Apatite as indicator of magmatic ore fertility

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Context

Magmatic-hydrothermal ore deposits form due to metal precipitation from fluids that are released from magmas in upper crustal magma reservoirs. As the most important complex-forming ligand for many base metals, chlorine plays a key role in fluid-assisted metal extraction from magmas. Therefore, the chlorine budget of magmas has a large impact on their ore fertility. Apatite is a common accessory mineral in igneous rocks and often occurs as mineral inclusion in major rock forming silicate minerals. In the anion site of the crystal lattice of apatite, Cl-, F- and OH- can freely substitute each other and the abundance of Cl can be used as an indicator of the Cl concentration in the co-existing silicate melt and magmatic fluid phase. Therefore, the composition of apatite may be used as a proxy of magma fertility and may be the best source of information on magmatic volatile abundances in igneous rocks that do not contain usable silicate melt inclusions in minerals.

Aims and Methods

The primary objective is to quantitatively constrain the exchange coefficients of Cl-, F- and OH- between apatite and silicate melt. High-pressure experiments designed to crystallize small amounts of apatite in silicate melt – aqueous fluid systems will be conducted. Pressure and temperature conditions relevant for upper crustal magma reservoirs will be attained by using externally heated pressure vessel apparatuses. The composition of the silicate melt and the fluid phase will be systematically varied to allow the acquisition of an exchange coefficient dataset that facilitates the derivation of thermodynamic parameters. Run product glass and apatite compositions will be determined by electron microprobe, and the data will be interpreted in a thermodynamic framework.

References

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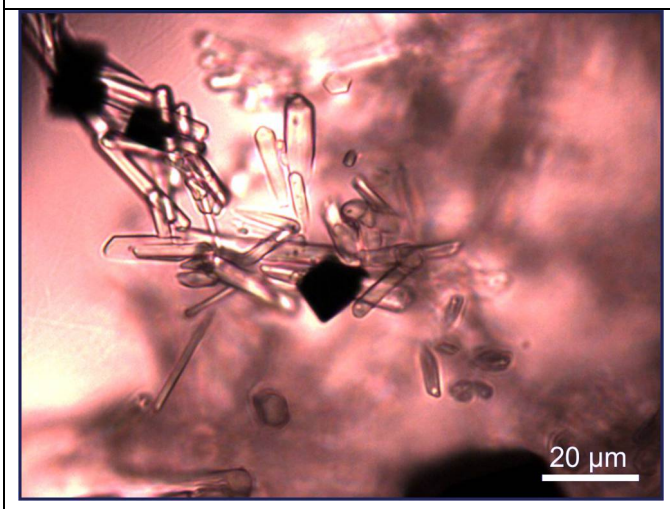

Website

http://minresunige.ch/

https://www.unige.ch/sciences/terre/en/groups/mineral-resources-and-geofluids/projects/

Prerequiste

None.