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NOTA BREVE - SHORT NOTE

NEW DEEP-SEA BRYOZOAN SPECIES FROM THE PLEISTOCENE OF SOUTHERN ITALY

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Key-words: Bryozoa, Pleistocene, deep-sea, Southern Italy, new taxa.

Riassunto. Vengono descritte due nuove specie ed una sottospecie di briozoi: *Tervia barrieri* (Cyclostomatida), *Heliodoma angusta* (Cheilostomatida) e *Crisia tenella* Calvet *longinodata* (Cyclostomatida). Tutte provengono da sedimenti essenzialmente marnosi affioranti nell'area dello Stretto di Messina (Italia meridionale) e depostisi in paleoambienti degli orizzonti sommitali del Piano Batiale. Si tratta di taxa endemici dell'area mediterranea, estinti, probabilmente stenotermi che potrebbero rivestire un interesse paleoclimatico e stratigrafico.

Abstract. Two new species: *Tervia barrieri* (Cyclostomatida) and *Heliodoma angusta* (Cheilostomatida) together with the subspecies *Crisia tenella* Calvet *longinodata* (Cyclostomatida) are described from Pleistocene deep-sea sediments cropping out in Southern Italy. They are Mediterranean palaeoendemics, closely related to Recent deep-water Atlantic species.

Introduction.

This study is part of a program to define the composition and structure of benthic palaeocommunities from Pleistocene deep-sea sediments (southern Italy). This area, and above all the Messina Strait, is particularly suitable for the study of deep-sea palaeocommunities, as strong Neogene tectonic activity caused a remarkable uplift of deep-sea Plio-Pleistocene sediments (Barrier et al., 1986; Barrier, 1987).

The sediments are very fossiliferous. Fossil assemblages are abundant and diverse with bryozoans, molluscs, scleractinians, isidids, serpulids, brachiopods, crinoids and barnacles. All these systematic groups show a clear Atlantic affinity as attested by numerous Atlantic Guests and Northern or Boreal Guests (Gaetani & Saccà, 1984, Zibrowius, 1987, Roux et al., 1988, Barrier et al., 1989, Di Geronimo & La Perna, 1996, 1997a, b; Rosso & Di Geronimo, 1998). The former are Atlantic deep-sea species which spread in the Mediterranean following the general climatic cooling since the Middle Pliocene. The latter are North Atlantic shelf species whose latitudinal range shifted southwards during cold Pleistocene phases, thus comprising the Mediterranean.

These Atlantic-like palaeocommunities are characterised also by the presence of some species closely related to Recent Atlantic taxa from which they differ by slight morphologic characters (Di Geronimo et al., 1996; Di Geronimo & La Perna 1996; 1997b). These species may be Mediterranean Pleistocene palaeoendemics. In this paper, new bryozoan species with paleoendemic characteristics are described.

Materials.

The material studied originates mainly (Fig. 1) from three Pleistocene fossil localities, two (Lazzàro: 20 samples; and Archi: 12 samples) located in southernmost Calabria, and one (Furnari: a single sample) in NE Sicily, along the Tyrrhenian side of the Peloritani Mounts. Fossil bryozoans came from sediment bulk-samples ranging in volume from 2 to 10 dm^3. Additional material (30 samples belonging to EOCUMM94-95 campaigns) comes from Upper Pleistocene (? Würmian) submerged sediments (300-1,500 m depth) from the SE Tyrrhenian Sea (Gioia and Cefalù basins adjacent to the Eolian Islands) and from the northern part of the Tyrrhenian Sea (2 samples from the BS/77 and BS/78 campaigns, 500-1500m depth), off Corsica and Sardinia. Samples were collected mainly with a box-corer; a few ones were dredged.

Sediments were disaggregated in water and gently washed using a 63 µm mesh to obtain even very small bryozoan specimens and fragments. Dried fractions >250 µm were routinely sorted, whereas finer materials were usually checked to look for rare and/or the smallest species.

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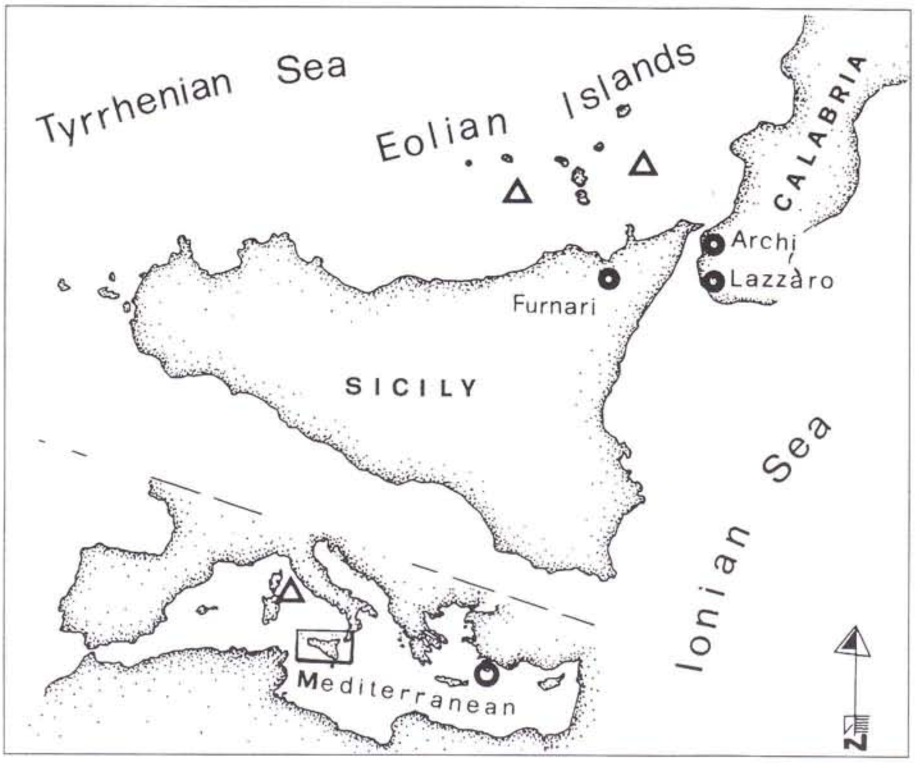


Fig. 1 - Location of studied samples. Triangles: submerged, Late Pleistocene thanatocoenoses; circles: Plio-Pleistocene outcrops.

The material described is deposited in the Paleontological Museum of the Istituto Policattedra di Oceanologia e Paleoecologia, Catania University (IPOP Museum, in the following).

Geological and palaeoecological setting.

The Messina Strait area (between Sicily and Calabria) offers exceptional opportunities for the study of Pleistocene deep-sea communities. The Plio-Quaternary sedimentation in this area has been strongly affected by tectonics which split the substrate into several "tectonic-sedimentary entities", each evolving independently from the neighbouring sectors (Barrier, 1987). Vertical displacements, occasionally exceeding 1,000 m, allowed the deposition of deep-sea sediments and their subsequent up-lift to 200-400 m above the present sea level (Barrier et al., 1986; Barrier & Montenat, 1987). Bathyal palaeoenvironments are often recorded perfectly by fossils and contain *in situ* palaeocommunities belonging to both hard and soft bottoms which have been referred to the Deep-Sea Corals (CAP) and the Bathyal Mud (VP) palaeobiocoenoses *sensu* Pérès & Picard (1964) and Di Geronimo (1987).

The Lazzàro section belongs to the Motta S. Giovanni tectonic-sedimentary entity, bordered landwards by a NW-SE fault system (Barrier et al., 1986). The section comprises basal Tortonian sandstones overlain by five sedimentary units, outlined by submarine truncations. Except for the topmost unit, the sequence was deposited in circalittoral to epibathyal palaeoenvironments indicating a sudden uplift to infra-circalittoral depths. Epibathyal sediments, mainly marls, were deposited during a cold or cold-temperate phase of the Early Pleistocene (Violanti, 1988) or, partly, during the Middle Pleistocene (Aifa et al., 1987). Marls containing embedded blocks colonised by deep-sea, hard-bottom species were deposited in a nearby fault palaeoescarpment, ca. 600 m deep. Fossil assemblages are rich and diverse, consisting mainly of scleractinians, gorgonians, molluscs, serpulids and bryozoans. They comprise mud-dwelling taxa and species living on hard substrata (boulders) and/or coarse biogenic bottoms around the boulders (Di Geronimo et al., 1996). Bryozoans consist mainly of slender erect species. Setoselliniform species, particularly adapted to colonise sand grains are common, whereas encrusting species, represented mainly by runners, are scarce. Dominant species are *Tessaradoma boreale* (Busk), *Gemellipora eburnea* Smitt, *Reteporella sparteli* (Calvet), *Caberea ligata* Jullien, *Euginoma vermiformis* Jullien, *Setosellina roulei* Calvet, *Hornera lichenoides* (Linnaeus), *Anguisia verrucosa* Jullien and a new species belonging to the genus *Tervia* (described below).

The section of Archi belongs to the Reggio tectonic-sedimentary entity, controlled by a N40°-50° fault system (Barrier, 1986). Sediments comprise transgressive, shallow-water deposits evolving into bathyal marls overlain by deltaic sands and gravels. Bathyal beds contain boulders encrusted by deep-sea scleractinians and serpulids. Marl deposition occurred in a cold phase of the upper part of the Early Pleistocene-Middle Pleistocene as demonstrated by foraminifers and nannofaunas (Di Geronimo et al., 1997). Fossil assemblages indicate a strong Atlantic affinity and a bathyal palaeoenvironment 500-1,000 m deep. Benthic faunas consist mainly of molluscs. Bryozoans are usually rare but common and well diversified in the coarsest (silty or sandy) samples. Slender erect, both rigid and flexible, often rhizoid-bearing species and setoselliniform taxa prevail. Encrusting species are rare. *Tessaradoma boreale* (Busk), *Tervia irregularis* Meneghini, *Hornera frondiculata* Lamouroux, *Anguisia verrucosa* Jullien, *Setosellina roulei* Jullien and *Setosella vulnerata* (Busk), together with a new species belonging to *Heliodoma* (described below) are the most common components of these assemblages.

The Furnari outcrop is located in the "Furnari block" recognised by Kezirian (1992). This fault-controlled entity is formed by a Miocene substrate overlain by shelf calcarenites and silts. A small N-S directed graben is located along the northern edge of the block. Deep-sea faunas encrust fault escarpments and the basin is filled by grey bathyal marls deposited during the Early Pleistocene as indicated by foraminifers. Benthic assemblages originate from a deep-sea muddy bottom community living near a fault paleoescarpment as demonstrated by the presence of sessile species needing a hard bottom or, at least, coarse biogenic substrates interspersed in the bathyal muds. Fossils consist mainly of molluscs with deep-sea mud-dwelling species and subordinate sessile bivalves (see Di Geronimo & La Perna, 1997b). Bryozoans are common but poorly diversified. They consist mainly of cemented, erect-rigid morphotypes with subordinate rhizoid-bearing erect-rigid and flexible specimens. A single setoselliniform species (described below) is present. *Tervia irregularis* (Meneghini), *Tessaradoma boreale* (Busk), *Hornera lichenoides* (Linnaeus) and *Anguisia verrucosa* Jullien are the dominant species.

The EOCUMM samples, studied incompletely by Di Geronimo et al. (1995) originate from bathyal (ca. 300-1,500 m deep), muddy to silty-muddy bottoms rich in planktonic gastropod and foraminiferan tests. Benthic assemblages are dominated by deep-sea molluscs, mainly nuculoids and small mud-dwelling species. Bryozoans are rare and quite absent from several samples. They comprise a few, mainly erect species among which *Anguisia verrucosa* Jullien and *Reteporella sparteli* (Calvet) prevail.

The BS samples come from bathyal (ca. 500-1700 m) muddy bottoms, including blocks originating from rocky scarps above. Benthic assemblages consist mainly of molluscs (deep-sea nuculoids, pectinids and arcids); isidid gorgonians and brachiopods are locally abundant. Bryozoans are subordinate but usually diverse. Erect-rigid specimens prevail, mainly belonging to *Tessaradoma boreale* (Busk), *Palmicellaria* cf. *elegans* Alder and *Jaculina* cf. *tessellata* Hayward.

Systematic accounts

Class **Stenolaemata** Borg, 1926
Order **Cyclostomatida** Busk, 1852
Family *Crisiidae* Johnston, 1838
Genus *Crisia* Lamoroux, 1812

Crisia tenella Calvet, 1906 **longinodata** ssp. nov.

(Pl. 1, fig. 6-10)

1995 ?*Crisia tenella*, Moissette & Spjeldnaes, pl. 1, fig. 5-6.
1998 *Crisia* sp.1, Rosso & Di Geronimo, tab. 1, fig. 4, 1-2.
1997 *Crisia* sp.1, Di Geronimo et al., tab. 3.

Material. Lazzàro marls: over 100 internodes or fragments from 3 samples, collected in the basal, Lower Pleistocene part of the marls; Archi section: a single internode from the topmost sample (Middle Pleistocene); EOCUMM campaigns: few specimens from three samples ranging from 485 to 750 m depth (?Late Pleistocene); BS 78 campaign: few specimens from 1,293-1,707 m depth (Late Pleistocene).

Etymology. *longinodata* from *longus* = long and *nodatus* = with nodes, i.e. characterised by long internodes.

Types. Holotype: a fertile internode (Pl. 1, Figs. 8-10) from the basal part of the Lazzàro marls (boulder 1993). Paratypes: 32 sterile internodes and a single fertile one from the same sample. IPOP Museum, IPOP. B2. 26.1.1995.

Diagnosis. Slender, long internodes comprising up to ten autozooids, characterized by a very acute basal angle.

Description. Very slender, poorly calcified, biserial internodes (Pl. 1, Figs. 6, 7). Basal width of internodes small; basal angle (α) very acute (10-13°); 2nd zooid long ($L2 = 600\text{-}845\mu m$; $N=10$). Each internode shows 0-2 basis rami. Gonozooid sub-erect (Pl. 1, Figs. 8-10) consisting of an apex-down cone with a convex base, rising frontally and obliquely at an angle of about 50° to the internode ($Lgon = 390\mu m$, $lgon = 260\mu m$; $N=2$). Ooeciostome (Pl. 1, Figs. 8-10) sub-terminal and dorsal; it is a short flared tube antero-distally compressed and facing upward.

Remarks. These fossil fragments agree rather well with *C. tenella* as described by Harmelin (1990) but differ in some morphometric characteristics such as the smaller gonozooid dimensions and the general shortening of L2. Moreover, internodes are longer and often comprise 8-9 zooids vs. 3, (range 1-7: Harmelin, 1990). These features are constant in the fossil specimens studied. Therefore, the designation of a subspecific taxon is proposed for these specimens.

Distribution. The subspecies *C. tenella longinodata* is presently known only as a fossil from the Mediterranean area where it lived in both western and eastern basins. *C. tenella longinodata* was found in sediments cropping out in the Messina Strait zone (Southern Italy) and in submerged sediments of the SE Tyrrhenian Sea. Few additional specimens come from the northern Tyrrhenian sea, off Sardinia. The specimens from the Plio-Pleistocene deep-water sediments of Rhodes, recorded as *C. tenella* by Moissette & Spjeldnaes (1995) seem to belong to this new taxon. The stratigraphic distribution ranges from the upper part of the Late Pliocene-lower part of the Early Pleistocene (Moissette & Spjeldnaes, 1995) to Late Pleistocene (submerged Würmian sediments from Tyrrhenian Sea). This is a deep-sea species as it was recorded from sediments deposited in depths ranging from ca. 400 to 1,700 m. Bathymetric and geographic distributions partially overlap those of the nominal species, known from bathyal bottoms in the NE Atlantic (Calvet, 1906a; Harmelin & d'Hondt, 1982; 1992; Harmelin, 1990), from epi-bathyal bottoms of the Alboran Sea (Harmelin & d'Hondt, 1992) and from deep-circalittoral bottoms off Marseille (Harmelin, 1978).

Family *Terviidae* Canu and Bassler, 1920

Genus *Tervia* Jullien, 1882

Tervia barrieri sp. nov.

(Pl. 1, fig. 1-5)

1998 *Tervia* sp.1, Rosso & Di Geronimo, tab. 1, fig. 4, 4.
1997 *Tervia* sp.1, Di Geronimo et al., tab. 3.

Material. Lazzàro marls: over 400 fragments from 8 samples from the basal part of the marls (Lower Pleistocene). Archi section: over 40 specimens from 4 samples of the middle part of the section (Middle Pleistocene) where fragments are more abundant in coarser (silty-sandy) sediments. EOCUMM campaigns: a few fragments from 3 samples from 300-360 m depth (Late Pleistocene); BS 77 campaign: over 100 specimens from 718-742 m depth (Late Pleistocene).

Etymology. Name in honour of the French geologist Pascal Barrier who actively studied the Plio-Pleistocene palaeoenvironmental evolution of the Messina Strait.

Types. Holotype: from the Pleistocene of Lazzàro (Lazzàro Cava Antica: Pl. 1, Figs. 2, 5). Paratypes: ca. 200 sterile and fertile branches from the same sample. IPOP Museum, IPOP. B3. 26.1.1995.

Diagnosis. Very slender branches with 1-3 zooids per transverse series. Small, sac-shaped gonozooid with flared ooeciostome.

Description: Colony vinculariform, dichotomous, with slender, sometimes curved branches (Pl. 1, fig. 1), round in cross section. Zooids arranged in alternating transverse series with peristomes facing frontally and laterally; each series with 2 tubes (range 1-3); the outermost the longest (Pl. 1, fig. 1). Sometimes tubes isolated in the middle line between the series. Inner spines absent (Pl. 1, fig. 4). Gonozooid (Pl. 1, fig. 2-3, 5) dorsally placed, sac-shaped, short (length once or twice the width), suddenly swollen in its proximal part and reaching its maximum in the mid-distal region. Gonozooidal wall with transversally growing grooves and densely spaced, round pseudopores. Ooeciostome (Pl. 1, fig. 2, 5) terminal, placed against the dorsal wall of the branch; it consists of a very short, transversally elongated, slightly flared tube facing distally.

Remarks. A single *Tervia* species is known presently from the Mediterranean, *T. irregularis* (Meneghini). It lives in lower circalittoral to bathyal environments (Harmelin, 1976; Harmelin & d'Hondt, 1982) and has a long (Eocene to Recent) and wide (Western Europe from Holland to Spain and Italy) distribution. *T. barrieri* differs from specimens of *T. irregularis* showing a feeble calcification. It presents a more slender appearance due to the few number of zooids per series, a smaller and a shorter gonozooid and a flared ooeciostoma. Inner spines, regarded by Harmelin (1976; 1977) as diagnostic for *T. irregularis*, are lacking. Another similar species *T. superba*, was described by Jullien (1882) on a few sterile specimens from bathyal bottoms (896 m) in the Biscay Gulf (NE Atlantic). Harmelin (1977), although with reservations, referred some specimens from the Concepcion Banc, Canary Island (200 m) to this species, previously considered by Harmelin (1976) as a deep morphotype of *T. irregularis.* He separated *T. superba* taking into account the absence of inner spines and the characters of the gonozooid described as "une vésicule renflée, assez courte, dont la partie proximale tubulaire est visible et comparable à celle d'un autozoide. L'ooeciostome est un tube court terminal qui s'ouvre en direction distale au niveau de la zone de croissance de la branche". Thus, the Pleistocene specimens show affinities to *T. superba*: zoarial morphology, a few tubes per series, and absence of inner spines. Nevertheless, they differ from *T. superba* as the gonozooid is longer and pear shaped and overall, has a different ooeciostome consisting of a compressed and flared tube, attached to the dorsal side of the branch. Such features are constant in the fossil specimens and allow an easy recognition of the species.

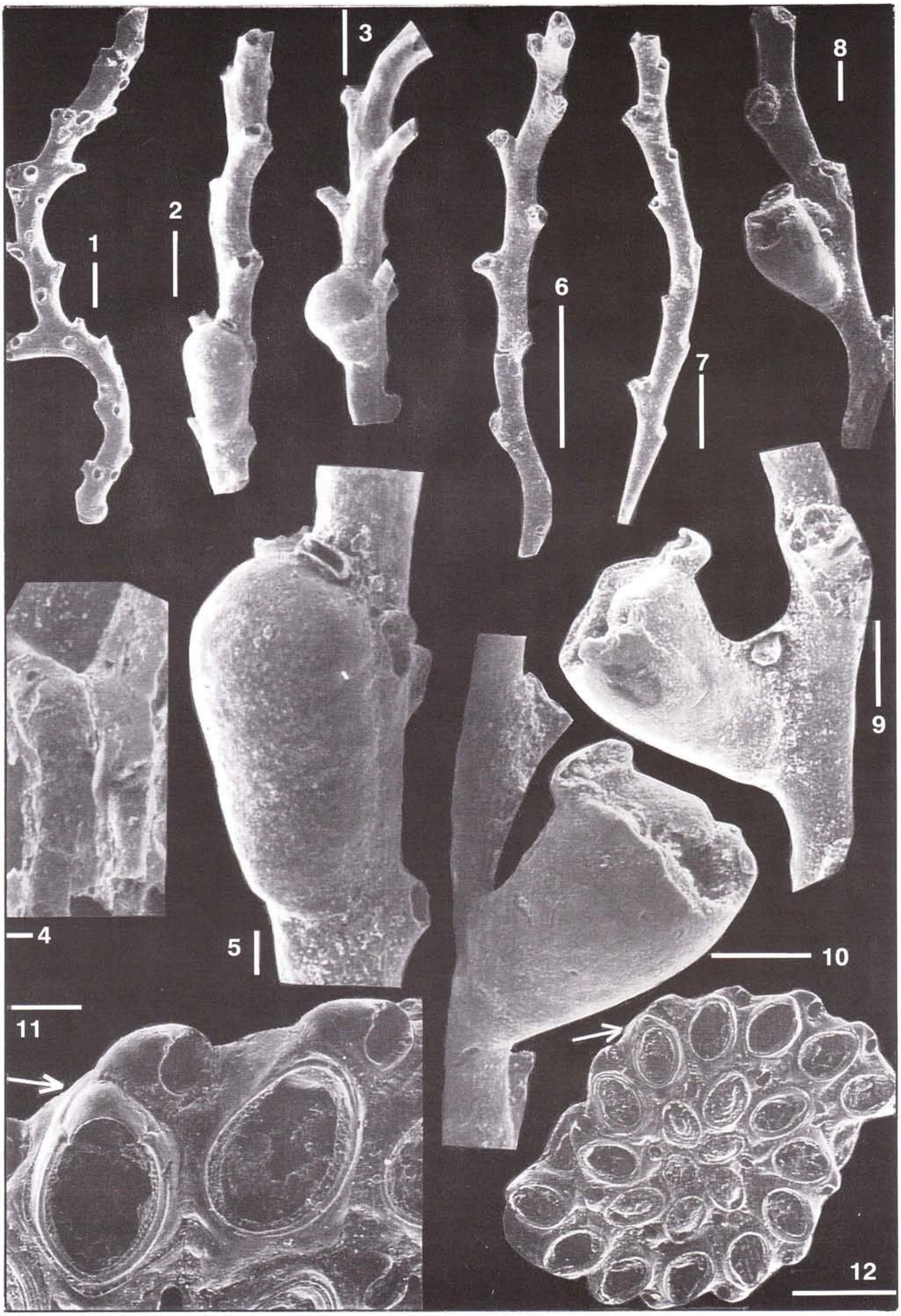
PLATE 1

Scale bars: 100mm for Figs. 4-5 and 8-11; 500mm for Figs. 1-3, 6-7 and 12.

Fig. 1-5 - *Tervia barrieri* sp. nov., Lazzàro, Early-Middle Pleistocene. 1) Sterile, slender branch: Liv. 1 (1993); 2, 5) holotype (Lazzàro, ancient quarry): 2) complete view of a fertile branch with a dorsally placed gonozooid; 5) detail of the swollen gonozooid and the ooeciostome, a short, slightly flared, proximal-distally compressed tube, medially located at its distal end; 3) fertile branch with a very short, distally inflated gonozooid: Liv. 1 (1993); 4) longitudinal section of two peristomes to show the absence of inner spines: Liv. 1 (1993).

Fig. 6-10 - *Crisia tenella* Calvet *longinodata* ssp. nov., Lazzàro: boulder 1993, Early-Middle Pleistocene. 8-10) holotype; 8) part of a fertile internode with a suddenly inflated gonozooid and its flared ooeciostome compressed in a proximal-distal fashion; 9 and 10) lateral close-ups of the gonozooid to show its semi-erect position and the distally located ooeciostome; 6 and 7) paratypes: slender, curved sterile internodes.

Fig. 11-12 -*Heliodoma angusta* sp. nov., Furnari, Early Pleistocene. Holotype. 11) detail of two zooid-avicularium couples with an ovicell (arrowed). Note the very narrow, beaded, cryptocyst, the entire, smooth mural rim and the very reduced frontal pore of the ovicell; 12) a complete mature colony with twenty-one zooids: note the ancestrula and the peculiar periancestrular budding pattern giving rise to two clockwise spirals of zooids and the ovicell (arrow).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Distribution. The species is presently known only as a fossil from the central Mediterranean area. It was found in Lower-to-Middle Pleistocene sediments cropping out in the Messina Strait (Rosso & Di Geronimo, 1998; Di Geronimo et al., 1997) and in submerged Würmian thanatocoenoses of the Tyrrhenian Sea. This species seems to be limited to bathyal bottoms from ca. 300 m (SE Tyrrhenian Sea) to ca. 1,000 m (inferred depth of deposition of the Archi fossiliferous layers).

Class Gymnolaemata Allman, 1856
Order Cheilostomatida Busk, 1852
Family *Setosellinidae* Hayward and Cook, 1979
Genus *Heliodoma* Calvet, 1906

Heliodoma angusta sp. nov.

(Pl. 1, fig. 11-12)

1998 *Heliodoma* sp.1, Rosso & Di Geronimo, tab. 1, fig. 5, 1.
1998 *Heliodoma* sp.1, Di Geronimo et al., tab. 3. pl. 3, fig. 2.

Material. Furnari marls: 6 colonies (Early Pleistocene); Lazzaro marls: over 20 colonies from coarse biogenic sands around the boulders (Early Pleistocene); Archi section: over 70 colonies from 9 samples from the base to the top of the section (Early-to-Middle Pleistocene).

Etymology. From its very narrow (*angustus*) cryptocyst.

Types. Holotype: a complete fertile colony (Pl. 1, fig. 11-12) from Furnari marls (Early Pleistocene). Paratypes: 1 entire and 4 incomplete colonies encrusting sandy lithic and biogenic (bivalve fragments and forams) grains from the same sample. IPOP Museum: IPOP. B 4. 26.1.1995.

Diagnosis. *Heliodoma* well characterised by an evenly narrow cryptocyst.

Description. Roughly elliptical colonies, 1-2 mm in diameter (Pl. 1, fig. 12). Zooids with well developed gymnocyst and a narrow (ca. 15 µm), depressed cryptocyst bordering lateral and proximal sides of the opesium (Pl. 1, fig. 11). Mural rim smooth. Ancestrula budding a distal avicularium (*sensu* Hayward & Cook, 1979) and a mid-lateral narrow and a distal-lateral, normal primary zooids (Pl. 1, fig. 12). Each of them gives rise to a separate, not dichotomous, clockwise, spiral of zooids. New zooids are laterally budded each with a distal-lateral avicularium so that the two zooidal spirals are separated by an avicularial spiral. Periancestrular zooids show complete, beaded closures, with a median longitudinal umbo, which covers the entire opesium except for the opercular zone. Ovicell large, terminal, not prominent, with a small, subcentral foramen, sometimes very reduced (Pl. 1, fig. 11-12: arrowed), presumably closed by a large operculum. The zooidal size increases rapidly from the approximately rounded ancestrula (La: 170-185µm; la: 160-175µm) and the first zooid of each spiral (Lz1: 234µm; lz1: 177µm and Lz1: 234µm; lz1: 195µm) in the holotype, to the fifth-sixth zooid. Size of zooids budded afterwards become constant (Lz: 380-410µm; lz:240-270µm).

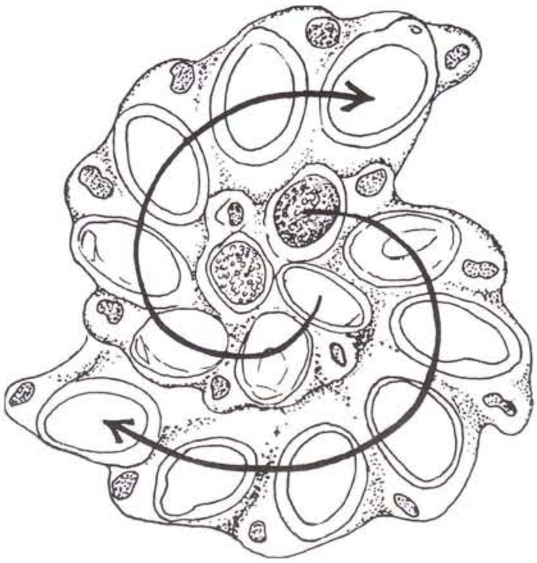

Fig. 2 - Heliodoma angusta sp. nov. Schetch showing the peculiar colony budding pattern giving rise to the two clockwise spirals of zooid-avicularial couples.

Remarks. *Heliodoma angusta* is very similar to the Recent deep-sea Atlantic species *H. implicata* Calvet, 1906b, for colony organization and periancestrular budding pattern (Fig. 2), typical of the genus (see Hayward & Cook, 1979). Neverthless, the latter differs from *H. angusta* for its wider, laterally extended cryptocyst (see Prenant & Bobin, 1966; Hayward & Cook, 1979) giving the opesium an elongated key-hole shape. Ancestrula and zooids from the repetition zone are constantly longer in *H. implicata* (ancestrula: 200-220 µm vs. 170-185 µm; zooids: 400-445 µm vs. 380-410µm) (see Hayward & Cook, 1979). Moreover, measures stabilise earlier in astogeny, from about the 4th zooid instead of the 6th as in *H. angusta*.

Distribution. *H. angusta* seems to be restricted to the Mediterranean Early-to-Middle Pleistocene where it has been recorded exclusively from deep-sea sediments deposited in 500-1,000 m depths.

Conclusions.

The three newly described taxa are known exclusively from the Early-to-Late Pleistocene of the Western Mediterranean area, except for *Crisia tenella longinodata* which was recorded also from the Late Pliocene of the Eastern Mediterranean Sea. Furthermore, all have deep-sea counterparts in the present day Atlantic Ocean, whereas only one (*C. tenella longinodata*) has a probable deep-circalittoral to bathyal Mediterranean relative: the nominal species. Furthermore, the new taxa belong to palaeocommunities showing strong Atlantic affinities indicating the psycrosphaeric conditions of the Mediterranean during the Pleistocene. *C. tenella longinodata, T. barrieri* and *H. angusta* could therefore represent cold stenothermic extinct taxa endemic to the Mediterranean area, and are potential indicators of palaeoclimatic and stratigraphic conditions (see Rosso & Di Geronimo, 1998).

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