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# A REVISION OF THE DASYCLADALE ALGA *Uraloporella* (CHLOROPHYCOPHYTA, UPPER PALEOZOIC, ASTURIAS, SPAIN)

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**ABSTRACT**

A well-preserved *Uraloporella* boundstone has been discovered in the Cuera Limestones lithostratigraphic unit of the Carboniferous of Asturias (Spain), in a level of Moscovian age (Podolsky time equivalent). The accompanying microfauna allows us to assign this level to the foraminiferal Zone 25 of Mamet, and to the B subzone of the *Fusulinella* Zone of van Ginkel. Biometric study of the thalli indicates that all previously-proposed species *(massieuxae, radiata, rara, setosa, sieswerdai)* are variants of one single taxon, *Uraloporella variabilis* Korde, 1950.

**Keywords: Beresellid algae, taxonomy, Moscovian.**

**RESUMEN**

En la parte media de las Calizas del Cuera (Sección de Playa La Huelga, Asturias) aparecen tramos con bioconstrucciones de *Uraloporella*, excelentemente conservados. Gracias al contenido en foraminíferos, dichas capas pueden correlacionarse con el horizonte Podolsky de la Plataforma Rusa (Moscoviense Superior) y ser situadas en la Zona 25 de foraminíferos de Mamet, Zona de *Fusulinella* (subzona B) de van Ginkel. El estudio biométrico de los talos muestra que todas las especies propuestas con anterioridad *(massieuxae, radiata, rara, setosa, sieswerdai)* son en realidad variedades de un mismo taxón, *Uraloporella variabilis* Korde, 1950.

**Palabras clave: Algas fósiles, bereséllidas, taxonomía, Moscoviense.**

## INTRODUCTION

The *Uraloporella* algal flora is widespread during the Middle Carboniferous-Early Permian in the Tethyan and Arctic domains (Mamet, 1992). Although the alga is sometimes very prolific, it is also very fragile and usually observed as broken fragments. This has led to taxonomic misinterpretation.

We have recently discovered, in the Carboniferous of Asturias, a well-preserved boundstone (bafflestone) composed of numerous intertwined thalli of *Uraloporella*. It will enable us to reassess the value of the different species that have been previously erected.

## GEOGRAPHIC AND STRATIGRAPHIC SETTINGS

The La Huelga Beach Section is exposed along the coast near La Huelga Beach, the latter situated some 15 kms east of Ribadesella (Asturias, Northern Spain). It exposes the Carboniferous succession of the northern part of the Ponga structural unit, one of the several provinces in which the Cantabrian Zone of Lotze (1945) has been divided by Julivert, 1971, and Perez Estaun *et al.*, 1988 (Fig. 1). From a stratigraphic point of view, the Carboniferous of this part of the Ponga Unit is characterised by a wholly calcareous succession in which the thick terrigenous intercalations, typical of the southern part, are absent or nearly absent.

The beds studied in this paper belong to the Cuera Limestones, an informal lithostratigraphic unit introduced by Navarro *et al.* (1986) for refering to the whole Carboniferous succession overlying the Barcaliente Formation in the northern part of the Ponga Unit. According to these authors, the age of the Cuera Limestones ranges from Bashkirian to late Moscovian, therefore being roughly equivalent to several formations of those of the southern part of the Ponga Unit. Navarro *et al. (op. cit.)* point to the closer resemblance between the stratigraphic succession of this area and that of Picos de Europa Unit, where the interval of time embraced by two calcareous formations (Valdeteja and Picos de Europa Formations) is equivalent to that of the Cuera Limestones.

The Cuera Limestones are composed of predominantly massive, bioclastic limestones, that occasionally show marly beds and minor siliciclastic intercalations. The La Huelga Beach Section shows, undoubtedly, the most complete and representative succession of the Cuera Limestones, having a thickness up to 1100 m. The age of this lithostratigraphic unit has been mainly established on fusulinaceans. The lower part of the Cuera Limestones in La Huelga Beach Section has provided fusulinaceans of upper Bashkirian age, whilst near the top some upper Moscovian (Myachkovsky) species have been recorded (Villa, *in press*).

The locality of interest in this paper (A-15) belongs to the Unit 17 of the stratigraphic succession established by Navarro *et al. (op. cit.)*. It is situated some 140 m above the occurrence of the first fusulinacean assemblages indicating an Upper Moscovian age, and is probably equivalent to the lower-middle part of the Podolsky horizon of the Moscow Basin (Navarro *et al.* 1986; Villa, *in press*). According to the fusulinacean biozonation established by van Ginkel (1965) in the Cantabrian Mountains, the fusulinacean fauna occurring at level A-15 belongs to the *Fusulinella* Zone, subzone B (lower part of this subzone).

The microfacies of Unit 17 range from fossil packstone to foraminiferal wackestone, *Ungdarella* - beresellid bafflestone, *Ungdarella - Komia* - beresellid boundstone and *Uraloporella* - beresellid boundstone. Algae are therefore omnipresent in the Unit 17, locality A-15 being the most prolific level.

The microfossils of the unit are:

*Anthracoporellopsis* sp.
Apterrinellidae
*Beresella* sp.

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*Biseriella* sp.
*Bradyina* sp.
*Bradyinelloides* sp.
*Calcivertella* sp.
*Calcitornella*? sp.
*Claracrusta*? sp.
*Climacammina* sp.
*Cuneiphycus* sp.
*Deckerella* sp.
*Dvinella* sp.
*Endothyra* sp.
*Endothyranella* sp.
*Eostaffella* sp.
*Epimastopora* sp.
*Fusulinella* cf. *meridionalis* Rauser, 1951
*Fusulinella* ex gr. *praebocki* Rauser, 1951
*Globivalvulina* sp.
*Haplophragmina* sp.
*Iberiaella* sp.
*Insolentitheca* sp.
*Komia* sp.
*Monotaxinoides*? sp.
*Nostocites* sp.
*Ozawainella* sp.
*Pseudobradyina* sp.
*Pseudoglomospira* sp.
*Pseudokomia* sp.
*Pseudopalaeospiroplectammina* sp.
*Pseudostaffella* sp.
*Schubertella* ex gr. *obscura* Lee & Chen, 1930
*Staffella* sp.
*Syzrania* sp.
*Tetrataxis* sp.
*Tuberitina* sp.
*Tubiphytes* sp.
*Ungdarella* sp.
*Uraloporella* sp.

Age: Upper Moscovian (equivalent to the lower or middle part of the Podolsky horizon), Zone 25 of Mamet (*in* Pinard, 1990), *Fusulinella* Zone (lower part of the subzone B) of van Ginkel (1965).

Although many algae would be worth while redescribing, and in particular the well-preserved thalli of *Pseudokomia*, we will concentrate here on the taxonomy of *Uraloporella*.

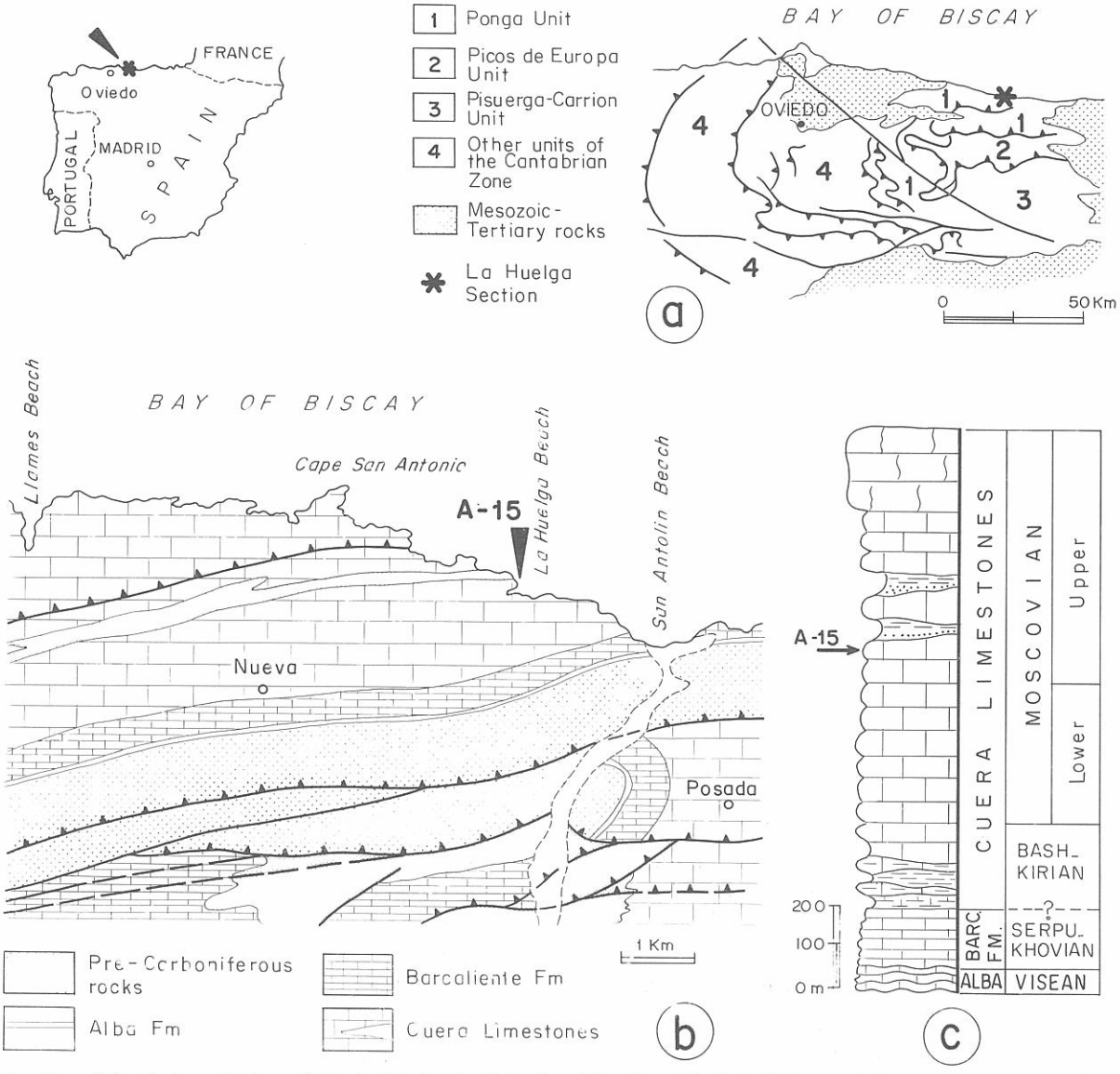



**Figure 1.** Location of the *Uraloporella* flora. A) Geological sketch of the Cantabrian Zone. B) Geological map of the area near La Huelga Beach (after Navarro *et al.* 1986, slightly modified) showing the situation of locality A-15. C) Stratigraphic sketch of the La Huelga Beach Section indicating the position of locality A-15.

## SYSTEMATIC PALEONTOLOGY

Suborder PALAEOSIPHONOCLADALES Shuysky, 1985
Tribe **Bereselleae?** Maslov and Kulik, 1956
or tribe **Uraloporelleae?** Shuysky, 1985
Genus *Uraloporella* Korde, 1950

**Type species:** *Uraloporella variabilis* Korde, 1950

1950 *Uraloporella* Korde, O. D., 570-571.
1956 *Samarella* Maslov and Kulik, O. D., 127.
1963 *Uraloporella* Korde; Korde, 211.
1964 *Samarella* Maslov and Kulik; Kulik, 1648.
1965 *Samarella* Maslov and Kulik; Güvenç, 847.
1966 *Uraloporella* Korde; Rácz, 101.
1974 *non Uraloporella* Korde; Vachard, 182.
1974 *Uraloporella* Korde; Riding and Jansa *pars* 1419-1421 *pars*, Pl. 2, Fig. 1-4, *non* Pl. 1, Figs. 1-6 (=*Jansaella*).
1975 *Uraloporella* Korde; Mamet and Roux, 1481-1490.
1975 *non Uraloporella* Korde; Malakhova, 84-85.
1976 *non Uraloporella* Korde; Riding and Jansa, 805-806.
1977 *Uraloporella* Korde; Vachard *pars*, 132.
1978 *non Uraloporella* Korde; Kazmierczak and Goldring, Pl. 1 c.
1979 *non Uraloporella* Korde; Faber and Riding, Figs. 4, 5.
1979 *Samarella* Maslov and Kulik; Zadorodnjuk, 10.
1981 *Uraloporella* Korde; Rauser-Chernousova and Koroljuk, 163-164.
1982 *non Uraloporella* Korde; Wright, 151-152.
1984 *Uraloporella* Korde; Saltovskaya, 19-20.
1985 *Uraloporella* Korde; Roux, 574-575.
1987 *Uraloporella* Korde; Mamet, Roux and Nassichuk, 30.
1987 *Uraloporella* Korde; Deloffre, Pl. Figs. 8, 9.
1987 *Uraloporella* Korde; Shuysky, Pl. 16, Figs. 14 (=Saltovskaya 1984).
1991 *Uraloporella* Korde; Mamet, 434.
1991 *Uraloporella* Korde; Vachard, Fig. 5U.

**Diagnosis:** Thallus cylindrical, elongate, unsegmented. Cortex perforated by numerous aspondyl, short, straight to slightly curved branches: they are thin, with a very slow rate of expansion. Thallus originally coated by mucilaginous coating, now a continuous cement layer. Medulla important, continuous, irregularly divided by curved pseudosepta. Conceptacles uncalcified, spherical, parietal, single or in pairs.

**Suprageneric attribution:** *Uraloporella* is considered by most Russian algologists as a beresellid. However, Shuysky erected in 1985 the tribe Uraloporelleae to separate thalli with continuous versus discontinuous bundles of pores. He includes in his new tribe, *Uraloporella, Jansaella, Nanopora, Samarella, Eouraloporella, Kundatia* and *Zidella*.

*Jansaella* has true partitions and no outer cement coating, thus does not fit the concept. *Nanopora* is a Salpingoporellinae Bassoullet *et al.*, 1979 (Deloffre, 1988). *Samarella* is synonymous with *Uraloporella* (Rauser-Chernousova and Koroljuk, 1981, Mamet *et al.*, 1987). *Eouraloporella* needs revision, but could have free functional pores (Mamet, 1991). The Cambrian *Kundatia* (and the Kundiataceae) are not chlorophytes. Only *Zidella* would partially fit the definition of the new tribe.

Thus, at present, Shuysky's taxon appears logical, but it should be tested further.

**Debatable attributions:** *Uraloporella* has caused some confusion, as the original representations were rather sketchy. This is unfortunate, as the original material of Korde is remarkably well fossilized, abundant and diversified. For a while, the taxonomy of the genus was in a state of flux, but has been stabilized by subsequent re-illustration of the type material (Mamet and Roux, 1975) and re-definition by Rauser-Chernousova and Koroljuk (1981).

If the taxonomy was debatable, so were the attributions. Riding and Jansa (1976) and Riding (1977) considered the taxon as a foraminifer?, but no proloculum has ever been encountered. Termier *et al.* 1977 considered *Uraloporella* as an hypercalcified sponge (Moravamminida), but the presence of an original coating contradicts this hypothesis. Wright (1982) called *Uraloporella* a *microproblematicum*, but his Devonian material is not even related to the beresellids.

More recently, Saltovskaya (1984) illustrated traces of spherical parietal conceptacles. Thus the attribution to the tubular green algae by Shuysky (1985) is plausible and has been followed by Shuysky 1987, Mamet *et al.*, 1987, Deloffre, 1988, Bogush *et al.*, 1990, and Mamet, 1991. Vachard (1991) departed from his earlier attributions and now considers the genus as a problematic.

Species attributed in the literature to *Uraloporella*:

*U. aurivella* Vachard 1977: reported to *Zidella* by Saltovskaya (1984).

*U. licis* Malakhova 1975: transferred to *Zidella* by Saltovskaya (1984).

*U. massieuxae* (Güvenç 1965) (as *Samarella*): reported with doubt to *U. variabilis* by Mamet *et al.* (1987).

*U. radiata* Saltovskaya 1984: transferred to *U. variabilis* (this article).

*U. rara* Saltovskaya 1984: transferred to *U. variabilis* (this article).

*U. setosa* Maslov and Kulik 1956: synonym of *U. variabilis* for Mamet and Roux 1987.

*U. sieswerdai* Rácz 1966: transferred to *U. variabilis* (this article).

**Stratigraphic distribution and mode of life:** The genus is usually associated with the beresellids *Beresella* and *Dvinella. Komia* and *Ungdarella* are common companions. It is present in protected lagoons, but also forms cemented boundstones. It can be so abundant that it forms dense thickets. It is however extremely fragile, as it is very long, slender and

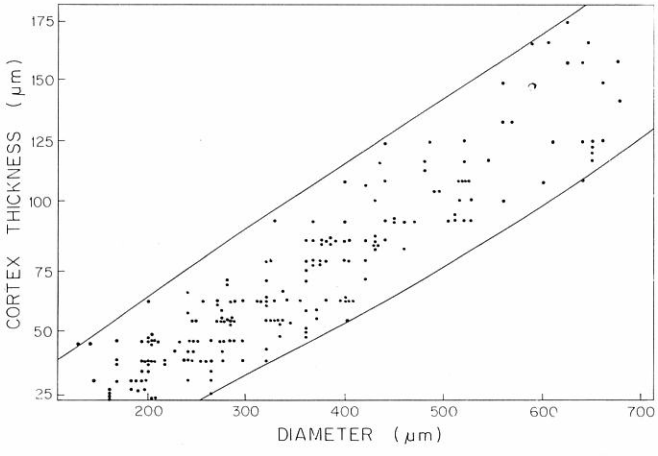



**Figure 2.** Ratio: diameter of thallus/thickness of cortex. Scatter envelope of results obtained for studied spanish material of *Uraloporella variabilis* Korde 1950.

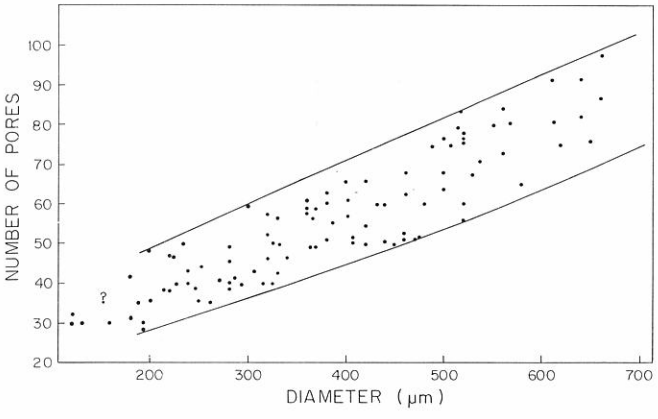


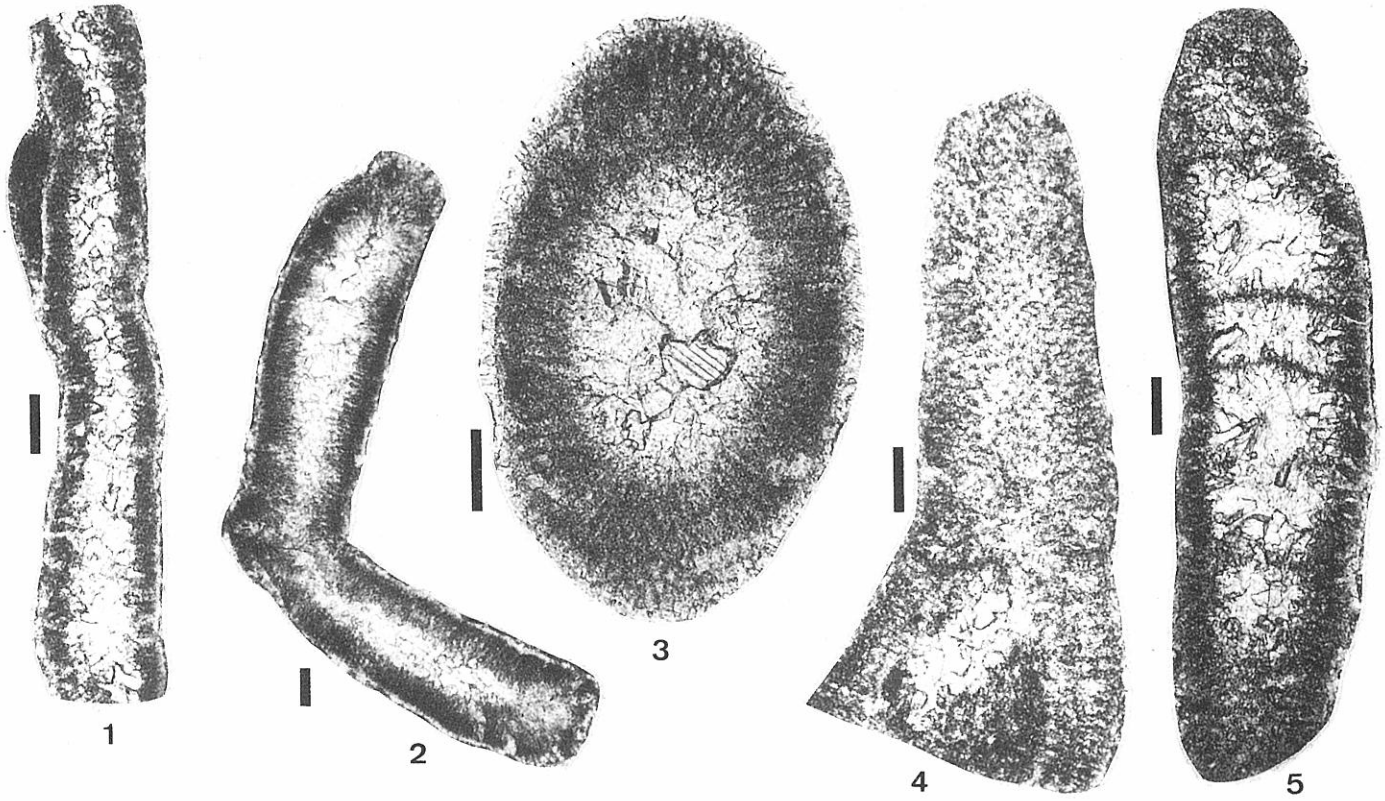

**Figure 3.** Ratio: diameter of thallus/number of pores. Scatter envelope of results obtained for studied spanish material of *Uraloporella variabilis* Korde 1950.

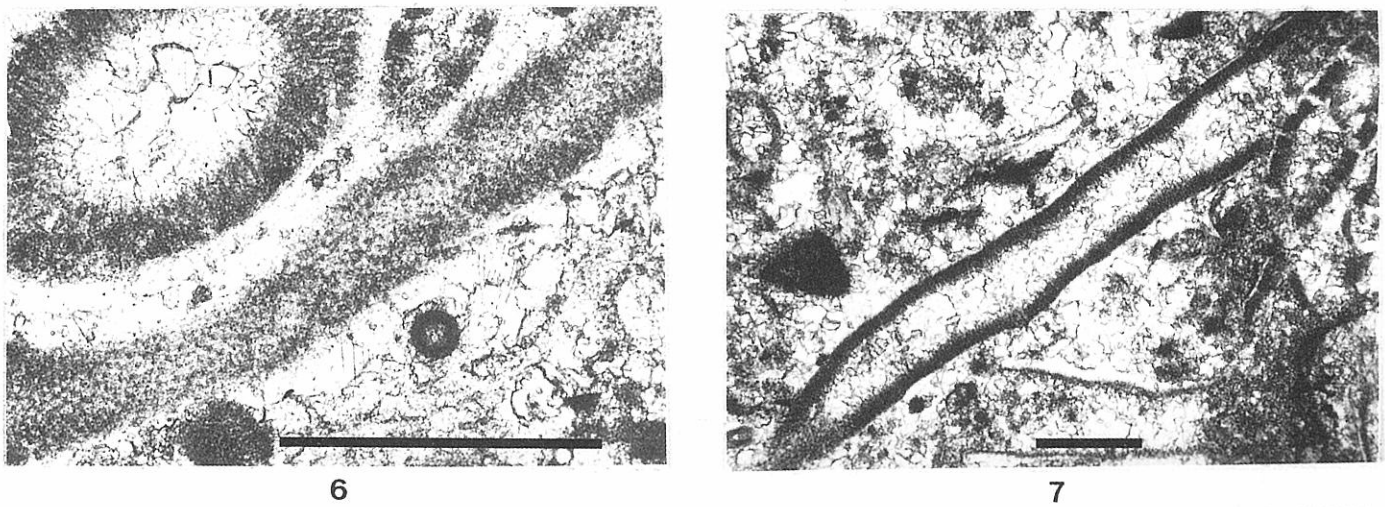
**Plate I**

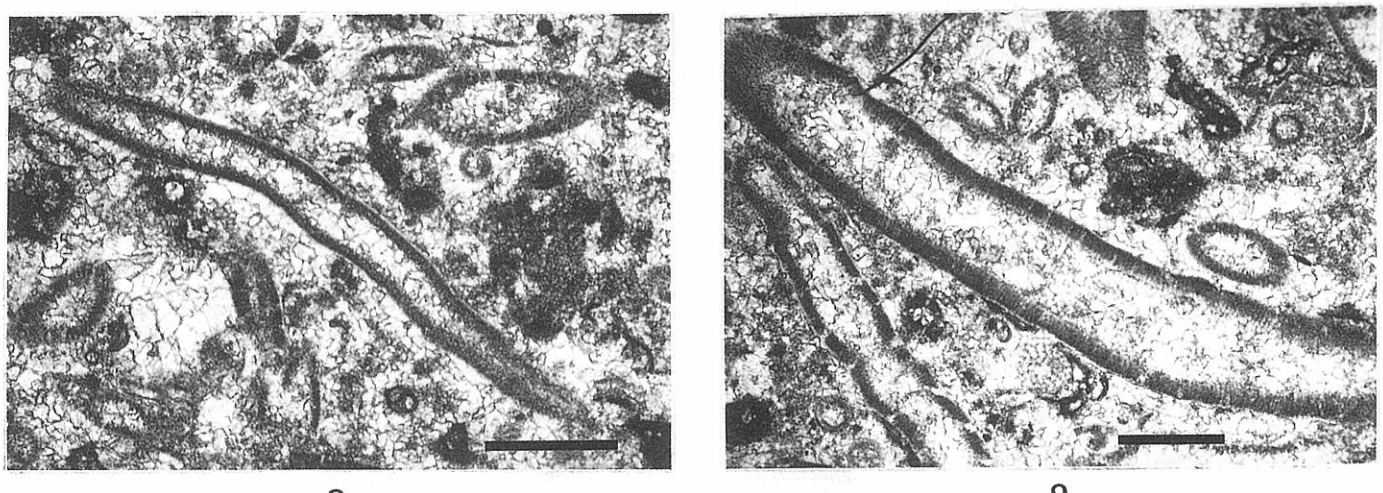
*Uraloporella variabilis* Korde, 1950. All figured specimens from locality A-15 of the La Huelga Beach Section, Cuera Limestones, Moscovian (equivalent to the Podolsky horizon), foraminiferal Zone 25, *Fusulinella* Zone (lower part of the subzone B). Horizontal scales: 0.5 mm; vertical scales: 0.1 mm.

1 U. of M. 820/23. Longitudinal section, showing clear cement coating.
2 U. of M. 820/12. Longitudinal section of a broken, regenerated thallus.
3 U. of M. 820/5. Subtransverse axial section, with details of pores.
4 U. of M. 820/7. High, oblique longitudinal section showing aspondyl character (see also disposition of pores in central part of Fig. 6).
5 U. of M. 821/4. Longitudinal section with curved pseudosepta (Compare with Saltovskaya 1984, Pl. 12 and 13).
6-9 U. of M. 820/6, 821/3, 821/1 and 821/2. *Uraloporella* boundstone. Diverse axial, oblique and longitudinal sections showing the great variability. Various state of preservation of the clear cement rim. Associated are bacterial pellets, algal lumps, *Calcisphaera, Beresella* and a few vagrant (Biseriamminidae) and attached foraminifers.

**Plate I**



perforated by a profusion of pores. Thus, it is usually observed as fragments, even in rather calm environments.

The known range is Late Namurian to Early Permian. Spain, Turkey, Russian Platform, Urals, Donbass, Kazakhstan, Siberia, China, Canadian Arctic, Alaska. It is one of the most prolific alga of the Carboniferous "Arctic".

*Uraloporella variabilis* Korde, 1950
Pl. I, Figs. 1-9

1950 *Uraloporella variabilis* Korde, O. D., 570-571, Fig. 3 (a, b).
1956 *Samarella setosa* Maslov and Kulik, O. D., 127, Fig. 1d.
1963 *Uraloporella variabilis* Korde *in* Osnovy Paleontologii, 211, Pl. 17, Fig. 7.
1964 *Samarella setosa* Maslov and Kulik; Kulik, 1648, Pl. 8, Fig. 9.
1965 *Samarella massieuxae* Güvenç, O. D., 847, Pl. 32, Figs. 6-8, text-fig. 3.
1966 *Uraloporella sieswerdai* Rácz "1964", 101, Pl. 4, Fig. 8, Pl. 5, Figs. 1-2.
1974 *Uraloporella variabilis* Korde; Riding and Jansa *pars.*, Pl. 2, Figs. 1-4 (only).
1974 *non Uraloporella variabilis* Korde; Riding and Jansa, 1421-1422, Pl. 1, Figs. 1-6.
1975 *Uraloporella variabilis* Korde; holotype reproduced in Mamet and Roux, 1481, Fig. 1.
1975 *Uraloporella variabilis* Korde; Mamet and Roux, 1483, Figs. 4-6.
1976 *non Uraloporella variabilis* Korde; Riding and Jansa, 805-806, text-fig. 1.
1979 *non Uraloporella variabilis* Korde; Faber and Riding (139-145), Figs. 4, 5.
1979 *Samarella setosa* Maslov and Kulik; Zadorodnjuk, 10, Pl. 2, Fig. 6
1981 *Uraloporella variabilis* Korde; Rauser-Chernousova and Koroljuk, 164, Pl. 3, Figs. 4, 5.
1982 *non Uraloporella variabilis* Korde; Wright, 151-152, Figs. 1, 2.
1984 *Uraloporella radiata* Saltovskaya, O. D., 21-22.
1984 *Uraloporella rara* Saltovskaya, O. D., 19-21, Pl. 12, Figs. 1-10, Pl. 13, Figs. 1-9.
1987 *Uraloporella variabilis* Korde; Mamet, Roux and Nassichuk, 30, Pl. 14, Figs. 1-14.

**Emended diagnosis:** *Uraloporella* thallus with external diameter ranging from 120 to 600 µm and exceptional forms of +700 µm. Diameter of the internal cavity usually 60 to 250 µm, but in very large forms, 250-400 µm. Thickness of the perforated cortex, 25 to 175 µm. Pores micrometric, with slow rate of expansion: thirty-forty in random axial sections of small thalli and eight-one hundred in more mature specimens. The total number of pores is in the one-to-ten thousand range.

**Discussion:** For a long time, we assumed that two separate species of *Uraloporella* were extant: the thin, slender *U. variabilis* Korde and the thick, stout *U. sieswerdai* Rácz. Indeed, in the abundant *U. variabilis* material studied in the Canadian Artic and Northern Russia, diameters ranged between 150-380 µm. *U. sieswerdai* illustrated by Racz was notably bigger.

Publication by Saltovskaya in 1984 of *U. rara* was of great importance, as it proved the existence of conceptacles. But it was also puzzling as it bridged *U. variabilis* and *U. sieswerdai.*

Do these species belong to one single botanical entity? To verify this assumption, three diagrams have been established. The first one (Fig. 2) is established on the external diameter versus the cortex thickness. It is based on axial and longitudinal sections. The second one (Fig. 3) gives the external diameter versus the number of pores. It is based only on well-oriented axial sections and there are fewer measurements than in the preceding figure. Moreover, it is difficult to identify individual pores in a very thin cortex that is usually micritized. Thus, estimates in the 100-200 µm range should be treated with caution. The third diagram (Fig. 4) gives the measurements recorded in the literature and in this study.

The Asturian material clearly encompasses all previously proposed "boundaries" which are therefore artificial. The diagnosis of the species has thus been emended accordingly and a reconstruction of the taxon is presented in Fig. 5.

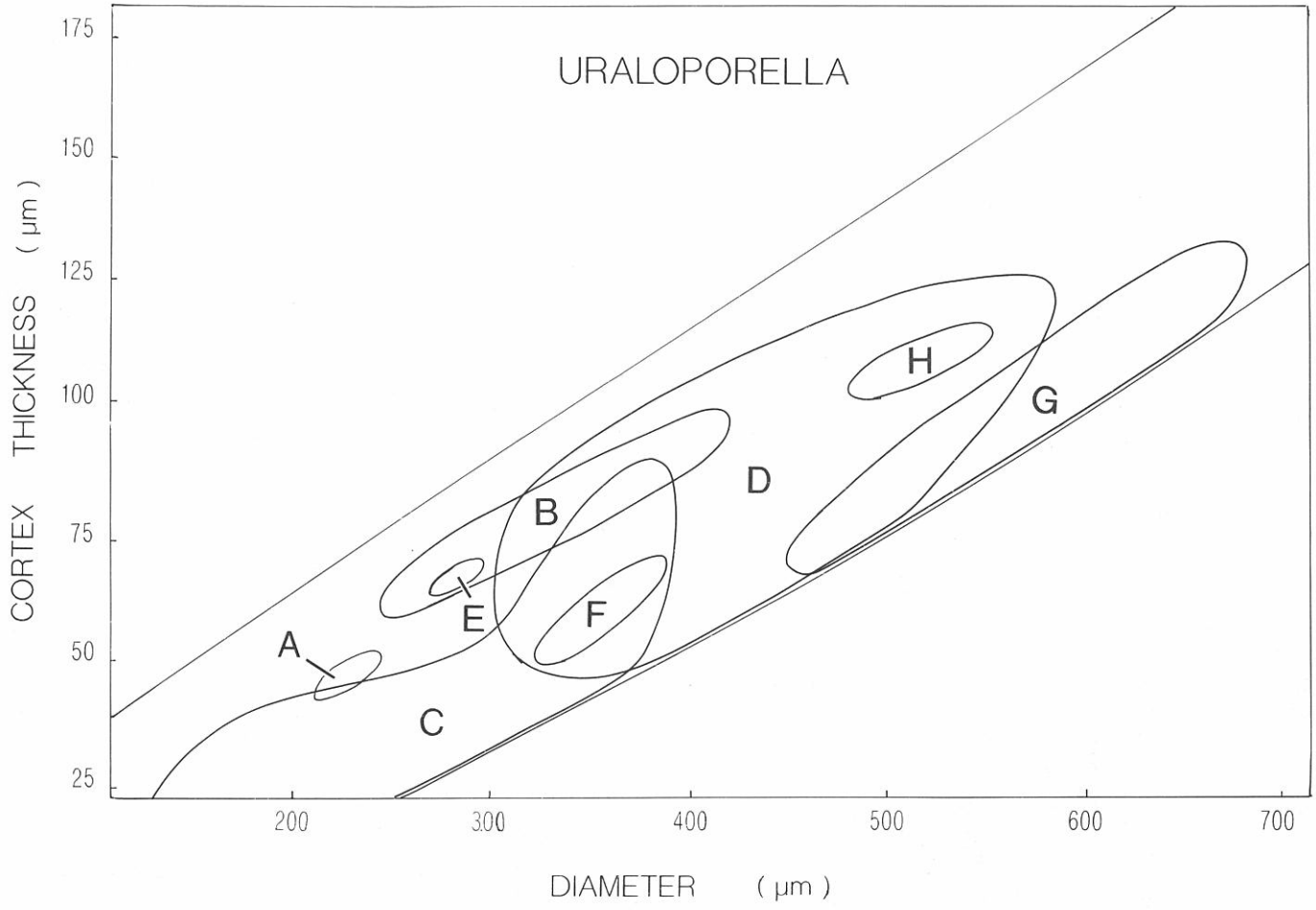



**Figure 4.** Ratio: diameter of thallus/thickness of cortex. Scatter envelope of results obtained for studied *Uraloporella variabilis* Korde 1950. Positions of published taxa: A, Holotype of Korde (remeasured on original material). B, Syntypes of Korde 1950. C, Material of the Canadian Arctic (Mamet *et al.*, 1987). D, *Uraloporella rara* Saltovskaya 1984. E, *"Samarella" setosa* Maslov and Kulik 1956. F, *"Samarella" massieuxae* Güvenç 1965. G, *Uraloporella sieswerdai* Rácz 1966. H, *Uraloporella radiata* Saltovskaya 1984. The scatter envelope of the spanish material is derived from Fig. 2.

## CONCLUSIONS

It is worth emphasizing that designation of a single holotype is requested by the Code of Botanical Nomenclature for validation of species erected since 1959. The aim is to stabilize nomenclature. But the principle is also debatable, when applied to material observed in thin-sections, which give a two-dimensional view of three-dimensional objects. For a long time, algologists such as Maslov, Pia, Johnson, Endo used numerous syntypes to illustrate their taxa, without necessarily designating a single holotype. This practice is now considered invalid, but at least it gave a clear vision of the taxon. Many modern taxa have been established on the basis of a single random holotype. They are "legal", but of little use. Syntypes or isotypes are not requested by the Code. They are truly essential for taxa erected from thin-sections.

It is probable that many extant "legal" species of beresellids are artificial. Further study of *in situ* boundstones would certainly drastically reduce the pseudo-diversity of such important algal builders as *Donezella, Beresella or Dvinella.*

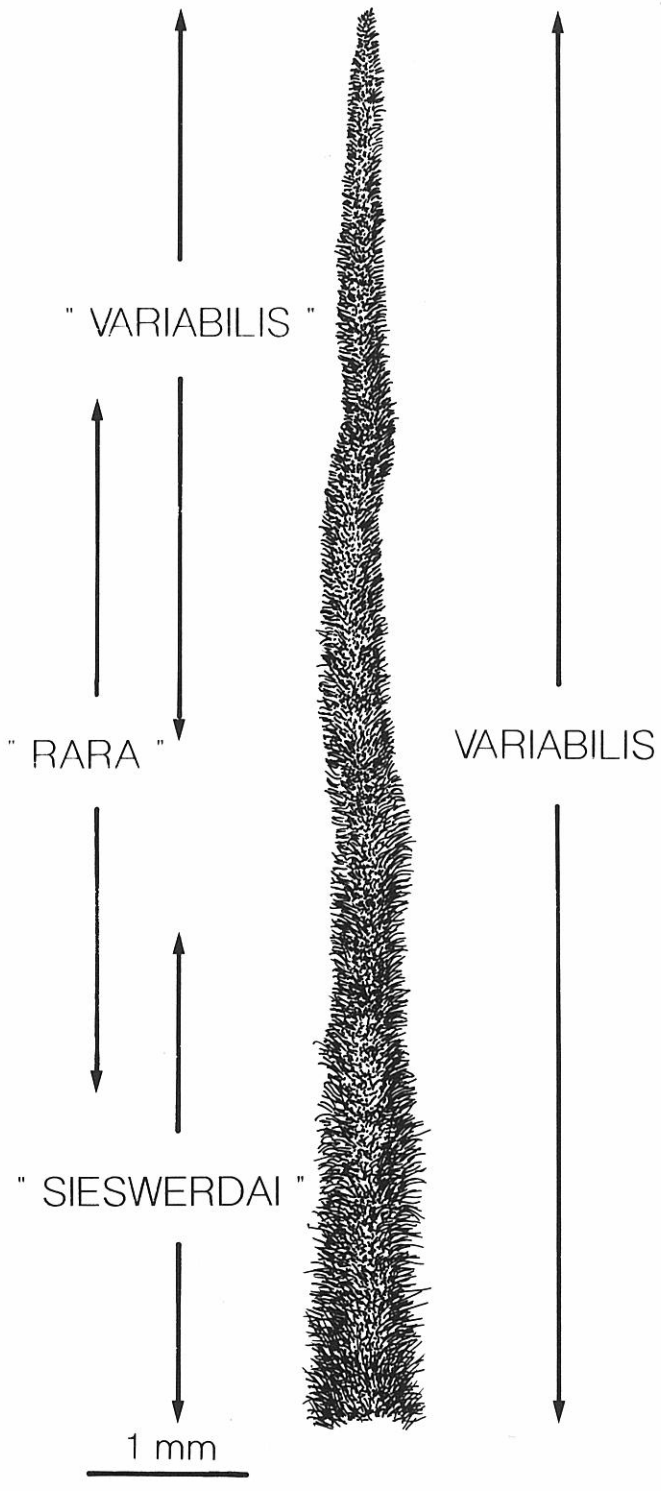



**Figure 5.** Reconstruction of *Uraloporella variabilis* Korde 1950. The three species reported in the literature and our interpretation.

## ACKNOWLEDGMENTS

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