Trace Element Intercalibration of EPMA and LA-ICP-MS for a Diverse Collection of Tourmalines

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Measurement of trace elements can be difficult in multi-element materials having open structures like tourmaline, having increased probability of spectral overlaps, and having the possibility to contain diverse impurities. Electron Probe micro-analysis (EPMA) and laser ablation incductively coupled plasma mass spectrometry (LA-ICP-MS) both face challenges from spectral interferences and matrix correction. These widely used microanalytical techniques can mutually benefit when employed in synergistic loops. Qualitative knowledge from LA-ICP-MS is sufficient to greatly aid the solution of trace-level interference in EPMA by blank correction and interference correction. Strengths of EPMA are accurate first principles matrix correction and flexibility of standardization which might be regarded as a guiding force for LA-ICP-MS method development.

Tourmalines are gathered from the collections of the New York State Museum and that of Rensselaer Polytechnic Institute (RPI). These are predominantly tourmalines from throughout the state of New York, and also those of Elba (Italy), and New England at large. LA-ICP-MS qualitative survey is conducted using the single-point calibration to NIST 610 trace element glass. EPMA for trace elements is conducted at high beam currents (200nA and above), with various trace elements acquired in separate passes for maximum sensitivity. Spatial correspondence between laser and electron probe sampling is maintained for improved precision of intercalibration. Technique of matrix-matched blanks is applied to obtain excellent low-level measurements by EPMA.

The results of intercalibration are typically highly linear and resonably precise, and populated by a wide range of tourmaline compositions. So it may be possible to analyze diverse tourmalines by a single calibration strategy. However, slopes of intercalibration for various elements are wide ranging from 1. It is hypothesized that the non-matrix matched calibration to NIST610 is problematic. The LA-ICP-MS calibration may be reconsidered using various strategies that have been put forth in the literature already including normalization or fractionation correction schemes. Several other measurments of multielement glass standards will also be presented including the IR95V, -W, -X series, and the Corning-A, -B, -C, and –D archeological glass series.