Tourmaline compositions as an indicator of emerald mineralization at Tsa da Glisza, Yukon Territory

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Tourmaline, a boron-bearing ring silicate, is ubiquitous at Tsa da Glisza (formerly Regal Ridge). It occurs as porphyroblasts in greenschist facies meta-volcanic and ultramafic rocks, as phenocrysts in granite, in quartz-tourmaline veins that cut the schists, and as granular black masses in highly altered gossan or fault zones. Contact metamorphism of the Devonian greenschist facies rocks by Cretaceous granite/aplite/quartz-tourmaline veins is responsible for local emerald mineralization. Tourmaline compositions include solid solutions between Na-Fe schorl, Na-Mg dravite, and Ca-Mg uvite. The quartz-tourmaline veins are particularly important because emeralds form along their selvages, although not all such veins have associated visible emerald mineralization. However, tourmalines of veins and alteration zones associated with emerald mineralization have subtle differences in Mg and Fe content when compared to tourmalines in schists and veins with no known emerald mineralization. Dravitic tourmalines are most common on the property, with Mg content between 0.25 to >3 atoms per formula unit (apfu), Fe contents between 0.4 to 2.25 apfu and Ca content between 0.05 to 0.75 apfu.

Tourmalines associated with emeralds are slightly more iron-rich dravites compared with tourmalines of schists

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and alteration zones without emeralds. Tourmalines of the schorl family are not associated with emerald mineralization, although they do occur in nearby aplites and granites. Uvite family tourmalines occur within and in veins cutting the ultramafic country rocks. The chemical variations of the tourmalines correspond quite well to the bulk-rock chemistry of their respective host rocks, but also relate to different equilibrium conditions at the time of emerald and/or tourmaline crystallization. During emerald mineralization, the mafic and ultramafic rocks, which are rich in iron and magnesium, as well as chromium and vanadium (the emerald chromophores) release mobile Fe, Mg, Cr, and V. These free elements are leached and subsequently transported by the quartz-tourmaline and aplite veins, some of which also carry beryllium, ejected from the granite. Because iron is less mobile than magnesium and tourmaline acts as an iron sink, the more iron-rich tourmalines associated with emerald mineralization imply a more iron-rich fluid, perhaps related to higher fluid temperatures of the veins during leaching.