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Evolution of photosynthesizing organisms- from microbiota to plants / Oral

Mesoproterozoic is a time of increasing diversity of microscopic life and appearance of intricate new cell morphologies. First eukaryotes may have evolved around 2.4 Ga, but the first microbiota with intricate sculpture and ornamentation are found in the younger, 1.8-1.6 Ga successions worldwide. Such microfossils were uncovered from the Ruyang Formation in Shanxi, China and Roper Group, Northern Territories, Australia, dating back to 1.6-1.0 Ga ago. Some of these unicellular organic-walled fossils share characters with Ediacaran and Phanerozoic fossils, as well as extant green microalgae. Key characters among some Precambrian acritarchs are acetolysis-resistant vesicle with multi-layered walls; vesicle ornamentation by diverse processes that are produced during cyst formation; and excystment openings for the release of gametes or daughter-cells. Combination of these morphological elements, also present in extant phytoplankton, reflects the fossils’ protective function as reproductive cysts, indicating that complex life cycles and reproduction were well under way in Mesoproterozoic. Several case studies of microfossil morphology likely induced by intrinsic eukaryotic mechanisms are presented. Distinctive vesicle wall composed of the primary layer reinforced by polygonal platelets in Mesoproterozoic taxa *Dictyosphaera* and *Shuiyouisphaeridium*, as well as the sophisticated vesicle-wall patterning on the fossil sphaeromorphs *Valeria* and younger *Cerebrosphaera* would have required a certain degree of complexity for their formation, as observed in the present day analogues among eukaryotic protists. This suggests the activity of the key eukaryotic organelles and cellular mechanisms and signalling for the cyst formation. Considering that Golgi apparatus and the endoplasmatic reticulum are the organelles regulating eukaryotic secretory pathway and synthesis of biopolymers used in cell-wall construction, they would have been required for the complex morphology observed in these Precambrian taxa. Therefore, the presence of GA and ER in the eukaryotic cell is inferred at the minimum age of 1.6-1.4 Ga. Similarly, morphology of acritarchs of the Cambrian galeate plexus, namely openings with opercula, is likely induced by the activity of the LFA organelle (lid-forming apparatus) as in the extant dasycladalean alga *Acetabularia*. Additionally, several new morphotypes from the Ruyang Formation are presented. These unicellular fossils bear a velutinous outer membrane surrounding an internal sphere, which suggests a protective function of a reproductive or a resting cyst. Cyst-like morphology varies in disparity, but its key features are consistent through Mesoproterozoic, Neoproterozoic and early Palaeozoic.