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The Al:Ti Geochemical Classifier: Distinguishing Between Granites of Similar Characteristics Under Different Degrees of Alteration

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The Pampa Paciencia vein system (PPVS) makes up the central zone of the Pampa Paciencia deposit (56-64Ma), located in the Paleocene mineral belt in northern Chile. In this zone, veins are hosted by the Sierra Gorda intrusive complex (Upper Cretaceous) and smaller Paleocene intrusives. Two units are identified as the PPVS' hosts. The microgranular quartz-feldspathic granite (GMQF) and the microgranular feldspathic biotitic granite (GMFB).

Similar mineralogy, texture affected by metasomatism, and the different degrees of alteration affecting the granites makes separating these two units quite a challenge.

To solve this, whole-rock geochemistry assay data (ICP-AES) from drill holes was used to geochemically characterize the hosts and alterations. To follow, representative samples were studied under hand sample/thin section and sampled by pXRF (averaging five measurements on flat surfaces) to relate their visual characteristics to their geochemistry and to test the diagrams created with the assay data.

First, feldspar Na-K GER diagrams revealed the hosts were mainly under two alterations (adularia and sericite, ±intermediate argillic). Al:Ti diagrams were created from the assays, with samples coloured by lithology. This showed two clusters, one richer in Ti dominated by GMFB and Al by GMQF, and samples were re-classified by them. After re-classification, the GMFB group had a linear regression with a slope of 13; the GMQF had a slope of 26. From thin section petrography, GMFB classified as a pyroxene bearing granodiorite-monzogranite (±biotite), and GMQF classified as a biotite-bearing syenogranite-monzogranite. The four samples classified petrographically as GMQF plotted (0.1-0.22% Ti; 5.5-6.5% Al) in the GMQF field in the Al:Ti diagram, while the 10 GMFB samples also did so in the GMFB field (0.2-0.35% Ti; 5.5-9% Al).

The Al:Ti plot is useful to separate similar granites with different degrees of alteration, not only with standard assay data, but also with lower cost alternatives like pXRF.