Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18426

Discovery of chemosynthetic micro-fossils in the Indus ophiolite-hosted hydrothermal ophicarbonate veins

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Since the discovery of living chemosynthetic ecosystems associated with serpentinite-carbonate rocks in the deep ocean floor beyond the reach of sunlight, it is strongly believed that serpentinization triggered chemosynthesis is a key process to the origin of life. However, there is paucity of records of chemosynthetic life in ancient oceanic lithospheres or ophiolites. In this contribution, we report discovery of fossil chemosynthetic microorganisms in ophicarbonate veins associated with serpentinized peridotite of the Indus ophiolite, Ladakh Himalaya, NW India. The micro-fossils are characterized by microscopy, Raman spectroscopy and $\delta^{13}C$ values. The host ophicarbonates are found in ophiolite-associated peridotites and bear signature of fluid-rock interaction either on ocean floor or during ophiolite emplacement. Geochemical data are consistent with an origin from bicarbonate dominated fluid and inconsistent with incorporation of atmospheric carbon dioxide in subaerial contact with high pH waters of serpentinization. Strontium isotope ratios of 0.711452–0.712041 are consistent with serpentinization subsequently to emplacement of the ophiolite and by interaction with cretaceous seawater mixed with continental crust-derived fluid during Neo-Tethys closure. The predominance of lizardite and chrysotile in ophicarbonate veins as documented by Raman spectra also supports a low temperature serpentinization during ophiolite emplacement. The presence of hydrocarbon peaks in fluid inclusions in serpentinized olivine suggests that some of the dissolved inorganic carbon reacted with hydrogen released through oxidation of iron. The ophicarbonates and serpentines in peridotite of Indus ophiolite bear signature of a paleo environment for Fischer-Tropsch reactions during the last phase of Neo-Tethys closure.