Early eukaryotes: insights from microanalyses of proterozoic microfossils

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The late Mesoproterozoic–early Neoproterozoic is an important period to investigate the diversification of early eukaryotes through changing global conditions. Although proterozoic fossils related to crown group eukaryotes are known [1,2], most microfossils of unambiguous eukaryotes remain unassigned to a particular clade. Among these, organic-walled microfossils include distinct forms such as ~820-720 Ma-old *Cerebrosphaera globosa*, 1100-720 Ma-old *Trachyhystrichosphaera aimika, T. botula*, and the multicellular 1100-720 Ma-old *Jacutianema solubila*. To characterise the taxonomy, the paleobiology and possible relationships to crown groups, we combine analyses of their morphology, wall ultrastructure and microchemistry, using optical and electron (SEM and TEM) microscopy and Raman and FTIR microspectroscopy.

Cerebrosphaera specimens from the Svanbergfjellet Fm (Spitsbergen) and the Kanpa Fm (Officer Basin, Australia) include vesicles with dark robust walls ornamented by cerebroid folds [3]. Our study shows the occurrence of complex tri or bi-layered wall ultrastructures, confirming the eukaryotic nature of these large ornamented microfossils, and a highly aromatic and recalcitrant biopolymer composition.

The genus *Trachyhystrichosphaera* is characterised by the presence of a variable number of hollow heteromorphic processes [3]. FTIR microspectroscopy performed on specimens from the Taoudeni Basin (Mauritania), and the Mbuji-Mayi Supergroup (RDC) indicates a strong aliphatic and carbonyl composition of the wall biopolymer. Morphometric analyses realised on 360 specimens of Mauritania allowed us to constrain the diversity and morphological plasticity of the genus. TEM permits to characterise the ultrastructure of the genus.

Various morphotypes of the species *Jacutianema solubila* from the Svanbergfjellet Fm (Spitsbergen) were observed by TEM. They show a complex wall ultrastructure comprising oblique sub-units, and a variable wall thickness. FTIR analyses show complex spectra dominated by aliphatic functional groups. These data will allow us to test previous hypotheses about its taxonomy.

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