

Melt-rock reaction and late-stage melting in peridotite xenoliths from Marsabit (Kenya)

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Mantle metasomatism is widespread in mantle rock suites worldwide, highlighting the importance of melt- and fluid-rock reaction in the Earth's upper mantle. Styles of metasomatism can be very complex and include a wide variety of mineralogical and geochemical signatures, reflecting both, the nature of the initial metasomatising agent (carbonate or silicate systems, melt or fluid) and its evolution through reaction with the pre-existing mantle rock. Here, we present a study on variably metasomatised peridotite mantle xenoliths (from Marsabit, Kenya) that aims to constrain either of the above parameters by integrating results from textural and *in-situ* (LA-ICPMS, SIMS) geochemical analysis.

The investigated xenoliths are cpx-bearing cryptically metasomatised harzburgite (LREE, Li, B, U, and Th enrichment of cpx) and modally metasomatised cpx-free harzburgite and dunite. Metasomatic phases include amphibole, phlogopite, apatite, graphite and opx. Transitional samples show that metasomatism led to replacement of cpx by amphibole. Further, in all modally metasomatised xenoliths melt pockets (silicate glass containing silicate and oxide microlites and carbonates) occur in close textural relationship with the earlier metasomatic phases. Textural, major and trace element compositions and results from thermobarometry and fO_2 calculations indicate that the mineralogy and compositions reflect complex interplay between melt-rock reaction processes, trace element fractionation, pre-existing mantle heterogeneity and effects of changing P , T and fO_2 during one single metasomatising event. The metasomatising agent was a SiO_2 - Na_2O - CO_2 - H_2O -rich liquid (possibly a fluid). The unusual style of metasomatism (composition of amphibole, presence of graphite, formation of opx) reflects low P - T conditions (ca. 750-850°C at <1.5 GPa) in the wall rock during impregnation and locally low fO_2 . The latter allowed the precipitation of graphite from CO_2 . The Si-rich fluid possibly derived from alkaline basic melts by melt-rock reaction during Tertiary-Quaternary magmatism. Melt pockets formed during late melting of the earlier phases (mainly amphibole) shortly before or during xenolith transport in the host magma and was triggered by CO_2 -rich fluid infiltration.

Uraniferous carbonate rocks from Mt. Kithaeron, central Greece

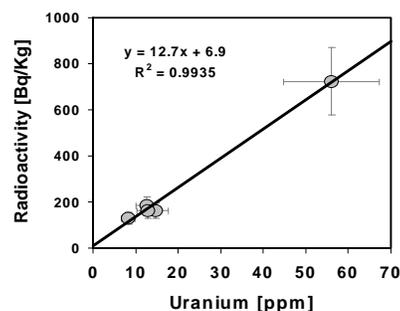
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The average abundance of U in carbonate sedimentary rocks is 2.2 ppm. Sandstones and shales contain 0.5 ppm and 3.5 ppm respectively while the typical U concentration in seawater is 3.2 ppb (Krauskopf and Bird 1994). Uranium in the oceans follows anoxic pathways and it is mainly removed from the water due to chemical processes taking place at the interface of organic-rich sediments. Uranium is therefore correlated to organic carbon whereas the diagenetic cycle of the element may include reduction of U(VI) to U(IV) related to sulfate bio-reduction (Mo *et al.* 1973, Klinkhammer and Palmer 1991). The concentration of U in marine carbonates from SE Europe and the eastern Mediterranean is reported to be in the region ca. 1 – 7 ppm. Here we present the occurrence of carbonate rocks, limestones and dolomitic limestones with variable organic content, from Mt. Kithaeron (central Greece) containing unusually elevated U concentrations up to ca. 56 ppm. We also present a relationship between the U content and radioactivity (see Figure below).



They are typical Alpine (Neotethyan) sediments, of likely Triassic age (according to existing paleontological data) belonging to the SubPelagonian zone of the internal Hellenides. The rocks were investigated using a combination of microscopic, spectroscopic and wet-chemical techniques. Our study revealed that U is probably associated to the non-carbonate part of the rocks (organic matter, Fe- and Mn-oxides, phosphates, etc.).

References

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