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Microanalyzes of remarkable microfossils of the Late Mesoproterozoic–Early Neoproterozoic

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The Late Mesoproterozoic–Early Neoproterozoic is an important period to investigate the diversification of early eukaryotes [1]. Following the first appearance of red algae in the Late Mesoproterozoic, other (morphological or molecular) fossils of crown groups are recorded during the Early Neoproterozoic, including green algae, sponges, amoebozoa and possibly fungi. Other microfossils also includes unambiguous eukaryotes, including several distinctive forms for that time period, such as the acritarchs *Cerebrosphaera buickii* (∼820–720 Ma)*, Trachyhystrichosphaera aimika* and *T. botula* (1100-720 Ma), and the multicellular eukaryotic *problematicum* taxon *Jacutianema solubila* (1100–?720 Ma). To further characterize the taxonomy of these microfossils and to test hypotheses about their possible relationships to crown groups, we combine analyzes of their morphology, wall ultrastructure and microchemistry, using optical microscopy, Scanning and Transmission Electron microscopy (SEM and TEM), as well as Raman and FTIR microspectroscopy respectively.

Cerebrosphaera populations from the Svanbergfjellet formation, Spitsbergen, and from the Kanpa Formation, Officer Basin, Australia, include organic vesicles with dark and robust walls ornamented by cerebroid folds [2]. Our study shows the occurrence of complex tri- or bi-layered wall ultrastructures and a highly aromatic composition [3].

The genus *Trachyhystrichosphaera* includes various species characterized by the presence of a variable number of hollow heteromorphic processes [2]. Preliminary infrared microspectroscopy analyzes performed on two species, *T. aimika* and *T. botula,* from the 1.1 Ga Taoudeni Basin, Mauritania, and from the ∼1.1 - 0.8 Ga Mbuji-Mayi Supergroup, RDC, indicate a strong aliphatic and carbonyl composition of the wall biopolymer, with some differences linked to thermal maturity between the two locations. TEM is also performed to characterize the wall ultrastructure of these two species.

Various morphotypes of the species *Jacutianema solubila* from the Svanbergfjellet Formation, Spitsbergen and from the Taoudeni Basin, Mauritania, are also characterized with infrared and Raman microspectroscopy as well as with TEM, permitting to test a previous hypothesis proposing that *Jacutianema* represents part of the life cycle of a Vaucherian alga [4].

Deciphering the identity of these distinctive microfossils will improve our understanding of the timing and pattern of eukaryote stem and crown group diversification in the mid-Proterozoic, prior to large “snowball Earth” glaciations and during time of changing ocean chemistry.

[1] Knoll *et al.* (2006) Philos. *Trans. R. Soc. B* 361 1023-1038 [2] Butterfield *et al.* (1994) *Fossils and Strata* 34 82p [3] Cornet *et al.* (in preparation) [4] Butterfield (2004) *Paleobiology* 30 (2), 231-25