Apatite: A proxy to study ore deposits?

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Apatite ($Ca_5(PO_4)_3(OH, F, Cl)$) is an ubiquitous accessory mineral found in many types of rocks and environments. This mineral has several key features for the characterization and/or the dating of fluid circulation or magmatism responsible for the emplacement of mineralization:

1. It often incorporates uranium during its crystallization. This makes it an excellent candidate for U-Pb dating. Moreover, apatite can also be dated by the fission tracks and (U-Th)/He methods. Therefore the same mineral can bring information on the age of the mineralization and its exhumation history.

2. Apatite is an excellent trap for the P, F, Cl, OH, but also for Rare Earth Elements (REE) [1].

3. This mineral can easily react in the presence of brines, or aqueous fluids containing CO_2, HCl, H_2SO_4 and/or F [2].

4. In many ore deposit, the crystallization of apatite is contemporaneous with mineralization processes [3].

5. Its closure temperature with respect to the U-Pb system (375-550°C) gives it a peculiar role for dating hydrothermal events [4].

Accordingly, apatite is, a priori, an excellent proxy for obtaining extensive information about mineralizing fluids and/or fertile magmas (temperatures, compositions and ages or durations of the events), information that is essential for establishing a metallogenic model.

We will present a comprehensive set of CL imaging, EPMA analyses, SIMS stable isotopes and U-Pb dating on apatite from several ore deposits in order to assess the potential of this mineral for the study of ore deposits.

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