

SYSTEMATIC REVISION AND BIOCHRONOLOGY OF SOME BERRIASIAN - VALANGINIAN CALPIONELLIDS (GENUS REMANIELLA)

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Abstract: According to present data the genus *Remaniella* includes five species: *Remaniella cadischiana* (Colom) - here emended, *R. ferasini* (Catalano), *R. filipescai* n. sp., *R. borzai* n. sp. and provisionally so-called "*R. aff. cadischiana*". These species are placed on three phyletic lineages. Two of the above mentioned species are at the origin of other calpionellids with composed collar (genera *Calpionellopsis* and *Praecalpionellites*). In this way the biostratigraphic potential of the studied calpionellids is better known.

Key words: Berriasian, Valanginian, calpionellids, genus *Remaniella*, new taxa, phyletic lineages, biochronology.

Introduction

Tithonian - Valanginian calpionellids represent a small group of planktonic microorganism generally well-known from both the taxonomic and biostratigraphic points of view. However, one of the unsolved problems is the systematics of the genus *Remaniella* Catalano 1965.

For many years a large morphological diversity of the calpionellids grouped in this genus has been noticed. Moreover, some depositional and especially diagenetic effects (mechanical deformations, calcite accretions) have multiplied their morphological aspects.

Before and at the same time as the introduction by Catalano (1965) of the genus *Remaniella*, four more or less related species, assigned (normally) to other genera, were proposed. Subsequently they were included in the above-mentioned genus and in another genus or abandoned. These species are: *Tintinnopsella cadischiana* Colom 1948; *T. ricotensis* Colom 1956; *Calpionellites dadayi* Knauer 1963; and *Calpionellites ferasini* Catalano 1965.

However, the first species distinguished was *Tintinnopsella cadischiana* Colom 1948, previously discovered and illustrated but not named by Cadisch (1932). Two types of forms were included in this species having the same collar (T-shaped); some are large, broadly cylindrical, comparable with those figured by Cadisch (1932), and others much smaller and more bell-shaped. Therefore, Colom (1848) introduced this new species in his new genus *Tintinnopsella* with the type-species *T. carpathica* (Murgeanu & Filipescu 1933).

Another species proposed by Colom (1856) was *Tintinnopsella ricotensis*, very comparable with the cylindrical forms of *T. cadischiana* but with a constricted lorica in its equatorial part. This species has been abandoned by other authors being considered (Remane 1964) a deformed *Tintinnopsella cadischiana* Colom 1948.

Later on, Knauer (1963) introduced his new species *Calpionellites dadayi* including two different groups of forms; some elongated with detached bipartite collar, figured as holotype and

some paratypes, and others bell-shaped with tripartite collar (some paratypes) consisting of two branches separated by a prolongation of the lorica wall. But its distinction from *Tintinnopsella cadischiana* was not discussed.

The last species under discussion named *Calpionellites ferasini* by Catalano (1965) was described as small ovoid forms with a collar formed of a detached triangular-shaped element (in thin section) disposed in the continuation of the lorica.

Remane (1963) had already questioned the assignment of *Tintinnopsella cadischiana* Colom 1948 and *T. ricotensis* Colom 1956 to the genus *Tintinnopsella*. Therefore Catalano (1965) introduced the new genus *Remaniella* with *Tintinnopsella cadischiana* as type-species, including the calpionellids characterized by a detached bipartite collar. Subsequently, *Calpionellites ferasini* Catalano 1965 was also included in the same genus by Catalano & Ligouri (1971) as it appeared that the collar of this species comprises a small outer branch too.

The most controversial species was *Calpionellites dadayi* Knauer 1963. According to Remane (in: Le Hégarat & Remane 1968) the holotype of this species is identical with the large variety of *Remaniella cadischiana* (Colom 1948). Only the forms with tripartite collars are new. Therefore the same author proposed to call these provisionally "*Remaniella dadayi*" in order to designate the transitional forms between the bell-shaped *Remaniella cadischiana* (Colom 1948) and *Calpionellites darderi* (Colom 1934). Afterwards, these forms with tripartite collars were described as *Remaniella "dadayi"* (Knauer) by Catalano & Ligouri (1971), *Calpionellites murgeanui* Pop by Pop (1974b) and *Remaniella murgeanui* (Pop) by Allemann & Remane (1979). Finally, the same forms were included by Pop (1986b) in his new genus *Praecalpionellites* as the type-species named *P. murgeanui* (Pop 1974).

Taking into account the large morphological diversity of the calpionellids grouped in the genus *Remaniella*, especially of *R. cadischiana*, we have tried to retain from *Calpionellites dadayi* Knauer 1963 only the aspect of the bipartite collar (V-shaped) similar to that of its holotype in order to designate *Remaniella dadayi* (Knauer 1963) (Pop 1974a, 1976, 1986a). Unfortunately

much evidence shows that it is not a constant feature and *Remaniella dadayi* in this way admitted cannot be maintained as an independent species.

A new species of *Remaniella* was proposed by Remane (in: Le Hégarat & Remane 1968) under the provisional name "*R. aff. cadischiana*". It includes some small ovoid forms with a very thin inner branch of the bipartite collar.

Finally, before the systematic revision, the genus *Remaniella* includes *R. cadischiana*, *R. ferasini* and "*R. aff. cadischiana*".

A systematic revision and biochronology of the genus *Remaniella* are attempted in the present paper.

Systematic description

Family *Calpionellidae* Bonet 1956
Genus *Remaniella* Catalano 1965

Type-species: *Remaniella cadischiana* (Colom 1948)

Description: Calpionellids displaying three important characters: a - ovoid, bell-shaped, cylindroid or cylindrical more or less elongated loricas; b - collar consisting of two circumoral, normally detached, pieces (rings); c - aboral part ended with a more or less marked caudal appendage. The composed collar is the most significant morphological feature of this genus (Catalano 1965; Catalano & Ligouri 1971). The two rings of the collar generally have a divergent and oblique position in comparison with the oral end of the lorica. In polarized light crossed nicols the undeformed inner ring reveals an extinction at 45° whereas the lorica walls extinguish at 0° and 90°. Particularly in the case of transition specimens to other calpionellids with composed collar, the oral extremity of the lorica sometimes presents a very small hollow in its inner part where the internal ring of the collar was jointed (articulated).

The morphological feature of both the collar and lorica are specific characteristics. According to these characteristics two formerly defined species are here admitted, namely *Remaniella cadischiana* (Colom 1948) - emended and *R. ferasini* (Catalano 1965); two new other species are also proposed, namely *Remaniella filipescui* n. sp. and *R. borzai* n.sp. At present we have no adequate material concerning "*Remaniella aff. cadischiana*" of Remane (Le Hégarat & Remane 1968), a possible new species (Fig. 1). There are also intermediate forms generally difficult to assign to one or other of the mentioned species.

In particular two of the above-mentioned species, namely *Remaniella cadischiana* and *R. filipescui* n. sp., having the same ancestor (*R. ferasini*), are placed on two important phyletic lineages, being at the origin of the genera *Calpionellopsis* and *Calpionellites* respectively.

Occurrence and stratigraphic range: The different species of this genus are encountered in many Tethyan areas, approximately from the middle part of the Early Berriasian or the boundary between the Jacobi and Grandis (ammonite) subzones until the Early Valanginian inclusively. In the calpionellid zonation, this genus ranges from the base of Ferasini Subzone (Calpionella Zone) to Calpionellites Zone (Major Subzone) inclusively (see: Allemann et al. 1971; Pop, in press).

Remaniella cadischiana (Colom 1948) (Fig. 1c; Pl. I, Figs. 1-4)

- 1932 *Calpionella* sp. - Cadisch, p. 250, Pl. 3, Figs. 18, 19.
1948 *Tintinnopsella cadischiana* Colom 1948. - Colom, p. 247, Pl. 33, Fig. 17; Fig. 12/25, 26.
1956 *Tintinnopsella ricotensis* Colom 1956. - Colom, p. 46-47, Pl. III, Fig. 2.
1963 *Calpionellites dadayi* Knauer 1963. - Knauer, Fig. 2/4, 5, 12; Pl. I, Figs. 4, 5, 12.
1965 *Remaniella cadischiana* (Colom 1948). - Catalano, p. 17-18, Pl. I, Figs. 6, 7, 11, 12; Pl. III, Fig. 1.
1974a *Remaniella dadayi* (Knauer 1963). - Pop, Pl. IV, Fig. 10.

Partially emended diagnosis: Cylindrical or cylindroid (only) more or less elongated lorica; collar consisting of two circumoral detached divergent rings, which are unequal to almost equal in length and oblique in comparison with the oral extremity of the lorica; acute aboral part or very often ended with a caudal appendage; in thin section the underformed inner ring shows an extinction between crossed nicols at 45°.

Description: Here emended, this species includes only the specimens showing a cylindrical or broadly cylindrical lorica, which is shorter in its early stages and more elongated in the later ones.

Lorica dimensions (without aboral appendage) are approximately 90 - 150 µm in length and 60 - 80 µm in width. Minimum length/width ratio of the lorica is about 1.5 but its cylindrical form is essential for recognizing this species.

The collar consists of two circumoral normally detached rings, which are frequently divergent and more or less oblique in comparison with the oral extremity of the lorica. In many cases the outer ring is slightly curved and leans on the inner one. Moreover the inner ring is shorter than the outer one and only occasionally

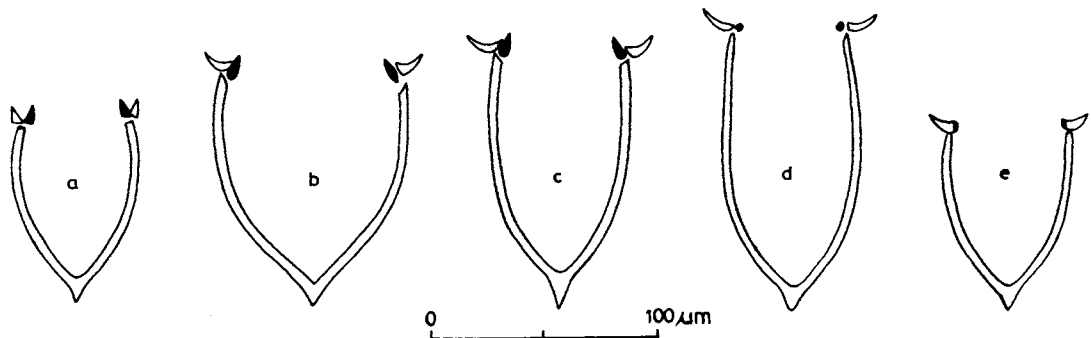


Fig. 1. Schematic presentation of the species included in the genus *Remaniella* Catalano 1965; a - *Remaniella ferasini* (Catalano 1965) (Pl. I, Fig. 5); b - *Remaniella filipescui* n. sp., holotype (Pl. I, Fig. 7); c - *Remaniella cadischiana* (Colom 1948) (Pl. I, Fig. 3); d - *Remaniella borzai* n. sp., holotype (Pl. I, Fig. 13); e - "*Remaniella aff. cadischiana*" (according to Remane, in Le Hégarat & Remane 1968, Tab. VIa).

equal, sometimes forming a V-shaped collar. In some instances the inner oral end of the lorica displays a very small hollow where the internal ring is inserted, suggesting that this species is at the origin of the genus *Calpionellopsis*.

In axial sections the aboral part of the lorica is pointed or very often ends with a caudal appendage.

This species corresponds to the cylindrical specimens originally described by Colom (1948) as *Tintinnopsella cadischiana*.

Occurrence and stratigraphic range: Species recorded from the Berriasian - Early Valanginian pelagic-derived limestones of many Tethyan areas. It ranges from the Middle Berriasian up to the latest Early Valanginian or from the Elliptica Subzone (Calpionella Zone) until the Major Subzone (Calpionellites Zone). The first appearance of this species has been observed in the basal part of the Elliptica Subzone in several revised and newly examined sections from the Southern Carpathians and Cuba (Pop 1974a, 1976, 1986a). It is often common in the calpionellid assemblages of the Calpionellopsis Zone.

Remarks: Emended *Remaniella cadischiana* (Colom 1948) differs from *R. borzai* n. sp., another species with cylindrical lorica, in the morphological form of the collar, especially in their internal rings, which in thin sections are lenticular in the first case and punctiform in the second one. When the collar is not well preserved, this species may be mistaken for *Tintinnopsella longa* (Colom 1939). There are many evidences that *Remaniella cadischiana* is derived from *R. ferasini* (Catalano 1965) and is at the origin of *Calpionellopsis simplex* (Colom 1939) and directly or indirectly of *C. oblonga* (Cadisch 1932).

Remaniella ferasini (Catalano 1965)
(Fig. 1a; Pl. I, Figs. 5, 6)

- 1957 *Calpionellites* sp. - Ferasin & Rigato, p. 25, Pl. I, Figs. 15, 16 (fide Catalano 1965).
1965 *Calpionellites ferasini* Catalano 1965. - Catalano, p. 14-15, Pl. II, Figs. 1-5; Pl. III, Figs. 5-7.
1971 *Remaniella ferasini* (Catalano 1965). - Catalano & Liguri, p. 195, Pl. 3, Figs. 1-5.

Diagnosis: Ovoid lorica with an acute aboral zone or ended with a short caudal appendage; collar made up of two detached circumoral rings, which have an almost equal and triangular-shaped profile in transversal sections.

Description: This species includes the forms with an ovoid lorica of 65 to 85 μm in length and 48 to 60 μm in width, having the maximum width in its upper third. Aboral part is sharply pointed or ends with a short caudal appendage in axial sections. The collar consists of two detached circumoral rings with almost equal and triangular-shaped profiles in transversal sections. Very often the inner ring appears as an inward continuation of the oral part of the lorica, whereas the outer ring is more or less divergent. In our figured specimens, the internal ring reveals an extinction at 45° in polarized light in comparison with the oral part of the lorica.

Occurrence and stratigraphic range: At present this species is known in the Berriasian basal limestones of many Tethyan areas. It ranges from the upper part of Early Berriasian up to Late Berriasian (lower part) or from the Ferasini Subzone (Calpionella Zone) up to the basal part of the Oblonga Subzone (Calpionellopsis Zone). The first occurrence of this species marks the beginning of the calpionellids with composed collar and the base of the second subzone of the Calpio-

nella Zone initially named Remaniella Subzone (Pop 1974a) and then Ferasini Subzone (Pop, in press). Generally it is a rare or very rare component of the successive unitary assemblages of Ferasini, Elliptica, Longa, Simplex and Oblonga (basal part) Subzones.

Remarks: This species is the first representative of the genus *Remaniella* and in our opinion the ancestor of *Remaniella filipescai* n. sp. and *R. cadischiana* (Colom 1948). It differs from the above-mentioned species as well as from *Remaniella borzai* n. sp. and "R. aff. *cadischiana*" in the forms of both the collar and the lorica.

Remaniella filipescai Pop n. sp.
(Fig. 1b; Pl. I, Figs. 7-12)

- 1948 *Tintinnopsella cadischiana* Colom 1948. - Colom, p. 247, Fig. 12/34, 35, 40.
1965 *Remaniella cadischiana* (Colom 1948). - Catalano, p. 17-18, Pl. I, Fig. 13.
1969 *Calpionellites? dadayi* Knauer 1963. - Borza, p. 104, Pl. LXXXIV, Figs. 7-10.
1974 a *Remaniella dadayi* (Knauer 1963). - Pop, Pl. IV, Fig. 16.

Derivation of name: Patronymic in honor of late Prof. M. Filipescu, one of the two authors of the well-known *Tintinnopsella carpathica* (Murgenu & Filipescu 1933).

Holotype: Pl. I, Fig. 7, thin section deposited in the Collection of the Geological Institute of Romania (Geological Museum), No. 18614 (93/08/12).

Paratypes: Pl. I, Figs. 8, 9, thin sections deposited in the same collection, No. 18615, 18616 (93/08/12).

Type locality: Valea Morilor, a small and left tributary of the Danube, near the village Svinita, Mehedinti District, Southern Carpathians.

Type level: Lower part of the Early Valanginian, in the Murgeanui Subzone (Calpionellopsis Zone), 2 m below the base of the Calpionellites Zone. It was encountered in the Murguceva Limestones, Valea Morilor section, sample no. 3085 (Pop 1986a).

Material: Numerous specimens in thin sections proceeding from the Berriasian to Early Valanginian limestones from the Romanian Carpathians, Cuba, Bakony Mts. (Hungary), Apennines (Italy), External Dinarides (Albania).

Diagnosis: Cup- or bell-shaped lorica with an aboral appendage and a collar composed of two unequal divergent circumoral rings more or less oblique to the oral extremity of the lorica wall. In polarized light, the internal ring shows an extinction at 45° with respect to the wall.

Description: Bell- or cup-shaped lorica with maximum width placed in its oral part. Common dimensions are 75 to 95 μm in length and 65 to 80 μm in width. Length/width ratios are generally under the value of 1.5. The holotype lorica is 90 μm in length and 87 μm in width. The aboral part is ended with a more or less elongated caudal appendage. The collar consists of two detached and very often unequal circumoral rings disposed divergently and more or less obliquely in comparison with the oral extremity of the lorica. Collar rings are of broadly lenticular form and of different lengths in transverse sections, the inner ring usually being shorter than the outer one; the last one is often slightly curved. The inner ring shows an extinction at 45° in comparison with the lorica wall in polarized light. The collar of this species is in general comparable with that of *Remaniella cadischiana* (Colom 1948) emended in the present paper.

The internal oral extremity of the lorica of *Remaniella filipes* n. sp. presents in some instances a very small hollow where the inner ring is articulated, proving that this species is at the origin of *Praecalpionellites murgeanui* (Pop 1974).

Occurrence and stratigraphic range: Berriasian - Early Valanginian pelagic-derived limestones from many Tethyan areas. It ranges from the upper part of Early Berriasian up to Early Valanginian inclusively; its first appearance is noticed soon after the occurrence of *Remaniella ferasini* (Catalano 1965), in the Ferasini Subzone (Calpionella Zone).

Assemblage of holotype: *Remaniella filipes* n. sp., *Calpionellopsis oblonga* (Cadisch 1932), *C. simplex* (Colom 1939), *Praecalpionellites murgeanui* (Pop 1974), *Tintinnopsella carpathica* (Murgeanu & Filipescu 1933), *T. longa* (Colom 1939), *Remaniella cadischiana* (Colom 1948) and *Lorenziella hungarica* Knauer & Nagy 1963.

Remarks: *Remaniella filipes* n. sp. differs from *R. cadischiana* (Colom 1948) by its bell-shaped lorica and from the other species of the genus *Remaniella* (*R. borzai* n. sp. and "*R. aff. cadischiana*") by both their lorica and collar forms. This

species derives from *Remaniella ferasini* (Catalano 1965) and is probably at the origin of "*Remaniella aff. cadischiana*" of Remane (in: Le Hégarat & Remane 1968) and much later of *Praecalpionellites murgeanui* (Pop 1974).

Remaniella borzai Pop n. sp.
(Fig. 1d; Pl. I, Figs. 13-16)

Derivation of name: Patronymic in honor of late Dr. K. Borza in recognition of his contributions to the study of calpionellids.

Holotype: Pl. I, Fig. 13, thin section deposited in the Collection of the Geological Institute of Romania (Geological Museum), Bucharest, No. 18617 (93/08/12).

Paratype: Pl. I, Fig. 14, thin section deposited in the same collection, No. 18618 (93/08/12).

Type locality: Valea Mandrisagului, a right tributary of the Minis Valley, 5.0 km south-west of the town Anina, Caras-Severin district, western Southern Carpathians.

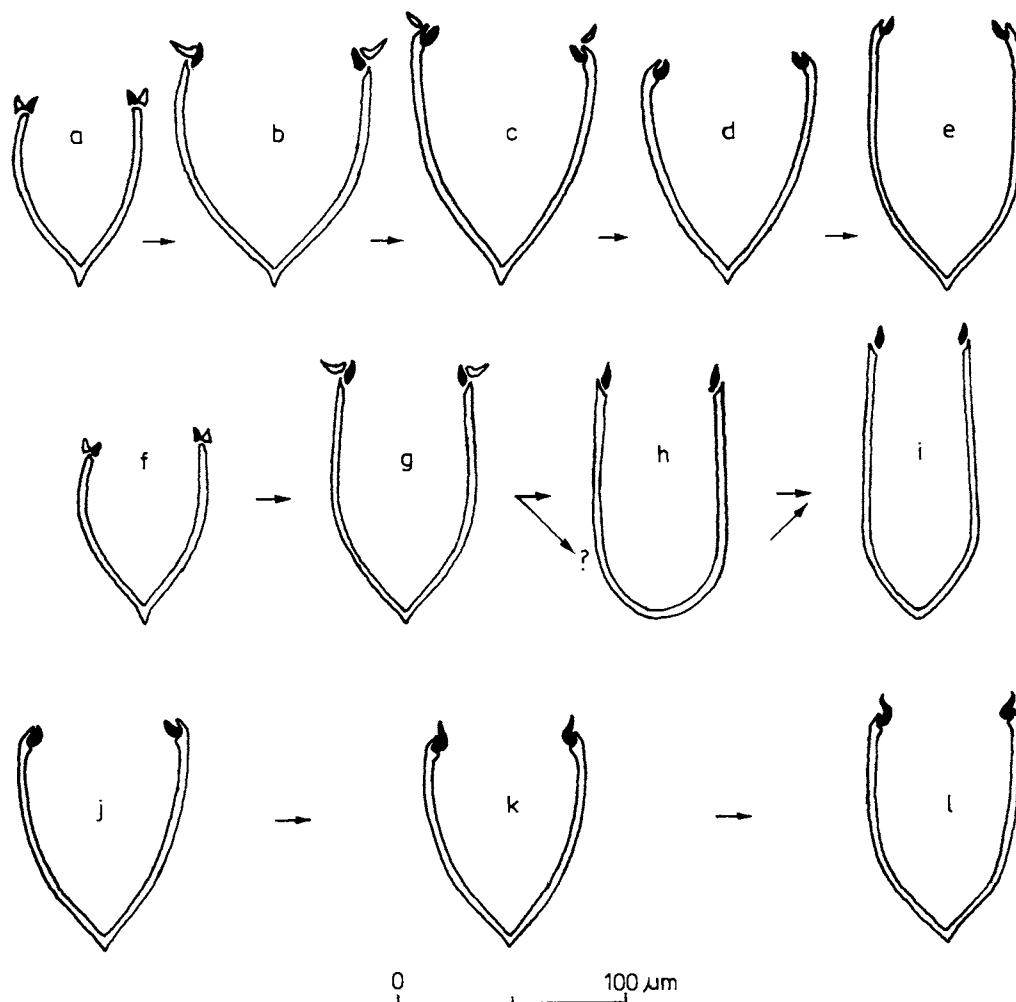


Fig. 2. Some more important phyletic lineages of the calpionellids with composed collar (a-e; f-l; j-l). a, f - *Remaniella ferasini* (Catalano 1965) (Pl. I, Fig. 5); b - *Remaniella filipes* n. sp., holotype (Pl. I, Fig. 7); c - *Praecalpionellites murgeanui* (Pop 1974) (Pl. II, Fig. 5); d, j - *Calpionellites darderi* (Colom 1934) (Pl. II, Fig. 7); e - *Calpionellites major* (Colom 1948) (Pl. II, Fig. 9); g - *Remaniella cadischiana* (Colom 1948); h - *Calpionellopsis simplex* (Colom 1939); i - *Calpionellopsis oblonga* (Cadisch 1932); k - *Calpionellites coronata* Trejo 1975 (Pl. II, Fig. 11); l - *Calpionellites caravacaensis* Allemann 1975 (Pl. II, Fig. 13). All the calpionellids are schematic drawings after photos (a-e, j-l in Pl. I, II; g-l after the forms encountered in the successive subzones Elliptica, Simplex and Oblonga respectively, Murgeceva section according to Pop (1986a), Southern Carpathians, Romania).

Type level: Middle Berriasian or Elliptica Subzone (Calpionella Zone), Marila Limestones, sample No. 76 in the Valea Mandrisagului section (Pop 1974a).

Material: Several specimens in thin sections proceeding from the Middle Berriasian to Early Valanginian carbonate formations outcropping in the Southern Carpathians and Cuba.

Diagnosis: Cylindrical lorica with an aboral appendage and a collar consisting of two detached circumoral rings; the outer ring is strongly developed and obliquely situated whereas the inner one is filiform.

Description: Cylindrical more or less elongated lorica with aboral appendage in the axial sections and a collar formed of two normally detached circumoral rings which is the most important character in recognition of this species. The outer ring is broadly lenticular - elongated, in some cases slightly curved, and more or less obliquely placed in comparison with the lorica wall. In exchange the internal ring is filiform and punctiform in

the transverse sections at microscopic level. In comparison with the oral extremity of the lorica it shows an extinction at 45° in polarized light.

Holotype lorica is 110 μm in length and 60 μm in width.

Occurrence and stratigraphic range: In our material this species appears as rare to very rare specimens from the Middle Berriasian (Elliptica Subzone) up to Early Valanginian (Major Subzone).

Assemblage of holotype: *Remaniella borzai* n. sp., *R. filipescai* n. sp., *R. ferasini* (Catalano 1965), *R. cadischiana* (Colom 1948), *Calpionella elliptica* Cadisch 1932, *C. alpina* Lorenz 1902 and *Tintinnopsella carpathica* (Murgeanu & Filipescu 1933).

Remarks: *Remaniella borzai* n. sp. differs from *R. cadischiana* (Colom 1948) by the aspect of the collar. It probably represents a descendent of "*Remaniella* aff. *cadischiana*" of Remane (in: Le Hégarat & Remane 1968).

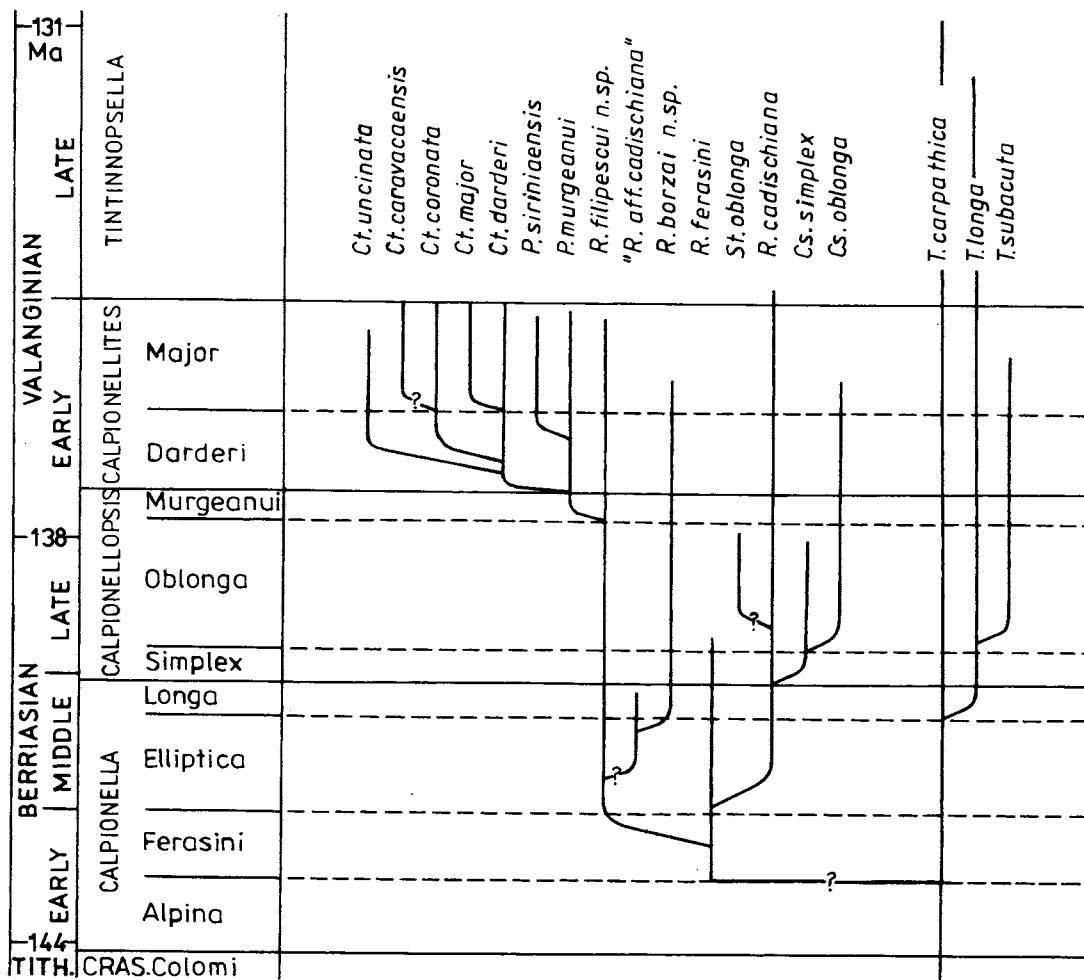


Fig. 3. Stratigraphic distribution and possible lineages in the evolution of calpionellids with composed collar. Biozonation scheme according to Pop (in press). Crassicollaria, Calpionella and Calpionellopsis Zones according to Allemann et al. (1971); Calpionellites and Tintinnopsella Zones according to Borza (1984); Simplex Subzone according to Remane et al. (1986); all other subzones according to Pop (1989, in press). Geochronological data according to Kent & Gradstein (1985). Complete names of calpionellids and their authors (from left to right): *Calpionellites uncinata* Cita & Pasquaré 1959; *Calpionellites caravacaensis* Allemann 1975; *Calpionellites coronata* Trejo 1975; *Calpionellites major* (Colom 1948); *Calpionellites darderi* (Colom 1934); *Praecalpionellites siriniaensis* Pop 1986; *Praecalpionellites murgeanui* (Pop 1974); *Remaniella filipescai* n. sp.; "*Remaniella* aff. *cadischiana*"; *Remaniella borzai* n. sp.; *Remaniella ferasini* (Catalano 1965); *Sturiella oblonga* Borza 1981; *Remaniella cadischiana* (Colom 1948); *Calpionellopsis simplex* (Colom 1939); *Calpionellopsis oblonga* (Cadisch 1932); *Tintinnopsella carpathica* (Murgeanu & Filipescu 1933); *Tintinnopsella longa* (Colom 1939); *Tintinnopsella subacuta* (Colom 1948).

Biochronology

Our attempt at systematics of the genus *Remaniella* leads to two important conclusions: a - the species of this genus are placed on different phyletic lineages which are directly or indirectly at the origin of all the other calpionellids having a composed collar, and b - the same species are all morphologically defined chronospecies resulting from successive speciation events. These events and species are used or may be used as additional markers or elements in the defining of some biostratigraphic units as well as of the unitary assemblages.

The first biochronological established species of the genus *Remaniella* is *R. ferasini* (Catalano 1965) that appears in the middle part of the Early Berriasian (Figs. 2, 3; Pls. I, II). This event has been used in the defining of the base of the *Remaniella* Subzone (Pop 1974a) or the recently newly named Ferasini Subzone (Pop, in press) from the Calpionella Zone (Allemann et al. 1971). The phyletic derivation of the above-mentioned species is unknown. Its possible ancestor could be either *Tintinnopsella carpathica* (Murgeanu & Filipescu 1933) according to Remane (1969, 1971) or rather a certain species of *Chitinoidella*.

The first descendent of *Remaniella ferasini* is *R. filipescai* n. sp. which occurs soon afterwards in the Ferasini Subzone and marks an important phyletic lineage (Fig. 2a-e). This species is first at the origin of "*Remaniella* aff. *cadischiana*", probably later leading to *R. borzai* n. sp., and then *Praecalpionellites murgeanui*, such as: *Remaniella ferasini* - *R. filipescai* - *Praecalpionellites murgeanui* - *Calpionellites darderi* - *C. major* (Fig. 2a-e).

Other speciations during the Valanginian have given the following derived-lineages: *Praecalpionellites murgeanui* - *P. siri-niaensis*; *Calpionellites darderi* - *C. uncinata*; *Calpionellites darderi* - *C. coronata* - *C. caravacaensis* (Figs. 2j-l, 3) (see also: Remane 1969, 1971, 1985; Pop 1974b, 1986b; Allemann & Trejo 1975).

Another important lineage is marked by the first appearance of *Remaniella cadischiana* (Colom 1948) in the basal part of the Elliptica Subzone (Middle Berriasian). It is a descendent of *Remaniella ferasini* (Catalano 1965) and at the same time an ancestor of the genus *Calpionellopsis*, so that *Remaniella ferasini* - *R. cadischiana* - *Calpionellopsis simplex* - *C. oblonga* (Figs. 2f-i, 3). Probably *Remaniella cadischiana* is also the ancestor of *Sturiella oblonga* Borza 1981.

At present only *Remaniella ferasini* is used in the calpionellid subzonation. Additional data are necessary with respect to the first occurrence of other species of the genus *Remaniella* in order to further elucidate their biochronological potential.

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Plate I: Fig. 1. *Remaniella cadischiana* (Colom 1948), Late Berriasian, Calpionellopsis Zone (Oblonga Subzone), sample No. B-305-2, Murguceva Limestones, Svinita (locality) area, Southern Carpathians, Romania. **Fig. 2.** *Remaniella cadischiana* (Colom 1948), subaxial section, slightly deformed, basal Valanginian, Calpionellopsis Zone (Murgeanui Subzone), sample No. B-305-4, Murguceva Limestones, Svinita area, Southern Carpathians, Romania. **Fig. 3.** *Remaniella cadischiana* (Colom 1948), Early Valanginian, base of Calpionellites Zone (Darderi Subzone), sample No. 124 in the Hacienda El Americano section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 4.** *Remaniella cadischiana* (Colom 1948), subaxial section, Middle Berriasian, Calpionella Zone (Elliptica Subzone), level No. 11 in the Kőzorkut Ravine II section (Horváth & Knauer 1986), Szentivánhegy Limestone Formation, Bakony Mts. Hungary. **Fig. 5.** *Remaniella ferasini* (Catalano 1965), basal Late Berriasian, Calpionellopsis Zone (Simplex Subzone), sample No. 2991 in the Murguceva Valley section (Pop 1986a), Murguceva Limestones, east of Svinita, Southern Carpathians, Romania. **Fig. 6.** *Remaniella ferasini* (Catalano 1965), slightly subaxial section, Early Berriasian, Calpionella Zone (Ferasini Subzone), sample No. 655-42, Murguceva Limestones, Svinita area, Southern Carpathians, Romania. **Fig. 7.** *Remaniella filipescai* n. sp., holotype, Early Valanginian, Calpionellopsis Zone (Murgeanui Subzone), sample No. 3085 in the Paraul Morilor I section (Pop 1986a), Murguceva Limestones, Svinita, Southern Carpathians, Romania. **Fig. 8.** *Remaniella filipescai* n. sp., paratype, basal Valanginian, Calpionellopsis Zone (Oblonga Subzone), sample No. 119 in the Hacienda El Americano section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 9.** *Remaniella filipescai* n. sp., paratype, Late Berriasian, Calpionellopsis Zone (Oblonga Subzone), sample No. 158 in the San Vicente section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 10.** *Remaniella filipescai* n. sp., slightly subaxial section, basal Valanginian, Calpionellopsis Zone (Oblonga Subzone), sample No. 121 in the Hacienda El Americano section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 11.** *Remaniella filipescai* n. sp., slightly subaxial section, Late Berriasian, Calpionellopsis Zone (Oblonga Subzone), sample No. 118 in the Hacienda El Americano section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 12.** *Remaniella filipescai* n. sp., Late Berriasian, Calpionellopsis Zone (Oblonga Subzone), sample No. 43 in the Ancon Valley section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 13.** *Remaniella borzai* n. sp., holotype, slightly subaxial section, Middle Berriasian, Calpionella Zone (Elliptica Subzone), sample No. 76 in the Valea Mandrisagului section (Pop 1974a), Marila Limestones, south of Anina, western Southern Carpathians, Romania. **Fig. 14.** *Remaniella borzai* n. sp., paratype, slightly subaxial section, Late Berriasian, Calpionellopsis Zone (Oblonga Subzone), sample No. 120 in the Hacienda El Americano section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 15.** *Remaniella borzai* n. sp., slightly subaxial section, Middle Berriasian, Calpionella Zone (Elliptica Subzone), sample No. 1074 in the Lindina Mare section (Pop 1974a), Marila Limestones, Muntii Aninei, western Southern Carpathians, Romania. **Fig. 16.** *Remaniella borzai* n. sp., oblique section but with clear nature of collar, Late Berriasian, Calpionellopsis Zone (Oblonga Subzone), sample No. 120 in the Hacienda El Americano section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. Marila Limestones, Murguceva Limestones (Romania), Artemisa Formation (Cuba) and Szentivánhegy Limestones Formation are all limestones of Maiolica type.

PLATE I



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2



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4



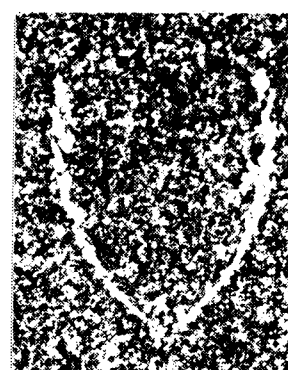
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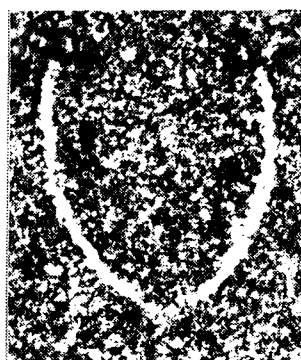
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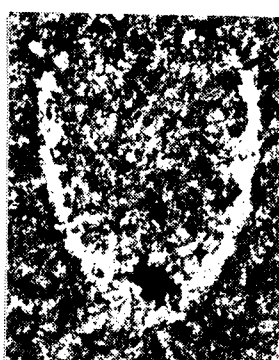
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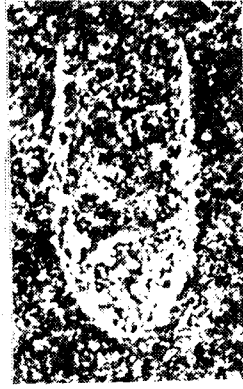
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PLATE II



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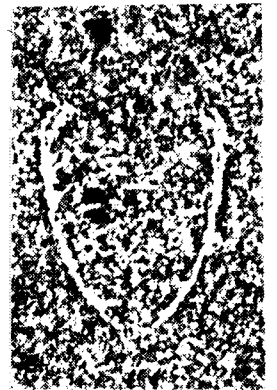
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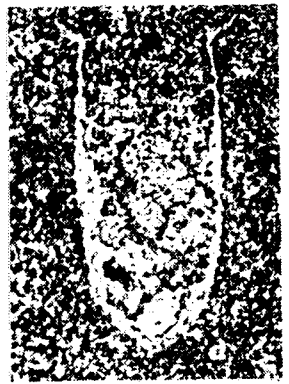
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15



16

0 100µm

Plate II: Fig. 1. *Calpionellopsis simplex* (Colom 1939), Late Berriasian, Calpionellopsis Zone (base of Oblonga Subzone), sample No. 7034 in the Crivina section (Pop, unpubl. data), Crivina "Marls", South of Anina, western Southern Carpathians, Romania. **Fig. 2.** *Calpionellopsis oblonga* (Cadisch 1932), slightly subaxial section, Late Berriasian, Calpionellopsis Zone (Oblonga Subzone), sample No. 119 in the Hacienda El Americano section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 3.** *Sturiella oblonga* Borza 1981, holotype (460 x), Late Berriasian, Calpionellopsis Zone (Oblonga Subzone), thin section No. 7229 in the Collection of the Geological Institute of the Slovak Academy of Sciences (Bratislava), massive limestones in the Belá Serie, west of Valaská Belá, Western Carpathians, Slovakia. **Fig. 4.** *Praecalpionellites murgeanui* (Pop 1974), subaxial section, Early Valanginian, Calpionellites Zone (basal Darderi Subzone), sample No. 139 in the San Vicente section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 5.** *Praecalpionellites murgeanui* (Pop 1974), Early Valanginian, Calpionellopsis Zone (Murgeanui Subzone), sample No. B-418-6, Murguceva Limestones, Svinita area (on the Danube), Southern Carpathians, Romania. **Fig. 6.** *Praecalpionellites siriniaensis* Pop 1986, holotype, Early Valanginian, Calpionellites Zone (Major Subzone), collection No. H-17312, Geological Museum of the Geological Institute of Romania (Bucharest), sample No. 3310 in the Sirinia Valley II section (Pop 1986a), Murguceva Limestones, Southern Carpathians, Romania. **Fig. 7.** *Calpionellites darderi* (Colom 1934), subaxial section, Early Valanginian, Calpionellites Zone (Darderi Subzone), sample No. 3005 in the Murguceva Valley section (Pop 1986 a), Murguceva Limestones, Svinita area, Southern Carpathians, Romania. **Fig. 8.** *Calpionellites darderi* (Colom 1934), Early Valanginian, Calpionellites Zone (base of Darderi Subzone), sample No. 124 in the Hacienda El Americano section (Pop, 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 9.** *Calpionellites major* (Colom 1948), lectotype (personal collection), Early Valanginian, Calpionellites Zone (Major Subzone), sample No. 3309 in the Sirinia Valley II section (Pop 1986a), Murguceva Limestone, Southern Carpathians, Romania. **Fig. 10.** *Calpionellites major* (Colom 1948), subaxial section, Early Valanginian, Calpionellites Zone (Major Subzone), sample No. 655-80, Murguceva Limestones, Svinita area, Southern Carpathians, Romania. **Fig. 11.** *Calpionellites coronata* Trejo 1975, subaxial section, Early Valanginian, Calpionellites Zone (Darderi Subzone), sample No. 124 in the Hacienda El Americano section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 12.** *Calpionellites coronata* Trejo 1975, slightly subaxial section, in the same sample. **Fig. 13.** *Calpionellites caravacaensis* Allemann 1975, slightly subaxial section, Early Valanginian, Calpionellites Zone (Major Subzone), sample No. 655-80, Murguceva Limestones, Svinita area, Southern Carpathians, Romania. **Fig. 14.** *Calpionellites uncinata* Cita & Pasquare 1959, subaxial section, Early Valanginian, Calpionellites Zone (Darderi Subzone), sample No. 135 in the San Vicente section (Pop 1976), Artemisa Formation, Sierra de los Organos, Pinar del Rio Prov., Cuba. **Fig. 15.** *Tintinnopsella carpathica* (Murgeanu & Filipescu 1933), subaxial section, Late Berriasian, Calpionellopsis Zone (base of Oblonga Subzone), sample No. 7035 in the Crivina section (Pop, unpubl. data), Crivina "Marls", South of Anina, western Southern Carpathians, Romania. **Fig. 16.** *Tintinnopsella longa* (Colom 1939), slightly subaxial section Late Berriasian, Calpionellopsis Zone (Oblonga Subzone), sample No. 654-10, Murguceva Limestones, Svinita area, Southern Carpathians, Romania. Crivina "Marls" are generally "periodites" of argillaceous limestone - marl type.

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