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Carbonaceous cherts of the Daitari Greenstone Belt, Singhbhum Craton, India: A well preserved record of early life.

Jodder, J.[1] and Hofmann, A. [1]

[1]Department of Geology, University of Johannesburg, Auckland Park 2006, South Africa.
jaganmoyj@gmail.com

The volcano-sedimentary succession of the Daitari greenstone belt, Singhbhum Craton (India) is characterized by a typical Palaeoarchaean greenstone assemblage, felsic volcanics of which have been dated at 3.51 Ga [1]. Common volcanic rocks include komatiite, pillow basalt, and felsic volcaniclastic rocks. Sedimentary rocks are dominated by chemical precipitates of banded black and white chert, thinly bedded carbonaceous chert and BIF. The Daitari greenstone belt is the best preserved Palaeoarchaean succession from India, and has experienced low-grade metamorphism [1]. The different lithological units examined record a predominantly sub-marine environment of deposition. Detailed field and petrographic investigations indicate processes of alteration of the volcano-sedimentary succession common to the Palaeoarchaean [2]. Apart from silicification, carbonate replacement is widely observed within ultramafic rocks, now widely preserved as talc-carbonate schists. Sedimentary and volcanic rocks once present close to the seafloor are intersected by various chert–filled hydraulic fractures of varying dimension. Sedimentary chert horizons overly sea-floor alteration zones and they host potential signatures for the oldest habitat of early life in the form of well-preserved carbonaceous matter.

Carbonaceous matter preserved within the various chert units can be categorized based on its occurrence, association and also its abundance or rather concentration of carbonaceous aggregates. It is present as: (1) Composite carbonaceous grains represented by dense aggregates of sand-sized detrital carbonaceous particles. (2) Reworked carbonaceous clasts preserved within botryoidal silica precipitate. (3) Finely laminated carbonaceous layers with composite grains. The carbonaceous matter preserved within chert of the Daitari belt appears similar to the well-studied carbonaceous matter from the Buck Reef Chert (3416 Ma), Barberton greenstone belt, South Africa, in terms of textural, morphological as well as diagenetic relationships [3]. Field, petrographic, and geochemical studies suggest primary biogenic processes for the origin of carbonaceous matter preserved within the chert horizons from the Daitari greenstone belt. Microbial activity may have operated under conditions of low-temperature hydrothermal activity on the Palaeoarchaean sea floor.

References:

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