



Strobilopsid land snails (Gastropoda: Pulmonata, Strobilopsidae) from the late Messinian - Early Pliocene (?) of Balze di Caspreno (central Italy)

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KEY WORDS - Strobilopsids, *Eostrobilops*, *Strobilops*, Palaeontology, Neogene, Italy.

ABSTRACT - *Strobilopsids* are a group of pupilloidean pulmonate gastropods now occurring in the Americas, Southeast Asia and New Guinea. In Europe, a rich fossil record (several species in the genera *Eostrobilops* and *Strobilops*) is reported from the Middle Eocene to the Late Pliocene, but only two species have been recorded from Italy so far: *Eostrobilops patuliformis* (Sacco, 1886) and *E. aloisii* Manganelli, Delle Cave & Giusti, 1989, found in the Pliocene of Piedmont and Umbria. Fossil strobilopsids collected in Balze di Caspreno (Tuscany) lacustrine clays turned out to belong to two different species (*E. aloisii* and *Strobilops* cf. *romani* Wenz, 1915) one of which is recorded for the first time in Italy.

RIASSUNTO - [Strobilopsidi (Gastropoda: Pulmonata, Strobilopsidae) nel Miocene superiore - Pliocene inferiore (?) delle Balze di Caspreno (Italia centrale)] - Gli strobilopsidi, un gruppo di gasteropodi polmonati pupilloidei oggi viventi nelle Americhe, in Asia Indomalese e in Nuova Guinea, presentano una ricca documentazione fossile nel Terziario europeo (Eocene medio - Pliocene superiore), con numerose specie appartenenti a due generi distinti: *Eostrobilops* e *Strobilops*. In Italia, fino ad oggi, sono state segnalate solo due specie del genere *Eostrobilops*: *E. patuliformis* (Sacco, 1886) ed *E. aloisii* Manganelli, Delle Cave & Giusti, 1989, per il Pliocene del Piemonte e dell'Umbria. Lo studio del materiale riferibile agli strobilopsidi proveniente dalle argille lacustri delle Balze di Caspreno (tardo Messiniano - Pliocene basale) ha consentito di accertare, per la prima volta, anche la presenza del genere *Strobilops* nel Neogene italiano. Il materiale analizzato è stato, infatti, assegnato a due diverse specie: *E. aloisii* e *S. cf. romani* Wenz, 1915, quest'ultima segnalata per la prima volta nel nostro paese.

INTRODUCTION

Recent strobilopsids occur in the Americas, Southeast Asia and New Guinea. American species belong to the genus *Strobilops* Pilsbry, 1893 (18 species: 12 to the subgenus *Strobilops* s.s.; three to the subgenus *Discostrobilops* Pilsbry, 1928; two to the subgenus *Coelostrobilops* Pilsbry, 1931; one species to the subgenus *Nesostrobilops* Pilsbry, 1931) and occur from northern Mexico to northern South America, including the West Indies and the Galapagos. Asian and New Guinea species belong to the genera *Eostrobilops* Pilsbry, 1928 (7 species from Japan, Korea, China and Borneo) and *Enteroplax* Gude, 1899 (6-7 species from Taiwan, the Philippines, Sulawesi and New Guinea) (Pilsbry, 1927-1934, 1948; Morrison, 1953; Solem, 1967; Miller & Christensen, 1980; Minato & Tada, 1992; Vermeulen, 1992a, b; Matsumura & Minato, 1998).

Fossil species date back to the early Tertiary of Europe, doubtfully the Late Cretaceous of China, the Late Pliocene of North America and the Late Cretaceous - Early Palaeocene of South America (Baker, 1938; Bartha & Soos, 1955; Steklov, 1961, 1966; Ho & Leonard, 1961; Krumbiegel, 1962; Yen, 1969; Schlickum, 1970; Ferreira & Dos Santos Coelho, 1971; Yü & Wang, 1977; Yü et al., 1982; Yü & Zhang, 1982; Wang, 1982; Manganelli et al., 1989; Karnekamp, 2000).

The most ancient European records are from the Middle Eocene of Eastern Germany, while several other

species have been reported from the Late Eocene of France, England and Germany. Three different groups of species, probably corresponding to present-day *Eostrobilops*, *Strobilops* (s.s.), and *Strobilops* (*Discostrobilops*) (Pilsbry, 1927), originated from these ancestral species and lived in various parts of Europe until the Late Pliocene (Wenz, 1915, 1919, 1932; Stworzewicz, 1999; Esu & Ciangherotti, 2004).

Only two species, both assigned to *Eostrobilops*, have been recorded in Italy: *E. patuliformis* (Sacco, 1886) from the early Middle Pliocene of Piedmont and *Eostrobilops aloisii* Manganelli, Delle Cave & Giusti, 1989 from the early Middle Pliocene of Piedmont and Umbria and the early Late Pliocene of Umbria (Manganelli et al., 1989; Esu & Ciangherotti, 2004).

New material collected in Balze di Caspreno (Tuscany) turned out to belong to two different species (*E. aloisii* and *S. cf. romani* Wenz, 1915), one of which is recorded for the first time in Italy.

GEOLOGICAL SETTING

The Siena Basin (Fig. 1) is one of the Neogene-Quaternary basins of the Northern Apennines, a fold-thrust chain formed during the Tertiary in response to interactions between the Adria and Corso-Sardinian microplates (Carmignani et al., 2001 and references therein). The structural origin of these basins is still

Pliocene, fluvio-lacustrine and marine sedimentation, from “peripheral basins” which only experienced continental sedimentation of Middle Pliocene-Pleistocene age.

Sedimentation in the Siena Basin started in the Late Miocene (Tortonian) with fluvio-lacustrine deposits, now exposed only in limited western marginal areas. Their correlatives are widely exposed in the nearby Casino Basin, which was the northern extension of the Siena Basin during the Miocene (Lazzarotto & Sandrelli, 1977; Bossio et al., 2000). There, the Upper Miocene succession consists of conglomerates, clays and marly clays with interbedded sandstones, concluding with upper Messinian continental, grey silty-marly clays with lenses of lignite (Argille del Casino Fm: Bossio et al., 2000). Conversely, Pliocene deposits crop out extensively in the Siena Basin and overlay both upper Messinian sediments and pre-Neogene successions. The Pliocene

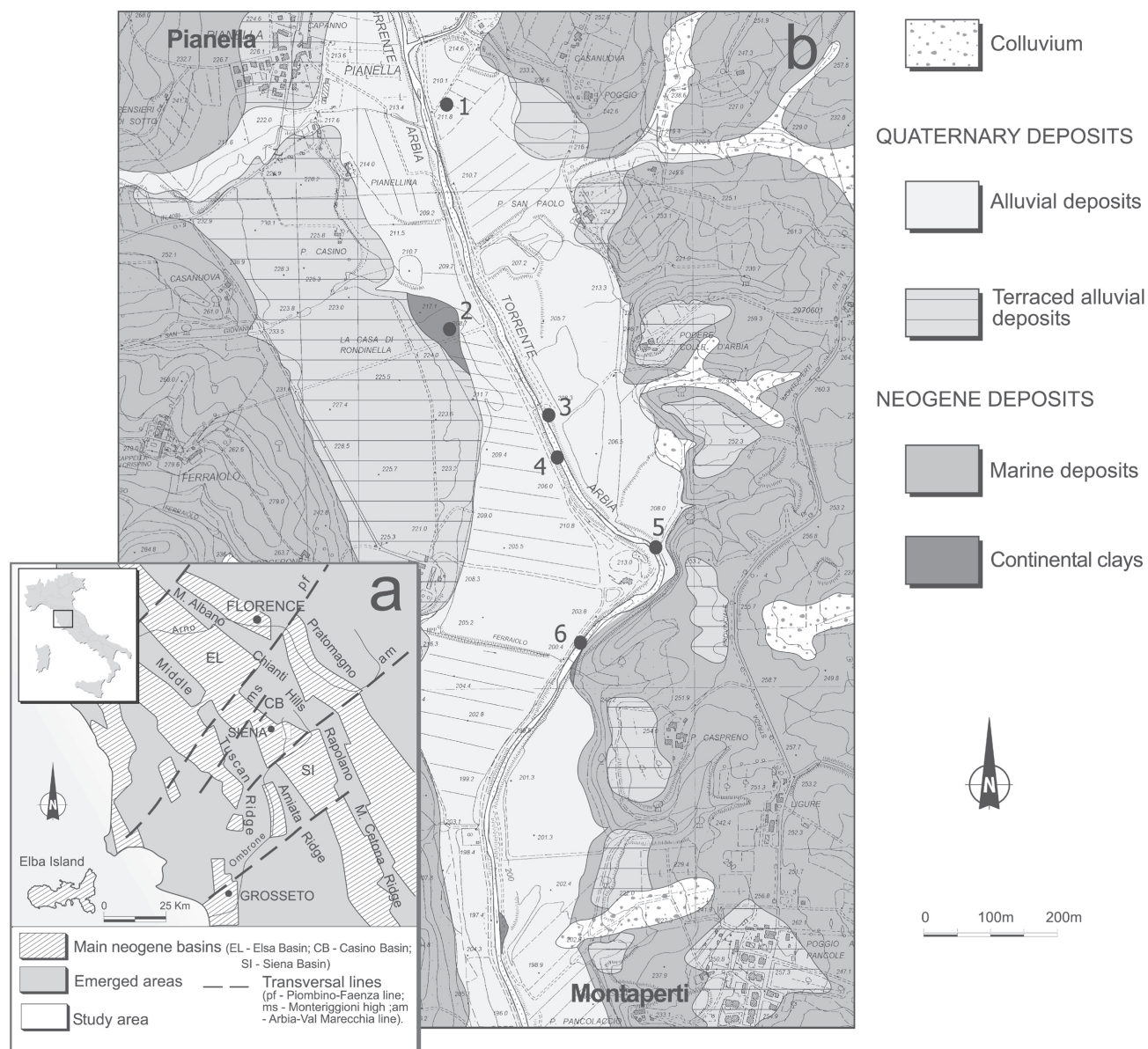


Fig. 1 - a) Structural setting of southern Tuscany. b) Geological sketch of the Montaperti-Pianella area. Numbers (1-6) indicate sites where fossiliferous clays were sampled during the 1990s (cf. Tab. 1). Most of these outcrops are now covered by recent alluvial deposits, vegetation or dumped rubble.

succession consists of Zanclean-Piacenzian dominantly marine deposits (Bossio et al., 1992), represented by coastal sands and conglomerates which pass basinward to open marine, offshore silty clays bearing turbiditic sands (Gandin & Sandrelli, 1992). Locally, fluvial sandy conglomerates and floodplain silty clays represent the lowermost part of the Pliocene succession (Aldinucci et al., 2007). Offshore silty clays are sealed by Piacenzian shallow marine sands manifesting the marine regression that led to emergence of all the Tuscan Pliocene “central basins” (Bossio et al., 1993). Evolving fluvial networks and local uplift of the eastern basin margin (Magi, 1992) gave rise to thin and discontinuous sandy-gravely Quaternary alluvial deposits, resting unconformably on Neogene sediments and locally terraced.

Along the Arbia River (Montaperti-Pianella area, east of Siena; Fig. 1), grey clays with intervening centimetre-thick lenses of lignite crop out in small, scattered outcrops. These clays represent the oldest part of the exposed Neogene succession, are overlain by Zanclean-Piacenzian marine sands and contain non-marine gastropods indicative of a continental setting. They were recently assigned to the upper Messinian Argille del Casino Fm (Carta Geologica d'Italia, scala 1:50000, Foglio 297 - Asciano; APAT, in press) based on overall stratigraphic framework and strong lithological similarities (e.g. the lignite horizons). However, biostratigraphic constraints are few and an Early Pliocene age therefore cannot be ruled out.

STROBILOPSIDS FROM BALZE DI CASPRENO

Strobilops cf. *romani* Wenz, 1915
Pl. 1, figs. 5-7

Material examined - Some shell fragments from sites 2 and 6 (G. Manganelli collection, Dipartimento di Scienze Ambientali, Università di Siena).

Remarks - Although this species is only represented by very fragmentary material, that available enables a tentative determination.

About twelve species of *Strobilops* have been described from the European Neogene: *Strobilops costata* (Clessin, 1877), *S. govorkaensis* Gozhik & Prisyazhnyuk, 1978, *S. joossi* (Gottschick, 1911), *S. labyrinthica* (Michaud, 1855), *S. menneri* Gozhik & Prisyazhnyuk, 1978, *S. pachychila* Soós in Bartha & Soós, 1955, *S. romani* (Wenz, 1915), *S. steklovi* Gozhik & Prisyazhnyuk, 1978, *S. tiarula* (Sandberger, 1886), *S. ukrainica* Steklov, 1966, *S. ukrainicaeformis* Gozhik & Prisyazhnyuk, 1978, and *S. vanderdussenii* Karnekamp, 2000 (Wenz, 1915, 1923; Steklov, 1966; Schütt, 1967; Schlickum, 1970, 1979; Gozhik & Prisyazhnyuk, 1978; Lueger, 1981; Stworzewicz, 1999; Karnekamp, 2000). A further species, *S. sandbergeri* (Lomnicki, 1886), though listed as distinct by Wenz (1923), is regarded by him as probably identical to *S. costata*.

The *Strobilops* from Balze di Caspreno has a medium-sized umbilicus and a short columellar lamella, a very short to short first basal plica, a long second basal plica and a long to very long third basal plica (Pl. 1, figs. 5-7). It is therefore unrelated to species such as *S. govorkaensis*, *S. labyrinthica*, and *S. ukrainicaeformis*, which have more than three basal plicae (Wenz, 1915; Gozhik & Prisyazhnyuk, 1978). Other species usually have three basal plicae, but due to lack of information and the variability of their pattern (at least in some species), detailed comparison is difficult. *S. costata*, *S. joossi*, *S. menneri*, *S. sandbergeri*, *S. steklovi*, and *S. tiarula* seem to have a very short first basal plica and a very short to short second basal plica; moreover some of these species also have a wide (*S. steklovi*) or a very small (*S. joossi* and *S. tiarula*) umbilicus (Wenz, 1915; Gozhik & Prisyazhnyuk, 1978; Lueger, 1981; Stworzewicz, 1999). *S. pachychila* has a short first basal plica, and long second and third basal plicae, but with second longer than third (Pl. 1, figs. 1-2; Schlickum, 1970, 1979). *S. romani*, *S. ukrainica*,

Sites	References (Gauss Boaga)	Notes
site 1	X = 1696266 Y = 4802677	exposed about 100 m from left bank of Arbia River, below ground level during quarrying in early 1990s; now covered by dumped rubble
site 2	X = 1696279 Y = 4802046	exposed on slope about 200 m from right bank of Arbia River
site 3	X = 1696549 Y = 4801812	exposed along left bank of Arbia River in early 1990s; now covered by recent alluvial deposits and vegetation
site 4	X = 1696551 Y = 4801725	exposed along right bank and on bed of Arbia River in early 1990s; now covered by recent alluvial deposits and vegetation
site 5	X = 1696885 Y = 4801399	exposed along left bank of Arbia River
site 6	X = 1696671 Y = 4801154	exposed along right bank of Arbia River in early 1990s; now covered by recent alluvial deposits and vegetation

Tab. 1 - Main collecting sites of the non-marine molluscs of the lacustrine grey clays of Balze di Capreno (Fig. 1).

and *S. vanderdussenii* have a short first basal plica, a long second basal plica and a very long third basal plica; two of them (*S. ukrainica* and *S. vanderdussenii*) also have a very small umbilicus (Wenz, 1915; Steklov, 1966; Karnekamp, 2000). The species that seems most similar to the *Strobilops* of Balze di Caspreno is therefore *S. romani* by virtue of its medium-sized umbilicus and pattern of the basal plicae.

S. romani is relatively unknown: since its description it has only been recorded a few times and is only known from the Early Pliocene of Hauterive (France) (Wenz, 1923; Truc, 1971; Esu, 1999). However, most Neogene European *Strobilops* species have been described rather summarily and a thorough revision is needed. Until then, we will do not give more detailed remarks.

This finding is the first report of a species of *Strobilops* from the Italian Neogene.

Eostrobilops aloisii Manganelli, Delle Cave & Giusti,
1989
Pl. 1, figs. 3-4, 8

Material examined - An almost entire but crushed shell from site 6 and some shell fragments from sites 2 and 6 (G. Manganelli collection, Dipartimento di Scienze Ambientali, Università di Siena).

Remarks - This species is represented by very fragmentary material that we assigned to *E. aloisii* based on the short palatal plica located about a quarter of a whorl inside the aperture (Pl. 1, fig. 8). *E. aloisii* (Pl. 1, figs 3-4) has been described from the early Late Pliocene of Dunarobba Fossil Forest and subsequently reported from other outcrops in central and northern Italy dating back to Middle Pliocene (Manganelli et al., 1989; Esu & Ciangherotti, 2004).

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EXPLANATION OF PLATE I

figs. 1-2 - *Strobilops pachychila* Soós in Bartha & Soós, 1955.

- 1 - A shell from the Late Miocene of Öcs (Hungary); Senckenberg-Museum, Frankfurt am Main, Germany, no. 245835. Note shell shape in a *Strobilops* species.
- 2 - A shell from the Late Miocene of Eichkogel (Austria); Senckenberg-Museum, Frankfurt am Main, Germany, no. 245838. Note the pattern of basal plicae in a *Strobilops* species.

figs. 3-4 - *Eostrobilops aloisii* Manganelli, Delle Cave & Giusti, 1989.

- 3 - A shell with palatum from the early Late Pliocene of the Fossil Forest of Dunarobba (Italy); G. Manganelli collection, Dipartimento di Scienze Ambientali, Università di Siena.
- 4 - A shell fragment with palatum from the early Late Pliocene of the Fossil Forest of Dunarobba (Italy); G. Manganelli collection, Dipartimento di Scienze Ambientali, Università di Siena.

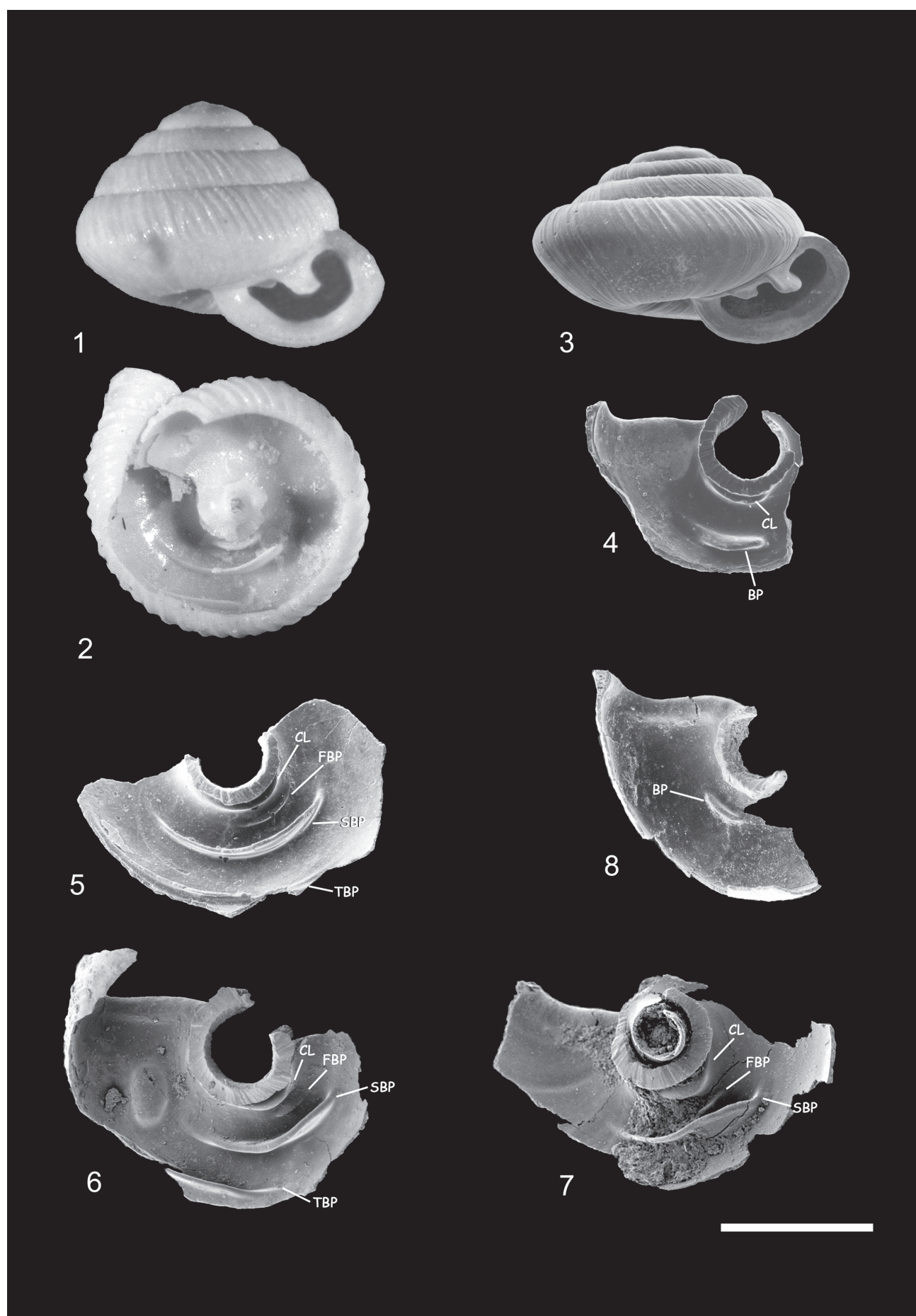
figs. 5-7 - *Strobilops* cf. *romani* Wenz, 1915.

- 5 - A shell fragment with palatum from Balze di Caspreno; G. Manganelli collection, Dipartimento di Scienze Ambientali, Università di Siena.
- 6 - A shell fragment with palatum from Balze di Caspreno; G. Manganelli collection, Dipartimento di Scienze Ambientali, Università di Siena.
- 7 - A shell fragment with palatum from Balze di Caspreno; G. Manganelli collection, Dipartimento di Scienze Ambientali, Università di Siena.

fig. 8 - *Eostrobilops aloisii* Manganelli, Delle Cave & Giusti, 1989.

- One shell fragment with palatum from Balze di Caspreno; G. Manganelli collection, Dipartimento di Scienze Ambientali, Università di Siena.

Acronyms: FBP first basal plica, CL columellar lamella, BP basal plica, SBP second basal plica, TBP third basal plica. Scale bar = 1 mm.



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