

## Trace element zoning in calcic garnets from the Tezhsar Alkaline Complex (Lesser Caucasus, Armenia)

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Trace element mapping of igneous minerals by LA-ICP-MS has become a key tool to visualise internal mineral structures that are undetectable by petrography or major element maps. Although generally rare in igneous rocks, calcic garnet may occur in alkaline rocks, offering an opportunity to gain insights into the record of magmatic and hydrothermal processes preserved in their compositional zoning. Here we combine textural information and major element data with trace element maps and spot analyses from calcic garnets from the Tezhsar Alkaline Complex (Armenia) to decipher their petrogenetic origin.

The Tezhsar Alkaline Complex formed around 41 Ma by low-degree melting of subduction-modified, subcontinental lithospheric mantle [1] and consists of several concentric units of volcanic and plutonic rocks, representing the remnants of a palaeo-caldera [2]. Calcic garnets with high Ti contents (c. 2-4 wt.% TiO<sub>2</sub>) occur in clusters in pegmatitic nepheline syenite and more rarely as phenocrysts in syenites. The major element chemistry of all garnets does not show any systematic patterns and only limited variability. In contrast, pronounced compositional zoning is evident for several trace elements. The heavy rare earth elements (HREE) show an overall core-to-rim decrease with superimposed, sharp fluctuations. These garnet HREE zoning patterns highlight complexities in their formation history that are not discernible from major element data. It is evident that magmatic fractionation was not the only relevant petrogenetic process and it will be discussed whether the garnets are a primary magmatic liquidus phase or whether they have a secondary, late-stage metasomatic origin due to reactions between earlier mafic minerals and late-stage fluids.

References:

[1] Grosjean, Moritz, Rezeau, Hovakimyan, Ulianov, Chiaradia & Melkonyan (2022), *Earth-Science Reviews* 226, 103949.

[2] Sokół, Halama, Meliksetian, Savov, Navasardyan & Sudo (2018), *Lithos* 320-321, 172-191.