STUDIES OF RADIOACTIVE COMPOUNDS:

II—META-ZEUNERITE, URANOPHANE, KASOLITE AND CUPROSKLODOWSKITE IN CANADA[1]

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During the summer of 1950, the writer was engaged in development work on the radioactive prospects of Nicholson Mines Limited whose property is located on the north shore of Lake Athabaska, Saskatchewan. The "No. 1 zone extension" vein which is on the west side of Anne Lake, about 2 miles east of the town of Goldfields, showed evidence of considerable oxidation at surface. It offered an opportunity to study the field relations of secondary uranium minerals in this area and to collect specimens of these little known minerals for subsequent laboratory study at the University of Toronto. The following is a brief account of four rare uranium minerals identified, their mode of occurrence in the vein and its geological environment.

The rocks in the Nicholson region belong to the Tazin series of Precambrian age. In general, the Tazin sediments include dolomite and argillite and their metamorphic equivalents, as well as blue-white and ferruginous quartzite. At the Nicholson an important structural control for radioactive material seems to be the contact between altered dolomite and ferruginous quartzite; the "No. 1 extension" seems to have this relationship.

The vein material is well fractured and weathered. In one place 6 feet of this "soft" rock was excavated with pick and shovel alone. Later shaft sinking showed that this soft material persisted to a depth of more than 40 feet. The vein is at least 40 feet long and has a maximum width of 9 feet. In appearance the vein material resembles the common gossan found above sulphide deposits; it consists chiefly of limonite and quartz.

Mineralogically the vein shows evidence of hydrothermal origin at moderate temperatures. Some 20 minerals were positively identified and there were indications of many more. The paragenesis is uncertain, but in general the following sequence may be applicable:

1. Hematite, sulphides, arsenides.
2. Pitchblende.
3. Quartz.
4. Carbonates.
5. Silicates of uranium, arsenates of uranium.

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This seems to be in accordance with the paragenesis of the Goldfields area as given by Robinson (1950). The sulphides are in masses and locally stain the limonite dark, while malachite, aragonite and bright-colored uranium oxidation products are often seen lining vugs and veinlets. The uranium minerals are of special interest and are described in greater detail below.

Meta-zeunerite, $CuO \cdot 2UO_3 \cdot As_2O_5 \cdot 12H_2O$, occurs as small green plates (to $\frac{1}{4}$ mm. diameter) in vugs and crevices to the east of the high grade area, in close proximity to sulphides, silver and altered pitchblende. Under the microscope the surfaces of the plates show traces of 2 cleavages at right angles. Cu and U were determined by blowpipe and wet tests. An *x*-ray powder pattern of the mineral was identical with that of synthetic meta-zeunerite prepared by I. H. Milne in this laboratory. This is the first recorded Canadian occurrence for meta-zeunerite.

Uranophane $CaU_2Si_2O_{11} \cdot 6H_2O$, occurs as clusters of radiating tiny yellow to greenish yellow needles lining crevices and as yellow colloform crusts filling cracks in a gum-like uranium mineral. These determinations were made by comparing the *x*-ray powder patterns with well known standards. It appears likely that much of the yellow to greenish yellow stain which contains uranium is uranophane, and this mineral may well be the most common oxidation product of pitchblende here. Uranophane has been reported from three other Canadian localities: Villeneuve, Quebec (Hoffman, 1899); Henvey township, Parry Sound district, Ontario (Spence, 1930); Great Bear Lake (Palache and Berman, 1933). This is the first occurrence identified by *x*-rays.

Kasolite $PbUSiO_6 \cdot nH_2O$, was noted as orange yellow crusts in association with an unidentified yellow-green radioactive mineral in fractures near the centre of radioactivity. Both minerals are colloform; kasolite appears to be the later of the two. Microscopic fragments show a prismatic outline. Optically kasolite shows a bluish interference colour; the main index of refraction is above 1.78. Identification was made by comparison of the *x*-ray powder pattern with that of crystallized kasolite from Kasolo, Katanga. The mineral appears to be common in the more highly radioactive areas in the vein. Previous to its identification at Nicholson kasolite was known only from Kasolo in the Belgian Congo.

Of particular interest is the identification of cuprosklodowskite $CuU_2Si_2O_{11} \cdot 6H_2O$, one of the rarest of uranium oxidation products. Previous to its identification at Nicholson this mineral had been found only at Kalongwe, Katanga (Vaes, 1933) and Jachymov, Bohemia (Nováček, 1935). It occurs as tiny bright yellow-green needles in a fissure in talcose argillaceous rock associated with other uranium minerals. It was also seen close to sulphides and malachite on a fine-grained carbonaceous rock as a coating which under high magnification sometimes shows a radiating fibrous structure, and it was noted on the gum-like radioactive mineral mentioned above. Positive tests were obtained for U and Cu and identification was made by comparison with an x-ray powder pattern of cuprosklodowskite from Jachymov, Bohemia (HMM-94862).

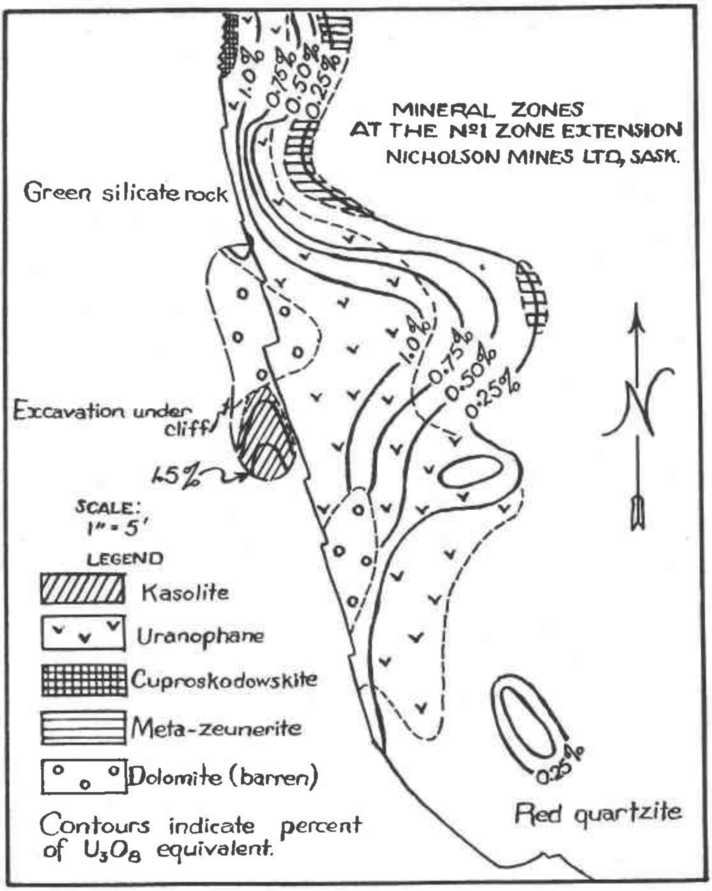

FIG. 1

The accompanying sketch (Fig. 1) is a generalization of the mineral zones as they appear at the Nicholson "No. 1 extension" vein. The grade at the surface (July, 1949) has been roughly blocked out with the aid of contours. It is interesting to compare the mineralogy here with that of uranium occurrences elsewhere. It may be seen that kasolite occurs near the zone of highest uranium concentration. Uranophane and cuprosklodowskite are scattered through a zone of lesser radioactivity. The uranium mica, meta-zeunerite, is distributed at the periphery. This assemblage is similar to that of Shinkolobwe, Katanga. Other analogies are apparent. In contrast to Bohemia where carbonates and sulphates of uranium predominate, silicates of uranium are the principal oxidation products at Nicholson and Katanga. Further, the Cu/Ni+Co ratios are high at both localities. As at Katanga the precious metals Au and Pt are present in significant amounts. Mineralogically therefore, the vein shows distinct similarities to the uranium occurrences in Katanga.

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