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Geochemistry of new blue corundum (sapphire) occurrence in Ilmen Mountains, South Urals of Russia: clues to "metamorphic" sapphire petrogenesis in placer deposits

Elena S. Sorokina (1), Mikhail A. Rassomakhin (2), Sergey N. Nikandrov (2), Maria O. Anosova (1), Natalia N. Kononkova (1), Tatiyana G. Kuz'mina (1), Tatiyana V. Romashova (1), and Ksenia A Philippova (3)

(1) Vernadsky Institute of Geochemistry and Analytical Chemistry Russian Academy of Sciences (GEOKHI RAS), Moscow, Russian Federation (elensorokina@mail.ru), (2) Ilmen State Reserve, Miass, Chelyabinsk region, Russia, (3) Institute of Mineralogy of Urals's Branch Russian Academy of Science (UB RAS)

Blue corundum (sapphire) megacrysts within syenite pegmatites caused by the intrusions of miaskites in Ilmen Mountains have been known since the 19th with geochemical features and solid inclusions common for "magmatic" sapphires found in placers in Northern Laos and Thailand (Sorokina et al. 2017). Meanwhile, to date, the enigmatic question of "metamorphic" sapphires in placer deposits linked to the alkali basaltic terrains in South-East Asia, Africa, and Australia is still not fully disclosed.
In 2016, new blue corundum (sapphire) occurrence has been discovered by Sergey N. Nikandrov (an employee of Ilmen State Reserve) in 4 km to the east from corundum syenite pegmatite mines in Ilmen Mountains. Zonal corundum with the white core and blue-colored rim has been detected within spinel (hercynite) corona embedded in phlogopite matrix. Their formation caused by the ultramafic intrusions to hosted gneisses. By powder EDXRF, hosted meta-ultramafic rocks are found to be with high contents of SiO_2 about 50 – 61 wt.%, MgO about 20 – 32 wt.%, and low alkaline elements concentrations $\sim$ 0.1 – 0.2 wt.%; phlogopite pockets with corundum and spinel showed high MgO content 16 - 25 wt.% combined with variable SiO_2 (25 – 80wt.%) and low alkaline elements concentration (Na2O + K2O $\leq$ 1wt.%). Whole rock ICP-MS analyses of samples showed similar features with enrichment of LREE and depletion of HREE (except hosted meta-ultramafic rocks) with negative Eu anomaly. Meanwhile, the REE trend of corundum-spinel micaceous rocks is closely similar to those found in corundum syenite pegmatites in Ilmen Mountains. LA-ICP-MS measurements showed Ga/Mg < 2.7, Fe/Mg < 74, Cr/Ga > 1.3, and Fe/Ti < 16 – common for metamorphic sapphires (Peucat et al. 2007; Sutherland & Abduriyim 2009). Raman spectroscopy detected apatite and zircon solid inclusions located along the corundum fractures. EMPA analyses of these inclusions showed 4.7 wt.% of Hf2O in zircon, up to 2,47 of F and 2,38 wt.% of Cl in apatite.
Further studies of new corundum occurrence will provide clues to the petrogenesis of "metamorphic" sapphires found in placer deposits.

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