

## Variations in abundance and morphology of *Watznaueria britannica* and *W. barnesiae* coccoliths in the Volgian sediments of the Ivkino section, Russian Platform

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Volgian black shales (Upper Jurassic) are documented in many areas of the Russian Platform. The widely known Gorodishche and Kashpir sections display many short hiatuses in this interval. The Ivkino section (Unzha River, left tributary of Volga River, Kostroma Oblast) seems to be more complete and shows sedimentary contrasts. Middle Volgian deposits (6 m) are made up of a rhythmical alternation of black shale (BS) and claystone/marlstone layers. Nannofossil assemblages of the Ivkino section significantly differ from those of the Gorodishche and Kashpir sections, where boreal *Stephanolithion atmetos* and *Crucibiscutum salebrosum* and high-fertility *Biscutum constans* and *Zeughrabdotus erectus* are found (Kessels *et al.*, 2003). In the section studied, the two first species are absent; the other species are common in underlying Kimmeridgian sediment (up to 28 and 12% respectively), but become almost absent in Volgian deposits (<1%). Nannofossil assemblages are mainly composed of *Watznaueria* spp. (*W. barnesiae/fos-sacincta*, *W. britannica/communis*, *W. ovata*, *W. manivittiae*) forming up to 70% of the total nannofossil assemblage in the lower part of the sequence and up to 98% in its upper part. The occurrence of this oligospecific assemblage, showing moderate preservation, seems to be caused by primary effect rather than by diagenetic impact. Successive occurrence of unique specimens of *Conusphaera mexicana*, *Polycostella beckmannii* and *Helenea chiastia* approximately mark the NJ20A-B and NJKA zones.

*W. britannica* quantities strongly decrease at the base of the Volgian sediments (from 40-50 to 15-20%), but its abundance slightly increases in isolated BSs and toward the top of the sequence, while *W. barnesiae* shows an inverse trend, reaching 85% of the total assemblage in the lower part of the sequence and decreasing in the BSs. To define morphological variation in different *Watznaueria* groups as a response to paleoecological changes during BSs accumulation, biometric measurements, including lengths and widths of coccoliths and of central opening, were made on 100 specimens of *W. barnesiae* and *W. britannica* groups, using digitally-captured images in light microscope. There are no significant changes in *W. barnesiae* size and ellipticity from the Kimmeridgian toward the top of the Volgian sediments. This implies an extreme r-selection mode for this taxon. *W. britannica* displays a rather narrow continuum of both coccolith length ( $L_c = 5.0-8.2 \mu\text{m}$ ) and proportion of coccolith and central opening lengths ( $L_c/L_o = 2.8-5.5$ ) in Kimmeridgian sediments. This continuum is interrupted in Volgian sediments, where two different *W. britannica* morphotypes occur. One of them is represented by small coccoliths ( $L_c = 3.5-5.0 \mu\text{m}$ ) with narrow central openings ( $L_c/L_o = 5.0-7.7$ ); the second mor-

photype is represented by large coccoliths ( $L_c = 6.0-9.8 \mu\text{m}$ ) with a large central opening ( $L_c/L_o = 2.2-4.1$ ). Ellipticity of *W. britannica* does not change significantly from Kimmeridgian to Volgian sediments. The lack of transitional forms between the two morphotypes likely indicates their different life-strategies or the affinity for different habitats, *e.g.* different depths in a stratified water column. Relative increase in number of *W. britannica* group toward the top of the BS sequence implies its high adaptive potential under increased fertilization during BS accumulation.

### References

- Kessels, K., Mutterlose, J. & Ruffell, A. 2003. Calcareous nannofossils from late Jurassic sediments of the Volga Basin (Russian Platform): evidence for productivity-controlled black shale deposition. *International Journal of Earth Sciences*, **92**(5): 743-757.