Canada
Department of Energy, Mines and Resources
Geological Survey of Canada

LEGEND

COPPERMINE RIVER GROUP

10 COPPER CREEK FORMATION: basalt flows, minor sandstone

DISMAL LAKES GROUP

9 Dolomite, undivided

8 Sandstone, intercalated black shale

C MUSKOX INTRUSION COMPLEX

HORNBY BAY GROUP

7 Sandstone, minor conglomerate

6 Sandstone, siltstone, shale

5 Dolomite

4 Sandstone, minor conglomerate

GREAT BEAR BATHOLITH

3 Granodiorite, quartz monzonite, granite

2 Volcanic flows and tuffs, sedimentary rocks, felsite intrusions undivided

1 METAMORPHOSED EPWORTH GROUP ROCKS

HEPBURN METAMORPHIC-PLUTONIC BELT

B Gneiss, migmatite

A Granitic rocks

Drift-cover
Geological boundary
Limit of geochemical survey
Fault

Geology derived from:

- B.G. Craig, W.L. Davison, J.A. Fraser, R.J. Fulton, W.W. Heywood, T.N. Irvine, 1959, G.S.C. map 18-1960

C.H. Smith, T.N. Irvine, D.C. Finlay, 1963
G.S.C. maps 1213A and 1214A

W.R.A Baragar and J.A. Donaldson, 1969,
G.S.C. maps 1337A and 1338A

P.F. Hoffman, I.R. Bell and R. Tirrul, 1975,
in G.S.C. Paper 76-1A, pg 354

J.C. McGlynn, 1976, Bear and Slave Provinces,
compilation map, in preparation

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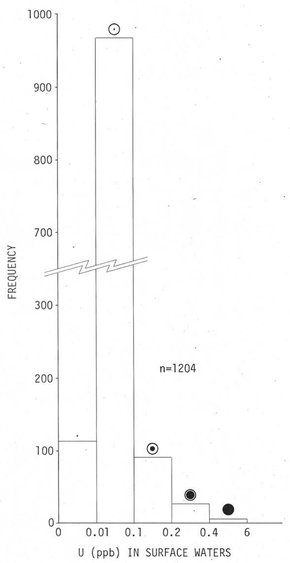
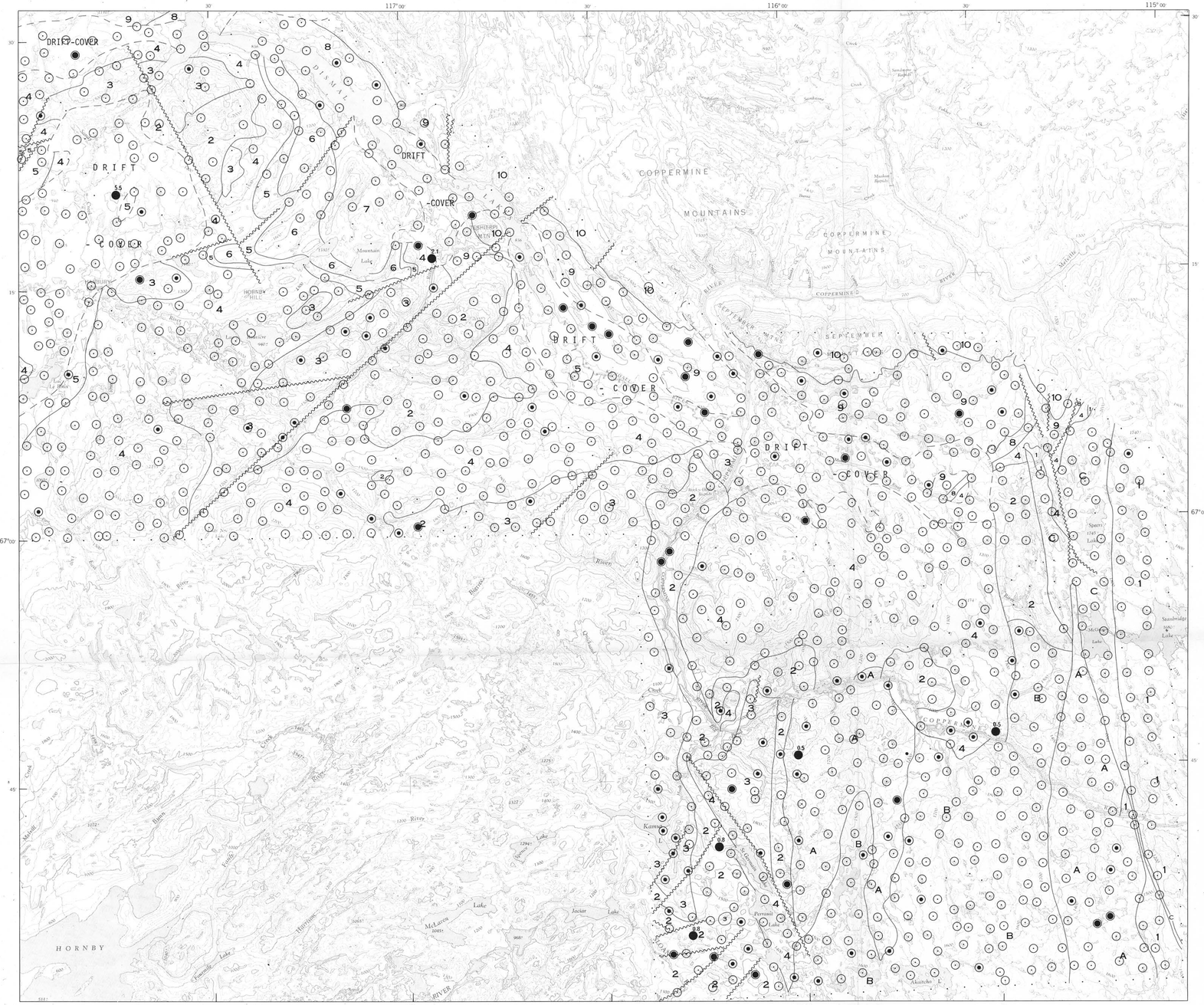
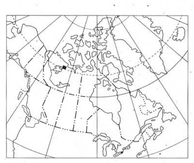
by
C.C. Durham
Geological Survey of Canada







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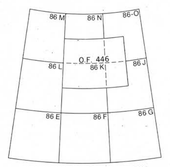
URANIUM IN SURFACE WATERS

HORNBY BASIN, DISTRICT OF MACKENZIE, N.W.T. 1975

Scale 1:250,000

Kilometres 6 0 6 12 18 Kilometres
Miles 4 0 4 8 Miles

Universal Transverse Mercator Projection



MARGINAL NOTES

An orientation survey was conducted in June 1975 to study the feasibility and technology of applying hydrogeochemical methods for uranium in Proterozoic sandstone terrane and to test new rapid methods of field collection. From June 15 to June 27, 1975 surface water was collected from lakes, mainly, and some streams and bogs, over a 6600 km² area in the Hornby Basin area of the Northwest Territories. The map includes parts of N.T.S. map sheets 86J, K, N and O. The primary objective was to investigate if a hydrogeochemical reconnnaissance-level survey could outline uranium targets. There are reported occurrences of uranium in the St. Germain Lake area and near Mountain Lake, south of Dismal Lakes. The survey area covered a geological series in which there is uranium potential for primary mineralization in the Great Bear Batholith, secondary mineralization near the sub-Helikian uncomformity and roll-type mineralization in the continental sediments. The survey area was also extended to include the base metal occurrences of the Muskox Intrusion. The area underlain by the Coppermine basalts was not sampled. These copper-rich basalts were studied by Hornbrook and Allan (1969) and Allan et al (1970).

The surficial geology has been described by Craig (1960). Ice flow direction was generally from the southeast to the northwest. Glacial drift covers broad areas of bedrock along the northern boundary of the map area and in the western part from Lac La Roux north to Dismal Lakes.

In many of the larger lakes (>3 km²) heavy ice conditions prevailed. The effect of the melt water on the surface sample collected from open leads or at the shoreline, was probably a serious dilution factor (MacDonald 1969). As a result the outline of some anomalies could have been missed and severely weakened others.

Sampling Method:

500 ml. of surface water were collected at each site using an automated, helicopter-mounted system described earlier by Cameron and Durham (1975). The system is designed to sample lake waters as rapidly as possible and at the same time to measure pH, conductivity and temperature. This was the first test of the system. While the sampling system performed to specifications, the electronics used to measure the above three parameters gave problems. Thus conductivity and temperature data are not given in this report and pH data are presented only in four broad classes. An overall sampling rate of 25 per hour was maintained at a sample density of one sample per 5 km². Although lake waters were the primary sampling medium, streams, bogs and small pot holes were sampled to fill in areas where large tracts did not contain any lakes.

Analytical:

Cu and Zn in the waters were determined by atomic absorption spectrometry after extraction of 50 mls of water chelated with APDC into MIBK. Uranium was determined fluorimetrically on 50 mls of water by the method of Smith and Lynch, 1969. Detection limits are 3 ppb for Zn and Cu and 0.01 ppb for U. This orientation study showed that a large proportion of the waters collected contained less than the detection limit for these three elements. This has caused the investigation of alternative techniques of analysis: fission track methods for uranium and graphite atomizer/atomic absorption method for Cu and Zn.

Uranium Results

In the south-west corner of the map, in the area dominated by the volcanic felsite intrusions of the Great Bear Batholith there are a greater number of waters with more than 0.1 ppb U than in almost any other rock-type, with the highest of these associated with fault structures. The potential for uranium mineralization in these rocks is well known, particularly in the Port Radium area. The values at or near major fault zones should warrant further investigations.

Along the unconformity of the Aphebian basement and the Hornby sediments there are numerous, albeit subtle, anomalies. This is particularly evident around St. Germain Lake and along the Coppermine River, from Big Bend eastwards. Some uranium mineralization has been reported near St. Germain Lake (DIAND, 1976).

In the main part of the survey area, within the Hornby sandstones and areas of drift cover, small, but persistent, concentrations of uranium are found in the water. There is a known occurrence of uranium east of Mountain Lake which gives a strong uranium-copper water anomaly (DIAND, 1976). The highest uranium value, 5.5. ppb U, was obtained from a small pond adjacent to an outcrop of dolomite of the Hornby group, east of Sandy Creek and north of Hanbury Kopje, within a large area of sandy drift cover.

Higher in the stratigraphic sequence of the sediments, above the lowest Hornby sandstone member, are many broad, uranium targets. These higher values are not only found in the Hornby dolomites (as noted above) but appear to be related to rocks in the Dismal Lake group of dolomites. Here, the higher pH of the waters, indicative of the carbonate environment, can maintian high concentrations of uranium in solution.

References

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