Geochemistry of micas and accessory minerals in P-rich NYF pegmatites at Mangodara, Burkina Faso, West Africa

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The Mangodara district consists of a dome-shaped granodioritic orthogneiss, including amphibolite and paragneiss septa, intruded by a series of granodiorite, leucotonalite and granite plutons. All units are cross-cut by pegmatite dykes, which show a regional variation in accessory mineralogy moving away from the leucotonalitic pluton. Type-I pegmatites form veins within the leucotonalite showing gradational contacts. In addition to quartz, feldspar and biotite, common to all pegmatite types, they contain accessory magnetite, apatite, zircon, epidote and allanite. Type-II pegmatites intrude the granodioritic orthogneiss; they contain muscovite, garnet, accessory apatite, tourmaline, zircon, monazite, xenotime, colombo-tantalite, thorite and Zr-U-Th metamict phases. Type-III pegmatites intrude the orthogneiss and granites in the eastern part of the studied area. They contain garnet, ilmenite-pyrophanite, and accessory amounts of altered Nb-Ti-Th oxides.

The mineralogy and trace composition of accessory minerals are typical of NYF pegmatites (Nb>Ta, affinity with Zr, U, Th and REE) except for low F (no topaz) and high P contents. The geochemical signatures of mica and plagioclase (Fe vs. Mg content, and An19-26) point for an origin of the Type-I pegmatites from fractional crystallization of the leucotonalite. The presence of K-felspar and U-Th-Zr-bearing phases in Type-II pegmatites suggests an origin by partial melting of orthogneiss and paragneisses, which could account for their rare metal content. Type-III pegmatites could either correspond to differentiated pegmatites, or derive from partial melting of an unidentified protolith. Alternatively, the differences between these pegmatite types might be induced by interaction with different host rocks.