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New Late Ypresian (Cuisian) Rotaliids (Foraminiferida) from Central and Southern Italy and Their Biostratigraphic Potential

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Abstract: Two new rotaliid genera and three new species are described from the Upper Ypresian of Sicily and Central Italy: *Ornatorotalia spinosa* n. gen. n. sp., *Ornatorotalia granum* n. sp. and *Granorotalia sublobata* n. gen. n. sp. The new taxa are all dated as SBZ 11 (middle Upper Ypresian, i.e., middle Cuisian) by the presence of *Cuvillierina vallensis* and alveolinid biostratigraphical markers such as *Alveolina cremae*, *A. decastroi* and *A. distefanoi*. The systematic position of these distinctive new taxa within the family Rotaliidae Ehrenberg, 1839 and their biostratigraphic potential are discussed.

Key Words: Foraminiferida, Rotaliidae, Ypresian, new taxa, *Ornatorotalia* n. gen., *Granorotalia* n. gen.

Orta ve Güney İtalya Yeni Geç İpreziyen (Kuiziyen) Rotalid Foraminiferleri ve Biyostratigrafik Potansiyelleri

Özet: Üç yeni türü içeren İki yeni rotalid foraminifer cinsi Sicilya ve orta İtalya bölgesindeki Geç İpreziyen yaşlı istiflerden tanımlanmıştır: *Ornatorotalia spinosa* n. gen. n. sp., *Ornatorotalia granum* n. sp. ve *Granorotalia sublobata* n. gen. n. sp. Bu yeni taksa'nın, *Cuvillierina vallensis* ve alveolinidlerden biyostratigrafik olarak anahtar gruplardan olan *Alveolina cremae*, *A. decastroi* ve *A. distefanoi* ile birlikteliği göz önüne alınarak SBZ 11 (orta Üst İpreziyen; orta Kuiziyen) için karakteristik olduğu ortaya konmuştur. Tanımlanan yeni foraminiferlerin Rotaliidae Ehrenberg, 1839 familyası içinde sistematiği ve biyostratigrafik potansiyelleri tartışılmıştır.

Anahtar Sözcükler: Foraminifer, Rotaliidae, İpreziyen, yeni taksa, *Ornatorotalia* n. gen., *Granorotalia* n. gen.

Introduction

One of the least investigated groups of larger foraminifera are smaller rotaliids, which commonly occur in Upper Ypresian (Cuisian) shallow-water deposits from the Mediterranean Neotethys. The abundance of these smaller ornamented rotaliids, generally associated with alveolinid- and orbitolitid-dominated assemblages, has already been recorded for the Cuisian of Central Italy (Maiella Mt. and the Fucino basin; Pignatti 1995). The aim of this work is to give a systematic description of these rotaliids and of some accompanying taxa of biostratigraphic significance.

Rotaliids are benthic hyaline foraminifera with calcitic bilamellar perforate tests (Smout 1954), characterized by oblique or backwards directed extensions of the chamber lumen and a system of spiral, intralocular, intraseptal channels. The complexity of the test and canal system in the Rotaliidae (Billman *et al.* 1980; Müller-Merz 1980; Boix *et al.* 2009) and the difficulty of investigating specimens from thin sections are the most conspicuous obstacles to their study, hampering their use in routine biostratigraphic analysis. In the light of these difficulties, systematic description at the high qualitative standard level achieved in larger foraminifera (Hottinger 2000) may seem a daunting or unfeasible task. Fortunately, for two of the new species established here, we were able to find fairly well-preserved matrix-free specimens which allowed us to supplement the evidence available from thin sections.

Despite their local abundance and short distribution range in the investigated areas of Central and Southern Italy, the full biostratigraphic potential of these taxa is as yet unknown, mainly due to the significant systematic difficulty of identifying architectural characters from random thin sections.

Materials and Methods

The present study is based on optical microscopy analysis of specimens from thin sections and on matrix-free specimens; the latter were analyzed also by SEM.

The suprageneric classification follows that by Loeblich & Tappan (1987, 1992). The description of morphological features uses the terms employed by Hottinger (2006).

The investigated material is deposited in the Palaeontological Museum at the Department of Earth Sciences, 'La Sapienza' University, Rome, Italy.

Our study comprises material from several coeval deposits from three different tectonostratigraphic domains of Southern and Central Italy (Figure 1): the Pre-Panormide domain, NW Sicily (Southern Italy): clasts from the Monte Bosco Formation; the Apulian domain: Maiella Mt. (eastern Central Italy); the Latium-Abruzzi platform, Central Apennines (Central Italy): Castrovalva (L'Aquila), Poggio di Roio (L'Aquila), and Mt. Torretta (L'Aquila). The investigated taxa are all assigned to the Late Ypresian (i.e., middle Cuisian; Hottinger 1960; Schaub 1981) and belong to the Shallow Benthics chronobiozone SBZ 11 of Serra-Kiel *et al.* (1998) on the base of the co-occurring alveolinids and *Cuvillierina vallensis* Ruiz de Gaona, 1949.

In the pre-Panormide domain, NW Sicily (Southern Italy), clasts from the Monte Bosco Formation, dated as lower Oligocene according to the planktonic foraminiferal assemblages, consists mainly of clays and reworked clasts. A section near Baglio Beatrice, Buseto Palizzolo (ca. 20 km E of Trapani: 38°0′13.47″N, 12°44′8.54″E; elevation: 297 m) sampled by Benedetti (2009) is the type locality of *Ornatorotalia spinosa* n. sp. and *Granorotalia sublobata* n. sp. The key material for this investigation is matrix-free reworked specimens of both species picked from washing residues of the

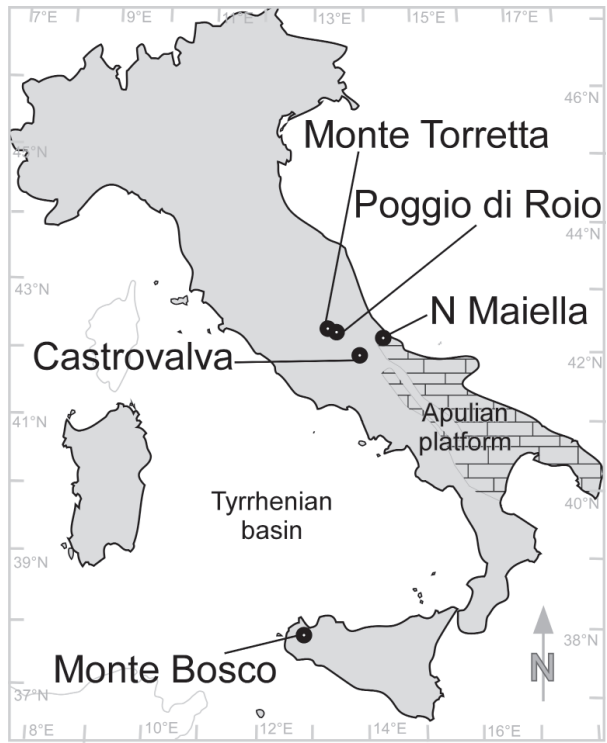

Figure 1. Location of the investigated samples.

clays. In addition, the new taxa occur in two dm-sized reworked limestone clasts, a packstone with *Alveolina* and *Cuvillierina* (8 thin sections of sample MB14bis of Benedetti 2009) and a grainstone with *Alveolina* and *Orbitolites* (3 thin sections of the sample labelled "canale" by Benedetti 2009). The assemblages in these clasts indicate SBZ 11 and are illustrated here (Figure 2).

In the Apulian domain, at Mt. Maiella the investigated taxa were first illustrated under the name of 'small rotaliids' by Pignatti (1995); these rotaliids come from two thin sections of the sample BI-263a from the Decontra section (north-western Maiella; 42° 9′51.84″N, 13°59′31.13″E; elevation: 486 m) of Vecsei (1991). This is the type locality of *Ornatorotalia granum* n. sp. The occurrence of alveolinids such as *A. distefanoi* and cuvillierinids suggest a lower–middle Cuisian age of the assemblages. *A.* cf. *decastroi* restricts this range to SBZ 11 (Figure 3a, b).

In the Latium-Abruzzi platform, Central Apennines (Central Italy) at Castrovalva, Poggio di Roio, and Monte Torretta (L'Aquila), specimens of *Ornatorotalia* n. gen. and *Granorotalia* n. gen. were

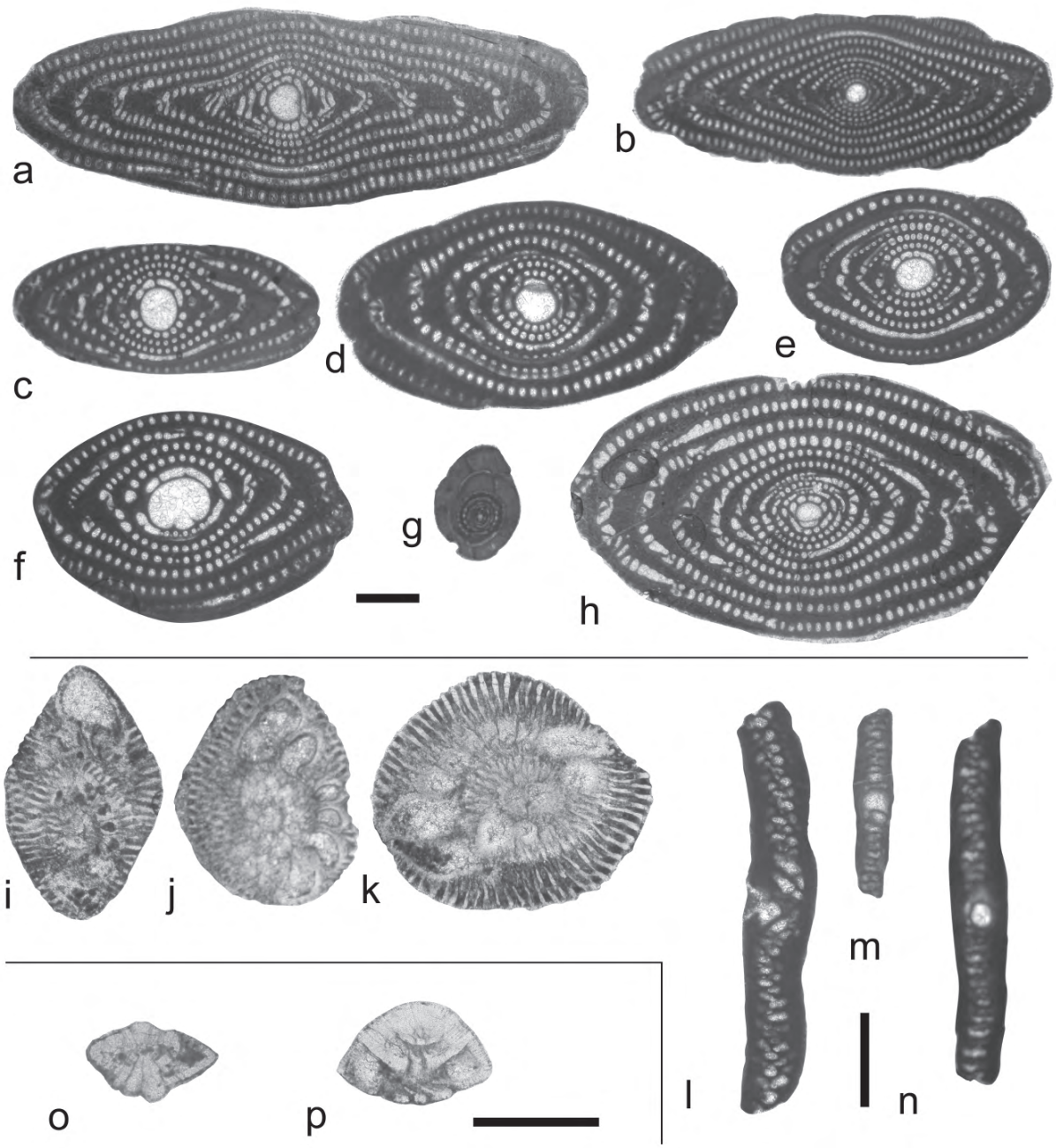

Figure 2. SBZ 11 faunal assemblage from clasts in the Monte Bosco Fm. (Sicily): **(a, b)** *Alveolina distefanoi* Checchia-Rispoli, 1905; **(c–f)** *A. cremae* Checchia-Rispoli, 1905; **(g)** *A.* cf. *dainelli* Hottinger, 1960; **(h)** *A. decastroi* Scotto di Carlo, 1966; **(i–k)** *Cuvillierina vallensis* (Ruiz de Gaona 1949); **(l, n)** *Orbitolites* aff. *biplanus* Lehmann, 1963; **(o)** unidentified rotaliid; **(p)** *Medocia blayensis* Parvati, 1970. Scale bar= 0.5 mm.

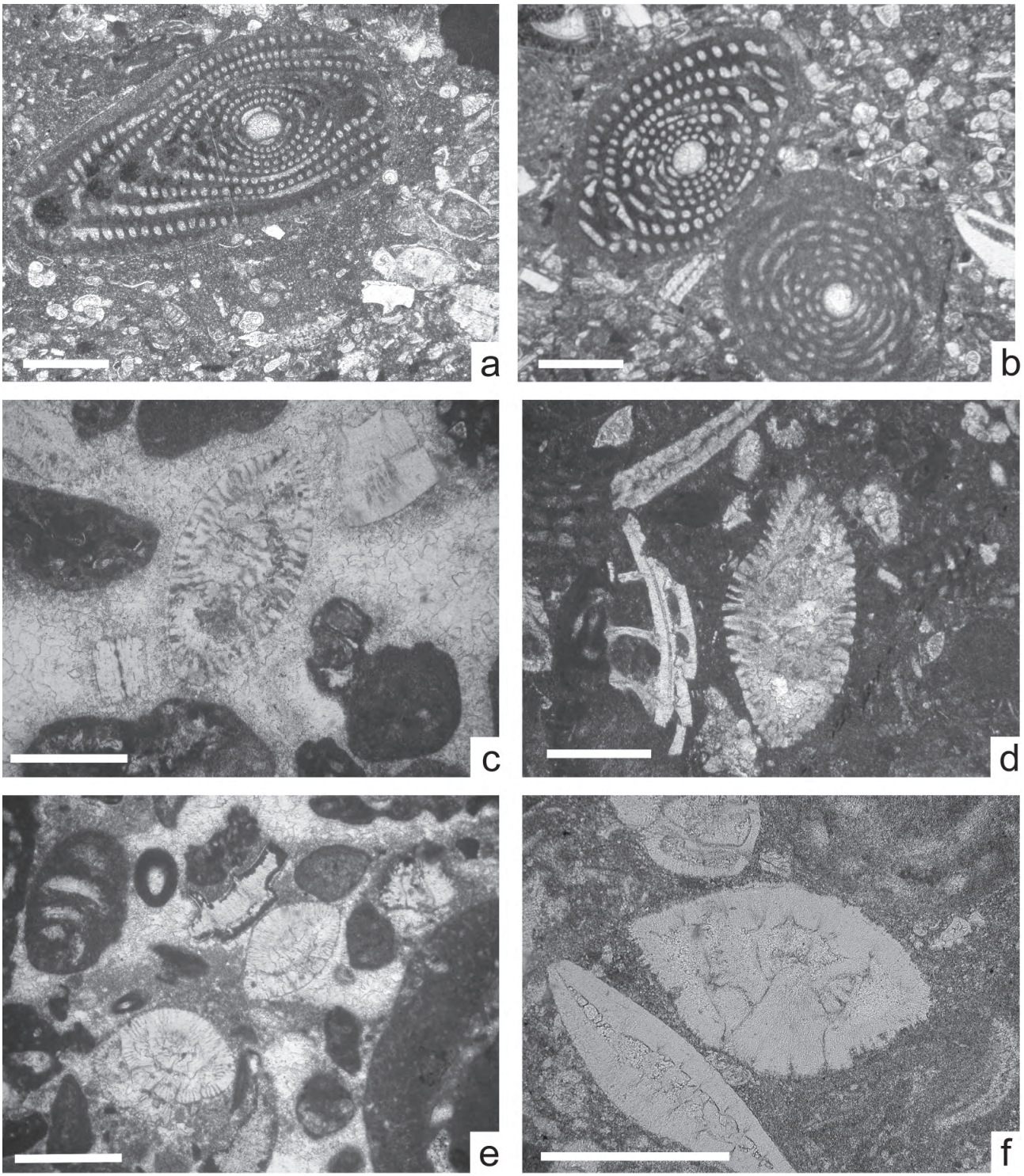

Figure 3. **(a)** *Alveolina distefanoi* Checchia-Rispoli, 1905, Decontra (Maiella Mt.); **(b)** *Alveolina* cf. *decastroi* Scotto di Carlo, 1966, Decontra (Maiella Mt.); **(c, d)** *Cuvillierina vallensis* (Ruiz de Gaona 1949); **(c)** from Monte Torretta (L'Aquila); **(d)** from Poggio di Roio (L'Aquila); **(e)** *Medocia blayensis* Parvati, 1970; **(f)** ?*Smoutina* sp. from Decontra (Maiella Mt.). Scale bar= 0.5 mm.

found in samples collected in three different outcrops in the province of L'Aquila. The new taxa occur in proximal slope settings, where hemipelagic deposits alternate with resedimented and reworked material from the platform, within either reworked grainstone clasts (Castrovalva: 41°58′59.68″N, 13°48′42.47″E; elevation: 776 m) or floatstones to bioclastic microbreccias (Poggio di Roio: 42°19′37.76″N, 13°23′9.68″E; elevation 928, and Monte Torretta: 42°22′40.84″N, 13°17′20.11″E; elevation 735 m) (Figure 3c, d).

The assemblages from Castrovalva and Poggio di Roio are dominated by alveolinids, fragments of *Orbitolites*, and by the new taxa herein described as *Ornatorotalia spinosa* n. sp. and *Granorotalia sublobata* n. sp., along with *Cuvillierina vallensis*, rare nummulitids and *Medocia blayensis.*

In the Monte Torretta succession (Renz 1936), resampled by us in its easternmost part, *Ornatorotalia granum* n. sp. and *O. spinosa* n. sp. are abundant in two samples at 31 and 32 m respectively above the top of the Upper Cretaceous Calcari Cristallini Formation. The two new species are found in a floatstone with *A. cremae* and *C. vallensis* indicating a middle Cuisian age of the assemblages.

Systematic Palaeontology

Superfamily Rotaliacea Ehrenberg, 1839

Family Rotaliidae Ehrenberg, 1839

Genus *Ornatorotalia* n. gen.

(Type species *Ornatorotalia spinosa* n. sp.)

Derivatio Nominis– From the latin *ornatus*= adorned and *Rotalia*.

Diagnosis– Test trochospiral, planoconvex or nearly biconvex, ornamented on both sides by discrete pustules (piles); chambers increasing rapidly in number in successive whorls, sutures not clearly visible; wall calcareous, fibrous, optically radial, thick, perforate; aperture interiomarginal. Dimorphism of generations generally indistinct, as in *Rotalia*; microspheric generation inferred on the basis of spine development and distinctly smaller proloculus. Retral bend and toothplates are present.

Remarks– *Ornatorotalia* n. gen. is characterized by spiral and intraseptal canals; the interlocular space between the frontal wall of the penultimate chamber and the proximal wall of the ultimate chamber is open on both the ventral and the dorsal sides. Vertical canals (funnels) are developed both on the dorsal and on the ventral side. A canal formed by the toothplate, an apertural lip and a retral bend of the septum are developed.

Large or short spines may occur along the periphery of the last whorl of the adult test of specimens interpreted as microspheric.

According to the suprageneric classification of Loeblich & Tappan (1987, 1992), *Ornatorotalia* n. gen. should be included within the subfamily Cuvillierininae Loeblich & Tappan, 1964 because of the presence of an open canal system in both the ventral and dorsal sides of the test. Leppig (1988), however, suggested that the subfamily Cuvillierininae is superfluous and assigned the genera with dorsally opened and sutural canals to Miscellaneidae Sigal, 1952, a planispiral family recently reassigned by Hottinger (2009) to the Nonionacea. We refrain from attempting suprageneric assignment at subfamily level of the taxa established here because of the state of flux in the classification within the Rotaliidae and pending further investigations on better preserved specimens, including in particular microspheric specimens.

Storrsella Drooger, 1960 is strictly planoconvex, trochospiral, with chambers increasing rapidly in number, a smoother surface, depressed sutures and differs from *Ornatorotalia* in the lack of the spines in the adult microspheric stage. *Calcarina* has multiple apertures.

Ornatorotalia spinosa n. sp.

Figure 4a–h; Figure 5a-l; Figure 7a–j; Figure 10e–f

Derivatio Nominis– From the Latin *spinosus*, i.e. spinose, relating to the presence of spines in the larger (microspheric) specimens.

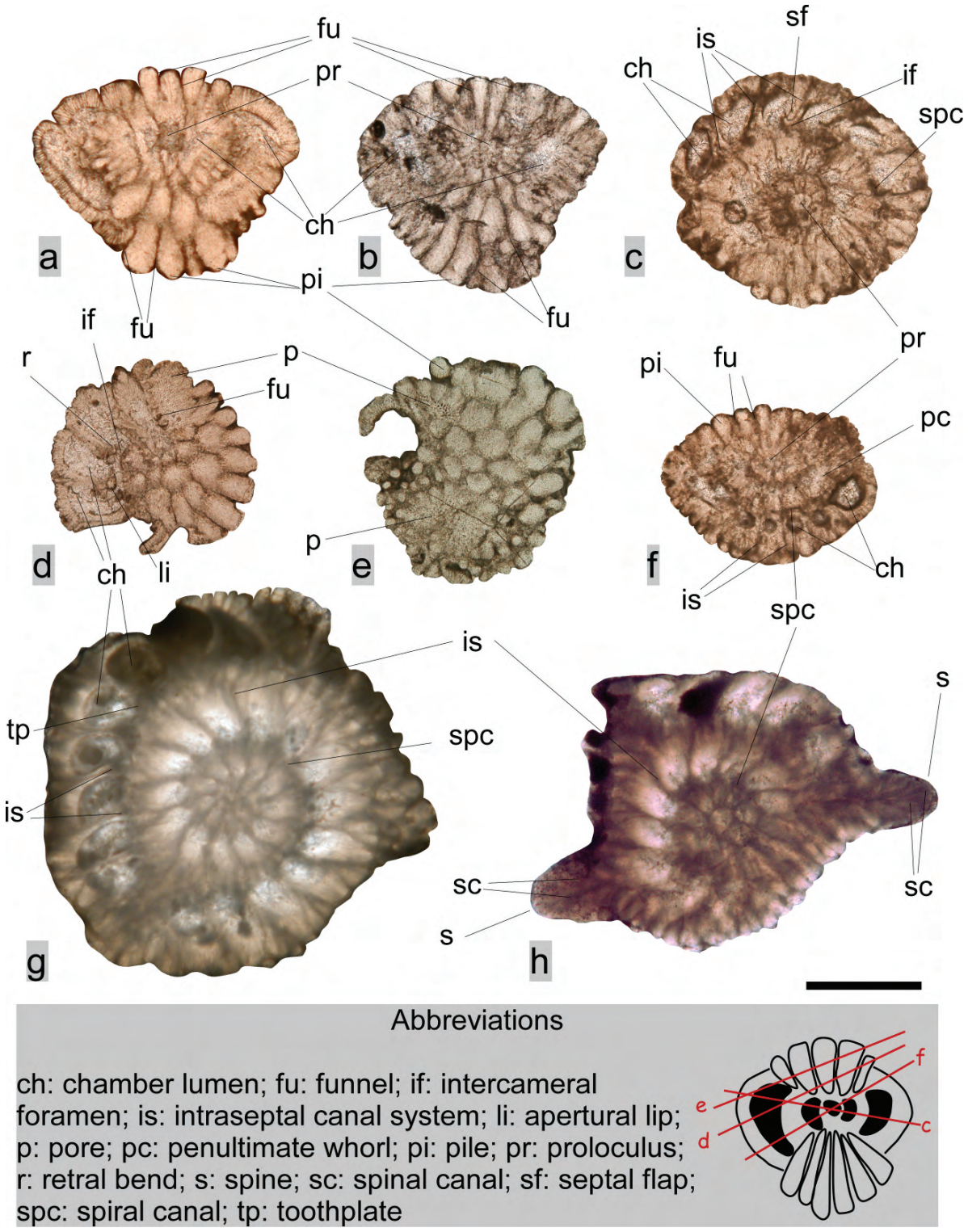

Figure 4. *Ornatorotalia spinosa* n. sp. from the Monte Bosco Fm. (Sicily): **(a)** oblique axial section; **(b)** subaxial section; **(c)** subequatorial section; **(d)** oblique section; **(e)** tangential section; **(f)** oblique section; **(g, h)** subequatorial section of microspheric specimens. Scale bar= 0.5 mm.

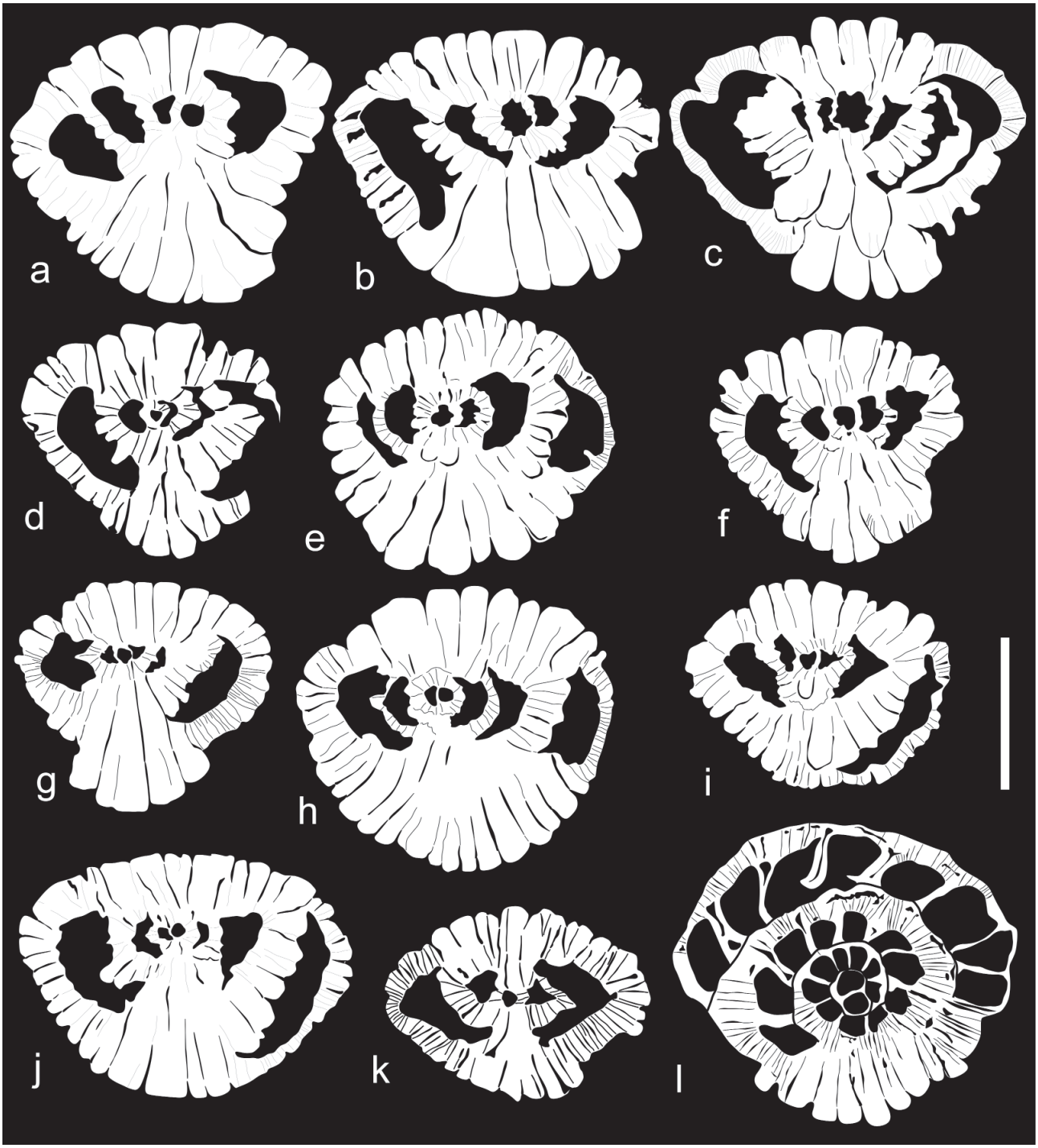

Figure 5. Drawings of *Ornatorotalia spinosa* n. sp. from the Monte Bosco Fm. (Sicily): **(a–k)** axial and subaxial sections; **(l)** subequatorial section. Scale bar= 0.5 mm.

Type Material– Holotype (MPUR NS154.1) and paratypes (MPUR NS154.2-12), deposited in the micropalaeontological collection of the Museum of Palaeontology, Department of Earth Sciences, 'La Sapienza' University, Rome.

Type Horizon– Upper Ypresian, middle Cuisian (SBZ 11); the reworked holotype and paratypes come from sample MB14bis (Benedetti 2009) of the Monte Bosco Fm. (Northwestern Sicily).

Type Locality– Baglio Beatrice, Buseto Palizzolo, Trapani province, Sicily (38°0′13.47″N, 12°44′8.54″E).

Diagnosis– A medium-sized rotaliid (diameter greater than 0.5 mm), with trochospiral, involute, inequally biconvex test totally covered by coarse pustules.

Description– Dorsal side hemispherical to flattened, strongly ornate with perforate, thick pillars arranged in a spiral pattern. Both sides are covered by coarse piles (pustules) reaching about 100 μm in diameter.

Ventral side hemispherical and visibly convex with thick piles starting from the umbilical region forming axially oriented umbilical piles on the surface and larger than those on the dorsal side.

Periphery rounded to subangular with little piles on the ventral side. 12–13 chambers in the ultimate whorl. In the equatorial plane, the ratio between the height and width of the chamber lumen is about 1.3. The height of the last chambers in the axial section is about twice the height of the chamber in equatorial section. The ornamentation of the previous whorl reduces the chamber lumen, as visible in axial section. The spherical proloculus measures 44–55 μm in diameter in the microspheric form, and 100–120 μm in the megalospheric forms.

A canal formed by the toothplate, an apertural lip and a retral bend of the septum are developed (Figure 6). The intercameral foramen consists of a single low arch aperture in interiomarginal position at the base of the septal face. The septal flap apparently does not cover fully the septal face. Retral bends are present at the base of some septa. Intraseptal canal systems

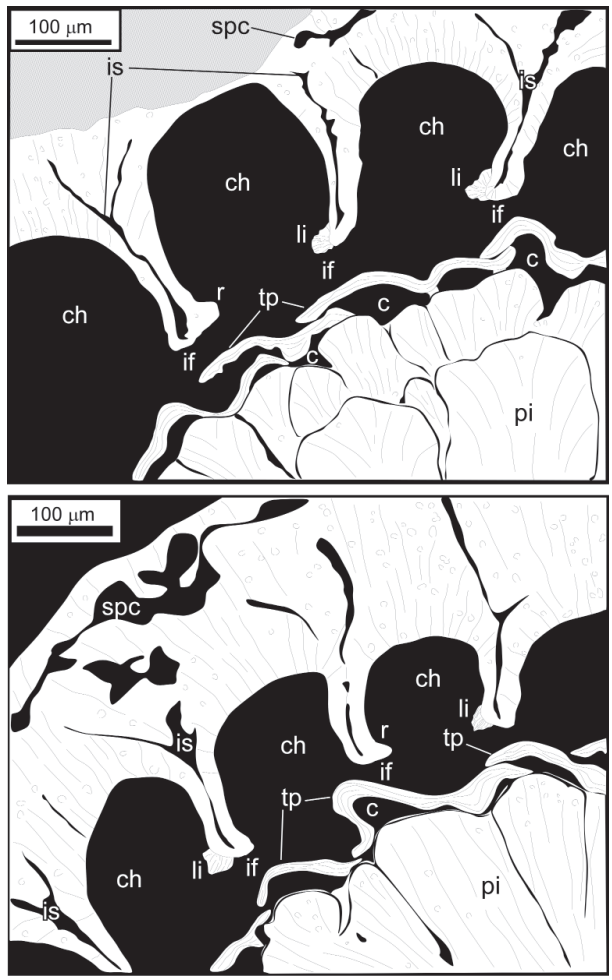

Figure 6. Interpreted drawings of an equatorially sectioned microspheric specimen of *Ornatorotalia spinosa* n. sp. from the Monte Bosco Fm. (Sicily). c– canal formed by toothplate; ch– chamber lumen; if– intercameral foramen; is– intraseptal canal system; li– apertural lip; pi– pile; r– retral bend; spc– spiral canal; tp– toothplate.

are developed for each chamber. The diameter of the funnels ranges from 2 to 13 μm.

The larger specimens present 4–5 robust spines near the periphery with distinct radial canals starting from the canal system of the last whorl.

Known Stratigraphic Range– Upper Ypresian, middle Cuisian (SBZ11 of Serra-Kiel *et al.* 1998). In addition to its type locality in Sicily, specimens interpreted as belonging to *O. spinosa* n. sp. were found by us at Monte Torretta (L'Aquila).

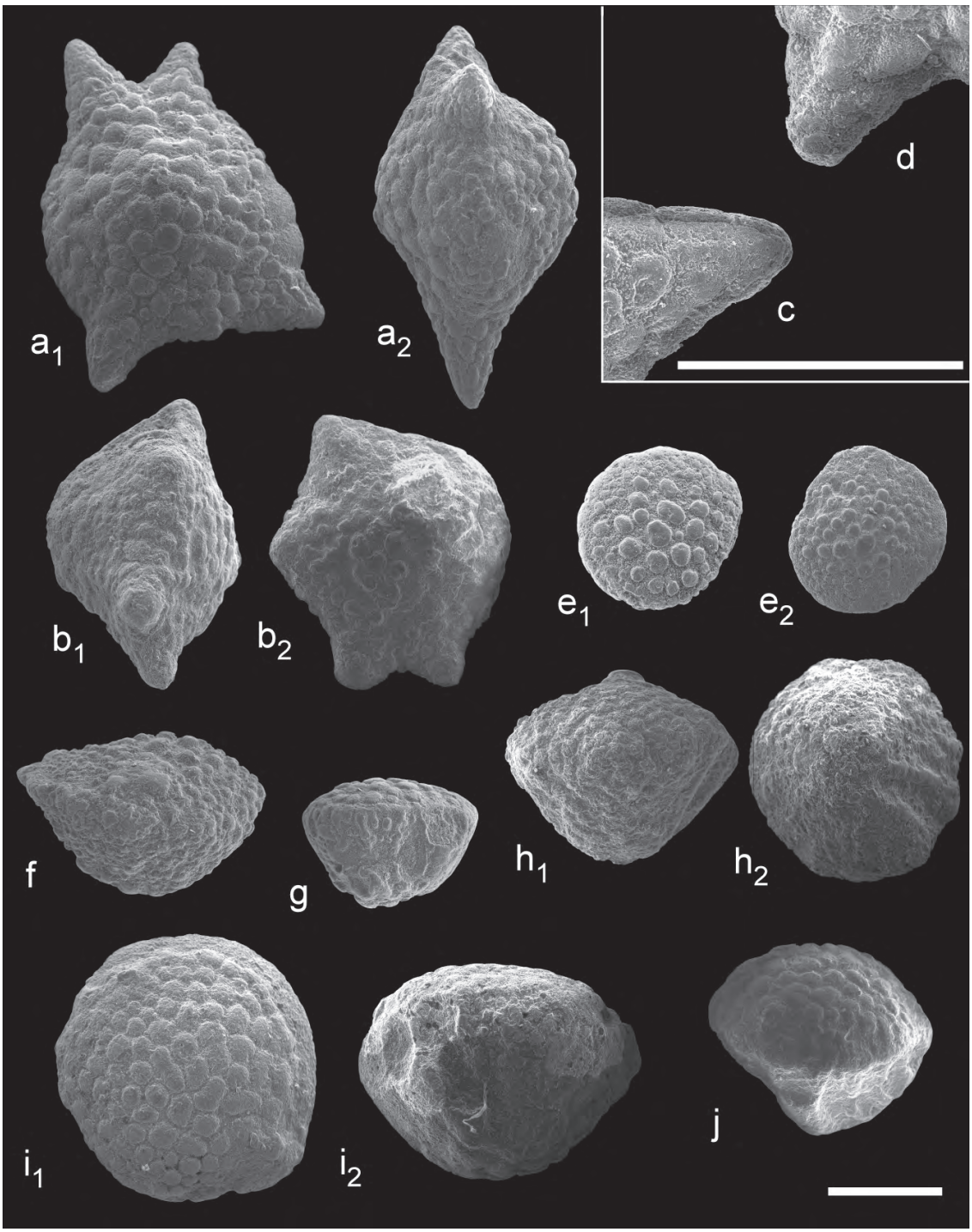

Figure 7. *Ornatorotalia spinosa* n. sp., SEM micrographs of free specimens from the Monte Bosco Fm. (Sicily); **(a)** holotype (MPUR NS154.1), microspheric specimen; **(a1)** dorsal view; **(a2)** lateral view; **(b)** paratype (MPUR NS154.2), microspheric form; **(b1)** lateral view; **(b2)** ventral view; **(c, d)** spines of microspheric forms; **(e)** megalospheric form (MPUR NS154.3); **(e1)** dorsal view; **(e2)** ventral view; **(f, g, j)** lateral view of megalospheric specimen (MPUR NS154.6-8); **(h)** megalospheric specimen (MPUR NS154.4); **(h1)** lateral view; **(h2)** ventral view; **(i)** non spinate microspheric specimen (MPUR NS154.5); **(i1)** dorsal view; **(i2)** lateral view. Scale bar= 0.5 mm.

Remarks– The specimen figured by Sztrákos (2005) as *Neorotalia* cf. *tuberculata* (Schubert 1901) from the Lower Thanetian (P4a) of the Pont-Labau Formation cropping out along the Gan-Rébénacq road (Aquitaine, South-Western France) is similar to *Ornatorotalia spinosa* n. sp. It differs from the latter, as far as can be assessed from the single ventral SEM microphotograph in Sztrákos (2005), in having coalescent and smaller pustules. According to Dr. K. Sztrákos (personal communication 2009), whereas there are only very rare recrystallized specimens of *Neorotalia* cf. *tuberculata* in the Thanetian, the classical lower Upper Ypresian (i.e., early Cuisian) outcrop of the Tuilerie of Gan (Schaub 1981) yields more typical specimens.

Ornatorotalia granum n. sp.

Figure 8a–g; Figure 9a–f; Figure 10a–d

Derivatio Nominis– From the Latin *granum*, i.e. grain, relating to the granulation on the surface of the test.

Type Material– Holotype (MPUR NS154.13) and paratypes (MPUR NS154.14-21), deposited in the micropalaeontological collection of the Museum of Palaeontology, Department of Earth Sciences, 'La Sapienza' University, Rome. Type horizon: Upper Ypresian, middle Cuisian (SBZ 11); the holotype and paratypes come from sample BI-263a of Decontra (Maiella Mt.) (Vecsei 1991).

Type Locality– Decontra, Maiella Mt., Central Italy (42° 9′51.84″N, 13°59′31.13″E).

Diagnosis– Medium-sized rotaliid, with trochospiral, involute, biconvex test covered by coarse piles.

Description– Involute trochospiral, biconvex test (diameter ranging from 660 to 1030 μm; thickness= 550–703 μm). Both sides are covered by coarse piles with a diameter ranging from 45 to 140 μm. Thicker umbilical piles are commonly abundant in the umbilical region of the ventral side.

Periphery rounded to subangular with very little ornamentation.

The subspherical proloculus measures 40–70 μm in diameter. 11–12 chambers are in the last whorl. In equatorial section, the chambers are subrectangular and separated by straight septa. The height of the last chambers in axial section is about twice the height of the chamber in equatorial section.

The aperture, as in the intercameral foramen, consists of a single low arch aperture in interiomarginal position. Intraseptal canal systems are developed for each chamber and are connected with the spiral canal system.

Known Stratigraphic Range– Upper Ypresian, middle Cuisian (SBZ11 of Serra-Kiel *et al*. 1998). In addition to its type locality, *O. granum* n. sp. occurs in coeval deposits at Poggio di Roio (L'Aquila) and Mt. Torretta (L'Aquila).

Remarks– *O. granum* n. sp. differs from *O. spinosa* n. sp. in being smaller, with a smaller proloculus, a more biconvex test and a lack of piles near the periphery. No matrix-free specimens of *O. granum* n. sp. were found and the presence of spines in the adult stage could not be ascertained.

Granorotalia n.gen.

(Type species *Granorotalia sublobata* n. sp.)

Derivatio Nominis– From the latin *granum*= grain and *Rotalia*.

Description– test biconvex, low trochospiral coil of 3–3.5 whorls, with acute periphery, ornamented on both the sides but not near the periphery. Chambers increasing rapidly in number in successive whorls, sutures indistinct except for the latest chambers in the last whorl where they appear weakly depressed. Wall calcareous, fibrous, optically radial, thick, perforate; aperture interiomarginal.

Granorotalia n. gen. is characterized by having a canal system mainly composed of spiral and intraseptal canals; vertical canals (funnels) are developed on both the sides. No folia are visible.

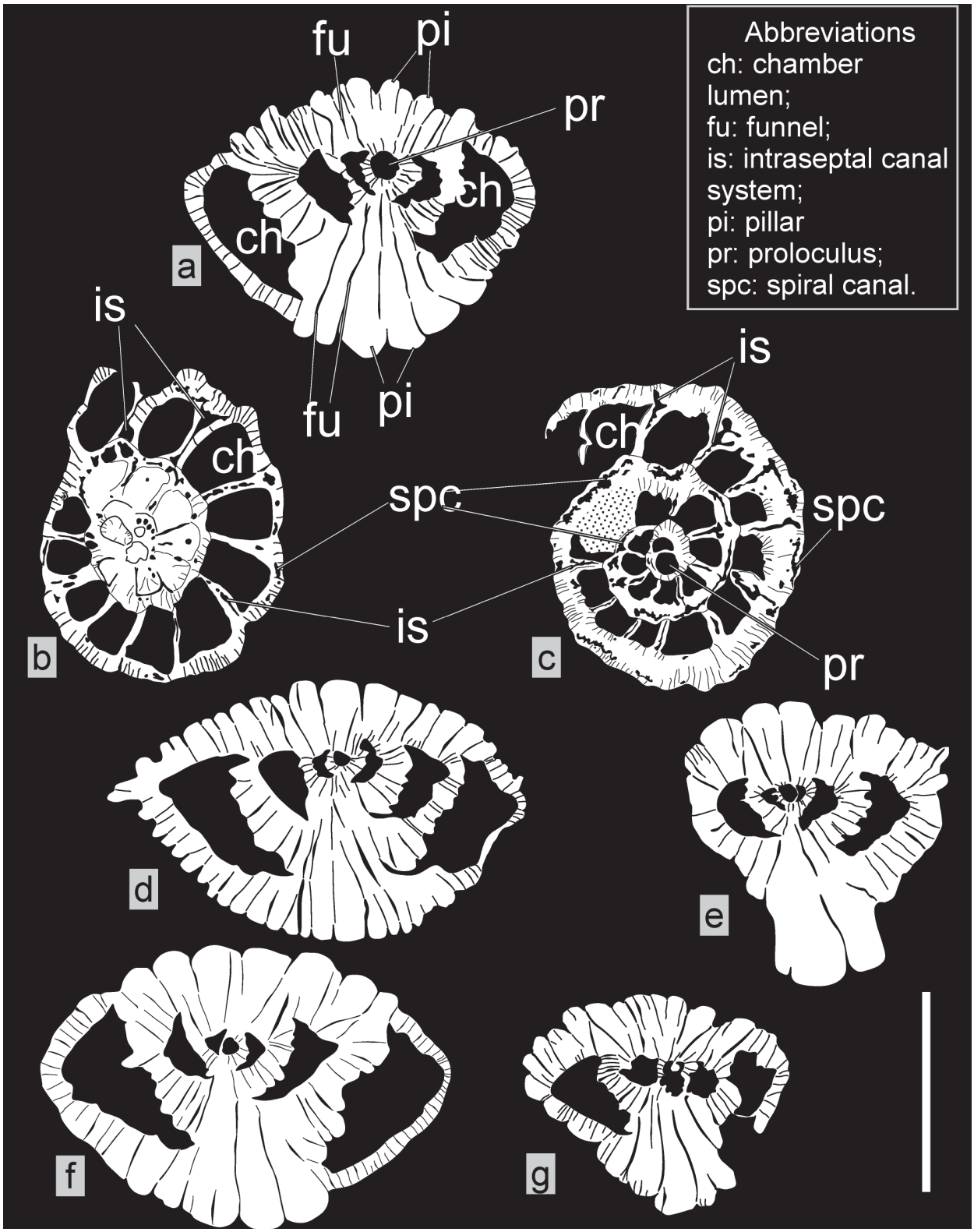

Figure 8. Drawings of *Ornatorotalia granum* n. sp. from Decontra (Maiella Mt.): **(a)** axial section; **(b)** oblique section; **(c)** equatorial section; **(d–g)** axial and subaxial sections. Scale bar= 0.5 mm.

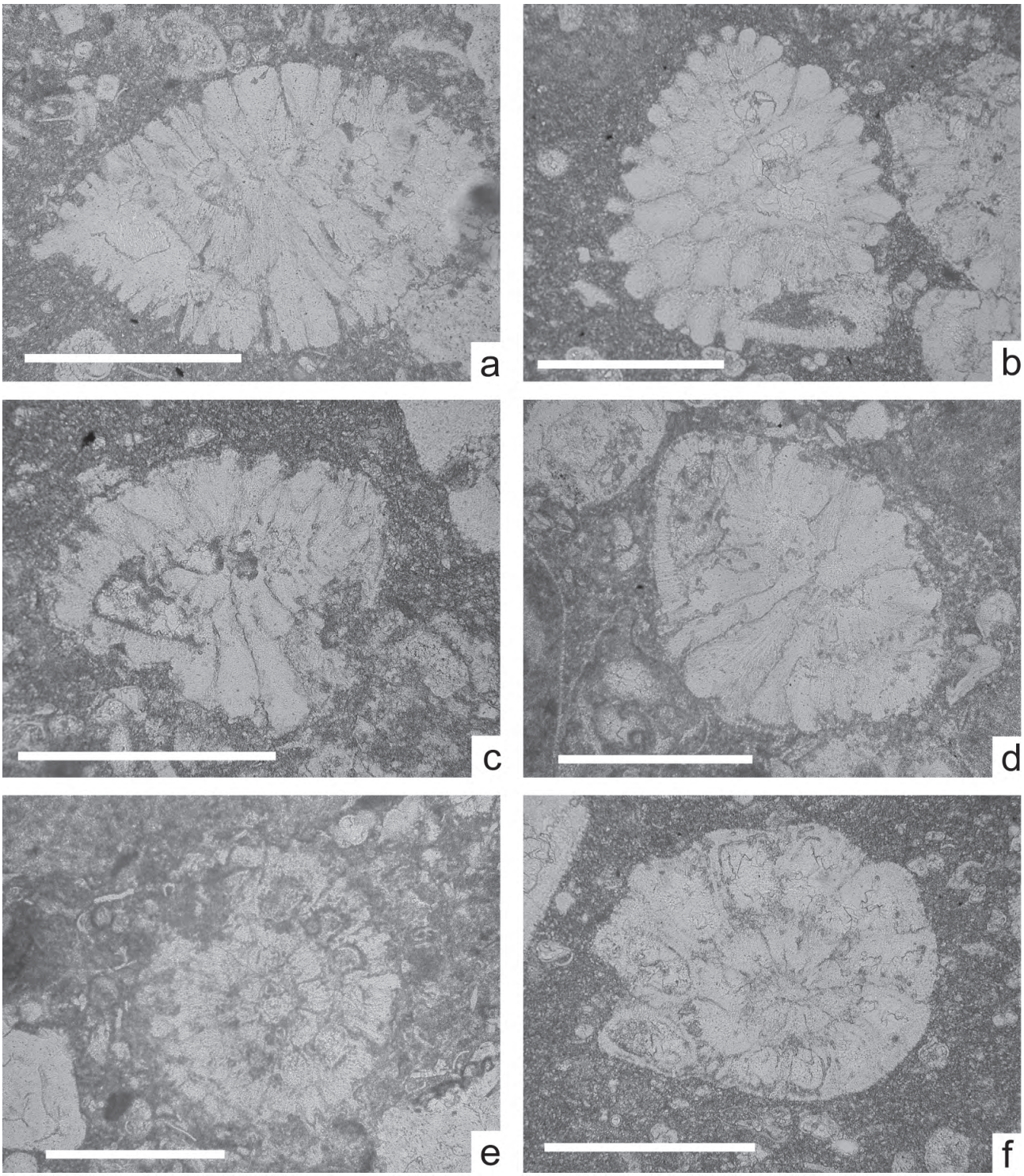

Figure 9. (a–f) *Ornatorotalia granum* n. sp. from Decontra (Maiella Mt.); **(a)** holotype (MPUR NS154.13); **(b)** paratype (MPUR NS154.14); **(c)** paratype (MPUR NS154.15); **(d)** paratype (MPUR NS154.16); **(e)** paratype (MPUR NS154.17); **(f)** paratype (MPUR NS154.18). Scale bar= 0.5 mm.

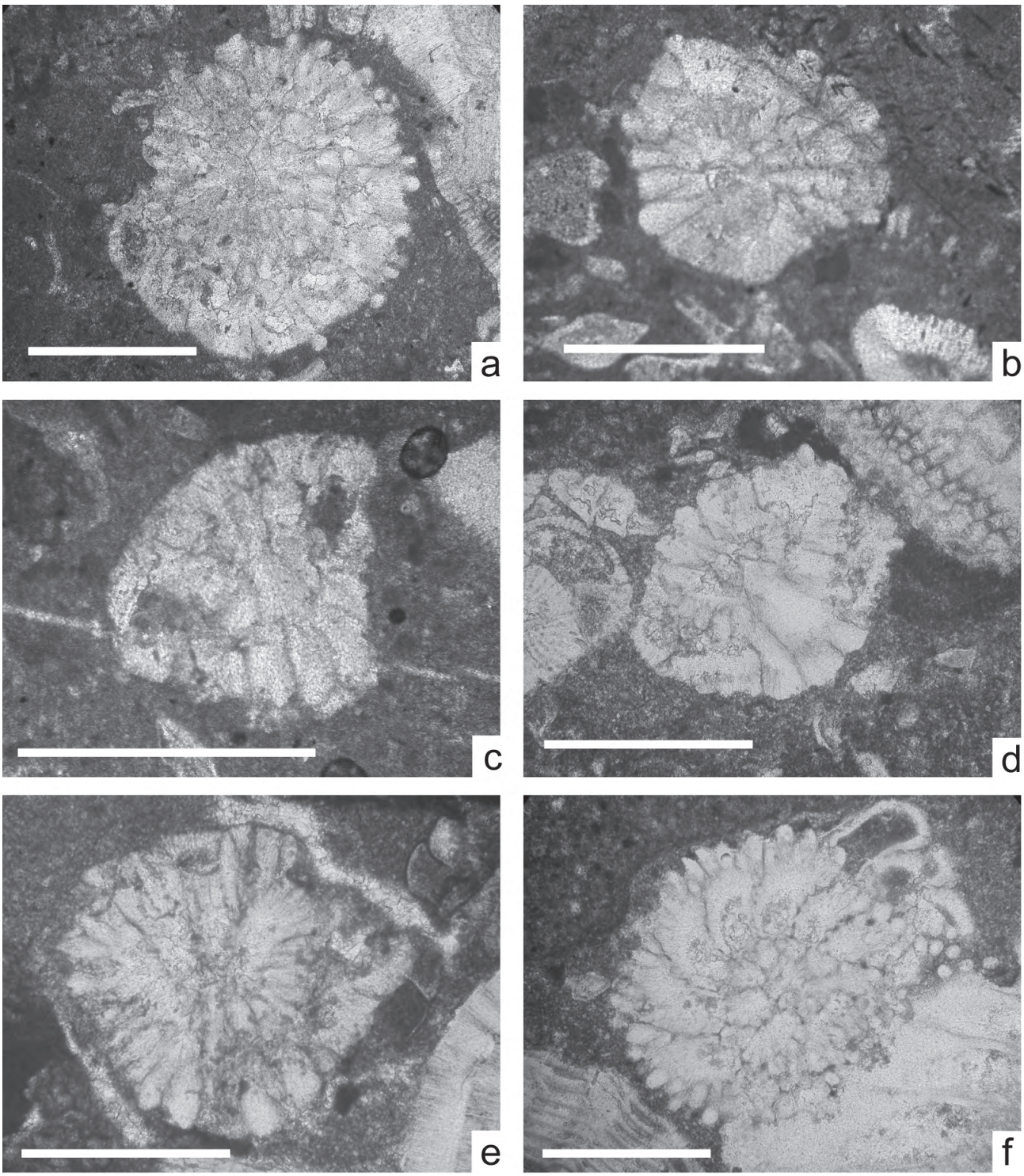

Figure 10. (a–d). *Ornatorotalia granum* n. sp.; **(a–c)** specimens from Poggio di Roio (L'Aquila); **(d)** from Mt. Torretta (L'Aquila); **(e, f)** *O. spinosa* n. sp. from Mt. Torretta (L'Aquila). Scale bar= 0.5 mm.

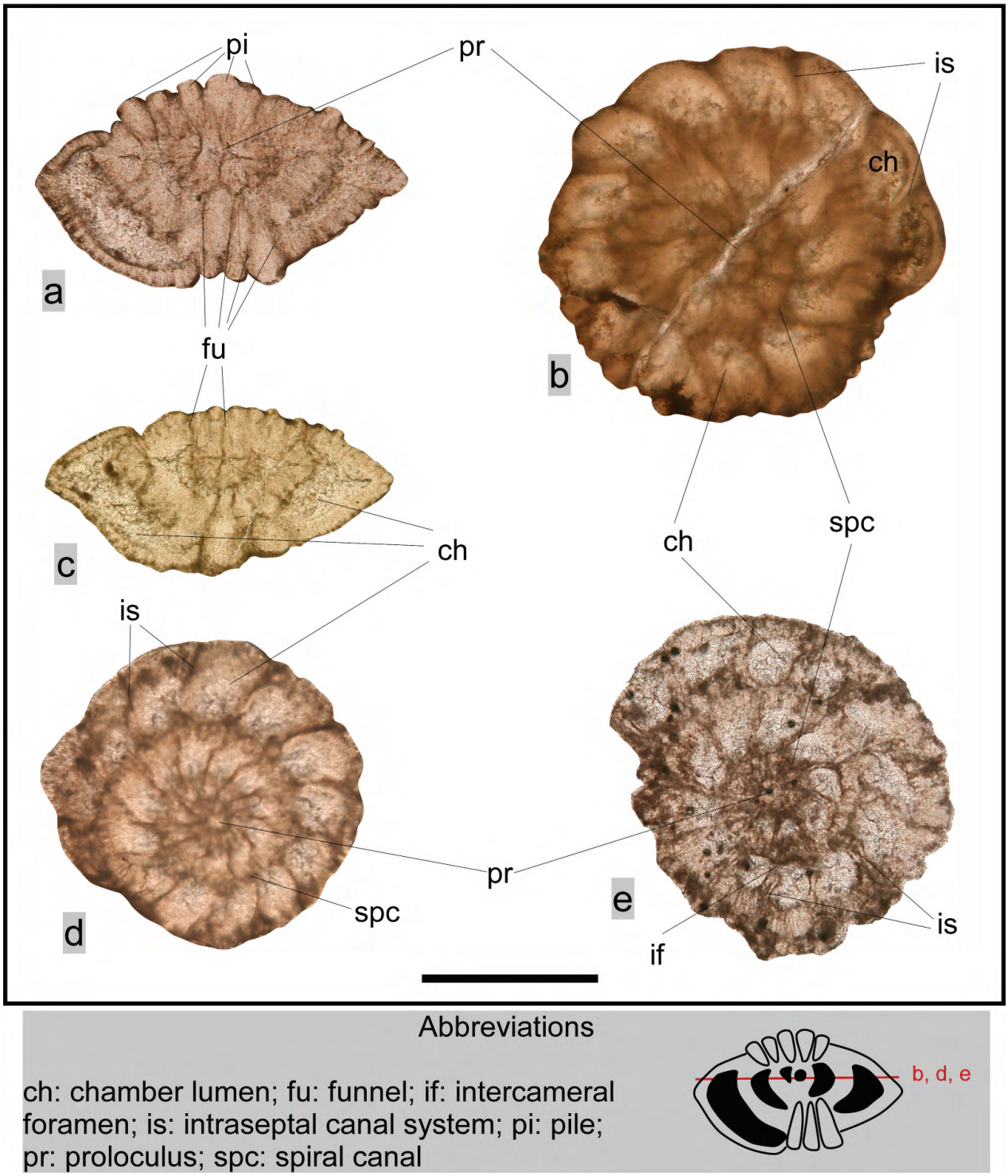

Figure 11. Thin sectioned specimens of *Granorotalia sublobata* n. sp. from the Monte Bosco Fm. (Sicily). **(a, c)** axial section; **(b, d, e)** equatorial sections. Scale bar= 0.5 mm.

Granorotalia sublobata n. sp.

Figure 11a–e; Figure 12a, b; Figure 13a–f;

Figure 14a–h

Derivatio Nominis– From the Latin *sublobatus*, i.e. slightly lobed, relating to the morphology of the test.

Type Material– Holotype (MPUR NS154.22) and paratypes (MPUR NS154.23-32), deposited in the micropalaeontological collection of the Museum of Palaeontology, Department of Earth Sciences, 'La Sapienza' University, Rome.

Type Horizon– Middle Cuisian (SBZ 11); the reworked holotype and paratypes come from samples MB14 and MB14bis (Benedetti 2009) of the Monte Bosco Fm. (Northwestern Sicily).

Type Locality– Baglio Beatrice, Buseto Palizzolo, Trapani province, Sicily (38°0′13.47″N, 12°44′8.54″E).

Diagnosis– Small-sized rotaliid with trochospiral, involute, biconvex test covered by piles on both sides in central position, periphery acute, sublobate and inornate.

Description– Trochospiral, lenticular, biconvex test. 11–13 chambers in the last whorl. System of funnels on both the ventral and the dorsal side of the test. 2–3 thick pillars in the umbilical region. The chamber lumen in axial section has a triangular morphology. Proloculus subspherical (diameter= 55–70 μm).

Remarks– *Granorotalia sublobata* n. sp. resembles the unidentified miscellaneid 5 of Sirel (1998) from the Thanetian of the Harebekayis section, Eastern Turkey. *G. sublobata* n. sp. differs from *Neorotalia alicantina* Colom, 1954 (which has a SBZ 10-11 and ?12 range after Serra-Kiel *et al.* 1998) in having vertical funnels on the dorsal side and a more irregular pattern of the piles.

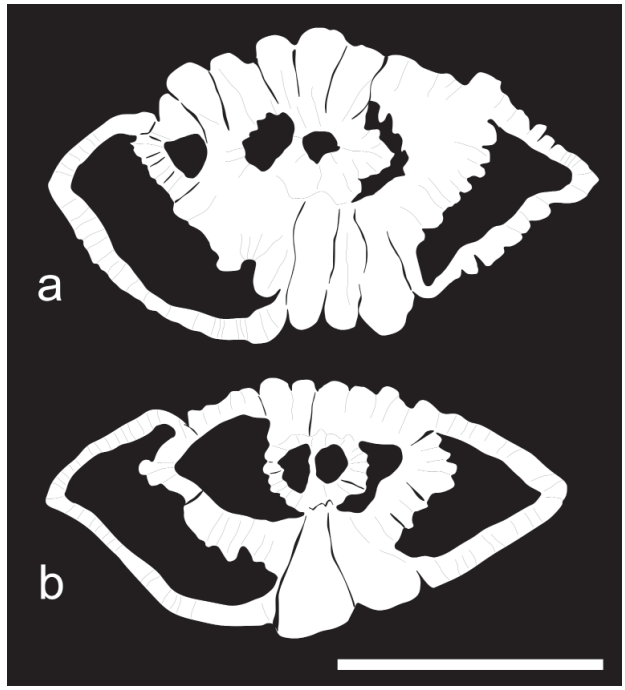

Figure 12. (a, b) Drawings of *Granorotalia sublobata* n. sp. from clasts found within the Monte Bosco Fm. (Sicily). Scale bar= 0.5 mm.

Subfamily Rotaliinae Ehrenberg, 1839

Genus *Medocia* Parvati, 1970

Medocia blayensis Parvati, 1970

Figure 2, p; Figure 3e

1971 *Medocia blayensis* Parvati, p. 17, plate 2, figures 2–4, plate 3, figures 1–5, plate 4, figures 2–6.

2007 *Medocia blayensis* Parvati – Hottinger, p. 15, plate 9, figures 2, 5, both top and 8 left; plate 10, figure 3 bottom; plate 12, figures 1–9; plate 13, figures 1–10.

Remarks– In order to improve the biostratigraphical potential of *Medocia*, a biometrical approach could be attempted. The Late Ypresian (Cuisian) specimens are smaller than the typical forms described by Parvati (1970) from the late Middle Eocene of France and by Hottinger (2007) from the late Middle Eocene of Iran (d>1 mm). Small *Medocia blayensis* specimens are reported from the Ypresian of Serra Pastorella, Southern Italy (Vecchio 2003). Thus, the Late Ypresian *Medocia* is possibly a biostratigraphically

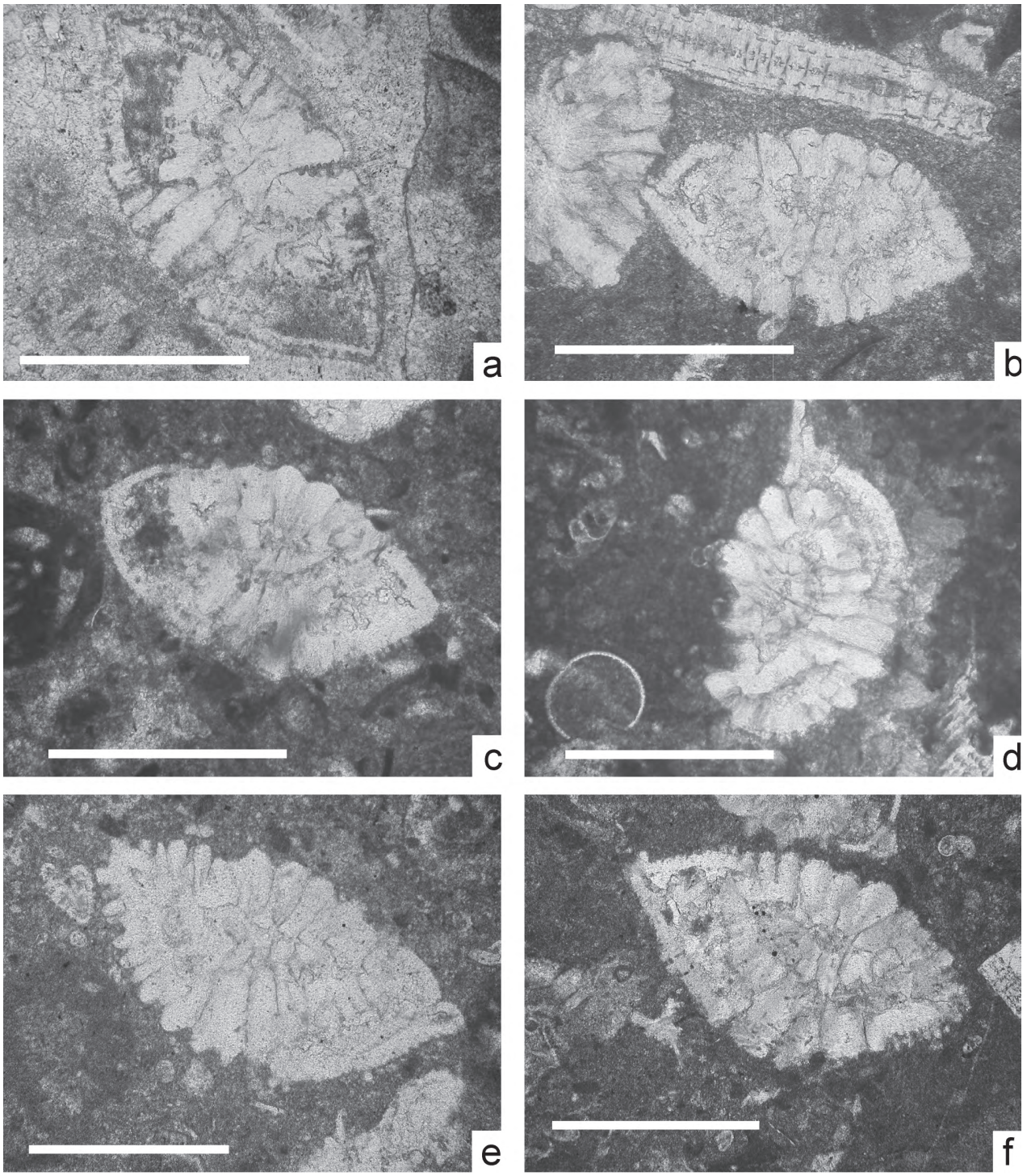

Figure 13. *Granorotalia sublobata* n. sp.; **(a)** specimen from Castrovalva (L'Aquila); **(b–d)** from Mt. Torretta (L'Aquila); **(e, f)** from Poggio di Roio (L'Aquila). Scale bar= 0.5 mm.

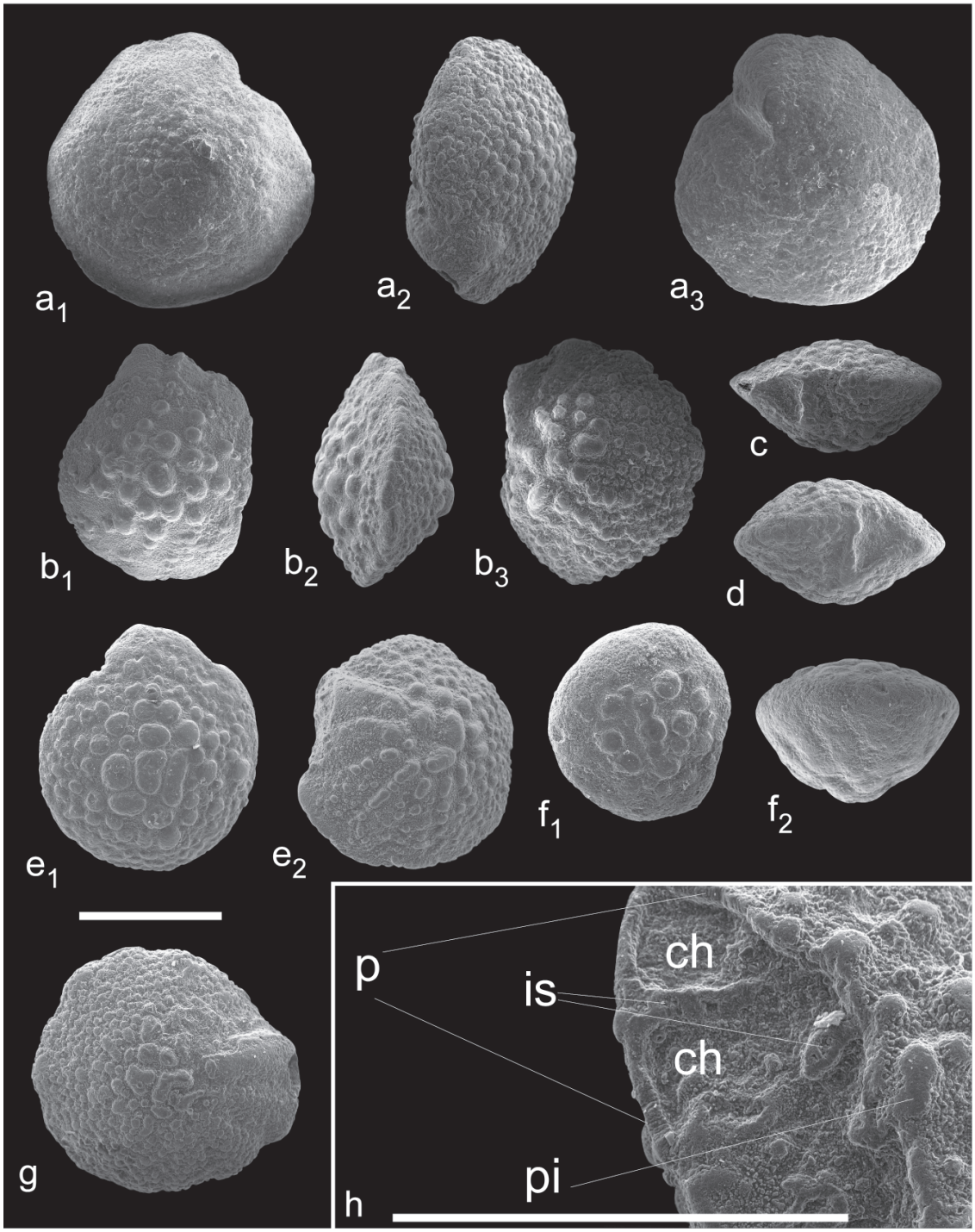

Figure 14. *Granorotalia sublobata* n. sp., SEM photo of free specimens; **(a)** holotype (MPUR NS154.22); **(a1)** dorsal view; **(a2)** lateral view; **(a3)** ventral side; **(b)** paratype (MPUR NS154.23); **(b1)** dorsal side; **(b2)** lateral view; **(b3)** ventral side; **(c, d)** lateral view of megalospheric forms (MPUR NS154.24-25); **(e)** megalospheric form (MPUR NS154.26); **(e1)** dorsal view; **(e2)** ventral view; **(f)** planoconvex shaped specimen (MPUR NS154.27); **(f1)** dorsal view; **(f2)** lateral view; **(g)** ventral side of a microspheric specimen (MPUR NS154.28); **(h)** view of a partially eroded specimen (MPUR NS154.29). ch– chamber; is– intraseptal canal; p– pore; pi– pile. Scale bar= 0.5 mm.

useful morphotype, which may represent a new chronospecies.

Genus *Smoutina* Drooger, 1960

?*Smoutina* sp.

Figure 3f

Test lenticular, biconvex, trochospiral, 2.5–3 whorls of chambers forming a broad cone, filled with pillars. Funnels occur between the pillars; wall calcareous, lamellar and optically radial.

Conclusions

The taxa established here appear to possess at least a regional biostratigraphic potential, in the light of their restricted vertical range. They may, however, represent members of long-lasting lineages, possibly going back to the Palaeocene. It is noteworthy that the new taxa are apparently missing from the slightly younger (SBZ 13) *Alveolina*-rich shallow-water assemblages of the Trentinara Formation of Campania, Southern Italy, which have been thoroughly investigated by Vecchio (2003) and Vecchio *et al.* (2007).

One of the aims of this work is to enable recognition for biostratigraphical purposes and comparison of the new taxa with coeval or phylogenetically related taxa. Several characteristics of the new taxa point to functional homoplasies with other Rotalidae. For example, the canaliculate spines may serve a function similar to that in present-day rotaliids and calcarinids, i.e. for allowing adhesion to hard substrates in high-energy environments. Similarly, the development of axially oriented piles, and in particular the umbilical piles, may enhance shell stability in shallow epibenthics on soft substrates. However, we still lack additional material, in particular microspheric forms, for assessing the skeletal architecture phylogeny and adequate material for defining apertural characters.

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