Gem Tourmaline Chemistry and Paragenesis

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Gem tourmaline is known from many highly fractionated pegmatites throughout the world and considerable chemical variation exists in tourmaline from locality to locality. This study examines tourmalines from six worldwide pegmatite locations (Transbaikalia, Russia, two central Madagascar locations, two North American locations, and northern Brazil) to determine their chemical characteristics and pegmatite paragenesis.

All the tourmalines are dominantly elbaite or liddicoatite. Darker colored varieties contain a minor schorl component. Y-site chemistry strongly correlates with color and appears to be strongly influenced by the chemical characteristics of the pegmatites in which the tourmaline occurs. X-site vacancies of all tourmalines are less than 0.3 apfu. Fe and to a lesser extent Mn, Ti and Cu are the principal chromophores. Pink and green tourmalines from Transbaikalia are essentially elbaites, however, yellow zones within these crystals show a substantial liddicoatite component, coupled with elevated Ti and Mn contents. Tourmalines from the Antandrokomby pegmatite, Madagascar are members of the schorl-elbaite series with significant Mg and Ca contents. Even though the pegmatite occurs in a metadolomite, tourmaline Ca content is less than that of tourmaline from the classic Fianarantsoa and Anjanabonoina regions, Madagascar, where the tourmaline is liddicoatite and the pegmatites occur in pelitic country rocks. Tourmalines from both Madagascar locations have the lowest Y-site Al content. Tourmalines from San Diego County, California, and Newry, Maine, USA, are very similar chemically and belong to the schorl-elbaite series, with lighter colored, gemmy varieties approaching end-member elbaite. Paraiba tourmaline from Brazil is elbaitic in composition but contains significant Cu, which imparts a vivid blue color.