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VALERIANO SPADINI <sup>(1)</sup>, MARCO SAMI <sup>(2)</sup>

## AN EXCEPTIONALLY WELL-PRESERVED COLONY OF BAMBOO-CORAL FROM THE EARLY PLEISTOCENE OF SCAVIGNANO (BRISIGHELLA, RAVENNA, ITALY)

**Abstract** - V. SPADINI, M. SAMI, *An exceptionally well-preserved colony of bamboo-coral from the Early Pleistocene of Scavignano (Brisighella, Ravenna, Italy)*.

A specimen of bamboo-coral on clayey matrix, collected in the Argille Azzurre Formation of Scavignano (Brisighella, Ravenna), is described. The specimen, which retains some “connected” parts, is characterized by simple internodes, a root with three branches, and sclerites of at least two types. For these characters the colony is to be included in the Keratoisididae family.

**Key words** - Keratoisididae, bamboo-coral, Early Pleistocene, Emilia Romagna, Italy

**Riassunto** - V. SPADINI, M. SAMI, *Una colonia di corallo bambù del Pleistocene inferiore di Scavignano (Brisighella, Ravenna) eccezionalmente ben conservata*.

Viene descritto un esemplare di corallo bambù su matrice raccolto nella Formazione Argille Azzurre di Scavignano (Brisighella, Ravenna). L'esemplare, che conserva alcune parti in “connessione”, è caratterizzato da internodi semplici, radice ramificata in tre rami, e da scleriti di almeno due tipi. Per questi caratteri la colonia è da includere nella famiglia Keratoisididae.

**Parole chiave** - Keratoisididae, corallo bambù, Pleistocene inferiore, Emilia Romagna

### INTRODUCTION

The name bamboo-corals designates a group of octocorals (Cnidaria, Anthozoa, Octocorallia) whose polyps are supported by an axial skeleton characterized by alternating nodes of proteic nature (gorgonine) and internodes of non-scleritic calcite. The alternation of nodes and internodes likens the coral to the stem of the bamboo plant, from which the name is derived. This group of octocorals was initially grouped in a single family, Isididae Lamouroux, 1812, with four subfamilies, but recent genetic studies have shown that it is a polyphyletic group. Heestand Saucier *et al.* (2021) proposes a classification with five families, all featuring a bamboo-like skeleton: Chelidonisididae, Isididae, Isidoidae, Keratoisididae and Mopseidae. The family Keratoisididae currently includes nine genera and about 60 species (Heestand Saucier *et al.*, 2021)

which live at depths of 200-4700 m (Lapointe & Watling, 2015), mainly on rocky substrates, but some live on soft bottoms. Watling *et al.* (2022) re-arranged the systematics of the family using DNA sequences and morphological data. This analysis recovered seven clades and several subclades that are differentiated by a number of morphological characters, including axis construction, polyp shape, branching pattern, and type and arrangement of sclerites. The colonies of this group can be simple or branched, fixed to the substrate with a compact basal holdfast or with branched laciniae. They may branch from nodes or internodes in a flat, fan-shaped or all-sided bush-like form (Daly *et al.*, 2007).

The north-east Atlantic fauna includes numerous bamboo-coral species of the genera *Acanella*, *Chelidonisis*, *Lepidisis* and *Keratoisis*, while the Mediterranean fauna currently includes three species divided into two genera, *Acanella* with *A. arbuscula* and *A. furcata*, and *Isidella elongata* (Altuna & Poliseno, 2019), all of which inhabit compact bathyal muds and are anchored to the substrate by a root-shaped base. Alongside simpler non-branched forms, such as *Lepidisis* Verril, 1883, there are others variously ramified in one or more planes with ramifications starting from nodes (*Acanella*, Gray, 1870; *Isidella* Sars, 1868) and internodes (*Keratoisis* Wright, 1869). Up to now all the fossil finds of the European area have generally been assigned to the latter genus.

Single bamboo-coral internodes have been common since the Cretaceous. Their presence during the Cenozoic is well documented in the Euro-Mediterranean domain, especially from the Miocene onwards (Zibrowius, 1991). The first species described is *Isis melitensis* Goldfuss, 1826 based on the figures of Scheuchzer (1723) and Scilla (1752). Michelotti (1847) subsequently described some new species from Piedmont (*Isis antiqua* Michelotti, 1847; *I. nummularia* Sismonda in Michelotti, 1847; *I. contorta* Sismonda in Michelotti, 1847). Seguenza (1864) distinguished three species from Sicily. Besides *Isis melitensis*, he described two new species: *I. peloritana*, which is dis-

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Figure 1. Localization of Scavignano (Brisighella, Ravenna).

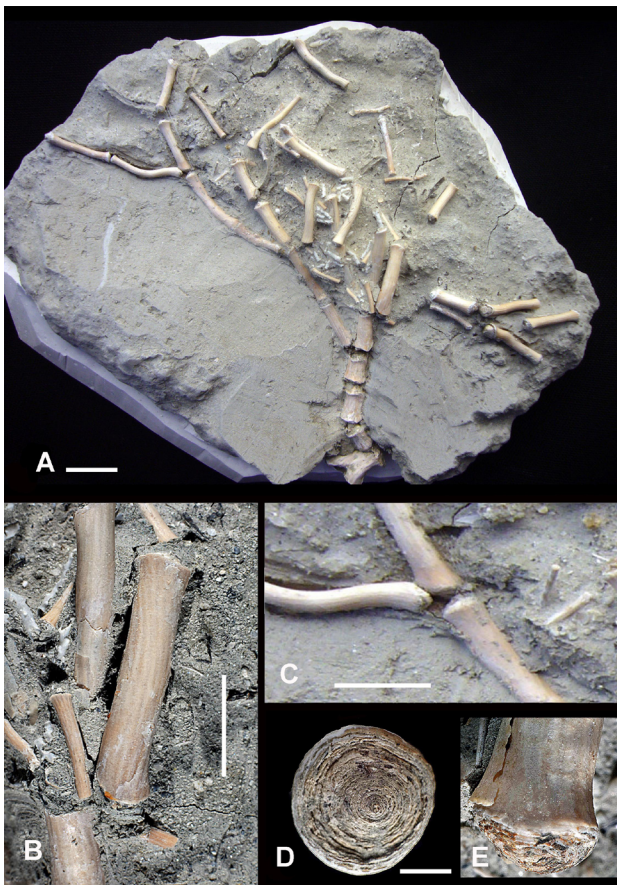


Figure 2. Bamboo-coral from the Early Pleistocene of Scavignano; A: overall view of the bamboo-coral colony (scale-bar = 10 mm); B: detail of some internode (Scale-bar = 5 mm); C: detail of the bifurcation of the internodes (scale-bar = 5 mm); D: details of the endings of an internode, with evident growth rings (scale-bar = 5 mm); E: articular angled face of an internode (scale bar = 5 mm).

tinguished by fragile elongated calcareous internodes, and *I. compressa*, as the name suggests characterized by compressed internodes. Last century Zuffardi Comerci (1928) made a synthesis of the alcyonaries of the Piedmont and Ligurian basin, listing the various species then included in the genus *Isis*, mostly Miocene, but in some cases older (*Isis brevis* and *I. contorta* of the Piedmont Eocene), and described a new variety, *Isis peloritana* var. *canaliculata*, characterized by a median canal running longitudinally along the internode, filled in adults by a secondary deposit of calcareous carbonate. Since the end of the 1970s, these species have been recognized as belonging to the genus *Keratois* (Colella and D'Alessandro, 1988; Di Geronimo, 1979; Placella, 1980; Grasshoff, 1980). In particular Grasshoff (1980) redescribes *Keratois melitensis* and *K. peloritana* which he distinguishes on the basis of the thickness of the internodes (greater in *K. melitensis* than in *K. peloritana*) and the branching (few branched internodes in *K. melitensis*, many branched internodes in *K. peloritana*). Zibrowius (1989) considers this distinction doubtful, while Langer (1989) suggests that branched and unbranched internodes, of various sizes, belong to *Keratois melitensis* and that *K. peloritana* is a junior synonym. *K. melitensis* is cited from numerous localities. In particular, we note its abundance in the Miocene deposit of La Atalaya de Mazarrón in Spain, where on the basis of the material found, a hypothetical colony of this species is reconstructed (De La Fuente, 2012). Although the internodes assigned to the two species (*K. melitensis* and *K. peloritana*), branched or unbranched, are substantially indistinguishable, on the basis of the original descriptions the root system of the two species is substantially different. The figures by Scheuchzer (1723) and Scilla (1752) that illustrate a colony of *Keratois melitensis* show a dilated encrust-



ing holdfast suitable for anchoring to hard substrates. On the contrary, the root of *K. peloritana* figured by Seguenza is lacinate and divided into numerous branches suitable for mobile substrates.

This note describes a small, particularly well-preserved colony, collected at Scavignano near Brisighella (RA) (Fig. 1). A unique find of its type, the colony is characterized by unbranched internodes and roots divided into numerous branches (Fig. 2A).

#### GEO-PALEONTOLOGICAL FRAMEWORK

The rocks outcropping in the studied Romagna Apennine sector belongs to the post-evaporitic succession of the Po-Adriatic margin; it dips quite regularly in a north-easterly direction, whereas in the plain it is covered by alluvial sediments of the Po valley. Since this succession has not undergone major horizontal translations, it is considered autochthonous (Cremonini, 1982). In particular, the Argille Azzurre Formation, dating from the basal Pliocene to the final part of the lower Pleistocene (between 5.3 and 0.9 million years ago), is made up of terrigenous sediments, mainly clays and blue-grey marly clays with little or no visible stratification due to bioturbation and/or poor granulometric sorting, having a total thickness approaching 3000 m (Vai, 1989). In this sector of western Romagna, relatively deep basinal sedimentation conditions were maintained throughout the Pliocene, although in the Piacenzian some clastic organogenic deposits ("spungone") were deposited locally, related to particular environmental conditions. From the lower Pleistocene, a sharply regressive trend was established, which progressively led from continental slope conditions to littoral-type environments ("Sabbie Gialle" or Formazione Sabbie di Imola). The marine succession is truncated at the top by alluvial gravel and sand deposits of the Emiliano-Romagnolo Supersynthem of Middle Pleistocene-Holocene age (Benini *et al.*, 2009). A sampling of the scarce fossil malacofauna associated with the bamboo-coral revealed a certain number of fairly characteristic taxa. The bivalves *Limopsis minuta*, *Jupiteria concava*, *Bathyspinula excisa* and *Neilo isseli* were very common. *Peplum clavatum*, *Gonimyrtea meneghinii* and *Delectopecten vitreus* were less common. Gastropods included *Nassarius semistriatus*, *Nassarius turbinelloides*, *Aporrhais serresiana*, *Sassia apenninica*, *Euspira catena*, *Epitonium cf. frondiculoides*, *Turricula nodulifera*, *Cerodrillia sigmoidea*, *Eulimella scillae*, *Archimediella spirata*, *Trophon vaginatus*, *Trophon squamulatus*, *Ringicula* sp. and *Oenopota brevis*. Scaphopods included *Entalina tetragona*, *Dentalium rectum* and *Dentalium passerinianum*. Small deepwater undetermined scleractinians of the family Caryophylliidae (Figs 3E and 3F), some indeterminate otoliths and the bryozoan *Buskea cf. dichotoma* (Hincks, 1862)

are also present (Fig. 3G). The malacofauna contains various elements suggesting an epibathyal paleoenvironment of deposition confirmed by the presence of scleractinians and the Bryozoan *Buskea cf. dichotoma*. More specifically, it would seem to belong to an association of the so-called "interposed paleocommunities", meaning a benthic paleocommunity with characteristics intermediate between those influenced by the thermosphere (shallower) and by the psychrosphere (deeper) (Tabanelli, 2008).

Micropaleontological analysis of some clay sediment samples by Prof. Stefano Vaiani (University of Bologna) revealed scanty microfauna consisting of prevalently benthic specimens. Among the few planktonic foraminifera *Globigerina bulloides*, *Globigerina falconensis*, *Orbulina universa*, *Globigerinoides ex gr. ruber*, *Globigerinoides elongatus* were found. Among the benthic species, the following are worth mentioning: *Uvigerina peregrina*, *Cassidulina neocarinata*, *Globocassidulina subglobosa*, *Valvulineria bradyana*, *Melonis padanus*, *Bu-*

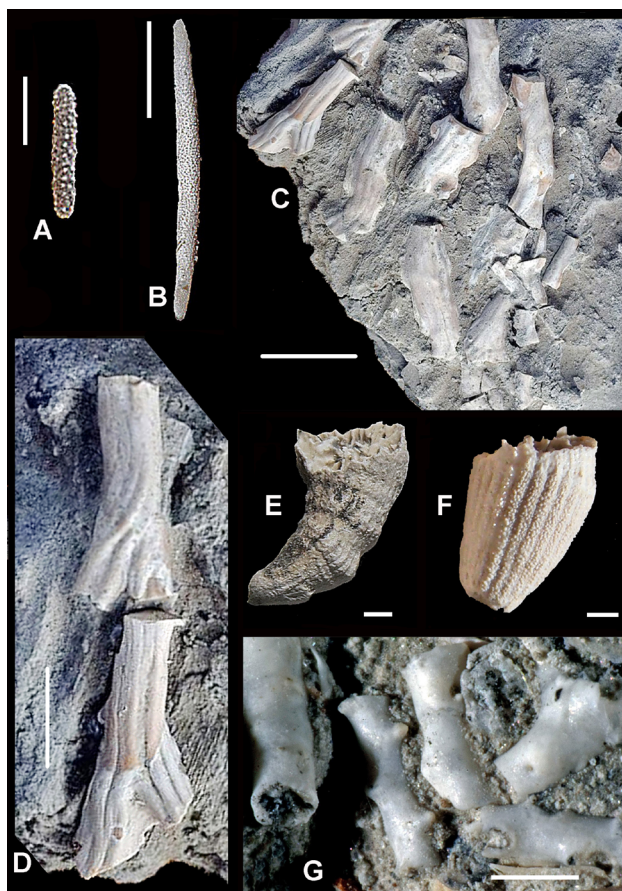


Figure 3. Bamboo-coral from the Early Pleistocene of Scavignano; A: tentacle sclerite. (Scale-bar = 0.2 mm); B: polyp body sclerite (Scale-bar = 0.5 mm); C: fragments of colony root (scale-bar = 10 mm); D: detail of the colony root (scale-bar = 5 mm); E: *Caryophyllia* sp. (Scale-bar = 1 mm); F: Indeterminate scleractinian (scale-bar = 1 mm). G: *Buskea cf. dichotoma* (Hincks, 1862) (scale-bar = 1 mm).

*limina marginata*, *Bolivina alata*, *Globobulimina affinis*, *Sphaeroidina bulloides*, *Pyrgo* sp., *Lobatula ungeriana*, *Textularia* sp. and *Sigmoilopsis schlumbergeri*.

The unfortunate absence of the genus *Globorotalia* prevented precise biostratigraphic attribution of the samples, however the presence of *Bulimina marginata*, which appears from 2.3 million years BP, indicates a Pleistocene attribution (Verhallen, 1991; Lourens *et al.*, 1996). This is also supported by the absence of benthic and planktonic species that become extinct in the Pliocene. On the other hand, the lack of benthic species common in the upper part of the Pleistocene (such as *Hyalinea balthica*) could suggest a Gelasian age.

#### MATERIALS AND METHODS

The material reported in this note was collected by one of the authors (M.S.) in autumn/winter 2005-2006 during excavations for the construction of a vast irrigation basin near Scavignano, a few km upstream from the village of Marzeno (municipality of Brisighella, RA). This find is currently kept in the collections of the Museo Civico di Scienze Naturali di Faenza (RA). Molluscs were also collected to obtain stratigraphical and paleoecologically useful information.

#### ABBREVIATION

D = maximum diameter of calice  
H = height  
H/D = height/diameter ratio.

#### SYSTEMATICS

Class Anthozoa Ehrenberg, 1834  
Subclass Octocorallia Haeckel, 1866  
Order Alcyonacea Lamouroux, 1812  
Suborder Calcaxonina Grasshoff, 1999  
Family Keratoisididae Gray, 1870

Keratoisididae ind.

*Examined material* – An incomplete, partly preserved colony, with some “connected” elements. Numerous fragments of the root. Numerous sclerites.

*Description* – Small colony, 82 mm high and 96 mm wide, with a total of 47 internodes, partly preserved in life position and partly arranged in a disorderly manner in the right portion of the find (Fig. 2A). The basal part is made up of the lower internode which branches into three radical extensions and three internodes, narrower in the centre and with dilated ends, in the shape of a spool. Two branches originate from the upper internode of the stem. The right branch is not preserved and

all the internodes are scattered in the sediment in a disorderly manner (Fig. 2B). The left branch is preserved in life position and the internodes are still “connected”, branching alternately in one plane, dichotomously from the nodes. The angle of insertion of the lateral branches varies between 35° and 42° (Fig. 2C). The internodes of the proximal part are short and stocky, those of the distal part are slimmer and elongated, slightly curved, presumably into candelabra shape, typical of various species of Keratoisididae. The internodes of the proximal part of the basal stem are short and thick (6.5-7.4 mm) with an H/D ratio between 2.04 and 2.58. The internodes of the central part are about 10-13 mm long with a H/D ratio of 0.2. Finally, the peripheral internodes, some of which are curved, are approximately 12 mm long with a H/D ratio of 0.1. The articular surfaces of the internodes are regularly conical, generally with evident growth rings (Fig. 2D). In the internodes from which the lateral branches originate, the articular faces are less regular and variably angled (Fig. 2E). The ornamentation of the internodes varies. The elements of the basal stem are almost smooth, while the others have an ornamentation consisting of 15-20 straight ribs, more or less evident, although some have spiral ornamentation, demonstrating the taxonomic insubstantiality of this character, used in the past to distinguish certain species (*Isis spiralis* Morren 1826). It is not possible to have a three-dimensional view of the colony, but the characters and the arrangement of the internodes suggest a uniplanar shape. Two types of sclerites were found (Figs 3A and 3B). The former is elongated, 1.6 mm long, slightly arched, with very fine not very evident granulation, sharp at both ends, identified as tentacle sclerites. The second type, shorter and cylindrical, about 0.8 mm in size with coarser and more evident granulation, are polyp body sclerites. The root, separated from the rest of the colony, is poorly preserved (Figs 3C and 3D). It consists of a dozen of fragments having a maximum length and width of 13.4 and 4.5 mm, respectively. Some fragments have a plano-convex, others an elliptical section. The surface of some fragments of the root is traversed by irregular furrows that give rise to regularly arched, variably raised ribs, missing in places.

#### REMARKS

The Scavignano colony has small, unbranched, straight or slightly curved internodes. Uniplanar, with sclerites of two types, it has a branched root, suitable for a soft bottom. On the basis of these characters, we can exclude the genus *Keratoisid*, characterized by branched internodes. For the two presumably sicilian species, *Keratoisid melitensis* and *K. peloritana*, are reported a frequency of branched internodes between 10% and 25% (Grasshoff 1980). In view of the high number of internodes examined, we can therefore be certain

that the colony was devoid of branching internodes. It could be a colony of the genus *Isidella*, or perhaps *Acanella*. Species of the genus *Isidella* Gray, 1858 are distinguished from other Keratoisididae by a flat, candleabra-like uniplanar colony, branched dichotomously from horny nodes, mainly in one plane (Kükenthal 1919, Bayer 1990). Species of the genus *Acanella* Gray, 1869 also branch from the nodes, but differ by virtue of the verticillate arrangement of their branches that imparts a bush-like appearance.

Other characters, such as the angle of insertion of the lateral branches, which in the Scavignano specimen varies between 35° and 42°, seem closer to the values of *Isidella* than of *Acanella* (Horvath, 2019). The sclerites, which are a true rarity in the fossil record, match those of *Isidella* (Carpine and Grasshoff, 1975) much more than those of *Acanella* species such as *A. arbuscula* (Heestand Saucier *et al.*, 2017; Johnson, 1862). In the fossil record, only three sclerites are known from the Pleistocene of Milazzo and are assigned to *Keratoisid melitensis*. However, the sclerites of this species differ from those of the Scavignano colony, being completely smooth and rounded at the ends (Langer, 1989). The most similar species therefore seems to be *Isidella elongata*, much larger than the described specimen, which currently lives in the Mediterranean at depths between 500 and 1000 m and is characteristic of facies of the bathyal biocenosis, on compact muds with a soft surface layer (Carpine & Grasshoff, 1975). The colonies of *I. elongata*, are anchored in the sediment by a broad branched root, like that of the Scavignano colony.

#### CONFLICT OF INTEREST STATEMENT

The Authors declare that they have no conflict of interest neither known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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#### REFERENCES

- ALTUNA A., POLISENO A., 2019. *Taxonomy, genetics and biodiversity of Mediterranean deep-sea corals and cold-water corals*. In: C. Orejas, C. Jiménez (eds), *Mediterranean Cold-Water Corals: Past, Present and Future*. Coral Reefs of the World 9: 121-156.
- BAYER F.M., 1955. *Contributions to the nomenclature, systematics, and morphology of the Octocorallia*. Proceedings of the United States National Museum 105: 207-220.
- BAYER F.M., 1990. *A new isidid octocoral (Anthozoa: Gorgonacea) from New Caledonia, with description of other new species from elsewhere in the Pacific Ocean*. Proceedings of the Biological Society of Washington, 103 (1): 205-228.
- BENINI A., MARTELLI L., AMOROSI A., MARTINI A., SEVERI P., 2009. *Note illustrative della Carta Geologica d'Italia alla scala 1: 50000, Foglio 239, Faenza*. ISPRA, Servizio Geologico d'Italia, 108 pp.
- CARPINE C., GRASSHOFF M., 1975. *Les Gorgonaires de la Méditerranée*. Bulletin de L'institut océanographique 71, 140 pp.
- COLELLA A., D'ALESSANDRO A., 1988. *Sand waves, Echinocardium traces and their bathyal depositional setting (Monte Torre Palaeostrait, Plio-Pleistocene, southern Italy)*. Sedimentology 35 (2): 219-237. <https://doi.org/10.1111/j.1365-3091.1988.tb00946.x>
- CREMONINI G., 1982. *Il substrato autoctono e alloctono nell'Appennino romagnolo*. In: G. Cremonini, F. Ricci Lucchi (eds), *Guida alla geologia del margine appenninico-padano*: pp. 9-11. Guida Geol. Reg. S.G.I., Bologna.
- DALY M., BRUGLER M.R., CARTWRIGHT P., COLLINS A.G., DAWSON M.N., FAUTIN D.G., SCOTT FRANCE C., MCFADDEN C.S., OPRESKO D.M., RODRIGUEZ E., ROMANO S.L., STAKE J.L., 2007. *The phylum Cnidaria: A review of phylogenetic patterns and diversity 300 years after Linnaeus*. In: Zhang Z.Q., Shear W.A. (eds), *Linnaeus Tercentenary: Progress in Invertebrate Taxonomy*. Zootaxa 1668: 1-766.
- DE LA FUENTE J.R., 2012. *Los yacimientos miocenos de La Atalaya de Mazarrón. Estado actual de las investigaciones y protección de los afloramientos*. Boletín de la Asociación Cultural Paleontológica Murciana 7: 16-37.
- DI GERONIMO I., 1979. *Il Pleistocene in facies batiale di Valle Palione (Grammichele, Catania)*. Bollettino Malacologico, 15 (5-6): 85-156.
- DI GERONIMO I., MESSINA C., ROSSO R., SANFILIPPO R., SCIUTO F., VERTINO A., 2005. *Enhanced biodiversity in the deep: Early Pleistocene coral communities from southern Italy*. In: A. Freiwald, J.M. Roberts (eds), *Cold-Water Corals and Ecosystems*: 61-86. Springer Verlag, Berlin-Heidelberg.
- GRASSHOFF M., 1980. *Isididae aus dem Pliozän und Pleistozän von Sizilien (Cnidaria, Octocorallia)*. Senckenbergiana lathaea 60 (4-6): 435-447.
- GRASSHOFF M., ZIBROWIUS H., 1983. *Kalkkrusten auf Achsen von Hornkorallen, rezent und fossil*. Senckenbergiana maritima 15 (4-6): 11-145.
- HEESTAND SAUCIER E., FRANCE S.C., WATLING L., 2021. *Toward a revision of the bamboo corals: Part 3, deconstructing the Family Isididae*. Zootaxa 5047 (3): 247-272.
- HEESTAND SAUCIER E., SAJJADI A., FRANCE S.C., 2017. *A taxonomic review of the genus Acanella (Cnidaria: Octocorallia: Isididae) in the North Atlantic Ocean, with descriptions of two new species*. Zootaxa 4323 (3): 359-390.
- HINCKS, T., 1862. *A catalogue of the Zoophytes of south Devon and south Cornwall*. The Annals and magazine of natural history; zoology, botany, and geology. 9 (3): 303-310.
- HORVATH E.A., 2019. *A review of gorgonian coral species (Cnidaria, Octocorallia, Alcyonacea) held in the Santa Barbara Museum of Natural History research collection: focus on species from Scleraxonia, Holaxonia, Calcaxonia – Part III: Suborder Holaxonia continued, and suborder Calcaxonia*. Zookeys 860: 183-306. <https://doi.org/10.3897/zookeys.860.34317>
- JOHNSON, J.Y., 1862. *Descriptions of two corals from Madeira, belonging to the genera Primnoa and Mopsea*. Proceedings of the Zoological Society of London. 1862, pp. 244-246.

- KÜKENTHAL W., 1919. *Gorgonaria. Wissenschaftliche ergebnisse der deutschen Tiefe-Expedition auf dem Dampfer, Valdivia 1898-1899*. 13: 1-946. Pls 30-89.
- LANGER M., 1989. *Haftorgan, Internodien und Sklerite von Keratoisis melitensis (Goldfuss, 1826) (Octocorallia) in den pliozanen Foraminiferenmergeln (Trubi) von Milazzo (Sizilien)*. Paläontologische Zeitschrift 63 (1-2): 15-24.
- LAPOINTE A., WATLING L., 2015. *Bamboo corals from the abyssal Pacific: Bathygorgia*. Proceedings of the Biological Society of Washington 128: 125-136.
- LOURENS L.J., ANTONARAKOU A., HILGEN F.J., VAN HOOF A.A.M., VERGNAUD-GRAZZINI C., ZACHARIASSE W.J., 1996. *Evaluation of the Plio-Pleistocene astronomical timescale*. Paleoceanography 11 (4): 391-413.
- MICHELOTTI G., 1847. *Description des fossiles des terrains miocènes de l'Italie septentrionale*. Natuurkundige Verhandelingen van de Hollandsche Maatschappij der Wetenschappen te Haarlem. 2, 3 (2): 1-408.
- PLACELLA B., 1980. *I coralli pliocenici di Masseria Concarone, Pisticci (MT)*. Bollettino della Società Naturalistica di Napoli 89: 19-32, 1 tav.
- SAUCIER E.H., SAJJADI A., FRANCE S.C., 2017. *A taxonomic review of the genus Acanella (Cnidaria: Octocorallia: Isididae) in the North Atlantic Ocean, with descriptions of two new species*. Zootaxa 4323 (3): 359-390.
- SCHEUCHZER J.J., 1723. *Erbarium diluvianum*. Lugduni Batavorum, 119 pp.
- SCILLA A., 1752. *De corporibus marinis lapidescentibus quae defossa reperiuntur auctore Augustino Scilla addita dissertatione Fabii Columnae de glossopetris*. Romae, 84 pp.
- SEGUENZA G., 1864. *Disquisizioni paleontologiche intorno ai Corallarii fossili delle rocce terziarie del distretto di Messina*. Memorie della Reale Accademia delle Scienze di Torino, Classe di scienze fisiche matematiche e naturali 21 (2): 399-560, 15 tav.
- TABANELLI C., 2008. *Associazioni di paleocomunità batiali a moluschi bentonici nel Pliocene della Romagna*, Quaderno Studi Naturalistici Romagna 26: 1-80
- VAI G.B., 1989. *A field trip guide to the Romagna Apennine geology. The Lamone valley*, Bollettino della Società Paleontologica Italiana 28, 2-3: 343-367.
- VERHALLEN P.J.J.M., 1991. *Late Pliocene to Early Pleistocene Mediterranean Mud-dwelling Foraminifera: Influence of a Changing Environment on Community Structure and Evolution*. Utrecht Micropaleontological Bulletins 40, 219 pp.
- WATLING L., HEESTAND SAUCIER E., FRANCE SCOTT C., 2022. *Towards a revision of the bamboo corals (Octocorallia): Part 4, delineating the family Keratoisididae*. Zootaxa 5093 (3): 27. <https://doi.org/10.11646/zootaxa.5093.3.4>
- ZIBROWIUS H., 1989. *A propos des Gorgonaires Isididae du Plio-Pléistocene de Méditerranée (Cnidaria: Anthozoa)*. Accademia Peloritana dei Pericolanti Classe FF.MM.NN., 67: 159-179.
- ZIBROWIUS H., 1991. *Gorgonaires Primnoidae bathiaux à croûtes calcaires massives dans le Plio. Pléistocène de la Méditerranée (Cnidaria, Octocorallia)*. Atti dell'Accademia dei Pericolanti 67: 473-481.
- ZUFFARDI COMERCI R., 1928. *Alcionari del bacino ligure piemontese*. Memorie della Regia Accademia dei Lincei 2 (18): 560-575.