DISTRIBUTION OF CO_2 IN THE LITHOSPHERIC MANTLE BENEATH NORTHERN VICTORIA LAND (ANTARCTICA): INSIGHTS FROM PETROLOGY, FLUID INCLUSIONS CHEMISTRY AND X-RAY µCT IN MANTLE XENOLITHS

Casetta, F.[1], Rizzo, A.L.[2,3], Faccini, B.[2], Ntaflos, T.[1], Lanzafame, G.[4], Faccincani, L.[2], Mancini, L.[5], Giacomoni, P.P.[2], Coltorti, M.[2,3]

[1]Department of Lithospheric Research, University of Vienna, Althanstraße 14, 1090 Vienna, Austria
[2]Department of Physics and Earth Sciences, University of Ferrara, Via Saragat 1, 44122, Ferrara, Italy
[3]Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Palermo, Via Ugo La Malfa 153, 90146 Palermo, Italy
[4]Department of Biological, Geological and Environmental Sciences, University of Catania, Corso Italia 57, 95129 Catania, Italy
[5]Elettra-Sincrotrone Trieste S.C.p.A., s.s. 14 km 163,500 in Area Science Park, 34149 Basovizza, Trieste, Italy
e-mail: cstfrc@unife.it

Modelling the carbon cycle in Earth's deepest reservoirs is crucial for enhancing our comprehension of the evolution of our planet. In fact, geodynamic processes are intimately linked to the storage and mobility of volatiles in the Earth's mantle, as C-O-H species play an important role in driving melt extraction, metasomatism and refertilization. A powerful way to investigate where and how carbon is stored in the deep Earth, and especially in the Sub-Continental Lithospheric Mantle, is the combined application of petrology, fluid inclusions geochemistry and high-resolution imaging techniques to mantle-derived xenoliths.

In the present study, modally and/or chemically heterogeneous mantle xenoliths brought to the surface by Cenozoic lavas in northern Victoria Land (Antarctica) were investigated by means of mineral chemistry, fluid inclusions composition and 3D textural/volumetric characterizations of intra- and inter-granular microstructures performed by X-ray computed microtomography (µCT).

Fluid inclusions are volumetrically abundant in both olivine and pyroxenes, and often associated with inter-granular reaction zones. Olivine-hosted fluid inclusions have the lowest CO_2 concentrations, ranging from 0 to 39 µg(CO_2)/g(sample), while amphibole- and pyroxene-hosted FI are typified by the highest contents [up to 187.3 µg(CO_2)/g(sample)].

X-ray µCT was used to image and quantify the abundance, connectivity, and density of glass/fluid components as well as to speculate about their origin and relationships with the networks of secondary fractures, likely formed during decompression, that sometimes pervade the rocks. In general, glass/fluid components have tetrahedral to prismatic shape and sizes between 2 and 50 µm.

Together with mineral chemistry data and *T*-fO_2 models, fluid inclusions chemistry and X-ray µCT results were used to: i) model the storage and distribution of carbon in intra- and inter-granular zones in mantle xenoliths; ii) relate the occurrence/mobility of carbon to the melt extraction and enrichment episodes that affected the Sub-Continental Lithospheric Mantle beneath Antarctica; iii) understand the role played by fluids during the major geodynamic processes.