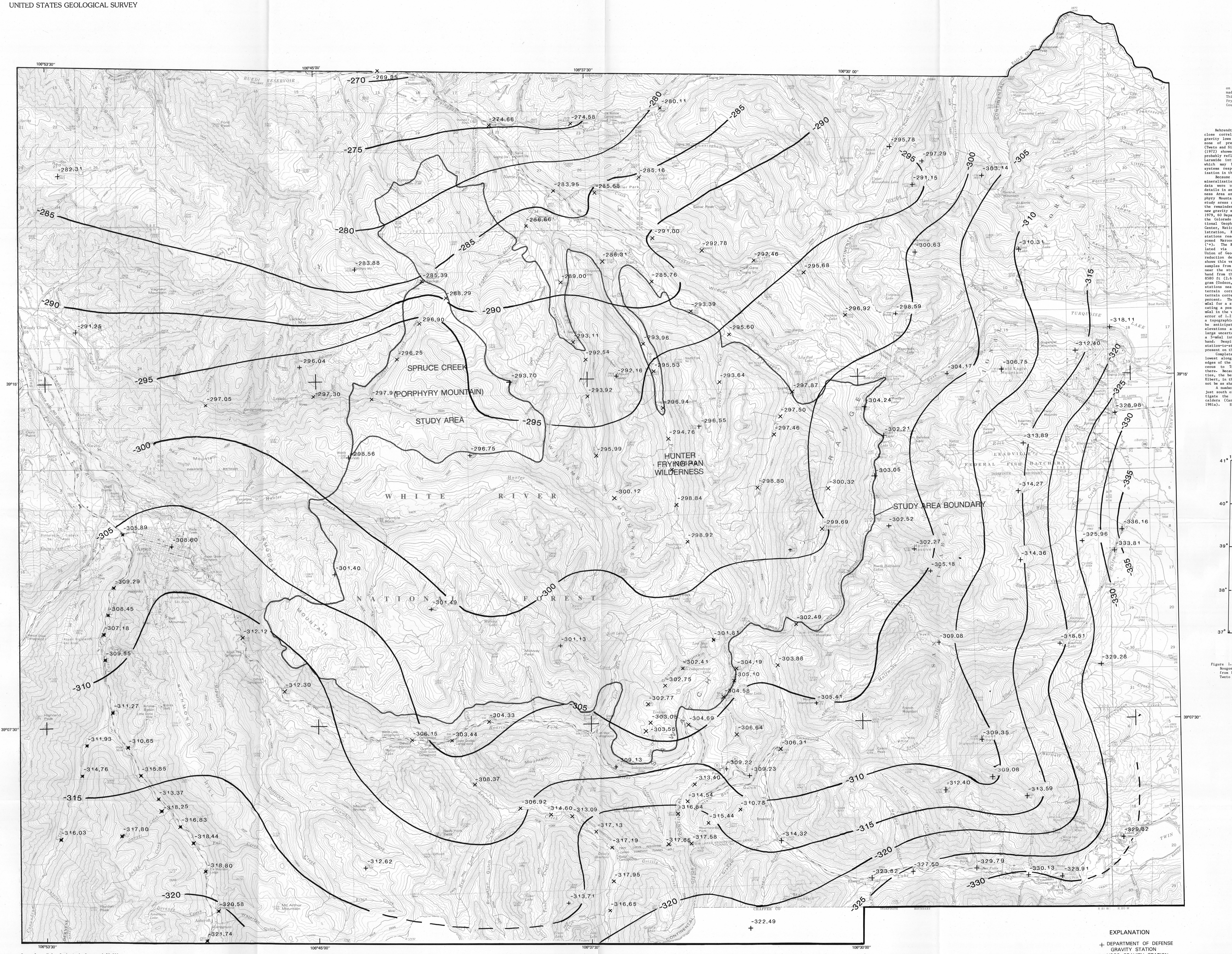
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MF-1236-C
1 OF 2 SHEETS



Public Law 95-237 requires the U.S. Geological Survey to survey certain areas on Federal lands to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This map and report present the results of a geophysical survey of the Hunter-Fryingpan Wilderness and the Porphyry Mountain Wilderness Study Area, Pitkin County, Colorado.

Behrendt and others (1968) pointed out the close correlation between a belt of extreme gravity lows (Behrendt and Bajwa, 1974) and a zone of precious and base mineral deposits (Tweto and Simms, 1963, fig. 1). Tweto and Case (1972) showed that this belt of gravity lows probably reflects a series of Laramide and post-Laramide intrusions of relatively low density which may have influenced the hydrothermal systems responsible for much of the mineralization in the Colorado Mineral Belt.

Because of the close correlation between mineralization and gravity lows, new gravity data were obtained to better define gravity details in and near the Hunter-Fryingpan Wilderness Area and the proposed Spruce Creek (Porphyry Mountain) Wilderness Area. (These two study areas are simply called the study area in the remainder of this report.) Map A shows 88 new gravity stations (x) measured during summer, 1979, 60 Department of Defense stations (+) from the Colorado Gravity File (available from National Geophysical and Solar-Terrestrial Data Center, National Oceanic and Atmospheric Administration, Boulder, Colorado), and 19 other stations read in 1974 while studying the proposed Maroon Bells-Snowmass Wilderness Area (•+). The Bouguer anomalies shown were calculated via standard equations (International Union of Geodesy and Geophysics, 1967) using a reduction density of 2.67 g/cm^3. (Figure 2 shows this value to be near the mean density for samples from the study area.) Stations in and near the study area were terrain corrected by hand from the station point to a distance of 8580 ft (2.615 km) and thence by computer program (Godson, 1979, written commun.). The other stations near the edges of the map area were terrain corrected wholly by computer. All terrain corrections are thought good to about 10 percent. The maximum terrain correction was 45 mGal for a station located on Mt. Elbert, indicating a possible uncertainty of as much as 4.5 mGal in the values reported here. An additional error of 1.21 mGal due to elevation error (half a topographic contour interval, or 20 ft) must be anticipated at those stations where spot elevations are not marked. Because of these large uncertainties, the contours on map A have a 5-mGal interval only, and were smoothed by hand. Despite such smoothing, artifacts due to station-to-station variability must certainly be present on this map.

Complete Bouguer gravity anomalies are lowest along the extreme southern and eastern edges of the map, indicating that shallow Cretaceous to Tertiary batholiths probably apex there. Because of terrain correction uncertainties, the bend in the gravity contours near Mt. Elbert, in the southeastern corner of map A, may not be as sharp as shown.

A number of gravity measurements were made just south of the study area in order to investigate the gravity signature of the Grizzly caldera (Candee, 1971; Ludington and Yeoman, 1981a). Sharp gravity gradients (about 3 mGal/km southwest of Independence Pass, and about 6 mGal/km along Lincoln Gulch Road) mark the caldera rim. The map indicates that the rocks in the caldera have lower density than those immediately north, an impression borne out by figure 2. Tertiary dike rocks associated with the caldera are shown to have lower densities than do schists and granites from the study area. Sample Nos. 713 and 714, Proterozoic rocks collected near the caldera rim, also have low densities and magnetic susceptibilities (fig. 6) in comparison with more typical granites and schists from the study area.

Inside the study area, the gravity contours are relatively smooth and widely spaced, sloping towards the south and east with gradients of 0.90 to 1.10 mGal/km. Such gradients are typical of the flanks of Colorado gravity low, and are assumed to be caused by regional batholiths which underlie its axis. Modeling by Tweto and Case (1972, fig. 6) of similar fields just east of the present study area indicates that gravity anomalies of these magnitudes and gradients can be explained as due to a batholith having -0.12 g/cm^3 density contrast whose apex lies at a depth of 2.0 to 3.3 kft (0.6-1.0 km) under the axis of the gravity minimum and whose flanks slope approximately 45°-50°. At this rate, the flank of the batholith must be at a depth of at least 20 kft (6 km), and possibly much more, under the east and south borders of the study area.

There are three minor features of interest on this map, all ambiguous because they are ill-controlled or at the noise level of the data set. First is the apparent gravity trough along Spruce Creek, whose sides are not well-controlled, and the corresponding bunching of contours at the north end of the trough, near Mt. Yeckel. This gravity trough corresponds to a portion of the Spruce Creek shear zone (Ludington and Yeoman, 1981a); the fact that it has such a gravity expression argues that the shear zone is quite wide and deep. Measured sample densities are consistent with this feature; lower-than-average densities were found for sample Nos. 277 and 339, from within the Spruce Creek gravity trough; sample Nos. 332 and 337 from outside the trough had normal (for area schists) densities.

A second feature of interest is the rather low anomaly (-300.12 mGal, near the very center of the map), seen just north of the Williams Mountains on the pass between Chapman Gulch and the South Fork of the Fryingpan River. This value, which was ignored in sketching the contours, falls on a fault zone (Ludington and Yeoman, 1981a) where rocks of lower density might be expected. Nearby gravity anomalies in the South Fork valley are not similarly low, however, though they are located in the same shear zone. The third ambiguous feature is the indication of a possible minor gravity trough along the Middle Fork of the Fryingpan, either side of the settlement of Nast. This feature is discussed on map B.

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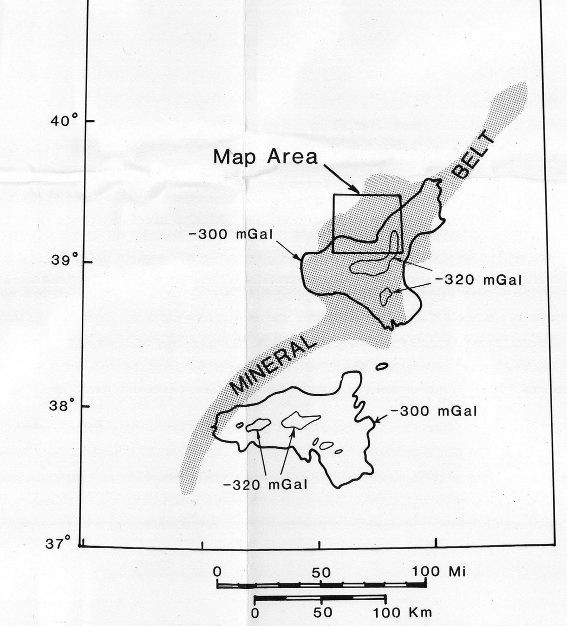


Figure 1.--Map of western Colorado showing correlation between Complete Bouguer gravity anomaly low (indicated by -300 and -320 mGal contours, from Behrendt and Bajwa, 1974), and Colorado Mineral Belt (shaded; from Tweto and Sims, 1963).

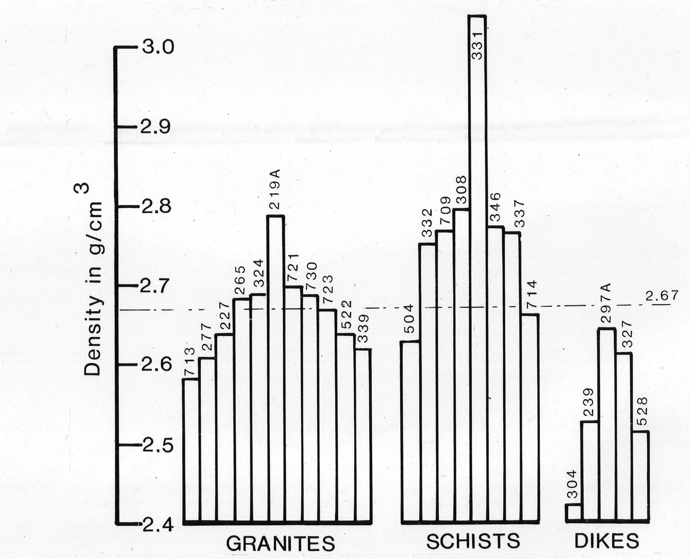
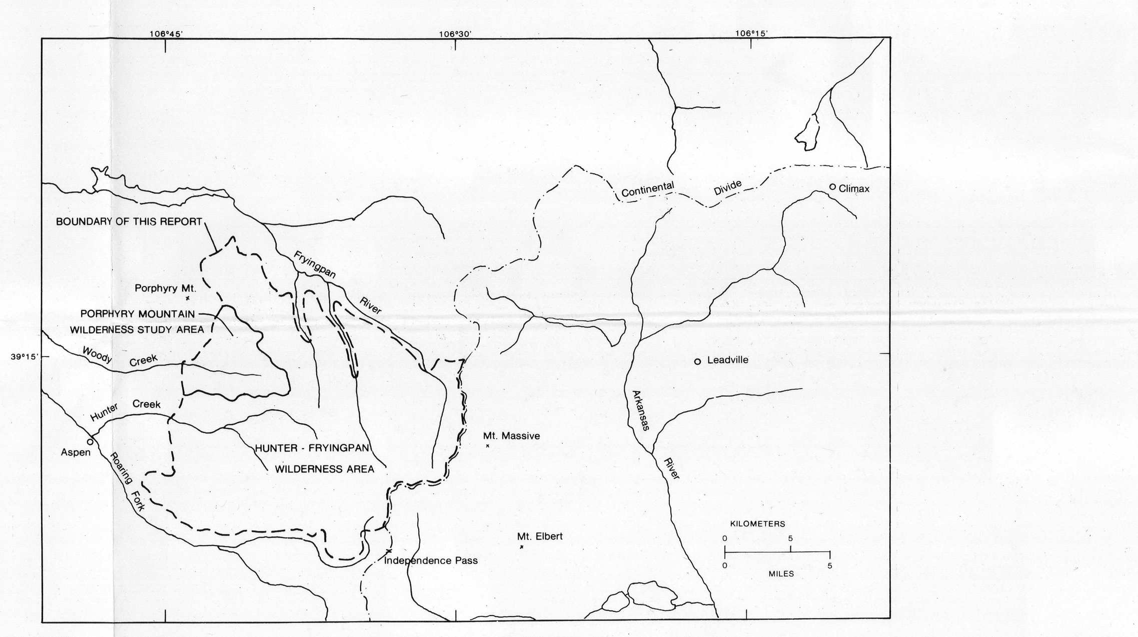


Figure 2.--Densities of selected samples from the study area. Horizontal bar (—— - ——) indicates 2.67 g/cm^3 reduction density used for calculating reported gravity anomalies. This density is close to the mean for Proterozoic granites from the study area, but somewhat below that for Proterozoic schists. Cretaceous to Tertiary dike rocks, which are volumetrically minor in the study area, generally have lower densities. Sample numbers (713) indicate collection site (see Ludington and Yeoman, 1981b).



INDEX MAP SHOWING LOCATION OF STUDY AREA

Base from U.S. Geological Survey 1:50,000, Colorado, Pitkin County E., 1976; Lake County, 1975

SCALE 1:50 000

1 ½ 0 1 2 3 MILES

1 .5 0 1 2 3 KILOMETERS

EXPLANATION

+ DEPARTMENT OF DEFENSE GRAVITY STATION

× USGS GRAVITY STATION (THIS STUDY)

⋇ USGS GRAVITY STATION (OTHER STUDIES)

—— 5-MGAL CONTOUR

MAP A-COMPLETE BOUGUER ANOMALY MAP

AEROMAGNETIC AND COMPLETE BOUGUER GRAVITY ANOMALY MAPS OF THE HUNTER-FRYINGPAN WILDERNESS AREA, PITKIN COUNTY, COLORADO

By

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1981

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