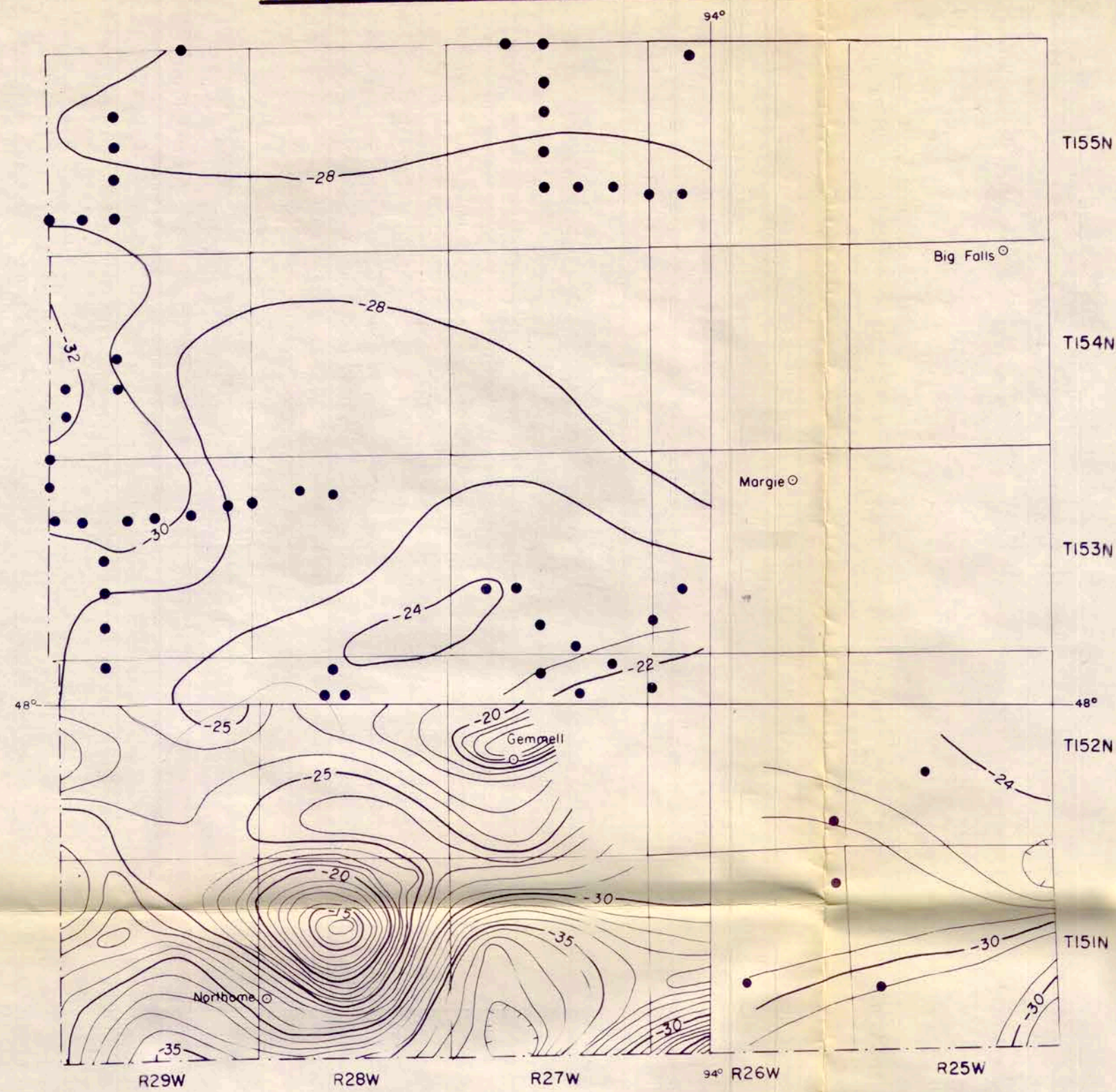
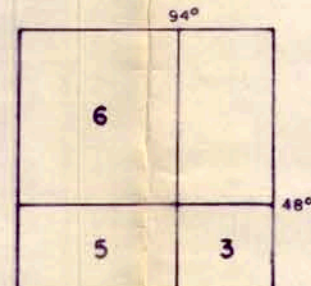


SIMPLE BOUGUER GRAVITY



EXPLANATION

Gravity from:
R. J. Ikola, 1961 (Ref. 3)
L. D. McGinnis, D. A. Steffy and C. P. Ervin, 1976 (Ref. 5)
L. D. McGinnis, G. Durfee and R. J. Ikola, 1973 (Ref. 6)

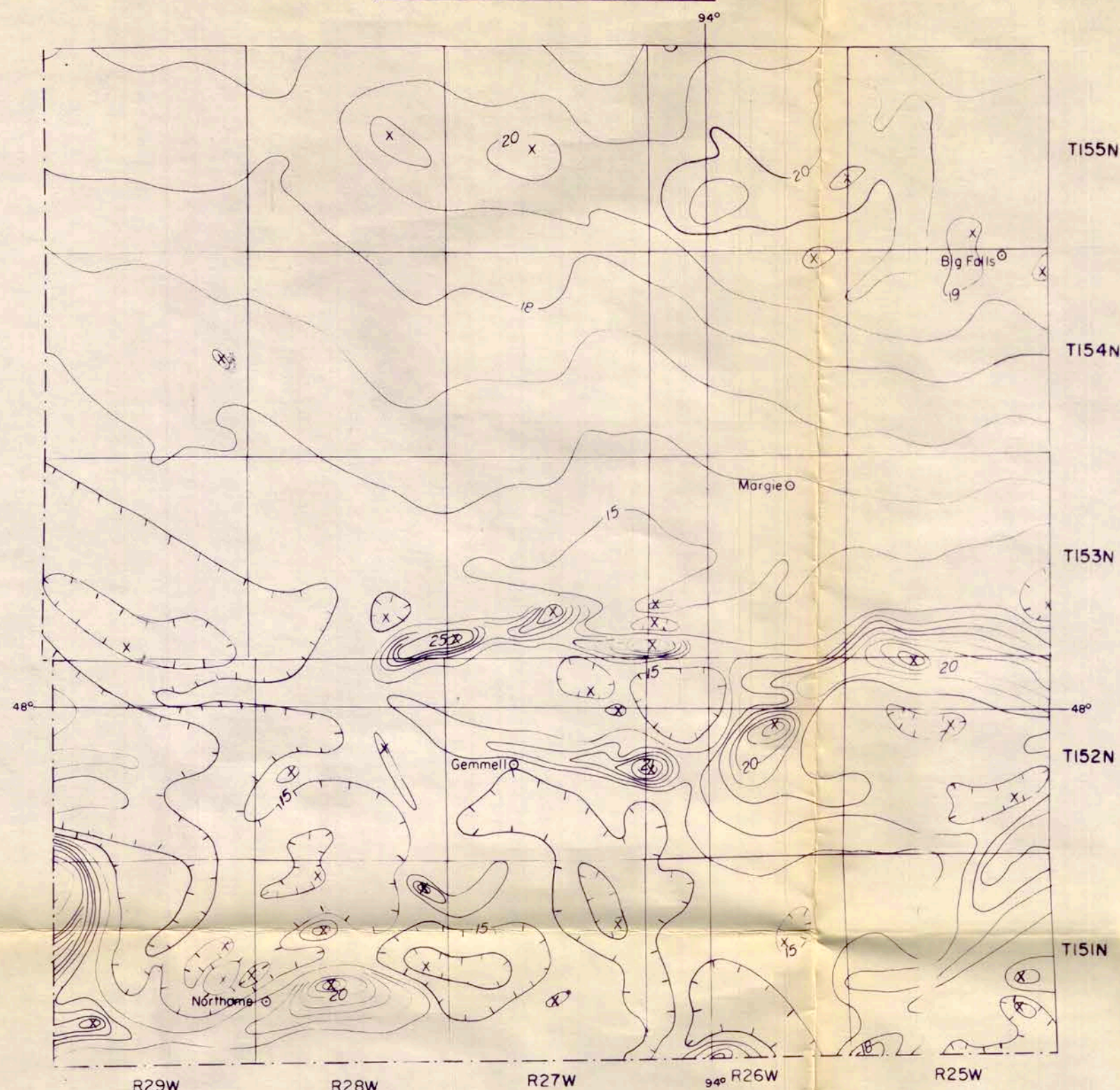


Gravity Map
Reference Index

Gravity contours: 2 milligal contour interval, except 1 milligal south of 48° degrees and west of 94° degrees; assumed density 2.67 grams per cubic centimeter

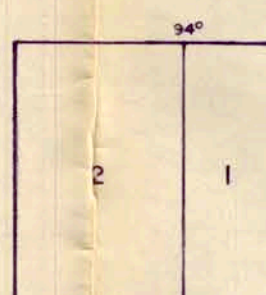
• Gravity station not shown on Reference 5

AEROMAGNETICS



EXPLANATION

Aeromagnetics from:
G. D. Bath, G. M. Schwartz and F. P. Gilbert, 1964 (Ref. 1)
G. D. Bath, G. M. Schwartz and F. P. Gilbert, 1965 (Ref. 2)



Aeromagnetic Map
Reference Index

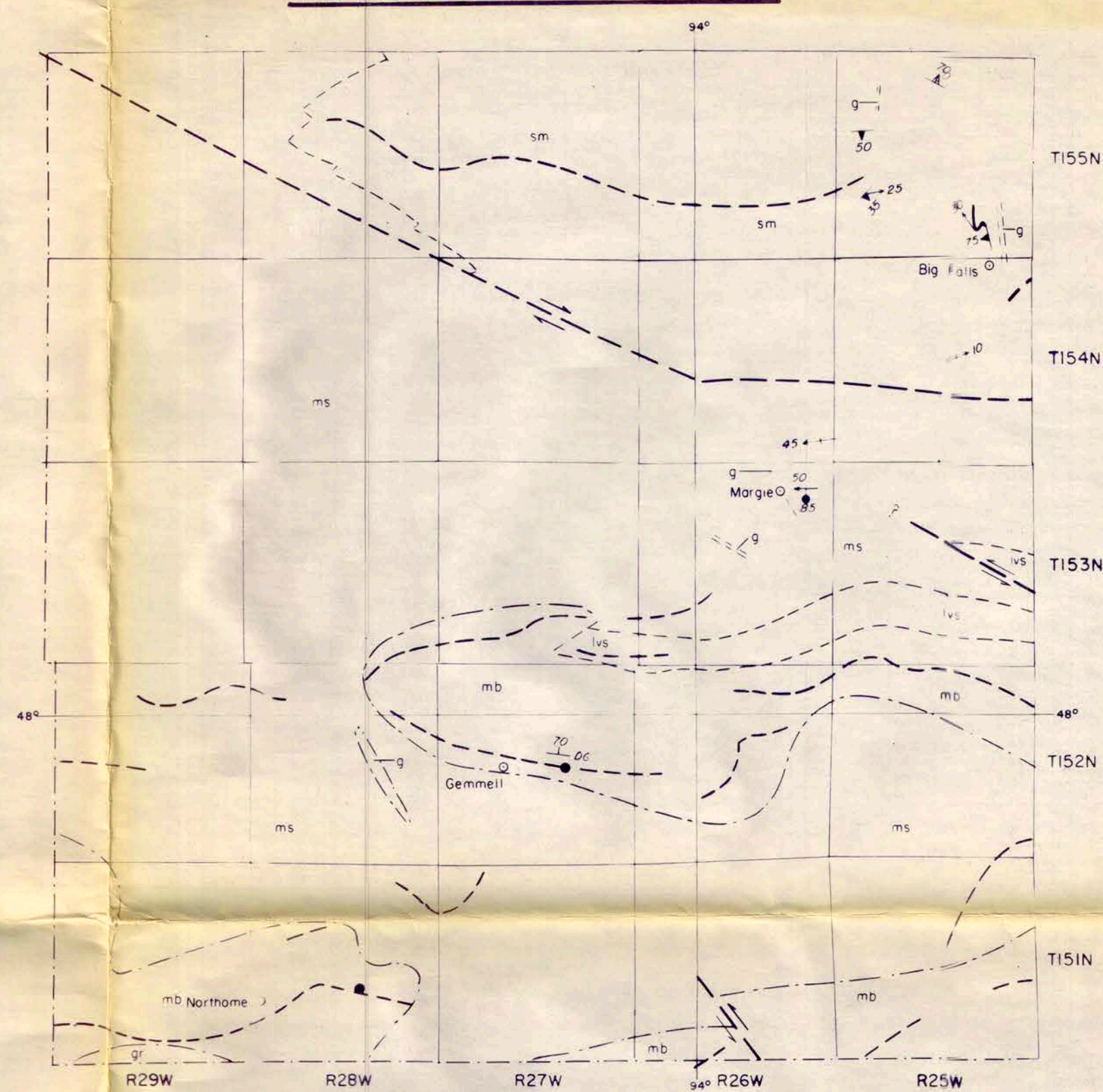
Magnetic contours showing total intensity magnetic field of the earth in hundreds of gammas relative to arbitrary datum; hachured indicates closed areas of lower magnetic intensity

x Measured maximum or minimum intensity within closed high or closed low

Total-intensity aeromagnetic data were obtained by flying north-south lines spaced one mile apart at altitudes ranging between 900 and 1,100 feet. Bird was towed 75 feet below aircraft (Ref. 7)

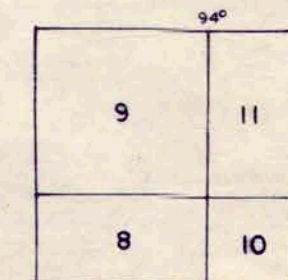
For detailed map (1:63,360) of aeromagnetic survey, see Reference 7.

PRECAMBRIAN GEOLOGY



EXPLANATION

Geology from:
G. S. Loper, 1973 (Ref. 8)
P. R. Sims and R. W. Ojakangas, 1973 (Ref. 9)
P. R. Sims, G. S. Loper, S. W. Ojakangas and S. Viswanathan, 1970 (Ref. 10)
D. L. Southwick and R. W. Ojakangas, 1973 (Ref. 11)



Geologic Map
Reference Index

Middle Precambrian

9 Diabasic gabbro and diorite dikes having chilled margins

Lower Precambrian

gr Granitic rocks, undivided, probably intermediate in composition

ms Metasedimentary rocks, undivided, dominantly metagraywacke and biotite schist possibly of volcanogenic derivation; probably includes felsic to intermediate volcanoclastic rocks and lesser amounts of mafic volcanic rocks south of T154N

sm Schist-rich migmatite, dominantly intercalated biotite schist and Vermilion Granite

lvs Layered volcanic sedimentary rocks

mb Metavolcanic rocks, undivided, dominantly basaltic lavas and associated synvolcanic rocks; lesser intermediate rocks; includes some volcanoclastic rocks, and oxide to sulfide facies iron-formation

--- Contact: inferred from geologic data

--- Contact: inferred largely from aeromagnetic and gravity data

--- High-angle fault showing inferred horizontal movement; inferred largely from aeromagnetic and gravity data

--- Trend of airborne magnetic anomaly from aeromagnetic map on this sheet and Reference 7

pg By structural symbol indicates structure interpreted from diamond core drilling and geophysics (Ref. 3)

Strike and dip, top direction not determined

Draw fold, showing direction and plunge of axis

Strike and dip of beds, top direction not determined, foliation parallel to bedding; arrow indicates bearing and plunge of lineation

Strike and dip, top in direction of dot, arrow indicates bearing and plunge of lineation

Strike and dip of lineation

Bearing and plunge of foliation

Diamond drill hole, vertical and inclined

Thickness of Quaternary deposits generally less than 200 feet

REFERENCES

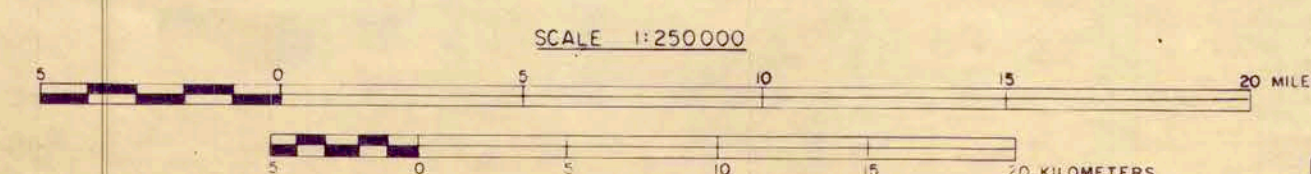
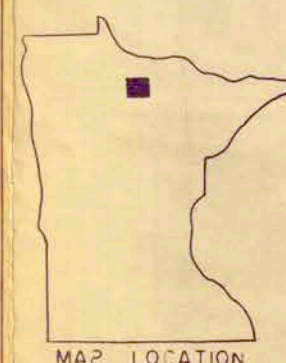
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- Sims, P. R. and Ojakangas, R. W., 1973, Precambrian Geology of Roseau Sheet, Minnesota: Open File Map, Minnesota Geological Survey.
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- Southwick, D. L. and Ojakangas, R. W., 1973, Geologic Map of Minnesota - International Falls Sheet: Open File Map, Minnesota Geological Survey.

Base for maps on this sheet from U. S. Geological Survey, 1:63,360, Hibbing, International Falls and Roseau 1:250,000 topographic maps.

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERALS

MINERAL COMPILATION OF SOUTHWESTERN KOOCHICHING COUNTY

By D.G. Meineke and W.H. Listerud
D.G. Meineke, Supervisor of Minerals Exploration



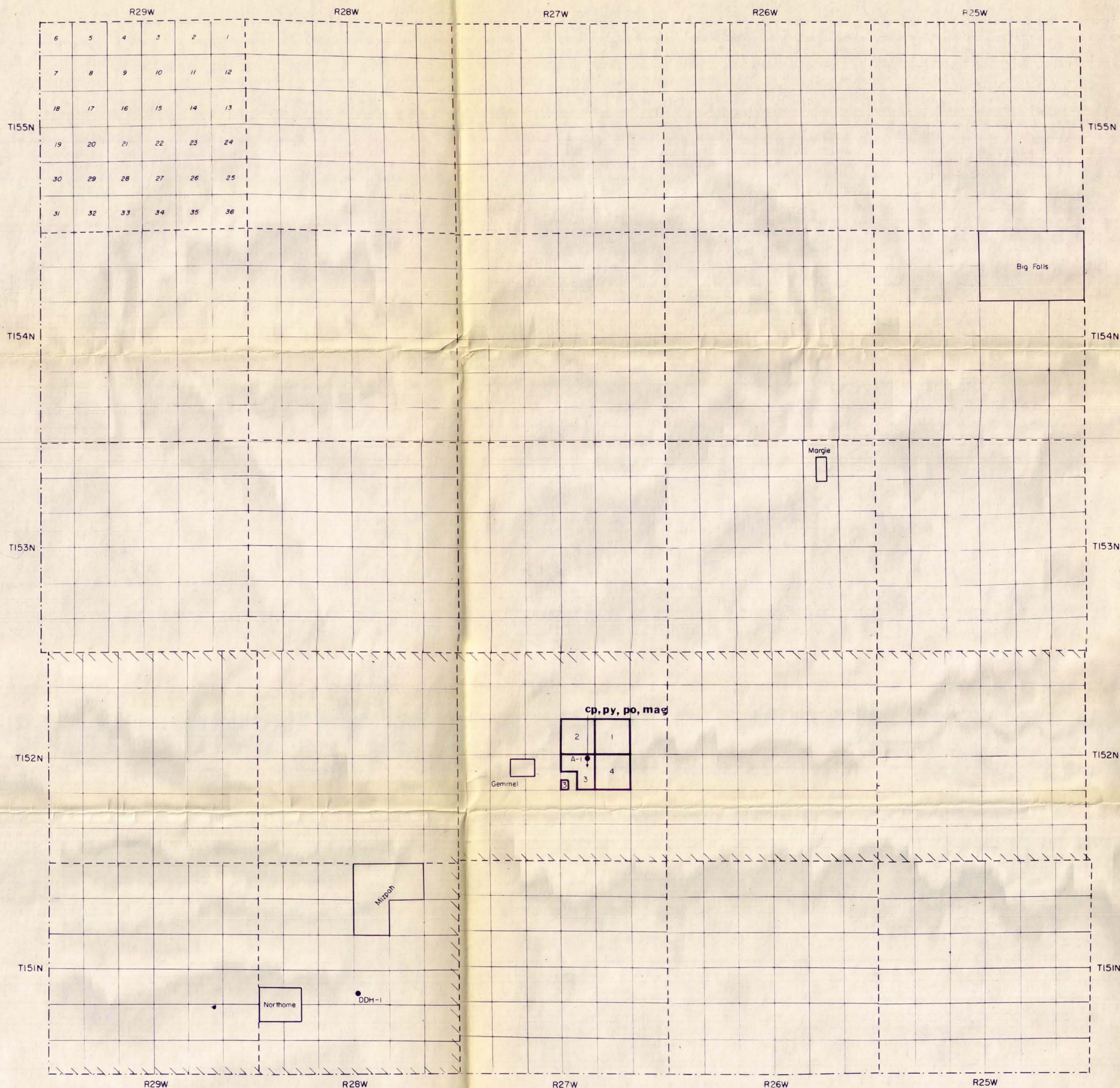
1976

MAP 87

SHEET 1 of 2

Drawn by J.M. Phipps

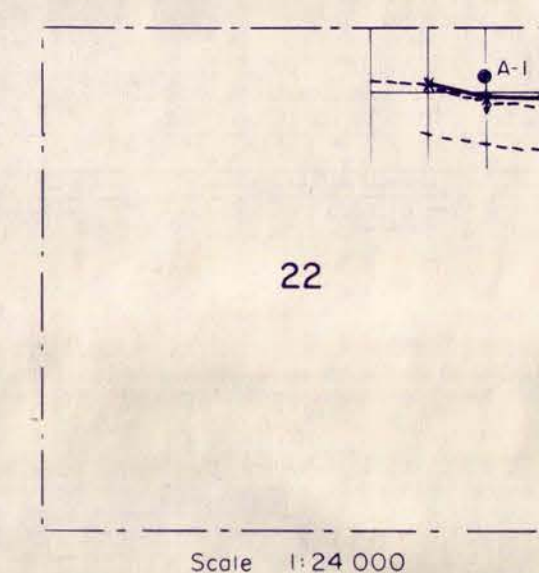
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EXPLANATION

- Boundary of area offered by the State of Minnesota for Cu-M Leasing
- Terminated State of Minnesota Cu-M Lease - number identifies lease in "data and drill core table"
- Diamond drill hole, arrow indicates direction of inclined hole
- Base for map on this sheet from Minnesota Highway Department 1:125,000 General Highway Maps.

SECTION 22-T152N-R27W



GROUND GEOPHYSICS

- Geophysical grid
- Vertical loop EM conductor axis
- Trend of magnetic anomaly

DATA AND DRILL CORE FILED AT THE DIVISION OF MINERALS, HIBBING, MINNESOTA							
MAP INDEX NUMBER	MINING COMPANY	GROUND MAGNETICS	VERTICAL LOOP ELECTROMAGNETICS	DIAMOND DRILLING			STATE LEASE NUMBER
				HOLE NUMBER	LOG	ASSAYS	
1	Humble Oil & Refining Co.	No	Data				CN-7372
2	Humble Oil & Refining Co.	No	Data				CN-7373
3	Humble Oil & Refining Co.	72	72	A-1	72	72	CN-7374
4	Humble Oil & Refining Co.	No	Data				CN-7375
Year indicates date surveys were conducted.							

MINERAL ABBREVIATIONS

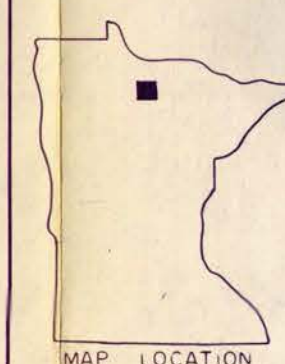
cp - Chalcopyrite py - Pyrite (>5%)
mag - Magnetite po - Pyrrhotite (>5%)

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1976

MAP 87
SHEET 2 of 2

SUMMARY OF DIAMOND DRILL HOLES

*A-1 Dacite porphyry: basalt dacite-andesite volcanoclastics with 25-30% py-po-cp (0.36% Cu over 5 feet); gabbro and diabase
**DDH-1 Hornblende schist, with granite and quartz stringers (Ref. 7)

Most rocks greenschist facies or higher grade metamorphism.

*Drill core filed at Division of Minerals - Drill Core Library, Hibbing, Minnesota.

**Actual diamond drill hole number and location of drill core unknown.

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Drawn by J.M. Perpich