



The complete Bouguer gravity map was compiled from a data set comprised of 5,326 gravity stations. Most of these data were collected by R. Black, S. Hazlewood, and D. Healey (unpub. data, 1957-61). Approximately 2,000 of their gravity station principal facts (observed gravity, elevation, latitude, and longitude) were obtained from the U.S. Department of Defense data bank. Principal facts associated with an additional 654 gravity stations were retrieved from the National Archives and Record Center files. Moreover, 2,031 Bouguer values and corresponding station locations were digitized from a simple Bouguer gravity map of the northern Black Hills (Hazlewood, 1964) and a complete Bouguer gravity map of the southern Black Hills (R. Black, unpub. mapping, 1961). The remaining data were acquired from miscellaneous sources resulting in the U.S. Department of Defense data bank and from a gravity survey of 218 stations recently accepted to increase uniformity of coverage. This map includes coverage presented in a previous publication by Kleinkopf and Redden (1975), although the present map contains considerably more gravity stations.

For stations with known principal facts, Bouguer values were calculated employing a reduction density of 2.45 g per cm<sup>3</sup> and the 1967 gravity formula (International Assoc. of Geodesy, 1967). The exact equations and related expansions used by U.S. Geological Survey (Gordon, unpub. computer program, 1978) are documented by Gordon and others (1981). Terrain corrections were made for the region extending radially from 0.895 to 167 km from each gravity station, using a computer program developed by Plouff (1977). Digital terrain data used in this correction exist in U.S. Geological Survey computer files as a grid with an interval of 30 seconds of longitude and latitude. Because terrain corrections from 0 to 0.895 km were not included, some error in Bouguer values is present, especially for those stations located in deep canyons or on steeply sloping terrain.

A different processing technique was required to reduce those stations for which only digitized Bouguer-anomaly values and corresponding locations are known. All digitized anomaly values had to be converted from the Potsdam system to the 1967 Geodetic Reference System. The appropriate conversion factor, which is dependent on latitude, varies from -3.4 to -3.2 mgals for the region of coverage. In addition, the reduction equations discussed above take into account curvature of the Earth's surface. Curvature corrections for this area range from -1.4 to -0.8 mgals, as indicated from the reduction of those stations for which principal facts were available. A final correction had to be included because the Bouguer values were based on an arbitrary datum. This correction was determined by finding duplicate locations of stations associated with digitized complete Bouguer-anomaly values and those computed from known principal facts and then comparing these anomaly values. A fairly consistent value of about -3.5 mgals was determined for the difference in anomaly amplitudes. The total correction applied to the digitized Bouguer-anomaly values was assumed to be a constant value of -8 mgals.

Digitized Bouguer anomaly values located above 44°N latitude did not include terrain corrections. Utilizing station elevations extracted from topographic maps, terrain corrections were computed and applied to these digitized anomaly values.

The estimated error for the majority of the reduced gravity stations is less than 2 mgals.

After reducing the gravity data to complete Bouguer-anomaly values, a 1-km grid of values, using a minimum curvature method (Briggs, 1974), was created. The data are shown on Universal Transverse Mercator projection, 105°W longitude as the central meridian.

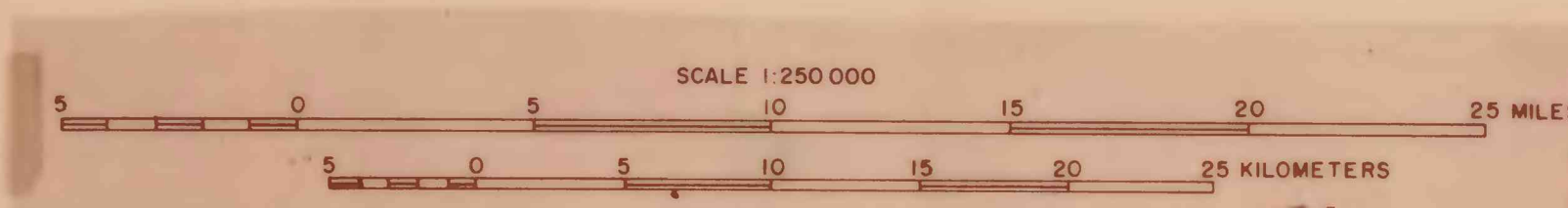
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**EXPLANATION**

x GRAVITY STATION--marks location of gravity station.

GRAVITY CONTOURS--showing complete Bouguer gravity anomaly values. Contour interval is 2 milligals. Hachures indicate closed areas of low values.



## COMPLETE BOUGUER GRAVITY MAP OF THE SOUTHERN BLACK HILLS: PARTS OF SOUTHWESTERN SOUTH DAKOTA AND EASTERN WYOMING

by  
T.G. Hildenbrand and R.P. Kucks  
1981

