Origin of spessartine-rich garnet in highly fractionated A-type granites of the north Arabian-Nubian Shield (Egypt): in situ EMPA and LA-ICP-MS evidences

Sami, M.[1,2,*], Ntaflos, T.[1], Hauzenberger, C.[3]

[1] Department of Lithospheric Research, University of Vienna, Althanstrasse 14, Vienna, Austria
[2]Department of Geology, Faculty of Science, Minia University, El-Minia 61519, Egypt
[3] Institute of Mineralogy and Petrology, Karl-Franzens University, Graz, Austria
** E-Mail: mabrouk.hassan@mu.edu.eg*

A combined study of EMPA and LA-ICP-MS of garnet was carried out for Gabal Abu-Diab Neoproterozoic garnet-bearing muscovite granites (GBMGs) in the CED of Egypt, in order to constrain their origin. The GBMGs are slightly peraluminous (A/CNK = 1.0–1.14) with high SiO_2 (>74.66 wt%) and high K_2O (>4.11 wt%). Petrographic and geochemical features show that they are highly fractionated calk-alkaline A-type granites. The GBMGs have tetrad-type REE patterns ($TE_{1,3}$ >1.1) with strongly negative Eu anomalies and are extremely depleted in Ba, Sr, P and Ti. Homogenous to weakly zoned garnets occur in interstices between feldspars and muscovite with end member formulas of $Sps_{61–72}Alm_{25–35}Prp_{1–4}Adr_{0–1}$ and rare earth element (REE) patterns that are enriched in heavy REE (∑HREE= 681–2494 ppm with Y =1616–2827 ppm) and contain strong negative Eu anomalies. The occurrences, mineral assemblages, major element compositions, and REE patterns of the garnets suggest they have magmatic origin and crystallized at relatively low temperatures and pressures.