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Abiotic formation of organic biomorphs under diagenetic conditions

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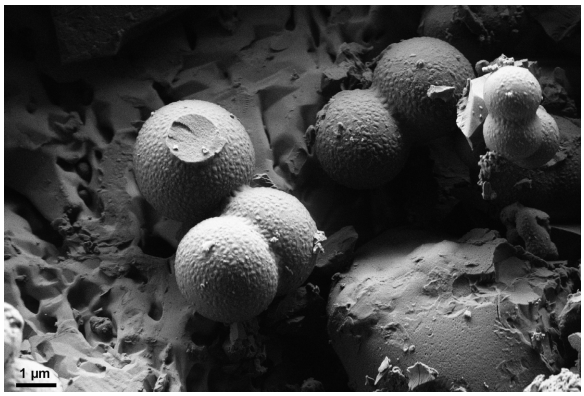

The fossil record offers a direct account of the evolution of Life on Earth, including unique information of the early evolution of eukaryotes which has likely taken place billions of years ago [1-4]. Yet, the early story of eukaryotes is not that easy to decode, as if it was told in an ancient language, with words that have vanished over time. A reason is that fossils of early eukaryotes are difficult to identify unambiguously, notably because most of ancient rocks have experienced a complex geological history responsible for the alteration of the initial cytological features of the organic microfossils that they may contain. Even size does not help: there is no shortage of ancient and modern eukaryotes with 1-3 µm cells, well within the prokaryotic size range. As a result, the identification of fossils of early eukaryotes only lies in the recognition of typically eukaryotic morphological/ultrastructural features [1-4]. However, by conducting laboratory experiment, we recently demonstrated that abiotic organic cell-like microstructures meeting all the criteria of biogenicity, even the most conservative ones, may form in cherts under classical conditions of diagenesis [5]. These organic biomorphs of about 2 µm in diameter were produced from a mixture of RNA and quartz exposed to temperature and pressure conditions (200°C, 15 bars, 20 days) in the presence of water. XANES investigations revealed a chemical nature quite similar to that expected for ancient microfossils. Because they exhibit morphological, chemical and even isotopic signatures typical of organic microfossils, the abiotic spheroidal organic biomorphs discussed here would logically be recognized as truly biogenic organic microfossils and could be identified as fossils of eukaryotes if found in ancient rocks. Altogether, the results of this study exemplify the pitfalls that may be encountered when searching for fossils of early eukaryotes in ancient rocks.

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[4] Javaux, Knoll & Walter (2003), *Origins of Life and Evolution of Biospheres* 33, 75-94.

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