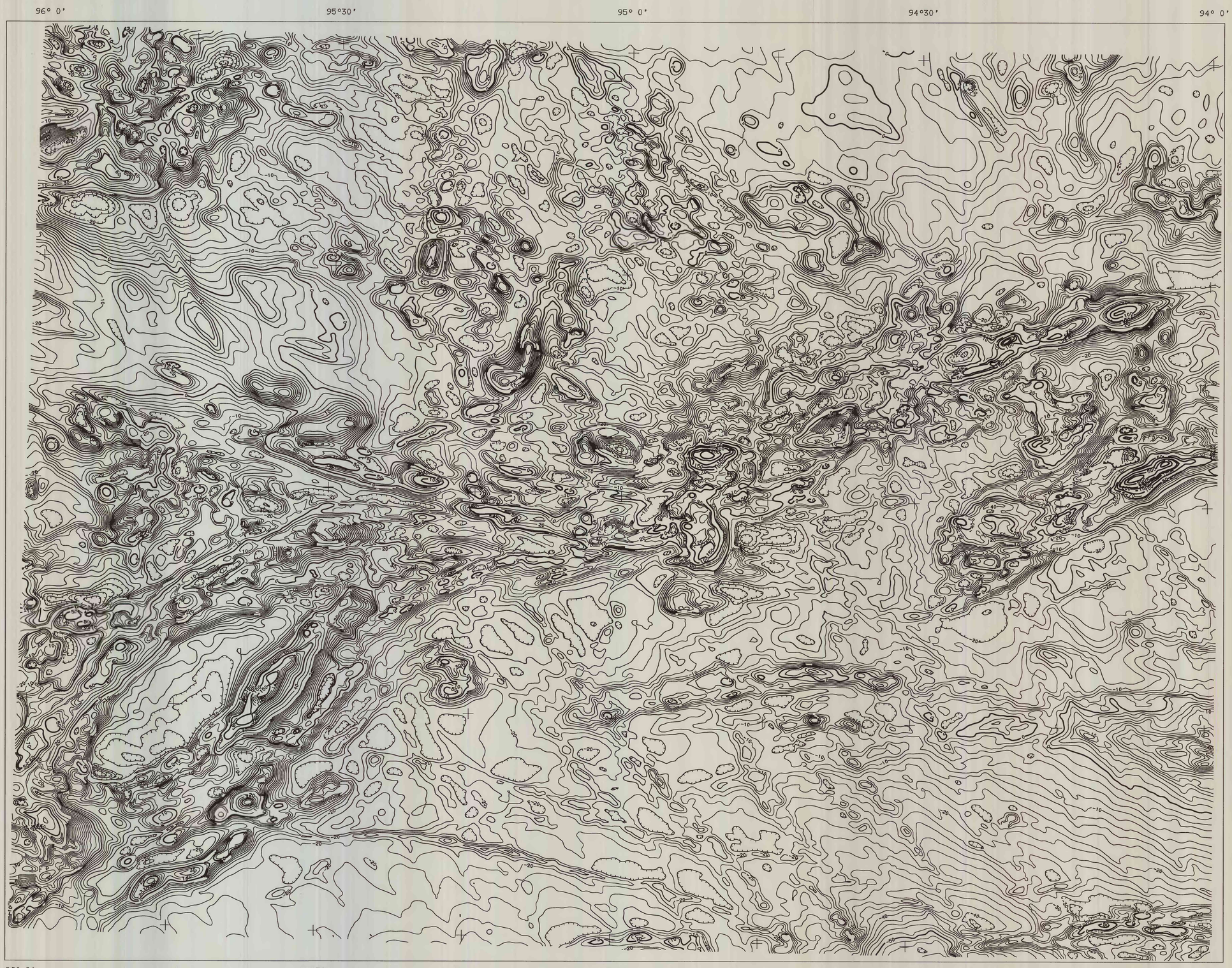
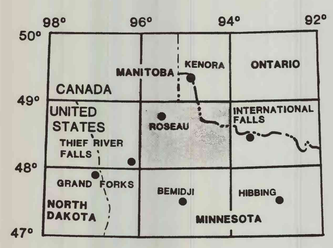
DEPARTMENT OF INTERIOR
U.S. GEOLOGICAL SURVEY

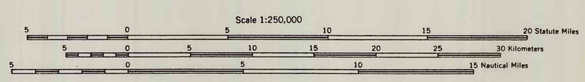
PREPARED IN COOPERATION WITH THE MINNESOTA GEOLOGICAL SURVEY AND THE GEOLOGICAL SURVEY OF CANADA

OPEN-FILE REPORT 89-452





LOCATION DIAGRAM



TRANSVERSE MERCATOR PROJECTION

CONTOUR VALUES (IN GAMMAS) ARE TEN TIMES THE CONTOUR LABELS

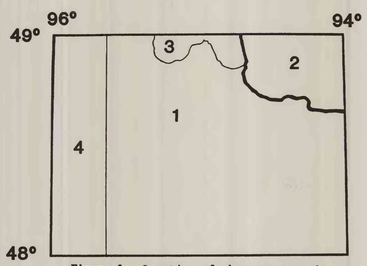


Figure 1. Location of the aeromagnetic surveys used in this report.

Aeromagnetic Map of the Roseau 1° X 2° Quadrangle, Minnesota and Ontario

By

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EXPLANATION

Aeromagnetic contours show the residual magnetic intensity of the earth in gammas relative to an arbitrary datum. Contour intervals are 20, 100, 500, 1000, and 2500 gammas, within the specified ranges. In areas of high gradient, only larger contour intervals are displayed. Actual contour values are equal to ten times the value of the contour label. Hachures indicate closed areas of lower magnetic intensity. No attempt has been made to remove anomalies due to culture.

20 gamma contour interval
range -600 to 500 gammas.

100 gamma contour interval — 10 —
range -500 to 1500 gammas.

500 gamma contour interval — 50 —
range -1500 to 3000 gammas.

1000 gamma contour interval — 100 —
range -1000 to 5000 gammas.

2500 gamma contour interval — 250 —
range 2500 to 25000 gammas.

INTRODUCTION

This aeromagnetic map was compiled by the U.S. Geological Survey in cooperation with the Minnesota Geological Survey and the Geological Survey of Canada, as part of the Roseau Conterminous United States Mineral Assessment Program (CUSMAP). The aeromagnetic map was made by merging data from 4 surveys (see figure 1). Due to variations in survey specifications, different reduction techniques and geomagnetic reference fields, the data from individual surveys were adjusted to produce the best match across survey boundaries (Bhattacharyya and others, 1979). For contouring purposes, the merged data set was upward continued 200 meters (Hildenbrand, 1983).

Survey #1 was flown by the U.S. Geological Survey in 1985 and 1986. The altitude was radar controlled at 91 meters above ground level (AGL) along north-south flight lines spaced about 380 meters apart. The geomagnetic reference field removed from Survey #1 was the International Geomagnetic Reference Field (I.G.R.F.), 1985, Julian day 180 (Peddie, 1982). For Survey #1, a 0.21336 km grid was produced using a program based on minimum curvature (Webring, 1981), then applying a low-pass filter (Urquhart, 1988) that reduces errors produced by level changes between flight lines.

The data set for Survey #2 was provided by the Geological Survey of Canada. This survey was flown in 1961. The altitude was 305 meters AGL, and the flight lines were north-south, spaced 680 meters apart. The geomagnetic reference field removed from Survey #2 was the I.G.R.F., 1961, Julian day 180 (Peddie, 1982). A constant of 105 gammas was subtracted from Survey #2 as a merging adjustment.

The data set for Survey #3 was also provided by the Geological Survey of Canada. This survey was flown in 1984. The altitude was 305 meters AGL and the flight lines were north-northeast-south-southwest, spaced 925 meters apart. The geomagnetic reference field removed from Survey #3 was the I.G.R.F., 1984, Julian day 180 (Peddie, 1982). A constant of 5 gammas was added to Survey #3 as a merging adjustment.

The data set for Survey #4 was provided by the Minnesota Geological Survey. Survey #4 was flown in 1987 and 1988. The altitude was 150 meters AGL with north-south flight lines spaced 400 meters apart. The geomagnetic reference field removed from Survey #4 was the I.G.R.F., 1987, Julian day 289 (Peddie, 1982). A constant of 368 gammas was added to Survey #4 as a merging adjustment.

A merged grid was produced from individual 0.21336 kilometer grids of the 4 surveys. The map was produced by contouring a version of the merged grid that was upward continued 200 meters using a program by Hildenbrand (1983). Upward continuation suppresses high frequency components of the data that cannot be contoured appropriately at the presented scale.

REFERENCES

Bhattacharyya, B.K., Sweeney, R.E., and Godson, R.H., 1979, Integration of aeromagnetic data acquired at different times with varying elevations and line spacing: Geophysics, v. 44, no. 4, p. 742-752.

Hildenbrand, T.G., 1983, FFTFIL: A filtering program based on two-dimensional Fourier analysis: U.S. Geological Survey Open-File Report 83-237, 30 p.

Peddie, N.W., 1982, International Geomagnetic Reference Field: The third generation: J. Geomag. Geoelectr., v. 34, p. 309-326.

Urquhart, Ted, 1988, Decorrugation of enhanced magnetic field maps: Expanded Abstracts vol. I; Society of Exploration Geophysicists Fifty-Eighth Annual International Meeting and Exposition, p. 371-372.

Webring, M.W., 1981, MINC: A gridding program based on minimum curvature: U.S. Geological Survey Open-File Report 81-1224, 41 p.

ACKNOWLEDGMENTS

The authors would like to thank both the Forestry and Minerals Divisions of the Minnesota Department of Natural Resources for their cooperation and assistance during the flying of Survey #1.