INTRODUCTION

The gravity data used to make this map were collected between 1959 and 1984. The data were collected by automobile, aircraft, and watercraft. Most of the data were collected as part of a U.S. Geological Survey (USGS) regional gravity data collection project. Some of the data were collected as part of other USGS local projects. One data set was collected by the NGS (National Geodetic Survey). This map ranges from 65° to 68° N latitude and 141° to 152° W longitude. The names of the 12 1:250,000 scale U.S. Geological Survey quadrangle maps that make up this map are labeled on the map. The boundaries of these quadrangles are shown as dashed lines. The western edge of the map is one degree of longitude east of the edge of the three most western quadrangles.

GRAVITY MAP

The gravity map shows the results of gridding the isostatic gravity anomalies on a 1 km by 1 km grid and displaying the resulting grid as color bands with a 5 mGal range. The data are gridded to a horizontal and vertical distance of 10 km from each gravity station. Areas of the grid that are outside this range are left blank and are shown as white space on the map. Showing gridded values beyond 10 km may result in interpreting anomalies that do not exist. Superimposed on the colored grid are solid black contour lines located at the edge of each color band. Contours are labeled at a 25 mGal interval. Closed gravity lows are shown with hachured contours. The locations of the gravity stations used to produce the grid are shown as small black dots. Gravity highs reflect higher density rocks than the ones that produce gravity lows. Gravity gradients occur at the boundary of adjacent rocks of different densities. Examples of this could be faults, intrusions, or lateral variations in rock densities in a sedimentary environment.

GRAVITY REDUCTION

Conversion to milligals are made using factory calibration constants and a calibration factor which varies with each gravity meter and has been determined by multiple gravity readings over the Mt. Hamilton calibration loop east of San Jose, CA (Barnes and others, 1969). Observed gravity values are based on an assumed linear drift between successive base readings. Horizontal control, in most cases, was by locating positions on 1:63,360 and 1:250,000 scale USGS topographic maps in the field. These positions were converted to latitude and longitude by using proportional measuring devices, latitude-longitude templates, or electronic digitizing equipment. Vertical elevation was controlled by bench marks, spot elevations, river gradients, altimetry, and contour interpolation. Some data used surveying techniques for horizontal and vertical control. Terrain corrections from a radial distance of 0.39 km (Hammer zone F) (Hammer, 1939) from the station to a radial distance of 166.7 km were computed with a FORTRAN program (Plouff, 1966, 1977; Godson and Plouff, 1988) and a digital terrain model. These data are processed with an isostatic reduction program (Jachens and Roberts, 1981) to compensate for the effects of crustal roots that buoyantly support topography. The isostatic reduction assumes an Airy-Heiskanen model with the following parameters from the station to 166.7 km: density of topography above sea level, 2.67 g/cm³; crustal thickness at sea level, 25 km; density contrast across the base of the model crust, 0.4 g/cm³. From 166.7 km to a point on the opposite side of the Earth, isostatic and terrain corrections were taken off maps by Karki and others (1961), which use a crustal thickness of 30 km for the isostatic correction. These corrections were added to the output of the isostatic program of Jachens and Roberts (1981) to produce the isostatic anomalies.

Theoretical gravity at sea level is based on the Geodetic Reference System 1967 (GRS 67) (International Association of Geodesy, 1971, p. 58) for the shape of the spheroid. The datum for the observed gravity is the International Gravity Standardization Net 1971 (IGSN 71) (Morelli, 1974. p. 18). Observed gravities are calculated by adding meter drift and earth-tide corrections to the milligal equivalent meter readings. Free-air anomalies are calculated by subtracting the theoretical gravity from the observed gravity and adding the free-air correction as defined by Swick (1942, p. 65). Simple Bouguer anomalies are calculated by subtracting the Bouguer correction, which accounts for the attraction of rocks between the station and sea level using a rock density of 2.67 g/cm³, from the free-air anomaly. Complete Bouguer anomalies are calculated by adding the terrain correction to the simple Bouguer anomaly. Isostatic anomalies are calculated by adding the isostatic correction to the complete Bouguer anomaly.

ISOSTATIC GRAVITY DATA

The gravity data used to produce this map are located in table 1, which lists the principal facts of the gravity stations. More detailed information about the individual data sets are found in table 2. Table 3 is an explanation of the data.

Table 2 gives detailed information on individual data sets which were collected by the USGS. This information is not available for other data sets. Data set codes from table 1 are unique for each day of data. The data set code in the first column of table 2 contains the name of the data set. The following two fields list the project name under which the data were collected and a traverse name, which best describes the geographic area in which the data are located. The next field provides the date on which the data were collected. Following the date field is the field listing the meter name and type. A type 1 meter is one that only has a meter factor, supplied from the manufacturer, that is applied to each reading. A type 0 meter is one that has a table of calibration constants supplied from the manufacturer. A type 2 meter is one that has a table of calibration constants supplied from the manufacturer plus an additional factor determined by multiple gravity readings over the Mt. Hamilton calibration loop east of San Jose, CA (Barnes and others, 1969). The next field lists the meter factor followed by the time zone in which the data were collected. Then the project chief and the party members are listed. Table 3 gives an explanation to the columns of data and codes in table 1.

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Approved for publication on August 12, 2002

SCALE 1:500 000

ISOSTATIC GRAVITY MAP OF YUKON FLATS, EAST-CENTRAL ALASKA
by
Robert L. Morin
2002
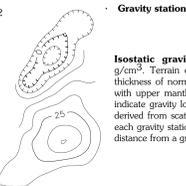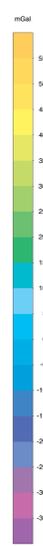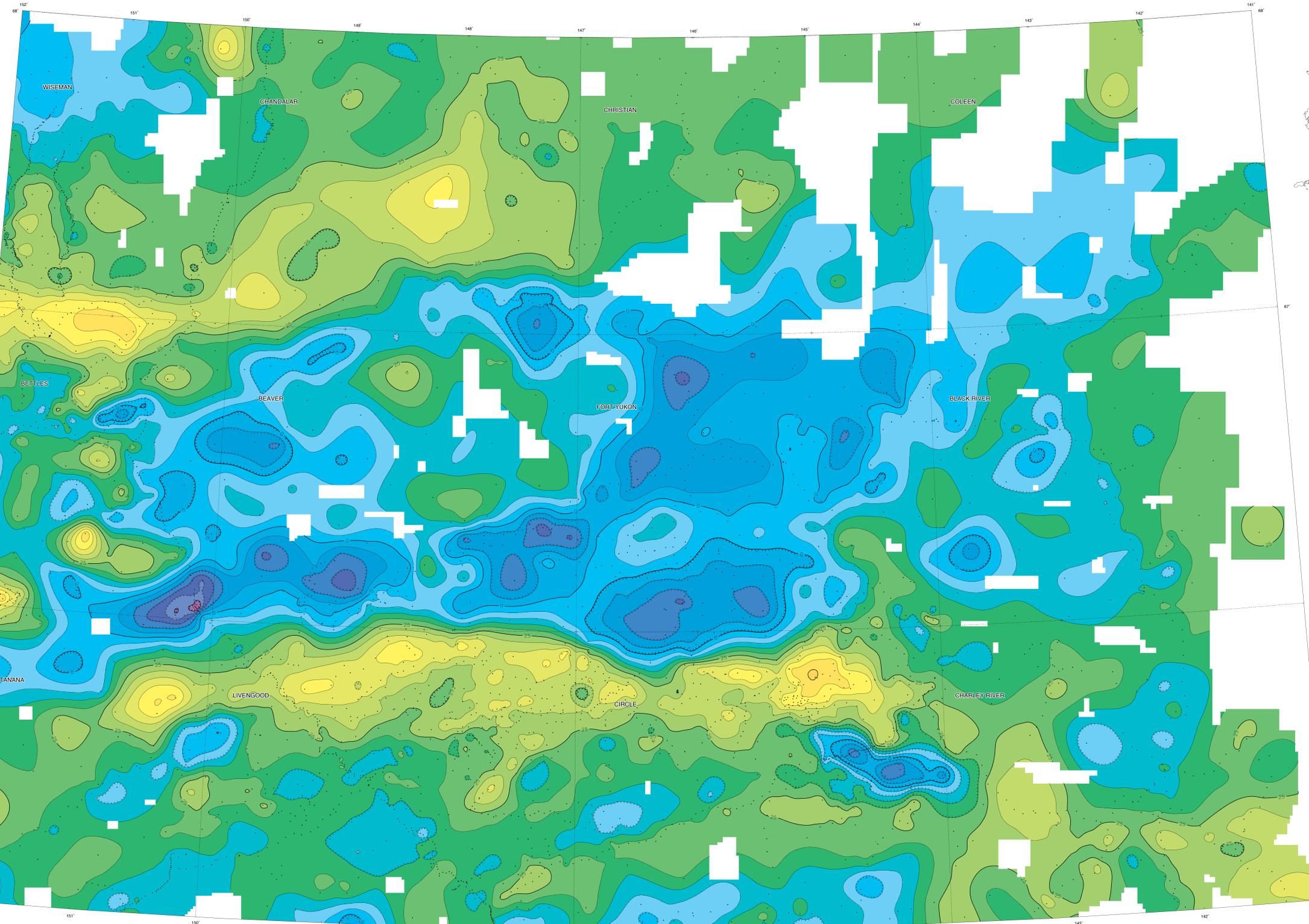
EXPLANATION

▪ Gravity station

Isostatic gravity anomaly contour—Reduction density 2.67 g/cm³. Terrain corrections from 0.39 km to 166.7 km. Assumed thickness of normal crust, 25 km. Assumed density contrast of crust with upper mantle, 0.4 g/cm³. Contour interval 5 mGal. Hachures indicate gravity low. Contours were generated based on a 1 km grid derived from scattered gravity data. A cell of 10 km by 10 km from each gravity station is represented in the grid. Areas further than this distance from a gravity station are blank.