The influence of HFSE-rich mineral fractionation on the geochemical evolution of alkaline to peralkaline melts.

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Zr/Hf and similar abundance ratios of High Field Strength Elements (HFSE) such as Nb/Ta or Th/U in igneous rocks are important geochemical parameters. These can be used to track the geochemical evolution of silicate melts and have the potential to elucidate the genetic relationships between various lithologies of a given igneous rock association (Claibrone et al., 2006).

In most igneous rocks types, zircon, titanite or allanite are the dominating HFSE carriers and thus, significant fractionation of these phases can strongly influence the geochemical evolution of the melts they crystallized from. In some types of alkaline to peralkaline rocks, however, other minerals, like for example, Ti-bearing andradite and eudialyte (a structurally complex Na-Ca-HFSE-rich mineral) dominate the HFSE budget of their host rocks.

In this study we present trace element data for HFSE-rich minerals (titanite, eudialyte, Ti-bearing andradite) from alkaline to peralkaline rocks of the Eocene Tamazeght complex, High Atlas Mountains, Morocco. In most lithologies significant amounts of titanite are present and obviously, titanite fractionation played a major role in the HFSE evolution of the whole complex. In contrast, zircon, eudialyte and Ti-andradite are generally rare and are restricted to localized special rock units.

Combining our data with the titanite-melt partitioning data of Prowatke & Klemme (2005) we will explore the effects of titanite fractionation on the evolution of geochemical parameters (Zr/Hf, Nb/Ta and Th/U ratios) during differentiation of silicate melts. Based on this, we will discuss the genetic relationships between the various rock types present in the Tamazeght complex.

Additionally, we derive first estimations of eudialyte-melt partitioning coefficients for REE. Applying these to eudialyte-bearing rocks of the Ilímaussaq complex (South Greenland) and comparing the results with published estimations for the parental melts of these rocks yields consistent results demonstrating the reliability of these estimations.

References

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