INTERPRETATION OF AN AIRBORNE MAGNETOMETER SURVEY IN KENOGAMING TOWNSHIP, SUDBURY MINING DIVISION, ONTARIO

INTRODUCTION

The following report represents a general interpretation of the results of an airborne magnetometer survey covering about four square miles in the northwest quarter of Kenogaming Township, Sudbury Mining Division, Ontario.

The main purpose is to outline ultra-basic intrusives, where possible, together with any indications of prospective asbestos veins within them. Other aspects of the conduct of the survey and equipment used are separately reported.

GEOLOGICAL SETTING

Geological information on the area is limited. The general environment is one of Keewatin greenstone, possibly including iron formation. It is understood that ultra-basic intrusives have been identified within the survey area. For the surroundings in general, the best published information is given in Map 1933a of the Ontario Department of Mines: Kamiskotia-Ridout Area (1938), at a scale of two miles to the inch. This map does not suggest more than a geological reconnaissance of Kenogaming Township and its surroundings. Pertinent information is that the regional strike of the Keewatin is roughly E-W'ly; iron formation is known in the near vicinity of the survey area but is not mapped within it; several Matachewan quartz diabase dykes are mapped within the survey area, and here, as for the region at large, their strike direction is usually between N-S and NW'ly; Keweenawan dykes of olivine diabase, striking NE'ly, are mapped to the southwest, in Penhorwood and Horwood Townships.

GEOPHYSICAL INTERPRETATION

The magnetic information can perhaps be most clearly described in terms of the different types of magnetic body apparently present. One type can be called a stock, probably basic to ultra-basic, and the calculated magnetic properties seem much the same for all bodies of this class. The other principal type consists of long and quite narrow bodies. Some of these may be volcanic strata or bedded iron formation in the Keewatin. Some may be post-Keewatin dykes. Others may be faults or fractures containing magnetite. There are also miscellaneous magnetic features of minor horizontal dimensions, and these cannot be satisfactorily interpreted without more specific geological control.

The features of chief interest are considered to be the linear magnetic bodies existing within the boundaries of the presumed basic or ultra-basic intrusives. These would be the logical places to look for asbestos. The fairly common association of magnetite with asbestos veins is the basis for this.

The object, then, is to outline the presumed ultra-basics and to isolate the magnetically distinct linear zones within them.

Broad magnetic highs in the survey suggest three units or groups of ultra-basics. A north group and a south group are separated by an obvious magnetic low, which strikes about N 70° E through the approximate center of the area. There is a third and smaller group in the southeast corner. In part, these broad highs can be represented by simple idealized magnetic bodies. One of the simplest is a circular cylinder with its axis roughly vertical; and this model can be usefully employed for analytical testing. Two such cylinders in the north group and one in the south group actually seem to represent much of the case; although a more complete treatment would call for other miscellaneous bodies extending from or linking these cylinders, or occurring separately.

Analytical checking shows that the three idealized cylinders have diameters ranging between 2000 and 2500 feet, and that the vertical distance between flight level and top of body is quite close to the nominal flying height (300 feet). Hence, if the actual bodies are not fully exposed, they appear to be nowhere deeply buried. There is close enough agreement between observed and theoretical anomalies to indicate that the actual bodies have a large depth extent and reasonably distinct boundaries. They can therefore be classed as stock-like intrusives. Their apparent magnetic susceptibility is about 0.01 or slightly less; and this is within the normal range for basic to ultra-basic rock types.

On the basis of cylinder analysis, the outline of each body would be roughly mapped by the magnetic contour of 61,000 gammas. There is no simple relationship that would justify the mapping of actual boundaries from such a magnetic contour. Nevertheless, the contour may be considered as a very rough guide in the present case. (The contour of steepest magnetic gradient is another rough guide commonly used.)

The analytical check also sets an approximate upper limit to the anomalies arising from basic intrusives alone. For practical purposes this is about the level of 62,300 gammas in the present survey. It could be exceeded by about 1000 gammas if the intrusives had much greater horizontal dimensions than they appear to have; and it can, of course, be much lower where horizontal dimensions are small.

Attention is now concentrated on the linear magnetic features within the presumed intrusives. In the south group there is one such anomaly with an amplitude of about 1000 gammas, and in the north group there are three of the same order. All strike about N 45°E and are evidently about 1000 feet long. In both groups there are other linear anomalies with amplitudes of a few hundred gammas, showing roughly the same strike direction, but with more variation in apparent lengths. The thickness of these formations is indeterminable; to be determinable it would have to be definitely greater than the flying height, and it is evidently not so great. Magnetic amplitude for such cases depends on the product of true thickness and specific magnetization of the material. For an amplitude of 1000 gammas and an assumed thickness of 100 feet, the apparent susceptibility would be about 0.025, which is somewhat above the range of common rock types. An assumed thickness of one foot would imply a susceptibility appropriate to solid magnetite.

It should be added that a single anomaly of this class does not necessarily signify a single body. A system of thin magnetic veins, if confined within a breadth comparable to flying height, would show only a single anomaly for the system. Individual veins might or might not be detectable in a detailed ground magnetic survey.

The main conclusion is that the distinct linear magnetic features within the presumed intrusives would seem to be the most logical places to check for asbestos possibilities. Magnetic amplitude in itself is unimportant, being merely a function of the total quantity of magnetite associated with these fractures, veins, or whatever they are.

A distinction is drawn between the above narrow or sharp anomalies and the various linear features of obviously greater breadth. Some of the latter may represent dykes of the Matachewan or Keweenawan systems, or, in some cases, extensions from the presumed basic stocks. It may be significant that the sharp anomalies have a reasonably consistent strike direction, as of faults or fractures arising from some specific tectonic stress.

In the accompanying sketch map of interpretation, solid double lines are used to indicate the axes of the principal magnetic linears within or extending from the presumed basic intrusives; and they are given reference numbers roughly in order of distinctness. The intrusives themselves are very approximately outlined by dotted lines; closer outlining of these would call for more analytical work than seems justified in the prospecting stage. "Possible dyke" is a term used loosely for apparently broad and not unduly magnetic units of various linear extent.

RECOMMENDATIONS

Two cross sections are recommended for prior investigation and are outlined in the interpretation map. One cuts across three distinct magnetic linears (Nos. 1 to 3) in the north group of presumed intrusives; the other cuts a single linear (No. 4) in the south group. Surface examination or trenching might be sufficient for identifying the cause of the anomalies and determining whether they may be of economic interest. If drilling is justified, it should be planned to investigate the length of cross sections indicated; the limits of actual magnetic zones may lie two or three hundred feet beyond the axes plotted in the map. Dip is probably near-vertical for most of the magnetic linears, but SE'ly for No. 5.

Respectfully submitted,

HUNTING SURVEY CORPORATION LIMITED

Ralph D. Hutchison

Ralph D. Hutchison, P.Eng.
Consulting Geophysicist.

Toronto, Ontario
December 10, 1964.

mber 18th, 1964.

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Report on the Conduct of an Airborne Magnetometer Survey in the

Mining Division of Sudbury

On January 22nd, 1964, Hunting Survey Corporation carried out an airborne magnetometer survey over parts of the township of Kenogaming.

The work was carried out under contract to Canadian Johns-Manville Company Limited, Asbestos Fibre Division.

The boundaries of the area surveyed are shown on the maps accompanying this report.

Aircraft and Equipment

The work was performed with a Cessna 180 aircraft with a crew of two. The aircraft carried the following equipment:

1) Varian magnetometer with bulk tuner #2.
2) A modified APN-1 radio altimeter, to measure terrain clearance between 0 and 800 feet.
3) A Canadian Applied Research Limited 35 mm discrete frame positioning camera (Mk VIII) set to take exposures at intervals of 0.75 seconds. Focal length of the lens was 18 mm.
4) Texas Instruments Limited recorder, recording terrain clearance on a 5 inch curvilinear chart. Chart speed was 3 inches per minute.
5) Sanborn recorder, recording variations in the earth's total magnetic field across a rectilinear chart two inches wide. Chart speed was 105 mm per second.

NOTE: A pulse was shown on the altimeter profile and magnetometer record, co-incident with every tenth exposure of the 35 mm positioning camera. This served to relate the records to the terrain over which they were made.

The magnetometer detector was located in a "bird" towed behind and below the aircraft.

Terrain clearance was maintained at 300 feet, where safety would permit. Traverses were flown N/S at a line spacing of 1320', and E/W at intervals of 187 feet. Forty two traverses were flown to cover the survey area, for a total of 62 linear miles. — This must be for all lines shown on maps

Mapping and Data Compilation

Mosaics on a scale of 1 inch to 400 feet were prepared from aerial photos exposed for this project in the spring of 1964.

Planimetric features were traced from these mosaics to provide a base map.

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Flight path was established by visual comparison of the 35 mm film with the above mentioned mosaics.

A map was compiled, showing:

a) Flight traverses and location of plotted 35 mm frames.
b) Magnetometric contours showing the observed total field values, at intervals of 10 gamma.

Preparation of mosaics and base maps; and data compilation was carried out in Hunting Survey Corporation's Toronto office.

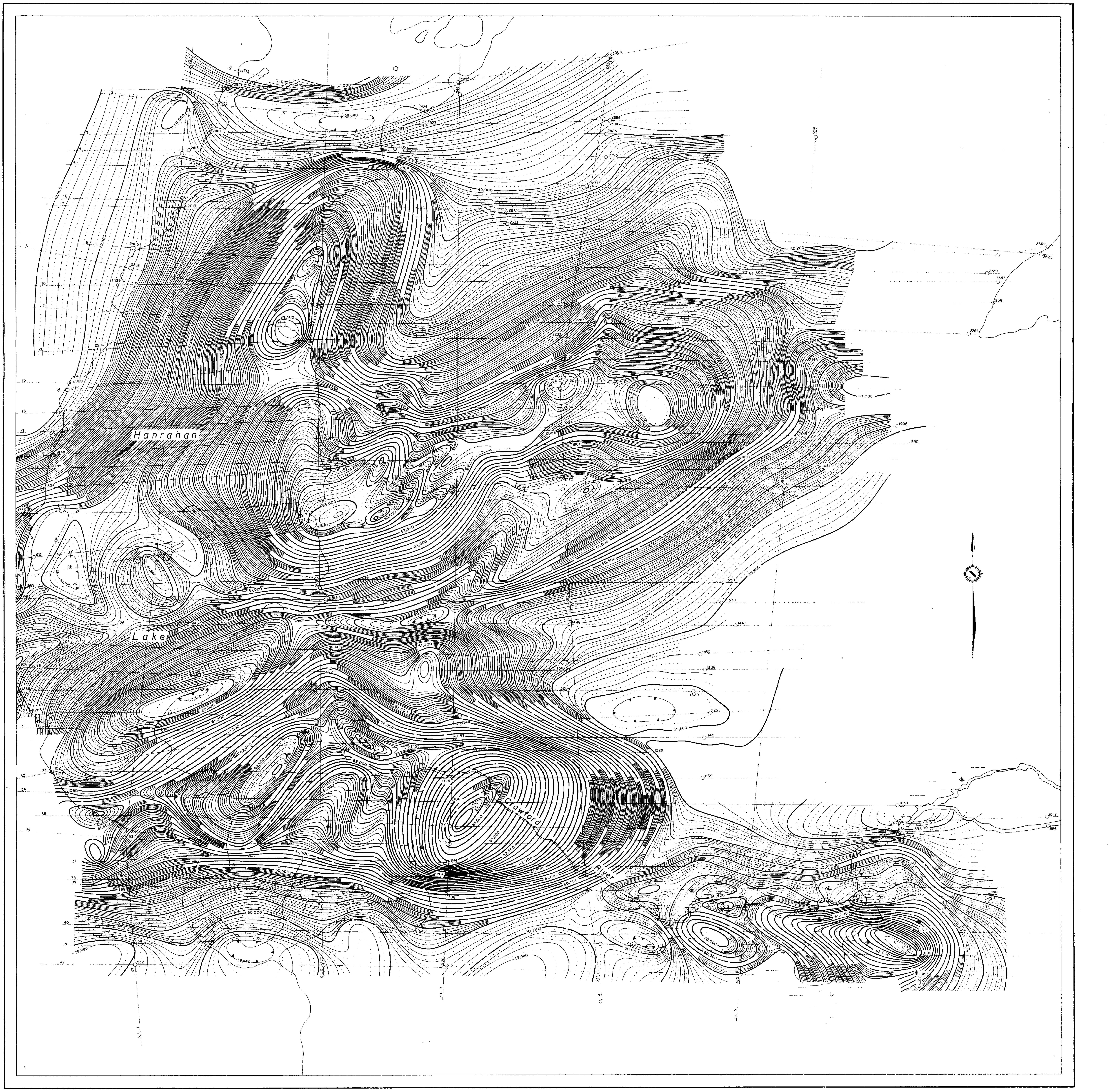
R. N. Parkinson
P. Eng.

RNP/FGC:pc

SEWELL TWP.
KENOGAMING TWP.
DEERFOOT LAKE
FORESTRY CABIN
124890
124904
124909
124891
124903
124900
124892
124902
124901
CRAWFORD RIVER
TRAIL TO DEERFOOT LAKE
FORESTRY CABIN
CAMPSITE
TRAIL
AKWESKWA LAKE
PHARAND TWP.
KENOGAMING TWP.
MINDEDO
CRAWFORD LAKE
CANADIAN
MATHESON
PROPERTY
KENOGAMING
SCALE 1" = 1320'
TRACED
APPROVED F.J.E.

200

CANADIAN JOHNS-MANVILLE COMPANY LIMITED
ASBESTOS FIBRE DIVISION



CONTOUR INTERVAL .... 10 GAMMA
MEAN FLIGHT LINE SPACING .... 187 FEET
MEAN TERRAIN CLEARANCE .... 300 FEET
500 GAMMA CONTOUR
100 GAMMA CONTOUR
20 GAMMA CONTOUR
10 GAMMA CONTOUR
MAGNETIC LOW
FIDUCIAL POINTS 3690
FLIGHT LINES

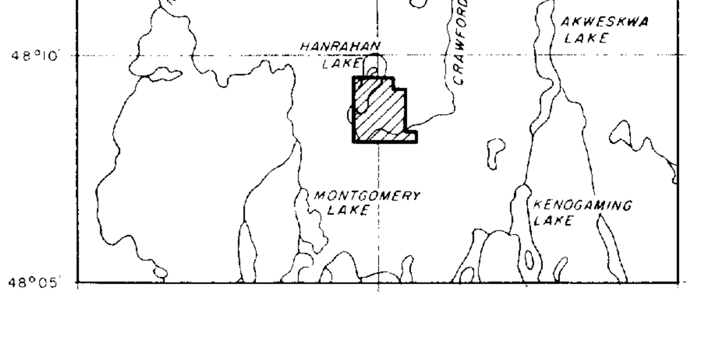
AIRBORNE MAGNETOMETER SURVEY
KENOGAMING TOWNSHIP, ONTARIO

SCALE

400 FEET 0 400 800 1200 FEET

1 Inch to 400 Feet

Flown and compiled by
HUNTING SURVEY CORPORATION LIMITED
Toronto, Canada
1963-1964



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63·1326

CANADIAN JOHNS-MANVILLE COMPANY LIMITED

ASBESTOS FIBRE DIVISION

CONTOUR INTERVAL .... 10 GAMMA
MEAN FLIGHT LINE SPACING .... 187 FEET
MEAN TERRAIN CLEARANCE .... 300 FEET
500 GAMMA CONTOUR
100 GAMMA CONTOUR
20 GAMMA CONTOUR
10 GAMMA CONTOUR
MAGNETIC LOW
FIDUCIAL POINTS 3690
FLIGHT LINES

APPROXIMATE OUTLINE OF BASIC INTRUSIVES
MAGNETIC VEINS OR FRACTURES
RECOMMENDED INVESTIGATION, SURFACE OR DRILLING
POSSIBLE DYKES

R W Hutchinson

INTERPRETATION

AIRBORNE MAGNETOMETER SURVEY
KENOGAMING TOWNSHIP, ONTARIO

SCALE

400 FEET 0 400 800 1200 FEET

1 Inch to 400 Feet

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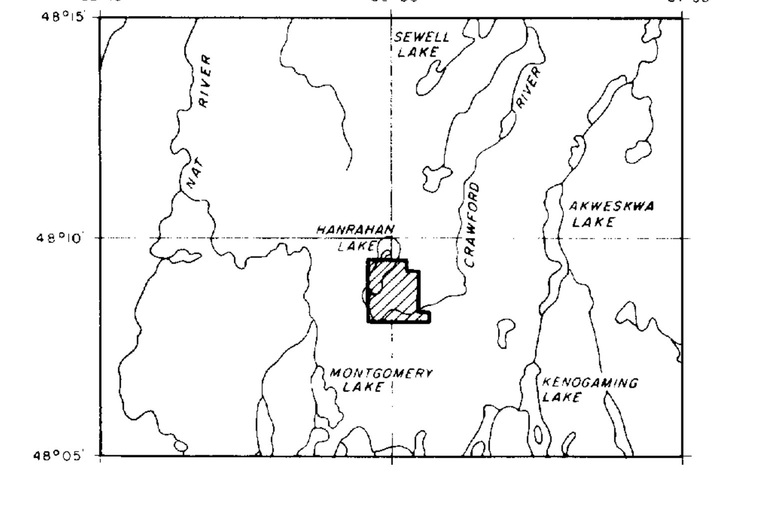

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CANADIAN JOHNS MANVILLE CO. LTD. 1"=200'
GEOLOGICAL AND TOPOGRAPHIC PLAN MAR. 66
KENOGAMING TOWNSHIP

230

PENHORWOOD TWP.
KENOGAMING TWP.

ADJOINS SHEET NO. K-14

ADJOINS SHEET NO. K-19

42A04NW0165 63.1328 KENOGAMING

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GEOLOGICAL AND TOPOGRAPHIC PLAN.
KENOGAMING TOWNSHIP

1"=200'
MAR. 1966
No. K-13