Chemical Fingerprinting as a Tool for the Characterisation of Gem Corundums from different genetic Environments

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Chemical fingerprinting (the characterisation of mineral specimen by their element contents) has become an important tool in gemmology when trying to trace back the origin of gem minerals such as corundum (ruby, sapphire), beryl (emerald), and chrysoberyl (alexandrite), furnishing data that reflect the genetic background in nature to a certain geological environment or even to geographic areas.

Sapphires related to basaltic rocks distinguish themselves by low V_2O_3 and Cr_2O_3 contents (in general <0.01 wt%). Their Ga_2O_3 and Fe_2O_3 concentrations are high (>0.02 and >0.5 wt%). On the other hand, the chemistry of pegmatite-related sapphires reflects the nature of the rocks involved in the exchange processes between pegmatite veins and surrounding host rocks. Kashmir sapphires which are found in veins composed of feldspar, mica, and tourmaline in the contact zone of ultramafites and amphibolites show low Fe_2O_3- and Ga_2O_3-contents (<0.25 and <0.015 wt%). Sapphires from the Umba valley (in veins with Ca-plagioclase and vermiculite, traversing a serpentine body) have high concentrations of V_2O_3, Cr_2O_3, and Fe_2O_3 (up to 0.14, 0.3, and 2 wt %).

Basalt-related rubies from Australia, Cambodia, Laos, and Thailand, have low V_2O_3 and Ga_2O_3 contents (<0.01 wt%), and high Fe_2O_3 (0.3 – 0.9 wt%). Rubies originating from marble-type deposits show many variations in their chemical data. Those from the Mogok area in Burma, for example, have low TiO_2 (<0.05 wt%), high V_2O_3 (up to 0.35 wt%). In contrast, rubies from the Mong Hsu region in Burma show high TiO_2-contents (up to 0.3 wt%), and varying V_2O_3 (0.01-0.15 wt%).