Principal Facts for Gravity Stations in the Wolf Creek Anticline Area, Piceance Basin, Colorado

by

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This report is preliminary and has not been edited or reviewed for conformity with the U.S. Geological Survey editorial standards. Any use of trade names is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey.

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DATA COLLECTION

A Gravity survey was made across the Wolf Creek anticline in the Piceance basin, Colorado (fig. 1) in Sept 1988. Gravity observations were made using La Coste and Romberg gravity meter G-551. The gravity stations were referenced to the U.S. Department of Defense (Defense Mapping Agency, 1974) base at Carbondale, Colorado (Appendix A). Gravity loops were started and closed daily. Access to the survey area was by secondary roads.

ELEVATION CONTROL

The survey area is bounded by latitudes 39°16'00" - 39°23'00"N and longitudes 107°22'00" - 107°28'00"W. Thirty-four stations were obtained from locations on U.S. Geological Survey topographic maps, Quaker Mesa, and Stony Ridge, scale 1:24,000. The uncertainty of elevation is one-half the contour interval; the correction factor is .06 mGal/foot; thus on a map with 40 ft contour intervals, the maximum Bouguer and free-air correction error is estimated to be 20 ft x .06 mGal = 1.2 mGals.

DATA REDUCTION

Computer programs existing on the USGS Branch of Geophysics Digital Equipment Corporation VAX 11-750 computer system were used to calculate principal facts and terrain-corrected gravity values. A program written by M. W. Webring (USGS, 1984, unpub. program) was used to reduce gravimeter readings to observed gravity values by calculating and correcting for earth-tides and linear meter drift. The theoretical gravity value was calculated using the 1967 formula of the Geodetic Reference System (International Association of Geodesy, 1971). Terrain corrections were computed using a program by R. H. Godson (USGS, 1978, unpub. program) correcting for the gravity effects of terrain from each station to a radius of 166.7 km using the method of Plouff (1977). Godson's program also calculates earth curvature corrections and
complete (terrain corrected) Bouguer gravity anomaly values. For a complete description of gravity reduction equations and approximations used by the Branch of Geophysics see Cordell and others (1982). These computed terrain corrections use mean elevation digital data on a 15-second grid for corrections from 0.59 to 5 km, 1-minute terrain data for corrections from 5 to 21 km, and 3-minute terrain data for corrections from 21 to 166.7 km. Terrain located less than 0.59 km from a station may not be corrected for by the above procedure due to the coarseness of the terrain model. A density of 2.67 g/cc was used to calculate terrain corrections, giving one complete Bouguer gravity anomaly value per station. The second complete Bouguer gravity anomaly value was calculated by using a reduction density of 2.45 g/cc. The corrections and gravity anomaly values are listed in table 1.
Figure 1.

WOLF CREEK ANTICLINE, GRAVITY STATIONS
scale 1:100,000
Table 1: Principal Facts of Gravity Data

Explanation of headings

Identification

<table>
<thead>
<tr>
<th>proj</th>
<th>Not used</th>
</tr>
</thead>
<tbody>
<tr>
<td>sta-id</td>
<td>Gravity station identification number</td>
</tr>
</tbody>
</table>

Locations

<table>
<thead>
<tr>
<th>latitude</th>
<th>North latitude in degrees, decimal minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>longitude</td>
<td>West longitude in degrees, decimal minutes</td>
</tr>
<tr>
<td>ele</td>
<td>Station elevation in meters</td>
</tr>
<tr>
<td>st</td>
<td>Not used</td>
</tr>
</tbody>
</table>

Gravity

<table>
<thead>
<tr>
<th>observed</th>
<th>Observed gravity in milligals</th>
</tr>
</thead>
<tbody>
<tr>
<td>theoretical</td>
<td>Theoretical gravity in milligals</td>
</tr>
</tbody>
</table>

Corrections

<table>
<thead>
<tr>
<th>Terrain</th>
<th>Terrain correction, 166.7 km radius, in milligals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bouguer</td>
<td>Simple Bouguer slab correction in milligals</td>
</tr>
<tr>
<td>curv</td>
<td>Curvature correction in milligals</td>
</tr>
<tr>
<td>special</td>
<td>Not used</td>
</tr>
</tbody>
</table>

Anomalies

<table>
<thead>
<tr>
<th>free-air</th>
<th>Free-air anomaly in milligals</th>
</tr>
</thead>
<tbody>
<tr>
<td>complete-Bouguer</td>
<td>Complete Bouguer anomaly in milligals for designated densities d1 and d2</td>
</tr>
<tr>
<td>spec fields</td>
<td>Not used</td>
</tr>
<tr>
<td>STATION IDENTIFICATION</td>
<td>LATITUDE (deg min)</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>1:143</td>
<td>39 22.46 -107 23.46</td>
</tr>
<tr>
<td>1:144</td>
<td>39 22.11 -107 23.24</td>
</tr>
<tr>
<td>1:145</td>
<td>39 21.86 -107 23.36</td>
</tr>
<tr>
<td>1:146</td>
<td>39 21.79 -107 23.28</td>
</tr>
<tr>
<td>1:147</td>
<td>39 21.53 -107 23.66</td>
</tr>
</tbody>
</table>

**BOUGUER GRAVITY DATA**

**WOLF CREEK ANTICLINE, CO**

**SEPT. 1949**

*elev ous .01  srt=tree m a-h l-x*
REFERENCES CITED


### Appendix A

#### GRAVITY BASE STATION

<table>
<thead>
<tr>
<th>LATITUDE</th>
<th>39° 24.04'N</th>
<th>(1)</th>
<th>STATION DESIGNATION</th>
<th>CARBONDALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LONGITUDE</td>
<td>107° 12.71'W</td>
<td>(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELEVATION</td>
<td>6170.2 ft</td>
<td>1880.6</td>
<td>METERS</td>
<td>USA/Colorado</td>
</tr>
<tr>
<td>COUNTRY/STATE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REFERENCE CODE NUMBERS</td>
<td>ACIC 4651-1</td>
<td>IGB 11997D</td>
<td>ADOPTED GRAVITY VALUE</td>
<td>g = 979459.34 mgals</td>
</tr>
<tr>
<td>ESTIMATED ACCURACY</td>
<td>± 0.1 mgals</td>
<td>DATE</td>
<td>MONTH/YEAR</td>
<td>10/71</td>
</tr>
</tbody>
</table>

#### DESCRIPTION AND/OR SKETCH

The station is located in Carbondale, on the southwest corner of Main Street and 3rd Street, at the First Baptist Church, in the northwest corner of the building on the sidewalk. (1)