

## Using apatite as an indicator mineral for ore-forming processes in hydrothermal deposits

XIN-FU ZHAO<sup>1\*</sup>, ZHI-KUN SU<sup>1</sup>, LI-PING ZENG<sup>1</sup>

<sup>1</sup> State Key Laboratory of Geological Processes and Mineral Resources, and Faculty of Earth Resources, China University of Geosciences, Wuhan 430074, China  
(\*correspondence: xfzha@cug.edu.cn)

Apatite is a type of ubiquitous accessory mineral in igneous, metamorphic, sedimentary rocks and hydrothermal ores. The structure and chemistry of apatite allow for numerous substitutions, including a multitude of metal cations (i.e. Na, Sr, Ba, REEs) that substitute for Ca (Pan and Fleet 2002). Because of its high affinity for many trace elements, the presence of apatite may control trace element patterns of igneous and hydrothermal systems. Apatite from different sources has significantly different trace element abundances and Sr-Nd isotopic compositions. Apatite contains significant amount of Sr (commonly hundreds to thousands of ppm) but essentially negligible Rb, making it an ideal mineral for microanalysis of Sr isotopic composition and preserving the initial <sup>87</sup>Sr/<sup>86</sup>Sr ratios after its formation. Therefore, Sr and O isotopes of apatite can be effectively employed to trace the source and evolution of the ore-forming fluids (e.g., Li and Zhou 2015; Zhao et al. 2015). Furthermore, apatite is a good host for fluid inclusions, which can directly reflect the nature of ore-forming fluids. Thus, apatite is an ideal phase for the study of ore genesis and the evolution of hydrothermal deposits. However, it has been documented that apatite can be partially or completely metasomatically altered by hydrothermal fluids, which raises questions about the interpretation of elemental and isotopic compositions. Fluid metasomatism usually leads to significant remobilization of trace elements, and the formation of new REE phosphates (e.g., monazite and xenotime) in the altered zones. The development of micro-analytical techniques has now made it possible to examine intracrystalline and sub-grain scale compositional variations and thus, allows us to decipher elemental and isotopic changes between reactant and product phases. This can greatly enhance our understanding of metasomatic processes, as well as their geological implications.

[1] Pan and Fleet (2002) *Reviews in Mineralogy and Geochemistry* 48.13-49. [2] Li et al. (2015) *Economic Geology*, 110.1339-1369. [3] Zhao et al. (2015) *Mineralium Deposita*, 5. 871-884.