

Diversity of acritarchs from the 3.0 Ga Farrel Quartzite, Pilbara Craton, Western Australia

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Among reported Archean microfossils, assemblages from the 3.0 Ga Farrel Quartzite and the 3.4 Ga Strelley Pool Formation in the Pilbara Craton of Western Australia are particularly important. They are morphologically diverse, including small and large spheroids (5~60 μm in diameter), “films” up to 300 μm across, thin and thick filaments (1~10 μm in width), and lenses from 20 to 100 μm across. The biogenicity of these microfossils, particularly lenses, has long been subjected to skepticisms, as their size and morphological complexity are unexpected for the early Archean “primitive” life. However, through multidisciplinary studies performed by over 20 researchers from 6 countries have demonstrated the biogenicity of lenticular microfossils. Here new image data of the Farrel Quartzite microfossils obtained by acid maceration are presented, providing further evidence for biogenicity and morphological diversity. Extracted microfossils include large flexible spheroids with thick or thin wall, paired lenses, linearly arranged multiple lenses, two dimensionally arranged lenses, three-dimensionally connected small rigid spheroids, and others. Their Raman spectra are identical to those obtained for carbonaceous clots and microfossils in petrographic thin sections, indicating that they are not contaminants. Abundant paired lenses corresponding to sequence of ordinary binary fissions are consistent with biogenicity and inconsistent with alternative interpretation that they are lenticular colony or biofilm-coated volcanic vesicles. This study also provides firm evidence for that each morphological type (e.g., small spheroid, large spheroid, and lens) is composed of multiple taxa as implied from examination of petrographic thin sections. Biotic diversity and preservation of the Farrel Quartzite microfossils are outstanding and may transform our images of Archean life.

Figure 1. a) Large spheroid with thick flexible wall; b) Two dimensionally arranged colony of lenses; c) Paired lenses; d) Tripled lense; e) Cluster of rigid small spheroids; f) Paired lenses associated with small spheroids. Scale bars = 50 μm .

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