**Staurodon cianfanellianus** n. sp. (Gastropoda Pulmonata), a new nesopupine vertiginid snail from the Middle-Late Pliocene Fossil Forest of Dunarobba (central Italy)

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**INTRODUCTION**

The finding of the Pliocene Fossil Forest of Dunarobba was one of the most exceptional palaeontological events in Italy in the 20th century. The forest consists of about fifty large trunks (2-8 m in circumference and up to 10 m in height), almost in life upright position, attributed to *Taxodioxylon gypsaceum*, as classified on the basis of the wood structure (Biondi & Brugiapaglia, 1991) and to *Glyptostrobus europaeus* on the basis of cones and seeds found in the sediment (Martinetti, 1994). Both are Tertiary taxodiaceous species of swamp environments and humid warm-temperate climates (Ambrosetti et al., 1995).

A rich fossil snail assemblage consisting of about twenty species, some of great palaeontological and biogeographical interest, was collected in the clay encrusting the trunks (Manganelli et al., 1989, 1990; Esu & Grottoli, 1991; Esu et al., 1993; Ambrosetti et al., 1995; Manganelli & Giusti, 2000). Only five species have been investigated in detail: *Eostrobilops alosii* Manganelli, Delle Cave & Giusti, 1989, *Leiostyla cf. gottschicki* (Wenz, 1922), *Lauria cf. cylindracea* (Da Costa, 1778), *Gastrocopta (Albinula) acuminata* (Klein, 1846) and *G. (Vertigoopsis) moravica* (Petrbok, 1959) (Manganelli et al., 1989, 1990; Manganelli & Giusti, 2000). This contribution concerns a new species of the nesopupine vertiginid *Staurodon* Lowe, 1852, a genus never previously found outside Madeira. This species was preliminarily reported as *Truncatellina* n. sp. by Gliozzi et al. (1997).

**DESCRIPTION OF THE SPECIES**

*Staurodon cianfanellianus* n. sp.

Pl. 1, figs. 1-11

*Diagnosis* - A species of nesopupine vertiginid *Staurodon* (?) differing from Recent Madeiran *S. seminulum* by virtue of its more elongate shape, its lower, more robust lamellae and plicae, its longer angular lamella (only a tooth-like lamella joined to upper vertex of peristome in *S. seminulum*) and its more reflexed peristome.

*Description* - Shell (Pl. 1, figs. 1-10) dextral, very small in size, cylindrical to ovate-cylindrical in shape with about four to five moderately convex whorls separated by deep sutures; last whorl about half shell height; umbilicus small, slit-like; aperture square, about one third of shell height, with thick parietal callus and five lamellae.
and plicae: very short angular lamella, starting near outer end of parietal lamella and ending tooth-like joined to upper vertex of peristome; short, straight, high parietal lamella; tooth-like columellar lamella; two very short palatal plicae; peristome thick, well reflexed; protoconch finely malleated; teleoconch with strong but rather irregular prosocline ribs, intersected by very irregular spiral grooves more evident in upper portion of whorls.

**Dimensions (n: 20) -** Shell height: 1.95 ± 0.07 mm; shell width: 1.01 ± 0.04 mm; aperture height: 0.70 ± 0.04 mm; aperture width: 0.65 ± 0.02 mm.

**Type locality and horizon -** “Fossil Forest of Dunarobba”, in massive Middle-Uperr Pliocene clay encrusting the Trunk 15V. Fornace Briziarelli, Dunarobba, (Avigliano Umbro, Terni; Sheet 130 of the Geological Map of Italy).

**Type material -** Holotype (Pl. 1, fig. 2), G. Manganelli & L. Delle Cave leg. 22.2.1988 (Giusti & Manganelli collection, Dipartimento di Scienze Ambientali, University of Siena, no. 36931); 115 paratypes (55 whole shells and 60 fragmented shells), G. Manganelli & L. Delle Cave leg. 22.2.1988 (Giusti & Manganelli collection, Dipartimento di Scienze Ambientali, University of Siena, no. 36932); 51 paratypes (whole shells), F. Giusti, G. Manganelli & L. Delle Cave leg. 5.5.1990 (Giusti & Manganelli collection, Dipartimento di Scienze Ambientali, University of Siena, no. 36933); 19 paratypes (whole shells, Esu & Girotti collection, Palaeontological Museum of University “La Sapienza” of Rome, MPUR7 nos. 1283/1-1284/1-1285/1-1286/1-1288/15).

**Derivation of name -** The new species is named after Simone Cianfanelli of the Museo di Storia Naturale, Florence University (Italy), as a token of friendship and esteem for his many and important contributions to the study of non-marine molluscs.

**Remarks -** Among pupilloidean vertiginid snails, the new species shows evident similarity in shell shape to the species of *Truncatellina* Lowe, 1852 (type species: *Pupa linearis* Lowe, 1852). However, no species of the Palaearctic and Afrotropical *Truncatellina* have similar apertural barrier structure, especially the angular lamella joined to the upper vertex of the peristome and the two palatal plicae. Indeed *Truncatellina* species have up to three denticles (one parietal, one columellar and one deep-set palatal) (Pilsbry, 1920a, b; Zilch, 1959; Pokryszyko, 1990).

In shell shape and structure of the apertural barrier, the new species also recalls certain forms of the aberrant Nearctic vertiginid *Vertigo californica* (Rowell, 1861) but it is again distinguished by the angular lamella joined to the upper vertex of the peristome. In all species of *Vertigo Müller*, 1773 (type species: *Vertigo pusilla* Müller, 1774), including *V. californica*, the angular lamella is absent, or, if present, it does not reach the upper vertex of the peristome (Pilsbry & Cooke, 1919a: 70; Pilsbry, 1948: 943). The structure of the apertural barrier (with an angular lamella joined to the upper vertex of the peristome) of the new species matches that of vertiginids traditionally assigned to the subfamily Nesopupiniae Steenberg, 1925 (type genus: *Nesopupa* Pilsbry, 1900) (cf. Zilch, 1959). This subfamily is an assemblage of about twenty genus-group taxa, the monophyly and inclusion in the vertiginids of which have been questioned (Pokryszyko, 1990: 137-138). As currently conceived (differences exist in the taxa included, cf. Pilsbry, 1935; Zilch, 1959; Schileyko, 1998), the Nesopupines include minute, diverse, mainly tropical and subtropical, almost cosmopolitan (only absent from mainland Palaearctic), vertiginid land snails. Those that are anatomically known have some features in common (penis with penial appendix and penial retractor branched; Pilsbry, 1935: xi; 1948: 1006; Baker, 1935: 192). Among them, the genus that best recalls the new species from Dunarobba is the monospecific Madeiran *Staurodon Lowe*, 1852 (type species: *Pupa saxicola* Lowe, 1852; *P. saxicola*, a junior primary homonym, was replaced by *P. seminulum* Lowe, 1852). We therefore assigned the new species to *Staurodon* on the basis of its overall similarity to the Madeiran species in shell and apertural armature structure. *S. cianfaneliana* differs from the Recent species by virtue of its more elongate shape, its lower, more robust lamellae and plicae, its longer angular lamella (only a tooth-like lamella joined to upper vertex of peristome in *S. seminulum*) and its more reflexed peristome. We are aware that inclusion of the new species in *Staurodon* is tentative due to taxonomic and systematic uncertainty and frequent character homoplasy in this group of land snails (Pokryszyko, 1994). However, besides being the nesopupine morphologically most similar to the Dunarobba species, *Staurodon* is also the closest geographically.

Despite these uncertainties, the finding of a nesopupine vertiginid in the European Pliocene is very interesting. In the western Palaearctic, fossil nesopupines, allegedly related to the Indomalayan *Indopupa* Pilsbry & Cooke, 1920 (type species: *Pupa filosa* Theobald & Stolicka, 1872), are only known from

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**EXPLANATION OF PLATE 1**

figs. 1-11 - *Staurodon cianfaneliana* n. sp.; Shells from trunk 15V of Middle-Late Pliocene Fossil Forest of Dunarobba.

1 - Holotype (Giusti & Manganelli collection, Dipartimento di Scienze Ambientali, University of Siena, no. 36931). Scale bar = 1 mm.

2-10 - Paratypes (Giusti & Manganelli collection, Dipartimento di Scienze Ambientali, University of Siena, no. 36932). Scale bar = 1 mm.

11 - Paratype, detail of aperture (Giusti & Manganelli collection, Dipartimento di Scienze Ambientali, University of Siena, no.36932). Acronyms: AL angular lamella, CL columellar lamella, PL parietal lamella, PP palatal plica. Scale bar = 0.5 mm.
the Late Oligocene to the early Late Miocene: *Nesopupa blumi* (Boettger, 1884) and *Nesopupa trigonostoma* (Sandberger, 1863) (Pilsbr & Cooke, 1920; Wenz, 1923). Two other European fossil species were assigned to *Nesopupa: Pupa priscilla* Paladilhe, 1875 and *Vertigo minor* Boettger, 1870 (Pilsbr & Cooke, 1920; Stowrzewicz, 1999), but the former is actually a species of *Leiostyla* Lowe, 1852 (type species: *Pupa vincta* Lowe, 1852) (Pupilidae) (Wenz, 1923) and the other could be a species of *Vertigo*. Stowrzewicz (1999) assigned it to *Nesopupa* on the basis of teleconch whorl sculpture (pitted-granulated sculpture associated with proscolline ribs), but aperture features bear a striking resemblance to those of *Vertigo antivertigo* Müller, 1774 (aperture heart-like with deep palatal scar; high rib bordering the columellar and palatal margins of the aperture internally).

The relationships of *Staurodon* are obscure. The only significant notions are from H.A. Pilsbr’s classical monograph on pupilloidean snails in the Manual of Conchology (cf. Pilsbr & Cooke, 1919b: 224; 1920: 225-226). He assigned this genus to the family Vertiginidae, placing it after some Tertiary genera of doubtful affinities, such as *Glândicula* Sandberger, 1874, *Enneopupa* Boettger, 1889, and *Pseudelix* Boettger, 1889, and before the recent Hawaiian *Lypopupa* Pilsbr, 1900. Pilsbr also surmised that some of its characters (“emergence of the angular lamella and its union with the outer lip”) could be ancestral since they were found in the Vertigininae and other subfamilies, such as the Gastrocoptinae, whereas another character, “the strong parietal callus” was “doubtless a later development”, shared by many snails of arid regions. Pilsbr concluded that “the genus has probably existed on Madeira since the early Tertiary, as it appears to have no near relatives in the European series from the Oligocene on”.

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