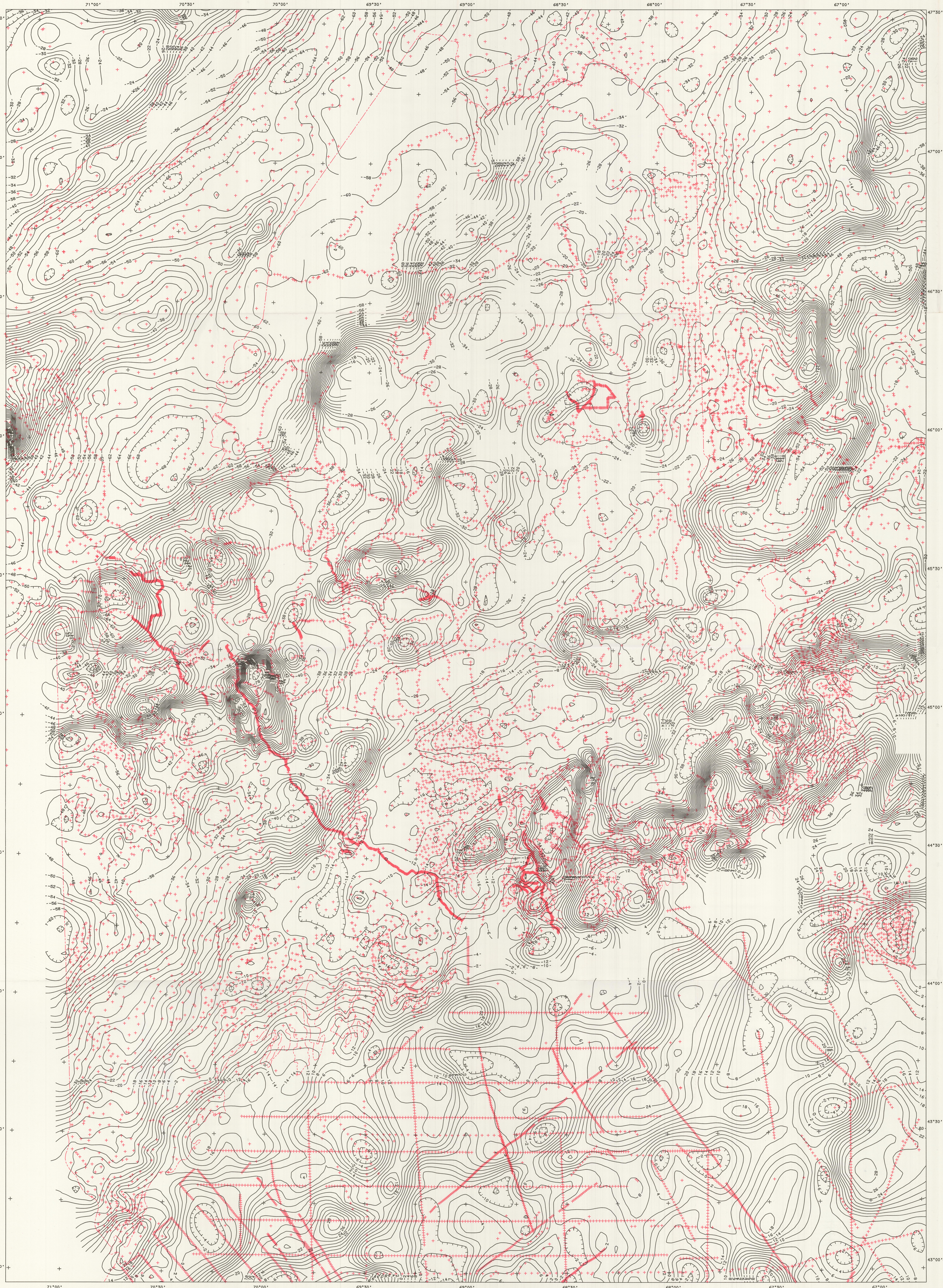

Complete Bouguer Gravity Anomaly Map of Maine and Vicinity

by

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INTRODUCTION

The gravity field observed at the Earth's surface is a combination of the Earth's main gravity field and much more subtle effects related to geologic structures. Corrections are made to observed gravity values to remove the Earth's main field and to remove gravitational effects due to changes in elevations and to topographic masses. The complete Bouguer gravity anomaly map of Maine and vicinity was prepared as part of a cooperative agreement between the U. S. Geological Survey and the Maine Geological Survey. The gravity data were obtained from these sources: Bothner (1985), Bothner, Simpson, and Diment (1980), Doll and Potts (1990), Geological Survey of Canada (1985, 1988), Phillips, Thomas, and Jahrling (1988), and Snyder and Phillips (1986). Much of the offshore data are unpublished (D. Hutchinson, unpub. data, 1988). The total number of observations used in the final map is approximately 20,000.

DATA REDUCTION

In order to isolate the component of the gravity field related to geological sources, a number of corrections are made to observed gravity values recorded on the Earth's surface. The Earth's main field is removed by subtracting a term for the theoretical value of gravity at sea level for the particular latitude of the station. Gravitational effects due to changes in elevations and to topographic masses are eliminated by applying the free air and Bouguer corrections, respectively, using a sea level datum. The free air correction, equal to 0.3086 milligal/meter, is added to the observed value. The Bouguer correction, for the mass of the rock between the station and sea level, is calculated assuming the mass to have the geometry of a horizontal infinite slab with a density of 2.67 g/cc, and is subtracted from the observed field. Where the terrain is rugged, thus causing a departure from the assumed geometry, additional corrections for terrain are required. The resulting gravitational field, called the complete Bouguer anomaly, reflects subsurface anomalous density distributions and is the standard gravity anomaly used for geological analysis.

After compiling a single data base of principal facts (observed gravity, elevation, latitude, and longitude) from all data sources, duplicate station pairs located within .001 degree (approximately 110 meters) of each other were compared and evaluated with one station being retained. All observed gravity values were adjusted to conform to the International Gravity Standardization Net of 1971 (Morelli, 1974). Onshore data were reduced to Bouguer anomaly values using a reduction density of 2.67 g/cc. These values were calculated using computer program BOUGUER (R. Godson, U. S. Geological Survey, Denver, CO, unpublished program) which uses theoretical values based on the Geodetic Reference System 1967 (International Association of Geodesy, 1967). BOUGUER also calculated an earth-curvature and a complete (terrain corrected) Bouguer value for the region extending radially from 0.895 to 166.7 km from the station. Terrain lying between the gravity station and a radial distance of 0.895 km was not considered in the terrain correction due to uncertainties in the accuracy of the digitized terrain. The terrain corrections were computed using mean elevation data digitized on a 30-second grid for corrections from .895 to 5 km, 1-minute data for corrections from 5 to 21 km, and 3-minute terrain data for corrections from 21 to 167 km. A complete description of the gravity reduction procedures currently in use by the U. S. Geological Survey for defining the corrections and anomalies is explained by Cordell et al. (1982).

Gravity stations were removed from the data set if the amplitudes of their Bouguer anomalies were unrealistically higher than those of nearby stations. Any anomaly defined by a single observation, especially if it is of significant amplitude, should be treated with caution. Since the digital terrain data available to program BOUGUER extends a limited distance into Canada, terrain corrections outside the United States are based on terrain data that are 10 to 40 percent incomplete. There is no method of accurately estimating the errors introduced by the missing terrain data. Since bathymetric terrain data were unavailable, the terrain offshore was assumed to be flat, and no terrain corrections were made to the offshore data.

The reduced data were then gridded at a spacing of 2 km using computer program MINC (Webring, 1981) based on minimum curvature (Briggs, 1974). Due to the wide separation between data sets offshore, the offshore data were first gridded at a spacing of 7.5 km to create a spatially uniform data set, then regridded at 2 km. The data were projected to a Lambert conformal projection with a base latitude of 0 degrees and a central meridian of 69 degrees west longitude using the computer program of Godson and Webring (1982). Contours extending into the state of New Hampshire are an artifact of the contouring process and are uncontrolled by data.

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EXPLANATION

GRAVITY CONTOURS
Contour interval is 2 milligals. Hachured contours indicate areas of low gravity closure.

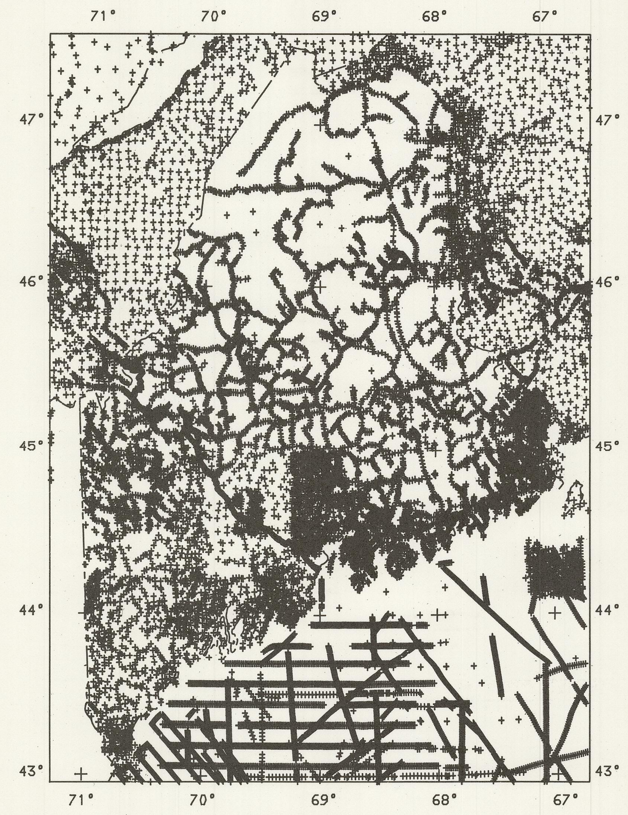
STATION LOCATION

GRAVITY TRAVERSE
Closely spaced stations

STATE/INTERNATIONAL BOUNDARY

Scale 1:500,000
1 inch equals approximately 8 miles

10 0 10 20 30 Miles
10 0 10 20 30 40 Kilometers



GRAVITY STATION DISTRIBUTION MAP
Scale 1:3,000,000