

New report of shallow water scleractinians from the Pliocene of Siena

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ABSTRACT Three species of scleractinians belonging to the genera *Hoplangia* Gosse, 1860, *Phyllangia* Milne Edwards et Haime, 1848 and *Thalamophyllia* Duchassaing, 1870 are reported. For *Hoplangia* and *Thalamophyllia* this is the first report from the Mediterranean Pliocene. The three species were linked to hard or detrital bottoms of the infralittoral zone.

KEY WORDS Early Pliocene; Tuscany, Monte Calcinaio; Scleractinians; Caryophyllidae; *Hoplangia*, *Phyllangia* and *Thalamophyllia*.

Received 28.05.2020; accepted 12.08.2020; published online 06.11.2020

INTRODUCTION

Several contributions to knowledge of the scleractinian fauna of Siena, and in particular to the fauna of Monte Calcinaio in the Siena-Radicofani basin (Tuscany, Siena), were recently published (Spadini, 2015, 2016, 2018). A feature of this population is its quantitative and qualitative species richness, related to hard or detrital bottoms of the infralittoral to circalittoral and, in some cases, bathyal environments.

This note describes three species of the Monte Calcinaio, two belonging to the genera *Hoplangia* Gosse, 1860 and *Thalamophyllia* Duchassaing, 1870. They have no fossil representatives in the Mediterranean Pliocene and are currently represented by one species each in the Mediterranean Sea. The third species belongs to the genus *Phyllangia* Milne Edwards et Haime, 1848, which is represented by various species, living and fossil, one of which (*P. mouchezii*) occurs in the Mediterranean Sea. All these species are linked to hard or detrital bottoms, a type of habitat little known in the Mediterranean Pliocene, but present in that of Siena.

Monte Calcinaio (altitude 732 m; 52°54'55"N, 11°48'59"E), where the materials were found, is

near Radicofani in the Radicofani sub-basin (Tuscany, Italy). Marine sedimentation in this area started in the Zanclean with deposition of deep-sea clays over continental Miocene sediments (Bonini & Sani, 2002). The microfaunal association in the Radicofani Basin has been attributed to the *Globorotalia margaritae/puncticulata* Biozone of the Early Pliocene (Zanclean) (Bossio et al., 1992; Pascucci et al., 2006). For other general characteristics of this site, see Spadini (2015, 2016, 2018).

RESULTS

Systematics

Classis ANTHOZOA Ehrenberg, 1834
Subclassis HEXACORALLIA Haeckel, 1866
Ordo SCLERACTINIA Bourne, 1900
Familia CARIOPHYLLIIDAE Dana, 1846

Genus *Hoplangia* GOSSE, 1860

TYPE SPECIES. *Hoplangia durotrix* Gosse, 1860, by monotypy.

REMARKS. *Hoplangia* Gosse, 1860 is only represented by the extant *H. durotrix* Gosse, 1858 that lives in the Eastern Atlantic and the Mediterranean Sea. Cairns (1995) reported this species from New Zealand. For its general characters, see Joubin (1927), as *Microcyathus neapolitanus* Doderlein, 1903, and Zibrowius (1980).

Hoplangia durotrix is linked to rigid substrates, common in coastal areas and coralligenous zones to depths of about 150 m (Zibrowius, 1980).

***Hoplangia* sp. (Fig. 1)**

EXAMINED MATERIAL. Monte Calcinaio: one colony.

DESCRIPTION. Fragment of colonial corallum, bushy, very small in size (17.6 x 8.4 x 11.6 mm) formed by extratentacular budding. The corallites originate from the sides of other corallites. Theca covered with coarse granules, wide costae, not always well defined.

Small, circular or slightly elliptical calices (max. 3.2 x 4.7 mm). Septa 24–36 arranged hexamerally in four incomplete cycles. Fossa very deep. S_1 more robust and thicker than S_2 , S_3 converging with S_2 deep in fossa; S_4 small, only present in some of the six systems. Axial edges of septa smooth, but the edges of S_1 and S_2 are slightly wavy in the centre, tuberculated and probably fused together at their base. Lateral faces of septa bear very thick circular granuli. Pali and columella absent.

REMARKS. Due to the general characters, the colony (inner edge of septa smooth and non-toothed, absence of pali and columella) it can be included in the Caryophylliidae family. In addition to the lack of pali and columella, the Siena colony shares the following characters with *Hoplangia*: the large granules of the theca, the costae not well defined, the septal characters with $S_1 > S_2$, the tubercles of the axial margin of the septa fused at the bottom of the calice, and the large granules on the lateral faces of the septa.

Genus *Phyllangia* Milne Edwards et Haime, 1848

TYPE SPECIES. *Phyllangia americana* Milne Edwards & Haime, 1849, by subsequent designation (Milne Edwards & Haime, 1850).

REMARKS. The genus *Phyllangia* was included

in the Rhizangiidae family, but was recently transferred to the Caryophylliidae by Zibrowius (1980).

The oldest fossils of the genus *Phyllangia* date back to the Oligocene of Albania (Lorenthey, 1926).

Other species have been described for the Miocene of Western Europe (Milne Edwards & Haime, 1848–1850; Michelotti, 1871; Chevalier, 1961), Borneo (Gerth, 1923), Florida (Wells, 1947; Gane, 1900) and Land of Fires (Squires, 1963).

Various species can be found along the Atlantic and Indo-Pacific coasts (Cairns & al., 1999). One of these, *Phyllangia mouchezii* (Lacaze-Duthiers, 1897), present in the Atlantic Ocean and in the Mediterranean Sea (Zibrowius, 1980), is considered a subspecies of *P. americana* Milne Edwards & Haime, 1848 (Chevalier, 1966; Cairns, 2000).

***Phyllangia* sp. (Fig. 2)**

EXAMINED MATERIAL. Monte Calcinaio: one colony.

DESCRIPTION. Colonial corallum composed of two complete and two incomplete corallites. Corallites arising by extratentacular budding from a thick crusty coenosteum or from the lower theca of a parent corallite. Corallites cylindrical, 5–6 mm tall, closely spaced or fused at their base. Theca granular and costate at the main septa. Shallow fossa, circular or slightly elliptical calice (max 12.6 x 9.7 mm). Septa in five incomplete cycles arranged hexamerally, but incomplete and poorly conserved. The largest calice has 52 septa, but is not fully preserved.

S_1 and S_2 equal or sub equal, thicker than the septa of higher cycles, S_3 dilated at their base, forming an indistinct paliform lobe, present only in some septa. Some S_4 seem to have slightly serrated margins, S_5 reduced and not very evident, present in the largest corallite. S_1 , S_2 and S_3 merge at bottom of calice, while S_4 and S_5 are free. Lateral face of septa with sharp granules. Columella papillary, very small, composed of few elements. Endothecal dissepiments present.

REMARKS. Among the species described, this colony resembles *Phyllangia blakey* Wells, 1947 from the Upper Miocene of Florida, and *Phyllangia mouchezii*, currently living in the Mediterranean Sea (see Zibrowius, 1980).

De Angelis (1894) described *Phyllangia mi-*

crocyderea, a species with completely different morphological characters from the Pliocene of Albugnano (Asti).

Genus *Thalamophyllia* Duchassaing, 1870

TYPE SPECIES. *Desmohyllum riisei* Duchassaing, 1860, by monotypy.

DIAGNOSIS. Colonial corallum formed by extra-tentacular budding of ceratoid corallites from a thin common basal coenosteum resulting in reptoid to phaceloid coralla. Pali and columella absent; fossa deep. Endotheca absent (Cairns, 1995).

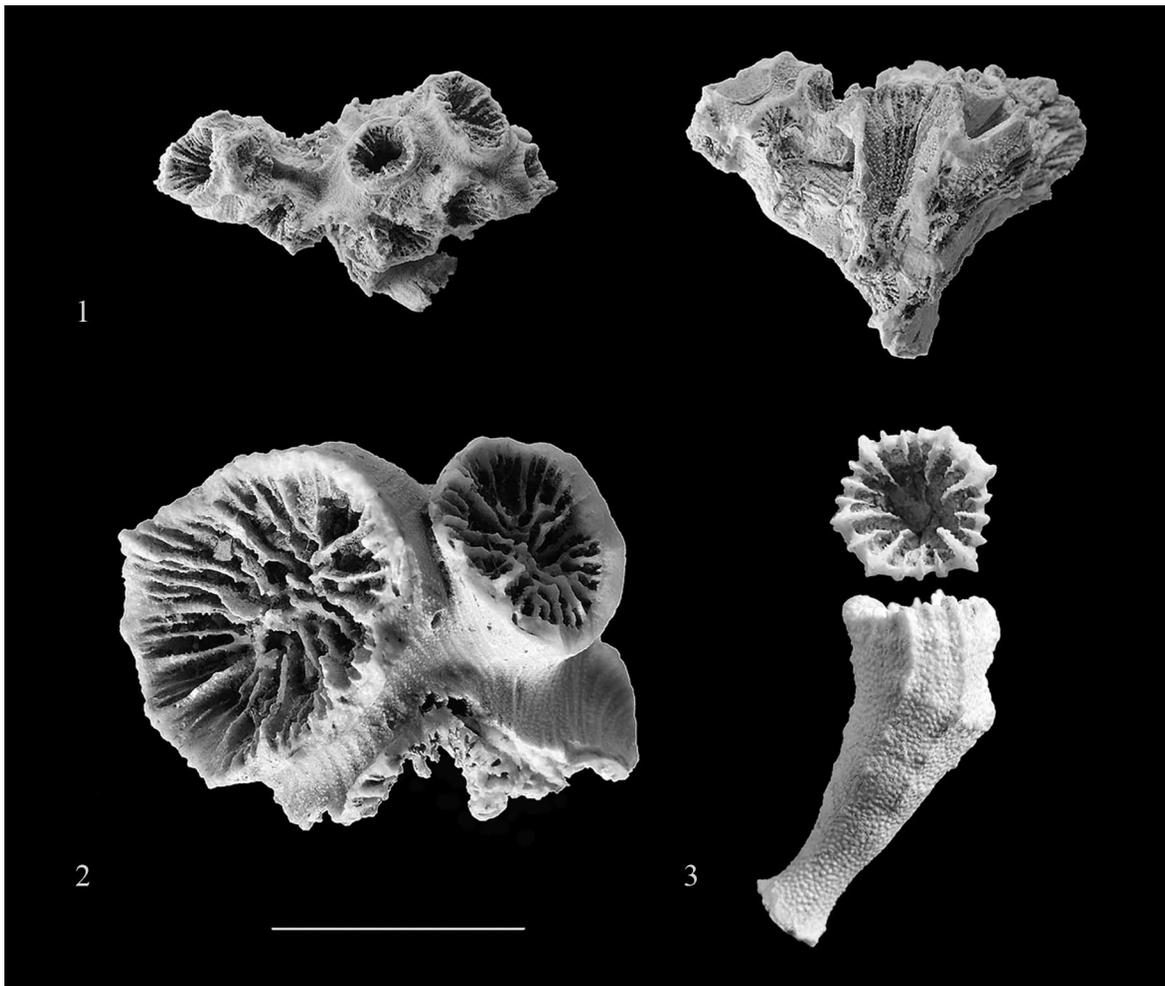
REMARKS. *Thalamophyllia* is a genus of colonial coral characterized by reptoid colonies, but isolated corallites have often been found (Cairns, 1995).

Four species are recognised: *T. riisei* (Duchassaing et Michelotti, 1864) of the western Atlantic, *T. tenuescens* (Gardiner, 1899) of the Indian Ocean and western and central Pacific, *T. gasti* (Doderlein, 1913) of the Mediterranean Sea and eastern Atlantic, and *T. gombergi* Cairns, 1979 of the western Atlantic (Cairns et al., 1999).

Thalamophyllia sp. (Fig. 3)

EXAMINED MATERIAL. Monte Calcinaio: one specimen.

DESCRIPTION. Corallum conical, elongated, 11.7 mm tall, with a calicular diameter of 2.2 mm, curved distally. Broad base, covered with evident granuli. The six costae corresponding to the septa



Figures 1–3. Scleractinian of Early Pliocene (Zanclean) of Monte Calcinaio. Fig. 1: *Hoplania* sp. Fig. 2: *Phyllangia* sp. Fig. 3: *Thalamophyllia* sp. (Scale bar = 1 cm)

of the first cycle are evident from the peduncle. The costae corresponding to the second and third cycle are faintly evident. Calice regularly circular. A total of 20 septa arranged in six systems and three incomplete cycles, with four S_3 missing in two opposing systems.

S_1 robust, reaching half of the calicinal radius, S_2 is thinner, shorter than S_1 , and S_3 is even smaller than the previous cycle. Very deep fossa, no columella.

REMARKS. According to the data reported in Zibrowius (1980) and Addamo et al. (2016), young *Desmophyllum* of equal calicinal diameter have more septa than *Thalamophyllia*. From a morphological point of view, the specimen from Monte Calcinaio is similar to *Desmophyllum fasciculatum* (= *T. gasti*) in Joubin (1927) and *Thalamophyllia tenuescens* (Gardiner, 1899) from New Zealand and the Philippines (Cairns, 1995).

Other small-sized specimens have been found on Monte Calcinaio, but they are generally in a very poor state of conservation. All these specimens are characterized by a broad base, three incomplete cycles of septa, theca with granules and costae variously developed.

CONCLUSIONS

The genera *Hoplangia* and *Thalamophyllia*, hitherto known only from the Pleistocene and still living in the Mediterranean Sea, are two new genera from the Mediterranean Pliocene. By contrast, the genus *Phyllangia* is reported since the Miocene, but its presence in the Pliocene was uncertain (Vertino et al., 2014).

The species described show a certain morphological affinity with the corresponding species extant in the Mediterranean and it is therefore likely that they had similar ecological needs (Zibrowius, 1980).

Thalamophyllia has a wide bathymetric range between 25 and 2460 m (Cairns, 2000). *T. gasti* currently lives in the Mediterranean Sea at shallow depths in caves, under small overhangs and in coral-ligenous environments with *Corallium rubrum*. *Hoplangia* lives between depths of 6 and 150 m (Zibrowius, 1980), while live specimens of *Phyllangia mouchezii* have been found between depths of 1 and 55 m (Zibrowius, 1980), although other species reach greater depths. It is therefore possible to hypothesize that the specimens found on Monte

Calcinaio lived at depths between 6 and 55 meters, corresponding to the infralittoral zone.

This bathymetric range matches that of other species typical of hard or detrital bottoms, from Monte Calcinaio, such as *Madracis almerai*, *Monomyces* sp., *Cladopsammia* sp., sharing the same habitats and is confirmed by various species of gastropods (*Gibbula* sp., *Persististrombus coronatus*, *Thais hörnesiana*) and bivalves (*Glycymeris bimaculata*, *Aequipecten scabrellus*, *Ostrea* sp., *Gigantopecten latissimus*, *Spondylus crassicauda*) which are found especially in the easternmost part of Monte Calcinaio.

The finding of these three species related to hard bottoms confirms the importance of this site for the study of the scleractinian fauna of the Pliocene of Siena and of the Mediterranean area in general.

ACKNOWLEDGEMENTS

I thank Helen Ampt (Siena, Italy) for revising the English.

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