Multiple carbon reduction pathways within serpentinized peridotites from the South-Western Indian Ridge and Northern Appenines ophiolites

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Large seawater circulation through fault and fracture leading to hydratation of the oceanic crust and serpentinization of the ultramafic rocks is chemically favorable to the reduction of carbon. Abiotic organic compounds can then be generated and locally accumulated serving as a base to sustain chemolithotroph ecosystems along with the byproducts of serpentinization and dissolved nutrients.

We present here the results of a set of high resolution micro-imaging and micro-analyzes techniques (SEM, Raman and FTIR spectroscopies, Synchrotron-based X-ray fluorescence and microprobe analyses) performed on serpentinized peridotites dredged along the South-Western Indian Ridge (MD183/Smoothseafloor cruise) and from ophiolites of the Northern Appenines (Italy). In both settings we identified the presence of organic aggregates forming discrete C-phases in strict association with peculiar mineral assemblages. A primary high-T paragenesis is characterized by lizardite and hydroandradite within bastititic replacement of olivine and orthopyroxene respectively. A secondary paragenesis show ferritchromite and hydroandradite rims around magmatic spinels and hematite+saponite. Associated organic compounds show an overall dominance of aliphatic and aromatic groups; however aggregates associated with high-T paragenesis are richer in C-O, C=O and C-N rich molecules, while aggregates associated with hematite are richer in aliphatic groups. The compositional and mineral differences are thought to reflect multiple pathways and mechanisms for carbon reduction and retention during fluid/rock interaction.