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POST-MAGMATIC ALTERATION PROCESSES AND ORE MINERAL ENRICHMENT IN THE PRECAMBRIAN KABELIAI GRANITES (SE LITHUANIA)

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The Kabeliai granite intrusion in southeastern Lithuania within the Precambrian crystalline basement of the East European Craton, exhibits significant post-magmatic mineralogical transformations. A biotite-bearing altered plagiogranite from the Marcinkonys-7 drill core (M7) was analyzed using Raman spectroscopy (Renishaw inVia Qontor, University of Warsaw), Scanning Electron Microscopy (Quanta 250 with EDS, Nature Research Centre), and LA-ICP-MS dating (Lund University, Sweden).

Large, euhedral titanite grains (up to 4.5 mm) are being replaced by smaller, irregular grains (0.3–0.8 mm) displaying corrosion textures and intergrowths with titanium oxide, magnetite, and calcite. Fe/Al ratio is close to 1:1 in the euhedral titanites indicating their magmatic origin. Magnetite grains with titanite rims and zoned titanite grains, where the core is older and the rim is younger, suggest multiple fluid episodes under oxidising conditions. Additionally, magnetite is altered to hematite along its edges, suggesting f_{O2} conditions above the hematite-magnetite buffer.

The newly formed titanite grains and rims on the earlier formed titanite often display sponge-like porous textures. Their Fe/Al ratio is close to 1:2. Some of these titanite grains, epidote, and associated calcite inclusions show enrichment in REEs (La, Ce and Nd up to 1 wt.%). Raman spectroscopy revealed that anatase has formed instead of rutile indicating a distinct oxidation-hydration regime.

Sericitization of feldspars and chloritization of biotite indicate fluid interactions, while plagioclase (An_{23}–An_{26}) is progressively replaced by albite (An_{2}–An_{10}) in association with epidote and muscovite, indicating albitization. Low temperature biotite-to-chlorite transition is accompanied by Fe-Mn ilmenite formation. Zoned apatite grains with jagged edges indicate partial dissolution and reprecipitation.

Geochronological analysis revealed two titanite ages: 1519 ± 5 Ma (MSWD = 6.3) for the euhedral magmatic titanite and 1479 ± 15 Ma (MSWD = 0.33) for the secondary titanite, consistent with Re-Os dating of molybdenite mineralization at 1486 ± 5 Ma [1]. These results confirm that the Kabeliai granites underwent extensive post-magmatic alteration, dominated by metasomatic and hydrothermal processes, which played a crucial role in redistributing Ti, Fe, Mn, Ca, and Na.

[1] Stein, Sundblad, Markey, Morgan & Motuza. (1998) *Mineralium Deposita* 33: 329±345