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MINING LANDS SECTION

# Report on a Geological and Radiometric Survey in Hutton Township, Sudbury Mining District

AMAX MINERALS EXPLORATION

Project 764

NTS 41 I/15

September 10, 1976

D.H. Waddington

# TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## MAPS

## SUMMARY

A geological and radiometric survey was performed on the grid covering parts of the two claim groups comprising this project. Several groups of radioactive conglomerate beds, not all of which have been tested by previous owners, were located but it was not possible to detect their presence beneath the drift covered portions of the property. The ratio of uranium to thorium would appear to be about 1:1 based on analyses of selected specimens from old trenches and radiometric data. The analyses were all quite low in uranium and thorium and they all contained traces of gold.

## INTRODUCTION

In mid-June, 1976, a grid of roughly 22 miles of cut lines was completed covering all the Mississagi Formation rocks on the property where they were thought to hold any potential for discovery of uranium mineralization. Grid lines were spaced at 400' intervals. In late June and early July a program consisting of detailed geological mapping (1" = 400') and a ground radiometric survey was carried out over this grid in an attempt to:

i) Detail the stratigraphy of the known radioactive conglomerate beds and their relationship to the basement rocks.

ii) Find any previously unrecorded conglomerate beds.

iii) Determine the structural elements controlling the distribution of the rock types.

iv) Detect any buried extensions of the exposed radioactive conglomerate beds.

## LOCATION & ACCESS

The property consists of two claim groups known as the Burns Option and the McVittie-Burns Option, made up of 17 and 19 unpatented mining claims respectively (Table I). The claims in Hutton Township lie in an area of rocks of the Huronian Supergroup about 25 miles north of the City of Sudbury and 10 miles north of the Town of Capreol (see Location Map, Figure 1).

Access to the property was by very rough bush road for approximately three miles, off the paved road from Capreol to the National Steel Company of Canada Ltd.'s Moose Mountain Mine. The road ends at the Vermilion River and a canoe was very convenient for travelling to the northwestern portions of the grid, although it is possible to walk to all parts of the grid.

Air and road transportation to the Sudbury area is normally excellent and Capreol is on the main trans-Canada line of the C.N.R.

TABLE I

Claims making up Hutton Township Project (764)

Mc Vittie - Burns Option (01):

| | |
|---|---|
| S 425294 - 298 | 5 claims |
| S 425419 - 421 | 3 claims |
| S 425424 - 426 | 3 claims |
| S 461494 - 499 | 5 claims |
| S 416548 - 549 | 2 claims |
| | 19 claims |

Burns Option (02):

| | |
|---|---|
| S 409528 - 542 | 15 claims |
| S 425422 - 423 | 2 claims |
| | 17 claims |

## HISTORY

The region has been mapped twice by ODM geologists (Kindle, 1932 and Meyn, 1970), at scales of 1" = 3/4 and 1/2 mile respectively. Both outline the gross stratigraphic features and basement relationships but Meyn (1970) incorporates a more up to date stratigraphic nomenclature and includes a description of the uranium showings and conglomerate beds on the Amax property.

Meyn (1970) reports that in 1966, the main part of the Amax property was held by Assembly Mines Ltd. Hudson Bay Exploration and Development optioned the ground and drilled sixteen diamond drill holes on the 3000' northern band of pebble conglomerate beds as well as three holes into the conglomerate beds on the west side of the Vermilion River. The logs of these holes were filed for assessment purposes. Six trenches, presumably opened during this period of work, were located during the present survey.

Two more trenches were found on the more southern major conglomerate band and it has also been reported that two diamond drill holes were drilled in this vicinity, one of which had encouraging results and the other not. (Ike Burnes, pers. comm.) No signs of this drilling were noticed during the present survey.

## TOPOGRAPHY & SURFICIAL GEOLOGY

The topography of the property is locally rugged with outcrops, especially of quartzites, occurring mainly on steep-edged ridges and plateaux. Relief is generally 40' to 100' along small scarps but more like 150' along larger ones near the Vermilion River (Plate I). Low ground near the river is filled with boulder fields of glacial outwash. Higher up and further from the river overburden is a more rolling boulder till with numerous small ridges and hills, possibly somewhat sculpted by glacial runoff action. The scarp-like nature of the outcrops, with boulder filled valleys between, creates many topographic lineaments, some of which may reflect faults in bedrock.

Many large (up to 25' diameter) glacial erratics of Bruce Formation conglomerate are visible around the shores of Bannagan Lake and along the trend of the lake to the southeast. If there are partly buried boulders of comparable size, they would be difficult, if not impossible, to distinguish from small outcrops.

At the time of the present survey the bush was very dry. One lake, Bannagan (locally known as Dunlop) Lake occurs on the property. Several other lakes, essentially formed by the damming action of beavers, were dried up. In addition, several dried up muskeg or spruce bog areas occupy local despressions.

Most of the white pine was logged off long ago (except for the extreme western part of the grid) and forest cover now consists of second growth birch, poplar and alder. Most open areas have a cover of thick bracken.

## GEOLOGY

### General

Rocks exposed on the property belong to three subdivisions. These are the Bruce and Mississagi Formations of the Huronian Supergroup which lie unconformably on intermediate volcanic basement rocks. This contact appears to be offset dextrally by two parallel faults but it is highly probable that other minor faults exist.

A three foot boulder of Espanola (?) Formation limestone was noted at 18+35N on L28E. As this rock type disintegrates readily, it probably did not travel far and may occur closer than the nearest outcrop on published maps, (about ½ mile east of this boulder).

### Stratigraphy

On the accompanying 1" = 400'. geology map (back pocket) the rocks have been placed into three divisions, two of which have been broken down further on the basis of lithology.

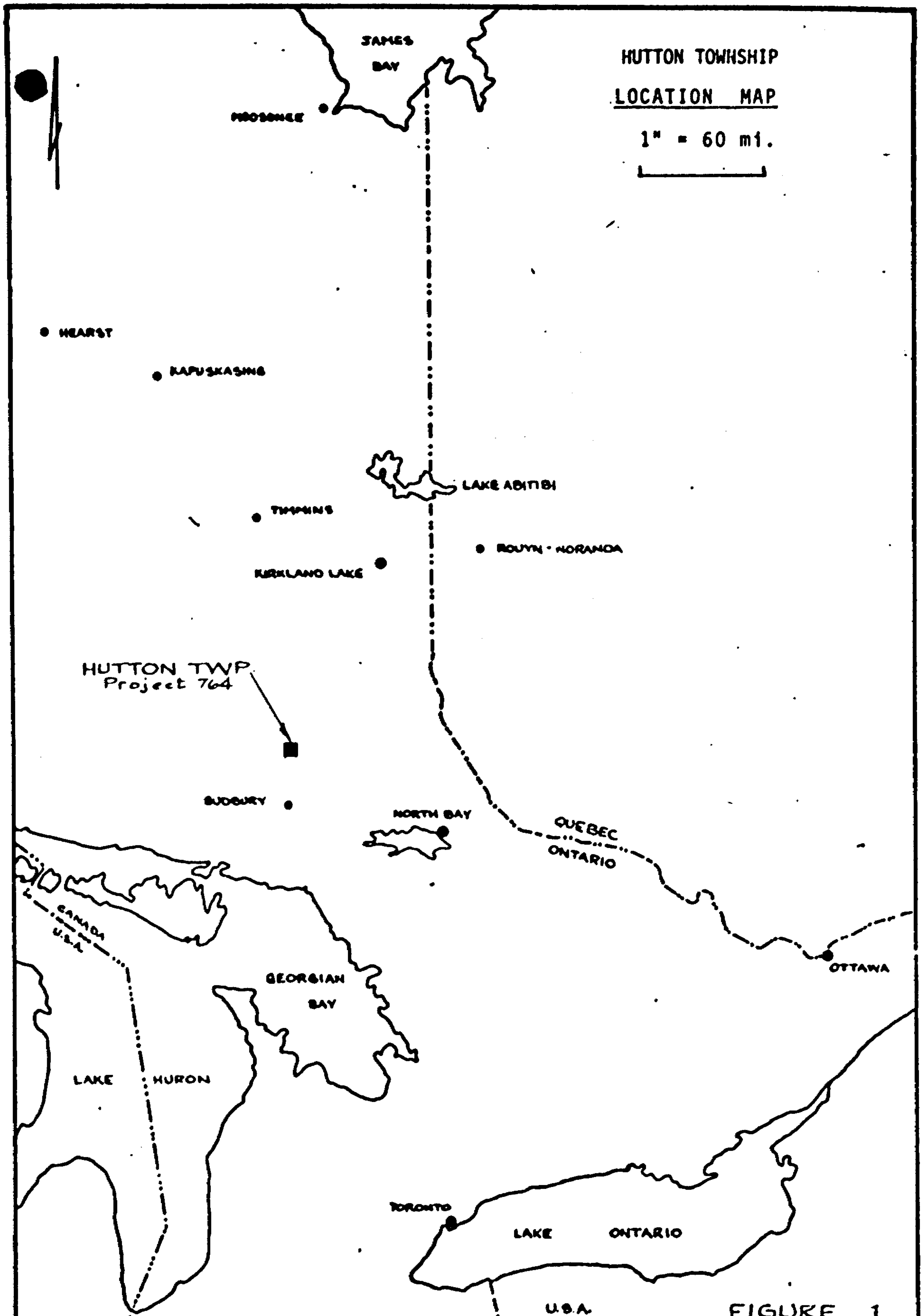

HUTTON TOWNSHIP
LOCATION MAP
1" = 60 mi.
JAMES BAY
MOOSONEE
HEARST
KAPUSKASING
LAKE ABITIBI
TIMMINS
ROUYN - NORANDA
KIRKLAND LAKE
HUTTON TWP
Project 764
SUDBURY
NORTH BAY
QUEBEC
ONTARIO
CANADA
U.S.A.
GEORGIAN BAY
LAKE HURON
OTTAWA
TORONTO
LAKE ONTARIO
U.S.A.

FIGURE 1

Map Unit 1:

Basement rocks to the Huronian supergroup are exposed at the southern edge of the eastern part of the Amax grid. They are all intermediate or intermediate to felsic volcanics, probably tuffs. They are usually schistose with no primary structures visible, but on the south tie-line around 18E they show prominent thin (½") bedding. Three to four hundred feet west of 10S on L48E they appear to contain a few diffuse scattered fragments up to 2" in diameter.

The volcanics are generally coloured a dark grey-green on the weathered surface and a lighter grey-green on the fresh surface. Tiny feldspar phenocrysts and biotite flakes or clots are sometimes visible in hand specimen.

One small outcrop near 17+50E on TL17S has a radioactivity level roughly six times background although the large, thin-bedded outcrop mentioned above is immediately adjacent and is nowhere above background.

Map Unit 2:

Rocks of the Mississagi Formation have been divided into four map units on the basis of lithology and are designated a), b), c), and d) on the accompanying 1" = 400' geology map (back pocket).

Map unit 2a is the uppermost member of the Mississagi Formation mapped on the property. It is a fine grained argillaceous sandstone. It is generally yellowish and even textured on the weathered surface and greyish on the fresh surface. Texture is usually massive. Tiny flakes of biotite are usually present, giving the dark colour and dirty appearance. It is not uncommon to find tiny specks of pyrite disseminated in this unit but there is no apparant radioactivity associated with it.

Map unit 2b is the most abundant of the Mississagi Formation subdivisions. It has a well defined contact where it underlies 2a in the western part of the grid. Further east small outcrops of 2a and 2b are found intermingled and there appears to be no clear cut contact, although Map unit 2b still tends to be best developed in the middle and lower parts of the formation. This unit tends to make up the larger outcrops and usually forms high ground.

The rock is mainly a medium grained quartzite or arkosic quartzite, coarser grained and cleaner than 2a, but there is probably a gradational facies change relationship between them. The weathered surface is commonly white to pinkish or yellowish white while the surface is generally pale greyish white (from very fine grained biotite impurities and feldspar) or pinkish white (due to reddish hematitic staining of the quartz and feldspar grains). Cross bedding is common allowing numerous tops determinations to be made. It is locally very prominent as in the outcrops near the Vermilion River at the south end of lines 12W, 16W and 20W. No paleocurrent measurements were attempted but it seemed that the cross beds changed from a southeasterly to a northwesterly component of current direction, as seen in outcrop exposures, near line 28W (going down in section?) along the river.

Map unit 2c is the member of the Mississagi Formation with the economic attraction. It is a pebble conglomerate which was radioactive everywhere on the property. Degree of radioactivity varied from three to forty times background. The conglomerate occurs in numerous beds or groups of beds ranging from small pebble trains one pebble thick to 10 to 15 foot thick beds. Pebble size varies from ¼" to 2" but is uniform in any outcrop. Beds usually have very sharp, straight upper and lower contacts. Distribution appears to be in bands containing numerous very long (much longer than any of the outcrops) conglomerate lenses. Pebble size and bed thickness is greatest in the central parts of the lenses, which thin and interfinger at the edges with the 2b quartzites. Some coarser grit beds in outcrops of 2b are faintly radioactive and may be the most distal fringes of conglomerate lenses.

There are four main beds or groups of beds of radioactive conglomerate exposed, at at least three different stratigraphic levels. It is difficult to determine their distance from basement because of the offset along the Milnet Fault which disrupts the Huronian stratigraphy, causing the rocks on the west side of the fault to be displaced from their proper stratigraphic position. Assuming non-repetition of sequences on the east side of the fault, the uppermost beds, occurring over 3000 feet of east-west strike, are exposed about 3500 feet from basement volcanics. Given the steep bedding attitudes, this is probably close to the true stratigraphic distance. This conglomerate has been tested in the past by diamond drilling and trenching.

The next conglomerate down section is exposed over 1200 feet of east-west stike, the west end against the Milnet Fault and the east apparently pinching out into several thin, fine beds. This conglomerate horizon would be roughly 2000 feet above the basement and has received less attention in the past in spite of its strong resemblance to the upper one and its more favourable stratigraphic position. About 700 feet lower still are several thin conglomerate beds exposed over about 150 feet against the Milnet Fault at the south end of line 16W. The strike of these beds is closer to 120°. Further east, around 7S between lines 16E and 20E, is a group of isolated, high weathering outcrops displaying numerous thin beds of radioactive conglomerate also striking approximately 120°. They occur about 1000 feet above basement and may correlate with the lowermost beds further west (at the south end of line 16W). These beds could not be traced east or west due to a lack of outcrops in this part of the property.

The nature of the conglomerate is a well sorted pebble conglomerate. Angularity of fragments varies from sub-angular at the fringes of the lenses to rounded in the thicker central portions. Pebbles are mainly very pure granular, white quartzite (or recrystallized quartz?) but with some glassy quartz, grey chert and pink chert pebbles as well. An occasional argillite pebble was noted. The rock is from 60% to 85% pebbles with the matrix being a grey, finer grained dirty quartzite, vaguely reminiscent of 2a. Rust and pyrite are not uncommon, especially in the thicker beds, and are associated with higher radioactivity. Pyrite is fine grained and disseminated, often as tiny cubes, and where the pebbles are more numerous (and matrix scarce) it commonly appears to be rimming the pebbles. Whether this is an effect of packing ratios or recrystallization can not be said.

Map unit 2d is called an argillite. Generally there occur thin interbeds of siltstone or argillite within the thick beds of 2b. Sometimes these thin (2" to 1') beds are slightly rusty and weakly radioactive (two or three times background). Occasionally there is a faint lamination of the argillite beds due to thin streaks of sandy material. Towards the base of the Mississagi some thicker argillite beds are found. Just east of the south end of L16W, on the shore of the river, a roughly 20 foot thick argillite bed is exposed. This bed is finely and evenly laminated with alternating light and dark laminae.

Caution must be exercised when using the thin argillite interbeds as bedding indicators as there are very similar appearing patches and bands of "Sudbury Breccia" (or "pseudo-tachyllite") which have been observed to crosscut bedding in many places.

The rock types in the Mississagi as mapped on the property are not inconsistent with a river-bed or deltaic depositional model.

Map Unit 3:

On the accompanying 1" = 400' geology map (back pocket) the Bruce Formation has been divided into two lithologies, 3a being conglomerate and 3b a fine grained dirty quartzite or sandstone. The 3b quartzite may in fact be zones devoid of large clasts rather than the characteristic quartzite described by Meyn (1970) and quoted below:

> "The Bruce Formation conformably overlies the Mississagi Formation. This formation is essentially a conglomerate but interbeds of quartzites are common near the base of the formation and occur locally higher up in the section. These rare quartzitic interbeds are good indicators of bedding in the conglomerate. Sometimes a zone devoid of pebbles next to a zone rich in them is taken as an indicator of bedding, but this is not a reliable indication because this zone can not be traced over an appreciable distance due to discontinuous outcrop, and probably due to the discontinuity of the feature itself ........
>
> "The typical Bruce Formation is a loosely packed paraconglomerate containing from 10 to 40 percent fragments. The fragments vary in size from 1/25 inch to 3 feet (1 mm to 1 metre) but measure usually about 1/2 inch to 4 inches. The fragments are most commonly a white to grey grantic rock but fragments of diabase, "greenstone", chert, greywacke, and argillite are also found. The matrix that supports these fragments is commonly dark grey-greenish in colour. This matrix is composed of rounded to subangular grains (0.2 mm to 1 mm) of quartz and felspar in a finer grained matrix of mica and quartz. This puts the matrix of the Bruce Conglomerate into the greywacke and subgreywacke group of the arenites."

## STRUCTURE

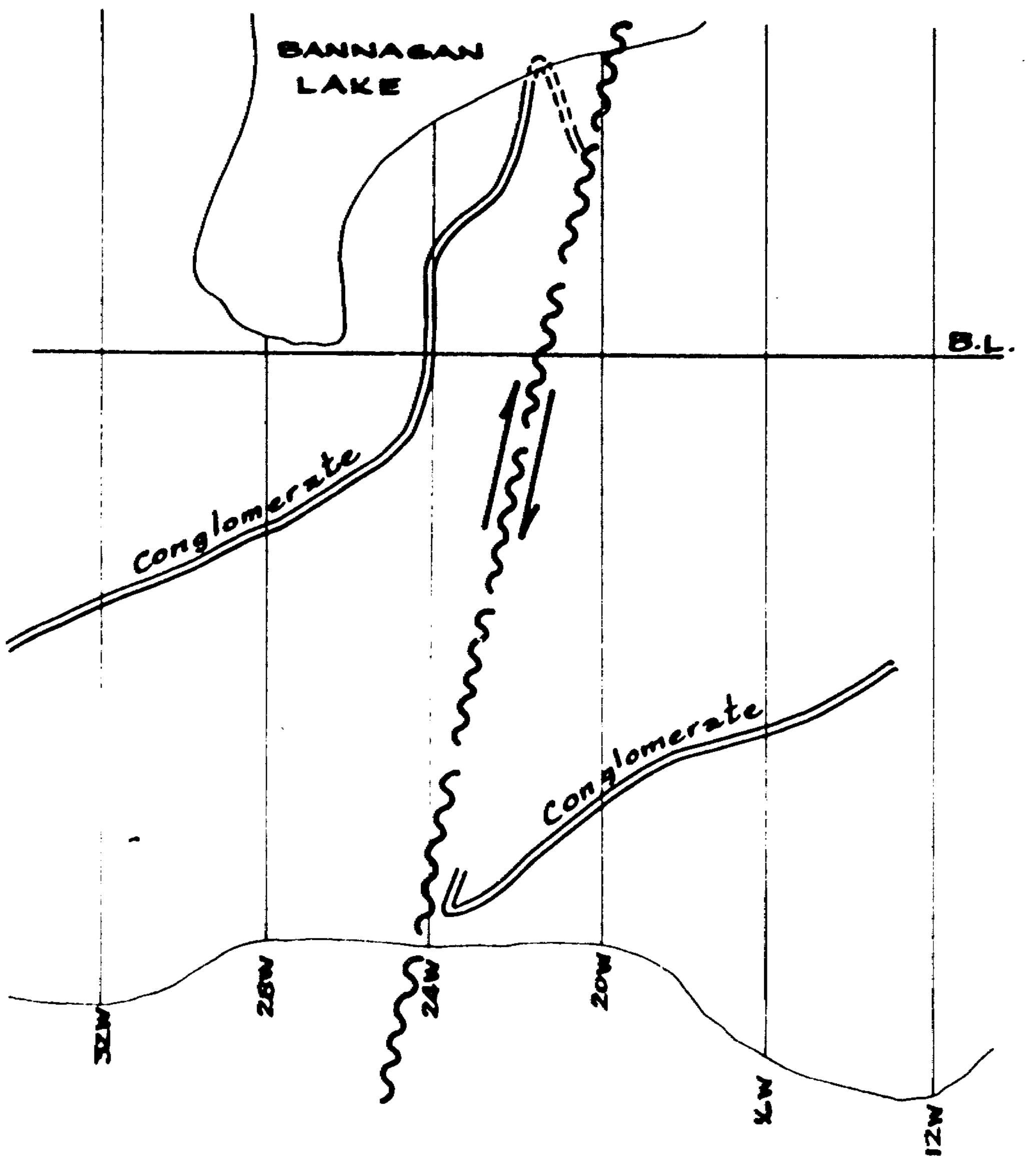
There is little evidence of obvious structural complexity to be seen. Bedding has been dragged slightly along the Milnet Fault as seen by the conglomerate bed attitudes. Two outcrops near the east end of the uppermost conglomerate unit show contorted and broken bedding which could indicate that the rocks reacted in a relatively brittle fashion to the gentle folding which occured in the northwest part of the grid, or could reflect some more intense but local event.

From available outcrop data the Bruce-Mississagi contact is seen to have undergone broad gentle folding in the northwest part of the grid and the attitudes of bedding in the uppermost conglomerate unit also reflect this feature. The Mississagi-basement contact is only seen in the southwest part of the grid and two north-south, dextral, strike-slip faults are invoked to explain its location.

It can be legitimately questioned whether more faults exist. It is highly probable because of the brittle nature of the deformation but they cannot be inferred from presently available information.

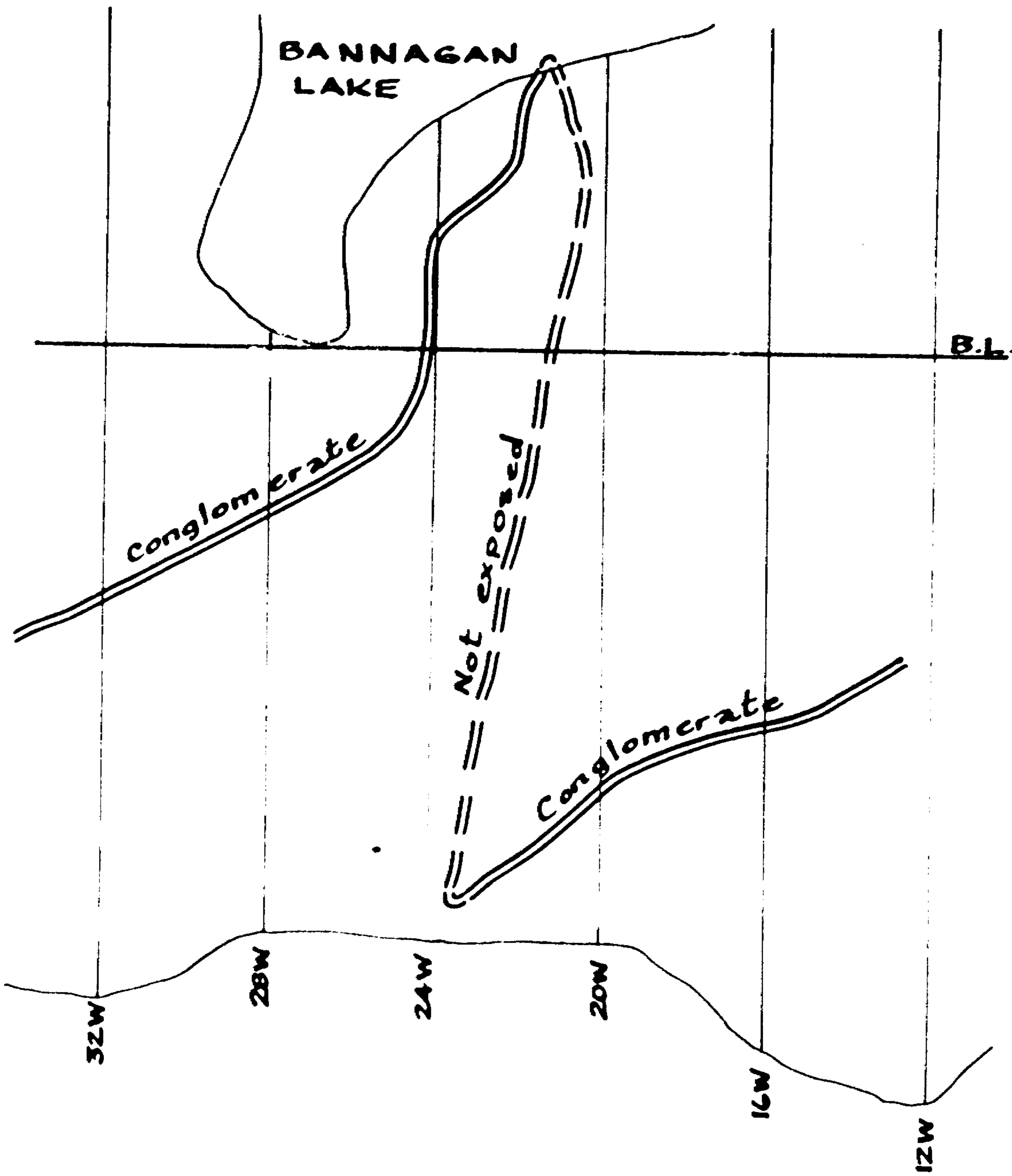
One possibility to keep in mind is that the two main (and stratigraphically highest) conglomerate beds, because of their strong lithologic similarities, may really be only one. Their present stratigraphic separation could result either from strike-slip faulting (Figure 2) or chevron folding (Figure 3). There is no evidence of an offset in the Bruce-Mississagi contact equivalent to that required by faulting and, while the folding could be intrafolial, there is no exposure of an intermediate limb or equivalent bedding attitude change.

Some more intricate structure may also be necessary to account for the occurrence of several possible outcrops of Bruce Formation from lines 24E to 32E north of the baseline.




REPETITION OF CONGLOMERATE BEDS: FAULT MODEL

FIGURE 2




REPETITION OF CONGLOMERATE BEDS: FOLD MODEL

FIGURE 3

## ECONOMIC GEOLOGY

All the exposures of pebble conglomerate (map unit 2c) are radioactive, usually at least five to ten times background and locally up to 45 times. Table II gives uranium, thorium, and gold assay results from samples collected from trenches and outcrops of conglomerate. The samples were selected from the most radioactive location possible in an attempt to minimize possible leaching effects on the assay results. It can be seen that the grade is low and the thorium content is fairly high relative to uranium. Surface leaching may have affected the values at the locations sampled but it is believed that they are similar in magnitude to those obtained in the drilling program on the uppermost conglomerate beds in 1967.

Table III compares the scintillometer readings on each assay sample (before crushing but after background was removed) with the assay results. Figures 4 and 5 are graphical comparisons of absolute uranium levels and uranium/thorium ratios with the scintillometer data from Table III. The graphs are certainly not ideal but this mainly reflects the inaccuracies of measuring such small samples over such small time periods (five minutes).

Table IV shows the detailed scintillometer readings taken on conglomerate beds at all the stations located on the 1" = 400' geology map (back pocket). Obviously the absolute readings cannot be compared directly to those in Table III because of the greatly increased mass being measured. The $T_2/T_3$ values should give a good idea of the uranium/thorium ratios though, and they appear to be similar to those in the assayed samples. The average $T_2/T_3$ values for each set of conglomerate beds (numbered 1 through 4 from northwest to southeast progressively) indicate uranium/thorium ratios of roughly 1:1 or slightly less (Table V). A $T_2/T_3$ of 3.5 indicates a pure thorium source when the instrument is properly calibrated.

Within the accuracy limitations of the present survey, there seems to be a direct relationship between coarseness, roundness, and pyrite content of the conglomerate and its radioactivity. While rust is found in other lithologies, they seldom show even double background radioactivity.

TABLE II

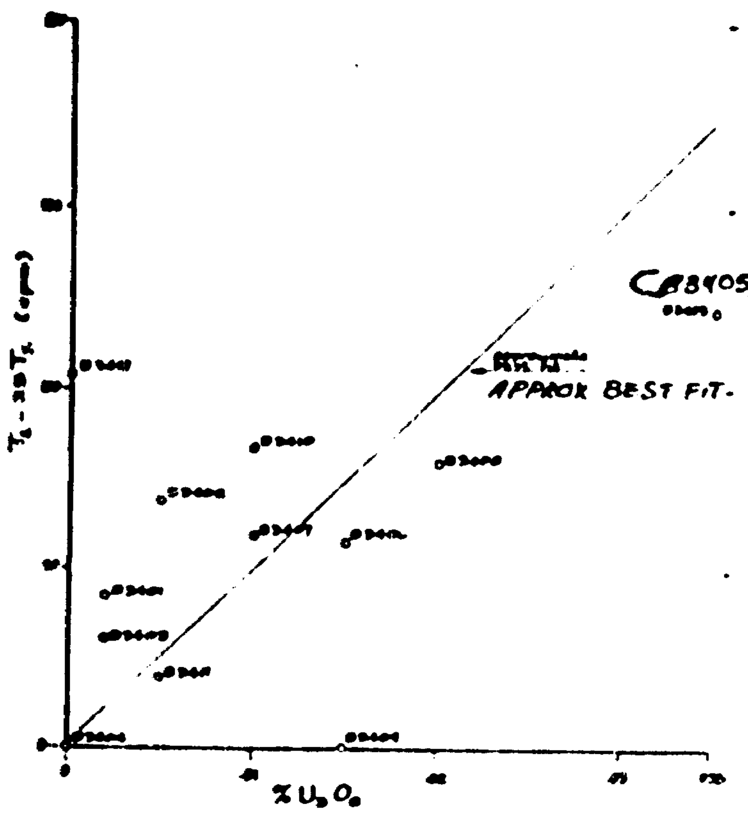
Assays of rock samples from surface exposures
(locations shown on 1"=400' geology map)

| Sample | $\%U_3O_8$ | $\%ThO_2$ | Au oz./ton |
|---|---|---|---|
| B3401 | Trace | | Trace |
| B3402 | 0.005 | | Trace |
| B3403 | Trace | 0.010 | Trace |
| B3404 | Nil | Trace | Trace |
| B3405 | 0.035 | 0.035 | Trace |
| B3406 | 0.015 | 0.025 | 0.01 |
| B3407 | 0.010 | | Trace |
| B3408 | 0.020 | | Trace |
| B3409 | 0.015 | 0.070 | Trace |
| B3410 | 0.010 | 0.020 | Trace |
| B3411 | 0.005 | 0.025 | Trace |
| B3412 | Nil | | Trace |

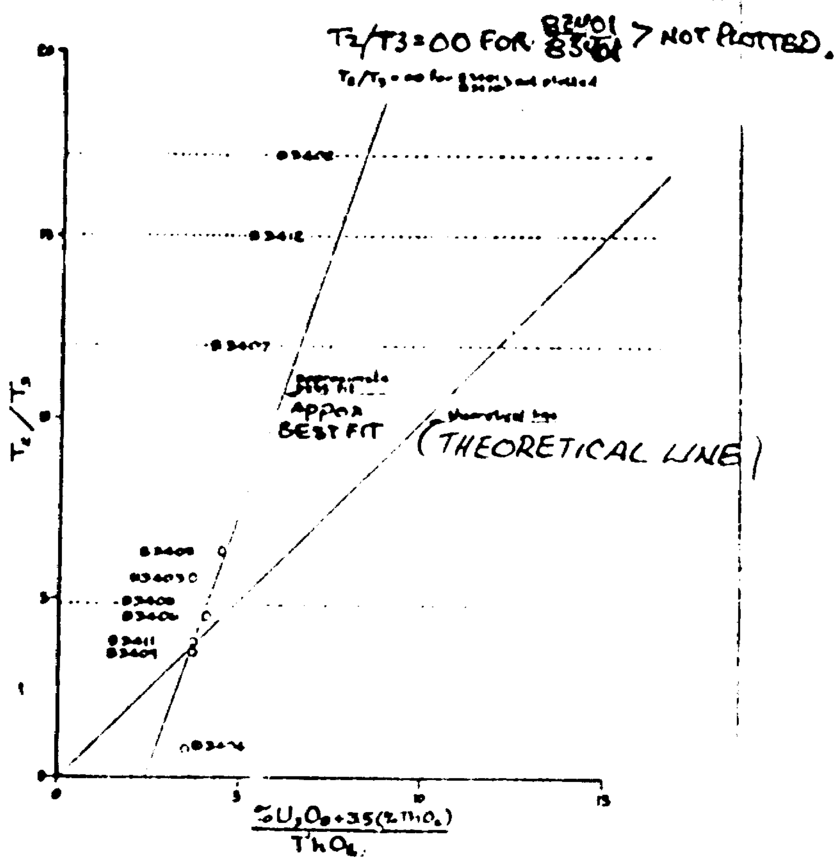
TABLE III

Comparison of Scintillometer and Assay Results from Analysed Samples (background removed)

| Sample | $T_1$ | $T_2$ | $T_3$ | $T_2/T_3$ | $\%U_3O_8$ | $\%ThO_2$ |
|---|---|---|---|---|---|---|
| B3401 | - | 42 | 0 | 00 | Trace | - |
| B3402 | - | 86 | 5 | 17.2 | 0.005 | - |
| B3403 | 136 | 86 | 16 | 5.4 | Trace | 0.010 |
| B3404 | 0 | 6 | 8 | 0.75 | Nil | Trace |
| B3405 | 421 | 276 | 44 | 6.3 | 0.035 | 0.035 |
| B3406 | 372 | 264 | 59 | 4.5 | 0.015 | 0.025 |
| B3407 | 110 | 84 | 7 | 12 | 0.010 | - |
| B3408 | 380 | 272 | 55 | 4.9 | 0.020 | - |
| B3409 | 450 | 342 | 99 | 3.5 | 0.015 | 0.020 |
| B3410 | 120 | 84 | 0 | 00 | 0.010 | 0.020 |
| B3411 | 417 | 289 | 77 | 3.8 | 0.005 | 0.025 |
| B3412 | 249 | 135 | 9 | 15 | Nil | - |




COMPARISON OF $U_3O_8$ ASSAYS AND RADIOMETRIC MEASUREMENTS
FIGURE 4




COMPARISON OF URANIUM TO THORIUM RATIOS DETERMINED BY ASSAY AND RADIOMETRIC METHODS
FIGURE 5

## TABLE IV

### Detailed Scintillometer Readings

| Station | $T_1$ | $T_2$ | $T_3$ | $T_2/T_3$ |
|---|---|---|---|---|
| H 1 | 1500 | 1450 | 410 | 3.5 |
| H 2 | 5020 | 4500 | 1025 | 4.4 |
| | 2660 | 1950 | 450 | 4.3 |
| H 3 | 3050 | 2300 | 550 | 4.2 |
| | - | 3200 | 890 | 3.6 |
| | - | 1620 | 320 | 5.1 |
| | - | 3200 | 850 | 3.8 |
| | - | 2400 | 590 | 4.1 |
| | - | 1120 | 208 | 5.4 |
| H 4 | >6000 | 4800 | 1350 | 3.6 |
| | 3200 | 2400 | 500 | 4.8 |
| | 3200 | 2300 | 580 | 4.0 |
| H 5 | - | 850 | 230 | 3.7 |
| | - | 2100 | 480 | 4.4 |
| | - | 1500 | 320 | 4.7 |
| H 6 | - | 2200 | 600 | 3.7 |
| | 3800 | 2650 | 660 | 4.0 |
| H 7 | 1220 | 830 | 220 | 3.8 |
| H 8 | - | ~ 250 | - | |
| H 9 | 2900 | 2400 | 600 | 4.0 |
| H10 | 4200 | 3000 | 600 | 5.0 |
| | 2600 | 1680 | 350 | 4.8 |
| H11 | 3050 | 2000 | 360 | 5.6 |
| H12 | 6800 | 4600 | 800 | 5.8 |
| H13 | 3600 | 2600 | 600 | 4.3 |
| | 4600 | 3000 | 700 | 4.3 |
| H14 | 3100 | 2000 | 390 | 5.1 |
| H15 | 4700 | 3000 | 800 | 3.8 |
| | - | 1320 | 250 | 5.3 |
| | - | 460 | 120 | 3.8 |
| H16 | 3800 | 2900 | 680 | 4.3 |
| H17 | ~ 500-600 (throughout) | | | |
| H18 | - | 1680 | 380 | 4.4 |
| | - | 2100 | 500 | 4.2 |
| | 1040 | 720 | 190 | 3.8 |
| | 1160 | 820 | 260 | 3.2 |

TABLE V

Average values of $T_2/T_3$

| Conglomerate Section | No. of Readings | Average $T_2/T_3$ |
|---|---|---|
| 1 | 18 | 4.4 |
| 2 | 9 | 4.3 |
| 3 | 3 | 4.3 |
| 4 | 4 | 3.9 |

No new radioactive conglomerate was discovered in this survey. Most outcrops were shown on the ODM map (Meyn, 1970) and all showed evidence of past stripping. It was not possible to trace buried extensions radiometrically with any certainty as the most significant controlling factor for the readings was overburden thickness. Whether the units are faulted off or repeated by folding as discussed in the section on structure, above, or pinch out or continue under the drift is therefore impossible to say at this point.

## CONCLUSIONS & RECOMMENDATIONS

Four groups of radioactive conglomerate beds ranging in length from several hundred to several thousand feet have been located. Assays indicate low levels of uranium and thorium in surface exposures, in proportions of roughly 1:1. Radiometric results support this ratio. Due to overburden conditions and possible structural complexities, the location, or even presence, of these beds cannot be reliably predicted under the glacial debris on the basis of presently available geological and radiometric data.

A reasonable first diamond drilling program for this property would have two target areas. The first would be to follow up on the exposed radioactive conglomerate beds and the second would be to test the actual basement contact zone. The uppermost and longest zones have been thoroughly drilled but by analogy with other uranium occurrences in the same formation to the northwest, the better mineralization occurs in the lower beds, usually within a few hundred feet of basement.

Three or four short holes could test the second highest and second longest exposure of radioactive conglomerate. One more short hole would test the somewhat lower and more westerly exposures on line 20E. These four or five holes would entail approximately 1300 feet of diamond drilling.

The second prong of the attack could entail four holes, for a total of 2000 feet, designed to penetrate the basement contact where it occurs on the property. This contact is not well exposed so a ground magnetometer survey of that portion of the grid and the area immediately south of the tie-line at 17S is recommended. In addition, some of the exposed contact is presently unstaked. Four claims should be located to cover this open ground.

If the drilling proves interesting enough to make it desirable to look for strike extensions of the conglomerate beds, geophysical methods of radon gas detection in the soil could prove useful. Although several techniques involving emmanometers and a; phameters appear to have cost and time advantages, the Track Etch system has proven much more reliable. The rugged nature of the topography may put the bulkier equipment of the emmanometer and a alphameter systems at a further disadvantage from a logistical point of view.

Recommended work, therefore, consists of the following propcsals:

1) Staking of four new claims to cover more of the basement contact zone.
2) Magnetometer survey to better define the basement contact where not exposed.
3) Roughly 1300 feet of diamond drilling to check the exposed conglomerate beds which are as yet untested.
4) Roughly 2000 feet of diamond drilling to test the basement contact zone as defined by outcrop and the ground magnetometer survey.

With encouragement, further work could consist of establishing strike extensions of surface exposures of radioactive conglomerate utilizing Track Etch methods, followed up by more diamond drilling.

J. Waddington

# REFERENCES

Kindle, L.F.
1932:Moose Mountain - Wanapitae area; Ontario Dept. Mines, Vol. 41, pt. 4, p.29-49. Published 1933. Accompanied by Map 41e, scale 1" = 3/4 mile.

Meyn, H.D.
1970:Geology of Hutton and Parkin Townships; Ontario Dept. Mines, Geological Report No. 80. Accompanied by Map 2180, scale 1" = 1/2 mile.

# PLATES

PLATE I

Looking west across Vermilion River Valley (Milnet Fault)

PLATE II

Pebble onglomerate at station H-1.

PLATE III

Pebble conglomerate at station H-2.

PLATE IV

Pebble conglomerate at station H-3 (east end)

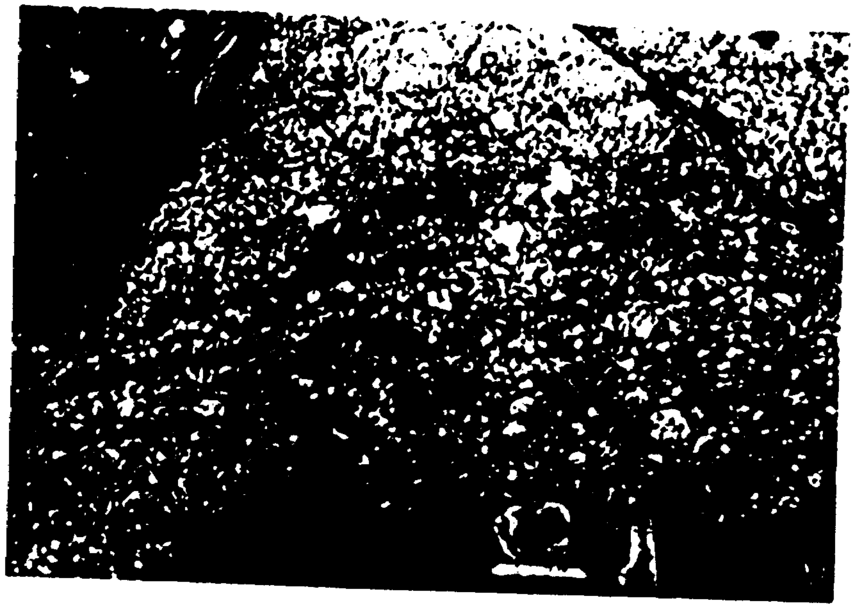


PLATE V
Pebble conglomerate at station H-4

PLATE VI
Pebble conglomerate at station H-5

PLATE VII
Pebble conglomerate at station H-6 (east half)

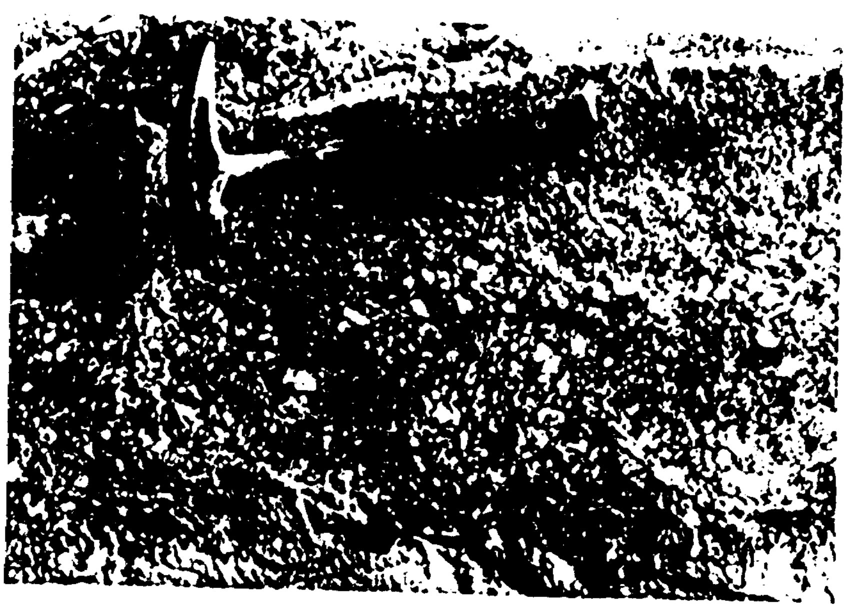


PLATE VIII
Pebble conglomerate at station H-6 (central portion)

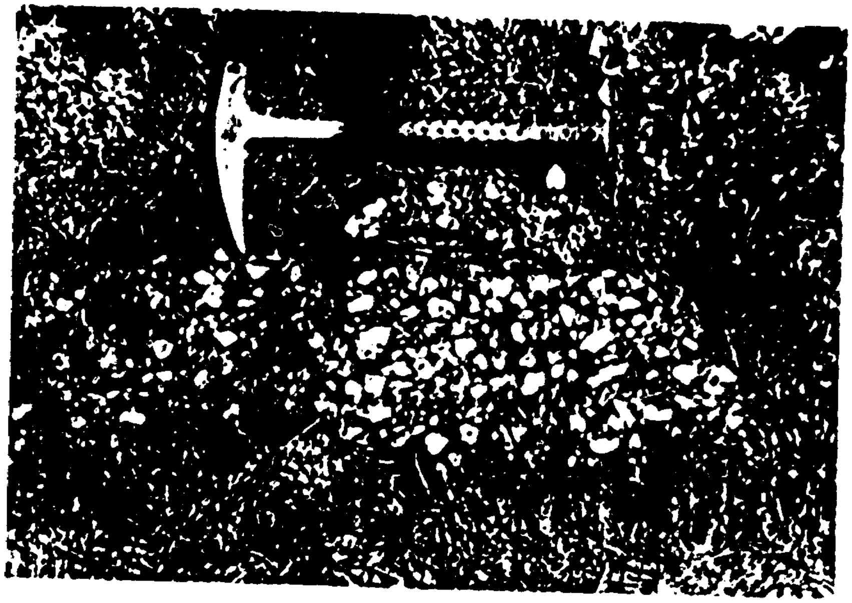


PLATE IX

Pebble conglomerate at station H-6 (west end)

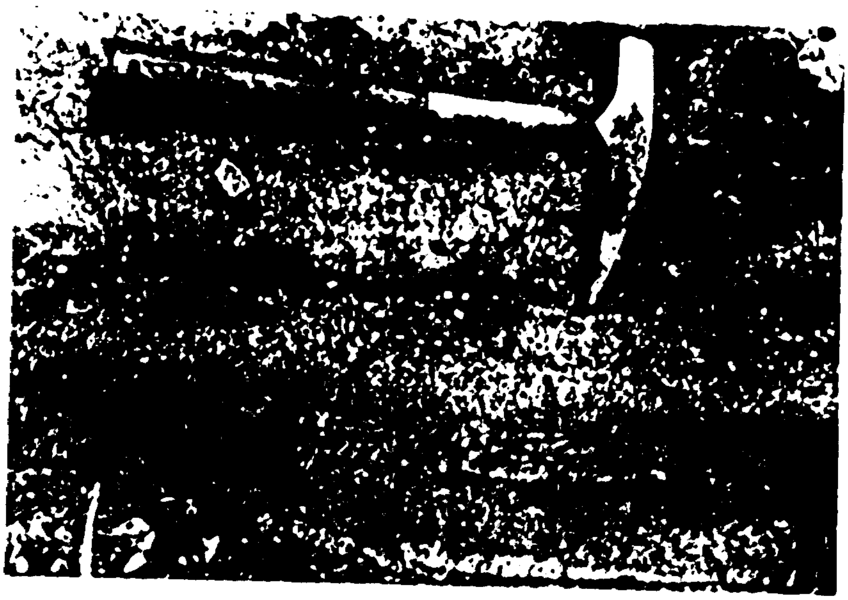


PLATE X

Pebble conglomerate at station H-7

PLATE XI

Pebble conglomerate
at station H-9 (trench)

PLATE XII

Pebble conglomerate
at station H - 10.
(north trench)

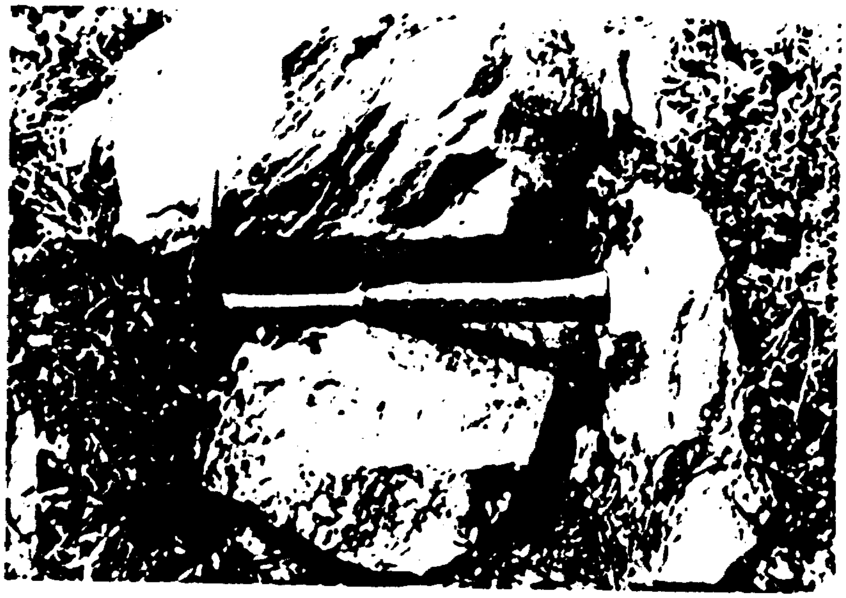


PLATE XIII
Pebble conglomerate at station H-12

PLATE XIV
Pebble conglomerate at station H-13 (east trench)

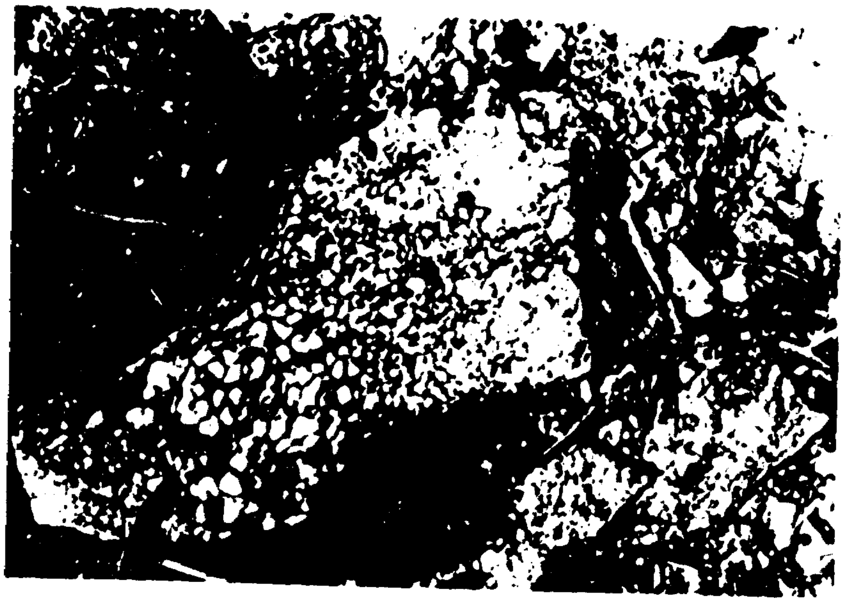


PLATE XV

Pebble conglomerate at station H-13 (west trench)

PLATE XVI

Pebble conglomerate at station H-15

APPENDIX I

## RADIOMETRIC SURVEY

In conjunction with the geological mapping, a ground radiometric survey was performed over the whole grid. Measurements were made at 100' intervals along all lines, on outcrops between such stations, and on radioactive conglomerate beds between lines. The measurements are plotted as profiles on a 1" = 400' grid map (back pocket).

The instrument used was a McPhar TV-4 Scintillometer. It allowed readings to be made differentially on a rate meter or integrally by a straight cumulative count. The rate meter employed time constants of 1, 3, or 10 seconds and the cumulative counts were made over periods of 1, 2, or 5 minutes. Four different channels measuring gamma radiation due to Thorium ($T_3$), Thorium + Uranium ($T_2$), Thorium + Uranium + Potassium ($T_1$), and all elements ($T_0$) were provided.

For the systematic coverage of the grid, measurements of $T_2$ (Thorium + Uranium) were recorded as shown on the profiles (back pocket). They were made with the tip of the probe 1.8' above the ground except over outcrops where it was placed directly on the surface. The instrument was calibrated with a pure thorium source daily and background checks were made twice daily over the thick sand and gravel deposits along the road in. Routine measurements were generally made on the rate meter with a time constant of 10 seconds. Where such readings were significantly higher (i.e. usually > 500 cpm) than background, a timed reading of $T_2$ and $T_3$, and in some cases $T_1$, was made over a period of 1 or 2 minutes.

41115SW9760 HUTTON 0017 HUTTON

900

File 2.2496

# GEOPHYSICAL – GEOLOGICAL – GEOCHEMICAL TECHNICAL DATA STATEMENT

RECEIVED

SEP 28 1977

MINING LANDS SECTION

**TO BE ATTACHED AS AN APPENDIX TO TECHNICAL REPORT**
**FACTS SHOWN HERE NEED NOT BE REPEATED IN REPORT**
**TECHNICAL REPORT MUST CONTAIN INTERPRETATION, CONCLUSIONS ETC.**

Type of Survey: GEOLOGICAL SURVEY

Township or Area: HUTTON TOWNSHIP

Claim holder(s): AMAX POTASH LIMITED
7 King St. East, Toronto, Ontario

Author of Report: D. H. Waddington

Address: 7 King St. East, Toronto, Ontario

Covering Dates of Survey: JUNE, 1976 JULY, 1976
(linecutting to office)

Total Miles of Line cut: 22

**SPECIAL PROVISIONS CREDITS REQUESTED**

ENTER 40 days (includes line cutting) for first survey.

ENTER 20 days for each additional survey using same grid.

| | DAYS per claim |
|---|---|
| Geophysical | |
| -Electromagnetic | |
| -Magnetometer | |
| -Radiometric | |
| -Other | |
| Geological | 40 |
| Geochemical | |

**AIRBORNE CREDITS** (Special provision credits do not apply to airborne surveys)

Magnetometer ______ Electromagnetic ______ Radiometric ______
(enter days per claim)

DATE: Sept. 23/77 SIGNATURE: [signature]
Author of Report or Agent
For Amax Potash Ltd.

**MINING CLAIMS TRAVERSED**
**List numerically**

See attached Schedule
(prefix) (number)

If space insufficient, attach list

TOTAL CLAIMS 27

PROJECTS SECTION

Res. Geol. ______ Qualifications on file

Previous Surveys ______

Checked by ______ date ______

GEOLOGICAL BRANCH ______

Approved by ______ date ______

GEOLOGICAL BRANCH ______

Approved by ______ date ______

# SCHEDULE OF MINING CLAIMS - HUTTON TOWNSHIP

S.409528 1/3
S.409531 1/2
S.409532
S.409533
S.409534
S.409535
S.409536 1/2
S.425294
S.425295
S.425296
S.425297
S.425298
S.425419 1/2
S.425420
S.425421
S.425422
S.425423
S.425424
S.425425 1/2
S.461494
S.461495
S.461496 1/2
S.461497
S.461498
S.461499
S.461548
S.461549

---

27 Mining Claims

Ontario | Ministry of Natural Resources | Lands Administration Branch | Projects Unit

# Technical Assessment Work Credits

File: 2.2496

**REVISED STATEMENT**

(Supersedes statement sent with Notice of Intent dated April 13, 1978)

Recorded Holder: Amax Potash Limited

Township or Area: Hutton Township

| Type of survey and number of Assessment days credit per claim | Mining Claims |
|---|---|
| Geophysical | S409528 |
| Electromagnetic ______ days | 409532 to 35 inclusive |
| Magnetometer ______ days | 425294 to 98 " |
| Radiometric ______ days | 425420 to 24 " |
| Induced polarization ______ days | 461494 - 95 |
| Section 86 (18) ______ days | 461497 to 99 inclusive |
| Geological 40 days | 461548 - 49 |
| Geochemical ______ days | |
| Man days ☐ Airborne ☐ | |
| Special provision ☒ Ground ☐ | NOTE: Mining Claims S.409531 - 36, 425419 - 25 and 491496 were only partly traversed therefore these five claims are being allowed only 20 days assessment credits each. |

**Notice of Intent to be issued:**

- ☐ Credits have been reduced because of partial coverage of claims.
- ☐ Credits have been reduced because of corrections to work dates and figures of applicant.
- ☐ No credits have been allowed for the following mining claims as they were not sufficiently covered by the survey:

The Mining Recorder may reduce the above credits if necessary in order that the total number of approved assessment days recorded on each claim does not exceed the maximum allowed as follows: Geophysical — 80; Geological — 40; Geochemical — 40;

Ministry of Natural Resources

Ontario

MAY 1978

Your file:

Our file: 2.2496

1978 05 03

Mrs. R. M. Charnesky
Mining Recorder
Ministry of Natural Resources
174 Douglas Street West
Sudbury, Ontario
P3E 1G1

Dear Mrs. Charnesky:

Re: Mining Claims S. 409528 et al, Hutton Twp. File 2.2496

The Geological assessment work credits as listed with my Notice of Intent dated April 13, 1978 have been approved as of the above date.

Please inform the recorded holder of these mining claims and so indicate on your records.

Yours very truly,

J. R. McGinn, Director
Lands Administration Branch
Whitney Block, Room 1617
Queen's Park
Toronto, Ontario
M7A 1W3
Phone: 416-965-6918

DN/mw

cc: Amax Minerals Exploration
Toronto, Ontario
Attn: Mr. K. R. Clemiss

cc: Amax Potash Limited
Toronto, Ontario

cc: Deputy Regional Director
Sudbury, Ontario
Attn: Resident Geologist

Ministry of Natural Resources

Ontario

Your file:

Our file: 2.2496

1978 05 09

Mrs. R. M. Charnesky
Mining Recorder
Ministry of Natural Resources
174 Douglas Street West
Sudbury, Ontario
P3E 1G1

Dear Mrs. Charnesky:

Re: Mining Claims S. 409528 et al, Hutton Twp. File 2.2496

Further to our telephone conversation with your office on May 5, 1978 enclosed is a revised statement indicating that mining claim S.461499 is entitled to 40 days geological credits. This claim was omitted in error from the statement sent with the Notice of Intent dated April 13, 1978 and is now approved as of May 3, 1978.

Please inform the recorded holder of this mining claim and so indicate on your records.

Yours very truly,

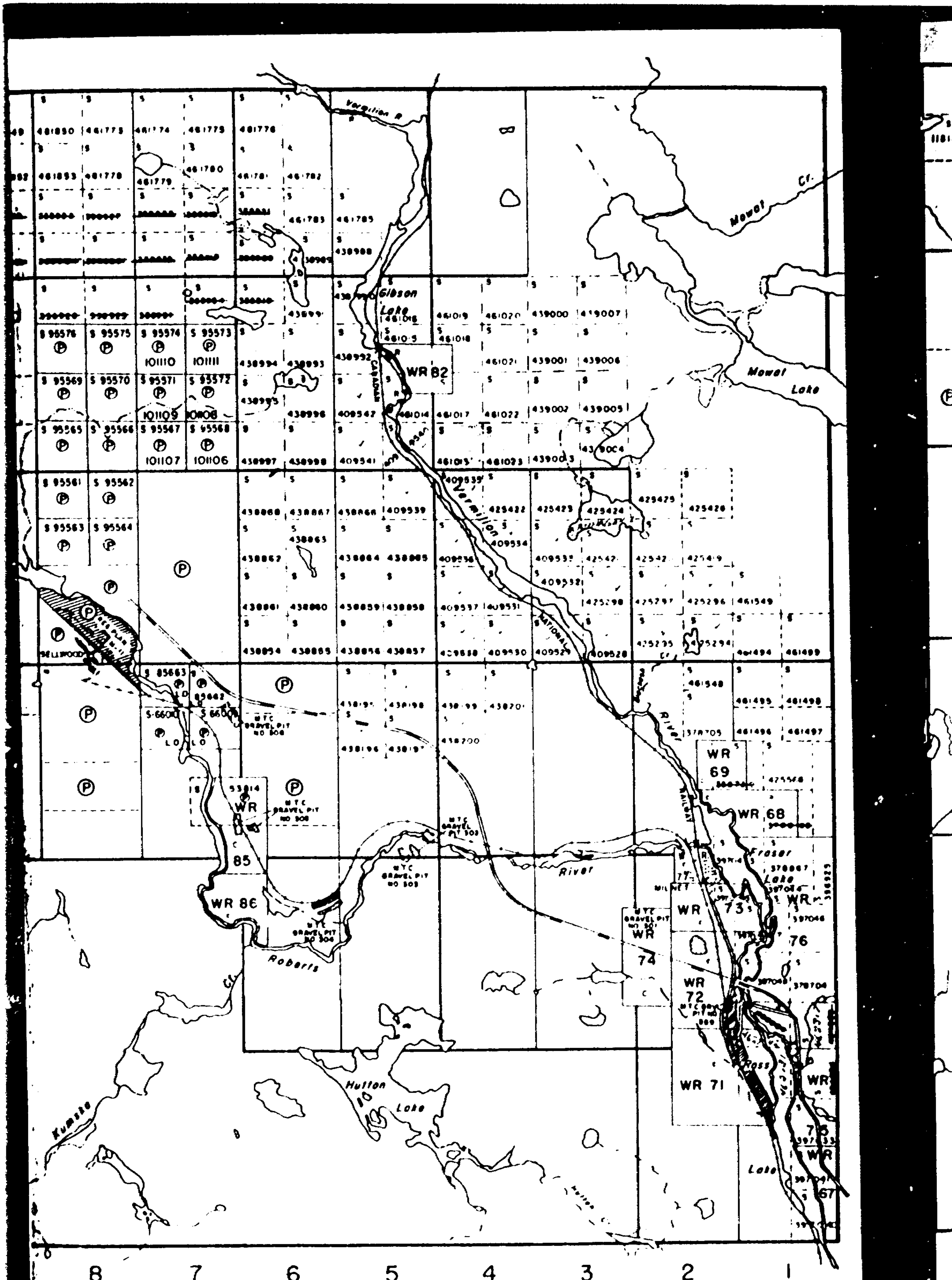
J. R. McGinn, Director
Lands Administration Branch
Whitney Block, Room 1617
Queen's Park
Toronto, Ontario
M7A 1W3
Phone: 416-965-6918

L.'/mw

cc: Amax Potash Ltd.
Toronto, Ontario

cc: Amax Minerals Exploration
Toronto, Ontario
Attn: Mr. K. R. Clemiss

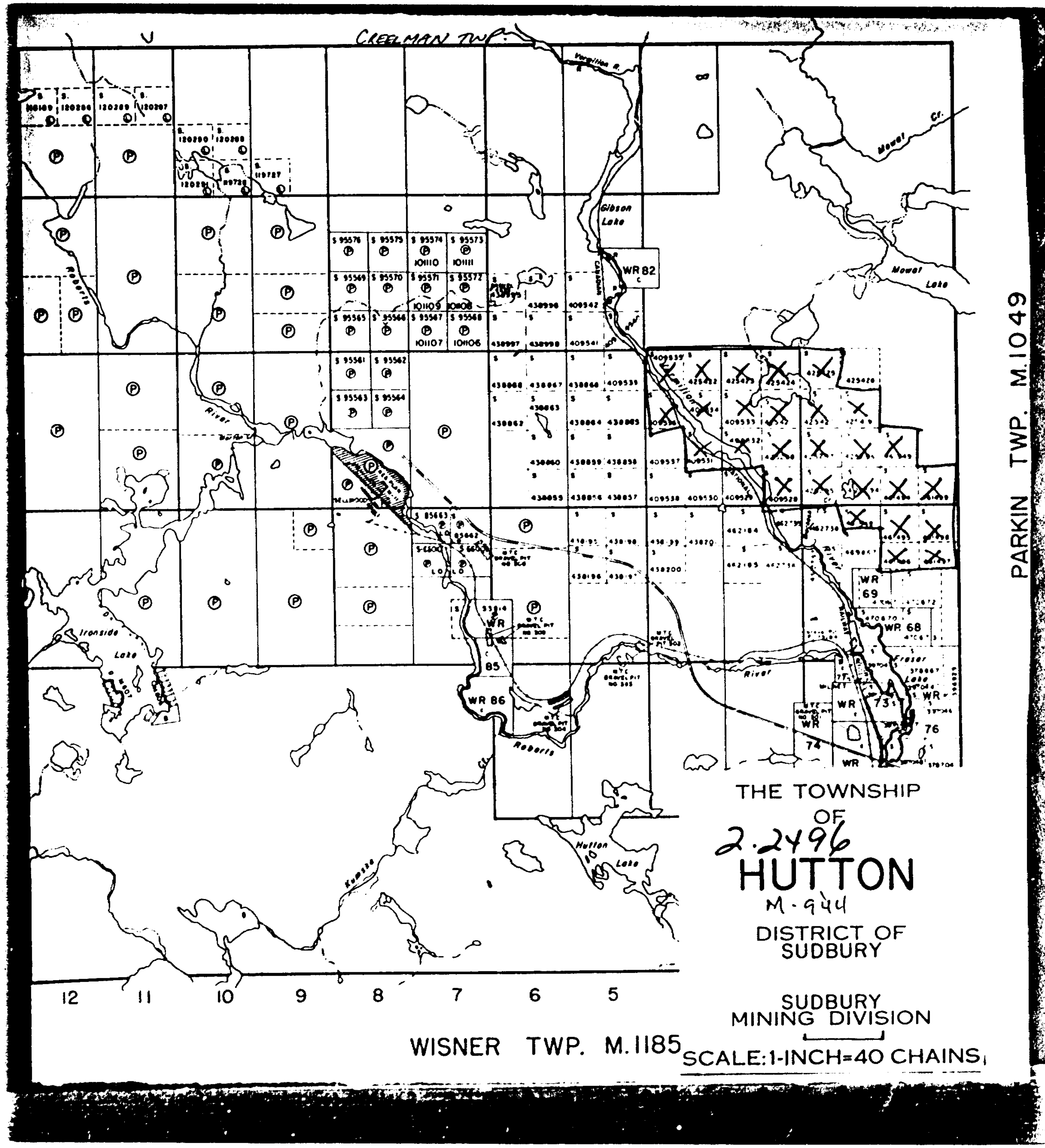
cc: Deputy Regional Director
Sudbury, Ontario
Attn: Resident Geologist




WISNER TWP. M.1185

Hutton Tp
Amax Minerals Expl.
6LYG Prad. surveys rpt.

Sent 1/1



CREELMAN TWP.
Vermilion R.
Gibson Lake
Mowat Lake
Mowat Cr.
WR 82
WR 69
WR 68
WR 86
85
WR
73
74
76
Ironside Lake
River
Roberts
Hutton Lake
Fraser Lake
12
11
10
9
8
7
6
5
PARKIN TWP. M.1049
WISNER TWP. M.1185
THE TOWNSHIP
OF
2.2496
HUTTON
M-944
DISTRICT OF
SUDBURY
SUDBURY
MINING DIVISION
SCALE: 1-INCH=40 CHAINS

AMAX EXPLORATION, INC
HUTTON TWP, ONTARIO
GEOLOGY
0 400 800 1200
FEET
Geology by D.H. Waddington — TORONTO-JULY 1976.
HUTTON-0017,#1
HUTTON-0017-#1
EXPLANATION
3 BRUCE FORMATION a) conglomerate
b) dirty quartzite
2 MISSISSAGI FORMATION a) f.g. dirty quartzite, minor biotite, tr. Py locally
b) mg. quartzite, arkosic quartzite, commonly cross bedded
c) pebble conglomerate
d) f.g. argillite; sometimes shows fine bedding
1 BASEMENT intermediate to felsic volcanic (tuffs?)
SYMBOLS
Claim Post (located)
Claim Post (not seen)
Witnessed Corner Position
Witness Post
Line Post
Drill Setup (located)
Drill Setup (not found)
Bedding - tops known; inclined, overturned
Bedding - tops unknown; inclined, vertical
Schistosity - inclined; vertical
Creek, seepage
Trench
Station Number (detailed notes)
Assay Number
Geological Contact - defined
Geological Contact - assumed
Fault - definite
Fault - possible
Swamp
MAGNETIC DECLINATION 9° W
NOTE: All pickets on L20E south of B.L. are labelled L24E.
DDH LOCATION MAP
1" = 400'
BANNAGAN LAKE
AREA OF DRILL HOLE LOCATION MAP
Gravel, Boulder Till
Boulder Ridge
Boulder Bed
Drained Beaver Lake
Beaver Flood
Vermilion River
MILNET FAULT
ROAD
BASE LINE 0+00
BASE LINE 1N
T.L. 23N
T.L. 17S


AMAX EXPLORATION, INC
HUTTON TWP, ONTARIO
RADIOMETRIC SURVEY
0 400 800 1200
FEET
To accompany report by: D.H. Waddington
TORONTO - JULY 1976.
HUTTON 0017- #2
INSTRUMENT: McPhar TV-4 Scintillometer
Readings by D. Martyn
Magnetic Declination 9°W
T2 (U+Th count)
300 200 100 0 cpm
Profile scale: 1" = 200 cpm
BANNAGAN LAKE
Vermilion River
Drained Beaver Lake
Beaver Flood
BASE LINE 0+00
BASE LINE 1N
T.L. 23N
T.L. 17S
3040
28W
24W
20W
16W
12W
8W
4W
0
4E
8E
12E
16E
20E
24E
28E
32E
36E
40E
44E
48E
52E
56E
60E
64W
60W
56W
52W
48W
44W
40W
36W
32W
24N
20N
16N
12N
8N
4N
4S
8S
12S
16S
425425
425424
425420
425419
425421
425423
425422
425297
425296
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425294
461003
461013
461549
461548
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