**INTRODUCTION**

The uniserial conical agglutinated foraminifera (called informally orbitoliniform foraminifera) are widespread in the shallow platform deposits of the Early and “middle” Cretaceous, but they are much more restricted in their distribution in the Late Cretaceous and Palaeogene, where they occupied only marginal areas of the shallow carbonate platform (Chiocchini & Mancinelli 1977, Hottinger & Drobne 1980; Caus & Cornella 1981; Vecchio et al. 2007; among others). Moreover, the large flatcones built by ring-shaped chambers typical of the “middle” Cretaceous orbitolines disappeared during the Cenomanian. Hottinger & Drobne (1980) suggested that these large forms developed only during Early and “middle” Cretaceous where these agglutinated foraminifera are not in competition with other larger benthic foraminifera. In the Late Cretaceous, the conical agglutinated foraminifera are in competition with large porcelainous and lamellar-perforated foraminifera. Consequently, the Late Cretaceous orbitoliniform foraminifera are relatively small, their facies distribution is very limited and their fossil record is discontinuous. These are probably the main reasons why only few taxa have been reported in the literature (*Pseudobirbulina mar-thae* Douvillé; *Dictyococulla complanata* Henson, *D. minima* Henson, *Dictyoconus mosae* Hofker, *Orbitionopsis senonicus* Gendrot, *Paleodictyoconus senonicus* Moullade & Viallard, *Abrardia catalannica* Bilotte, *Calvezi-conus lecalvezae* Caus & Cornella, *Falsugonina parva* Luper-to-Sinni & Martin-Chivelet and *Dictyoconus bakhtiari* Schlagintweit, Rashidi & Babadipour although in several geological works they were mentioned as indeterminate *Orbitolinidae* (see, for instance, Luper-to Sinni & Ricchetti 1978; Chiocchini & Mancinelli 1977).

Therefore the aim of this paper is to contribute to the knowledge of the Late Cretaceous uniserial conical agglutinated foraminifera by describing a new taxon from the Campanian deposits cropping out in the Lepini Mountains.

**GEOLOGICAL SETTING**

The Lepini Mountains are located in the southern part of the Latium region, central Italy (Fig. 1A). Together with the adjacent Ausoni and Aurunci Mountains, they constitute the Vosci Range (Fig. 1B), which represents a continuous mountain belt of almost 80 km in length and mainly composed of shallow-water carbonates (Accordi 1966; Centamore et al. 2007). During the Mesozoic, the Volsci Range was part of a tropical Tethyan carbonate platform bordered by deep hemipelagic to pelagic domains (Cosentino et al. 2010; Zarcone et al. 2010). From the Early Jurassic to the early Miocene, the shallow-water carbonate sedimentation persisted in...
a long-standing palaeogeographic element (Apen- 
nine Platform formerly named Latium-Abruzzi 
Platform; e.g., Accordi 1966; Chiochini & Man 
cinelli 1977; Chiochini et al., 1995; Chiochini & 
Pichezzi, 2016). These deposits were subsequen 
tly deformed during the Apennine compressional 
phase resulting in a fold-and-thrust belt structure 
(Centamore et al. 2007; Parotto & Tallini 2013; 
Cardello & Doglioni 2015). The sedimentology, 
stratigraphy and biostratigraphy of  the Cretaceous 
deposits from Lepini Mountains were previously 
studied by Carbone & Catenacci (1978), Chioc 
chini & Mancinelli (2001) and Brandano & Loche 
(2014) among others. In particular, the classical 
“Rava Santa Maria” section of  Chiochini & Man 
cinelli (2001) is located in the Lepini Mountains. 
The stratigraphic distribution of benthic foraminif 
era in this section was crucial to the definition of 
many of  the biozones used for the biostratigraphy of 
Upper Cretaceous shallow water carbonates of 
the central Apennines (Chiochini et al. 2008).

Material and Methods

The new taxon comes from a stratigraphic section about 
100 m thick measured on the dirt track leading to the base of 
the Monte Filaro, east of  the village of  Gorga (base of  the sec 
tion: N 41º39’19”-E 13º07’17”; top of  the section: N 41º39’25” 
-E13º07’11”, Fig. 2A, C). This section, falling in the lower part of 
the Rava Santa Maria section of  Chiochini & Mancinelli (2001), 
can be attributed lithostratigraphically to the Radiolitid Limestone 
Formation (Di Stefano et al. 2011) and biostratigraphically to the 
A. conica and R. scarsellai biozone (Chiochini et al. 2008; 2012).
The series is composed of  limestones, with intercalated dolomitic levels, characterized by birdseyes and other desiccation 
structures. The fossil content consists of  benthic foraminifera 
(mainly rotalids, see fig. 4D in Consorti et al. 2017), the demo 
sponge Sarmentofacis zamparelliae Schlagintweit, Frijia & Parente, 
Thaumatoporella, cyanobacteria probably referable to Decastronema 
kotori (Radiočić) and crustacean remains. The most common fo 
raminifera are Accordiella conica Farinacci, Moncharmontia apenninica 
(De Castro), Scandonea mediterranea De Castro, Rotalispira scarsellai 
(Torre), R. maxima Consorti, Frijia & Caus and Dicyclina schlumbergeri 
Munier-Chalmas. Lepinoconus chiocchinii gen. n., sp. n. has been found 
only within its type-level, which is also the type-level of  R. maxima 
(Consorti et al. 2017).
The study is based on sixteen thin-sections of  limestone. 
About fifty random sections of  Lepinoconus chiocchinii have been 
obtained from sample 057. The studied material is housed in the 
micropalaeontological collection of  the Universitat Autònoma de Bar 
celona, Spain, under the numbers PUAB 82524LP01-16.

For the definition of  the architectural terms used in the 
diagnosis and description of  the genus we refer to Hottinger & 

Systematic Paleontology

Phylum FORAMINIFERA D’Orbigny, 1826
Class GLOBOTHALAMEA Pawlowski et al., 2013
Order Textulariina Delage & Hérouard, 1896
Superfamily Coskinolinoidea Moullade, 1965
Family Coskinolinidae Moullade, 1965
Genus Lepinoconus gen. n.
Type species: Lepinoconus chiocchinii sp. n.

Derivatio nominis: named after Lepini Mountains.

Diagnosis: Pseudo-keriothecal shells of  high-conical shape 
with flat or slightly convex base. In the earliest stages of  growth, 
the chambers are probably spirally arranged, and later, uniserial. The 
multiple apertures are situated in the central area of  the cone. The 
exoskeleton consists of  radial partitions (main beams and intercala 
ry beams) in line from one chamber to the next. The endoskeleton 
consists of  irregularly positioned pillars.

Differential diagnosis: The textural and 
main architectural characteristics of  the new genus 
Lepinoconus seem to correspond to those described 
for the American Palaeogene Coskinolina (Coleiconus) 
elongata Cole (for details, see Hottinger & Drohne
Conical agglutinated foraminifera from the Upper Cretaceous of Italy: In honour of Prof. Maurizio Chiocchini and "Coskinolina B Thaumatoporella - Decastronema associa (Schlagintweit et al. 2017).

Fig. 2 - A) Stratigraphic log of the section studied in this work with the distribution of selected larger benthic foraminifera. B) Biozones and subzones of the inner platform facies of the Apennine Carbonate Platform according Chiocchini et al. (2008) and Friija et al. (2015). Numerical age from strontium isotope stratigraphy of Friija et al. (2015). C) Location of the measured section in the field.

1980, p. 233-234, text-fig. 11; pl. 13, fig. 7-14), but this last taxon (see Loeblich & Tappan 1987, for generic reassessment) has marginal apertures that are lacking in Lepinoconus. The representatives of the Tethyan Coskinolina (Coskinolina) liburnica Stache (type species of the genus, for details, see Hottinger & Drobe 1980, p.226, text-fig. 2; pl. 4, fig. 14; pl. 6, fig. 1, 3, 5; pl. 7, fig. 1-15; pl. 8, fig. 1-10) lack exoskeletal elements. The lower Cretaceous genera Paracoskinolina Moullade and Coskinolinoides Keijzer have simple Lepinoconus-like exoskeletal elements, but they do not develop a thick keriothecal structured wall. The new genus differs from Abrardia Neumann & Damotte (species type: Dictyoconus mosae Hofker) due to the complexity of the exoskeleton of this latter genus, which is formed by beams and rafters; moreover, it lacks a keriothecal structure. Calveziconus Caus & Cornella (species type: C. lecalvezae) occurs in the same stratigraphic interval as Lepinoconus and possess an exoskeleton constituted by alcoves, but the chamber lumen is subdivided by septula. After the illustrations given by the authors and reproduced by Loeblich & Tappan (1987, pl. 170, fig. 7; pl. 171, fig. 1-8; pl. 172, fig. 8-11), the genus Pseudorbitolina Douville and Dictyoconella Henson, unlike Lepinoconus gen. n., seem to have a reticulated subepidermal exoskeleton (see also Schlagintweit et al. 2017).

Lepinoconus chiocchinii gen n., sp. n.

Pl. 1, 2

1970 Coskinolina sp. – Fleury, pl. 1, fig. 5-7
1976 Urgonia sp. - Luperto Sinni, pl. 37, fig. 1-6
1976 Paracoskinolina sp. - Luperto Sinni, pl. 38, fig. 1-3
1976 Abrardia mosae (Hofker) - Luperto Sinni, pl. 41, fig. 1-12.
1977 Orbitolinidae - Chiocchini and Mancinelli, pl. 42, fig. 1,2
1978 Orbitolinidae gen. indet. - Luperto Sinni and Ricchetti, pl. 42, fig. 1-2; 4-6; pl. 43, fig. 4; pl. 44, fig. 7-9; pl. 45, fig. 15-17.
2008 Orbitolinidae - Chiocchini et al., pl. 31, fig 1.
2015 Accordiella aff. conica - Schlagintweit et al., fig. 6D.

Derivatio nominis: In honour of Prof. Maurizio Chiocchini, who studied the Mesozoic benthic foraminifera from Central Italy and their application in biostratigraphy.

Holotype: Specimen figured in Figure A from Plate I. PUAB 825224LP-01.

Paratypes: Specimens figured in Figure B-D from Plate I. PUAB 825224LP01, 825224LP07, 825224LP02, respectively.

Type locality: Gorga Village, Lepini Mounts (Central Italy). Coordinates: N 41º39’26”- E 13º07’05” (see also fig. IB, sample 057, of Consorti et al. 2017).

Type level and age: Packstone with Rotalispira maxima, R. scarsellai, Accordiella conica and "Thaumatoporella - Desiatruna association". Campanian.

Diagnosis: High conical shell with pseudo-keriothecal structure (Fig. 3). The marginal chamber cavity is subdivided by exoskeletal elements consisting of beams (main and intercalary) aligned from one chamber to the next. The endoskeleton consists of irregularly positioned pillars. The chambers in the earliest stages of growth form probably a spire. Later, chambers consist of discs uniserially arranged. The available sections are not sufficient to define if there is a significant dimorphism between A and B generations.
Description. Small-sized (maximum length 2 mm; maximum diameter 1 mm; D/L 1/2), high-conical shells with flat to slightly convex apertural face. The chambers in the earliest stage of growth probably form a small trochospire followed by discoidal uniserially arranged chambers, which constitute the main shell. There are 12-13 uniserial chambers per 1 mm axial length in the adult part of the cone. The comparatively thick chamber wall (about 40 µm, Fig. 2) results in a texture formed by closely spaced radial elements (“traverse pores” in Douglass, 1960). The exoskeleton consists of a few and relatively spaced thick beams of two orders (main and intercalary beams), which are aligned from one chamber to the next. The main beams extend from the external wall to the center of the chamber about one half of the radius of the disc, while the intercalary beams occupy only one third of this radius. In transversal sections there are about 10 partitions (main and intercalary beams) for a circumference diameter of 0.5 mm, and 18-20 (main and intercalary beams) for a diameter of 1 mm have been counted in transverse sections.

The central part of the uniserial discoid chambers is occupied by few pillar-shaped elements. There are about 2-3 pillars in the growth stage corresponding to a cone diameter of 0.5 mm; 5-6 for a cone diameter of 1 mm. The earliest stages lack endoskeletal elements. The apertures are rounded and have a large caliber which is around 0.04 mm. The early growth stages are difficult to recognize, although some sections cutting the apex of the shell almost axially suggest a short spire of half moon-shaped chambers following a simple proloculus.

Differences and similarities. Lepinoconus chiocchini differs from Orbitolinosps senonicus Gendrot (from the Coniacian-Santonian of Martigues, South-east of France) and from Calveziconus lecalvezae Caus & Cornella (from the Campanian of the Southern Pyrenees, North-east of Spain) in their endoskeleton-type, with “cupola” in O. senonicus and septula in C. lecalvezae, respectively. Abrardia mosae and A. catalanica from Aquitania (South-west France) and Southern Pyrenees, respectively, have an exoskeleton constituted by beams and rafters, instead of only beams. Paleodictyoconus senonicus (from the Santonian of the Iberian Ranges) differs from L. chiocchini for the greater complexity of its complex exoskeleton (beams and rafters forming a sub-epidermal network). Falsurgonina parva (from the Santonian of the Prebetic domain), differs from
Conical agglutinated foraminifera from the Upper Cretaceous of Italy

PLATE I

1 mm
Conical agglutinated foraminifera from the Upper Cretaceous of Italy

**Discussion**

The high conical, agglutinated uniserial *Lepinoconus chiocchinii* gen. n., sp. n. shears with the Palaeogene American genus *Coleiconus* Hottinger and Drobne the presence of exoskeleton in alveoles (only beams) with a thick pseudo-keriothcal structured wall and a pillared endoskeleton. In contrast, the marginal apertures visible in *Coleiconus* are not present in *Lepinoconus* gen. n. The exoskeleton pattern with deep main beams (and short intercalary beams) in line from one chamber to the next reminds *Coskinolinoidea* Keijzer, but this latter genus lacks endoskeletal elements.

*Lepinoconus chiocchinii* gen. n., sp. n. is a characteristic component of mudstone-wackestone facies deposited in restricted shallow-water environments. The type-level consists of foraminiferal-calcimicrobial laminated facies with “*Thaumatoporella-Decastronema* association” and crustacean remains (see fig. 4D in Consorti et al. 2017; other examples of this facies are figured in Ruberti & Toscano 2002, fig. 4B, and Schlagintweit et al. 2015, fig. 4C, 5A).

Field correlation suggests that the section studied in this paper corresponds to the upper part of the section of Consorti et al. (2017), which is located only 1.5 km to the south of the section studied in this paper. According to this correlation, the type-level of *L. chiocchinii* is younger than the *Keramosphaerina tergestina* level, which was dated by means of strontium isotope stratigraphy as early Campanian (82.09 Ma) in Consorti et al. (2017).

In the studied section, the type-level of *L. chiocchinii* coincides with the last occurrence of *Scanoidea mediterranea*, which is dated 81.1 Ma in the southern Appennines (Frijia et al. 2015). The distribution of *Lepinoconus chiocchinii* gen. n., sp. n. in the Lepini Mountains seems thus to be very narrow. It is bracketed within the *K. tergestina* level and the upper limit of the *S. mediterranea* subzone, spanning in a range of nearly 1 Ma. This record is only partially in agreement with Luperto Sinni & Richetti (1978), who indicated the stratigraphical distribution of *L. chiocchinii* (reported as Urgonina sp., *Paraspinolina* sp. and *Abrardia mosae*, see synonym list in this paper) in the Apulian Platform spanning from the base of *Keramosphaerina* level until the upper part of the *Orbitoides* subzone.

**Conclusions**

A detailed study of the Upper Cretaceous shallow-water platform deposits of Lepini Mountains has provided abundant and well preserved specimens of a new conical, agglutinated, uniserial foraminifer that has been included in the *Coskinolina* Superfamily. *Lepinoconus chiocchinii* gen. n., sp. n. has a typical exoskeleton in alveoles (only beams) with a pseudo-keriothcal wall. The endoskeleton is constituted by irregularly distributed pillars. The new taxon has been found in restricted platform areas with “*Thaumatoporella-Decastronema* association” and crustacean remains. The stratigraphic distribution of *Lepinoconus chiocchinii* gen. n., sp. n. in the Lepini Mounts seems to be very narrow (early Campanian). *Lepinoconus chiocchinii* gen. n., sp. n. geographical distribution seems to be wide, comprising southern Italy, Greece and Albania.

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