Structural Analysis of the Matoush Uranium Deposit, Quebec

L. Robichaud*
University of New Brunswick, Fredericton, NB
lise.robichaud@unb.ca

J. Lafontaine
Ressources Strateco Inc., Boucherville, Quebec

and

J.C. White
University of New Brunswick, Fredericton, NB

Summary

The Matoush deposit is hosted in the Proterozoic Indicator Formation in the western part of the Otish basin, Quebec. The deposit is structurally controlled by the Matoush fault, which strikes 007° and dips 85°E. Mineralization is dominantly uraninite lenses that pitch 45° towards the south on the fault surface. The predominance of chromium tourmaline and eskolaite near the mineralization indicates that there is a strong Cr association with the uranium. Structural elements were collected in order to determine the relationship between mineralization and deformation. The results indicate that the Matoush fault is the dominant control on fracture and vein orientation.

Geological Setting

The Matoush deposit is situated 260 km north east of Chibougamau in the Otish basin (Fig. 1), 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 (Gatzweiler, 1987).

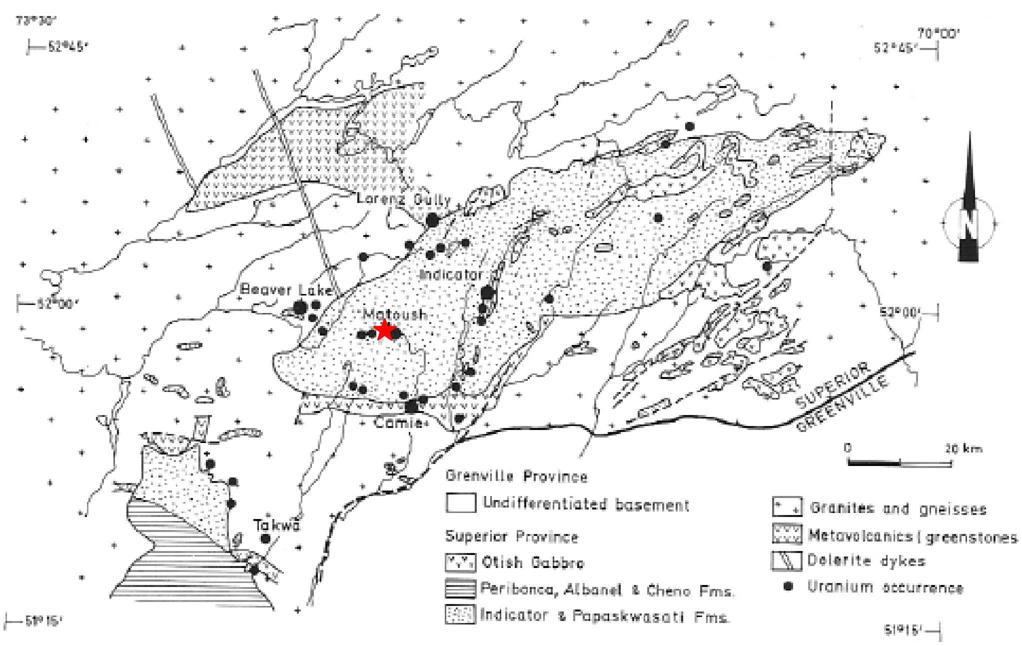

Figure 1: Geology of the Otish Mountains area and location of the uranium occurrences (after Gatzweiler, 1987). The Matoush deposit is marked by a red star.

The deposit is structurally defined by the Matoush fault, which has a strike of 007° and dips 85°E. Displacement is mainly sinistral strike-slip along the fault's length. The Matoush deposit consists of mineralized lenses that are mainly of uraninite and that pitch 45° towards the south on the fault plane. The thickness of the mineralized zone can reach up to 10 meters.

Mineralization

A halo of alteration extends out from the fault, the composition of which varies as a function of distance from the fault. The proximal and distal alteration minerals vary considerably. The paragenetic mineral sequence proximal to the fault (within the fault zone) is tourmaline, eskolaite, uraninite chlorite, illite, fuchsite and hematite. The distal (10s of meters from the fault zone) paragenesis is quartz, muscovite, tourmaline, hematite and fuchsite.

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 grimaldiite and other Cr-oxides and hydroxides (Fig. 2) which are usually intergrown with the uranium phase. This is indicative of a strong chromium association with the uranium mineralization.

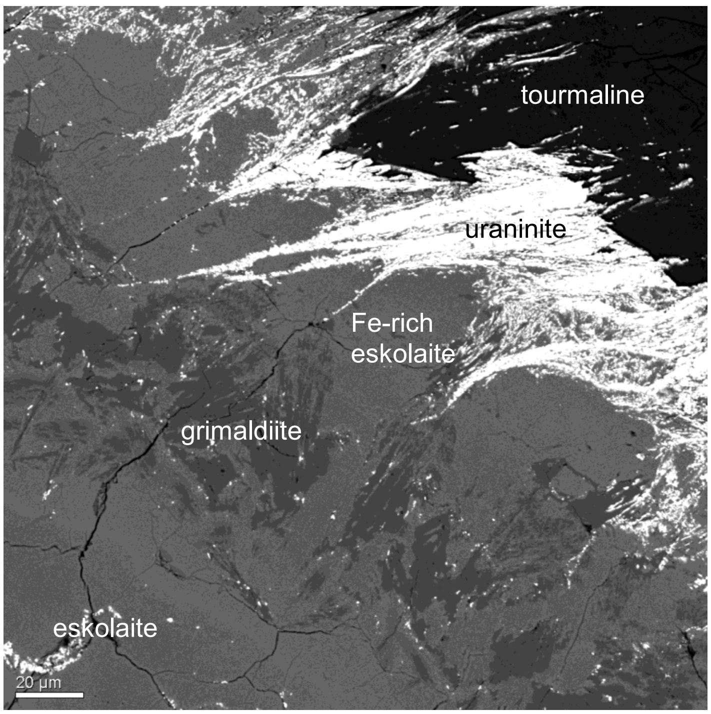

Figure 3: Scanning electron microscope image SEM-LR-610-C-3 showing variations in Cr-oxides as well as strong association with uranium mineralization. The tourmaline in this case is enriched in Cr relative to smaller amounts of V, Mn and Fe.

Structural Elements

Structural measurements were acquired from drillcore that was deemed adequately oriented for determination of true orientation. Two angles (α and β) (Fig. 3) were collected from each feature of interest and combined with borehole orientation measurements (φ and θ) (Fig. 3) to obtain the true orientation of measured features. These 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

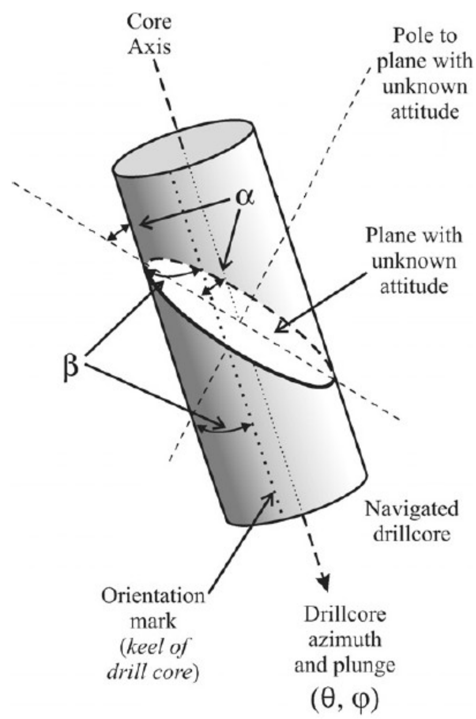

Figure 2: Drillcore measurements used to determine the orientation of poles to planes with unknown attitude (after Stanley and Hooper, 2003).

mesoscopic observations to the macroscopic scale. The consistently shallow dipping bedding surfaces were used to verify that the structural elements were properly determined.

Fracture, fault, slickenside and vein orientations were measured. Fractures differ from faults in that they do not show displacement. Several kinds of fractures were observed, the most predominant being argillaceous, bleached, silicified and pyritized. The argillaceous fractures (Fig. 4a) contain visible amounts of clay and show a strong association with the Matoush fault

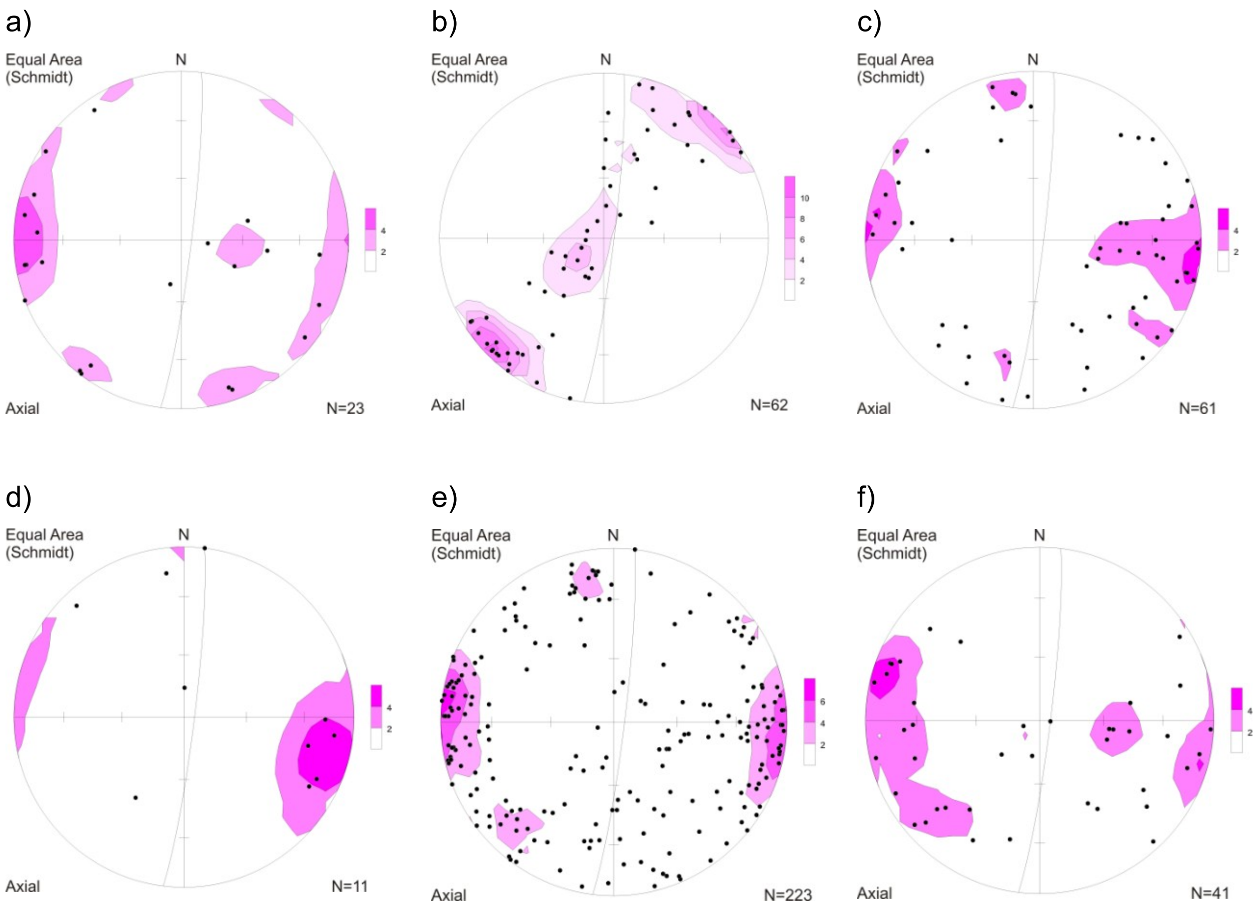

Figure 4: Fractures are plotted as argillaceous fractures (a), bleached fractures (b), silicified fractures (c) and pyritized fractures (d). A synoptic plot (e) of fractures includes all fracture populations. Veins (f) are also plotted. The Matoush fault (striking 007° and diping 85°E) is plotted on all the stereograms. Number of data is shown as N.

orientation. The bleached fractures (Fig. 4b) are depleted in iron around the fractures and form a distinct pattern of mostly vertical fractures with a trend quasi-perpendicular to the Matoush fault. The silicified fractures (Fig. 4c) show a clear association with the Matoush fault, but the spread of measurements is wider than for the argillaceous fractures. The pyritized fractures (Fig. 4d) are at a shallow angle to the fault, and have a westerly dip. A synoptic plot (Fig. 4e) of all fractures suppresses the fractures having smaller populations. The latter indicates that the Matoush fault is the dominant control on fracture orientation. Similarly, veins (Fig. 4f) show a clear correlation with the Matoush fault.

Conclusions

Fault-fluid interaction has affected element transport and concentration; most notably U. Cr concentration is a positive indicator of U mineralization. However, spatial distribution and localization of U 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 is suggestive of similar fault-scale structures for which exploration is ongoing.

Acknowledgements

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