Early traces of life preserved in 3.51 Ga old cherts of the Daitari Greenstone Belt, India

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The Daitari Greenstone Belt (DGB) of the Singhbhum Craton in India contains a remarkably well preserved Palaeoarchaean volcano-sedimentary succession subjected to only low-grade metamorphism. Mafic-ultramafic and felsic volcanic rocks dated at 3.51 Ga using U-Pb in zircon are intercalated with chert, shale, and iron formation. Carbonaceous cherts are represented as laminated, granular, and banded black-and-white varieties. Petrologically and geochemically, the carbonaceous cherts of the DGB have close similarities with those from the Barberton belt, South Africa, and East Pilbara Craton, Australia, but predate those by several tens of millions of years.

Cherts of the DGB are associated with silicification of underlying volcanic rocks and show rare earth element signatures indicative of marine conditions and hydrothermal activity. Carbonaceous matter occurs as thin lamina and granular aggregates, and rarely preserves microbial morphologies, including spindle-shaped features. Total organic carbon (TOC) content of carbonaceous cherts ranges from 0.03-1.14 wt. %. Carbon isotopic compositions range from -34 to -21‰ VPDB. Occurrences of microfossil-bearing chert units associated with abundant OC and light $\delta^{13}C$ values indicate a biologically active marine habitat ~3.5 Ga ago.