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New specimens of *Prenantia cheilostoma* (Manzoni) from the Pliocene of Castell'Arquato area (Western Emilia Region, N Italy).

(Bryozoa Gymnolaemata Cheilostomata Smittinidae)

Abstract

At present no type-material of *Lepralia cheilostoma* Manzoni is known to exist and Manzoni did not mention the exact location where he collected the species in Castell'Arquato area (Piacenza Province, N. Italy), as a result designation of a neotype from topotypes is difficult. Researches were done to find topotypes of *Prenantia cheilostoma* in Pliocene sediments, cropping out close to Castell'Arquato, to make possible the designation of a neotype. These researches permitted to collect specimens of this species in two Pliocene outcrops, in the Monte Oliveto section in Ongina Valley (Vernasca district, Piacenza Province), Zanclean (Early Pliocene) in age, and in the Monte Padova section in Arda Valley (Castell'Arquato district, Piacenza Province), Piacenzian (Late Pliocene). Besides, specimens of the species were found also in Early Pleistocene sediments, cropping out in riverbed of the Arda River at Castell'Arquato. However, since *P. cheilostoma* specimens have been found in two Pliocene outcrops of different age, it is almost impossible to define which specimens from the two outcrops can be regarded as topotypes. First zooecia of the younger Pliocene colonies from Castell'Arquato area seem to have a zooecial feature rather different from that of peripheral zooecia of older colonies, but, in a large Pleistocene colony late in astogeny, the two features were found together, so it can be inferred that both features pertain to the same species. A description of the two zooecial feature kinds and the more general one of the species are given. No fairly complete colony has been collected in the two Pliocene outcrops; it is thus unsuitable to designate a neotype with a colony fragment and without knowing where Manzoni collected his type material.

Key words: Bryozoa, Cheilostomata, Smittinidae, *Prenantia cheilostoma*, Pliocene, Pleistocene, Mediterranean.

Riassunto

[Nuovi esemplari di *Prenantia cheilostoma* (Manzoni) (Bryozoa Cheilostomata) provenienti dal Pliocene di Castell'Arquato (Emilia occidentale)]
Il materiale tipo di *Lepralia cheilostoma*, raccolto da Manzoni nella zona di Castell'Arquato, risulta essere andato disperso e purtroppo l'autore nel suo lavoro non menzionò l'ubicazione dell'affioramento pliocenico, in cui l'esemplare descritto era stato trovato. La necessità di istituire un neotipo ha indotto ad eseguire ricerche negli affioramenti pliocenici sparsi intorno a Castell'Arquato, per trovare dei topotipi di *Prenantia cheilostoma* (Manzoni) e così eventualmente poter istituire un neotipo. Queste indagini hanno permesso di trovare la specie in due affioramenti pliocenici, nella sezione di Monte Oliveto nel Comune di Vernasca (PC), Zancleano (Pliocene inferiore), e in quella di

Monte Padova nel Comune di Castell'Arquato (PC), Piacenziano (Pliocene superiore), inoltre anche alcuni altri esemplari sono stati trovati in sedimenti del Pleistocene inferiore affioranti nell'alveo del torrente Arda a Castell'Arquato. Purtroppo la presenza della specie nei due affioramenti pliocenici di diversa età non permette di stabilire quali sono gli esemplari che potrebbero essere considerati i topotipici. Visionando solo i frammenti di colonia rinvenuti negli affioramenti pliocenici, gli zooeci di colonie neanastiche sembrano avere una fattura abbastanza diversa da quella degli zooeci periferici di colonie nello stadio a sviluppo più maturo. Il reperimento di una colonia pleistocenica abbastanza matura astogeneticamente, che insieme a zooeci efebici possiede anche una serie di zooeci neanici, ha permesso di stabilire che le due sembianze zooeciali appartengono ad un'unica specie. Si è fatta anche una descrizione della specie evidenziando le differenze esistenti fra i giovani zooeci di colonie neanastiche e zooeci di quelle gerontastiche. Il mancato ritrovamento nei sedimenti dei due affioramenti pliocenici di almeno una colonia abbastanza completa ed estesa, ha sconsigliato di proporre un neotipo per questa specie, rimandando la designazione a quando si sarà trovato un esemplare adatto allo scopo e sarà stabilito, con buona approssimazione, in quale affioramento il tipo della specie può essere stato raccolto da Manzoni.

Introduction

Investigations, aimed at collecting topotypes of *Prenantia cheilostoma* (Manzoni) in Pliocene sediments cropping out in Castell'Arquato area (Piacenza Province, N Italy), have permitted to find specimens of this species, instituted by Manzoni (Manzoni, 1869c), in sedimentary layers of two Pliocene outcrops. Further researches, done in Pleistocene sediments, yielded specimens of the species from an Early Pleistocene outcrop too. Manzoni (Manzoni, 1869c) did not mention the exact location, where the type of *Lepralia cheilostoma* has been collected, but reported "Castell'Arquato (Pliocene)" generically, and in the present day no type-specimen of this species is known to exist. In Pliocene sediments cropping out in Castell'Arquato area, specimens of *P. cheilostoma* have been found in two outcrops, in the Monte Oliveto section, Zanclean (Early Pliocene) in age, and Monte Padova section, Piacenzian (Late Pliocene, after new subdivision of the Neogene, by ICS in 2009). In these two Pliocene outcrops and in that of the Pleistocene the species is little frequent to rather rare. In Castell'Arquato area, Pliocene specimens of *P. cheilostoma* were already found by Poluzzi (Poluzzi, 1975) who collected colonies of this species in the Piacenzian Monte Falcone section, which crops out around to 1 km north-east of the Monte Padova section. In the three Pliocene outcrops, Zanclean Monte Oliveto section and Piacenzian Monte Padova and Monte Falcone sections, a lot of species, instituted by Manzoni (Manzoni, 1869a, 1869b, 1869c, 1870) upon type specimens from Castell'Arquato area, can occur (personal data); Manzoni might perhaps have collected bryozoans in all of the three above-mentioned Pliocene outcrops. As a result it is very difficult or impossible to infer where type-material of *L. cheilostoma* was collected by Manzoni in Castell'Arquato area. Without possessing complete adult colonies, but only with few and small zoarium fragments like those collected in the two Pliocene outcrops, in these Pliocene populations of *P. cheilostoma* there would seem to exist two different either forms or subspecies or species. This is due to the fact that zooecia of the younger colonies show a zooecial feature rather different

from that of peripheral zooecia of colonies in later ontogenetic and astogenetic stages. But to confront the fragments of the Pliocene colonies, together with one of the almost complete ones collected in Pleistocene sediments, permits to state the two different zooecial features belong to only one species.

Sample location, age and stratigraphic setting

The specimens of *P. cheilostoma* under study were collected in three outcrops:

1) Monte Oliveto section in Ongina Valley, Vernasca district (Piacenza Province, N Italy), around 3 km south of Castell'Arquato. The whole section is referred to Monte Oliveto unit (Roveri et al., 1998) which is part of the Lugagnano Formation ("Argille di Lugagnano" of Laureri, Petrucci and Venzo, in the official geologic map, Boni et al., 1971) (Monegatti et al., 2001). Its age is Zanclean (Early Pliocene), within planktonic foraminifer biozone MPl3 (after Cita, 1975, emend.) and calcareous nannoplankton biozones MNN13 and MNN14-15 (after Rio et al., 1990), (Cauquil et al., 1992, Monegatti et al., 2001). Specimens of the species were found in a layer cropping out in the upper part of the section; this layer is around 31 m above the base of a sandy, yellowish, and glauconitic layer. In this sedimentary section the yellowish glauconitic layer can locally be of use as guide layer in the high part of the section. The sedimentary layer in which *P. cheilostoma* is present is 25 to 30 cm thick, consists of muddy silt and is abundant in bioclasts; its sediments had to be of shallow circalittoral environment (around 40-60 m deep) (Cauquil et al., 1992; personal data, assumed by associated foraminiferal fauna and zoarial growth forms of bryozoans).

2) Monte Padova section, in Arda Valley, Castell'Arquato district (Piacenza Province, N Italy), around to 2.5 km south-west of Castell'Arquato. Sedimentary layers cropping out in the lower part of the section were thought by Rio et al. (1988) and Raffi et al. (1989) to belong to the "Argille di Lugagnano", but today are referred to the Upper Montezago unit (Roveri et al., 1998) of the Castell'Arquato Formation ("Formazione di Castell'Arquato" Laureri and Petrucci, in the official geologic map, Boni et al., 1971) as in Monegatti et al. (2001). Those superposed to them are thought to belong to the Monte Giogo unit (Roveri et al., 1998) of the Castell'Arquato Formation (Monegatti et al., 2001) (see "il-piacenziano", 2008). The entire Monte Padova section is Piacenzian (Late Pliocene) in age (Rio et al., 1988; Raffi et al., 1989). Monte Giogo, Monte Padova and Monte Falcone sections, all cropping out on the left side of Arda Valley between Lugagnano Val d'Arda and Castell'Arquato (see: Barbieri, 1967; Colalongo et al., 1972; Poluzzi, 1975; Rio et al., 1988; Raffi et al., 1989; "il-piacenziano", 2008), are outcrops of the same sedimentary layers and a number of these layers can have some lateral facies variation. As a result most or all of sedimentary layers cropping out in Monte Falcone section are coeval with those of Monte Padova section. Specimens of the species have been collected from the layers interbedded between the First and Second Monte Giogo Biocalcarenites of Raffi et al. (1989) and the Second Monte

Giogo Biocalcarenite is included too. These layers crop out in the lower part of the Monte Giogo unit (Monegatti et al., 2001) and are stratigraphically within planktonic foraminifer biozone MPl5a (after Cita, 1975, emend.) and calcareous nannoplankton biozone MNN16a (after Rio et al., 1990), (Rio et al., 1988; Raffi et al., 1989; Monegatti et al., 2001). They consist of silt or muddy silt, often with abundant bioclasts and had to be of shallow circalittoral environment (around 50-70 m deep), rich in vegetation and with some episodes of low oxygenation (Rio et al., 1988).

3) Riverbed of the Arda River, at Castell'Arquato, around 260 m downstream from the bridge crossing the Arda River in the village of Castell'Arquato (see Ceregato et al., 2003). Specimens of the species have been collected in two layers, one under and the other above a yellowish calcarenitic layer abundant in pectinids (Mollusca: Bivalvia: Pteriina) and other molluscs. The inspected sediments are interpreted to have formed in an infralittoral environment and are Calabrian in age (Early Pleistocene, after new subdivision of the Quaternary, by ICS in 2009), within planktonic foraminifer biozone MPle1 (after Lourens et al., 2004) (see Dominici, 2001, 2004). In this sedimentary series cropping out in the Arda riverbed, specimens of *Arctica islandica* (Linnaeus) (Mollusca: Bivalvia, a 'Boreal Guest') first occur around 43 m above the yellowish calcarenitic layer (see Dominici, 2001). Both sedimentary layers, from which *P. cheilostoma* has been collected, consist of middle to coarse sand with a variable matrix of muddy silt. The stratigraphically lower one is rich in molluscs and characterized by shells of *Glycymeris* (Mollusca: Bivalvia: Arcoida), sometimes concentrated in shell beds. On these *Glycymeris* shells several species of encrusting bryozoans often occur.

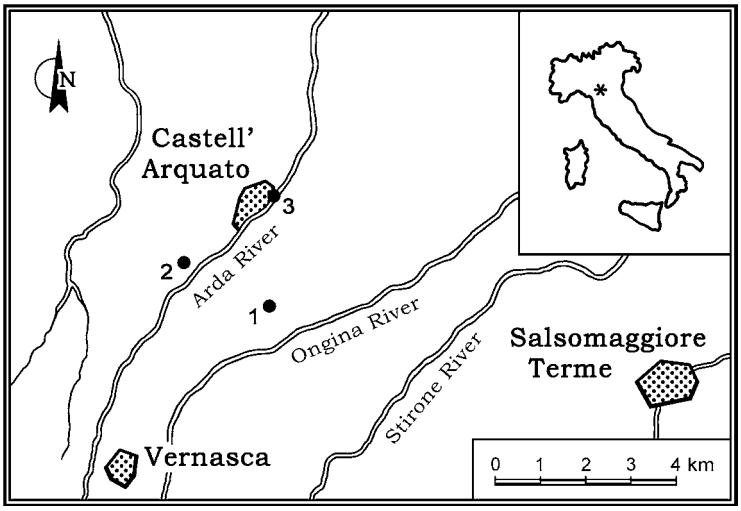


Fig. 1 - Location of the three outcrops where specimens of *Prenantia cheilostoma* (Manzoni) were collected in Castell'Arquato area. 1 - Monte Oliveto section, Vernasca district. 2 - Monte Padova section, Castell'Arquato district. 3 - Riverbed of Arda River, Castell'Arquato.

The second layer, the stratigraphically upper one, is rich in both molluscs and bryozoans.

Material and methods

The whole studied material is made up of few specimens, all of them collected in Pliocene and Pleistocene sedimentary layers cropping out in the Castell'Arquato area. Pliocene specimens always consist of small colony fragments, while those of the Pleistocene more often comprise complete colonies. Sampled sediments were scarcely indurated by lithification. They were dried, broken into smaller pieces, treated initially with dilute hydrogen peroxide (H_2O_2), afterwards with sodium hypochlorite (NaClO) and again hydrogen peroxide, and then washed and sieved to remove the fine-grained matrix. Residues were dried and afterwards looked at under a stereomicroscope to isolate specimens of the species present in samples. Part of the material under study is deposited at the Museo Geologico "Giuseppe Cortesi" of Castell'Arquato (Piacenza Province, Italy): the sample containing specimens from Early Pliocene Monte Oliveto section with inventory number MG1147, sample with specimens from Late Pliocene Monte Padova section MG1148, and sample with specimens of the Pleistocene sedimentary layers outcropping in riverbed of the Arda River, MG0999; the remaining material is stored in a private collection.

Systematics and description of the species

The adopted Bryozoa systematics is that proposed by D. P. Gordon ("treatfam. pdf", 2010)

Suborder	Neocheilostomina d'Hondt, 1985
Infraorder	Ascophora Levinsen, 1909
"Grade"	Lepraliomorpha Gordon, 1989
Superfamily	Smittinoidea Levinsen, 1909
Family	Smittinidae Levinsen, 1909
Genus	*Prenantia* Gautier, 1962

Type species: *Lepralia cheilostoma* Manzoni.

In the 'treatgen.pdf' (2010), compiled by Gordon, *Lepralia cheilostoma* Manzoni is reported as type species of the genus *Prenantia* Gautier, 1962.

Diagnosis: Colony encrusting, multiserial. Frontal wall regularly and evenly pierced by pores. Primary orifice with lyrula and condyles. Peristome well developed, notched proximally, without spines. No avicularium. Ovicell prominent to subimmersed, perforated. Mural septular pores present. Orifice of ancestrula

encircled by oral spines.
This diagnosis is modified from those in Hayward & Ryland (1979) and Zabala & Maluquer (1988).

Remarks

Since no avicularium is present in *L. cheilostoma*, Canu and Bassler (Canu & Bassler, 1925) suggested instituting a new genus for this species. With Canu and Bassler, Gautier (Gautier, 1962) shared necessity to institute a new genus for *Smittina cheilostoma* and *Smittina inerma* Calvet and, thus, proposed the new genus *Prenantia* and as its type species *Lepralia cheilostoma* Manzoni, but did not give a formal diagnosis to this new genus. Gautier was laconic enough in defining characters of the genus *Prenantia*, to which he referred orifice with deep and strong peristome, lyrula and condyles, without avicularia. First Hayward and Ryland (Hayward & Ryland, 1979) gave a formal diagnosis of the genus *Prenantia*, but reported, contradicting Canu and Bassler (Canu & Bassler, 1925) and Gautier (Gautier, 1962), "Suboral avicularia present or absent." and, in this genus, inserted also *Prenantia bella* (Busk), to which the two authors referred a small suboral avicularium. Although Busk (Busk, 1860), in instituting *Lepralia bella*, did not do mention any avicularium and, comparing it with *Lepralia Landsborovii* Johnston, remarked « In the absence of any avicularian organ on the lower border of the orifice ». Afterwards the two authors (Hayward & Ryland, 1999) did not report the genus *Prenantia* and inserted *P. cheilostoma* in the genus *Smittina* Norman. Zabala (Zabala, 1986) and Zabala and Maluquer (Zabala & Maluquer, 1988) gave a diagnosis of the genus *Prenantia*, where spines and avicularia are reported as absent. In defining the genus *Prenantia*, Gordon (Gordon, 1989) reported the same characters referred by Hayward and Ryland (Hayward & Ryland, 1979), keeping as valid « Suboral avicularium present or absent », and added « Colony encrusting or erect, branching ». Finally to the genus *Prenantia*, Zagorsek (Zagorsek, 2003) assigned an encrusting or erect colony, as in Gordon (1989), a very inconstant suboral avicularium and small lyrula and condyles.

The genus *Prenantia* includes at present the type species *P. cheilostoma*, *P. ligulata* (Manzoni) (Poluzzi, 1975; Poluzzi & Rosso, 1988; El Hajjaji, 1992), *P. inerma* (Calvet) (Gautier, 1962, Zabala, 1986; Zabala & Maluquer, 1988; Harmelin et al., 1989; Costa et al., 1991; Chimenz & Faraglia, 1995; Rosso, 1996a; Di Geronimo et al., 1998), *P. spectrum* (Jullien) (Reverter-Gil & Fernández-Pulpeiro, 1999), *P. firmata* (Waters) (Gordon, 1989), *P. dichotoma* Gordon (Gordon, 1989) and *P. phymatopora* (Reuss) (Zagorsek, 2001, 2003).
Prenantia firmata (Waters) as stated by Gordon (Gordon, 1984, 1989) would appear to belong to *Prenantia*. The ovicell, as seen on the colony surface, appears to be very similar to that of *Prenantia*. However, rounded condyles and a little developed or lacking pseudosinus do this species to be slightly otherwise from the *Prenantia* species.
Prenantia dichotoma Gordon (Gordon, 1989) might perhaps belong to a different

genus. It is erect, with a peristome very little or not developed and condyles seem to be absent. Figured ovicell is rather different from those of *Prenantia* species. An ovicell in early ontogeny might help to assess if *P. dichotoma* ovicell is similar to those of *Prenantia* species. Gordon attributed his species to *Prenantia*, due to fact that the characters, shared with the type-species of *Prenantia*, are: « no avicularium or oral spines and one ovicell closed by the zooidal operculum ».
Zagorsek (Zagorsek, 2001, 2003) shared opinion of Gordon (Gordon, 1989) on erect zoarium and presence of suboral avicularium in *Prenantia* and thought *Eschara phymatopora* Reuss to belong to Gautier's genus. But in the specimens of Zagorsek the lyrula is not seen, the zoarium is erect, the peristome is not known and a rare small suboral avicularium is present. As a result, to ascribe these specimens to the genus *Prenantia* might be improper. In the holotype of *E. phymatopora* an immersed ovicell occurs (*fide* Zagorsek, 2001), but in Zagorsek's material from Hungary and Austria (Zagorsek, 2001, 2003) there is no ovicell.
In the past and at present the genus *Prenantia* would seem to be mainly circumscribed to the Mediterranean and north-east Atlantic. The records, doing it to be present in the South Pacific, might mean either that the genus had and has to occur in a much wider area than the Mediterranean and north-east Atlantic, or species from South Pacific might belong to other genera.
Poluzzi (Poluzzi, 1975) first synonymised *P. inerma* with *P. ligulata*. But this synonymy should be revised because of zooecial size that might be smaller in *P. ligulata* than in *P. inerma* (personal data). To define size and shape of *P. ligulata*, topotypes of the species will have to be looked for in Pezzo and Cannitello (Reggio Calabria Province, S Italy) (see Manzoni, 1870).

Prenantia cheilostoma (Manzoni)

List of quotations concerning the species.

1869c *Lepralia cheilostomata*, mihi – Manzoni, p. 942, Pl. 4, f. 22.
1880 *Smittia cheilostoma* Manzoni – Hincks, p. 349, Pl. 42, ff. 7, 8.
1887 *Smittia cheilostoma* Manz. – Pergens, p. 30.
1889 *Smittia cheilostoma* Manzoni – Jelly, p. 247.
1893 *Smittia cheilostoma* Manz. – Carus, p. 26.
1895 *Smittia cheilostoma* Manzoni – Neviani, p. 118, Pl. 6, ff. 29, 30.
1901 *Smittia cheilostoma* Manzoni – Neviani, p. 207.
1902 *Smittia cheilostoma* Mnz. sp. – Neviani, p. 338.
1905 *Smittia cheilostoma* Manzoni – Neviani, p. 538, text f. 13.
1907 *Smittia cheilostoma* Manzoni – Calvet, p. 434.
1921 *Smittina cheilostoma* Manzoni – Cipolla, p. 118, Pl. 6, f. 11.
1925 *Porella* (?) *cheilostoma* Manzoni – Canu, Bassler, p. 42.
1926 *Porella* (?) *cheilostoma* Manzoni – Cipolla, p. 5.
1962 *Smittina cheilostoma* (Manzoni) – Gautier, p. 192.
1974 *Smittina cheilostoma* – Hayward, p. 371.

1975 *Prenantia cheilostoma* (Manzoni) – Poluzzi, p. 61, Pl. 18, f. 7.
1979 *Prenantia cheilostoma* (Manzoni) – Hayward, Ryland, p. 104, text ff. 37a-b.
1986 *Prenantia cheilostoma* (Manzoni) – Zabala, p. 429, ff. 140a-c.
1986 *Prenantia cheilostoma* (Manzoni) – Boyer, Mastricardi, Pisano, p. 304.
1987 *Prenantia cheilostoma* (Manzoni) – Reguant, p. 160, ff. 2-4.
1988 *Prenantia cheilostoma* (Manzoni) – Poluzzi, Capozzi, Giordani, Venturini, p. 73.
1988 *Prenantia cheilostoma* (Manzoni) – Poluzzi, Rosso, p. 91, Pl. 2, f. 12.
1988 *Prenantia cheilostoma* (Manzoni) – Zabala, Maluquer, p. 122, text f. 270, Pl. 11, f. C.
1989 *Prenantia cheilostoma* (Manzoni) – Harmelin, Boronat, Moissette, Rosso, p. 487.
1991 *Prenantia cheilostoma* (Manzoni) – Costa, Rosso, Sanfilippo, Zanini, p. 419.
1992 *Prenantia cheilostoma* (Manzoni) – Pouyet, Moissette, p. 69.
1992 *Prenantia cheilostoma* (Manzoni) – El Hajjaji, p. 181, Pl. 13, f. 1.
1993 *Prenantia cheilostoma* (Manzoni) – Reguant, p. 130, Pl. 2, f. 5.
1994 *Prenantia cheilostoma* (Manzoni) – Reguant, Mayoral, p. 157.
1996a *Prenantia cheilostoma* (Manzoni) – Rosso, p. 60.
1996b *Prenantia cheilostoma* (Manzoni) – Rosso, p. 210.
1998 *Prenantia cheilostoma* (Manzoni) – Reverter-Gil, Fernández-Pulpeiro, p. 46, Pl. 1, f. D.
1998 *Prenantia cheilostoma* (Manzoni) – Di Geronimo, La Perna, Rosso, Sanfilippo, p. 250.
1999 *Prenantia cheilostoma* – Chimenz, Gravina, Nicoletti, p. 208.
1999 *Smittina cheilostoma* (Manzoni) – Hayward, Ryland, p. 258, ff. 114A-B, 115A-B.
2002 *Prenantia cheilostoma* (Manzoni) – Hayward, McKinney, p. 49, ff. 22D-H.

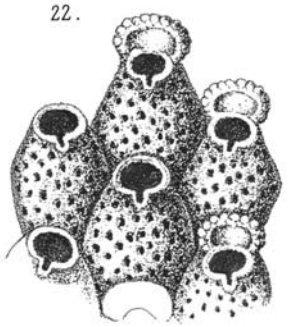
Original diagnosis and description of *Lepralia cheilostomata* Manzoni (1869)

Zooœciis quincuncialiter dispositis, ovato-rhombicis, subventricosis, tota superficie porosis. Apertura magna, subrotunda, peristomate incrassato, infra medio profunde inciso cincta. – Ooœciis depressis, transversim elongatis, ad marginem crenulato-annulatis, areolatis.

Tav. IV, fig. 22 – Castell'Arquato (Pliocene).
Questa n. sp. è principalmente caratterizzata dalla profonda incisione che porta nel mezzo dell'orlo buccale inferiore e dalla configurazione degli ovicelli, i quali sono trasversalmente allungati, piatti e lungo il margine orlati da un rilievo annulare che circonda la fronte depressa dell'ovicello stesso. Questa porzione annulare è crenulata al margine, e la restante superficie dell'ovicello leggermente rugosa.

[Zooecia quincuncially arranged, oval-rhombic, sub-swollen, whole surface perforated. Orifice wide, suborbicular, peristome thickened, proximal peristomie deeply notched in middle. Ovicell depressed, lengthened transversally, with crenate-annular edge, punctured.
This new species is mainly characterized by a deep cleft, occurring in middle of the proximal peristomial edge, and shape of ovicell, which is lengthened transversally, flat and with peripheral border enclosed by an annular ridge encircling the depressed frontal ovicell wall. This annular part is crenate along the edge and the remaining ovicell surface is slightly wrinkled.]

In text of pag. 492, Manzoni spelled the species *cheilostomata*, but in fig. 22 of



L. cheilostoma Man.

Fig. 2 - Figure 22 on Plate IV of *Lepralia cheilostoma* Manzoni, in "Bryozoi fossili Italiani. Terza contribuzione" (original slightly retouched).

Plate 4 he spelled it *cheilostoma*. Hayward & McKinney (Hayward & McKinney, 2002) resolved this nomenclature problem, due to Manzoni's mistake, with: « Hincks (1880: 349) used the trivial name *cheilostoma*, which Manzoni, (1869b, p. 942) had originally spelled *cheilostomata* in the text when describing the new species, although the name as given by Manzoni on the plate (1869: pl. 4, fig. 22) was *cheilostoma*. Hincks (1880) did not mention both spellings, and therefore his use of *cheilostoma* does not satisfy Article 24.2.3 of the ICZN Code for selection of one from among two or more spellings in an original work, but *cheilostoma* has become established in the literature to the virtual exclusion of *cheilostomata* for the species, which allows its preservation as "established usage" under Article 33.3.1 (Ride et al., 1999)».

Description of the specimens of *P. cheilostoma* from Castell'Arquato area.

Colony encrusting, unilaminar and multiserial, sometimes with a very small layer of superposed zooecia, due perhaps to an irregular substratum. Zooecia oval-hexagonal, convex to slightly convex, separated by shallow to little deep grooves; when substratum is regular zooecia arranged in radiating series in early astogeny and in alternating linear series in the distal region of colonies in later astogenetic stage. A raised mural rim can sometimes occur between some neighbouring zooecia in early ontogeny stage, but usually no raised rim is present in zooecia late in ontogeny. Primary orifice subellipsoidal, slightly wider than long, deeply to very deeply immersed in older zooecia, with trapezoidal lyrula. Lyrula sometimes small to hardly developed or lacking in some zooecia (when incomplete or lacking perhaps due to fossilization and/or washing) and deeply immersed, like primary orifice, in late ontogeny. In Pleistocene colonies lyrula can be also anvil-shaped. A pair of small and spiked condyles, placed slightly deeper than lyrula. Oral spines and avicularia absent. In first zooecia of the younger colonies, peristome little developed, forming a rim enclosing orifice, sub-vertical, and sometimes

little raised, proximally with a wide U-shaped pseudosinus. In peripheral zooecia of Pliocene colonies in late astogenetic and ontogenetic stages, peristome well developed, raised, forming a wide, pad-shaped thickening encircling the entire orifice, sometimes wider proximally, with convex and granulated outside surface. A pseudosinus suborbicular to U-shaped present medially and proximally into the peristomial thickening. When suborbicular, as in colonies from Zanclean Monte Oliveto section, this pseudosinus can be small too; when U-shaped, as often occurring in Piacenzian colonies, it is usually wide. In ovicelled zooecia, peristome extending onto the proximal border of frontal ovicell wall joined or disjoined to it. Frontal wall pierced by numerous small pores; in older zooecia frontal area affected by thick secondary calcification and each pore can be within a deep, thin, infundibuliform pit. Peripheral ovicell thickening and sometime frontal wall coarsely granulated. Most of exposed zooecial surface usually finely granulated. In frontal area of zooecia later in ontogeny of old colonies, coverings of secondary calcification can overlay the peristomial thickening partially, as a result it appears to become much less raised and smaller. Ovicell hyperstomial, subimmersed to prominent, perhaps initially independent.

Fig. 3 - Zooecium and ovicelled zooecia of *P. cheilostoma* in longitudinal section.

Ovicell chamber often rather deep (when subimmersed), in suborbicular section and middle size. In early ontogenetic stage frontal wall of ovicell hemispheric, thin, with silky surface and pierced by pores in central area, and afterwards distal and lateral edge thickened by calcification, added by subsequent distal zooecium probably. In later ontogeny frontal area of ovicell wider than longer, thus transversally lengthened, depressed to little raised, almost flat. Central area of frontal ovicell wall crescentic to subellipsoidal, depressed, thin, almost smooth, with silky surface and pierced by small pores. Whereas peripheral zone of frontal ovicell wall very thickened, coarsely granulated, without pores, more raised and wider in distal zone and often continuous with the peristome proximally. Ovicell can sometimes be entirely overlaid by granularity when zooecia are affected by thick secondary calcification in later ontogeny. Edge of ovicell crenelate laterally and distally and pierced by a series of pores on the outside. Young colonies consisting of few zooecia can already have some ovicelled zooecia. In zooecial vertical wall next to the basal one, twelve to fourteen basal septular pores occur, two proximally and distally, four to five laterally. Ancestrula subelliptical; frontal wall like a truncated cone in obtuse angle, with slightly convex wall, with smooth and silky surface initially and afterwards granulated; a suboral spiramen and some pores occur; vertical walls wanting. Orifice similar in shape and size to zooecia; insertions of small oral spines present, often poorly visible in the material examined.

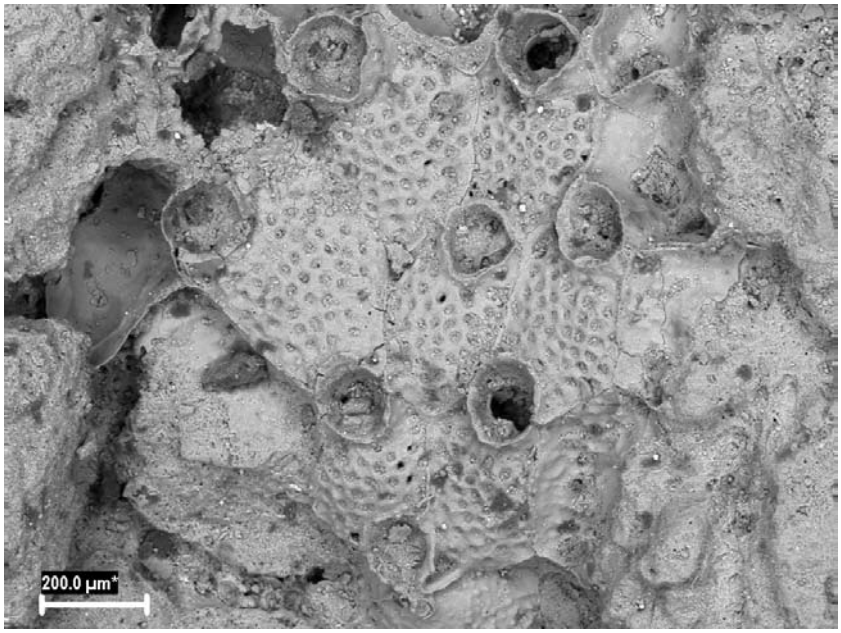


Fig. 4 - *Prenantia cheilostoma* (Manzoni), Monte Oliveto section, late Zanclean (Lower Pliocene), MG1147: First zooecia of a colony in early astogeny. Below it is visible orifice of the ancestroecium.

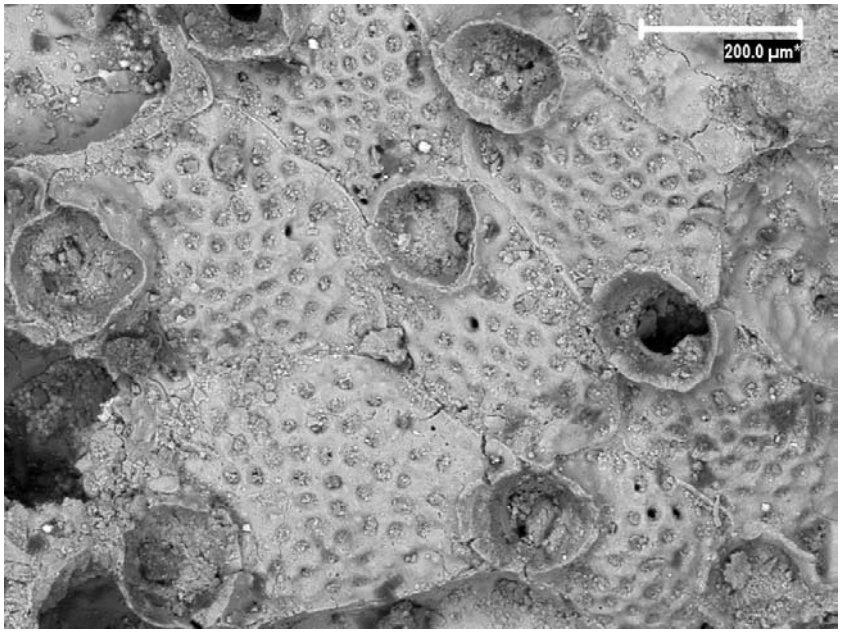


Fig. 5 - *Prenantia cheilostoma* (Manzoni), Monte Oliveto section, late Zanclean (Lower Pliocene), MG1147: Zooecia of the same colony as in Fig. 4.

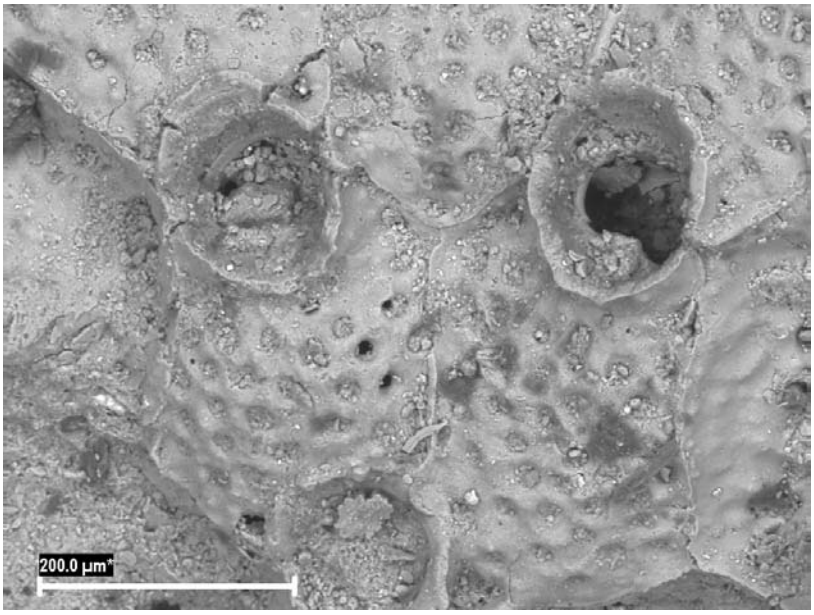


Fig. 6 - *Prenantia cheilostoma* (Manzoni), Monte Oliveto section, late Zanclean (Lower Pliocene), MG1147: Orifice of the first two zooecia and ancestroecium (that below) of the same colony as in Fig. 4.

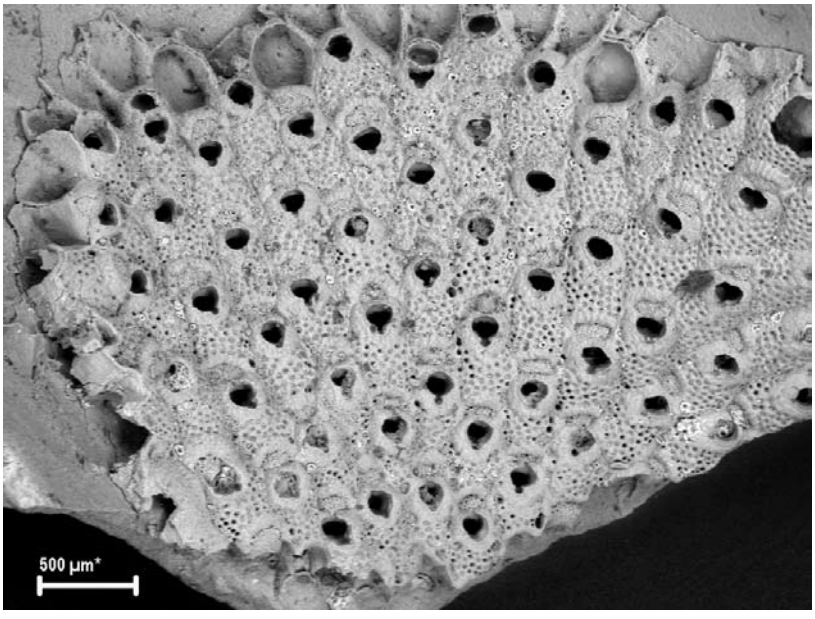


Fig. 7 - *Prenantia cheilostoma* (Manzoni), Monte Oliveto section, late Zanclean (Lower Pliocene), MG1147: Fragment of a colony in late astogeny and ontogeny having a large number of ovicelled zooecia.

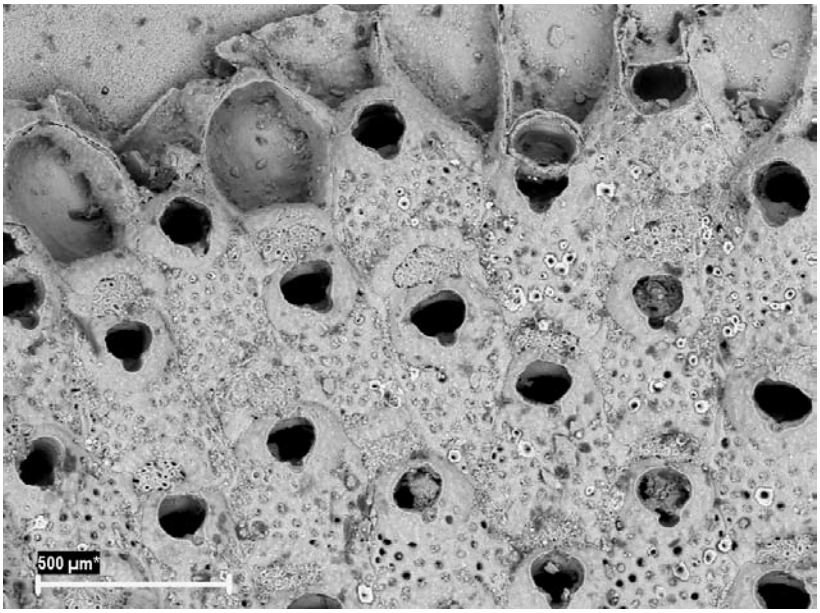


Fig. 8 - *Prenantia cheilostoma* (Manzoni), Monte Oliveto section, late Zanclean (Lower Pliocene), MG1147: Distal zooecia of the same colony as in Fig. 7.

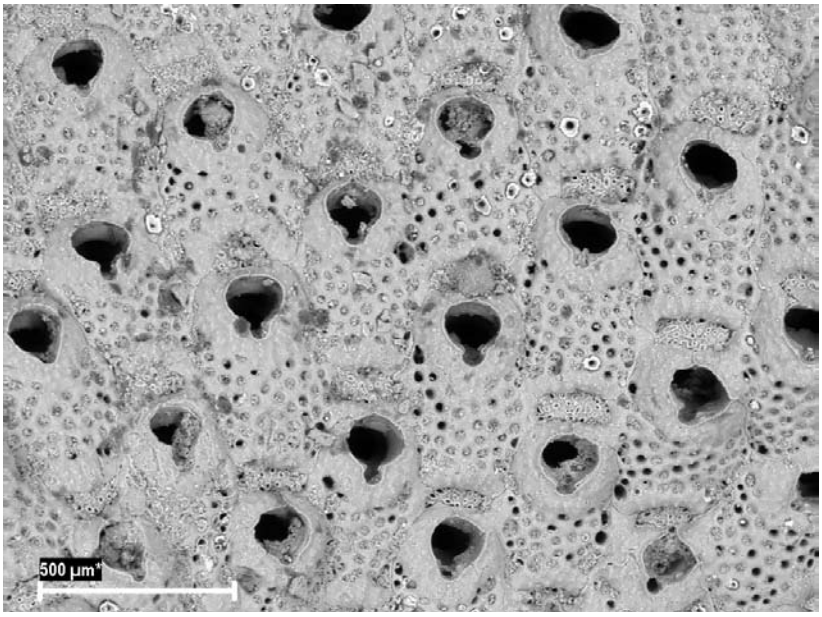


Fig. 9 - *Prenantia cheilostoma* (Manzoni), Monte Oliveto section, late Zanclean (Lower Pliocene), MG1147: Zooecia of the same colony as in Fig. 7.

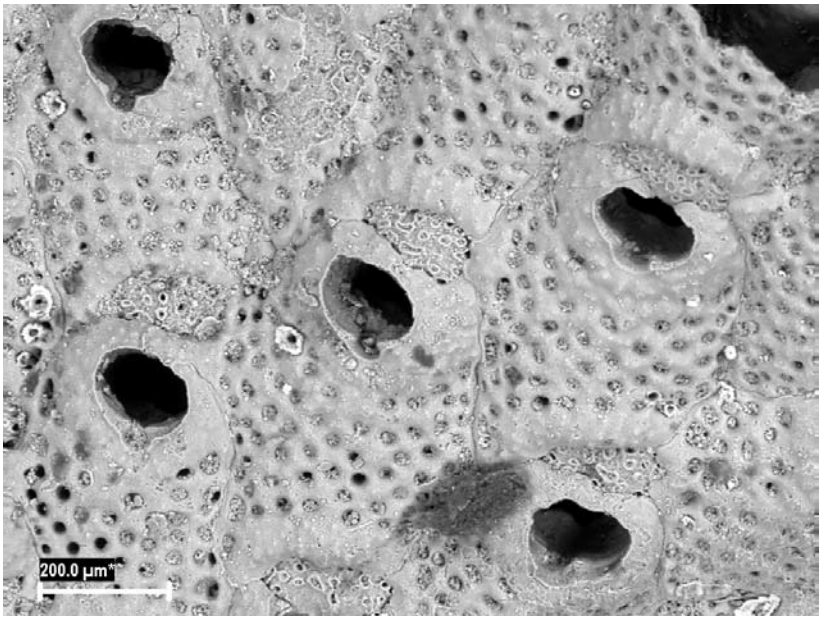


Fig. 10 - *Prenantia cheilostoma* (Manzoni), Monte Oliveto section, late Zanclean (Lower Pliocene), MG1147: Ovicells and pad-shaped peristomial thickenings as seen on colony surface in zooecia of the same colony as in Fig. 7.

Fig. 11 - *Prenantia cheilostoma* (Manzoni), Monte Oliveto section, late Zanclean (Lower Pliocene), MG1147: Ovicell chamber and deeply immersed lyrula of the same colony as in Fig. 7.

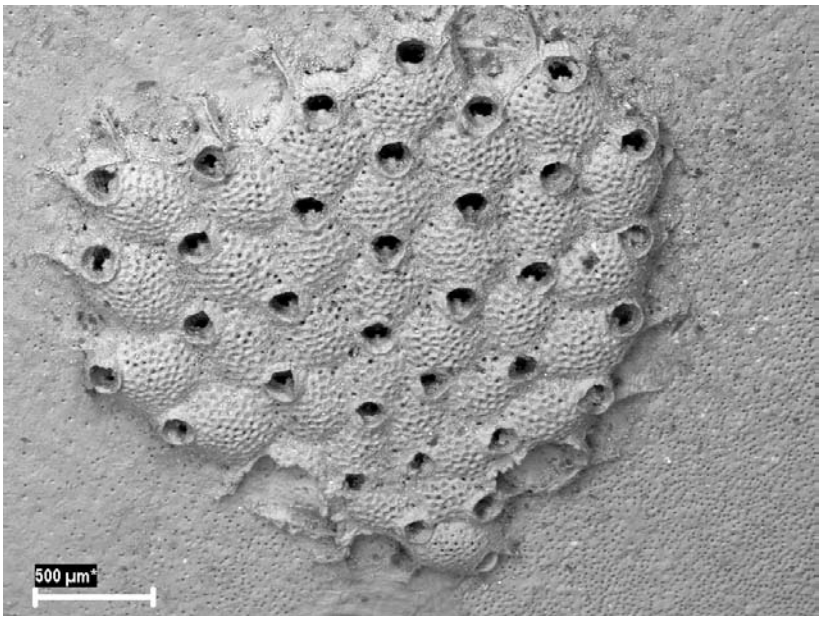


Fig. 12 - *Prenantia cheilostoma* (Manzoni), Riverbed of the Arda River, Calabrian (Early Pleistocene), MG0999: Small colony in early astogeny and ontogeny. Below it is visible the ancestroecium.

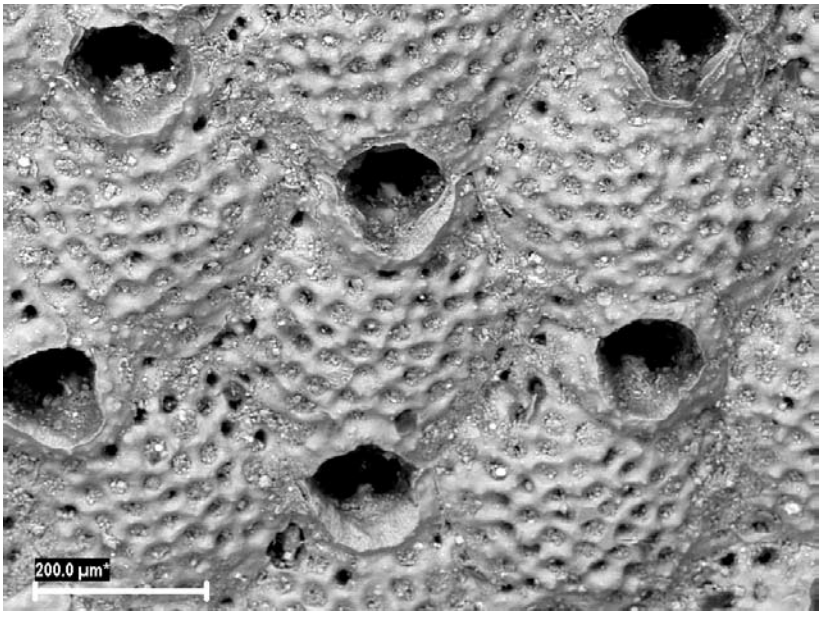


Fig. 13 - *Prenantia cheilostoma* (Manzoni), Riverbed of the Arda River, Calabrian (Early Pleistocene), MG0999: Orifice of the first zooecia of the same colony as in Fig. 12.

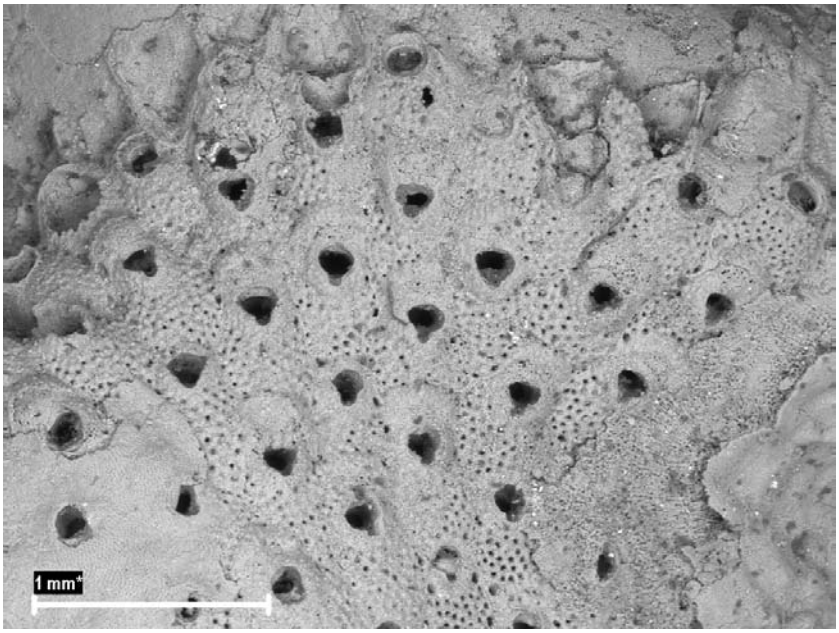


Fig. 14 - *Prenantia cheilostoma* (Manzoni), Riverbed of the Arda River, Calabrian (Early Pleistocene), MG0999: Colony in late astogeny.

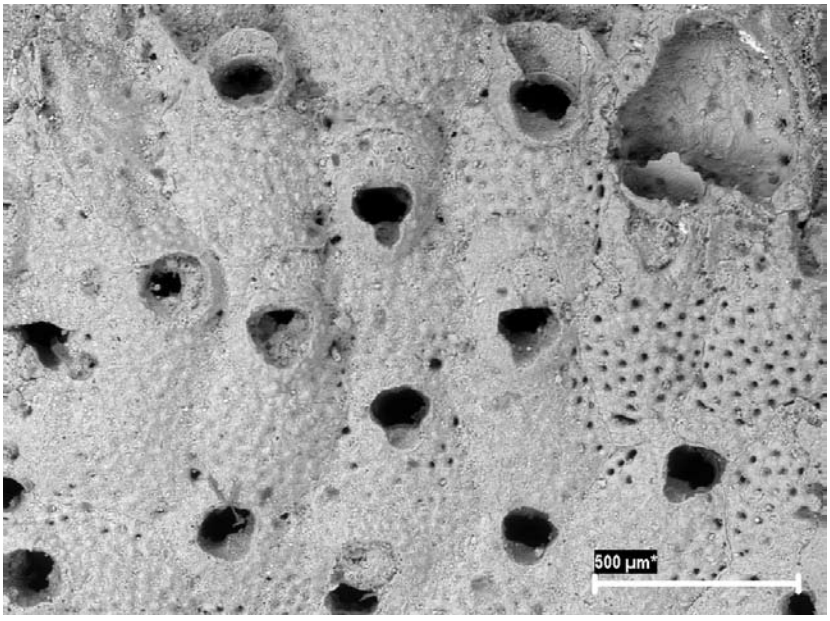


Fig. 15 - *Prenantia cheilostoma* (Manzoni), Riverbed of the Arda River, Calabrian (Early Pleistocene), MG0999: Distal zooecia in early ontogeny of the same colony as in Fig. 14.

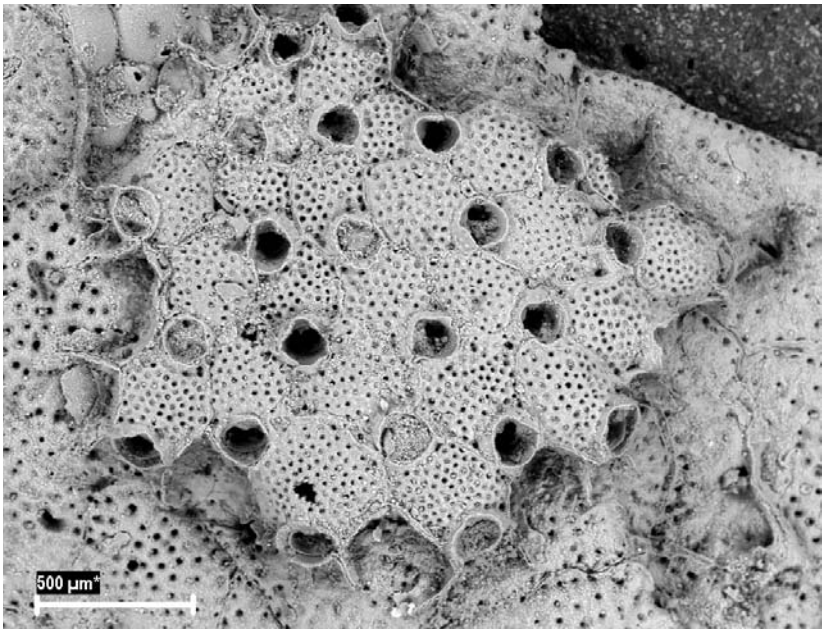


Fig. 16 - *Prenantia cheilostoma* (Manzoni), Riverbed of the Arda River, Calabrian (Early Pleistocene), MG0999: Small colony in early astogeny and ontogeny. Above it is visible the ancestroecium.

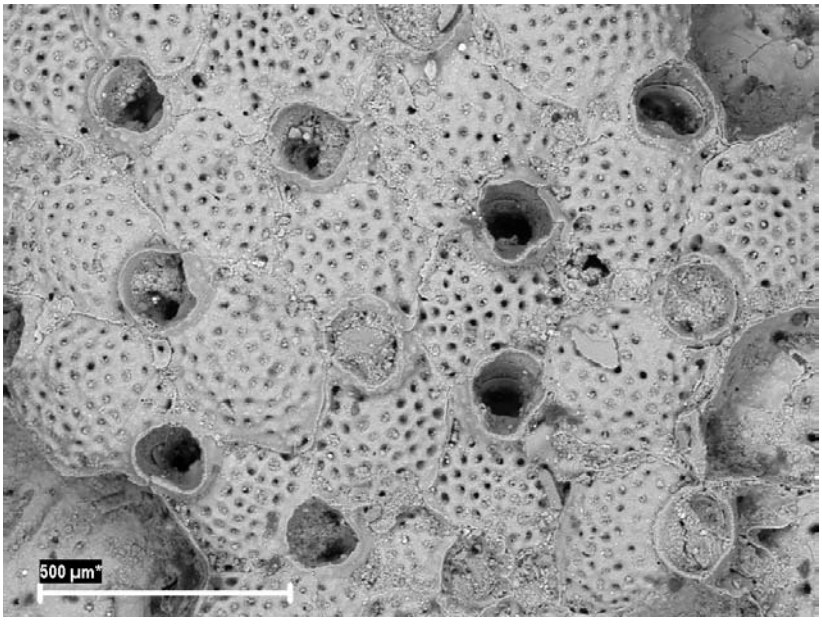


Fig. 17 - *Prenantia cheilostoma* (Manzoni), Riverbed of the Arda River, Calabrian (Early Pleistocene), MG0999: Orifice of zooecia of the same colony as in Fig. 16. Below it is visible orifice of the ancestroecium.

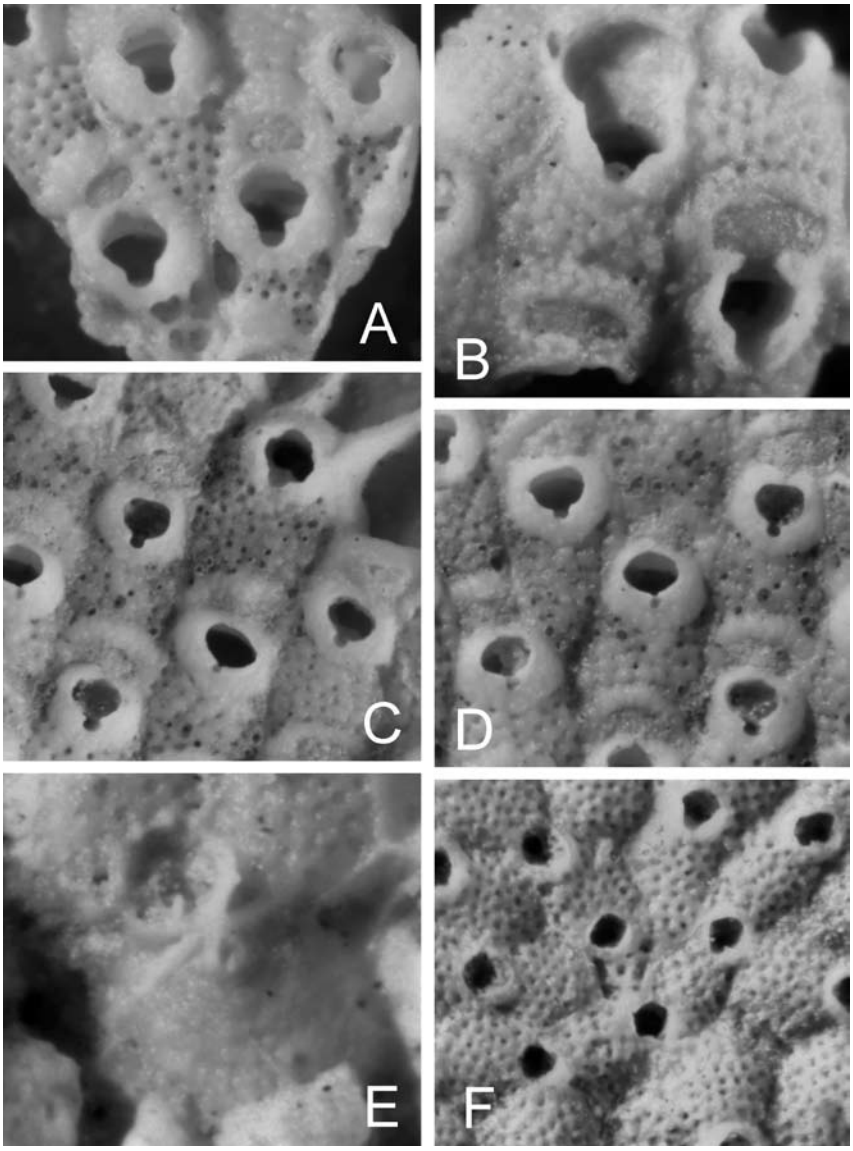


Fig. 18 - *Prenantia cheilostoma* (Manzoni): A. - Fragment of a colony in late astogenetic stage from Piacenzian (Late Pliocene) Monte Padova section, MG1148. B. - Fragment of colony from Piacenzian (Late Pliocene) Monte Padova section, MG1148. C, D. - Distal zooecia of the same colony as in Fig. 7 in late astogenetic stage from late Zanclean (Lower Pliocene) Monte Oliveto section, MG1147. E. - Ancestroecium of the same colony as in Fig. 4 in the early astogenetic stage from late Zanclean (Lower Pliocene) Monte Oliveto section, MG1147. F. - Ancestroecium surrounded by zooecia in a Calabrian (Lower Pleistocene) colony in early astogenetic stage from riverbed of the Arda River, MG0999. (Photos of this figure taken by optical microscope.)

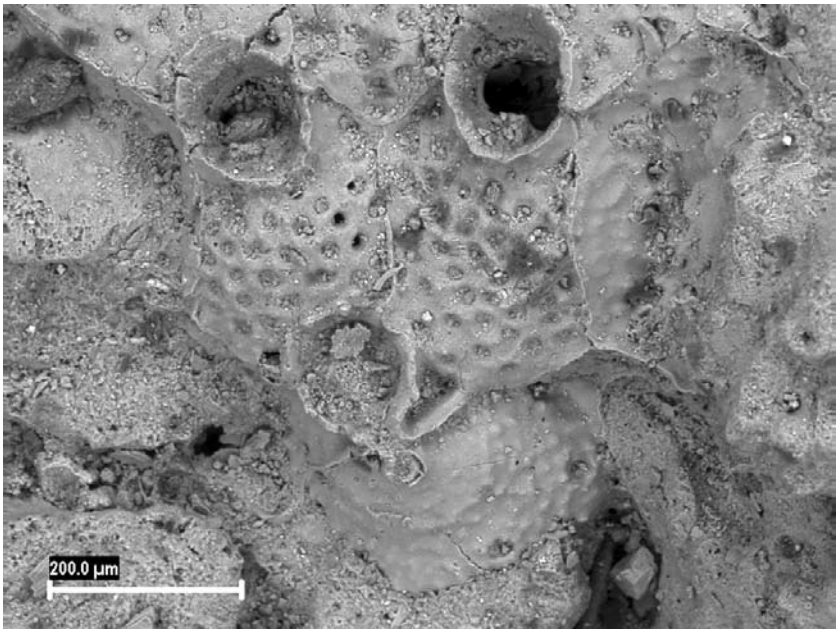


Fig. 19. - *Prenantia cheilostoma* (Manzoni), Monte Oliveto section, late Zanclean (Lower Pliocene), MG1147: Ancestroecium and the first two zooecia of the same colony as in Fig. 4.

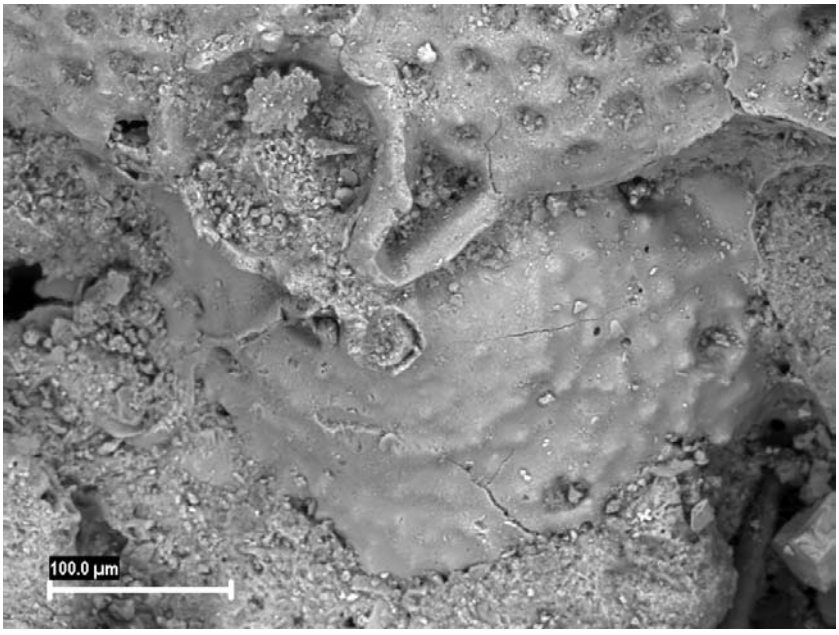


Fig. 20. - *Prenantia cheilostoma* (Manzoni), Monte Oliveto section, late Zanclean (Lower Pliocene), MG1147: Ancestroecium of the same colony as in Fig. 4.

Measurements

Length of zooecium as seen on colony surface:
First zooecia of zoaria in early astogeny: 0.48-0.52 mm
Distal zooecia of zoaria in later astogeny: 0.48-0.60 mm
Distal ovicelled zooecia of zoaria in later astogeny: 0.50-0.60 mm

Remarks

First zooecia of the younger colonies of *P. cheilostoma* show a morphological feature that is rather different from that of peripheral zooecia of colonies in later astogenetic and ontogenetic stages. Peripheral zooecia of Pliocene colonies later in ontogeny and astogeny have a wide and thickened pad-shaped peristome usually with a suborbicular pseudosinus, a very deep primary orifice, frontal wall affected by very thick secondary calcification and pores of frontal wall sometimes in deep, thin, infundibuliform pits. On the contrary, in the first zooecia of most of the younger colonies peristome is less raised and thinner, pseudosinus always U-shaped, primary orifice little deep, frontal wall slightly or not affected by secondary calcification and pores are small. These differences, existing between the two zooecial feature kinds, often do zooecia of a fragment of colony in later astogenetic stage to seem to belong to a different species, when compared with zooecia of a colony in early astogeny and ontogeny. In a Pleistocene colony later in astogeny, both zooecial feature kinds are present due to fact that a proliferation of zooecia in early ontogenetic stage grew in a piece of the peripheral zoarium region, thus in this colony there are together zooecia in early and later ontogenetic stages. A comparison of this Pleistocene colony with the fragments of Pliocene *P. cheilostoma* colonies, in different astogenetic stages, has enabled to infer that zooecia of the two feature kinds belong to the same species. In gerontastic colonies when affected by strong secondary calcification, peristomial area is almost totally overlaid by the secondary calcification, which overspreads on frontal area and sometimes ovicell too. In complete colonies affected by thick secondary calcification, zooecia of periancestrular area and the peripheral ones are well distinguishable as a result of their position in colony. But in colony fragments it is more difficult to infer if zooecia, when affected by secondary calcification, are from peripheral or periancestrular region. In zooecia figured by Manzoni (Manzoni, 1869c), granulated thickening encircling ovicell is fairly wide but peristomial edge appears to be little developed, the latter character does resemble that occurring in the younger colonies collected in the Plio-Pleistocene of Castell'Arquato area. In zooecia of old colonies from the Pliocene of Castell'Arquato area, the thickening encircling ovicell is a little wider than as figured by Manzoni and peristomial edge is pad-shaped and very wide. In pad-shaped peristomial edge of Pliocene colony zooecia, pseudosinus can be often suborbicular, whereas in all the zooecia figured by Manzoni it is clearly U-shaped. In most of zooecia of old colonies from the Early Pliocene Monte Oliveto section pseudosinus is suborbicular and sometimes small, whereas in zooecia of colonies from the Late Pliocene Monte

Padova section it can be more often U-shaped. In the colony figured by Poluzzi (Poluzzi, 1975) from Late Pliocene Monte Falcone section, most zooecia have an U-shaped pseudosinus, but in some zooecia it is suborbicular. In zooecia of Early and Late Pliocene colonies in early astogenetic stage, pseudosinus is always U-shaped; as a result this character cannot help to infer where the type of species was collected by Manzoni. Zooecia figured by Manzoni (Manzoni, 1869c) should belong to a young colony with zooecia in early ontogeny probably. In the figured zooecia, presence of ovicelled zooecia is due to fact that both fossil and Recent young colonies of *P. cheilostoma* can develop ovicelled zooecia.

The Recent Atlantic *P. cheilostoma* reported by Hincks (Hincks, 1880) seems to have an ovicell very different from that occurring in Pliocene old colonies from Castell'Arquato area. Hincks wrote « *Oœcia* depressed, closely united to the cell above, rounded, slightly elongated transversely (almost semicircular), punctured, with a subgranular border round the base. », but ovicells of zooecia occurring in colonies from Castell'Arquato area (see also figure in Poluzzi, 1975) are markedly transverse, as seen on colony surface. Ovicells figured by Hincks might belong to a young colony with zooecia in early ontogenetic stage probably; besides these figured zooecia do not present a wide peristomial thickening. Their peristomial edge is little wide and similar to that figured by Manzoni (Manzoni, 1869c).

The description and measurements of *Smittina cheilostoma* given by Gautier (Gautier, 1962) accord with those of Plio-Pleistocene specimens from Castell'Arquato area. Poluzzi (Poluzzi, 1975) instituted two "*Plesiotypi*" of *P. cheilostoma*: I.B. 384-385 (sample 131) from Monte Falcone section (Castell'Arquato area), deposited in the Collection of the Geology and Palaeontology Institute of Bologna. Zooecia of the *Plesiotypus* I.B. 384 of *P. cheilostoma* figured by this author (Poluzzi, 1975) should be some peripheral zooecia of a colony late in astogeny and ontogeny, because of their wide peristomial pad-shaped thickening and ovicells that are in late ontogenetic stage.
On account of « M. Falcone. Pliocene superiore (zona a *Globorotalia inflata*) », Poluzzi thought sediments of the Monte Falcone section, due to biozone *G. inflata*, to be within planktonic foraminifer biozone MPl6 (after Cita, 1975, emend.), coinciding to planktonic foraminifer biozone *G. inflata* of Iaccarino (1985). Probably Poluzzi took the biozone *G. inflata* from Barbieri (1967, 1971) and Colalongo et al. (1972). Barbieri (Barbieri, 1967) reported « *Globorotalia inflata* (d'Orbigny) is represented by specimens which are rather typical ». But presence of *Globorotalia bononiensis* Dondi and absence of *G. inflata* in the high part of the Monte Falcone section, that underlying the Monte Padova-Castell'Arquato bio-calcarenitic body, (Rio et al., 1988; Raffi et al., 1989; Monegatti et al., 2001) enables to think the silty layers of the Monte Falcone section are within planktonic foraminifer biozone MPl5a (after Cita, 1975, emend.). The description of *P. cheilostoma* by Hayward and McKinney (Hayward & McKinney, 2002) accords with that of Plio-Pleistocene specimens from Castell'Arquato area. Only ovicells seem to be slightly different, because more raised than those of Plio-Pleistocene old colonies from Castell'Arquato area. Their Recent figured colony would seem not

to be in late astogeny and ovicelled zooecia might be in early-middle ontogenetic stage. Finally, the Upper Miocene *P. cheilostoma* reported by El Hajjaji (El Hajjaji, 1992) has a large lyrula and greater zooecial dimension (0.69-0.93 mm in length) than that of the Pliocene specimens collected in the Castell'Arquato area, as well as the fossil and Recent colonies reported in Hayward & Ryland (1979, 1999), Zabala (1986), Reguant (1987, 1993) and Hayward & McKinney (2002). Although El Hajjaji's specimens are morphologically very closely related to Manzoni's species and may be the Miocene ancestor of it, it is probably different enough to be thought as a distinct species.
Jelly (Jelly, 1889) thought *Lepralia ligulata*, as defined by Manzoni (Manzoni, 1870, 1871) and that reported by Seguenza (Seguenza, 1880), to be synonymous with *Smittia cheilostoma*. Also Neviani (Neviani, 1895, 1901, 1905), following Jelly, thought *L. ligulata* as a synonym of *S. cheilostoma*. This author (Neviani, 1895) regarded specimens of *S. cheilostoma* from Farnesina to be rather polymorphic, but as per his description, in Farnesina faunas both species could perhaps occur. Zooecia figured in fig. 29 would seem to belong to a *P. cheilostoma* colony, while on that of fig. 30, it is impossible to give a determination. The poor figure of *S. cheilostoma* given afterward (Neviani, 1905) does not permit any determination, but in apertural area of these figured zooecia there seems to be a wide pad-shaped peristome. Also Cipolla (Cipolla, 1921) inserted the two *L. ligulata* of Manzoni (Manzoni, 1870, 1871) and those reported by Seguenza (Seguenza, 1880) and Namias (Namias, 1891), within synonyms of *Smittina cheilostoma*. However, this author found only one specimen of *P. cheilostoma* and no specimen of *L. ligulata*, so his synonymy is certainly based only on bibliography data. Some subsequent authors (e.g. Poluzzi, 1975; El Hajjaji, 1992) thought the two species *P. cheilostoma* and *P. ligulata* to be different. The two species are actually rather different because of the shape of orifice, lyrula, condyles and ovicell, and might perhaps belong to two genera very allied but different. Finally, Zabala and Maluquer (Zabala & Maluquer, 1988), comparing the Recent *P. inerma* with *P. cheilostoma*, thought the latter with smaller and scarcely distinguishable condyles (not at the level of the lyrula), broad lyrula, less developed peristome (not so tall) and smaller zooids.

Ecology

In Emilia Region *P. cheilostoma* has been found in sediments of deep infralittoral to shallow circalittoral, on fragment of or mollusc shells and rhodoliths, and can be without substratum, thus to have been epiphytic too. As defined by Gautier (Gautier, 1962) *P. cheilostoma* is epiphytic, on seaweeds and rhizomes of *Posidonia*, and epilithic on fragment of or calcareous shells, in sea-bottom from 20 to 150 metres deep.

Stratigraphic distribution in Western Emilia Region

- In the Monte Oliveto section in Ongina Valley, Vernasca district (Piacenza Province), Zanclean (Early Pliocene).
- In the Monte Padova and Monte Falcone (see Poluzzi, 1975) sections, Castell'Arquato district (Piacenza Province), Piacenzian (Late Pliocene).
- In the Campore quarry, Salsomaggiore Terme (Parma Province), Piacenzian (Late Pliocene) (personal data).
- In the riverbed of the Arda River, Castell'Arquato (Piacenza Province), Early Pleistocene.

Stratigraphic distribution

? Upper Miocene (quotation in El Hajjaji (1992) should be reviewed), Pliocene to Recent.

Concluding remarks

At present no type specimen of *Lepralia cheilostoma* Manzoni is known to exist, so a neotype should be designated. Manzoni collected his specimen in Pliocene sediments cropping out in Castell'Arquato area, but at present there is no possibility to infer in which of the three Pliocene outcrops, Monte Oliveto, Monte Padova and Monte Falcone sections, Manzoni found his material. As a result it is impossible to establish where topotypes can be collected. Besides complete enough *P. cheilostoma* specimens, later in astogeny and consisting, in the same colony, of the first zooecia of ancestrular region together with peripheral ovicelled zooecia, were not found in Pliocene sediments cropping out in Castell'Arquato area. The collected Pliocene colonies were always small fragments of zoaria. So I prefer not to designate the *P. cheilostoma* neotype with a colony fragment and without realizing in which of the three Pliocene outcrops Manzoni collected his type material, provided that he collected it in one of these three outcrops. When a colony, showing all the peculiar zooecial characters of the species, will be found and also defined the outcrop from which the Manzoni's type specimen comes, in that case a neotype can be designated. Even if the type of the species figured by Manzoni had to be a colony in early astogenetic stage, the neotype has to be a colony late in astogeny.

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