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RAMAN MICROSCPECTROSCOPY: THE KEY ROLE IN THE RECONSTRUCTION OF PT-PATHS OF HP-METAMORPHISM

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Raman microspectroscopy was applied to determine Al_2SiO_5 polymorphs situated in high-AlMg sapphirine-bearing metamorphic rocks from shear zones in the Central-Kola terrain (Kola Peninsula, Russia). Rocks consist predominantly of cordierite, biotite, orthopyroxene, sapphirine, spinel and sillimanite. The rocks also contain very small acicular crystals and ultra fine-grained orthopyroxene-Al_2SiO_5 intergrowths that replace cordierite and biotite. These aggregates mark a late rock alteration. Previous investigators considered the aluminosilicate as sillimanite (fibrolite). Hence, the rock alteration was interpreted as retrograde branch of the granulitic metamorphism.

Previously reported Raman spectra of Al_2SiO_5 polymorphs allow a clear identification of the mineral observed. Polarized Raman spectra were taken at room temperature from polished thin sections using the microscope-based DILOR XY Raman spectrometer equipped with 514.5 nm Ar^+ ion laser, backscattering geometry, lateral resolution $\leq$12 μm, spectral resolution 1 cm^{-1} To control the anisotropy of crystals, the spectra were registered for two crystal orientations for each measured point (the polarization plane of incident light was oriented parallel and perpendicular to the crystal elongation [001] or to the cleavage {010}).

Most of the Raman band positions and intensities from the studied acicular aggregates are in full conformity with the Raman spectrum of kyanite. In some measured points up to 15 additional bands in the spectrum of acicular aggregates have been revealed. Most of them exactly correspond to the Raman spectrum of cordierite. One can conclude, Raman micro-probe undoubtedly reveals the presence of kyanite both in its intergrowths with orthopyroxene and (for most long needle-shaped grains) in the surrounding rock matrix represented by early cordierite.

The kyanite-orthopyroxene paragenesis is an extremely rare one world-wide and the Central-Kola terrain is the second proved granulitic locality of it. Reaction textures and thermodynamic considerations suggest that this assemblage was prograde and formed at a new HP metamorphic event (ca. 700 °C and 8-9 kbar) which followed another HP-HT metamorphism (peak at ca. 920 °C and 9.5 kbar). Both these HP events overprinted metamorphic rocks locally within long-lived shear zones.

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