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*, *sieswerdaia*) 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 (Moscovíense 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*, *sieswerdaia*) son en realidad variedades de un mismo taxón, *Uraloporella variabilis* Korde, 1950.

Palabras clave: Algas fósiles, beresellidas, taxonomía, Moscovíense.

**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 characterized 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 referring 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.
Riseriella sp.
Bradyina sp.
Bradyinellides sp.
Calcevertella sp.
Calcitornella sp.
Claracrusta? sp.
Climecanmina sp.
Cuneipycus sp.
Deckereilla sp.
Dvinella sp.
Endothyra sp.
Enotheana sp.
Eostaffella sp.
Epimastopora sp.
Fusulinella cf. meridionalis Rauser, 1951
Fusulinella ex gr. praebocki Rauser, 1951
Globivabulina sp.
Haplophragmina sp.
Heroidea sp.
Insolentitheca sp.
Konia sp.
Monotaxineoides sp.
Nostoeites sp.
Oxawinella sp.
Pseudobradyina sp.
Pseudokomasia sp.
Pseudokomasia sp.
Pseudopalarospiroplactamina sp.
Pseudostaffella sp.
Schubertella ex gr. obscura Lee & Chen, 1930
Staffella sp.
Syprania sp.
Tettitectaxis sp.
Tubentina sp.
Tubiphytes sp.
Ungarella sp.
Uraloporella sp.

Age: Upper Moscovian (equivalent to the lower or middle part of the Podolsky horizon), Zone 25 of Manet (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 Pseudokomasia, we will concentrate here on the taxonomy of Uraloporella.

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**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 PALAEOSPONGINOCALDALEES Shuysky, 1985
Tribe Berezellece? Maslov and Kulik, 1956
or tribe U vaporollace? Shuysky, 1985
Genus U vaporollae Korde, 1950

Type species: U vaporollae variabilis Korde, 1950

1950 U vaporollae Korde, O. D., 570-571.
1956 Samaraella Maslov and Kulik, O. D., 127.
1963 U vaporollae Korde; Korde, 211.
1964 Samaraella Maslov and Kulik; Kulik, 1648.
1965 Samaraella Maslov and Kulik; Güvenç, 847.
1966 U vaporollae Korde; Rez; 8, 191.
1974 U vaporollae Korde; Riding and Zansae 415-421 pars; Pl. 2, Figs. 1-4, non Pl. 1. Figs. 1-6 (=Jansae). 1975 U vaporollae Korde; Manet and Roux, 141-1490.
1975 non U vaporollae Korde; Maksheva, 84-85.
1976 non U vaporollae Korde; Riding and Zansae, 805-806.
1977 U vaporollae Korde; Vachard pars, 132.
1978 non U vaporollae Korde; Kaminsczak and Golding, Pl. 1 c.
1979 non U vaporollae Korde; Faber and Riding, Figs. 4, 5.
1981 Samaraella Maslov and Kulik; Zadorodnijuk, 10.
1981 U vaporollae Korde; Rauser-Chernousova and Koroljuk, 163-164.
1982 non U vaporollae Korde; Wighton, 151-152.
1984 U vaporollae Korde; Saltovskaya, 19-20.
1985 U vaporollae Korde; Roux, 574-575.
1987 U vaporollae Korde; Manet, Roux and Naaschak, 39.
1987 U vaporollae Korde; Delprat, Pl. Figs. S, 9.
1987 U vaporollae Korde; Shuysky, Pl. 16, Figs. 14 (=Saltovskaya 1984).
1991 U vaporollae Korde; Manet, 434.
1991 U vaporollae Korde; Vachard, Fig. 5U.

Diagnosis: Thallus cylindrical, elongate, unsegmented. Cortex perforated by numerous aspynoid, 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: U vaporollae is considered by most Russian palaeontologists as a beroellid. However, Shuysky erected in 1985 the tribe U vaporollae to separate thalli with continuous or discontinuous bundles of pores. He includes in his new tribe, U vaporollae, Janasae, Nanosae, Samaraelia, Berezellea, Konkata and Ziedela. Jansae has true partitioning of the thallus, thus does not fit the concept. Nanosae is a Salpingoporellinae Bassoulet et al., 1979 (Deloffre, 1988). Samaraelia is synonymous with U vaporollae (Rauser-Chernousova and Koroljuk, 1981, Manet et al., 1987). Esanoporella needs revision, but could have free functional pores (Manet, 1991). The Cambrian Kandata (and the Kandataeae) are not chlorophytes. Only Ziedela 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: U vaporollae has caused some confusion, as the original interpretations were rather sketchy. This is unfortunate, as the original material of Korde is remarkably well fossilised, 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 (Manet and Roux, 1975) and re-definition by Rauser-Chernousova and Koroljuk (1981).

If the taxonomy was debatable, so were the attributions. Riding and Zansae (1976) and Riding (1977) considered the taxon as a foraminifer, but no proloculum has ever been encountered. Termiet et al., 1977 considered U vaporollae as a hypercalcified sponge (Moravamminia), but the presence of an original coating contradicts this hypothesis. Wright (1982) called U vaporollae a microporiferan, but his Devonian material is not even related to the beroellids.

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, Manet et al., 1987. Deloffre, 1988, Bogush et al., 1990, and Manet, 1991. Vachard (1991) departed from his earlier attributions and now considers the genus as problematic.

Species attributed in the literature to U vaporollae:
U. aurelia Vachard 1977; reported to Ziedela by Saltovskaya (1984).
U. lutesis Makakhova 1975; transferred to Ziedela by Saltovskaya (1984).
U. massicae Güvenç (1969) (=Samaraelia); reported with doubt to U. varibasis by Manet et al. (1987).
U. radiata Saltovskaya 1984; transferred to U. varibasis (this article).
U. rara Saltovskaya 1984; transferred to U. varibasis (this article).
U. setosa Makakhov and Kulik 1956; synonym of U. varibasis for Manet and Roux 1987.
U. sten wastewater Rach 1966; transferred to U. varibasis (this article).

Stratigraphic distribution and mode of life: The genus is usually associated with the beroellid Berezellea and Dunellia. Komia and U vaporollae 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
perforated by a profusion of pores. Thus, it is usually observed as fragments, even in rather calm environments.

The known range is Late Nummulite to Early Permian. Spain, Turkey, Russian Platform, Ural, Donbass, Kazakhstan, Siberia, China, Canadian Arctic, Alaska. It is one of the most prolific algae of the Carboniferous “Arctic”.

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

1950 *Uraloporella variabilis* Korde, O. D., 570-571, Fig. 3 (a, b).
1956 *Samarella setosa* Moslov and Kulik, O. D., 127, Fig. 14.
1960 *Uraloporella variabilis* Korde in Osyov Paleontol. R, 211, Pl. 17, Fig. 7.
1964 *Samarella setosa* Moslov and Kulik, 1648, Pl. 8, Fig. 9.
1965 *Samarella massiacea* Gîveneț, O. D., 847, Pl. 32, Figs. 6-8, text-fig. 3.
1966 *Uraloporella stiewendai* Racz “1964”, 101, Pl. 4, Fig. 8, Pl. 5, Figs. 1-2.
1971 *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 *Uraloporella variabilis* Korde; Mamet and Roux, 855-806, text-fig. 1.
1979 *Uraloporella variabilis* Korde; Faber and Riding (139-145), Figs. 4, 5.
1979 *Samarella setosa* Moslov and Kulik; Zadomnijkhi, 10, Pl. 2, Fig. 6.
1981 *Uraloporella variabilis* Korde; Rauser-Chernousova and Koroju, 164, Pl. 3, Figs. 4, 5.
1982 *Uraloporella variabilis* Korde; Wright, 151-152, Figs. 1, 2.
1984 *Uraloporella radiata* Sal'tovskaya, O. D., 21-22.
1984 *Uraloporella radiata* Sal’tovskaya, 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.

**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, Synotypes of Korde 1950. C, Material of the Canadian Arctic (Mamet et al., 1987). D, *Uraloporella radiata* Sal’tovskaya 1984. E, *Samarella setosa* Moslov and Kulik 1956. F, *Samarella massiacea* Gîveneț 1965. G, *Uraloporella stiewendai* Racz 1966. H, *Uraloporella radiata* Sal’tovskaya 1984. The scatter envelope of the Spanish material is derived from Fig. 2.

**Extended 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-four 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-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. stiewendai* Racz. Indeed, in the abundant *U. variabilis* material studied in the Canadian Arctic and Northern Russia, diameters ranged between 150-300 μm. *U. stiewendai* illustrated by Racz was notably bigger.

Publication by Sal'tovskaya in 1984 of *U. rario* was of great importance, as it proved the existence of conceptacles. But it was also puzzling as it bridged *U. variabilis* and *U. stiewendai*.

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 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 extended accordingly and a reconstruction of the taxon is presented in Fig. 5.
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 Dovinella.

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