Preriminary report of Archean (3.0 Ga) large sphaeromorph acitarchs from the Pilbara Craton, Western Australia

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Palynomorphs are microfossils that consist of organic walls and shells and are extracted from host rocks by maceration (decomposing with hydrofluoric acid at room temperature). Palynomorphs are important research targets in Precambrian evolutionary biology and paleontology, especially in the Proterozoic. Some of them have been considered eukaryotic based on their surface and cross-sectional fine structures and projections [1], but most of them are grouped together as acritarchs with unknown biological affinities. However, as modern microbes capable of producing acid-resistant walls are limited to cyanobacteria and eukaryotes, many researchers have accepted that acritarchs could be eukaryotes or cyanobacteria. Cyanobacteria are thought to have appeared at least 2.7 billion years ago, and eukaryotes about 2 billion years ago [2, 3]. On the other hand, various palynomorphs have been extracted from strata older than 3 billion years [4], and doubts about the above interpretation could arise.
Based on the above background, in this presentation, we report on Archean sphaeromorph acritarchs. A representative example of sphaeromorph acritarchs is the genus Leiosphaeridia, which is spherical to elliptical in shape, reaches several tens to 300 micrometers across. This acritarch is abundantly described from the Proterozoic successions. Specimens with an aparture, central opening, and/or geometric patterns on the wall are assumed to be eukaryotic cysts, and in extension those without such features have also been speculated to be eukaryotic. However, Leiosphaeridia-like acritarchs have been described also from the Archean successions (3.2 and 2.5 billion-years-old strata in South Africa) [5, 6], and the authors also discovered from the ca. 3.0 billion-years-old Farrell Quartzite in Western Australia [1]. They are abundantly present in carbonaceous black cherts, together with microfossils of the other morphotypes (lens, film, filament, and small spheroid). Notably, some appear to have aparture and central opening. Thus, the following questions would arise.

1) Could the presence of aparture or central opening be diagnostic as eukaryotic cysts?
2) Are Leiosphaeridia with and without aparture or central opening the same taxon?
3) Are Archaean Leiophaeridia-like fossils eukaryotes or cyanobacteria?
4) Are the Proterozoic Leiophaeridia and those of the Archean phylogenetically related or not?

Challenging such questions should deepen our understanding of the early evolution of life in the Precambrian. In this presentation, I would first like to report on the occurrence and morphological characteristics of Archean Leiosphaeridia-like fossils, focusing on those of the Farrell Quartzite.

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