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LARGE ASTRORHIZID FORAMINIFERA FROM OLIGOCENE - LOWER MIOCENE DEEP-SEA SEDIMENTS, NORTHERN APENNINES, ITALY: A NEW PERSPECTIVE ON THE GENUS *ASTRORHIZINOIDES* STSCHEDRINA, 1969

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Abstract. *Nulliporites bombicoides* Sacco, 1888 and *Nulliporites stellaris* Sacco, 1888 from the Oligocene - Lower Miocene deep-sea turbiditic sediments of Liguria and Piedmont (Monastero and Rocchetta formations) appear to be large, agglutinated astrorhizid foraminiferids both assigned in this study to the genus *Astrorhizinoides* Stschedrina, 1969 under a single species, *Astrorhizinoides bombicoides* (Sacco, 1888). This foraminifer is characterized by a simple, straight to slightly curved or rarely branched test, which displays a thick, smooth, finely agglutinated wall, with constrictions, and a very thin chamber lumen, whose apertures are observed at least at one of the terminal ends of the test. The tests, partly crushed, are preserved mostly on the soles of thin turbiditic sandstones, where they may be aligned. Probably, the foraminifer was originally a semi-infaunal, free-standing form, the test of which was partly flexible.

Introduction

This paper concerns unique large, tubular, occasionally branched foraminiferids that occur in Oligocene deep-sea clastic sediments of the Monastero Formation, and rarely of the Rocchetta Formation (Upper Oligocene-Aquitanian), both cropping out on the edge of the foredeep Tertiary Piedmont Basin. These fossils were originally described by Sacco (1888) as *Nulliporites bombicoides* and *Nulliporites stellaris*, at first considered as algae, later treated as trace fossils, and finally almost forgotten. Examination of their type material and new material from the type areas allows us to reinterpret them as larger agglutinated foraminifera ascribed to the order Astrorhizida, having distinct morphological features.

Geological setting

The Monastero Formation (Bellinzona et al. 1971; Mutti et al. 1995; Marroni et al. in press) is an about 1000 m thick unit that overlies the Savignone Conglomerate in the lower part of the filling of the Tertiary Piedmont Basin on the northern edge of the Northern Apennines. The unit is dominated by turbiditic sandstones and mudstones, which overlie fan delta conglomerates of the Savignone Conglomerate (Gelati 1977; Ghibaudo et al. 1985). In the lower part, the sandstones are locally coarse-grained and conglomeratic, while pelitic facies prevail in the upper part. Locally, pebbly mudstones and slump deposits are present. Calcareous nannoplankton dates this unit to the NP23/NP24 zones (late Rupelian - early Chattian; Marroni et al. in press).

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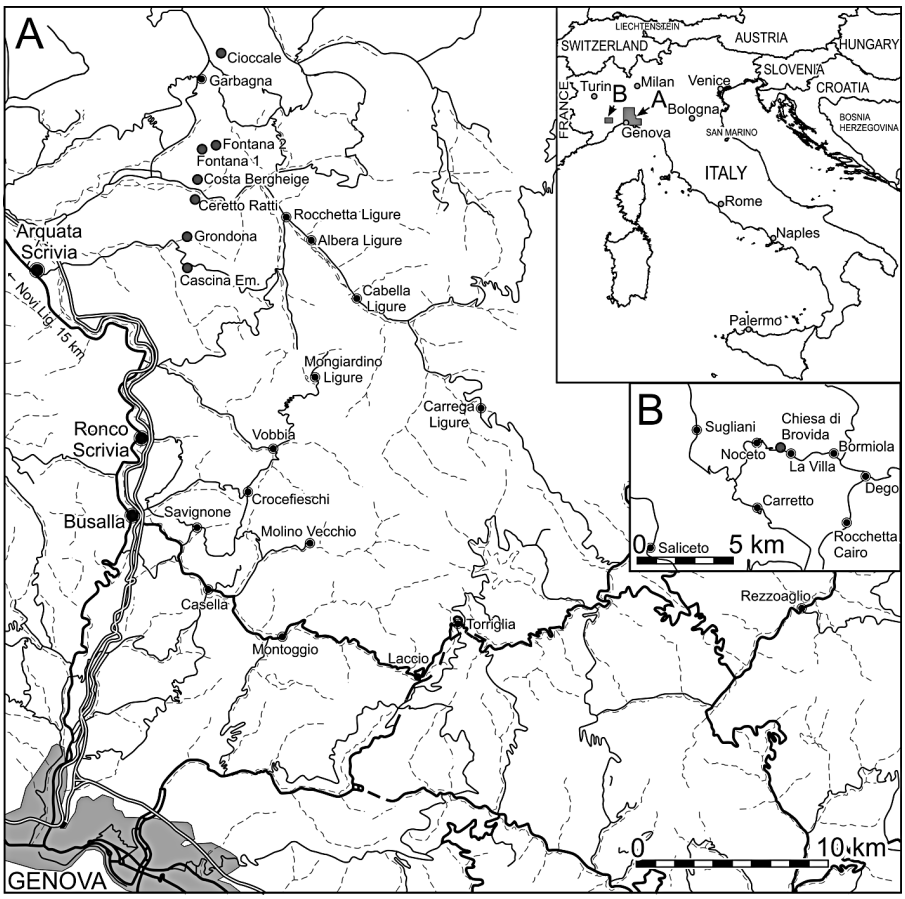

Fig. 1 - Location map. A) The area with sampled outcrops (upper left) of the Monastero Formation. B) The single sampled locality of the Rocchetta Formation.

Locality	GPS coordinates	Features of the locality
Grondona	N44°42'03.1"; E009°58'30.9"; ± 5 m	~25 m high wall on the road side and nearby gullies; sandstones to mudstones; a conglomerate bed at the top
Cascina Emanuele	N44°41'48.6"; E009°58'41.5"; ± 4 m	A gully below the road; a few tens of metres thick succession of sandstones to mudstones; nearby debris material
	N44°41.817'; E008°58.593'; ± 5 m	Gullies below the road; ~30 m thick section of thin-bedded sandstone-mudstone turbidites with isolated ~30 cm thick turbiditic sandstones
Costa Bergheighe	N44°43.562'; E008°59.443'; ± 6 m.	Gullies on the northern side of the Val Borbera gorge; ~50 m thick section of thin-bedded sandstone-mudstone turbidites with isolated thick beds of sandstones, conglomeratic sandstones and conglomerates; this outcrop may belong to the Savignone Conglomerate because of thick conglomerate beds are present above
Fontana	N44°44.745'; E009°00.118'; ± 10 m	Small gullies; ~10 m thick section of thin- to medium-bedded sandstone-mudstone turbidites
	N44°44.752'; E009°00.395'; ± 12 m	A complex of large outcrops on slopes of a side valley; at least 100 m thick section of thin- to medium-bedded sandstone-mudstone turbidites with conglomerate intercalations in the upper part
Ceretto Ratti	N44°43.157'; E008°58'598'; ± 10 m	Gullies on slopes of a side valley and along a ground road above; ~40 m thick section of thin- to medium-bedded sandstone-mudstone turbidites with conglomerate intercalations at the top
Cioccale	N44°47.769'; E009°0.629'; ± 10 m	On a slope, loose fragments of fine-grained sandstone beds, 5-6 cm thick
Chiesa di Brovida	N44°27.628'; E008°15.381'	Side road scarp, sandstone intercalated with mudstone, at least 10 m thick section

Tab. 1 - Studied localities.

The studied foraminifers occur in the lower to middle part of the Monastero Formation in thin sandstone beds that show a sharp base transitionally passing to mudstone at the top, graded bedding and ripple lamination. They display features of turbidites. The localities in which the studied foraminifers occur are shown in Fig. 1 and Tab. 1.

The Rocchetta Formation (Upper Oligocene-Aquitanian) is a clastic unit composed mostly of mudstones interbedded with sandstones or more rarely with

limestones, which were deposited as hemipelagic and turbiditic sediments (Gelati 1968). It overlies the Molare Formation, the basal unit of the Tertiary Piedmont Basin in the western part, and is followed by the Monesiglio Formation. The Rocchetta Formation is 100-550 m thick. The studied foraminifers occur in the upper part of the formation. The Rocchetta Formation is composed of hemipelagic and prodeltaic marls (Artoni et al. 1999). It is Rupelian-Chattian in age in the eastern part and Chattian-Aquitanian in the western part (Gelati 1968; Gelati et al. 1993; d'Atri et al. 1997). The Rocchetta Formation and the Monesiglio Formation are considered together as the Rocchetta-Monesiglio Group or the Rocchetta-Monesiglio Formation (Gelati et al. in press). The locality is shown in Fig. 1 and Tab. 1.

Systematic Palaeontology

Astrorhizidae Brady, 1881

Astrorhizinoides Stschedrina, 1969

Type species: *Astrorhiza cornuta* Brady, 1879.

Diagnosis: Test free, consisting of a thick, simple or branched tube with constrictions, that branches at irregular intervals, not radiating from a central area as in *Astrorhiza*. Wall firmly cemented. Apertures at the ends of the tube.

Remarks. In their description of the genus *Astrorhizinoides* Stschedrina, 1969, Loeblich & Tappan (1987) stated that the test is made of coarse sand grains, with a rough exterior, and that a thick inner organic lining protrudes from the ends of the test. This description applies only to the type species *Astrorhizinoides cornutus* (Brady, 1879) illustrated by Brady (1884) from the modern Atlantic Ocean. The discussed specimens from the Oligocene of Italy are finely agglutinated, with a thick wall and they do not display any organic lining. The above-mentioned features of *Astrorhizinoides* (i.e., the relative size of the agglutinated grains and whether or not an inner organic lining is preserved in fossil specimens) are considered herein as non-diagnostic at the genus level and therefore they are not mentioned in the diagnosis.

Astrorhizinoides bombicoides (Sacco, 1888)

Figs 2-6

v**Nulliporites bombicoides* Sacc. - Sacco 1888, p. 19, pl. 1, fig. 22.

v *Nulliporites stellaris* Sacc. - Sacco 1888, p. 19, pl. 1, fig. 23.

Types: As Sacco (1888) did not designate any holotype, therefore all specimens on slab 17476 (Museo Regionale di Scienze Naturali in Torino; Fig. 2A) are considered as syntypes.

Diagnosis: Test free, large for the genus, straight or gently curved, formed of a robust tube with constrictions and rare branches, with a very thin chamber lumen. Wall thick, finely agglutinated, with a smooth surface. Apertures at least at one of the terminal end of the tubes.

Description - general features. Test free, large (up to 15.5 mm in length and 2 mm in width), consisting of a robust straight or slightly curved tube that branches rarely. Branching may be dichotomous or side branches may diverge at angles up to 90°. The tube displays gentle swellings and constrictions, indicating the tube is partially subdivided into pseudochambers. Wall thick, of firmly cemented silt to very fine sand-sized grains, with a smooth exterior. The central chamber lumen is developed as a very thin tunnel. Terminations of the tubular branches, if not broken, are hemispherical, some possess an apical nip. Apertures, when present, are at the terminal ends of the branches. Some terminations

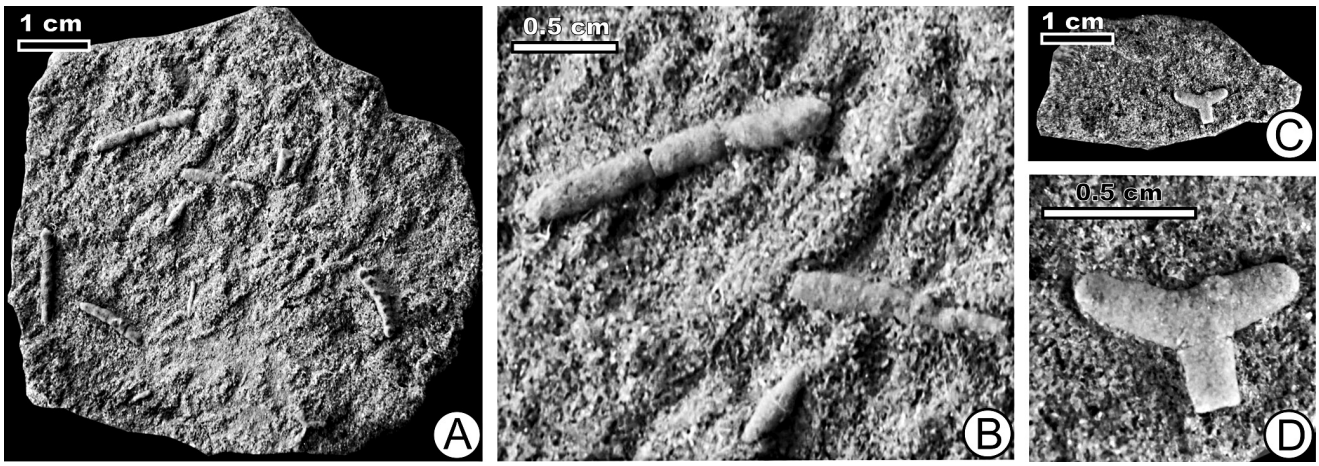

Fig. 2 - Type material of the discussed foraminifers housed in the Museo Regionale di Scienze Naturali in Torino, all ascribed to *Astrorhizinoides bombicoides* (Sacco, 1888) in this paper. A) *Nulliporites bombicoides* Sacco, 1888, general view, Monastero Formation (Lower Oligocene), Cioccale, specimen 17476. All specimens are syntypes. B) Detail of A. C) *Nulliporites stellaris* Sacco, 1888, general view, Monastero Formation (Lower Oligocene), Cioccale, specimen 17477. D) Close view of the type specimen.

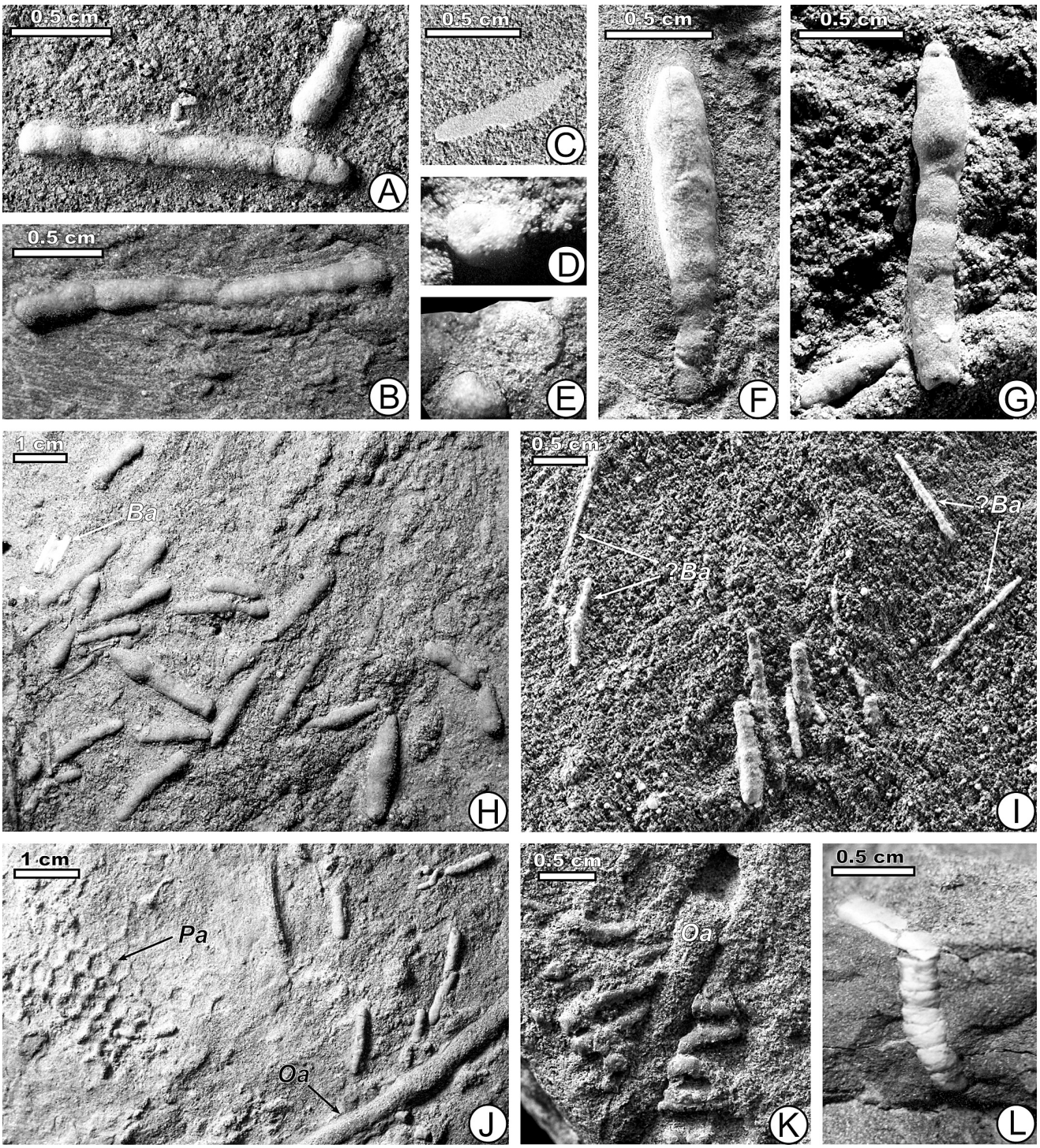

Fig. 3 - New specimens of simple *Astrorhizinoides bombicoides* (Sacco, 1888) in sandstone beds of the Monastero Formation (Lower Oligocene). A) Well-segmented, long and short morphotype, Grondona, INGUJ175P54. B) Long, slightly curved form, slab 7305. C) A section through test within a sandstone bed, Grondona, INGUJ175P53. D) Termination of test with well-visible entrance to a thin tunnel, Grondona, slab 7311. E) Termination of test with well-visible entrance to a thin tunnel, Cascina Emanuele, slab 6253. F) A club shaped test, Grondona, INGUJ175P52. G) Two tests, the larger one with a nip at the termination, Grondona, INGUJ175P70. H) Several tests of different shape, crushed test of *Bathysiphon* sp. (*Ba*), Grondona, slab 7288. I) Partly aligned tests of *A. bombicoides* and ?*Bathysiphon* sp. (?*Ba*), Costa Bergheighe, INGUJ175P56. J) *A. bombicoides* on the lower bedding plane with the trace fossils *Paleodictyon* isp. (Pa) and *Ophiomorpha annulata* (Oa), Grondona, slab 7289. K) A few tests of *A. bombicoides* crossed by the trace fossil *Ophiomorpha annulata* (Oa), Grondona. L) A subvertically oriented ?*A. bombicoides* in a sandstone bed, with a broken upper part, Grondona slab 7310.

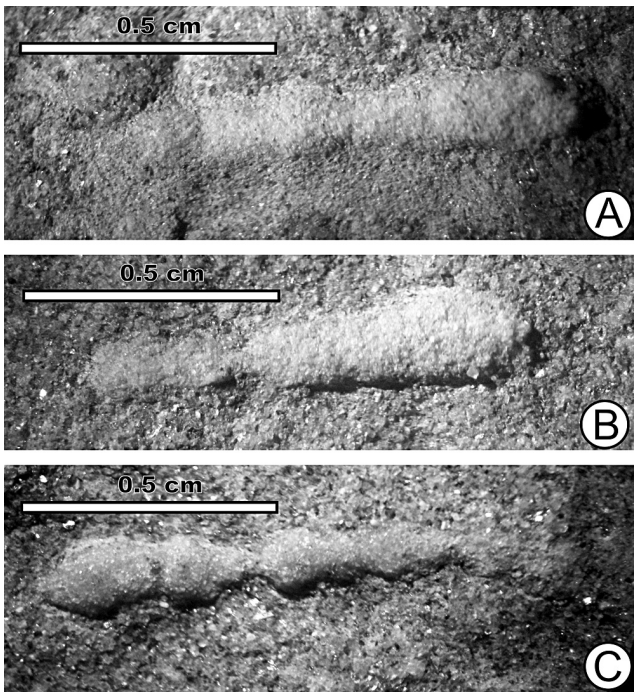

Fig. 4 - Specimens of *Astrorhizinoides bombicoides* (Sacco, 1888) from the Rocchetta Formation (Upper Oligocene-Aquitanian) from Chiesa di Brovida. A) Specimen 2266a. B) Specimen 2266b. C) Specimen 2267.

(presumably the initial portion of the test) do not display open apertures.

The original material. The type specimens of *Nulliporites bombicoides* Sacco, 1888 and *Nulliporites stellaris* Sacco, 1888, originally described by the same author, are housed in the Palazzo Carignano, in the part belonging to the Museo Regionale di Scienze Naturali in Torino. Sacco (1888) described them as new taxa of *Nulliporites* Heer, 1865, considered as algae, together with several trace fossils, which were commonly interpreted as algae at the time. They were found at Cioccale, 200-300 m from the village of Vallescura, about 40 km north of Genova (Fig. 1).

The original specimens of *Nulliporites bombicoides* Sacco, 1888 (No 17476) are preserved as simple, tubular bodies on the lower bedding surface of very fine-grained muscovitic sandstone (grain size mostly about 0.1 mm) sandstone (Fig. 2A, B). The lower bedding surface is uneven, sharp, with low, elongate elevations and depressions. Five more complete, and five less complete light-coloured tubular specimens are present. Most of the tubes are parallel to surface, attached or partly embedded into the rock, while others are gently inclined and plunging partly into the bed. The tubes are not oriented. All the specimens are considered here as syntypes. The more complete specimens are 10-15.5 mm long and 1.8-2 mm in maximal diameter. They are straight or curved in a gentle arc. The smallest ones are 2.5-5 mm long, 0.5-0.7 mm in maximal diameter. The diameter of the larger and smaller tubes is smaller towards the terminations, so the individuals display overall symmetrical or asymmetrical spindle-like shape. The terminations of the tubes, if not broken, are hemispherical, some of them show an apical nip. The larger tubes show gentle, distinct to indistinct swellings separated by constrictions, with 7-8 swellings per specimen. Locally, small, secondary elevations can occur on the surface. The face of the broken tube does not show macroscopically any trace of an entrance to the chamber interior. The tubes are built of light, hard, silt grains, without muscovite. The agglutinated grains are distinctly smaller than in the hosting sandstone bed.

The type specimen of *Nulliporites stellaris* Sacco, 1888 (No 17477) firstly described by Sacco (1888) is preserved on a fragment of muscovitic, very fine-grained (grain size mostly about 0.1 mm) sandstone, on its bedding surface. It is composed of a branched tube, circular in cross section, attached to the surface, but not embedded in the rock (Fig. 2C, D). The tube is 1.7-1.9 mm in diameter. It is composed of a straight segment, 2.5 mm long, with a broken end and two branches diverging from the other end under the angle of 110° and 113°, respectively. The branches are 3.5 and 4.1 mm long, respectively. Their termination is hemispherical. The diameter of the branches increases slightly and gradually toward the branching point, however no swelling or "central chamber" is observed at the junction. The face of the broken tube does not reveal macroscopically any trace of an entrance to a possible canal. The tube is built of light, hard, silt grains, without muscovite. The grains are distinctly smaller than those of the hosting sandstone bed. The arm with the broken end shows a transverse crack fissure in the proximity of the branch junction. One of the branches shows a low secondary elevation, almost circular in outline, with an apical nip. The elevations occupy about one third of the surface from the external side of the fossil, close to the junction area. The other branch is slightly curved at the end. Its surface shows very gentle swellings and constrictions.

New material. Fragments of sandstone beds containing the studied foraminifers were collected from outcrops of the Monastero Formation at Grondona, Cerreto Ratti, Cascina Emanuele, Costa Bergheighe, Cioccale and Fontana (Tab. 1, Fig. 1). The lithology of the beds is very similar to that of the original material. The foraminifers are represented by tubular, simple, and rarely branched forms (Figs 3, 5, 6). Additional specimens were collected from an outcrop of the Rocchetta Formation (Upper Oligocene-Aquitanian) at Chiesa di Brovida near Dego (Tab. 1, Figs 1, 4). Some of the newly collected specimens are housed in the Jagiellonian Uni-

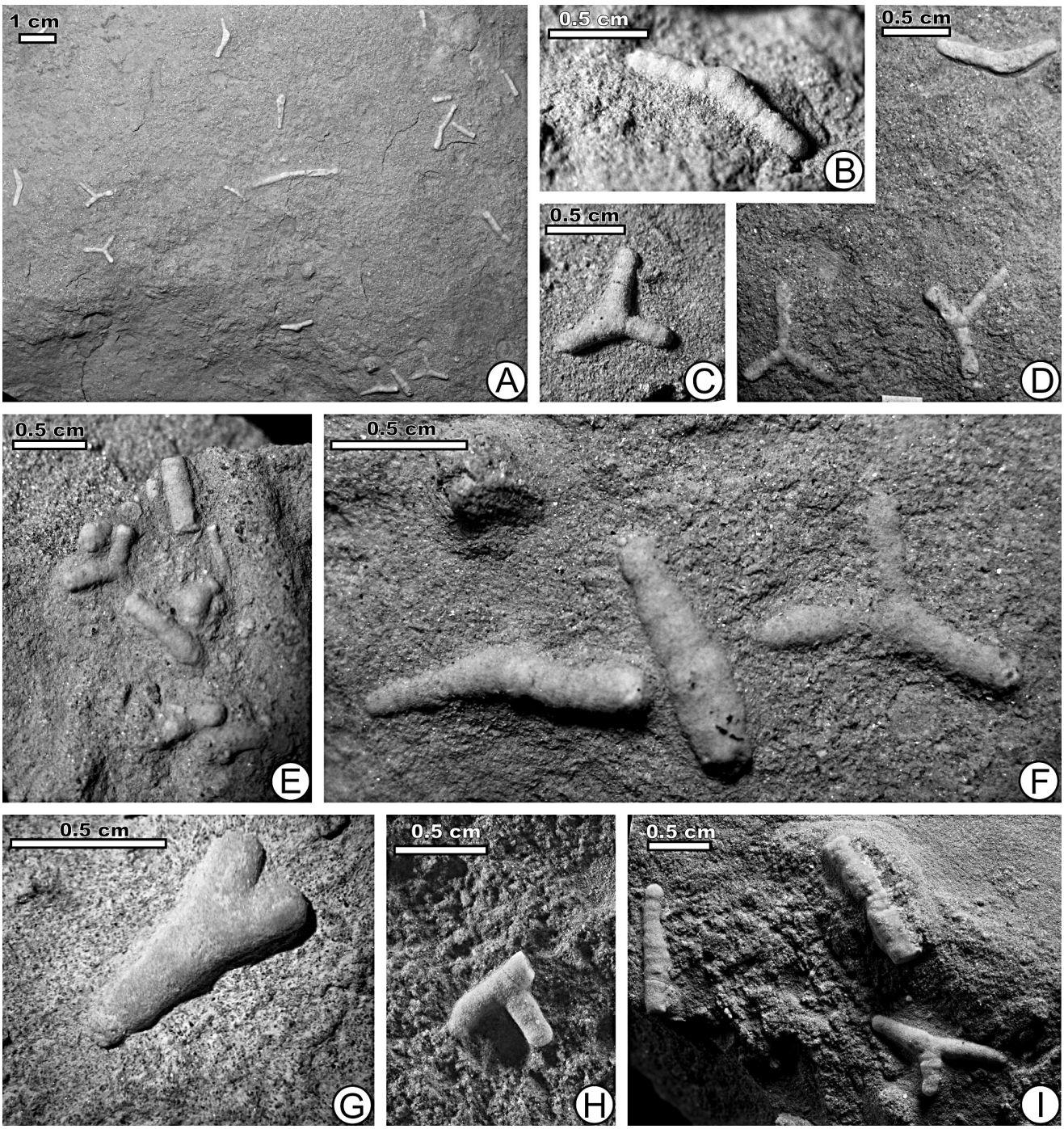

Fig. 5 - New specimens of simple and branched *Astrorhizinoides bombicoides* (Sacco, 1888) from sandstone beds of the Monastero Formation (Lower Oligocene). A) Simple and branched tests together, Ceretto Ratti, slab 7130. B) A detail of A showing a simple form with a side swelling interpreted as an initial branching. C) Branched form, Cascina Emanuele, 6252. D) Detail of A. E) Branched and simple test, some of them are broken, Cascina Emanuele, 6253. F) Detail of A. G) A test with short dichotomous branches, Grondona, 7301. H) A test with an almost right angle branch, Grondona, INGUJ175P57. I) Two tests and one with a side branch, INGUJ175P52.

versity (institutional abbreviation and prefix INGUJ175P).

The simple forms are the same as the type material of *Nulliporites bombicoides* Sacco, 1888. They occur almost exclusively on the lower surface of very fine- or fine-grained, thin-bedded, muscovitic, calcareous sandstones that show ripple cross lamination. Only at Cascina Emanuele, Costa Bergheighe and Cioccale, they can be found also in medium-grained, ripple laminated sandstones. The sandstone beds are up to 3.5 cm thick, exceptionally 5 cm thick at Cioccale. Their lower surface is erosive, sharp, and the upper surface shows a transition to the overlying grey, calcareous siltstone and mudstone. Rarely, fragments of the discussed foraminifers are found in the sandstones, within the few-millimetre-thick basal part.

The fossils are straight agglutinated tubes, 3-26.5 mm long (mean = 10.58 mm, n = 95), 0.8-2.8 mm (mean = 1.67 mm; n = 95) in diameter. The diameter changes slightly along the length of the tube, which shows gentle swellings and constrictions (Figs 3A-B, F-G, 4C). The endings, if preserved, are hemispherical, without any change in diameter, or they taper but without acute pointed tips (Figs 3F-G, 4A-B, 6C). In some cases, at least one ending is broken (Fig. 5E). The surface of the tube is smoothly finished.

Very rarely, an entrance to the tunnel is macroscopically visible at the face of the broken ends (Fig. 3D-E). Most of the broken faces look massive. However, computed tomography analysis and thin sections confirm the presence of a very thin, central, slightly winding tunnel running along the length of the tube (Fig. 6E). In specimen INGUJ175P35, which is a simple cylinder, the tunnel is 74-139 μm in diameter. It shows some swellings and constrictions and disappears before the tapering end of the tube. The tunnel is also visible in thin section (Fig. 6A).

In the tests from the Monastero Formation, the wall of the tube is built of silt-size quartz grains, 5-40 μm in diameter (Fig. 6A-D). The grains are moderately well-sorted, mostly angular, well fitted, with small grains filling space between the larger ones. In the surrounding sandstone, grains are up to 100 μm in diameter. Subtle grain-size changes are observed along the tube, which appears to be constructed of fused segments (pseudochambers) that are 1-2 mm long (Fig. 6E). In the tests from the Rocchetta Formation (Fig. 4), the grains are coarser (very fine sand).

The branched forms (Fig. 5) are much rarer than the simple unbranched forms. Only 10 specimens have been found in almost all localities at which the simple forms occur. Both morphotypes co-occur in the same beds (Fig. 5A, E, I). The morphology of the branched forms shows the same features as the type specimens of *Nulliporites stellaris* Sacco, 1888. The branches are 2.5-6 mm long and 0.8-1.8 mm in diameter. They diverge at angles of 81°-184° (mean = 120°, n = 27). The external morphology of the tubes is the same as in the simple

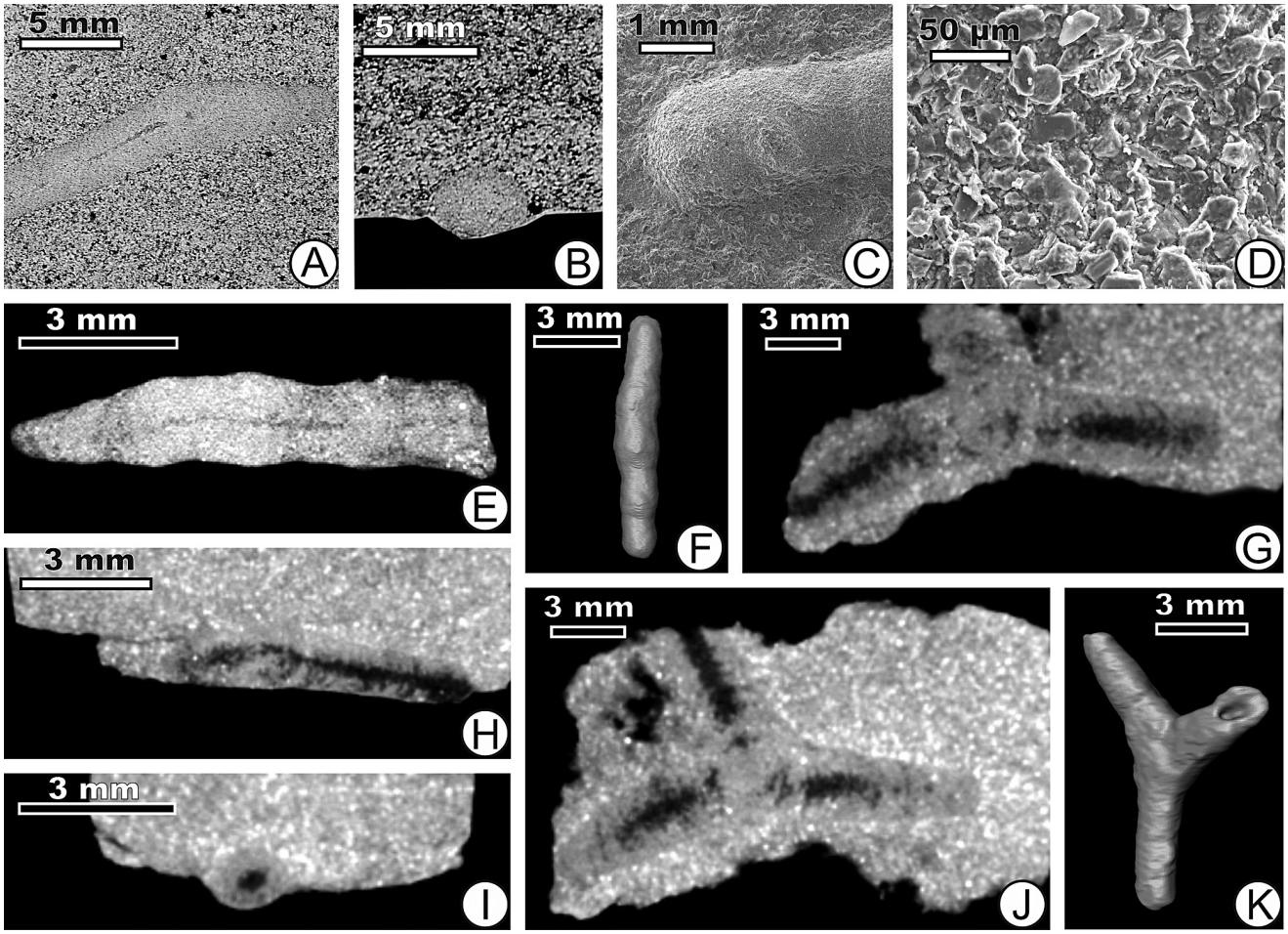

Fig. 6 - Microscopic features of *Astrorhizinoides bombicoides* (Sacco, 1888) from Grondona. A) Thin section along the test showing a thin chamber lumen. B) Cross section of the test, Grondona. C) SEM image of the termination of the test. D) SEM image of test wall showing densely packed silt quartz grains. E) Computed tomography image of the test with well visible thin chamber lumen, INGUJ175P35. F) Spatial view of specimen INGUJ175P35 based on CT images. G-J). CT images of a branched test; H, I - view from the side; G, J - planar view; INGUJ175P36. K). Spatial view of specimen INGUJ175P36 based on CT images.

forms. There are no swellings or central "pseudochambers" around the branching point. Computed tomography of sample INGUJ175P36 shows also a thin tunnel as in the simple forms, which runs through all the branches (Fig. 6G-J).

Discussion

Previous interpretations. The genus name *Nulliporites* was used independently by Krüger (1823) for a Cretaceous coral (*N. nodulosus*) and by Heer (1865) for algae (ten species; see also Heer 1877). Sacco (1888) used *Nulliporites* Heer, 1865 and distinguished *Nulliporites bombicoides* and *Nulliporites stellaris*. These two taxa have been included in the algal genus *Nullipora* Lamarck, 1801 by Maschinelli & Squinabol (1892) as *Nullipora lombricoides* (Sacco) and *Nullipora stellaris* (Sacco). It is unknown whether Maschinelli & Squinabol (1892) corrected the original name of Sacco from *bombicoides* to *lombricoides*, or if this is an unjustified emendation. Heer's species of *Nulliporites* still exists in the catalogue of algae (Guiry & Guiry 2014); however Schimper (1879) already questioned this assignment. Häntzschel (1965, 1975) considered *Nulliporites* Krüger, 1823 as *nomen nudum*, and included *Nulliporites* Heer, 1865 in *Chondrites* Sternberg, 1833. Also Chamberlain (1977) included with a question mark *Nulliporites angustus* Heer, 1877 and *N. granulosus* Heer, 1865 in *Chondrites targionii* (Brongniart, 1828). Fu (1991) included *Nulliporites angustus* Heer, 1877 in *Chondrites targionii* (Brongniart, 1828). The similarity of *Nulliporites* Heer, 1865 to *Chondrites* was discussed by Heer (1877), however he described them separately. Sacco (1888) also noted the problem and invoked the opinion by G. Saporta, who regarded *Nulliporites* as a synonym of *Chondrites* and the opinion by G. Maillard, who regarded them as burrows. Nevertheless Sacco (1888) pointed to the difference in the filling material of *Chondrites* and his *Nulliporites* and suggested that they must have been produced by different organisms.

In summary, neither *Nulliporites* Heer, 1865 as the junior synonym of the trace fossil *Chondrites* Sternberg, 1833, nor *Nullipora* Lamarck, 1801 as an algal genus can be used for the discussed material.

New perspective. The morphological features of *Nulliporites bombicoides* Sacco, 1888 and *Nulliporites stellaris* Sacco, 1888 in their types and the additional material examined show that they are sparsely branched agglutinated tubes with a central canal and some development of pseudochambers. These features are typical of protists, foremost of astrorhizid agglutinated foraminifera (sensu Kaminski 2014). The distinctive feature of the described fossils is the very thin central canal, thinner than the wall, while most other astrorhizid foraminifers show canals that are thicker than the wall. The segments showing slightly different grain size are probably poorly developed pseudochambers connected by the central canal. The protists selected silt grains and packed them very tightly in the very thick agglutinated wall.

The branched and unbranched forms co-occur and they show the same morphological features (Fig. 5A, D, F). Also the smaller, unbranched forms show the same features, except for their size and generally less developed swellings and constrictions. This raises the question if they belong to the same species or not. It is probable that they belong to the same species, that juveniles produced the smaller tubes, while adults produced the larger, occasionally branched tubes. This is shown by curved forms with a side node that can be an initial branching (Fig. 5B). One of the examined tests shows short branches than can be interpreted as not fully developed (Fig. 5G).

Because of their branching morphology and relatively large size, these species are best placed into the genus *Astrorhizinoides* Stschedrina, 1969 [type species *Astrorhiza cornuta* Brady, 1879], which consists of a thick tube that branches at irregular intervals, not radiating from a central area as in *Astrorhiza,* and not possessing a swollen central pseudochamber as in *Rhabdammina*. The type species of *Astrorhizinoides*, *A. cornuta* (Brady, 1879), is reported from Challenger Sta. 122, SE of Pernambuco (about 320 m depth), in the western Atlantic. It has an agglutinated wall made of firmly cemented coarse sand grains with a rough exterior. The analysed specimens from Italy are more finely agglutinated and likely have a thicker wall than the type species. Because of the page priority in the original description of Sacco (1888), the species *Nulliporites bombicoides* is here placed in the genus *Astrorhizinoides*, and *Astrorhizinoides bombicoides* (Sacco, 1888) regarded to be the valid name, with *Nulliporites stellaris* Sacco, 1888 as its synonym.

Loeblich & Tappan (1987) reported the stratigraphic range of *Astrorhizinoides* as "Holocene". Our finding of *Astrorhizinoides* in the Oligocene of Italy is the first fossil record of the genus. Their deep-sea occurrence is proven by sedimentological interpretations (see Geological setting) and co-occurrence with trace fossils typical of the Paleodictyon ichnosubfacies of the Nereites ichnofacies, e.g. *Paleodictyon* (Fig. 3J), which is typical of thin- to medium-bedded turbiditic sediments in different parts of deep-sea fans (e.g., Uchman & Wetzel 2012).

Their life position is not certain, but it is likely that they were erect forms, possibly semi-infaunal, similar to *Bathysiphon* (see Gooday et al. 1992), with which they co-occur in some slabs (Fig. 3H, I). Some

specimens have been found in vertical position in a sandstone bed, with broken upper parts (Fig. 3L), suggesting they protruded above the muddy sea floor. The tests do not show any traces of attachment to objects.

The fossil specimens show some distinct taphonomic features. They are partially fragmented (Fig. 5E). They occur mostly on the lower bedding surface of turbiditic sandstones, being locally oriented (Fig. 3I, J). Some of them occur within the lower part of the bed (Fig. 3C). These features suggest that the tubes are transported or at least aligned by a turbidity current, however if they were transported, it was a rather short distance. Otherwise, the branched forms should be more crushed. The fragmentation of some tests suggests that they were rigid before final deposition. Some tests, however, are truncated by the trace fossil *Ophiomorpha annulata* (Fig. 3K) proving that some tests were enough soft to be abraded by appendages of the crustacean producer. Therefore, it seems that the test was originally partly flexible. Such a feature would have provided better resistance against current action.

Conclusions

This work revises the species *Nulliporites bombicoides* and *Nulliporites stellaris,* previously described as algal remains and now both attributed to the genus *Astrorhizinoides* and to the single species *A. bombicoides*. The agglutinated, large, astrorhizid foraminiferid *Astrorhizinoides bombicoides* (Sacco, 1888) is the first reported fossil species of the genus *Astrorhizinoides* Stschedrina, 1969. It is characterized by a simple or rarely branched test formed of a thick-walled, smooth, finely agglutinated tube with constrictions. It displays a very narrow chamber lumen, with apertures at least at one of the terminal end of the tubes. It is found in Oligocene – Lower Miocene deep-sea turbiditic sediments, where its tests are preserved mostly on the lower bedding surfaces of thin turbiditic sandstones. *Astrorhizinoides bombicoides* was probably a semi-infaunal, freely standing form, which apparently survived being transported for short distances. Its preserved tests are partly crushed.

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