Accessory mineral constraints on crustal evolution: elemental fingerprints for magma discrimination

Emilie Bruand [1*], Mike Fowler [2], Craig Storey [2], Oscar Laurent [3], C. Antoine [1,4], M. Guitreau [1], Jean-Luc Devidal [1], Esa Heilimo [5], Oliver Nebel [6]

[1] Laboratoire Magmas et Volcan, Université Clermont Auvergne - France
[2] School of Earth and Environmental Sciences, university of Portsmouth – Royaume-Unis
[3] Géosciences environnement Toulouse - France
[4] Université de Genève - Suisse
[5] University of Turku – Finland
[6] University of Monash, Melbourne - Australia

Underexplored accessory minerals such as titanite and apatite have the potential to give insights into the nature and the petrogenesis of their host rock. Their trace element and REE-rich compositions carry a record of crystallization history and chemical characteristics of their source. Moreover, titanite and, to a certain extent, apatite are resistant to erosion during sedimentary cycles which makes them ideal to reconstruct the history of long-eroded continental landmasses. Results presented in this contribution, reveal that these underexplored minerals give new insights into their behaviour in magmas through time. In this study, we report new trace element data on apatite and titanite from granitoids of different Archean cratons and comparative granitoids from the Phanerozoic. Trace element signatures of both minerals reveal systematic chemical trends in Y, LREE and Sr contents related to the nature of their host magma, which are used to construct discrimination diagrams delineating Archean TTGs from sanukitoids, and modern adakites from S/I-type granites. By comparing Archean granitoids (TTG and sanukitoids) and their Phanerozoic counterparts (adakite and high Ba-Sr granites), we demonstrate that trace element analysis and detailed petrographic work can give direct information about the petrogenesis of the host magmas even when the granitoids have been affected by metamorphism. We show that the robust nature of these phases makes them reliable recorders of petrogenetic information from Archean rocks, that usually have been affected by secondary processes (metamorphism, deformation, hydrothermal activity). Applied to the rock record, both phases potentially provide detailed archives of magmatic evolution through time.

Mots-Clés : TTG, sanukitoid, crustal evolution, trace elements, titanite, apatite inclusion in zircon.

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