Structural analysis of the Matoush uranium deposit, Quebec

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The Matoush deposit is situated 260 km north east of Chibougamau in the Otish basin, north of the Grenville front in the Superior Province. The deposit is hosted in the Proterozoic Indicator Formation, which comprises conglomerates, conglomeratic sandstones, and subarkosic sandstones. The deposit is structurally controlled by the Matoush fault, which strikes 007° and dips 85°E. Mineralization is primarily uraninite lenses pitching 45°S on the fault surface.

Tourmaline and eskolaite are the phases most commonly associated with the uranium mineralization. In areas of intense mineralization, the tourmaline contains varying levels of Cr (15–39 wt% oxides), Fe (up to 8.82 wt% oxides), V (up to 1.75 wt% oxides), and Mn (up to 0.43 wt% oxides) whereas the tourmaline in unmineralized areas contains Fe (with only up to 5 wt% oxides). The uranium is also strongly associated with eskolaite as well as other Cr-oxides and hydroxides which are usually intergrown with the uranium phase. This is indicative of a strong chromium association with the uranium mineralization. Three-dimensional distribution of the mineral phases shows a strong zonation centered on the uranium mineralization.

Measurements were collected for sets of structural elements in order to establish in detail the relationship of mineralization to deformation features, and to extend these mesoscopic observations to the macroscopic scale. Fracture, fault, slickenside, and vein orientations were measured. Several kinds of fractures were observed, the most predominant being argillaceous, bleached, silicified, and pyritized. The fracture orientations indicate that the Matoush fault is the dominant control on fracture orientation. Similarly, veins show a clear correlation with the Matoush fault. The mineral zonation is nevertheless strongly linked to overall fracture density.

Fault-fluid interaction has affected element transport and concentration. Cr concentration is a positive indicator of uranium mineralization. However, spatial distribution and localization of uranium mineralization as of this time defies characterization by simple geometric relationships. This is exemplified by the lack of obvious intersections of structural elements or clear development of dilatational zones that correspond with deposit orientations. However, the observation of rare U-bearing microscopic fault oversteps and linkages are suggestive of similar fault-scale structures for which exploration is ongoing.

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