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## Blue sapphires in syenite pegmatites from Ilmen Mountains, South Urals

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At the Ilmen Mountains, located in the South Urals of Russia, blue-coloured corundums are found *in-situ* within syenite pegmatites. The occurrence is situated inside of the Ilmenny State Reserve and its commercial exploration is forbidden.

The Ilmen Mountains corundum syenite pegmatites are an A-type mantle source of NFY-family (Nb, Y, and F - rich pegmatite - see [2] and references there in), where the transparent to translucent sized up to 6 cm blue sapphires are found. However, due to syn- and post-tectonic processes took place at the deposit and the area around it, the mineral was largely fractured, thus only small stones could be faceted [5]. The sequence of mineral crystallization in the deposit was studied on petrographic thin-sections. In the 1<sup>st</sup> magmatic stage, the following mineral assemblage was observed: zircon ≤ orthoclase + corundum + columbite < microcline-perthite + biotite. In a 2<sup>nd</sup> metasomatic stage, muscovite + diaspore were also crystallized. Muscovite was found in the thin-sections as replacing K-feldspar reflecting the acidic character in the 2<sup>nd</sup> stage, where fluid removes K from the feldspar to form mica as part of the neutralization reaction [2]:  $\text{Al}_2\text{O}_3 + \text{K}(\text{AlSi}_3\text{O}_8) + \text{H}_2\text{O} \leftrightarrow \text{KAl}(\text{AlSi}_3\text{O}_{10})(\text{OH})$  with subsequent damping of the crystallization temperature below 400°C (corundum-diaspore equilibrium [1]). Laser ablation inductively couple plasma mass spectrometry (LA-ICP-MS) combined with electron micro-probe analysis (EMPA), for the first time applied to these sapphires, showed the presence of 2470 – 3620 ppmw of Fe, 190 – 280 ppmw of Ga, 2 – 27 ppmw of V, 7 – 74 ppmw of Ti, 2 – 15 ppmw of Cr, 3 – 9 ppmw of Mg, Ga/Mg ratio > 29 [5] to be in the range of most magmatic sapphires [see 3, 6]. Ferro-columbite, zircon, and K-feldspar, identified by Raman spectroscopy (RS), were observed as syngenetic inclusions within blue sapphires, along with epigenetic muscovite and exsolved needles likely to ilmenite [5]. All these detected solid inclusions are common for the mineral association of Ilmen corundum syenite pegmatites. By using RS, multiphase fluid inclusions (FI) were identified as well, where gas and liquid phases both determined as <sup>12</sup>CO<sub>2</sub> (Fermi doublet for the liquid phase at 1282.9 - 1283.2 and 1387.2 - 1387.6 cm<sup>-1</sup>) with average distances between lines (Δ) at around 104.1 – 104.4 [5] – equivalent of CO<sub>2</sub> density at ≈0.7 g/cm<sup>3</sup> [7]. The melting temperature for FI measured previously at 510 – 530°C [4] occurring with pressure around 1.8 kbar (CO<sub>2</sub> P-T isochrones, [5]). By using the estimated pressure, the temperature of stability for corundum-orthoclase-H<sub>2</sub>O system combining with determined CO<sub>2</sub> density [8], calculated higher at above 670°C [5]. Solid phase in FI was found as diaspore.

Further research is necessary for better understanding of the geological history occurred at this locality, moreover the obtained information can also be used for the characterization of the blue sapphires in secondary placers.

*References:*

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