Introduction

Over the past two years, research on drift prospecting in the District of Keewatin has been directed towards developing reconnaissance and detailed sampling techniques that can indicate uranium mineralization as well as base metal mineralization. Shilts and Klassen (1976) have presented some preliminary results of the uranium phase for Boothia Peninsula and central Keewatin. The purposes of this report are: (1) to discuss briefly the techniques of sampling and processing samples; (2) to update the uranium dispersal map of the Kaminak Lake area; (3) to show the results of detailed sampling around a site of known uranium mineralization, which also was indicated by reconnaissance anomalies; and (4) to show the results of reconnaissance uranium drift sampling in the Baker Lake area. Figure 93.1 is an index map of the Kaminak and Baker Lake areas.

Techniques

The mudboil sampling technique developed by Shilts (e.g., Shilts, 1973; Ridler and Shilts, 1974) was employed for both regional reconnaissance and detailed sampling. One to two-kilogram samples were collected from the mineral sediment at the centres of mudboils (sorted, nonsorted circles, frostboils) from the bottoms of holes dug by hand to depths of 30 to 60 cm. Organic inclusions and any till with obvious iron or manganese oxide staining were avoided, but a few samples (<5%) were unavoidably collected from such material or from postglacial marine muds or silty sands on which mudboils also can form.

Samples from the Kaminak Lake reconnaissance grid were processed either by using a centrifuge to separate the <2 µm fraction from a dried, <250-mesh separate from till ("dry clay") or by separating the <2 µm fraction from a slurry derived by agitating undried till in a milk-shake machine with a plastic agitator ("wet clay"). In the detailed grid three separates were analyzed for each sample: (1) "dry clay"; (2) "wet clay"; and (3) <250-mesh (<64 µm) separate derived by sieving of dried, disaggregated till. In the Baker Lake grid, all results are from analysis of <2 µm material separated from the slurry derived from undried till.

Figure 93.2 illustrates the comparative results of these techniques in histogram and scatter-plot form. From the data presented, it appears that the "wet clay" technique (derived from a slurry with no drying of the sample) gives the best background to anomalous value contrasts. In the Kaminak Lake area the distribution of uranium values for "wet clay" samples indicates a principal mode that tends to be higher than that for "dry clay". Analysis of both "wet" and "dry" clays provides a range of values and an areal clustering of high values that can be meaningfully contoured. Both types of clay analysis are evidently superior to those of <250-mesh fractions which have a much more restricted range of concentrations that are generally close to the analytical detection limit. Although not discussed here, other till fractions, such as rock fragments in the 0.5 to 4 mm size range and sand sized methylene iodide heavy mineral separates, were analyzed for some of the samples discussed above. Too few methylene iodide separates have been done to draw any conclusions other than that their uranium values seem to be slightly higher than clay values in the Kaminak Lake area and slightly lower than clay values in the Baker Lake area. The analysis of the crushed rock fragment fraction gives even less contrast among samples than <250-mesh separates in these areas. One till sample collected a few metres from uranium (U) mineralization was analyzed at 1280 ppm U for wet clay, 57 ppm U for methylene iodide heavies, and 11 ppm U for rock fragments.

A selected suite of clay separates also was analyzed by neutron activation techniques for comparison with the fluorescence analyses commonly used in this project. These analyses were close to the results obtained commercially by fluorescence analysis, and the authors could not see any outstanding advantage of one method over the other for these types of samples.

Results: Kaminak Lake Area

Figure 93.3 shows the results of reconnaissance scale sampling in the Kaminak Lake area (the sampling was originally designed to cover areas of high base metal potential). None of the results have been

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1 Analyses by Atomic Energy of Canada Limited
2 Analyses by Bondar–Clegg and Co., Ltd.
Figure 93.2
Histograms and scatter plots of uranium values from various fractions of till. Shaded part of the reconnaissance grid histogram represents samples done by the "wet clay" technique.
Figure 93.3.
Uranium dispersal in clay from till of the Kaminak Lake area. Arrow in southwest corner points to the site of the detailed grid (Fig. 93.4). Co-ordinates of lower right (southeast) cross are 62°00'N, 94°08'W and of upper left (northwest) cross are 62°30'N, 96°30'W. General direction of ice flow was northwest towards southeast. Geology is from maps by Davidson (1970) and Bell (1971).
"smoothed" statistically; all samples within a contour are within the concentration ranges described for the contour. Most areas of abnormal uranium content can be related to two principal rock types: (1) Apebian sediments—Hurwitz, Montgomery Lake, and Mackenzie lake groups (Bell, 1971; Davidson, 1970) and (2) plutons comprising porphyritic acid intrusive complexes mapped by both Davidson and Bell as having been emplaced during Late Archean plutonic events (map-unit 3).

Uranium mineralization has long been known to be associated with the Apebian basal conglomerates and sandstones. The anomalies at the southwestern corner of the map are closely related to several occurrences of uranium mineralization that were described by Bell (1970) in Montgomery Lake metasediments of the Padlei area. Other fairly coherent anomalies occur over the Hurwitz Group immediately north of Carr Lake and on a till plain eastward along the strike of Mackenzie Lake metasediments at the north end of Victory Lake. It should be noted that only some portions of the areas underlain by Apebian rocks are characterized by till having elevated uranium content; well over 75 per cent of the Apebian rocks are associated with till having low to background uranium contents. This may mean that uranium mineralization potential in Apebian rocks is relatively greater in areas with tills of higher uranium content.

An unexpected and as yet unexplained series of large, coherent zones of uranium enriched till are associated with some Apebian porphyritic plutons, mainly those that occur in Davidson's (1970) bedrock region B, a zone of amphibolite-grade metamorphism where the porphyritic bodies are intruded into Apebian metasediments rather than Apebian volcanics. At the northwest corner of the sampled area, strong, coherent anomalies are associated with till having low to background uranium contents. This may mean that uranium mineralization potential in Apebian rocks is relatively greater in areas with tills of higher uranium content.

Other lithologically similar batholiths near Carr, Kaminak, and Southern lakes show no comparable development of uranium anomalies. Strong anomalies near Southern and Quartzite lakes are in areas mapped as basic volcanics or basic intrusives, but these anomalies are close to areas known to be cut by swarms of fluorite-bearing pegmatite dykes, apparently associated with the batholith just east of Southern Lake (Davidson, 1970, p. 10).
Uranium in Clay (≤2 μ) from Till

- Sample points
- 1st contour ≥ 3 ppm Uranium
- 2nd contour ≥ 5 ppm Uranium
- 3rd contour ≥ 7 ppm Uranium
- Known Zone of Uranium Mineralization

Figure 93.4. Uranium in clay from detailed grid (see Fig. 93.3 for location). Geology after Bell (1970).
Figure 93.5. Uranium in clay from till in the Baker Lake area. Geology after Donaldson (1965).
The contrast of the uranium concentration patterns for till in the Baker Lake area with those of the Kaminak Lake area is striking. The mineralization in the Kaminak area may be dispersed at low levels through a large volume of bedrock rather than consisting of small, discrete zones of uranium-enriched bedrock as in the Dubawnt Group. Alternatively many small, enriched zones in the bedrock may be closely clustered, acting like a larger source of dispersed mineralization. It is presently an imperfectly explained paradox that the area of the Keewatin Shield that is presently one of the most attractive for uranium exploration, the Dubawnt Group rocks of the Baker Lake area, gives a weak drift geochemical response for uranium.

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