A new geochemical tool to separate basaltic from metamorphic blue sapphires

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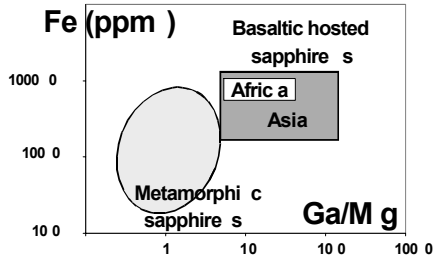
Attempts to separate metamorphic from basaltic blue sapphires have been done so far combining five elements : Fe , Ti, Cr, V and Ga. We demonstrate that magnesium (determined by ICPMS-LA) in combination with iron and gallium, is a more efficient discriminant (Fig. 1). Blue-sapphires from alkali-basalts are medium-rich to rich in Fe (2000 to 11000 ppm) and Ga (100 to 300 ppm) and low in Mg (generally < 10 ppm), with Ga/Mg ratios often >10. Metamorphic blue-sapphires have variable iron contents (300 to 5000 ppm), low Ga contents (<100 ppm), but high Mg values (30 to 250 ppm) with Ga/Mg ratios <3.

Figure 1: Fields representing basaltic and metamorphic blue sapphires in the Fe vs Ga/Mg diagram.



Painite ($CaZrBAl_9O_{18}$): A second source in Myanmar and Metasomatic Origins

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Painite, $CaZrBAl_9O_{18}$, is a rare mineral that was previously known only as crystals from the vicinity of Ongaing village in the Mogok Stone Tract, Mandalay district, northern Myanmar. Specimens of the orange-red to brownish-red painite from Ongaing number at least thirteen. It has now been found as slightly water worn crystals among alluvial spinel, corundum and zircon from Namya (Nanyaseik), Kachin State, some 300 km to the northwest of Mogok. Minor elements observed in EMP and XRF analyses of all painites include Ti, V, Cr, Fe and Hf. Inclusions within painite include liquid CO_2, srilankaite [$(Ti,Zr)O_2$], baddeleyite (ZrO_2), a CaAl-silicate, and calcite.

The new crystals purchased in Namya, 50 km NW of Mogaung, are pale pink and dichroic from pale orangish-pink to nearly colorless. Painite from Namya is fluorescent under UV light. CL shows both planar and irregular growth zoning on a scale of <10 μm banding.

Cr and V control the red to brown coloration in all samples and produce optical absorption bands near 398, 455 and 550 nm. The Namya material analyzed to date contains nearly an order of magnitude lower concentration of these elements and is proportionally less intensely colored. Crystals from both localities share a distinctive Raman spectrum.

The Mogok and Namya deposits, known for rubies (corundum), are sourced from the marbles of the Mogok Belt, interpreted as late Proterozoic limestones that have experienced various metamorphic events as late as Oligocene intrusions and metasomatism. The corundum's origin is ascribed either to paleosols that were Fe^{2+}-depleted by metasomatism or to Si-depletion metasomatism followed by Ca-reaction metasomatism. Painite is consistent with these models that yield refractory oxides and calc-silicate overgrowths.