Metamorphic evolution of corundum-bearing metapelitic xenoliths in the contact zone of the Mte. Capanne monzogranite, Elba Island, Italy

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Elba Island, Italy, is located at the northern margin of the Tyrrhenian Sea and belongs to the Apennine Mountains. During the Miocene, this region was strongly affected by the Alpine orogeny and Elba Island became part of the Tuscan Magmatic Province. The subduction and collision of the Adriatic plate with Corsica Island led to the rollback of the lithospheric mantle slab, resulting in an extensional regime and enabling the uprise of asthenospheric mantle material (Dini et al., 2002). This caused the formation of various mantle and crustal melts.

The magmatic units of Elba Island occur within stacked tectonic complexes as several laccoliths, an extensive dyke swarm and a major plutonic centre (Mte. Capanne pluton). These are interpreted to represent the intrusive and extrusive melts of various mantle and crustal sources including their hybridisation products (Dini et al., 2002).

The western part of the Island is dominated by the Mte. Capanne pluton, a generally medium- to coarse-grained monzogranite consisting mainly of plagioclase + partially phenocrystic K-feldspar + quartz + biotite. Within the border zone of the pluton, mafic enclaves and less frequently, metapelitic xenoliths occur. Principally, the evolution of the Mte. Capanne body can be explained by combined AFC- and magma mingling processes (Frisch et al., 2008).

This study is based on the petrographic and petrological investigation of 15 drilled samples from 13 metapelitic xenoliths. All xenoliths occur as 4 to 10 cm long and 2 to 4 cm thick elongated bodies. They display a macroscopic metamorphic foliation of large amounts of biotite. The contact between the xenoliths and the host granite is generally sharp.

Their typical mineral assemblage is biotite + plagioclase + K-feldspar + quartz $\pm$ fibrolitic sillimanite $\pm$ corundum (in some cases blue sapphire) $\pm$ hercynite $\pm$ magnetite. However, the modal proportion of these phases varies systematically with distance from the surrounding granite. The equilibria between these phases mainly depend on temperature (T), oxygen fugacity (f_{O2}) and silica activity (a_{SiO2}). Obviously, the host granite did not only act as a heat source but also chemical exchange between granite and metapelitic xenoliths occurred.

By the combination of petrographic analysis and electron microprobe data on the present mineral phases, we will try to quantify the contact metamorphic evolution path of the xenoliths in terms of T, a_{SiO2} and f_{O2}. The results of this study will provide further insights into the detailed evolution of contact-metamorphosed corundum-bearing metapelitic rocks.

References

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