High-Cr minerals from the Matoush uranium deposit in the Otish Basin, Quebec, Canada

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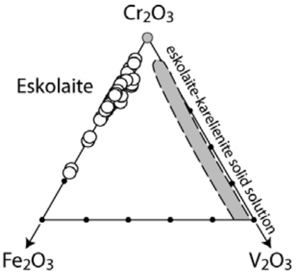
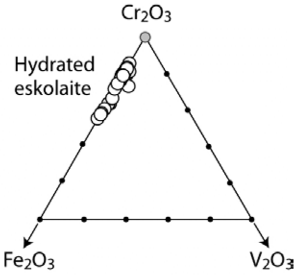
High-Cr paragenesis is observed at the enigmatic Matoush uranium deposit, Otish Basin (Quebec, Canada), which is associated with the bimodal and very narrow (<2 m) Matoush dike intruding the sandstones of the Indicator Formation. In addition to uraninite, both silicate (Cr-dravite and Cr-muscovite) and oxide (eskolaite) high-Cr minerals are present in large amounts. While high-Cr dravite and high-Cr muscovite have been described previously, eskolaite, Cr_2O_3, has not been studied extensively.

The highest Cr contents observed in the Matoush silicates, obtained by electron microprobe, are comparable with those documented in the literature, with Cr_2O_3 of up to ca. 22 wt% in Cr-muscovite (or chromphyllite) and ca. 37 wt% in Cr-dravite.

Complete solid solutions between hematite (Fe_2O_3), eskolaite, and karelianite (V_2O_3) are theoretically possible, but only the complete Cr-V substitution has been documented. In contrast, the Matoush eskolaite contains significant amounts of Fe, with up to 37% wt% Fe_2O_3 substitution, and minimal V (typically under 0.5 wt% V_2O_3).

A hydrated Fe-Cr oxide with the hematite structure is also observed to be closely associated with eskolaite at Matoush, This phase has the same Cr-Fe-V ratio as eskolaite, but with ca. 14 wt% H_2O. Synthetic hematite with significant OH is known to occur and exhibits increased c axis length with increased OH substitution. Rietveld analysis of the X-ray powder diffraction data of the Matoush material is best fit using a model that includes anhydrous eskolaite and a second hydrated crystalline Fe-Cr oxide with the hematite structure and a larger c axis dimension.





Measurement of $\delta^{34}S$ and $\delta^{33}S$ values in wild animal hair samples by MC-ICP-MS

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Sulfur isotopic compositions vary widely in nature, which give much scope to trace sources and processes of sulfur components in biological systems. The investigation of the diets of wild animals using the sulfur isotopic composition of hair has been demonstrated to be a powerful tool in ecological investigations [1]. The challenge is to measure these differences in sulfur isotope abundances accurately from small amounts of sample. The use of multiple collector inductively coupled plasma mass spectrometry enables reliable determination of the isotopic composition of ^{32}S, ^{33}S, and ^{34}S from microgram quantities of S [2, 3, 4]. This requires that the sulfur is separated from the sample matrix and possible spectral interferences are resolved by the mass spectrometer. Sample digestion using microwave techniques or on-line combustion of the sample to SO_2 using an elemental analyzer ensures that sulfur is prepared in a form suitable for analysis. The high mass resolving power of the Thermo Scientific Neptune ensures that isotopes of sulfur are resolved from polyatomic ions, in particular isotopologues of oxygen. We developed a method to measure accurately and precisely $n(^{34}S)/n(^{32}S)$ and $n(^{33}S)/n(^{32}S)$ free from spectral interferences that might affect the results, which was demonstrated by plotting $\delta^{34}S$ and $\delta^{33}S$ values on a three-isotope plot. The analytical methods for the MC-ICP-MS were applied to study the diet of wolf and caribou in Canada revealing subtle variations in sulfur isotopic composition in the hair samples from these animals. Initial data show that these results can be used to assist in the identification of the principal sources of food in wild animal populations.

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