Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.17455

High resolution analysis of carbonaceous texture within lenticular microstructures from Archean Chert (Strelley Pool Formation - Farrel Quartzite) of the Pilbara Craton (Western Australia)

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Putative archean microfossils have been investigated with innovative approaches and techniques to assess their biogenicity and draw inferences on their possible taxonomic classification, metabolism, and environments[1,2]. Biomorphs mimic biological shapes, in natural environments or in laboratory experiments, and are examined to understand their origin[3]. In chert, organic matter mobilized through diagenesis or metasomatism may play a role on quartz crystallization[4] and may be deposited onto growth surfaces. The 3.4Ga Strelley Pool Formation (SPF, Pilbara Craton – W. Australia) yields the oldest undisputedly biogenic stromatolites[5]. Cherts units contain carbonaceous microstructures interpreted as putative microfossils[6]. Among those, lenticular microstructures are abundant, and occur in the younger 3.0Ga Farrel Quartzite (FQ) of the same craton[7]. The rocks have experienced metamorphism and hydrothermal fluid circulation that may have displaced indigenous and/or exogenous carbonaceous matter into/onto inferred microfossils or mineral biomorphs. Possible biogenicity was argued based on morphology[6], heterogeneities in carbon isotopic ratios between lenticular and other microstructures such as veins and some spheroids[1], and chemical composition[8].

Here we investigate lenticular microstructures from SPF and FQ cherts using high resolution petrographic techniques, to examine relationships of the carbonaceous textures to their host mineral matrix and to further assess their morphogenesis and possible biogenicity. Features and characteristics of each morphotype are detailed and documented. Lenses, in contrast with clearly abiogenic spheroids of the SPF[9], present either sub-continuous carbonaceous walls or reticulated carbonaceous fillings, localized at quartz crystal boundaries. In hollow specimens, some walls appear flexible and do not follow any identified quartz grain texture, consistent with possible microfossils. In contrast the carbonaceous structure of specimens with a reticulated inner texture may result from taphonomic alteration and/or diagenetic processes. Investigation of a possible morphological gradient between these end-member textures is required to fully assess the biogenicity of lenses.

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