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Garnet as indicator of magma evolution and rare metal mineralization: A case study of granites and pegmatites from the Mufushan area in Central China

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The Mufushan granitic complex in central China, formed by multistage magmatism, is closely related to rare-metal pegmatites. It comprises the following lithologic units with low to high magmatic evolution: biotite granite, two-mica granite, muscovite granite, microcline pegmatite, albite pegmatite, and spodumene–albite pegmatite [1, 2].

Chemical analysis of garnets in the six lithologic samples mentioned above reveals the continuous evolution of the magma of granites and pegmatites in the Mufushan area. Rare-metal elements are initially enriched in the early stage of granitic magma evolution, and the mineralization intensity gradually increases with progressing magma evolution. During magmatic evolution, garnets are gradually enriched in Mn and heavy rare earth elements (HREEs). Influenced by the crystallization of biotite, the evolution trend of the Mn content of garnet in the granite stage is inversely related to the magmatic evolution degree. The significant reduction in the HREE content of garnet in the late pegmatite stage indicates that the magmatic system has changed from the magmatic stage to the fluid-rich stage. The Mn content of garnet in pegmatite is positively related to magmatic evolution. Thus, garnet with high Mn content (MnO > 27.1 wt.%) is an effective indicator of highly fractionated and rare-metal mineralized pegmatite. In addition, garnet with low HREE content (<66.3 x 10^{-6}) and high "Rb + Cs + Li" content (>572 x 10^{-6}) can also be used as indicators of highly fractionated and mineralized pegmatite.

[1] Li *et al*. (2021) *Ore Geol Rev* **138**, 104380. [2] Li *et al*. (2021) *Mineral Deposits, 40 (4): 819-841(in Chinese with English abstract)*