Characterizing the composition of tourmaline in the Gryphon uranium deposit, the REE-rich Maw Zone, and sandstones above the Phoenix deposits, Athabasca Basin, Saskatchewan, Canada

I O'Connell[1], K Hattori[1], E Adlakha[1], S Chen[1], C Sorba[2]

[1]Department of Earth Sciences, University of Ottawa, Ottawa, Ontario; [2]Denison Mines Corp., Saskatoon, Saskatchewan

Various species of tourmaline have been reported from the Athabasca Basin, northern Saskatchewan. We examined the occurrence and mineral chemistry of tourmaline from three areas of the Denison Mines' Wheeler River property; the Gryphon zone, the Maw zone, and the Phoenix deposits. The newly discovered Gryphon zone is high-grade basement-hosted uranium deposit and samples for tourmaline analysis are collected from a graphitic pelite 17 m above the mineralization of the discovery hole, WR-556. The Maw zone is a REE-rich breccia pipe in highly hematitized sandstones with no significant uranium (mostly less than 8 ppm). Samples were collected from sandstones of MFd, MFc, and MFb members of the Manitou Falls formation, and RD formation. The Phoenix uranium deposits (confirmed resources of 70.2 M lb U_3O_8) occur primarily along the unconformity between the Athabasca sandstones and the crystalline basement rocks. Samples were collected from upper most part of RD and MFb; both over 100 m above the deposits. Tourmaline in all three study areas occurs as fan-shaped aggregates of needles (up to 0.2 mm in length) together with illite, kaolin and sudoite in grain boundaries of quartz grains that have already been coated with overgrowth. Similar compositions of tourmaline and its mineral assemblages in three sites suggest that they are all contemporaneous. EPMA analysis shows that all tourmaline grains belong to vacancy group and are identified as magnesiofoitite following the classification method of Hawthorne and Henry (1997). Tourmaline from the Gryphon zone show a high X-site vacancy (0.7-0.8) and Mg-rich with Mg/Fe atomic ratios ranging from 0.98-0.99. Tourmaline from the Phoenix ore also shows very high X-site vacancy. The composition of these tourmaline grains plots in the field of tourmaline associated with the McArthur River uranium deposit. Tourmaline in sandstones far from the uranium ore, such as those from the Maw Zone and MFb/RD sandstones above the Phoenix uranium deposits, shows low vacancy < 72% in the X-site and a large range in Mg/Fe (0.88-0.96). The difference in H+/Na+ in the X-site and Mg/Fe in the Y-site likely reflect the composition of hydrothermal fluids.