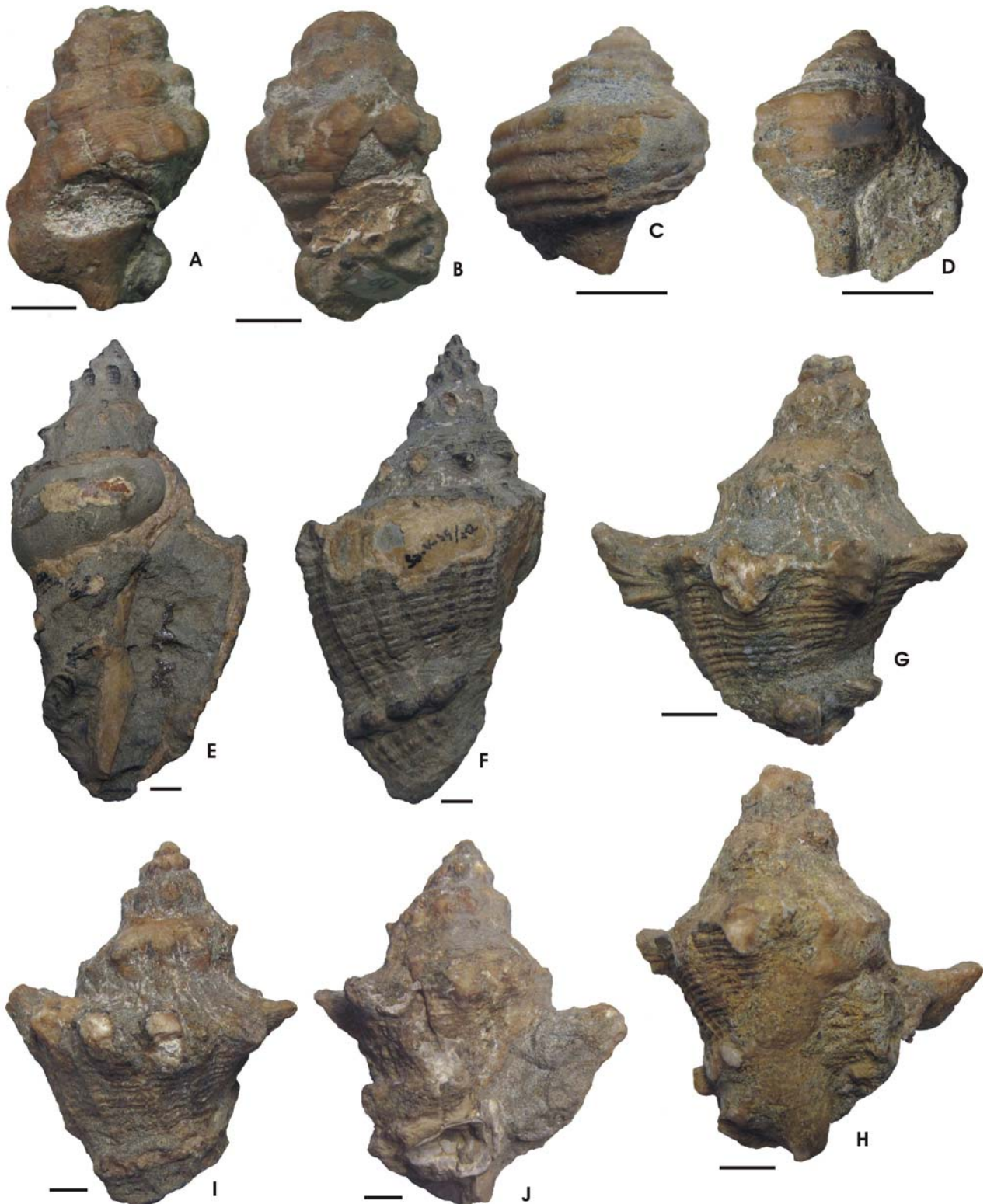


Figure 2: ROVERETO's gastropod taxa. Scale bars = 1 cm. A-B: *Gourmya nimbata* (ROVERETO, 1914) - holotype, 2976/Sa-II-S 195. C-D: *Cymatium (Ranularia) semifucosum* (ROVERETO, 1914) - holotype, 1175/Sa-II-S 12. E- F: *Melongena laxecarinata* (MICHELOTTI, 1861) - holotype, 1158/Sa-V-SG 89. G-H, I-J: *Melongena laxecarinata* (MICHELOTTI, 1861) - lectotype, 1178/Sa-II-S 15 (G-H); paralectotype, 1178/Sa-II-S 196 (I-J).



noted that the morphology, but not dimensions, are also comparable to that reported on by RUSSO (2015) for the genus *Aptyxis* TROSCHER, 1868.

The species in hand parallels *Gourmya tuberosa* (GRATELOUP, 1847), but differs in having more pronounced nodes and spiral riblets.

Distribution: Oligocene: Sassello (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Order Neogastropoda WENZ, 1938

Superfamily Tonnoidea SUTER, 1913

Family Ranellidae GRAY, 1854

Subfamily Cymatiinae IREDALE, 1913

Genus *Cymatium* RÖDING, 1798

Subgenus *Ranularia* SCHUMACHER, 1817

***Cymatium (Ranularia) semifucosum*
(ROVERETO, 1914)**

(Fig. 2.C-D)

1914 *Tritonium (Ranularia) semifucosum* ROVERETO, p. 136, Pl. IV, fig. 6.

1997 *Cymatium semifucosum* (ROVERETO), BONCI *et al.*, p. 40, Pl. 1, figs. 1a-b.

Type material: One shell, the original label has been lost, holotype (by monotypy) 1175/Sa-II-S 12.

Type locality: Sassello (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Fusiform, medium sized, dextral shell with angular whorls and long anterior canal; inner lip encrusted by sediments; apex, outer lip, and basal part of the anterior canal lacking. Three whorls counting spire. Body whorl covering 2/3 of the entire shell. Sculpture of the spire: three spiral riblets on the sutural ramp and two bold, nodulose, spiral ribs on the abapycal part (the upper forms the shoulder); sculpture of the body whorl: three spiral riblets on the sutural ramp and six bold, large, evenly spaced spiral ribs with small nodules. Suture linear, impressed. Aperture elongate-ovate. Size: H= about 26.00 mm; D= 21.65 mm; SH= about 12.00 mm; AH= about 13.00 mm; AW= about 10.00 mm; SA= 83°.

Remarks: The allocation of this species into *Cymatium (Ranularia)* SCHUMACHER, 1817, only hypothesised by BONCI *et al.* (1997), is here confirmed on the basis of the subgenus description reported on by BEU (1986). The bulk of characters of this species enables to distinguish it from all the other Oligocene species of *Cymatium*.

Distribution: Oligocene: Sassello (NW Italy), Molare Formation (Tertiary Piedmont Basin).

**Superfamily Buccinoidea
RAFINESQUE, 1815**

Family Melongenidae GILL, 1871

Subfamily Melongeninae GILL, 1871

Genus *Melongena* SCHUMACHER, 1817

***Melongena laxecarinata*
(MICHELOTTI, 1861)**

(Fig. 2.E-F)

1861 *Fusus laxecarinatus* MICHELOTTI, p. 181, Pl. XII, figs. 11-12.

1914 *Melongena laxecarinata* MICHTT. var. *depromta* ROVERETO, p. 131, Pl. IV, fig. 3; Pl. V, fig. 1.

Type material: One shell, the original label has been lost, holotype (by monotypy) 1158/Sa-V-SG 89.

Type locality: Santa Giustina (SV), Molare Formation, Tertiary Piedmont Basin.

Remarks: Size: H= 132.00 mm; D= 72,00 mm; SH= 58,00 mm; AH= 74.00 mm; AW= 43.00 mm; SA= 67°. According to ROVERETO (1914), this variety differs from the species s.s. being elongated and spindle-shaped and in having a sculpture characterized by almost knotty, heavy radial ribs alternating with light radial riblets, interrupted by longitudinal ribs. But these characters are to be considered within the variability of the species *Melongena laxecarinata* because they are more or less evident in all specimens of this species coming from Santa Giustina and preserved in the BTP Collection (about 35 shells), as well as in those figured in literature (*e.g.*, MICHELOTTI, 1861; BOUSSAC, 1911; LORENZ, 1967). Therefore, we consider this variety an invalid taxon. As regards the assignment to the genus *Melongena*, we concur with VERMEIJ and RAVEN (2009, p. 115) when they state: "Further work may show that the Oligocene and Miocene species of the Old World that have been assigned to *Melongena* ... should be separated as a separate genus or subgenus. For now, however, we continue to use the generic name *Melongena* in the broad sense for both the New World lineage ... and for the fossil species from Europe and Asia".

Distribution: Oligocene: Santa Giustina (NW Italy), Molare Formation (Tertiary Piedmont Basin).

***Melongena laxecarinata*
(MICHELOTTI, 1861)**

(Fig. 2.G-H, .I-J)

1861 *Fusus laxecarinatus* MICHELOTTI, p. 181, Pl. XII, fig. 11-12.

1914 *Melongena laxecarinata* MICHTT. var. *praepilata* ROVERETO, p. 131, Pl. V, figs. 2-2a.

1967 *Melongena laxecarinata* MICHTT. var. *praepilata* ROVERETO, LORENZ, p. A90.



1997 *Pugilina (Pugilina) laxecarinata* (MICHELOTTI), BONCI *et al.*, p. 50 and 52, Pl. 2, figs. 1a-b, 3a-b).

Type material: Two shells: 1178/Sa-II-S 15 (lectotype, here designated) and 1178/Sa-II-S 196 (paralectotype). The original labels have been lost.

Type locality: Sassello (SV), Molare Formation, Tertiary Piedmont Basin.

Remarks: Lectotype size: H= about 65.50 mm; D=63,30 mm, spines included; SH= about 34,50 mm; AH= about 31.00 mm; SA= 41°, spines excluded. ROVERETO (1914) states that this variety differs from the species s.s. in having on the main whorl elongated, irregular, recurved, and roughly scaly knots developed close to the suture and on the minor whorls inconspicuous knots partially covered by the sutural ramp of the main whorl. But these characters are within the variability of the species *Melongena laxecarinata*, being more or less present in all specimens of this species preserved in the BTP Collection. Therefore, we consider invalid this variety. With respect to the allocation in the genus *Melongena*, we agree with VERMEIJ and RAVEN (2009, p. 115).

Distribution: Oligocene: Sassello (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Genus *Volema* RÖDING, 1788

Volema basilica (BELLARDI, 1872)

(Fig. 3.A-B)

1872 *Myristica basilica* BELLARDI p. 158-159, Pl. X, figs. 4-5.

1900 *Melongena (Myristica) basilica* BELL. var. *Justinensis* ROVERETO, p. 171.

1904 *Melongena basilica* var. *justinensis* ROVER., SACCO, p. 32.

1914 *Melongena basilica* BELL. var. *justinensis* ROVERETO, ROVERETO, p. 130, Pl. IV, fig. 1

1995 *Galeodes (Volema) basilica* (BELLARDI, 1872), BONCI & CIRONE, p. 554-557, Figs. 1-3.

1997 *Volema basilica* (BELLARDI, 1872), BONCI *et al.*, p. 48-50, Pl. 1, figs 9a-c.

Type material: One shell, the original label has been lost, holotype (by monotypy) 1177/Sa-II-S 14.

Type locality: Sassello (SV), Molare Formation, Tertiary Piedmont Basin.

Remarks: Size: H= 93.84 mm; D= 100,93 mm; SH= 18,57 mm; AH= 75.27 mm; AW= 57.30 mm; SA= 121°. ROVERETO (1900) described the variety on the basis of an unspecified number of specimens collected at Santa Giustina, Mioglia and Sassello, but not figured any specimen. ROVERETO (1914) redescribed this variety, figured one specimen, and included only Sassello in the list of the collecting sites. In any case, the materials from Mioglia and Santa Giustina are lost and only one fossil from Sassello (figured by ROVERETO, 1914) is present in the Collection. LORENZ

(1967, p. A91) included the var. *justinensis* in the synonymy list of the species *M. basilica*, but not justifies his decision. According to ROVERETO (1914), this variety differs from the species s.s. in having a more acute spire, a row of pointed and protruding nodes close to the suture. But these characters are to be considered within the variability of the species *basilica*, in fact they are more or less evident in all specimens of this species collected in the Oligocene BTP sedimentary rocks. Therefore, we consider this variety an invalid taxon. As regards the assignment to the genus *Volema*, we concur with BONCI *et al.* (1997).

Distribution: Oligocene: Santa Giustina, Sassello and Mioglia (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Superfamily Conoidea FLEMING, 1822

Family Conidae FLEMING, 1822

Subfamily Coninae FLEMING, 1822

Genus *Cryptoconus* KOENEN, 1867

Cryptoconus thalassinus

(ROVERETO, 1914)

(Fig. 3.C-D)

1914 *Pleurotoma thalassina* ROVERETO, p. 125-126, Pl. II, figs. 8-8a.

1997 *Cryptoconus thalassinus* (ROVERETO), BONCI *et al.*, p. 42, Pl. 1, figs. 2a-b.

Type material: One shell, the original label has been lost, syntype 1176/Sa-II-S 13.

Type locality: Sassello (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Biconical, dextral shell; three and half whorls counting spire. Apical whorls, outer lip, and neck's terminal part lacking; partially abraded. Spire higher than aperture. Slightly convex whorls. Body whorl convex in the adapical part and slightly inflated in the abapical part and covering 2/3 of the entire shell. Suture linear, impressed. Aperture elongate-ovate. Siphonal canal long and deep. Sculpture: evenly spaced, fine, regular spiral riblets on the abapical part of the body whorl. Size: H= about 25.20 mm; D= 10.90 mm; SH= about 13.35 mm; AH= 11.80 mm; AW= 4.60 mm; SA= 35°.

Remarks: ROVERETO described and figured two specimens, one of which (Pl. II, fig. 8, the largest) has been lost, the other one (Pl. II, fig. 8a) is present in the Collection and is here considered. The allocation into the genus *Cryptoconus* KOENEN, 1867, proposed by BONCI *et al.* (1997) is confirmed on the basis of the distinguishing characters suggested by AMITROV (2008). Moreover, we agree with BONCI *et al.* (1997) when state that the complex of features of this species allows to distinguish it from all the other Oligocene species of *Cryptoconus*.



Distribution: Oligocene: Sassello (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Class Bivalvia LINNAEUS, 1758

Subclass Autobranchia GROBBEN, 1894

**Superorder Pteriomorphia
BEURLEN, 1944**

Order Arcida GRAY, 1854

Superfamily Limopsoidea DALL, 1895

Family Limopsidae DALL, 1895

Genus *Limopsis* SASSI, 1827

Subgenus *Pectunculina* ORBIGNY, 1843

***Limopsis (Pectunculina) turgida*
ROVERETO, 1898**

(Fig. 3.E-F)

1898 *Limopsis turgida* ROVERETO, p. 41.

1900 *Limopsis turgida* ROVERETO, ROVERETO, p. 82, Pl. V, fig. 9.

1904 *Limopsis (Cosmetopsis an Pectunculina) turgida* ROVERETO, SACCO, p. 155, Pl. XXIX, fig. 21.

1911 *Limopsis turgida* ROVERETO, BOUSSAC, p. 80, Pl. XXI, figs. 1-4.

1921 *Limopsis (Cosmetopsis) turgida* ROVERETO, COSSMANN, p. 138-139, Pl. VII, figs. 57-60.

1997 *Limopsis (Pectunculina) turgida* ROVERETO, BONCI *et al.*, p. 42-43, Pl. 1, figs. 5a-b.

Type material: One double-valved external mould, the original label has been lost, holotype (by monotypy) 1167/Sa-II-S 4.

Type locality: Sassello, alla Battella (SV), Molare Formation, Tertiary Piedmont Basin.

Description: One moderately preserved double-valved external mould (the RV is better preserved); ventral margin partially broken, orbicular in shape with a little, prominent, orthogyrous umbo. Slightly inequilateral. Posterior and anterior margins rounded, cardinal margin straight. Cancellate ornamentation, with about 30 evenly spaced ribs. Size: L= 24.20 mm, H= 23.00 mm, C more inflated valve = 8.25 mm, EE= 0.95, CE= 0.36.

Remarks: This species was discussed and accepted by COSSMANN (1921). A generic comparison is possible with the species described by BEREZOWSKI (2015a, 2015b) which clearly differ in having a higher EE and/or a lower CE, straight posterior and anterior margins, a higher number of ribs.

Distribution: Eocene: Biarritz (SW France), "Nummulitique". Oligocene: Sassello (NW Italy), Molare Formation (Tertiary Piedmont Basin); Aquitaine (France).

Order Ostreida FÉRUSSAC, 1822

**Superfamily Ostreoidea
RAFINESQUE, 1815**

Family Ostreidae RAFINESQUE, 1815

Subfamily Ostreinae RAFINESQUE, 1815

Genus *Ostrea* LINNAEUS, 1758

Subgenus *Ostrea* LINNAEUS, 1758

***Ostrea (Ostrea) meridionalis*
ROVERETO, 1900**

(Fig. 3.G)

1897 *Ostrea (Ostrea) caudata* MÜNST. var. *meridionalis* ROVERETO, p. 12.

1897 *Ostrea* cfr. *Cosmanni* DOLLF. var. *oligoplicata* SACCO, p. 12, Pl. III, figs. 31-35.

1900 *Ostrea (Ostrea) meridionalis* ROVERETO, p. 47, Pl. I, fig. 7; Pl. II, figs. 6-7.

1904 *Ostrea oligoplicata* SACCO var. *meridionalis* ROVERETO, SACCO, p. 135, Pl. XXVII, figs. 6-8.

1920 *Ostrea oligoplicata* SACCO var. *meridionalis* ROVERETO, LOMBARDINI, p. 22.

Type material: One lower valve, the original label has been lost, lectotype (here designated) 1086/Sa-V-SG 17.

Type locality: Santa Giustina (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Well preserved, convex, oval and slightly crescentically curved lower valve, with a large, oval, strongly concave, attachment area; the lower valve is infilled by sediments that form the internal mould of the upper valve. Triangular, longer than high ligamental area. Few, inconspicuous chomata (observable only on the posterior margin). Sculpture: about 40, fine, rounded, evenly distributed, radiating ribs. Size: L= 38.00 mm, H= 38.00 mm, C= 21.00 mm, EE= 1.0, CE= 0.55.

Remarks: ROVERETO (1897) claims to have specimens from Santa Giustina, Sassello and Pareto, and in his subsequent paper (ROVERETO, 1900) he figures one specimen from Santa Giustina (preserved in Collection, the lectotype here designated) and other two specimens of unknown provenance (Pl. II, figs. 6-7) that are lost as well as the other specimens.

The ROVERETO's taxon exhibits some similarity with: a) *Ostrea ventilabrum* GOLDFUSS, 1826-1833 - for comparisons see also WOŻNY (1977) - but differs in having finer and evenly spaced ribs, greater number of ribs, larger attachment area, turned umbo, and for the lacking of the typical sinuate anterior margin; b) *Ostrea (Ostrea) stattiellorum* ROVERETO, 1897 - for comparisons see also this paper - but differs in having a larger attachment area, smaller number of ribs, which are never dichotomous.



Distribution: Oligocene: Santa Giustina, Sassello, Pareto, Carcare, Dego, Cassinelle (NW Italy), Molare Formation (Tertiary Piedmont Basin); Aquitanian: Osoppo (NE Italy), Preplans Sandstone.

***Ostrea (Ostrea) statiellorum*
ROVERETO, 1897**

(Fig. 3.H-I)

1897 *Ostrea (Ostrea) statiellorum* ROVERETO, p. 13.
1900 *Ostrea (Ostrea) Statiellorum* ROVERETO, ROVERETO, p. 50, Pl. I, figs. 5-5b.
1904 *Ostrea (Ostrea) Statiellorum* ROVERETO, SACCO, p. 136, Pl. XXVII, fig. 3.

Type material: One lower valve, lectotype (here designated) 1088/Sa-V-SG 19a. Paralectotypes: 1088/Sa-V-SG 19b and 19c, two lower valves. The original labels have been lost.

Type locality: Santa Giustina (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Poorly preserved, convex, subcircular lower valve, with a large, oval, strongly concave, attachment area. Rostrate and pointed umbo. Triangular, longer than high ligamental area. Ostreine chomata occur along the margin near the hinge. Reniform muscle scar. Sculpture: probably about 60, fine, rounded, evenly distributed, radiating, partially dichotomous, ribs (the number of ribs is inferred on the base of the counting of 20 ribs on a third of the shell). Size: L= 50.00 mm, H= 47.00 mm, C= 15.00 mm, EE= 0.94, CE= 0.32.

Remarks: ROVERETO (1897) studied some specimens collected at Santa Giustina, three of which were figured (ROVERETO, 1900) and are present in the Collection (*i.e.*, the lectotype= Pl. I, fig. 5a, the paralectotypes= Pl. I, figs. 5 and 5b). Comparing the specimen 1088/Sa-V-SG 19c with the photograph of ROVERETO (Pl. I, fig. 5b), it can be noted that it has been damaged, lacking about a third of the shell.

The ROVERETO's taxon exhibits a moderate similarity with: a) *Ostrea ventilabrum* GOLDFUSS, 1826-1833 - see also WOŹNY (1977) - but differs in having more numerous, finer and evenly spaced ribs, larger attachment area, and for the absence of the typical half-moon shaped anterior margin; b) *Ostrea (Ostrea) meridionalis* ROVERETO, 1897 - see also this paper - but differs in having a smaller attachment area, more numerous and partially dichotomous ribs, rostrate and pointed umbo.

Distribution: Oligocene: Santa Giustina (NW Italy), Molare Formation (Tertiary Piedmont Basin).

**Subfamily Crassostreinae
SCARLATO & STAROBOGATOV, 1979**

Genus *Crassostrea* SACCO, 1897

***Crassostrea crebricosta*
(ROVERETO, 1897)**

(Fig. 3.J)

1897 *Ostrea (Ostrea) ventilabrum* GOLDF. var. *crebricosta* ROVERETO, p. 12.
1900 *Ostrea (Ostrea) ventilabrum* GOLDF. var. *crebricosta* ROVERETO, ROVERETO, p. 49, non Pl. I, fig. 6.
1904 *Ostrea (Ostrea) ventilabrum* GOLDF. var. *crebricosta* ROVERETO, SACCO, p. 136, non Pl. XXVII, fig. 2.

Type material: One lower valve, the original label has been lost, holotype (by monotypy) 1089/Sa-V-SG 20.

Type locality: Santa Giustina (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Well preserved, convex, suboval lower valve, with a moderately large, oval, flat, attachment area; backwards turned, rounded umbo. No chomata. Probably reniform muscle scar. Sculpture: about 50, fine, narrow, evenly distributed, slightly scaly, radiating ribs. A fragment of the RV, lamellose and without ribs, is preserved in the cavity of the lower valve. Size: L= 56.00 mm, H= 64.00 mm, C= 25.00 mm, EE= 1.14, CE= 0.39.

Remarks: The specimen figured as *Ostrea (Ostrea) ventilabrum* var. *crebricosta* by ROVERETO (1900, Pl. I, fig. 6) is not the one on which he erected the variety but a specimen of *Ostrea (Ostrea) ventilabrum*; SACCO (1904, Pl. XXVII, fig. 2) reported the same image. Therefore, the holotype of this taxon is figured for the first time in this paper. The ROVERETO's taxon exhibits some similarity with: a) *Ostrea ventilabrum* GOLDFUSS, 1826-1833 - for comparisons see also WOŹNY (1977) - but differs in having finer and evenly spaced ribs, greater number of ribs, larger attachment area, turned umbo, and for the lacking of the typical sinuate anterior margin (half-moon shaped); b) *Ostrea (Ostrea) meridionalis* ROVERETO, 1900 - for comparisons see also this paper - but differs in having smaller and flat attachment area and greater number of ribs; c) *Ostrea (Ostrea) statiellorum* ROVERETO, 1897 - for comparisons see also this paper - but differs in having smaller and flat attachment area, lower number of ribs, and rounded umbo; d) *Crassostrea cyatula* (LAMARCK, 1806) - for comparisons see also GOLDFUSS (1826-1833) and HOŞGÖR and OKAN (2009) - but differs in having finer and regular ribs and greater number of ribs; e) *Ostrea*

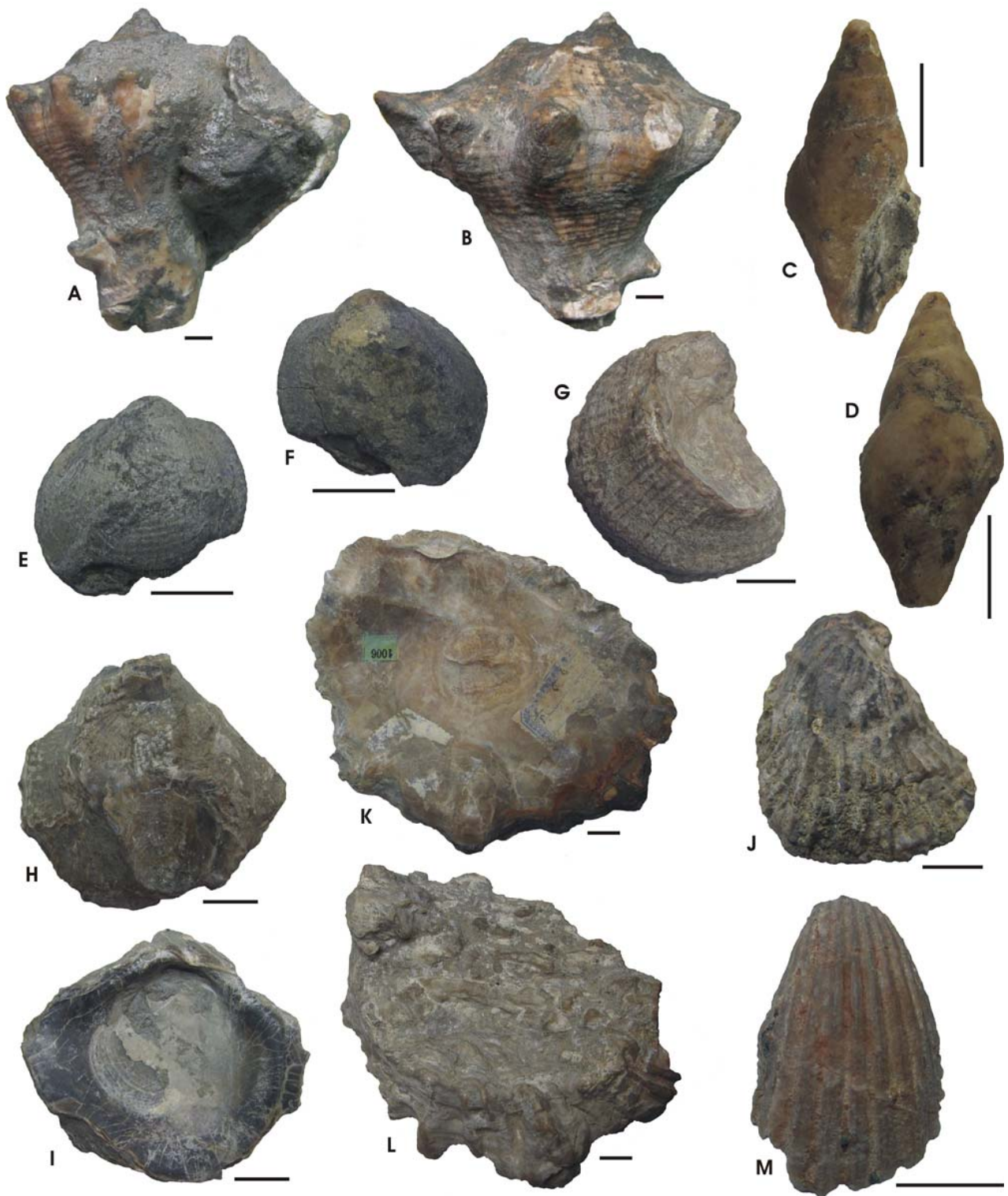


Figure 3: ROVERETO's gastropod and bivalve taxa. Scale bars = 1 cm. A-B: *Volema basilica* (BELLARDI, 1872) - holotype, 1177/Sa-II-S 14. C-D: *Cryptoconus thalassinus* (ROVERETO, 1914), - syntype, 1176/Sa-II-S 13. E-F: *Limopsis* (*Pectunculina*) *turgida* ROVERETO, 1898 - holotype, 1167/Sa-II-S 4, right valve (E), left valve (F). G: *Ostrea* (*Ostrea*) *meridionalis* ROVERETO, 1900 - lectotype, 1086/Sa-V-SG 17. H-I: *Ostrea* (*Ostrea*) *statiellorum* ROVERETO, 1897 - lectotype, 1088/Sa-V-SG 19a. J: *Crassostrea crebricosta* (ROVERETO, 1897) - holotype, 1089/Sa-V-SG 20. K-L: *Hyotissa prestantina* (ROVERETO) - lectotype, 2067/Sa-II-S 163, lower valve (L), upper valve (K). M: *Pecten arcuatus* (BROCCHI, 1814) - holotype, 1077/Sa-V-SG 8.



syrtica Cox, 1962, but differs in having greater number of ribs and much smaller attachment area. Since it does not match with any known species we raise the var. *crebricosta* to species rank and transfer it to *Crassostrea* because of the lacking of chomata.

Distribution: Oligocene: Santa Giustina and Tagliolo (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Family Gryphaeidae VIALOV, 1936

**Subfamily Pycnodonteinae
STENZEL, 1971**

Genus *Hytotissa* STENZEL, 1971

***Hytotissa prestantina* (ROVERETO, 1897)
(Fig. 3.K-L)**

1897 *Ostrea (Alectryonia) prestantina* ROVERETO, p. 13-14.

1900 *Ostrea (Alectryonia) prestantina* ROVERETO, ROVERETO, p. 51.

1904 *Alectryonia prestantina* (ROVERETO), SACCO, p. 137.

Type material: One double-valved shell, lectotype (here designated) 2067/Sa-II-S 163. Paralectotype: one double-valved shell, 2067/Sa-II-S 163bis. The original labels have been lost.

Type locality: Sassello (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Well preserved double-valved shell. Lower valve infilled by sediments and with damaged margins, upper valve encrusted by oysters and sediments. Shell oval in shape, with a large, oval, concave, attachment area. Subcircular muscle scar. Subtriangular, longer than high ligamental area. Vermiculate chomata near the hinge, on the upper valve are also visible the lath chomata. Sculpture of the lower valve: about 13, irregular, unevenly distributed, radiating pliae; sculpture of the upper valve: weak, low undulations close to the margins. Size: L= 100.00 mm, H= 82.00 mm, C lower valve= about 30.00 mm, EE= 0.82, CE= about 0.37.

Remarks: The species is transferred to the genus *Hytotissa* STENZEL, 1971, according to the synopsis proposed by HARRY (1985). This species is clearly different from any and all other *Hytotissa* described from the Eocene - lower Miocene European basins, because of the marked difference between the ornamentation of the upper and lower valve and the high number of ribs on the lower valve.

Distribution: Oligocene: Sassello, Pareto, Giusvalla, Mioglia, and Reboaro (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Order Pectinida GRAY, 1854

**Superfamily Pectinoidea
RAFINESQUE, 1815**

Family Pectinidae RAFINESQUE, 1815

Subfamily Pectininae RAFINESQUE, 1815

Genus *Pecten* MÜLLER, 1776

***Pecten arcuatus* (BROCCHI, 1814)**

(Fig. 3.M)

1814 *Ostrea arcuata* BROCCHI, p. 578-579, Pl. XIV, fig. 11.

1898 *Pecten arcuatus* BROCCHI var. *stricta* ROVERETO, p. 35.

1900 *Pecten arcuatus* BROCCHI var. *stricta* ROVERETO, ROVERETO, p. 68, Pl. II, fig. 13.

1904 *Pecten arcuatus* BROCCHI var. *stricta* ROVERETO, SACCO, p. 146, Pl. XXVIII, fig. 19.

Type material: One valve, the original label has been lost, holotype (by monotypy) 1077/Sa-V-SG 8.

Type locality: Santa Giustina (SV), Molare Formation, Tertiary Piedmont Basin.

Remarks: Size: L= about 12.00 mm, H= 20.00 mm, C= 9.00 mm, EE= 1.67, CE= 0.45, A = 36°. ROVERETO (1898) deals with specimens from Sassello and Santa Giustina, currently only one specimen from Santa Giustina is preserved in the Collection. ROVERETO (1898) erected this variety on the basis of his narrow and elongated shape, but these characters are within the morphological variability of the species *Pecten arcuatus* s.s., as is well documented by the specimens included in the BTP Collection. Therefore, we consider this variety as an invalid taxon. In this regard, it should be noted that COSSMANN (1921), LORENZ (1967) and BOSCHELE *et al.* (2011) include in the synonymic lists of *P. arcuatus* the whole page of the ROVERETO's paper (1900, p. 68) in which the varieties *stricta*, *fallax*, and *deperdita* are redescribed, probably implicitly suggesting that all are synonyms of the species s.s.

Distribution: Oligocene: Santa Giustina and Sassello (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Subfamily Chlamydinae TEPPNER, 1922

Genus *Aequipecten* FISCHER, 1886

***Aequipecten oligocenicus*
(ROVERETO, 1898)**

(Fig. 4.A)

1898 *Chlamys ventilabrum* GOLDF. var. *oligocenica* ROVERETO, p. 34.

1900 *Chlamys ventilabrum* GOLDF. var. *oligocenica* ROVERETO, ROVERETO, p. 66, Pl. III, fig. 5.



1904 *Aequipecten* cf. *ventilabrum* var. *oligocenica* ROVERETO, SACCO, p. 143, Pl. XXVIII, fig. 11.

1997 *Aequipecten* (*Aequipecten*) *ventilabrum* (GOLDFUSS), BONCI *et al.*, p. 56-57, Pl. 1, fig. 8.

Type material: One left valve, the original label has been lost, holotype (by monotypy) 1169/Sa-II-S 6.

Type locality: Sassello (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Moderately preserved left valve infilled by sediments, strongly inequilateral, posterior auricle partly preserved; small, orthogyrus, pointed umbo. Sculpture: 15-16 narrow, rounded, prominent, finely scaly, radiating ribs; scaly intervening furrows wider than ribs. Size: L= 35.15 mm, H= 37.00 mm, C= 12.00 mm, EE= 1.05, CE= 0.32, A= 104°.

Remarks: The ROVERETO's taxon exhibits some similarity with: a) *Pecten ventilabrum* GOLDFUSS, 1826-1833, but differs being more inequilateral and in having a lower number of ribs and wider interspaces; b) *Pecten miocenicus* MICHELOTTI, 1861, but differs in having a lower number of ribs, wider interspaces, finer ribs, and being much more inequilateral; c) *Chlamys* (*Aequipecten*) *miocenica* (MICHELOTTI, 1861) var. *dexterogibbosa* SACCO, 1897 (= *Chlamys* (*Aequipecten*) *dexterogibbosa* SACCO, 1897, according to COSSMANN, 1921), but differs in having a greater number of ribs, wider interspaces, finer ribs, and being more inequilateral. Since the var. *oligocenica* there is no comparably known species and therefore we raise it to species rank.

Distribution: Oligocene: Sassello (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Family Spondylidae GRAY, 1826

Genus *Spondylus* LINNAEUS, 1758

Subgenus *Spondylus* LINNAEUS, 1758

Spondylus (*Spondylus*) *hastatus* ROVERETO, 1900

(Fig. 4.B-C)

1897 *Spondylus* ? *hastatus* ROVERETO, p. 16.

1900 *Spondylus hastatus* ROVERETO, ROVERETO, p. 57, Pl. II, fig. 11.

1904 *Spondylus hastatus* ROVERETO, SACCO, p. 147, Pl. XXVIII, fig. 22.

1997 *Spondylus* (*Spondylus*) *hastatus* ROVERETO, BONCI *et al.*, p. 43-44, Pl. 1, figs. 6a-b.

Type material: One double-valved shell, the original label has been lost, holotype (by monotypy) 1170/Sa-II-S 7.

Type locality: Sassello (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Fairly preserved, flattened, double-valved shell. Dorsal margin and large part of the left valve lacking, umbos and hinge preserved

as internal moulds. Inequivalve, pectiniform, right valve umbo higher than those of the left valve. Anterior, posterior and ventral margins rounded. Sculpture right valve: bold, irregular, radial ribs (about 18) curved along the posterior margin, with strong and squared spines; sculpture left valve: inconspicuous, packed and flat ribs, probably without spines. Size: L= 55.15 mm, H= 57.00 mm, C RV= about 15.00 mm, EE= 1.03, CE= 0.26.

Remarks: This species is clearly different from any other *Spondylus* described from the Eocene - lower Miocene European basins, because of its ornamentation.

Distribution: Oligocene: Sassello (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Superfamily Crassatelloidea FÉRUSAC, 1822

Family Crassatellidae FÉRUSAC, 1822

Subfamily Crassatellinae VAUGHT, 1989

Genus *Crassatella* LAMARCK, 1799

Crassatella gigantea ROVERETO, 1898

(Fig. 4.D)

1898 *Crassatella gigantea* ROVERETO, p. 42.

1900 *Crassatella Ombonii* OPPENHEIM, p. 272.

1900 *Crassatella gigantea* ROVERETO, ROVERETO, p. 86, Pl. VI, fig. 2.

1904 *Crassatella gigantea* ROVERETO, SACCO, p. 157, Pl. XXX, fig. 5.

1911 *Crassatella Bertrandi* BOUSSAC, p. 200-201, Pl. XII, figs. 4-4a.

1913 *Crassatella Ombonii* OPPENHEIM, OPPENHEIM, p. 608, Pl. XXII, figs. 1-1a.

1914 *Crassatella gigantea* ROVERETO, ROVERETO, p. 151.

Type material: One left valve, the original label has been lost, holotype (by monotypy) 1098/Sa-V-SG 29.

Type locality: Santa Giustina (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Well preserved left valve infilled with sediment; posterior and anterior margins partially broken, suborbicular in shape, prosogyrous umbo, large and well defined lunule. Straight posterior margin, ventral margin rounded with crenulations on the interior side. Sculpture: growth rugae. Size: L= 115.00 mm, H= 111.00 mm, C= 13.54 mm, EE= 0.97, CE= 0.12.

Remarks: ROVERETO (1914, p. 151) includes *Crassatella Bertrandi* BOUSSAC, 1911, and *Crassatella Ombonii* OPPENHEIM, 1900, in the synonyms list. In our opinion, BOUSSAC's species perfectly matches with *C. gigantea*. As regards OPPENHEIM's species, it is of note that ROVERETO (1914, p. 151) reports that OPPENHEIM (1913, p. 608-609) affirms that his species corresponds to *C. gigantea*; but ROVERETO misunderstands the description of OP-



PENHEIM, who states that his species is very similar but differs from the ROVERETO's one in having the umbo clearly curved forward. The analysis of OPPENHEIM's (1913) figures and description allows us to state that there are no real differences in the morphology and position of the umbo of the two species. Therefore, we consider *Crassatella Bertrandi* BOUSSAC, 1911, and *Crassatella Ombonii* OPPENHEIM, 1900, as junior synonyms of *Crassatella gigantea* ROVERETO.

Distribution: Eocene: Pierrefeu (SE France), Nummulitique. Oligocene: Santa Giustina (NW Italy), Molare Formation (Tertiary Piedmont Basin); Vicentino (Veneto, NE Italy).

Order Venerida GRAY, 1854

Superfamily Arcticoidea NEWTON, 1891

Family Arctidae NEWTON, 1891

Genus *Arctica* SCHUMACHER, 1817

Arctica oncodes (ROVERETO, 1898)

(Fig. 4.E-F)

1898 *Cyprina oncodes* ROVERETO, p. 47.

1900 *Cypriniadea oncodes* ROVERETO, ROVERETO, p. 97, Pl. VII, fig. 1.

1904 *Cyprina oncodes* ROVR., SACCO, p. 162, Pl. XXXI, fig. 7.

Type material: One double-valved shell, the original label states: "Collez. PERRANDO *Cyprina oncodes* n. sp., tipo, Mioglia, 1349", lectotype (here designated) 3106/M-III-M 20.

Type locality: Mioglia (SV), Molare Formation, Tertiary Piedmont Basin (geographic and geologic information in BONCI *et al.*, 2017).

Description: Well preserved double-valved shell, partially abraded; subtrigonal in shape, transversely elongated, convex valves, tumid prosogyrous umbos, no lunule and escutcheon. Anterior margin moderately rostrate, posterior margin arched, ventral margin almost straight. Sculpture: growth foliaceous lamellae. Size: L= 42.07 mm, H= 32.47 mm, C more inflated valve= 8.30 mm, EE= 0.77, CE= 0.26.

Remarks: ROVERETO (1898) collected some specimens from Santa Giustina, Pareto and Mioglia and based the new species description on the specimen from Mioglia (the lectotype here designated, figured by ROVERETO, 1900, and SACCO, 1904), which is the only one still present in the Collection. As regard the genus assignment, it should be noted that *Cyprina* LAMARCK, 1818, and *Cypriniadea* ROVERETO, 1900, are synonyms of *Arctica* SCHUMACHER, 1817 (COX *et al.*, 1969a, p. N646). This species exhibits a generic similarity with a) *Arctica rotundata* (BRAUN in AGASSIZ, 1845) - for comparisons see also VENZO (1937) and HARZHAUSER and MANDIC (2001) - but differs in having a less rounded outline, a higher EE and a

lower CE; b) *Arctica planata* (SOWERBY, 1840) - for comparisons see also KACHHARA *et al.* (2012) - that differs for the outline of the ventral and anterior margins, the coiled subterminal umbos and the marked posterior carina.

Distribution: Oligocene: Santa Giustina, Pareto and Mioglia (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Superfamily Chamoidea LAMARCK, 1809

Family Chamidae LAMARCK, 1809

Genus *Chama* LINNAEUS, 1758

Chama tongriana ROVERETO, 1898

(Fig. 4.G-H)

1898 *Chama tongriana* ROVERETO, p. 45-46.

1900 *Chama tongriana* ROVERETO, ROVERETO, p. 95, Pl. V, fig. 11-11a-11b.

1904 *Chama tongriana* ROVER., SACCO, p. 160, Pl. XXX, figs. 18a-c.

1920 *Chama tongriana* ROVERETO, LOMBARDINI, p. 26-27.

Type material: One double-valved shell, the original label states: "Collez. PERRANDO *Chama tongriana* n. sp., Pareto, 1334", lectotype (here designated) 792/SM-VI-P 169. Paralectotypes: one lower valve filled with sediments from Squaneto, 907/M-I-S 16; five lower valves filled with sediments from Pareto, 1744/SM-VI-P 75 and 1745/SM-VI-P 76; one lower valve filled with sediments from Mioglia, 2863/M-3-M 101.

Type locality: Pareto (AL), Molare Formation, Tertiary Piedmont Basin (geographic and geologic information in BONCI *et al.*, 2014).

Description: Well preserved double-valved shell, ventral margin and lower valve slightly damaged; strongly inequivalve, suborbicular in shape, lower valve strongly convex with maximum inflation close to the umbo, upper valve flat, coiled umbos, rounded margins. Sculpture: unevenly distributed growth rugae vanishing near the beaks. Size: L= 25.93 mm, H= 25.28 mm, C upper valve= 13.54 mm, EE= 0.98, CE= 0.54.

Remarks: The original description probably deals with three valves, but only one was measured (ROVERETO, 1898) and the same information are reported in the subsequent description (ROVERETO, 1900). ROVERETO (1898) collected some specimens from Santa Giustina, Pareto, Mioglia and Squaneto, but he based the new species description only on specimens from Santa Giustina (figured by ROVERETO, 1900, and SACCO, 1904) that have been lost. Other specimens are still present in Collection (the lectotype and paralectotypes here designated). The species exhibits a generic resemblance with *Chama gryphoides* LINNAEUS, 1758, and *Chama vicentina* FUCHS, 1870, from which clearly differs being strongly inequivalve and having a simpler sculpture (no radial elements and spines).



Distribution: Oligocene: Santa Giustina, Pareto, Mioglia and Squaneto (NW Italy), Molare Formation (Tertiary Piedmont Basin); Aquitanian: Osoppo (NE Italy), Preplans Sandstone.

Superfamily Cyrenoidea GRAY, 1840

Family Cyrenidae GRAY, 1840

Genus *Polymesoda* RAFINESQUE, 1828

***Polymesoda convexa*
(BRONGNIART, 1822)**

(Fig. 4.I-K)

1822 *Cytherea convexa* BRONGNIART, p. 46, Pl. 8, figs. 7a-b.

1898 *Cyrena strangulata* ROVERETO, p. 58.

1900 *Cyrena strangulata* ROVERETO, ROVERETO, p. 108, Pl. VII, figs. 9-9a.

1900 *Cyrena sirena* var. *strangulata* ROVR., SACCO, p. 62, Pl. XIV, figs. 15-16.

1904 *Cyrena sirena* var. *strangulata* ROVR., SACCO, p. 167, Pl. XXXI, fig. 31.

1920 *Cyrena cyrenoides* Mich. var. *strangulata* ROV., LOMBARDINI, p. 29, Pl. I, figs. 11-12.

1967 *Cyrena strangulata* ROVERETO, LORENZ, p. A41, Pl. XXIX, figs. 6a-b.

Type material: Almost all specimens studied by ROVERETO are lost, currently only two are present in the Collection: one partially abraded, flattened, double-valved shell from Santa Giustina (1100/Sa-V-SG 34, lectotype, here designated) and one partially preserved right valve from Mioglia (2874/M-III-M 112, paralectotype). The original labels have been lost.

Type locality: Santa Giustina and Mioglia (SV), Molare Formation, Tertiary Piedmont Basin.

Remarks: Lectotype size: L= 25.30 mm, H= 19.26 mm, C= 13.54 mm, EE= 0.76, CE= 0.7. ROVERETO (1898) studied some specimens collected at Sassello, Santa Giustina, Mioglia, Pareto, and Squaneto two of which were figured (ROVERETO, 1900). The name of this species has a troubled history that has been reconstructed by ESU and GIROTTI (2010). As regard the validity of this ROVERETO's species, it should be noted that: a) it was reduced to a variety of *Cyrena sirena* (BRONGNIART, 1823) by SACCO (1900, XVIII, p. 62) on the basis of own materials; b) it has been regarded to be a variety of *Cyrena cyrenoides* MICHELOTTI, 1861, by LOMBARDINI (1920, p. 29, Pl. I, figs. 11-12) that included in the synonymy list the variety erected by SACCO (1900); c) GLIBERT and VAN DE POEL (1966) stated that *Cyrena sirena* of the Tongrian (Oligocene) of Italy strictly resemble *Polymesoda convexa subarata* (BRONN, 1837); d) LORENZ (1967) accepted the taxon of ROVERETO at the rank of species; e) LEBKÜCHNER

(1974) accepted the taxon *Cyrena sirena* var. *strangulata*; f) HARZHAUSER and MANDIC (2001) listed the specimens identified as *Cyrena sirena* et var. div. by SACCO (1900) in the synonymy of *Polymesoda subarata sowerbii* (BASTEROT, 1825); g) ESU and GIROTTI (2010) reported that *Cyrena sirena* (BRONGNIART, 1823) is considered a synonym of *Polymesoda convexa* (BRONGNIART, 1822); h) ESU and GIROTTI (2010) included *Cyrena sirena* and related varieties described by SACCO (1900), *Polymesoda convexa subarata* and *Polymesoda subarata sowerbii* in the list of younger synonyms of *Polymesoda convexa* (BRONGNIART, 1822); i) the specimens in hand fits in with the characters *P. convexa* recorded by ESU and GIROTTI (2010). On the base of the above reported consideration, the ROVERETO's taxon is to be considered a younger synonym of *Polymesoda convexa* (BRONGNIART, 1822).

Distribution: Oligocene: Sassello, Santa Giustina, Mioglia, Pareto, and Squaneto (NW Italy), Molare Formation (Tertiary Piedmont Basin); Aquitanian: Osoppo (NE Italy), Preplans Sandstone.

**Superfamily Tellinoidea
BLAINVILLE, 1814**

Family Semelidae STOLICZKA, 1870

Subfamily Semelinae STOLICZKA, 1870

Genus *Abra* LEACH in LAMARCK, 1818

***Abra rossii* nomen novum**

(Fig. 5.A)

1898 *Syndesmya intermedia* ROVERETO, p. 65-66.

1900 *Syndesmya intermedia* ROVERETO, ROVERETO, p. 123, Pl. VI, fig. 3.

1901 *Syndesmya intermedia* ROVERETO, SACCO, p. 121.

1904 *Syndesmya? intermedia* ROVERETO, SACCO, p. 169, Pl. XXXI, fig. 39.

1997 *Abra (Syndosmya) intermedia* (ROVERETO), BONCI *et al.*, p. 45-46, Pl. 1, fig. 3.

Type material: One left valve external mould, the original label has been lost, holotype (by monotypy) 1172/Sa-II-S 9.

Type locality: Sassello (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Fairly preserved left valve external mould, posterior margin broken, suboval in shape with a little, slightly prosogyrous umbo. Anterior and ventral margins rounded, cardinal margin straight. Sculpture: unevenly distributed bold growth rugae. Size: L= 15.70 mm, H= 8.75 mm, C= 2.70 mm, EE= 0.56, CE= 0.31.



Figure 4: ROVERETO's bivalve taxa. Scale bars = 1 cm. A: *Aequipecten oligocenicus* (ROVERETO, 1898) - holotype, 1169/Sa-II-S 6. B-C: *Spondylus (Spondylus) hastatus* ROVERETO, 1900 - holotype, 1170/Sa-II-S 7, left valve (B), right valve (C). D: *Crassatella gigantea* ROVERETO, 1898 - holotype, 1098/Sa-V-SG 29. E-F: *Arctica oncodes* (ROVERETO, 1898) - lectotype, 3106/M-III-M 20, left valve (E), right valve (F). G-H: *Chama tongriana* ROVERETO, 1898 - lectotype, 792/SM-VI-P 169, right valve (G), left valve (H). I-J-K: *Polymesoda convexa* (BRONGNIART, 1822) - parallectotype, 2874/M-III-M 112 (I); lectotype, 1100/Sa-V-SG 34 (J-K), left valve (K), right valve (J).

Remarks: According to Cox *et al.* (1969b, p. N637), *Syndesmya* is a spelling error for *Syndosmya*, that is subgenus of *Abra*. But BOUCHET and GOFAS (2015) state that *Syndesmya* FISCHER, 1887, and *Syndosmya* RÉCLUZ, 1843, are synonyms of *Abra* LAMARCK, 1818. Therefore, we assign the ROVERETO's species to the genus *Abra*. Consequently, the ROVERETO's species becomes a secondary homonym of the living species *Abra intermedia* (THOMPSON, 1845); so, in compliance with the articles 10.6 and 60 of the ICZN (Inter-

national Commission on Zoological Nomenclature, 1999), the specific epithet *intermedia* given by ROVERETO must be replaced with a new name (*nomen novum*), even if HUBER and GOFAS (2015) consider the THOMPSON's species a subjective junior synonym of *Abra nitida* (MÜLLER, 1776). The *nomen novum* *Abra rossii* is here assigned in compliance with the articles 11.9 and 31 of the ICZN (International Commission on Zoological Nomenclature, 1999) and is formed from the name of Giovanni Battista ROSSI (1859-1909), a

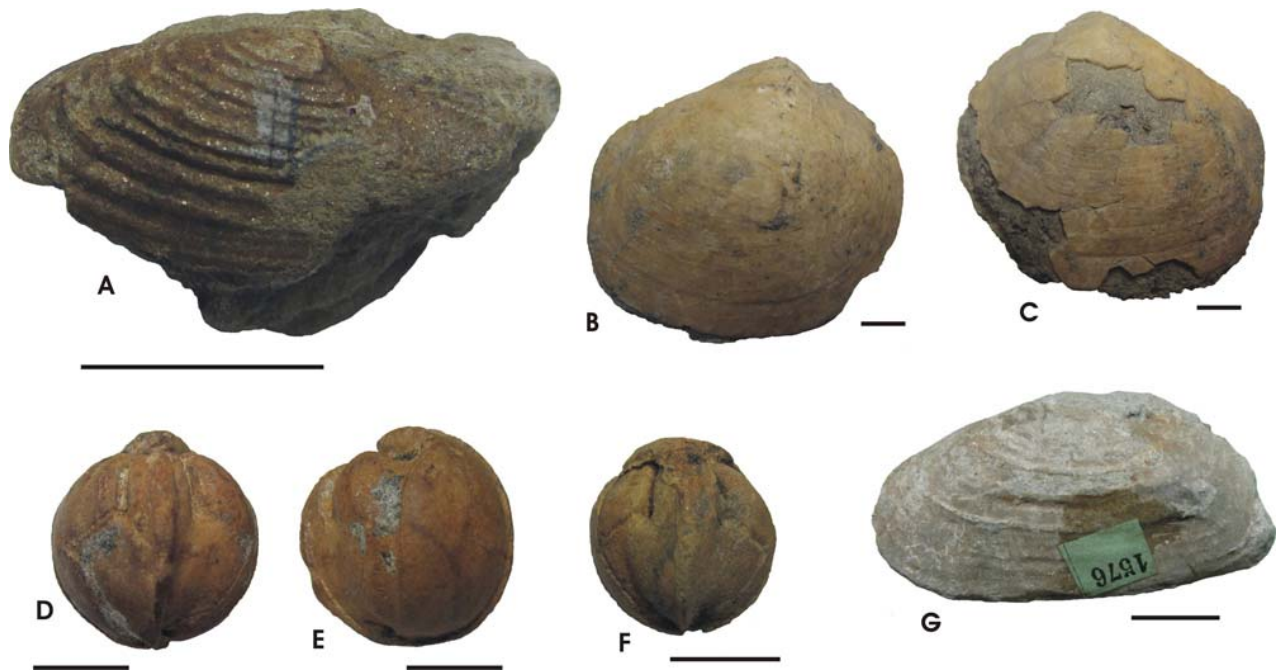


Figure 5: ROVERETO's bivalve taxa. Scale bars = 1 cm. A: *Abra rossii* nomen novum, 2018 - holotype, 1172/Sa-II-S 9. B-C: *Diplodonta alepis* ROVERETO, 1898 - holotype, 1181/Sa-II-S 18, right valve (B), left valve (C). D-E-F: *Jouannetia (Jouannetia) tournoueri* LOCARD, 1877 - lectotype, 2089bis/Sa-II-S 185 (D-E); paralectotype, 2089/Sa-II-S 185 (F). G: *Thracia stenochora* ROVERETO, 1898 - lectotype, 908/OV-III-C 1.

Sassello citizen that, although self-taught, significantly contributed to the exploration of prehistoric sites, especially the Ligurian ones, and made relevant collection of prehistoric artefacts.

This species is clearly different from any and all other *Abra* described from the Eocene - lower Miocene European basins, because of its bold sculpture.

Distribution: Oligocene: Sassello (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Superfamily Ungulinoidea GRAY, 1854

Family Ungulinidae GRAY, 1854

Genus *Diplodonta* BRONN, 1831

Diplodonta alepis ROVERETO, 1898

(Fig. 5.B-C)

1898 *Diplodonta alepis* ROVERETO, p. 60.

1900 *Diplodonta alepis* ROVERETO, ROVERETO, p. 110-111, Pl. VII, fig. 10.

1901 *Lucina* (?) *alepis* (ROVERETO), SACCO, p. 69, Pl. XVI, fig. 9.

1997 *Diplodonta alepis* ROVERETO, BONCI *et al.*, p. 44-45, Pl. 1, figs. 4a-b.

Type material: One double-valved shell, the original label has been lost, holotype (by monotypy) 1181/Sa-II-S 18.

Type locality: Sassello (SV), Molare Formation, Tertiary Piedmont Basin.

Description: Double-valved shell, the left valve is damaged, trapezoidal in shape with little, pro-

sogyrous umbos; small, narrow, lanceolate lunule. Anterior and ventral margins rounded, truncate posterior margin, cardinal margin straight. Dorsal angulation weak. Sculpture: fine growth lines. Size: L= 60.10 mm, H= 55.60 mm, C more inflated valve= 19.31 mm, EE= 0.93, CE= 0.35.

Remarks: *D. alepis* exhibits a general resemblance with *Diplodonta bezanconi* MEUNIER, 1880, *Diplodonta fragilis* BRAUN in SANDBERGER, 1853, *Diplodonta incerta* ARCHIAC, 1850, and *Diplodonta rotundata* (MONTAGU, 1803) - for comparisons see also RALTE (2012) and LOZOUET *et al.* (2015) - but clearly differs being larger and trapezoidal in outline and in having a straight cardinal margin.

Distribution: Oligocene: Sassello and Dego (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Order Myida STOLICZKA, 1870

Superfamily Pholadoidea LAMARCK, 1809

Family Pholadidae LAMARCK, 1809

Subfamily Jouannetiinae TRYON, 1862

Genus *Jouannetia* DESMOULINS, 1828

Subgenus *Jouannetia* DESMOULINS, 1828

Jouannetia (Jouannetia) tournoueri

LOCARD, 1877

(Fig. 5.D-F)

1877 *Jouannetia (Jouannetia) Tournoueri* LOCARD, p. 202, Pl. I, figs. 16-18.



1914 *Jouannetia avellanaria* ROVERETO, p. 162, Pl. VII, figs. 5-5a.

Type material: One double-valved, well preserved internal mould, 2089bis/Sa-II-S 185 (lectotype, here designated); one double-valved, moderately preserved internal mould, 2089/Sa-II-S 185 (paralectotype). The original labels have been lost.

Type locality: Sassello (SV), Molare Formation, Tertiary Piedmont Basin.

Remarks: Lectotype size: L= 15.00 mm, H= 16.00 mm, C= 15.00 mm, EE= 1.07, CE= 0.94. ROVERETO (1914) states that his species is closely related to *Jouannetia unguiculus* COSSMANN & LAMBERT, 1884. But ROVERETO's specimen clearly differs in shape, dimensions and morphology/dimension of the special lamina for attachment of posterior muscles. Conversely, their morphological features fully match those of *Jouannetia (Jouannetia) tournoueri* LOCARD, 1877; for a detailed description of the internal mould of this species refer to SORRENTINO (1931).

Distribution: Oligocene: Sassello (NW Italy), Molare Formation (Tertiary Piedmont Basin).

Order Pholadomyida NEWELL, 1965

Superfamily Thracioidea STOLICZKA, 1870

Family Thraciidae STOLICZKA, 1870

Genus *Thracia* LEACH in BLAINVILLE, 1824

***Thracia stenochora* ROVERETO, 1898**

(Fig. 5.G)

1898 *Thracia stenochora* ROVERETO, p. 66.

1900 *Thracia stenochora* ROVERETO, ROVERETO, p. 125, Pl. VII, fig. 21.

1901 *Thracia Bellardii* var. *stenochora* ROVR., SACCO, p. 135, Pl. XXVII, fig. 15.

1911 *Thracia stenochora* ROVERETO, BOUSSAC, p. 241, Pl. XV, fig. 41.

Type material: One mould, the original label states: "Collezione PERRANDO *Thracia stenochora* n.sp., N. 1976, Tagliolo", lectotype (here designated) 908/OV-III-C 1.

Type locality: Tagliolo (AL), Molare Formation, Tertiary Piedmont Basin (geographic and geologic information in LORENZ, 1969).

Description: One badly preserved double-valved mould (external mould of left valve, internal mould of right valve); trapezoidal in shape, slightly carenate, moderately inequilateral, with a little, pointed, slightly prosogyrous umbos. Posterior margin slanting straight and truncate, anterior margin rounded, ventral margin straight. Sculpture: unevenly distributed growth lines. Size: L= 43.89 mm, H= 22.52 mm, C LV= 5.82 mm, EE= 0.51, CE= 0.26.

Remarks: ROVERETO (1898, 1900) studied one specimen collected at Tagliolo (the lectotype here designated) and 2 specimens from Sassello (lost). This species was recorded as *Thracia (T.) stenochora* ROVERETO by DARGA (1990, p. 20, Eocene of Eisenrichterstein, Bavaria, Germany) and as *Thracia stenochora* ROVERETO by BAGLIONI MAVROS (1990, p. 258, lower Oligocene of Laverda, Veneto, NE Italy). The species is similar to *Thracia elongata* SANDBERGER, 1863, but differs in having a truncate posterior margin.

Distribution: Eocene: Chateaugarnier (SW France), "Nummulitique"; Eisenrichterstein, Bavaria, Germany. Oligocene: Tagliolo and Sassello (NW Italy), Molare Formation (Tertiary Piedmont Basin); Laverda, Veneto, NE Italy.

Conclusions

The new taxa of Oligocene molluscs described by ROVERETO have received a little attention in recent times, therefore these faunas are scarcely known if not forgotten and their systematic position need for a complete review. This paper deals with the revision and re-documentation of 22 taxa (6 gastropods and 16 bivalves) described by ROVERETO (1897, 1898, 1900, 1914). These fossils are from Santa Giustina and Sassello areas and are preserved in the BTP Collection housed at the Museo di Paleontologia, Dipartimento di Scienze della Terra, dell'Ambiente e della Vita (DISTAV), Università di Genova. The performed field surveys allowed to rediscover the majority of the collecting sites, which have been recognized as belonging to the Oligocene Molare Formation. As a result of this revision, 22 name-bearing types have been designated, one *nomen novum* (*Abra rossii*) has been assigned, and 3 bivalve and 3 gastropod taxa have been recognized as younger synonyms of other species. As regards the stratigraphic distribution, all the detected taxa are restricted to the Oligocene, except for *C. tongriana* and *O. (O.) meridionalis* that also occur in the Aquitanian and *C. gigantea*, *L. (P.) turgida* and *T. stenochora* which are already recorded in the Eocene time. A little more diversified in the paleogeographic distribution: *C. tongriana* and *O. (O.) meridionalis* are also present in NE Italy (Veneto), *C. gigantea* in SE France and NE Italy (Veneto), *L. (P.) turgida* in SW France, and *T. stenochora* in SW France, Bavaria and NE Italy (Veneto); the other species occur in the Tertiary Piedmont Basin only.

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