Metasomatism of the UHP Svartberget olivine-websterite body in the Western Gneiss Complex, Norway

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The Svartberget olivine-websterite is cut by fractures filled with websterites and garnetites. P-T estimates using standard geothermobarometric techniques cluster around 4.0 GPa at 800°C for the body and 5.5 GPa at 800°C for a fracture-filling websterite, confirmed by the presence of microdiamond. The bulk rock chemistry of the olivine websterite (wall rock) is intermediate between an ultramafic and mafic composition. Within the fractures a metasomatic column developed principally consisting of garnetite in the core and garnet-bearing phlogopite websterite towards the wall rock. Fluid immobile elements like Zr are transported to an extent that the garnetite in the core of the fractures have up to 300 ppm Zr. Age corrected initial $^{87}Sr/^{86}Sr$ ratios in the different metasomatic zones are clustering around 0.735. Even the most pristine remnants of the olivine-websterite (the wall rock) show signs of fluid/rock interaction e.g., in terms of high $^{87}Sr/^{86}Sr$ ratios (0.723). The most likely source for the metasomatic agent is the hosting felsic gneiss that shows many leucocratic pods and lenses. Samples from both gneiss and leucocratic lenses have Sr ratios as high as 0.750 and Zr contents up to 250 ppm.

In order to better understand the metasomatism of the Svartberget body numerical modelling is used to make a first order quantification of the dominant processes of element transport needed to produce the metasomatic column now present.

Is assimilation of sedimentary basement responsible for the temporal geochemical variations of Etna magmas?

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Mount Etna (Sicily, Italy) is located in a peculiar tectonic position between the colliding African and European Plates. The volcano is constructed on a 5 km thick succession of Meso-Cenozoic marine sediments (carbonate, marls and sandstones). Mt Etna volcanic rocks are characterized by complex spatial and temporal evolution. The oldest eruption products are of sub-alkaline tholeiitic lavas that evolved with time into Na-alkaline-type lavas. Many explanations have been brought forward to explain the geochemical composition, including mantle plume magmatism, subduction influenced magmatism and assimilation of crustal material. Although Etna belongs to one of the best studied volcanoes in the world, there is a lack of a complete data set on well dated rocks. In this new study we aim to disentangle the secular changes in composition by (1) obtaining precise Ar-Ar dates for good stratigraphic control, (2) investigating if assimilation of crustal material is an important process.

We present new major- and trace element Sr-Pb isotope data and precise Ar-Ar dates for 40 samples spanning the whole eruption history of Mt Etna. This sample set gives us for the first time precise stratigraphic control of processes occuring in the source of Etna and the magma chamber. We also analysed 10 sediments from the basement on which Etna is constructed. The sediments display significant variations in Sr and Pb isotopes ($^{87}Sr/^{86}Sr$=0.708-0.786, $^{206}Pb/^{204}Pb$=18.6-19.8). As previously reported by other studies, there is often Sr isotope disequilibrium between clinopyroxene and whole rock. In our study the maximum difference in $^{87}Sr/^{86}Sr$ between groundmass and clinopyroxene is 0.0002. This observation, coupled with detailed trace-element modelling, establishes that assimilation of material from the sedimentary basement is an important process. In addition, the precise Ar-Ar dates suggest that the role of crustal assimilation increases through time.