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| Early eukaryote evolution: microanalyses 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, prior to large “snowball Earth” glaciations and during time of changing ocean chemistry and supercontinent formation and breakup. Proterozoic fossils related to crown group eukaryotes include red algae, green algae, amoebozoa, putative fungi, and the first animals (Knoll et al, 2006; Butterfield, 2015). However most Proterozoic microfossils of unambiguous eukaryotes remain unidentified, and include biomineralized scales, vase-shaped microfossils, macroscopic remains, and microscopic organic-walled vesicles (acritarchs). The latter includes distinct forms such as ~820-720 Ma *Cerebrosphaera buickii,* 1100-720 Ma *Trachyhystrichosphaera* *aimika, T*. *botula*, and the multicellular 1100-720 Ma *Jacutianema solubila*. To characterize the taxonomy of these microfossils and test hypotheses about their paleobiology, and possible relationships to crown groups, we combine analyzes of their morphology, wall ultrastructure and microchemistry, using optical microscopy, Scanning and Transmission Electron microscopy (SEM, TEM), and Raman and FTIR microspectroscopy respectively.

*Cerebrosphaera* from the Svanbergfjellet Fm, Spitsbergen and the Kanpa Fm, Officer Basin, Australia, include organic vesicles with dark robust walls ornamented by cerebroid folds (Butterfield *et al.,* 1994). Our study shows the occurrence of complex tri or bi-layered wall ultrastructures, confirming the eukaryotic nature of these microfossils, and a highly aromatic composition.

The genus *Trachyhystrichosphaera* includes species characterized by the presence of a variable number of hollow heteromorphic processes (Butterfield *et al.,* 1994). FTIR microspectroscopy analyzes performed on the two speciesfrom the 1.1 Ga Taoudeni Basin, Mauritania, and the ~1.1-0.8 Ga Mbuji-Mayi Supergroup, RDC, indicate a strong aliphatic and carbonyl composition of the wall biopolymer. TEM permits to characterize the wall ultrastructure on these two species and morphometric analyze constrain their morphological diversity and plasticity.

Various morphotypes of the species *Jacutianema solubila* from the Svanbergfjellet Fm, Spitsbergen and from the Taoudeni Basin, Mauritania, are also characterized using microspectroscopy and electronic microscopy techniques to test previous hypothesis proposing that *Jacutianema* represents part of the life cycle of a Vaucherian alga (Butterfield, 2005).

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| **References** |
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