

Trace element geochemistry of gem beryl

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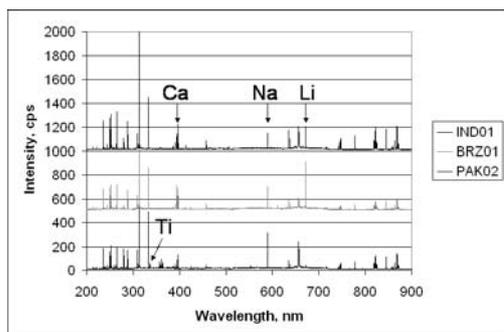
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Trace element concentrations of minerals are a reflection of fluid source (e.g. magma, metamorphic, hydrothermal, or sea water). This pilot study examines the use of trace element variation of gem beryl to determine gem provenance.

Trace element variations of gem beryl from four zones of two pegmatites from the Palermo district, North Groton, New Hampshire, USA, are compared to each other and to nine other gem beryl localities worldwide (Afghanistan, Antarctica, Brazil, China, India, Mozambique, Namibia, New Mexico, Pakistan). LIBS (Laser Induced Breakdown Spectroscopy) and LA-ICP-MS analyses provide complementary data. LIBS is a simple, real-time, and potentially portable analysis tool that requires no sample preparation. In LIBS, a pulsed laser is used to generate a high-temperature plasma on a sample surface; the visible emission spectrum from the plasma is captured and resolved. In this study, qualitative LIBS spectra are calibrated by quantitative ICP-MS analyses.



Trace element variations in beryl are complex and unique to locality, as seen in the three LIBS spectra below (aquamarines from India, Brazil, and Pakistan).

Mineralogical and geochemical study of the True Blue aquamarine showing, Shark property, southern Yukon

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The True Blue aquamarine occurrence in the Quiet Lake area of southern Yukon is underlain by Paleozoic Cassiar Platform miogeoclinal clastic and carbonate rocks, a Mississippian syenite stock, and Mississippian felsic metavolcanic rocks (Pelly Mountain Volcanic Belt). Evolved Cretaceous granite bodies are regionally present; however none have been recognized within the property limits. Beryl occurs in quartz veins and tension gashes and is restricted to those that cut the syenite. Accessory minerals in the quartz veins include varying amounts of fluorite, siderite, calcite, allanite and ilmenite. Mineralization has been dated as Mid-Jurassic (172 ± 5 Ma) using the Sm-Nd system on fluorite from several veins. This age suggests that mineralization is unrelated to the intrusion of the Mississippian syenite and a buried Cretaceous intrusion should not be invoked to explain the beryl mineralization. Previous studies have constrained major regional thrusting in the Pelly Mountains to have occurred between Late-Triassic and Late-Cretaceous, suggesting a link between beryl mineralization and metamorphic fluids. Aquamarine discovered on the property is distinctive because of its deep blue colour and high Fe^{+2} concentration, up to 5.92 wt.% FeO.