

Petrogenesis of Neoproterozoic high-K calc-alkaline granites forming large batholiths in SE Brazil: clues from trace-element chemistry of apatite and titanite

VALDECIR DE ASSIS JANASI¹, LUCELENE MARTINS¹,
ADRIANA ALVES² AND SILVIO R F VLACH¹

¹Instituto de Geociências, Universidade de São Paulo

²Geoscience Institute, University of São Paulo

Presenting Author: vajanasi@usp.br

Recent advances in granite petrogenesis have revealed that many granites exhibit a cumulate component, resulting in significant differences between their whole-rock geochemistry and that of the original magmas. Consequently, the chemistry of individual minerals with well-understood textural relationships should be prioritized for inferring magma sources and crystallization conditions. Apatite and titanite are common and abundant accessory minerals in granites and their chemical and isotope composition have been the focus of extensive research in recent literature. Their robust crystal structures are known to preserve relevant chemical information regarding magmatic crystallization processes. We investigated the major and trace element chemistry of apatite and titanite from a series of well-studied Neoproterozoic metaluminous granites in SE Brazil. Detailed textural studies, major-element analyses by EPMA, and trace-element analyses by LA-ICPMS bring key information on magma genesis and evolution. Titanite is absent or of restricted occurrence in high-K calc-alkaline (HKCA) metaluminous granites from the allochthonous high-metamorphic grade Socorro-Guaxupé Nappe (SGN), reflecting magmatic crystallization at higher temperatures (>800°C) compared to similar granites from the Apiaí Domain (Ribeira Belt), where it occurs as large crystals preserving temperature-related zonation, reflected in decreasing rimward LREE and Zr contents. The S content of apatite and the negligible negative Eu anomalies in both apatite and titanite are consistent with the relatively oxidizing character of all studied metaluminous granites. Inferred $x(\text{H}_2\text{O})$ (from apatite F and Cl relative to whole-rock contents) suggests lower H_2O in younger (post-orogenic) granites, in line with the progressive dehydration of the crust following cessation of subduction. A particularly relevant finding is the wide variation of Sr/Y (and La/Yb) in apatite (and also titanite and hornblende), which confirms suggestions from whole-rock geochemistry that magmas that formed the granites intrusive in the Apiaí Domain equilibrated at significantly greater depths (and by inference in a thicker crust) as compared to coeval and similar granites intrusive in the SGN. Within each of these two domains, slightly younger granites equilibrated at shallower crustal levels, likely reflecting post-collisional orogenic collapse.