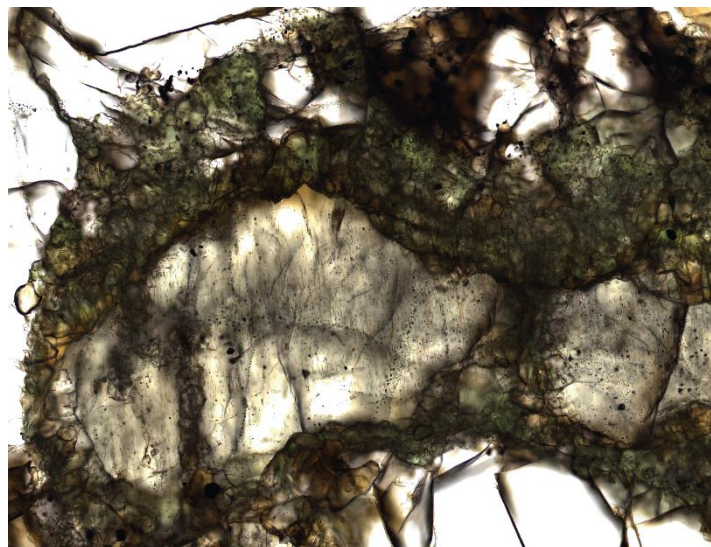


GMPV Seminar:**Monday 18 November 2024 at 4.30 pm, room U1-07 Marchetti****The role of metasomatized lithosphere in carbon cycling at ocean intraplate settings****Dr. Andrea Maffei**

University of Milano-Bicocca

Through a comprehensive petrological, fluid and melt inclusion, and thermodynamic analysis of spinel harzburgite and lherzolite xenoliths from Cape Verde, a Cl-P-S-F-volatile-rich alkaline silicate-carbonate metasomatic agent is shown to be present beneath ocean islands. Geobarometry indicates equilibration pressures from 16 kbar up to 35 ± 4 kbar (107 ± 13 km depth) within the aragonite stability field, confirmed by finding aragonite in harzburgite xenoliths. Thermometry yields temperatures of ~ 950 – 1060 °C for harzburgites and ~ 1140 – 1200 °C for metasomatic reaction coronas. Thermodynamic modeling shows that orthopyroxene–silicate–carbonate melt interaction in thick, depleted lithosphere can produce deep-seated CO_2 , explaining elevated CO_2 emissions in ocean islands. Multiphase fluid inclusions in orthopyroxene and olivine contain $\text{CO}_2 + \text{CO}$ (XCO from 0.19 to 0.01) and locally disordered graphite. The $\text{CO}_2 + \text{CO}$ mixture is strongly carbon-supersaturated and metastable due to graphite not precipitating before fluid entrapment, allowing calculation of fluid $f\text{O}_2$ in equilibrium with mantle $f\text{O}_2$. Fluid-derived $f\text{O}_2$ at 35 kbar and 1200 °C is low matching olivine–spinel $f\text{O}_2$ estimates in harzburgites. Furthermore, the metasomatic melt composition resembles experimental silicate–carbonate melts from carbonated sediments and oceanic crust, and similar melts in mantle xenoliths from other ocean islands, suggesting a common mechanism for mantle metasomatism and carbon cycling. Metastable fluid inclusion and Spl-Ol $f\text{O}_2$ data reflect the mantle's initial reduced state beneath Cape Verde. Comparison with equilibrium conditions reveal the elevated oxidizing capacity of sediment derived silicate-carbonate metasomatic melt, while allowing to gain a mechanistic understanding of such process.



Photomicrograph of peculiar metasomatic reaction corona around relict-fluid inclusion cluttered-orthopyroxene in a aragonite-bearing harburgitic xenolith.

The seminars are open to students, PhD students, Postdocs, and all the interested colleagues.