

Praerhapydionina murgiana Crescenti, 1964: emendation and transfer to the genus *Pseudorhipidionina* De Castro, 1972 (Foraminifera, Upper Cenomanian, Italy)

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KEY WORDS - *Foraminifera*, *Pseudorhipidionina murgiana*, *Neotype*, *Pseudorhipidionina casertana*.

ABSTRACT - *Praerhapydionina murgiana* Crescenti, 1964, and *Rhipidionina casertana* De Castro, 1965, later designated as type species of *Pseudorhipidionina* De Castro, 1972, were erected for vertical partition-bearing peneropline foraminifera of upper Cenomanian carbonate-platform facies of Southern Italy (Bari Murge and western Campania respectively). According to the original diagnosis *Praerhapydionina murgiana* differs from *Pseudorhipidionina casertana* mainly in having a single aperture (distinctive of *Praerhapydionina*) instead of a multiple one (distinctive of *Pseudorhipidionina*). Most papers on Mediterranean Cenomanian (Portugal versus the Balkans, through North Africa and neighbouring East) usually report *Pseudorhipidionina casertana* while they mention neither *Praerhapydionina murgiana* nor *Pseudorhipidionina murgiana*.

In the early eighties, taking into consideration the poor quality of the *Praerhapydionina murgiana* original pictures, the writer pointed out that *Praerhapydionina murgiana* Crescenti (transferring however to *Pseudorhipidionina*) may be a senior valid synonym of *Pseudorhipidionina casertana*. A few years ago, a study on the type-locality material was carried out, and the present paper documents, among other things, that the aperture of this species is not simple, as reported in its diagnosis, but multiple; accordingly, it is transferred from *Praerhapydionina* to *Pseudorhipidionina*. An emended diagnosis is proposed for *Pseudorhipidionina murgiana* (Crescenti, 1964) and its neotype is established because the searches for the original type material have proved unsuccessful.

With the reservations due to the scarce measurements of some characters of the topotypes of both species, it seems that *Pseudorhipidionina murgiana* (Crescenti, 1964) differs from *P. casertana* in its usually slightly smaller proloculus while other features are often more developed.

RIASSUNTO - [*Praerhapydionina murgiana* Crescenti, 1964: emendamento e trasferimento al genere *Pseudorhipidionina* De Castro, 1972 (Foraminifera, Cenomaniano superiore, Italia)] - *Praerhapydionina murgiana* Crescenti, 1964 e *Rhipidionina casertana* De Castro, 1965, successivamente designata come specie tipo del genere *Pseudorhipidionina* De Castro, 1972, furono istituite per indicare Foraminiferi peneropliformi, provvisti di lame verticali, caratteristici delle facies di piattaforma carbonatica del Cenomaniano superiore, rispettivamente delle Murge baresi e della Campania occidentale (Italia meridionale). Secondo le diagnosi originarie *Praerhapydionina murgiana* differirebbe da *Pseudorhipidionina casertana* principalmente per avere un'apertura singola (caratteristica di *Praerhapydionina*) anziché multipla (caratteristica di *Pseudorhipidionina*).

Nei primissimi anni dopo l'istituzione delle due specie, alcuni lavori segnarono *Praerhapydionina murgiana* assieme a *Rhipidionina casertana* (attribuzione generica iniziale di questa specie) ritenendole, quindi, due specie distinte di generi differenti. *Praerhapydionina murgiana* fu segnalata, anche singolarmente, in qualche lavoro a carattere regionale. Nei primi anni '70, comparvero alcune segnalazioni, pur esse concomitanti, di "Pseudorhipidionina murgiana" e di *Pseudorhipidionina casertana*; queste indicazioni fanno ritenere che non si escludesse che i due taxa fossero due specie distinte del genere *Pseudorhipidionina*. Nel 1980 e 1981, lo scrivente prospettò che *Praerhapydionina murgiana* (da trasferire, però al genere *Pseudorhipidionina*) potesse essere un sinonimo valido per motivi di priorità di *Pseudorhipidionina casertana*; la questione si sarebbe potuta chiarire in base all'esame del materiale tipo di *Praerhapydionina murgiana*. Successivamente, in base alle riserve da me espresse, alcuni lavori sull'Appennino Centrale hanno attribuito *Praerhapydionina murgiana* Crescenti al genere *Pseudorhipidionina*. La massima parte dei lavori sul Cenomaniano dell'area mediterranea, dal Portogallo ai Balcani, inclusi alcuni paesi del Nord-Africa e del Vicino Oriente, hanno segnalato, però, abitualmente *Pseudorhipidionina casertana* e non *Pseudorhipidionina murgiana* né *Praerhapydionina murgiana*.

In questa sede, tenendo conto della qualità poco buona delle figure originali di *Praerhapydionina murgiana* e delle sue relazioni poco chiare con *Pseudorhipidionina casertana*, sono forniti i risultati di uno studio della specie delle Murge basato su materiale della località tipo. Questo materiale è in condizioni di fossilizzazione molto mediocri (gusci rotti, abrasi e più o meno micritizzati; aperture molto spesso riassorbite ed apparentemente uniche) e può indurre perciò, facilmente, a interpretazioni imprecise. Questo lavoro documenta, tra l'altro, che l'apertura di *Praerhapydionina murgiana* non è unica ma multipla; conseguentemente, la specie è trasferita motivatamente dal genere *Praerhapydionina* a *Pseudorhipidionina*; la sua diagnosi viene emendata e, poiché sono risultate infruttuose le ricerche del materiale tipo originale, è designato il suo neotipo.

Con le riserve imposte dallo scarso numero di misure che si sono potute eseguire sui topotipi dei due taxa, *P. murgiana* sembra differire da *P. casertana* per avere un proloculo generalmente un po' più piccolo, mentre altri parametri sono generalmente più sviluppati: in particolare le dimensioni del guscio, la lunghezza e la larghezza delle logge e lo spessore dei setti. La possibile diversità tassonomica delle due specie potrebbe essere avvalorata dalla loro appartenenza a due differenti domini geografici: la Piattaforma Apula per *P. murgiana*, la Piattaforma Abruzzese-Campana per *P. casertana*.

INTRODUCTION

Praerhapydionina murgiana Crescenti, 1964, and *Pseudorhipidionina casertana* (De Castro, 1965) are peneropline Foraminiferida of the upper Cenomanian (-lower Turonian?) carbonate-platform facies of the Mediterranean Tethys (Mediterranean Seuil by Vrielynck & Dercourt, 1995) (Fig. 1). Both of them are usually recorded in the *Cisalveolina fraasi* level.

According to original diagnoses, *Praerhapydionina murgiana* differs from *Pseudorhipidionina casertana* mainly in having a single rather than a multiple aperture.

The gross morphology and exoskeletal-structure similarity of these two species and, on the other hand, the poor original pictures and inexact diagnosis of *Praerhapydionina murgiana*; moreover the finding by some authors of both *Praerhapydionina murgiana* and *Pseudorhipidionina casertana* at the same time, may give rise to an imprecise opinion about these species. It is not even to underestimate that these two taxa were established in a comparatively short time span (1964-1965) and when knowledge about the Cenomanian platform-microfossils was scarce. The situations concerning the foregoing, briefly follow.

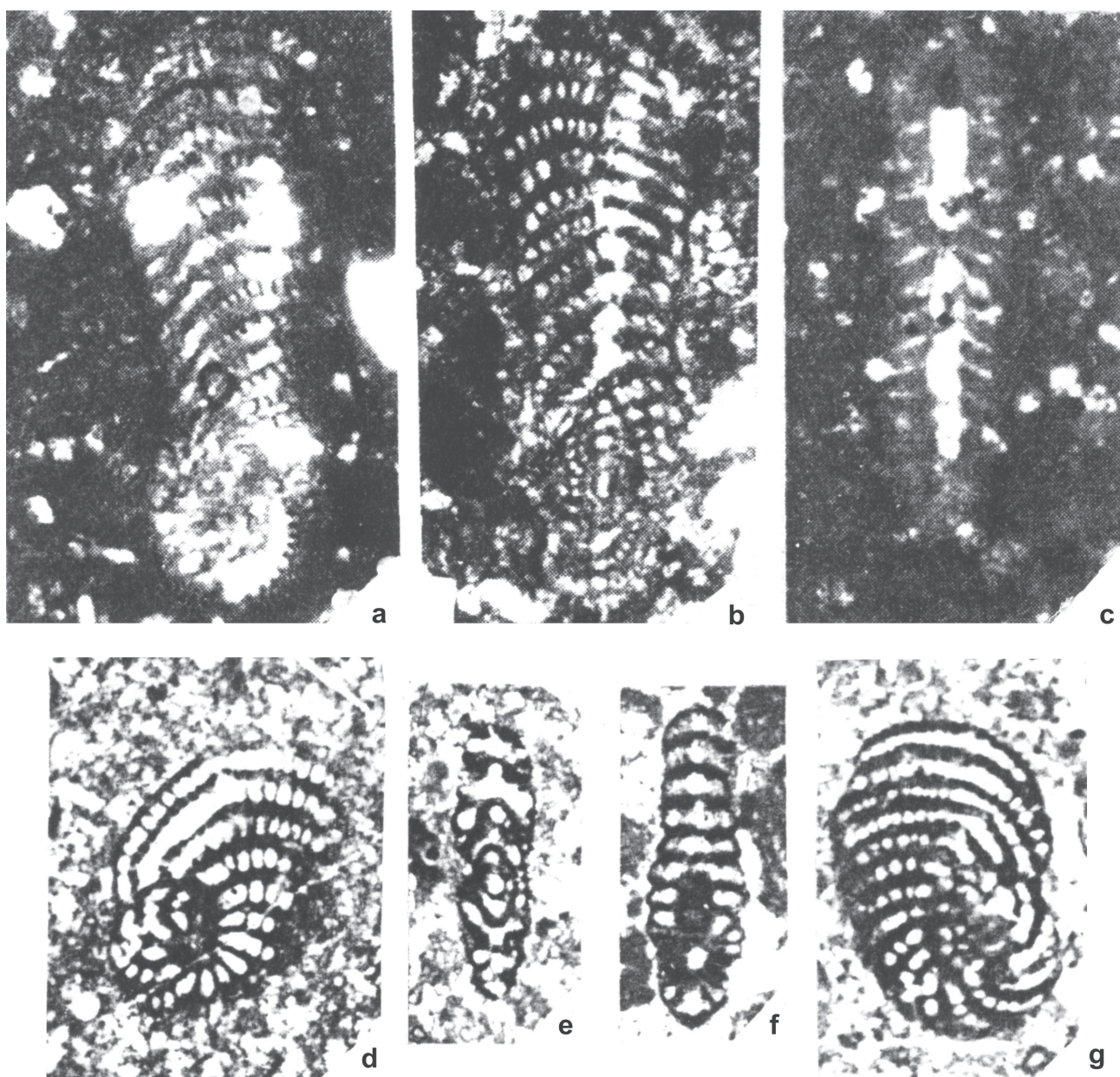


Fig. 1 - a-c) original pictures of *Praerhapydionina murgiana* Crescenti, 1964. The sections a and c are very poorly preserved. a) holotype: longitudinal oblique section; b) paratype: longitudinal, centered (?), oblique section, cutting obliquely the poorly preserved aperture of the adult chambers; c) paratype: longitudinal paraxial section mainly perpendicular to the septa; d-g) original pictures of *Rhipidionina casertana* De Castro, 1965; d) and g) holotype and paratype respectively: uncentered slightly-oblique subequatorial sections showing the multiple aperture in some adult chambers; e) paratype: axial section; f) paratype: tangential section; a-c) Bari Murge; d-g) Caserta Mounts; upper Cenomanian; about 66 x. The present figures are reproductions of the original ones except for magnifications and numberings.

In 1964 Crescenti ascribed to *Praerhapydionina murgiana*, a new species of *Praerhapydionina* Van Wessem, 1943, some porcelaneous foraminifers, found in thin sections only, coming from the upper Cenomanian-lower Turonian of Southern Italy (Bari Murge); the accompanying illustrations were not clear. According to the same author, the new species was characterized by a flattened, planispiral (about two whorls) test with an uncoiled uniserial stage tending to be flabelliform in shape; chambers numerous (14-16 in number in the uniserial stage) supplied with numerous vertical partitions alternating or, seldom in continuous arrangement between adjacent chambers, sometimes occurring at chamber roof only; aperture simple, terminal, central, large, nearly oval.

Crescenti nevertheless, probably because of the poor fossilization, expressed some reservations on the features observed: particularly on the “embryonic apparatus (flexostyle?)”, the aperture type and the morphologic dimorphism; on this subject, he believed it likely that all the observed specimens could be microspheric forms. Moreover, since *Praerhapydionina* included, according to Van Wessem’s diagnosis, forms with uncoiled only-cylindrical stage, he emended the genus and referred to it the specimens with uncoiled stage flattened to flabelliform, too.

In 1965, the present author established from the Cenomanian *Cisalveolina fraasi* level of the Caserta Mounts *Rhipidionina casertana*, later designated as type species of *Pseudorhipidionina* De Castro, 1972.

In the early years immediately after their establishment, some works reported *Praerhapydionina murgiana* together with *Rhipidionina casertana* believing them, therefore, different species of different genera (Crescenti, 1966; Colalongo, 1967). In some regional papers (Luperto Sinni, 1966; Radoičić & Pejović, 1969) only *Praerhapydionina murgiana* was recorded.

In the early 1970s some occurrences of “*?Pseudorhipidionina murgiana*” were reported together with *Pseudorhipidionina casertana* (Radoičić, 1972 a, b); however, this did not exclude the fact that both taxa could be two different species of *Pseudorhipidionina*. According to these papers, *P. casertana* seemed to have a stratigraphical distribution more extended upward.

In 1980 and 1981, the present writer (see De Castro, 1985 and 1983 respectively) expressed the hypothesis that *Praerhapydionina murgiana* (transferred however to *Pseudorhipidionina*) might be a valid synonym of *Pseudorhipidionina casertana* according to the priority principle; the question could be clarified by the study of new topotypic material, the original one having been lost. On the basis of the aforesaid hypothesis alone, Chiocchini et al. (1984, footnote on p. 169), in a monograph on the Central Apennines, referred the Crescenti’s species to *Pseudorhipidionina*. This taxonomic identification has been maintained in later papers (e.g. Chiocchini et al., 1994).

Excluding the above-mentioned *P. murgiana* occurrences, most works on the Cenomanian of the Mediterranean area (Portugal to the Balkans, through

North Africa and Near East) usually report *P. casertana* while they mention neither *Praerhapydionina murgiana* nor *Pseudorhipidionina murgiana*.

I refer, for instance, to Bauer & Polsak (1979, Istria), Berthou (1984, Portugal), Bismuth & Mahjoub (1981, Tunisia), Cherchi & Schroeder (1985, Sardinia), Cherchi et al. (1976, Serbia-M. Pastrik), Chiocchini & Mancinelli (1977, Italy-Latium), Crosaz-Galletti (1979, Portugal), Decrouez (1978, Greece), Fleury (1980, Greece), Kuss & Malchus (1989, Egypt), Mavrikas (1993, Greece), Polsak et al. (1982, Outer Dinarids), Radoičić (1974, Kosovo; 1994a, b, Pastrik and Kosovo; 1995, Serbia-Zlatibor), Saint-Marc (1978, Lebanon), Vila (1980, Algeria).

Occasionally, both *P. murgiana* (Radoičić, 1972c) and *P. casertana* (Chiocchini et al., 1976; Chiocchini & Mancinelli, 1977) have been referred (oversight?, intention?) to *Pseudorhapydionina*, a genus characterized, other features being equal, by an uncoiled cylindrical stage. If this taxonomic indications were deliberate a problem of a certain importance would arise, involving other genera, too, distinguished on the ground of the uncoiled-stage shape only, cylindrical or flattened, e.g. *Peneroplis-Spirolina*.

The present paper is a contribution to a better knowledge of the above-mentioned species on the ground of topotypes examination.

MORPHOLOGICAL TERMINOLOGY AND MEASUREMENTS

In the coiled-specimen sections, the terms axial, equatorial, transversal and tangential without other indication are referred as a rule to the coiling axis. The adjective tangential is used in the present paper for the sections parallel or oblique to the coiling axis which cut one test-coil at least and are characterized outside and/or inside by closed lines, circular to elliptical or alike. The sections parallel to the coiling axis but not tangential as mentioned above (e.g. sections in adult uncoiled chambers) are named paraxial; these sections cut the test in many ways so that in some cases their prevailing direction (parallel, perpendicular) with respect to the septa is indicated. Longitudinal sections are of various types (axial, paraxial, etc) cutting numerous adult chambers mainly along their length. The sections pertaining with certainty to the uncoiled stage are indicated explicitly as belonging to it; in these cases the attributes, transverse, oblique and so on, are referred to its axis instead of the coiling axis.

Adult chambers - In a peneropline test the equatorial sections only (fairly rare in random thin rock-section) allow us distinguish with certainty the coiled chambers from the uncoiled ones. Moreover some important features are measurable more easily in the larger parts of the test. The measurements have been carried out therefore, except where otherwise indicated, in adult chambers irrespective of whether they belong to the coiled stage or to the uncoiled one.

In equatorial sections of the peneropline tests, adult chambers are regarded the ones, coiled or uncoiled,

having the outer margin along an almost-straight line. In the longitudinal sections, crossing numerous chambers and bounded at the lower end by the test margin and at the upper one by the aperture, adult chambers are regarded as those, uniseriate in appearance, having height, paraxial and apertural breadth little different from those of the last chamber.

Chamber length (eL) has been measured in equatorial or subequatorial sections between the centers of adjacent septa. Nevertheless, because of the scarcity of these sections, the longitudinal ones perpendicular to the septa have been utilized, too. The equatorial breadth (eB) has been measured in the median plane of the test and, particularly in the coiled chambers, between the median points of the roof and the floor. The breadth perpendicular to median plane, i.e. parallel to the coiling axis, is named *paraxial breadth* (pB).

Subepidermal vertical partitions and chamberlets - It is intended here as thickness of a vertical subepidermal partition (from now on, in short: partition), the smallest one occurring in its middle length (parallel to the chamber length) about, and as by chamberlet-breadth the greatest one occurring near the test-wall. The number of partitions per mm has been measured along segments, perpendicular to the partitions themselves, passing through the breadth of the interposed chamberlets; this measurement includes the chamberlet preceding or following the row of partitions.

Measurements - Measurements are in micrometers (μm) until further notice. Statistical values, if given, are: minimum, *average* (in italics), maximum and, in brackets, standard deviation (std) and measurements number (no.). If this order has not been respected, the lowest and greatest values only are supplied and eventually the most frequent ones (in italics), too.

Pseudorhipidionina murgiana (Crescenti, 1964)
emend.

1964 *Praerhapydionina murgiana* n. sp. CRESCENTI, pp. 4-5, Pl.1, figs. 1-4, 7-8.

Neotype - The original pictures (photos from rock thin sections) of *Praerhapydionina murgiana* given by Crescenti (1964) are reproduced in the present Fig. 1 (A1: holotype; A2 and A3: paratypes). The thin sections labeled SF 217 containing the holotype and paratypes of this species and the rock sample no. 9058 from which they were prepared, were deposited in the Istituto di Geologia e Paleontologia (today Dipartimento di Scienze della Terra e Geologico Ambientali) of the Bologna University. In 1980, I tried to examine this material and asked for information to Prof. Samuele Sartoni and Prof. Uberto Crescenti. These colleagues answered that, in spite of their search, it was not possible to find that material (cf. De Castro, 1983). Very recently (2005, October) in order to leave no stone unturned for examining the type-material, I have again asked for information the Museo di Paleontologia e Geologia of the Bologna University. This Museum completed its reorganization some years ago and is the depositary of the Crescenti thin-section collection. However, the searches carried out by Carlo Sarti, curator of the Museum, proved unsuccessful.

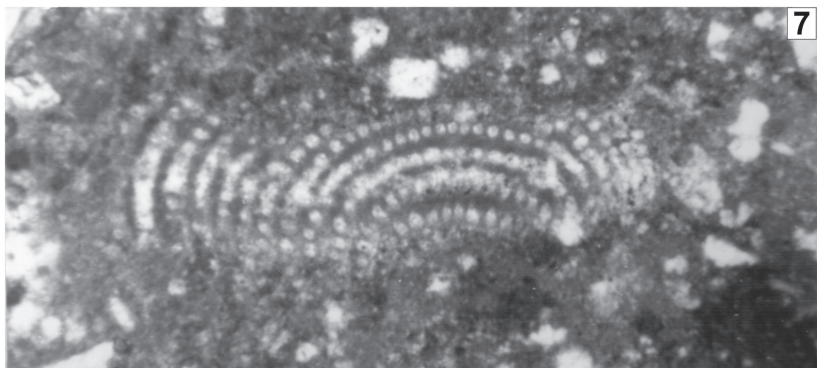
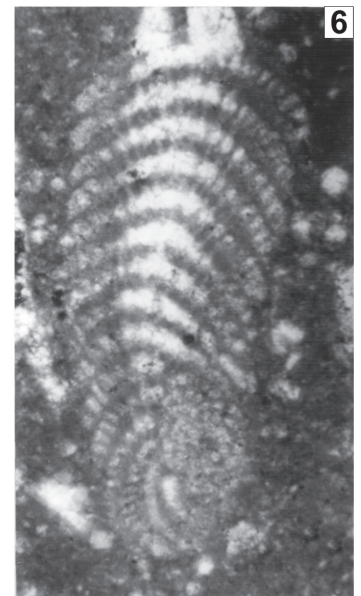
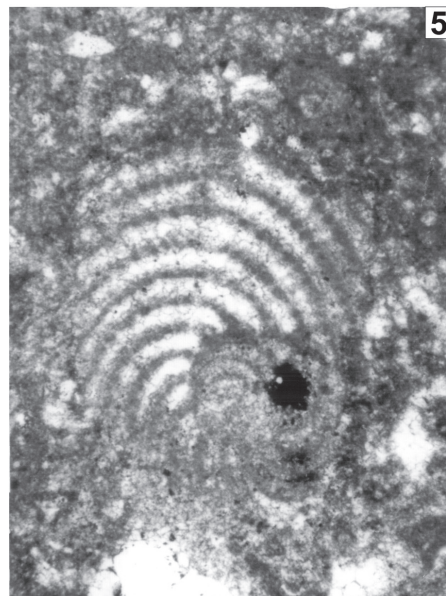
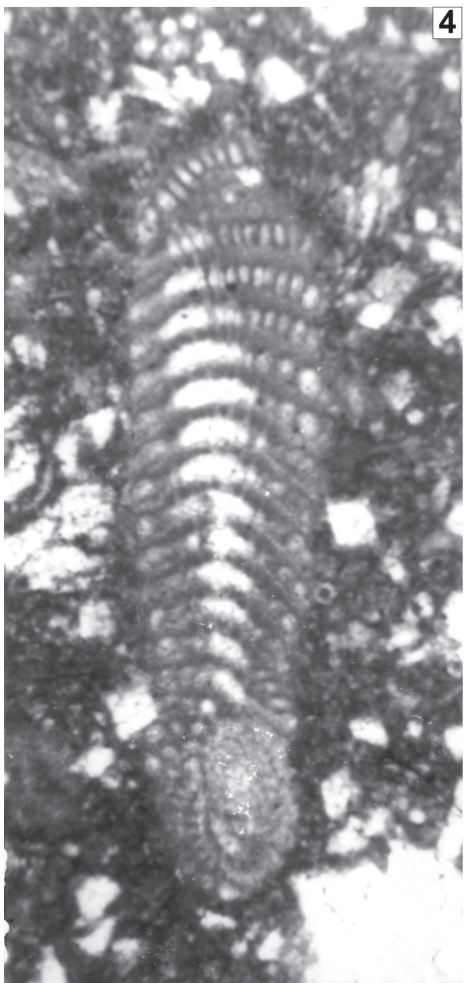
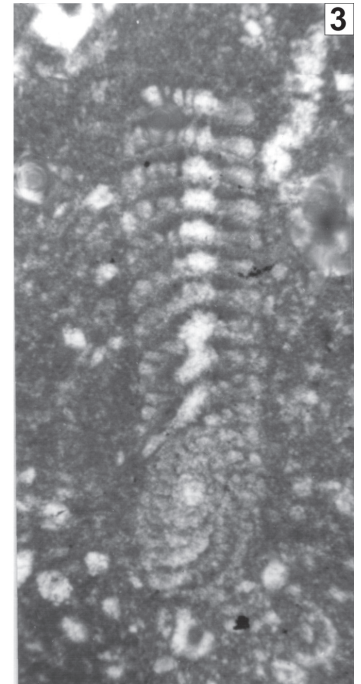
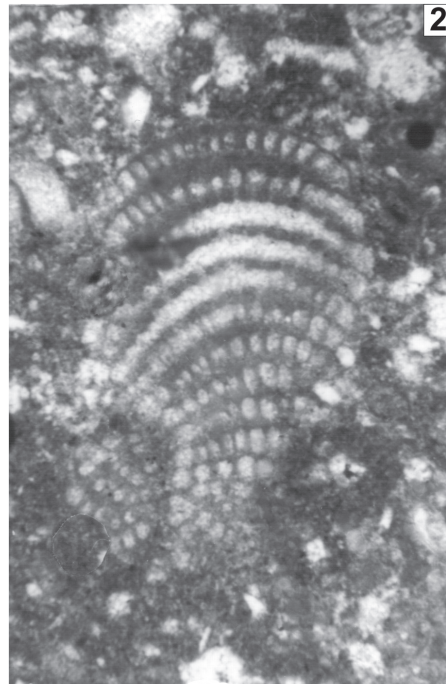
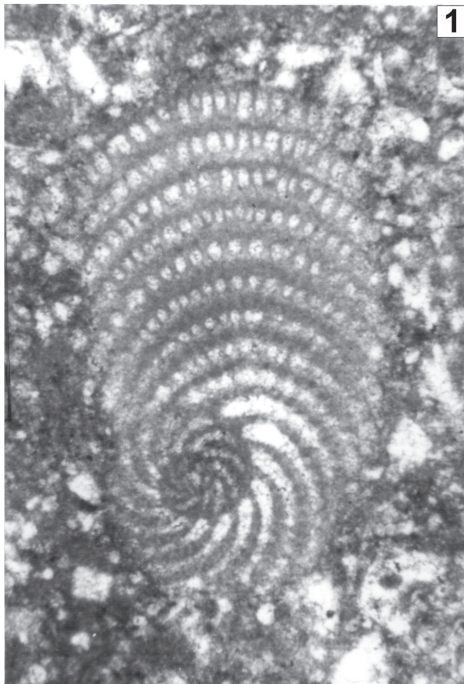
From the foregoing, and moreover in consideration of the poor quality of the *P. murgiana* original pictures as well as the unclear relation between this species and *P. casertana*, I designate as neotype the specimen, coming from the type locality, figured in Pl. 1, fig. 1 of the present paper (thin section A9142.18; De Castro collection).

Type locality - The *Pseudorhipidionina murgiana* type-locality is in the northern Murge (Apulia, Southern Italy), about 18 km south of Bari (I.G.M. topographical map 1:25,000 -189 I NO Sannicandro di Bari), in the locality named Parco Peragine. It is bounded to the east by the road to Aquaviva delle Fonti and to the west by the Via vecchia di Cassano. The zone is a flat

EXPLANATION OF PLATE 1

Pseudorhipidionina murgiana (Crescenti). All specimens are topotypes. All x 60.

- fig. 1 - Neotype. Equatorial section of the coiled stage passing near the test wall of the uncoiled stage (4-5 chambers) so that the openings are not visible and the septum is thin. Thin section A9142.18.
- fig. 2 - Transverse slightly-oblique section showing apertural openings from antepenultimate to fifth from the end adult-chambers. The middle part of the penultimate chamber shows the great septum thickness. Thin section A9142.3.
- fig. 3 - Longitudinal section mainly perpendicular to septa of adult chambers, showing their apertures. Thin section A9138.15.
- fig. 4 - Longitudinal section oblique to septa of adult chambers, showing their apertures. The penultimate chamber is anomalous and, lessening progressively, ends at the central-part of the test. Thin section A9138.7.
- fig. 5 - Equatorial section showing apertural openings. The initial coiling is secondarily obliterated. The last two adult chambers are uncoiled. Thin section A9142.25.
- fig. 6 - Longitudinal section oblique to septa of adult chambers, showing their apertures. Note the septa-thickness besides the apertural area. Thin section A9138.12.
- fig. 7 - Oblique section, mainly parallel to the septa. Thin section A9138.3.



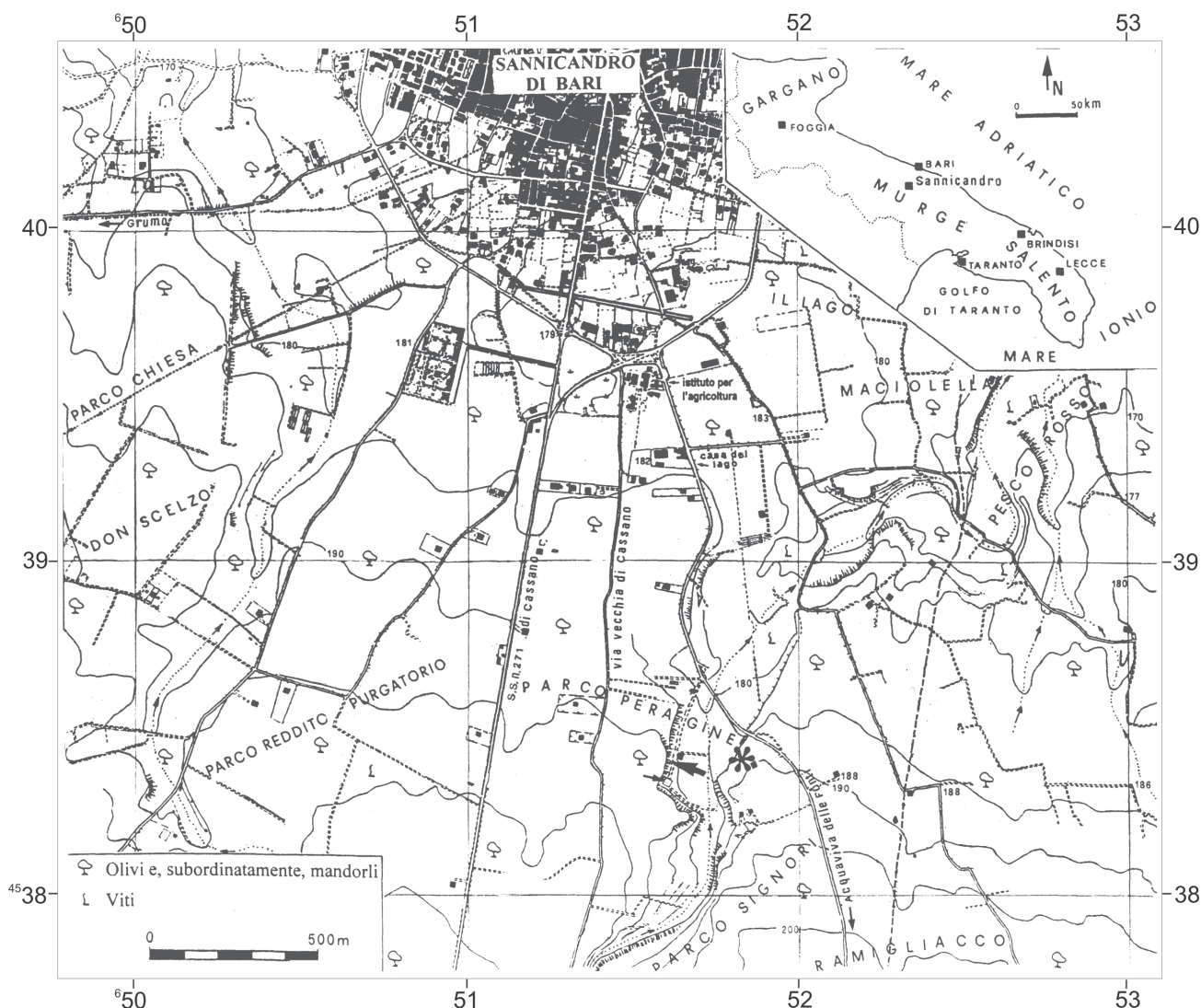


Fig. 2 - *Pseudorhipidionina murgiana* (Crescenti). The type-locality lies in the northern part of the Murge plateau (Apulia, Southern Italy), about 18 km south of Bari, at Parco-Peragine country. In the middle-lower part of the picture, the smaller arrow shows the "vascone" (refer to the text); the larger one agrees with good approximation to the position reported by Crescenti (1964). The asterisk marks another site of the type-locality, not far from the former, at Parco Peragine eastern side, where the fossil preservation is little better. The specimens studied in the present paper come mainly from the latter place.

area, 180-195 m a.s.l., slightly lowering north-eastward, and crossed axially by a slight depression northward-directed.

The type-locality is situated in the relatively small area of the Parco Peragine. The position reported by Crescenti lies at its western-side, at the foot of a steep slope a few meters high, occupied by bush and olives, about 15 metres north of a large reservoir (called "vascone"). The U.T.M. coordinates reported by Crescenti are 33TXF 516384 (= 33T 06516 E, 45384 N). This place is reached through the NE-SW pathway that branches off from the bridge (182 m a.s.l.) on the road to Acquaviva delle Fonti (Fig. 2). The *Pseudorhipidionina murgiana* and *Cisalveolina fraasi* beds outcrop more extensively, less dolomitized and

richer in microfossils at the eastern side of Parco Peragine, beyond its longitudinal depression, at about 200 m from the "vascone", along a footpath half way up the hill (P in Pl. 5, fig. 5) as well as some ten metres from the north-western corner of an extensive boundary wall. The studied samples (A9138 and A9142) come from the latter place; their UTM position is 33TXF 5179038433 (= 33T 0651790 E, 4538433 N).

Type level - According to Crescenti (1964), *Pseudorhipidionina murgiana* occurs in carbonate-platform facies (Crescenti & Vighi, 1964) referred to the uppermost part (uppermost Cenomanian) of the *Cuneolina pavonia parva* coenozoone and to the lower part (lower Turonian) of the *Cuneolina pavonia parva*

and *Dicyclina schlumbergeri* coenozone (Sartoni & Crescenti, 1963). The microfossils cited by Crescenti are, besides zonal indexes, *Nezzazata simplex* Omara, *Pseudolituonella reicheli* Marie, *Nummuloculina heimi* Bonet, *Thaumatoporella parvovesiculifera* (Raineri), "rotalines", valvulinids, miliolids, ophthalimidids, and rudist fragments.

On the basis of personal observations, in the type locality as well as in other Apennine zones, *P. murgiana* is associated with *Cisalveolina fraasi* Gümbel (Reichel), a distinctive upper Cenomanian species (De Castro, 1983). In the Murge, the *Cisalveolina* level is about 8 m in thickness; it was labelled at first (Azzaroli & Reichel, 1964; Ricchetti, 1975) as a stratigraphical formation (Calcare di Mola) but afterwards it was referred to the base (Sannicandro Member) of the Calcare di Bari Formation (Ciaranfi et al., 1988, Luperto Sinni et al., 1994).

To the northern side of the "vascone", in particular, carbonates bearing rare *Cisalveolina* outcrop for about three metres in thickness about and dip south-south-eastwards at about 15°. They underlie no more than ten meters of ostreid and radiolitid breccias having millimetric to centimetric cavities often bordered by reddish material; the rock matrix, too, may have more or less reddened zones and is affected randomly by stylolite-type irregular surfaces. It is not excluded that these breccias transgress over the *Cisalveolina* level and are separate from it by a hiatus. Ostreids are in laminar fragments, millimetric to centimetric in size; the prismatic structure often interposed between the fibrose one, allowed us to refer them to *Pycnodonte*. The *Cisalveolina*-*Pseudorhipidionina* level underlying radiolitid breccias outcrops also at the above mentioned footpath half way up the hill.

At Parco Peragine, the *Cisalveolina*/*Pseudorhipidionina* level is made up by strata 20-60 cm in thickness of dolomitic calcarenites, whitish or yellowish, not very hard, bioclastic, very porous, including numerous ruditic grains and sometimes very fine mineral grains (pyrite?). Dolomite occurs in idiomorphic crystals, often in mould condition. Macrofossil fragmentary remains are numerous and pertain mainly to bivalves (mostly *Pycnodonte* and other small more or less thin shells), small gastropods, echinoids (mostly spines); moreover, individual corals less than one cm in transversal diameter, often recrystallized or as moulds. These layers contain numerous tubular cavities too, little less than one centimeter in transversal diameter, irregularly upward directed, referring to burrows. The microfossils, in agreement with field observation, induce us to believe that the *Cisalveolina*/*Pseudorhipidionina* layers agree with turbiditic slope-sediments bearing a certain amount of nepheloid fine-grained material.

The microfossils, also in fragmentary conditions, are (r = rare, f = frequent, n = numerous): halimedeans (n), ataxophragmiids (r), *Praechrysalidina* (r), miliolids (f), *Coxites zubairensis* Smout (r), *Pseudorhapydionina* ? (r), *Pseudorhipidionina murgiana* (Crescenti) (f), *Cisalveolina fraasi* Gümbel (Reichel) (f), *Trocholina* spp. (f), small nodosarids (r), hedbergellids (r).

The fossilization of *Pseudorhipidionina murgiana* in particular is rather poor, therefore some of the

following measurements are scarce in number and may be not precise. The specimens are usually incomplete, usually micritized and lacking wall. Micritization usually destroys the first test-coils and thus prevents observations on the proloculus and nepionic stage. Subordinate recrystallization may concern the outer part of the septum, the postseptal one of the partitions and rounded to irregular small test-spots; it extends seldom over the whole of the septum or to the partitions.

Emended diagnosis - Test free, calcareous, imperforate, porcelaneous. A-form planispiral involute with small umbilici, with or without an uncoiled uniserial stage. Coiled chambers (the very first excepted), peneropline, arched, rapidly increasing in equatorial breadth but slowly in length; equatorial breadth (eB) usually much greater than the paraxial one (pB) and of the length; equatorial margin slightly lobed or smooth; axial section laterally flattened with upper and lower peripheral parts subacute or tightly-rounded. Only coiled adult specimens flabelliform.

Uncoiled stage more or less flattened; sections of certainly cylindrical uncoiled stages have not been observed so far. Sutures slightly depressed or often flush with the surface in a same specimen too. Aperture multiple. Vertical subepidermal partitions, alternating or in continuity, extending from septum to septum, subdivide the chamber marginal-zone.

Very weak ribs perpendicular to sutures, occurring in *Pseudorhipidionina* (see De Castro, 1965) have not been observed probably because of both the poor

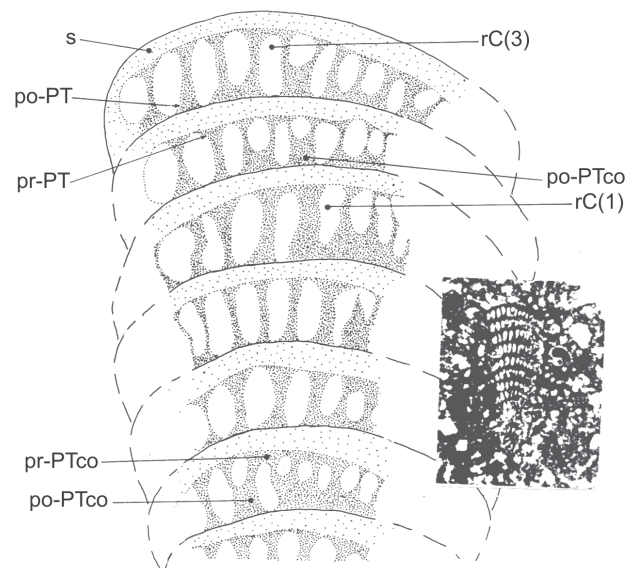


Fig. 3 - *Pseudorhipidionina murgiana* (Crescenti). Drawing of the last six uncoiled chambers of a specimen in submedian slightly-oblique section. The discontinuous chamber-boundaries overlain marginal zones left out because of bad preservation. po-PT: postseptal partition-thickening; po-PTco: postseptal partition-thickening confluence; pr-PT: preseptal partition-thickening; pr-PTco: preseptal partition-thickening confluence; rC(1) and rC(3): reduced chamberlet-lumen due to po-PTco and pr-PTco respectively; s: septum. The drawing comes from the adjacent photo (thin section A9138.2; x 30). Drawing: about x 110.

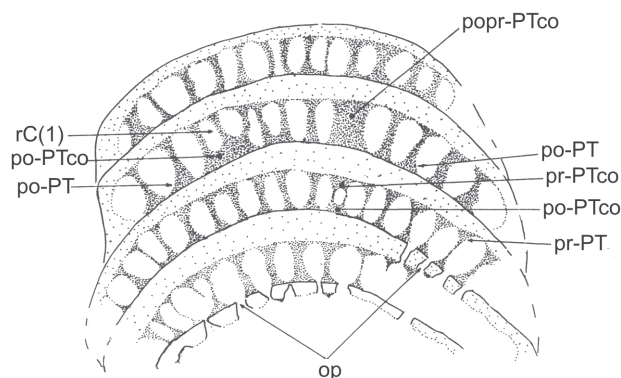


Fig. 4 - *Pseudorhipidionina murgiana* (Crescenti). Drawing of the last four uncoiled chambers of a specimen with uncoiled stage in submedian slightly-oblique section. The discontinuous chamber-boundaries overlain side-zones left out because of bad preservation. op: opening; po-PT: postseptal partition-thickening; po-PTco: postseptal partition-thickening confluence; pr-PT: preseptal partition-thickening; popr-PTco: postseptal to preseptal partition-thickening confluence; pr-PTco: preseptal partition-thickening confluence; rC(1): reduced chamberlet-lumen due to po-PTco. The drawing comes from the specimen figured in Pl. 2, fig. 4; about x 84

fossilization and abrasion. The available specimens do not give information on the difference between the A and B form.

Test diameter (tD) (coiled stage and uncoiled one, if present): 340-1.090-2.080 μm ; (std. 380 μm ; no. 50). The given dimension is based on specimens in equatorial/subequatorial sections and on longitudinal section of various types. Some measurements are surely

lower than the real ones. Coiling axial thickness (caT): 150-180-225 μm (std. 40 μm , no. 3). Test thickness of the adult chambers (paraxial breadth pB): 217-267-325 μm (std. 28 μm ; no. 31). These values do not take into account a marginal paraxial section, believed to be anomalous owing to its greater breadth (374 μm).

Adult chambers (coiled or uncoiled) - Chamber number: 1-7.7-14 (std. 3; no. 50). Chamber number per mm: 10.1-13.3-18.5 (std. 2.2; no. 45). Chamber length (eL): 50-77-108 μm (std. 11 μm ; no. 29). Ratio eB/eL between equatorial breadth and length of the chambers: 6.7-9.7-16.4 (std. 3.6; no. 11).

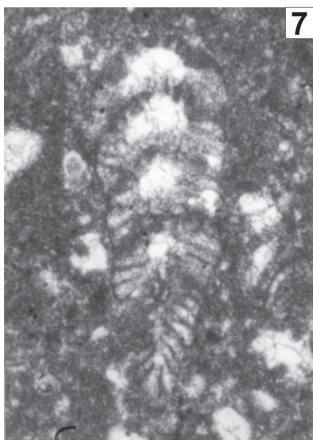
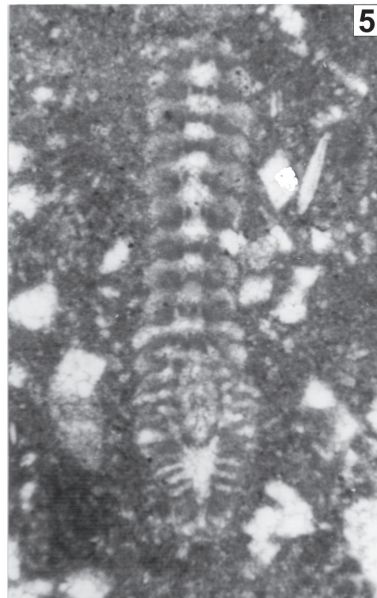
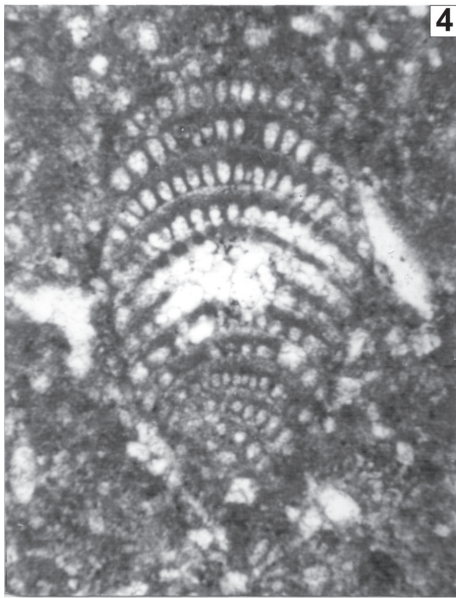
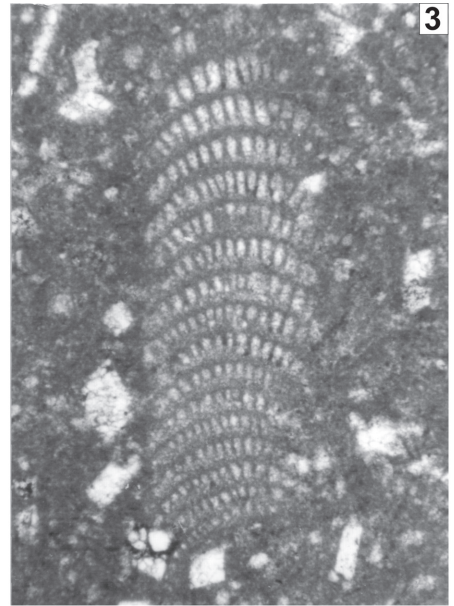
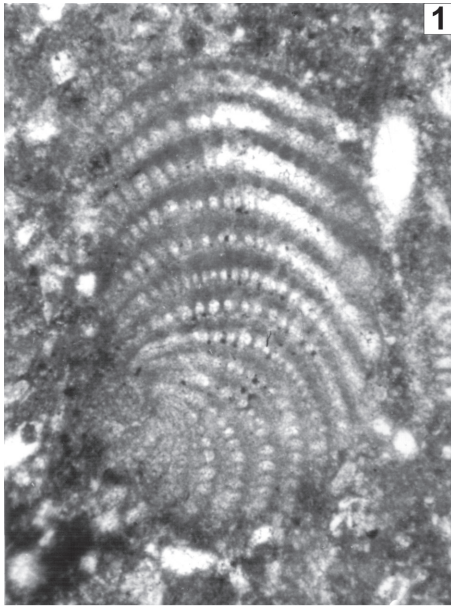
Perpendicularly to the test median plane the apertural face is moderately convex. Axial and paraxial sections crossing the aperture of adult chambers, show the apertural area extending over a small part of the central septum-surface. Accordingly, the chamber-lumen breadth subtended by the apertural area (AVpB) is three to four times smaller than that of the whole chamber-lumen one (CVpB). The test material pertaining to the apertural area grows thinner and thinner towards this plane. The aperture consists of numerous openings, the arrangement of which is conditioned by the apertural-face shape: they are roughly in two or more series in the flattened chambers with large equatorial breadth; they are randomly arranged in a roughly elliptical, more or less elongate area in the less flattened ones. The openings are funnel-shaped with the larger side inward. An opening little larger than the others and slightly prominent may occur near the chamber axis. The openings breadth in their narrower (outer) part is about: 6-14-21 μm (std. 3 μm ; no. 28).

The test wall thickness (wT) near the half chamber-length is 5-8-15 μm (std. 2 μm ; no. 32). It increases slightly towards the sutures of both the adjoining

EXPLANATION OF PLATE 2

Pseudorhipidionina murgiana (Crescenti). All specimens are topotypes. All x 60.

- fig. 1 - Transverse slightly-oblique section showing the apertural openings of the adult chambers. Note the strong septa-thickness besides the apertural area on the middle left side of the photo. Thin section A9142.10.
- fig. 2 - Longitudinal section mainly parallel to the septa of the adult chambers, showing the irregular partitions-distribution: mainly alternating but in continuity, too. Thin section A9138.39.
- fig. 3 - Submedian section near to the test wall of a specimen with a long and narrow uncoiled stage. Note the irregular partitions-distribution (alternating but in continuity, too), the postseptal inter partition thickenings of the fifth from the end chamber (central part) and the bifurcation of some partitions (penultimate and fourth from the end chambers). Thin section A9138.21.
- fig. 4 - Oblique submedian section showing, in the middle upper part, apertural openings, the septum thickness and the irregular partition-distribution (mainly in continuity). Note at the penultimate chambers the inter partition thickening confluences: two postseptal confluences (central-left part) and one postseptal to preseptal confluence (central part). Thin section A9142.5.
- fig. 5 - Longitudinal tangential section. Chamber apertures and openings are evident. Note the subacute lower margin. Thin section A9142.10.
- figs. 6-9 - Slightly oblique, longitudinal-paraxial sections. Chamber apertures and openings are evident. Note the subacute lower margin.
 - 6 - Thin section A9138.3.
 - 7 - Thin section A9138.62.
 - 8 - Thin section A9142.27.
 - 9 - Thin section A9142.21.
- fig. 10 - Marginal paraxial section cutting four chambers. In the lowest one the section cuts the apertural area and its openings. In the lower left zone some shorter partitions occur between longer ones. Thin section A9138.6.



Proloculus outer diameter (PrD)	40 - 52 - 67 (std. 8; no.18)		
Proloculus wall thickness	3.3 - 4.4 - 6.6 (std. 1; no. 16)		
Coils number	2 - 2.3 - 2.8 (std. 0.2; no. 17)		
	1st coil	2nd coil	last coil
Coiling diameter (cD)	108 - 146 - 167 (std. 20; no. 14)	325 - 413 - 483 (std. 53; no. 14)	566 - 658 - 766 (std. 70; no. 7)
Pitch	42 - 56 - 71 (std. 10; no. 14)	121 - 165 - 217 (std. 30; no. 10)	112 - 276 - 367 (std. 86; no. 7)
Coiling axial thickness (caT)	100 (no. 2)	192 - 225 (no. 2)	150 - 180 - 225 (std. 40, no. 3)
cD / caT	1.6 - 1.7 (no. 2)	2 - 2.1 (no. 2)	?
Chambers number	5 - 6 - 7 (std. 1; no. 3)	10 - 12 - 14 (std. 2; no.5)	16 - 17 - 19 (std. 1,3; no. 6)
Last chamber length (ICL)	?	?	67 - 72 - 75 (std. 4,4; no. 3)
Last chamber: length/equatorial breadth	?	?	0.12 - 0.13 - 0.14 (std. 0; no. 3)

Tab. 1 - *Pseudorhipidionina murgiana* (Crescenti), type-locality. Measurements of the coiled stage. The fractions of one coil are given in coil-tenths. The last-coil extent, measured backward from the last coiled chamber, may include part of the previous coil measured from the proloculus. The numbers in italics correspond to the more frequent values; statistical values are given as follows: min., avg, max., std, no. Measurements are in micrometers (μm). Because of rather poor fossilization, some of the following measurements are scarce in number and may be not precise.

chambers; at the postseptal site it occurs as a short meniscus that thins quickly inwards.

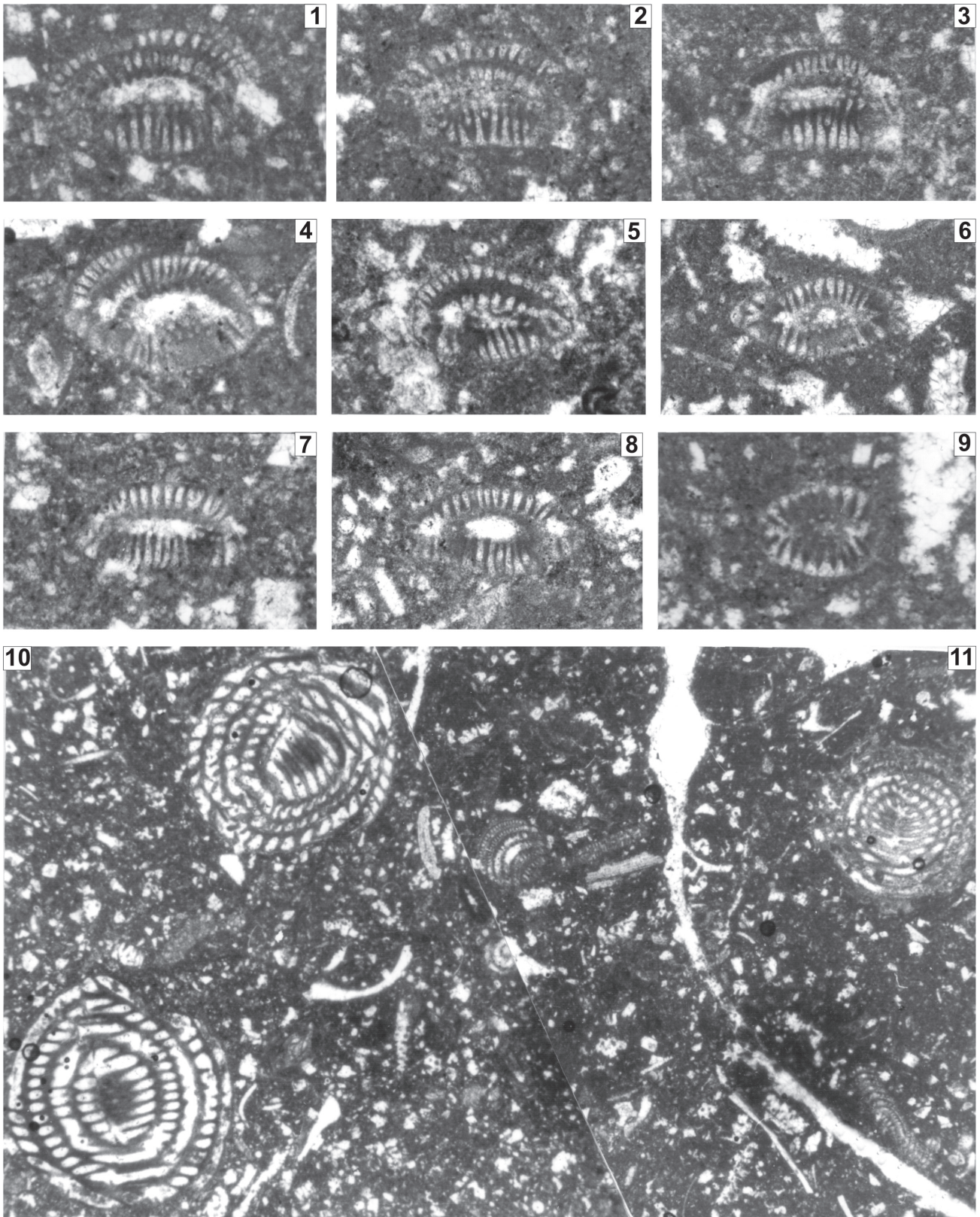
The septa transversal sections are claviform and weakly inclined forward. After a thin initial part, they thicken considerably towards the apertural area and reach the greatest thickness (sT) at apertural boundary; the septum-thickness increase is slightly larger towards the chamber interior instead of the outside. Greatest septum thickness (sT): 21-29-40 μm (std. 4 μm ; no. 21). Ratio eL/sT between chamber length and greatest septum thickness: 1.6-2.6-3.3 (std. 0.4; no. 21).

Proloculus and coiling - The coiled stage is made up by 1.5-2.5 involute coils (usually little more than two) and exceptionally reaches the third coil. It begins with a proloculus of 40-67 μm in outer diameter, followed by a flexostyle, the length of which it has not been possible to ascertain. In the equatorial sections, the early chambers following the proloculus have the length greater than the breadth; afterwards the breadth increases more quickly so that the chambers, at the first-coil end already, show peneropline morphology. The aperture adapts itself to the chamber shape; at first

EXPLANATION OF PLATE 3

Pseudorhipidionina murgiana (Crescenti). All specimens are topotypes. All x 60 except figs. 10-11, x 19.

- fig. 1 - Section transverse-oblique to the test median-plane crossing four chambers pertaining probably to the uncoiled stage. Note in the central part the openings of the older chamber; moreover, in the lower part, a partition-bifurcation. Thin section A9138.22.
- fig. 2 - Section transverse to the test median-plane crossing two uncoiled chambers. In the section lower-part some partitions are very thin proximally and likely continue as far as the openings with their postseptal thickenings. Thin section A9138.6.
- fig. 3 - Section transverse to the test median-plane crossing two uncoiled chambers. The older chamber (central part of the section) shows some openings. Two partition bifurcate transversally (i.e. from the test-wall inward) at their end in the right lower part of the section. Thin section A9138.13.
- fig. 4 - Section transverse-oblique to the test median-plane crossing four uncoiled chambers. Note the apertural openings tangentially cut in the older chamber and obliquely cut in the antepenultimate one. Thin section A9138.6.
- fig. 5 - Section transverse-oblique to the test median-plane crossing three uncoiled chambers. The small breadth of this uncoiled stage is comparable with the specimen in Pl. 2, fig. 3. Thin section A9138.5.
- figs. 6-8 - Transverse section of the uncoiled stage crossing two or three (fig. 6) chambers.
 - 6 - Thin section A9138.6.
 - 7 - Thin section A9138.11.
 - 8 - Thin section A9138.3.
- fig. 9 - Transverse section crossing two chambers of an uncoiled stage; in the older (central) chamber the section tangentially crosses the aperture only. This section is considered anomalous because of its small breadth. Thin section A9138.3.
- figs. 10-11 - Microfacies of the *Pseudorhipidionina murgiana* type-level. This level, pertaining likely to slope deposits, is made up mainly by dolomitic calcarenites 20-60 cm in thickness. Macrofossils are mainly upward directed burrows, fragmentary remains of solitary corals and *Pycnodonte*. Microfossils consist usually of halimedaceans and foraminifers; among the latter, *Pseudorhipidionina murgiana* and *Cisalveolina fraasi* are present in the picture.
 - 10 - thin section A9138.1.
 - 11 - thin section A9138.2.



it lies likely near the apertural-face base; during the course of ontogenesis it extends towards the equatorial margin of the test. In the postnepionic chambers the coil-height and the chamber equatorial-breadth increase quickly whereas the paraxial breadth enlarges slowly. The measurements of the coiled stage, that may be the only one of the test, are summarized in Tab. 1.

Vertical partitions - They reach the subapertural lumen outer-margin and, in alternation with foramina, may extend very little beyond (mainly with their preseptal and postseptal thickenings) but not farther (Pl. 1, fig. 4; Pl. 2, fig.1). The term "septula" chosen by Loeblich & Tappan (1987) for the partitions of this genus itself and *Taberina* has not used in the present paper, because it is more often referred to structures crossing the chamber lumen in a much more extensive way, and more involved in the protoplasmic flow (e.g. alveolinas).

In *P. murgiana*, the partitions are irregularly arranged in adjacent chambers: at some places continuity prevails, at others alternance. Shorter secondary partitions may be inserted locally between those with normal length (Pl. 2, figs. 8, 10; Pl. 4, fig. 8). The partitions occur at least from the first-coil end. Single chambers may be supplied with partitions sometimes more numerous than usual (therefore with smaller chamberlets).

In the adult chambers, the partitions can project so much toward the apertural area as to include the more peripheral openings (Pl. 3, figs. 1-3); this is witnessed, too, by some longitudinal sections, showing partition

underlying the test-material interposed between openings (Pl. 1, fig. 4; Pl. 2, fig. 1).

The partitions are usually straight, seldom twisted in the initial thinner part, with slightly concave inner margin; rarely bifurcate longitudinally upwards (i.e. along the chamber-length direction) (Pl. 2, fig. 3; Pl. 4, fig. 6) or transversally (i.e. from the test-wall inward) (Pl. 3, figs. 1, 3; Pl. 4, figs. 7, 10).

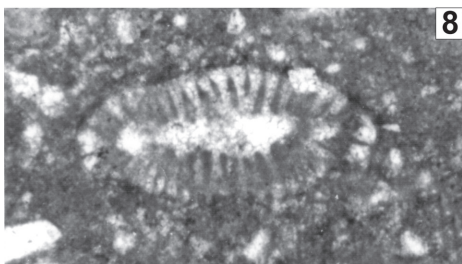
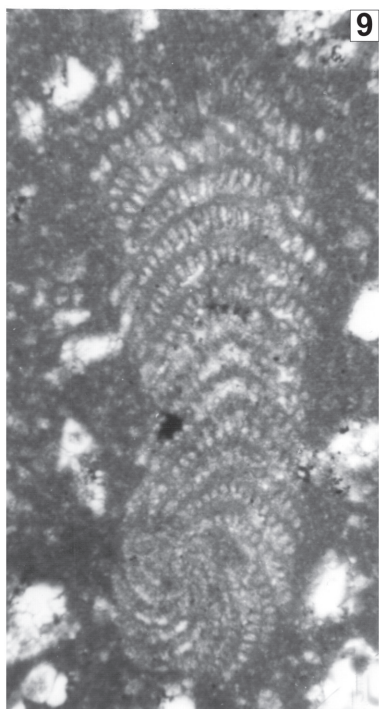
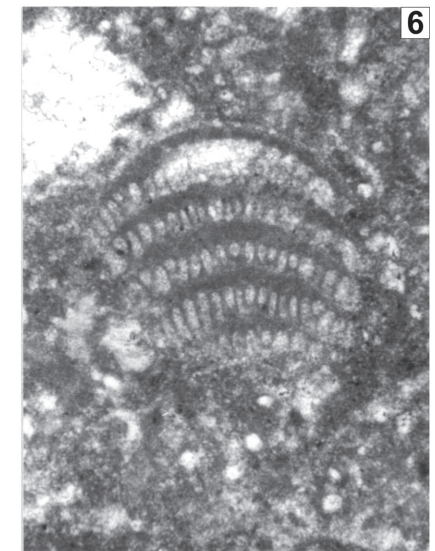
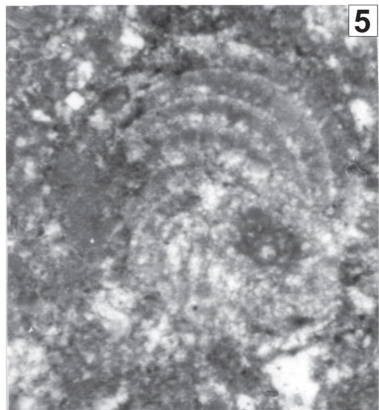
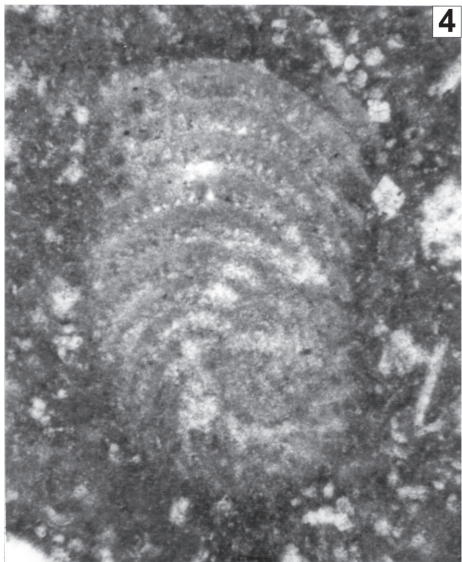
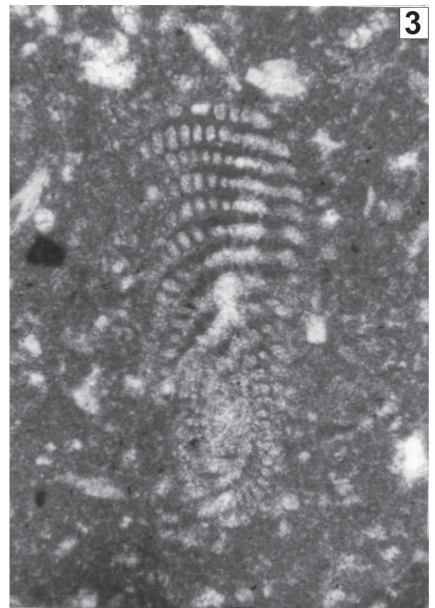
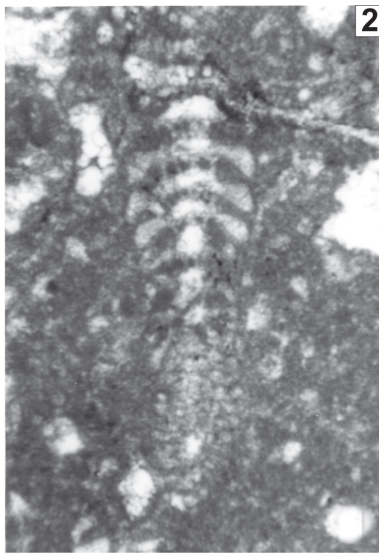
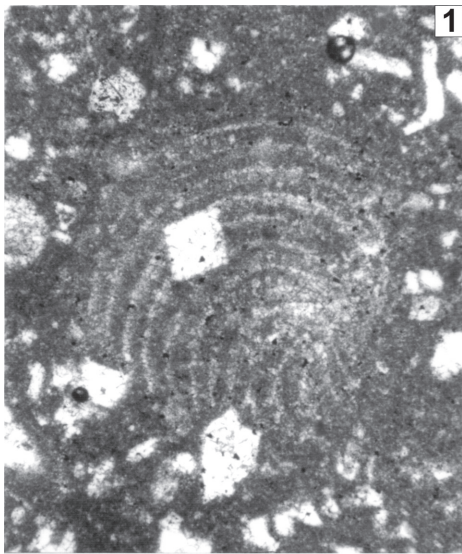
The partitions agree again the test wall with a weak proximal partition thickening; they agree again the contiguous septa, too, but here the thickening (preseptal and postseptal partition-thickenings) is much larger than the proximal one. At the test walls, the postseptal partition-thickening (less often the preseptal one) of two adjacent partitions can join up with one another (partition-thickening confluence), thus narrowing the proximal space of the interposed chamberlet (Figs. 3-4; Pl. 2, fig.4; Pl.4, fig. 6); sometimes the confluence can extend from postseptal to preseptal position (Figs. 3-4; Pl. 2, fig. 4).

Midway along their transversal width, the partitions show a more or less constant thickness or more often thicken gradually until the apertural area (Pl. 3, figs. 1-3, 6-9). It is doubtful, however, how much this centripetal thickening is illusory and can arise from the oblique crossing (i.e. from the middle part of the partition to its basal thickening). Sometimes the partitions begin very thin at test wall (4-8 μm) (secondary phenomenon?), but after a very short tract display their usual thicknesses (Pl. 3, figs. 2-3). The change in apparent thickness due to a change of position and orientation of the partition-section makes it

EXPLANATION OF PLATE 4

Pseudorhipidionina murgiana (Crescenti). All specimens are topotypes. All x 60.

- fig. 1 - Subequatorial sections of a micritized, badly preserved specimen. These cases occur frequently in the type-locality material. Thin section A9138.5.
- fig. 2 - Axial slightly-oblique section. The micritization has obscured the proloculus and the early part of the coiling. Thin section A9138.60.
- fig. 3 - Longitudinal-oblique section. The micritization has obscured the proloculus and the early part of the coiling. Thin section A9138.13.
- fig. 4 - Equatorial sections of a micritized, badly preserved specimen; in the uncoiled stage the section is submedian and does not cross the apertural area. The proloculus is obscured but still recognizable. Thin section A9142.12.
- fig. 5 - Section as in the fig. 4 above. The proloculus is obscured but still recognizable Thin section A9142.30.
- fig. 6 - Section transverse-oblique to the coiling axis. Some partitions bifurcate longitudinally upwards (i.e. along the chamber-length) (left side of the penultimate and antepenultimate chambers). Postseptal interpartition-thickening confluences are present in the central part of the fourth chamber from the end and narrow the proximal space of the interposed chamberlets. Thin section A9142.3.
- fig. 7 - Transverse slightly-oblique section of the uncoiled stage crossing two adult chambers. Thin section A9142.31.
- fig. 8 - Transverse section of the uncoiled stage crossing about three adult chambers. In the central upper part of the section a pair of shorter partitions alternates with longer ones. Thin section A9142.1.
- fig. 9 - Equatorial or subequatorial section with a long uncoiled stage having some anomalous chambers ending at the central-part of the test. Thin section A9138.23.
- fig. 10 - Paraxial section crossing four adult chambers. The section is believed to be anomalous because of its considerable paraxial breadth. Two partitions bifurcate transversally in lower left-side of the section. Thin section A9138.3.



	<i>P. casertana</i> (Caserta Mounts)	<i>P. murgiana</i> (type locality)
Proloculus outer diameter (PrD)	53 - 83 (no. 7)	40 - 52 - 67 (std. 8; no. 18)
Test diameter (tD)	? [500 - 614 - 754 - 950] (no. 21)	340 - 1.090 - 2.080; (std. 380; no. 50)
Coiling axial-thickness (caT)	-	150 - 180 - 225 (std. 40, no. 3)
Paraxial breadth (pB) of adult chamber	142 - 175	217 - 267 - 325 (std. 28; no. 31)
Coils number	2 - 2.5	2 - 2.3 - 2.8 (std. 0,2; no. 17)
Adult chambers per mm	13.3 - 18.8	10.1 - 13.3 - 18.5 (std. 2,2; no. 45)
Adult chambers length (CL)	50 - 66	50 - 77 - 108 (std. 11; no. 29)
Ratio pB/CL:	-	2.8 - 2.8 - 3.8 - 5.8
Whole chamber-lumen breadth (CVpB)	138 - 147 - 158 (std. 9; no. 4)	225 - 276 - 367 (std. 35; no. 13)
Apertural area breadth (AVpB)	29 - 35 - 42 (std. 5; no. 4)	58 - 93 - 133 (std. 25; no. 13)
Greatest septum thickness (sT)	17 - 29	21 - 29 - 40 (std. 4; no. 21)
Test-wall thickness (wT)	6 - 12	5 - 8 - 15 (std. 2; no. 32)
Beams per mm	28.8 - 48	23 - 34 - 48 (std. 4; no. 28)
Beams thickness (bT)	8 - 15	3 - 10 - 23 (std. 3; no. 23)
Chamberlet breadth	-	8 - 24 - 38 (std. 4; no. 25)

Tab. 2 - Comparison between the main biometrical values of the topotypes of *Pseudorhipidionina murgiana* and *Pseudorhipidionina casertana*. In the *P. casertana* column the values are slightly more numerous than in the original diagnosis (1965). The numbers in italics correspond to the more frequent values; statistical values are given as follows: min., avg, max., std, no. Measurements are in micrometers (μ m) with the exception of adult chamber x mm. Because of the rather poor fossilization, some of the following measurements are scarce in number and may be not precise.

problematic to measure its exact conventional value. The above-cited adapertural extension mainly involves the preseptal and postseptal thickenings of the partition. Partition thickness: 3-10-23 μ m (std. 3 μ m; no. 23). Partition number per mm: 23-34-48, (std. 4; no. 28).

In the sections parallel to the test middle plane, the chamberlets of adult chambers are oval or ovaloid, more or less elongate depending on the chamber length. They can become more rounded near the test-surface because of a preseptal/postseptal partition-thickening

confluence. The diminution of the size together with the increase of the roundness, can occur near the apertural area too, because of the greater septum-thickness and the associated lowering of the chamber-lumen. Chamberlet breadth: 8-24-38 μ m (std. 4 μ m; no. 25).

Teratological occurrences - Teratological occurrences are fairly rare; it cannot be certain however whether the observed anomalies correspond to original

EXPLANATION OF PLATE 5

Pseudorhipidionina murgiana (Crescenti). Type-locality.

- fig. 1 - The site of *Pseudorhipidionina murgiana* type-locality reported by Crescenti (1964). A good reference for the site location in the field is the "vascone" (V) (refer to the text). The arrow shows a sampling position. The photo was taken facing southward.
- fig. 2 - Detail of one characteristic bed of the *Pseudorhipidionina murgiana* level in the type-locality site reported by Crescenti (1964). The stratum of dolomitic calcarenite, about 60 cm in thickness, shows numerous tubular burrows. The marks on the hammer are at more or less at 5 cm intervals.
- fig. 3 - A site of *Pseudorhipidionina murgiana* type-locality at about 200 m from the "vascone", at Parco Peragine eastern side; the specimens figured in this paper come from this site. Here the *Cisalveolina* and *Pseudorhipidionina* level, although not well evident in the photo, outcrops more extensively, is less dolomitized and richer in microfossils. A good reference for the site location in the field is the right corner (C) of the boundary wall in the background of the photo. The photo was taken facing southward.
- fig. 4 - Detail of one characteristic bed of the *Pseudorhipidionina murgiana* level in the site of the type-locality at Parco Peragine eastern side, along a footpath half way up the hill (P in fig. 5). This stratum is quite similar to that of fig. 2.
- fig. 5 - Sites of *Pseudorhipidionina murgiana* type-locality at Parco Peragine eastern side. The arrow and the letter P indicate, respectively, the site from which the specimens figured in this paper come and the footpath mentioned in fig. 4. The photo was taken facing eastward.



features or, on the contrary, to modifications acquired secondarily owing to test-parts regeneration or deformation. In the later-parts of the test, chambers can be present that show a more or less normal growth on one side while, lessening progressively, they end at the central-part of the test (Pl. 1, fig. 4; Pl. 4, fig. 9).

Systematics - As far as has been reported, in particular on the multiple aperture and the more or less flattened test, *P. murgiana* is referred to *Pseudorhipidionina* instead to *Praerhapydionina*. The latter, established in the "Campanian-Maastrichtian" of the present-day Ciego de Avila (former Camaguey) province (Cuba), is characterized, on the basis of the Van Wessem's (1943) original diagnosis, by a subconical rectilinear uncoiled stage and a single aperture (refer to Loeblich & Tappan, 1987, too). However, it has been hypothesized also that the aperture may be multiple (Frost & Langenheim, 1974; Pecheux, 1984; Fleury, 1996). On the basis of good photos of specimens coming from the type locality, belonging really to the Oligocene (personal communication and photos of L. Hottinger, 2003), the aperture of *Praerhapydionina cubana* is single and stellate (star-shaped) as in *Praerhapydionina delicata* Henson, 1948 (refer to Hottinger 1963, too); this is clear in transverse or oblique test-sections through the septa; but longitudinal sections crossing the apertural star-arms can simulate a cribrate aperture.

P. murgiana and *P. casertana* have the same age (late Cenomanian) and both are associated with some of the more peculiar microfossils of this stage e.g. *Cisalveolina fraasi* and *Coxites zubairensis*. On the ground of the comparison between their biometrical values, but at same time with the above-reported reservations in view of their scarce number, *P. murgiana* might differ from *P. casertana* in having an usually slightly smaller proloculus while others features are larger, e.g. test-size, length and breadth of the chambers and septum-thickness (Tab. 2). The possible diversity between the two species can be enhanced by their belonging to different paleogeographic platform domains: the Piattaforma Apula (for *P. murgiana*) and the Piattaforma Abruzzese-Campana (for *P. casertana*). In my opinion, the available data do not yet allow to establish their synonymy (though it may not be excluded) as indicated by the expression "*Pseudorhipidionina (ex casertana) murgiana* (Crescenti)" reported in Michaud et al. (1994).

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