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Organic-walled flanged microfossils from the 3.4 Ga Strelley Pool Formation in the Pilbara Craton, Western Australia

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The Strelley Pool Formation (SPF) in the Pilbara Craton, Western Australia is known to contain well-preserved and morphologically diverse stromatolites. Recently we discovered fossil-like microstructures from the four remote localities of this formation. The structures are present in carbonaceous black chert associated with evaporite and stromatolite, at the upper horizon of SPF. They are morphologically diverse, including film-like structures (possible fragmented biofilm), spheres, filaments, and lenses. Another assemblage of possible microfossils, which are morphologically distinct from ours, was reported also from sandstones at the lower unit of SPF. The most enigmatic and thus most important microfossil type among them is the lens-like one with flange-like appendage along the equatorial plane (the photo shows the polar view). Many of them are 40 to 60 microns along the major dimension and rarely up to 120 microns, and have thickness at the center is generally 2/3 of the major dimension. Their sizes are significantly larger than those of the majority of prokaryotic cells. In addition to the solitary occurrence, the structures more commonly occur as colony-like clusters and chain-like composite structures, probably corresponding to their reproducing, one of fundamental functions of life. Carbon isotopic values of individual structures range -35 to -29 per mil. These lines of evidence indicate that the structures are genuine microfossils. More recently, we successfully extract the lens-like microfossils by acid (HF-HCl) maceration. This indicates that the microfossils have acid-resistant organic wall, which has been paleontologically regarded as an important feature of eukaryotic algae and cyanobacteria. Such the microfossils extracted by acid-maceration are called ”acritarchs”. Since the oldest-known acritarchs are carbonaceous spheroids discovered from 3.2 Ga siliciclastic rocks in South Africa, our study put the oldest record of acritarch back 2 billion-years. At present, unfortunately, it is difficult to specify the biological affinity of these lens-like microfossils. However, it may be mentioned that the very ancient microfossils are morphologically quite similar to ”phycoma” of Prasinophyte (gleen algae) and similar microcfossils have been reported from the Paleozoic and the Proterozoic.

Keywords: Archean, Strelley Pool Formation, microfossils, chert