UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Complete Bouguer Profiles and Principal Facts for Gravity Stations in the Divide Creek Anticline Area, Piceance Basin, Colorado

by

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ILLUSTRATIONS

TABLES

DATA COLLECTION

A Gravity survey was made across the Divide Creek anticline in the Piceance basin, Colorado (Figs. 1 and 2) in August 1987. Gravity observations were made using La Coste and Romberg gravity meter G-500. 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 and jeep trails. The survey was restricted by unmaintained, wet clay roads.

ELEVATION CONTROL

The survey area is bounded by latitudes 39°15'00" - 39°28'00"N and longitudes 107°23'00" - 107°39'00"W. Thirty-eight stations were obtained from locations on U.S. Geological Survey topographic maps, Flatiron Mountain, Gibson Gulch, Hunter Mesa, and Quaker Mesa, scale 1:24,000. The uncertainty of elevation is one-half the contour interval; thus on a map with 40 ft contour intervals, the maximum Bouguer and free-air correction error is estimated to be 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.

PROFILE EXTRACTION

To examine the data across the Divide Creek Anticline, we projected the data points onto two straight lines A and B (Figure 2). These projected profile data are shown on Figures 3 and 4 in two profiles as complete Bouguer values reduced at 2.67 g/cc and 2.45 g/cc densities. The 2.45 g/cc density profile was selected from twelve preliminary density profiles that varied in density from 1.90 g/cc to 2.90 g/cc because it had the least correlation with topography. This density, determined thusly by the Nettleton profiling method (Telford and others, 1986), probably represents the average bulk density of the rocks comprising Divide Creek anticline. Therefore, the profiles of the data reduced at 2.45 g/cc should best represent the gravitational effect of sources beneath the mountain that have densities other than 2.45 g/cc.

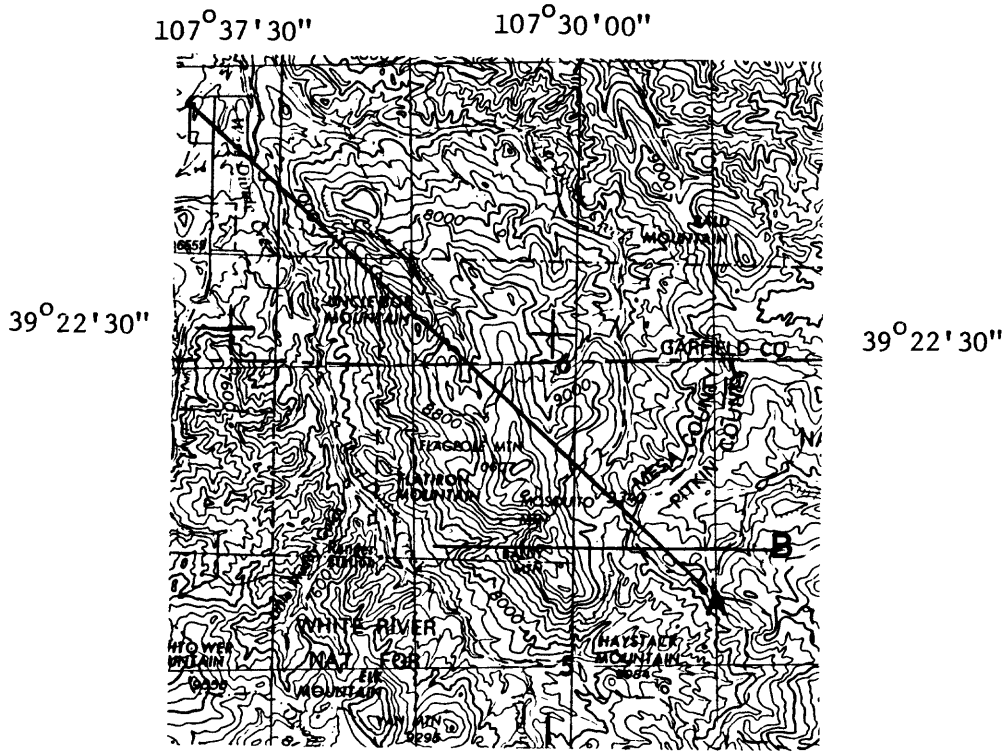


Figure 1. Lines A and B
Location Map extracted from Leadville 2° Topographic Map.

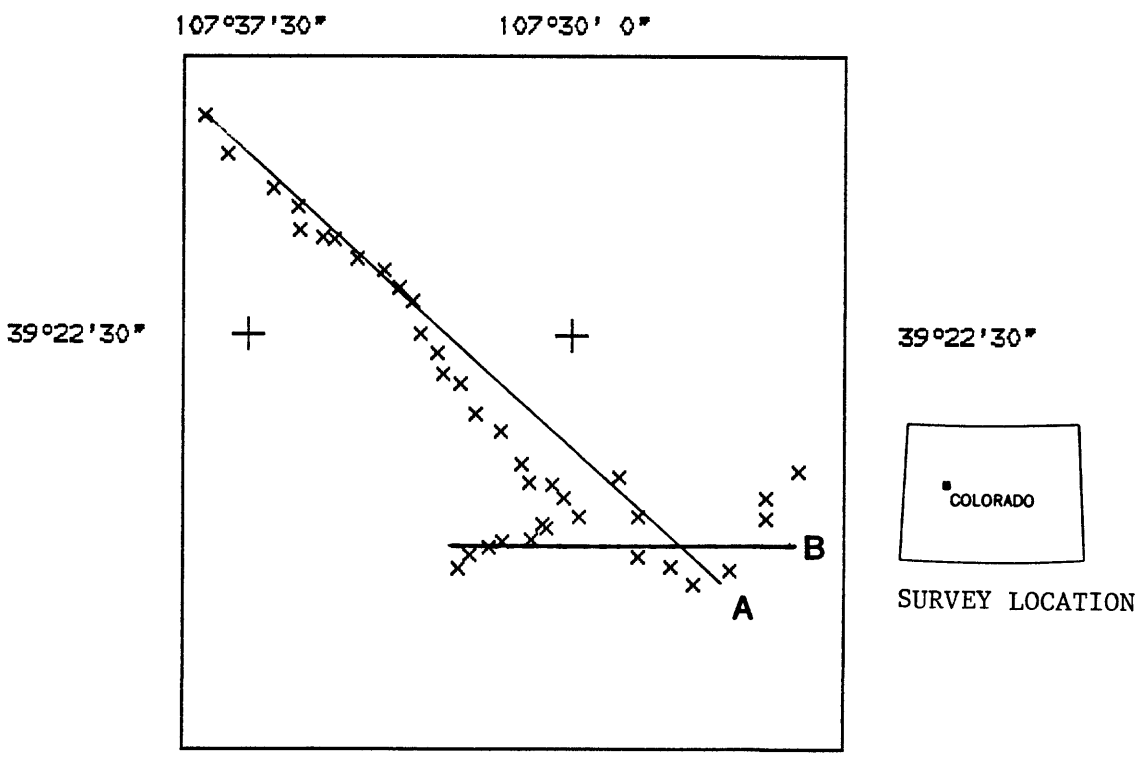
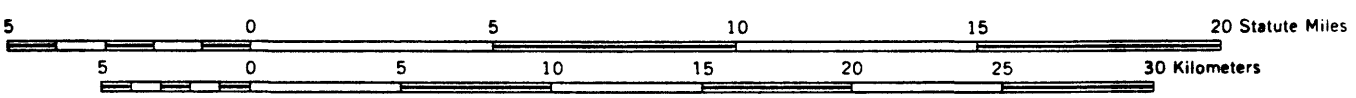


Figure 2. Location of Gravity Stations and Lines A and B



Scale applies to Figure 1 and 2

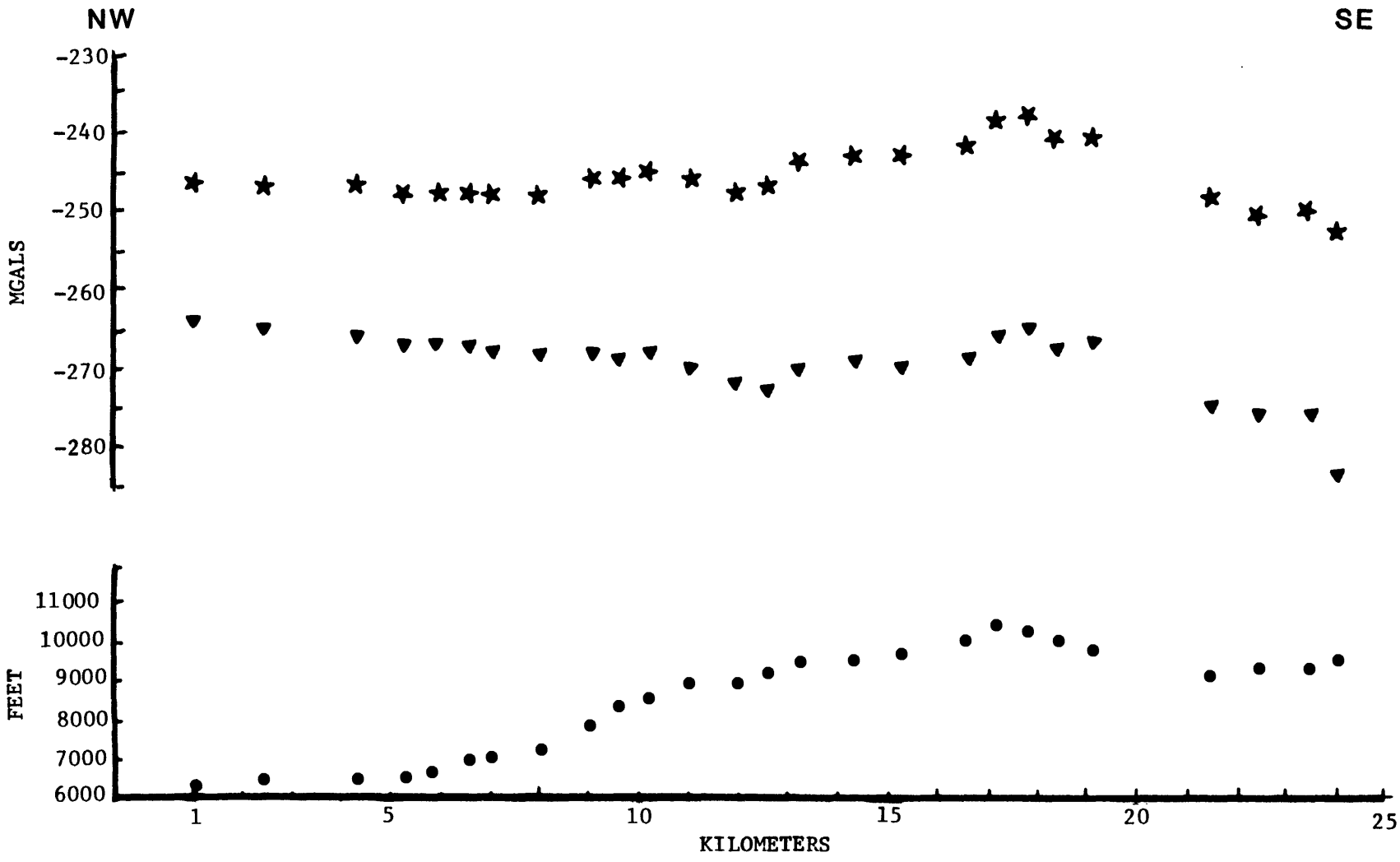


Figure 3. Line A
NW-SE profiles across anticline
Refer to Figure 1.

ELEVATION: ●
DENSITY: ▼ 2.67g/cc
DENSITY: ✱ 2.45g/cc

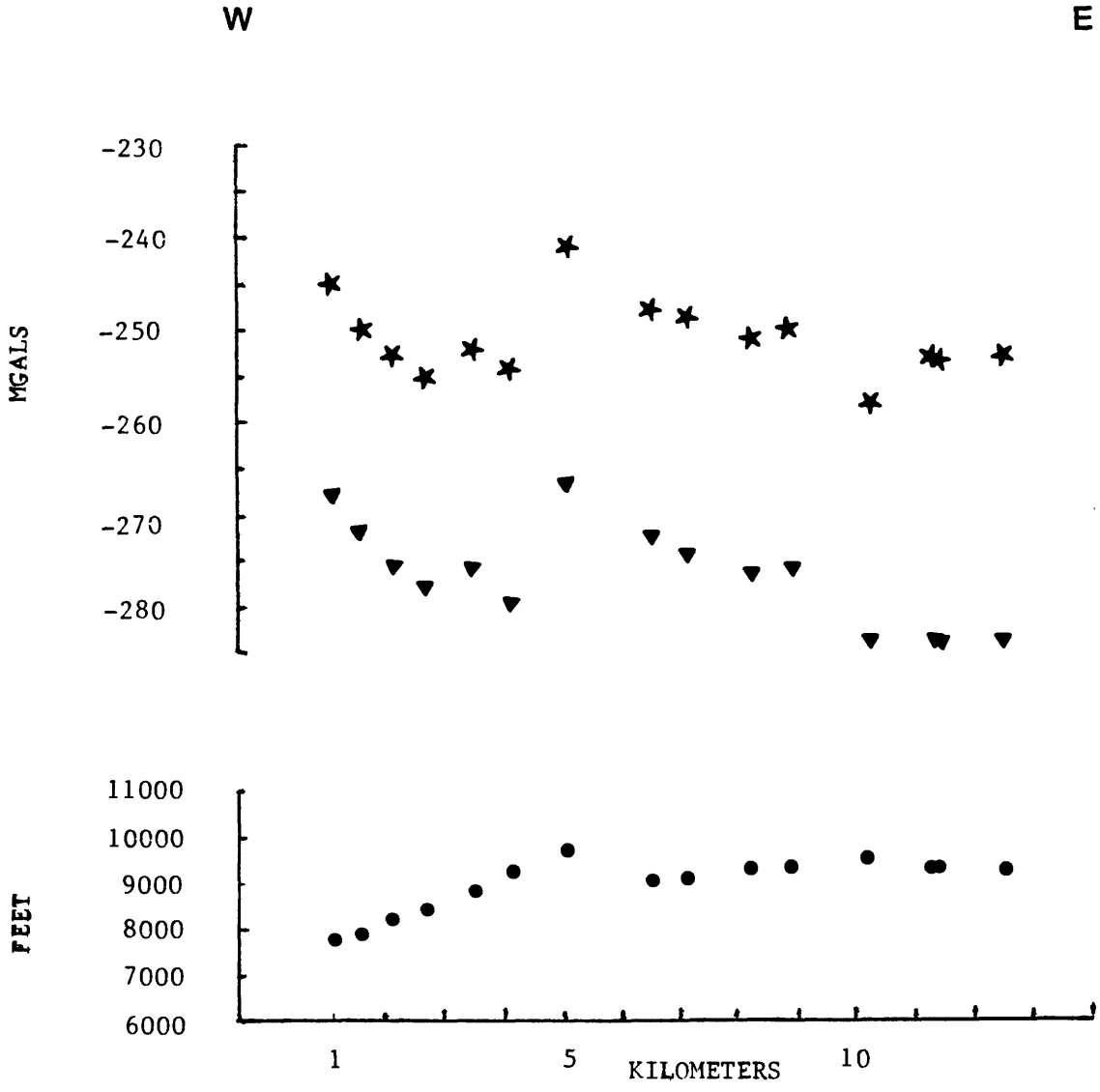


Figure 4. Line B
W-E profiles across anticline
Refer to Figure 1.

ELEVATION: ●
DENSITY: ▼ 2.67g/cc
DENSITY: ✱ 2.45g/cc

Table 1: Principal Facts of Gravity Data

Explanation of headings

Identification	
proj	Not used
sta-id	Gravity station identification number
Locations	
latitude	North latitude in degrees, decimal minutes
longitude	West longitude in degrees, decimal minutes
ele	Station elevation in meters
st	Not used
Gravity	
observed	Observed gravity in milligals
theoretical	Theoretical gravity in milligals
Corrections	
Terrain	Terrain correction, 166.7 km radius, in milligals
Bouguer	Simple Bouguer slab correction in milligals
curv	Curvature correction in milligals
special	Not used
Anomalies	
free-air	Free-air anomaly in milligals
complete-Bouguer	Complete Bouguer anomaly in milligals for designated densities d1 and d2
spec fields	Not used

BOUGUER GRAVITY DATA

ANTICLINE, CO
AUGUST 1987
2q-550

STATION IDENTIFICATION proj	sta-id	LOCATIONS LATITUDE deg	min	LONGITUDE deg	min	ELE (in ft)	ST	GRAVITY OBSERVED	THEORETICAL	CORRECTIONS TERRAIN (d1=2.67)	BOUGUER	CURV	SPECIAL	ANOMALIES FREE AIR	COMPLETE-BOUGUER d1=2.67	d2=2.45	SPEC FIELDS
:	00	39	20.07	-107	24.73	9240.00	co	979275.41	980109.82	2.97	-315.15	-1.32	0.00	34.12	-279.38	-253.55	
:	01	39	19.58	-107	25.47	9329.00	co	979268.85	980109.09	2.99	-318.19	-1.31	0.00	36.65	-279.85	-253.77	
:	02	39	19.22	-107	25.50	9397.00	co	979264.35	980108.56	2.99	-320.50	-1.30	0.00	39.07	-279.74	-253.47	
:	04	39	18.27	-107	26.32	9560.00	co	979247.06	980107.16	4.09	-326.06	-1.27	0.00	38.49	-284.75	-258.11	
:	05	39	18.03	-107	27.16	9355.00	co	979264.35	980106.80	6.66	-319.07	-1.30	0.00	36.89	-276.83	-250.98	
:	06	39	18.35	-107	27.69	9355.00	co	979265.17	980107.28	6.21	-319.07	-1.30	0.00	37.23	-276.94	-251.05	
:	07	39	18.53	-107	28.43	9150.00	co	979279.44	980107.55	6.21	-312.08	-1.34	0.00	31.97	-275.23	-249.92	
:	08	39	19.25	-107	28.44	9370.00	co	979268.47	980108.61	8.69	-319.58	-1.30	0.00	40.61	-271.59	-245.86	
:	09	39	19.96	-107	28.88	9040.00	co	979289.21	980109.66	7.32	-308.33	-1.35	0.00	29.30	-273.06	-248.14	
:	10	39	19.23	-107	29.82	9830.00	co	979237.97	980108.58	15.39	-335.27	-1.22	0.00	53.35	-267.75	-241.29	
:	13	39	19.56	-107	30.16	10040.00	co	979221.73	980109.07	19.02	-342.44	-1.17	0.00	56.34	-268.25	-241.51	
:	14	39	19.81	-107	30.42	10240.00	co	979210.46	980109.44	21.05	-349.26	-1.13	0.00	63.49	-265.85	-238.71	
:	15	39	19.85	-107	30.96	10410.00	co	979196.22	980109.49	24.87	-355.06	-1.09	0.00	65.16	-266.12	-238.82	
:	16	39	20.19	-107	31.16	10160.00	co	979215.49	980110.00	17.87	-346.53	-1.15	0.00	60.44	-269.36	-242.19	
:	17	39	20.77	-107	31.65	9760.00	co	979244.20	980110.86	13.25	-332.89	-1.23	0.00	50.72	-270.14	-243.70	
:	18	39	21.09	-107	32.24	9540.00	co	979259.59	980111.33	12.26	-325.38	-1.27	0.00	44.98	-269.41	-243.51	
:	19	39	21.62	-107	32.58	9485.00	co	979264.23	980112.11	10.92	-323.51	-1.28	0.00	43.67	-270.20	-244.34	
:	20	39	21.79	-107	32.96	9200.00	co	979281.01	980112.36	8.45	-313.79	-1.33	0.00	33.43	-273.24	-247.97	
:	21	39	22.16	-107	33.13	8920.00	co	979301.05	980112.91	6.33	-304.24	-1.37	0.00	26.62	-272.66	-248.00	
:	22	39	22.50	-107	33.52	8919.00	co	979301.10	980113.41	8.62	-304.20	-1.37	0.00	26.07	-270.88	-246.41	
:	23	39	23.08	-107	33.70	8630.00	co	979321.31	980114.27	8.68	-294.34	-1.41	0.00	18.27	-268.80	-245.15	
:	24	39	23.33	-107	34.01	8378.00	co	979336.34	980114.64	8.22	-285.75	-1.44	0.00	9.26	-269.70	-246.72	
:	25	39	23.63	-107	34.35	7960.00	co	979366.34	980115.09	5.17	-271.49	-1.47	0.00	-0.46	-268.25	-246.19	
:	26	39	23.86	-107	35.01	7320.00	co	979406.07	980115.42	3.53	-249.66	-1.51	0.00	-21.20	-268.84	-248.43	
:	27	39	24.20	-107	35.51	7160.00	co	979416.98	980115.92	3.45	-244.21	-1.51	0.00	-25.83	-268.10	-248.13	
:	28	39	24.23	-107	35.77	7000.00	co	979427.21	980115.97	3.25	-238.75	-1.52	0.00	-30.67	-267.69	-248.16	
:	29	39	24.34	-107	36.34	6658.00	co	979448.35	980116.13	2.91	-227.09	-1.52	0.00	-41.83	-267.52	-248.93	
:	30	39	24.76	-107	36.39	6577.00	co	979453.98	980116.75	3.19	-224.32	-1.52	0.00	-44.44	-267.08	-248.74	
:	31	39	25.09	-107	36.94	6373.00	co	979468.57	980117.24	2.35	-217.36	-1.51	0.00	-49.51	-266.03	-248.19	
:	32	39	26.39	-107	38.57	6279.00	co	979478.58	980119.16	1.55	-214.16	-1.51	0.00	-50.25	-264.37	-246.73	
:	33	39	25.73	-107	38.00	6301.00	co	979475.35	980118.19	1.62	-214.91	-1.51	0.00	-50.44	-265.23	-247.53	
:	36	39	18.53	-107	32.32	7990.00	co	979352.12	980107.55	5.70	-272.52	-1.47	0.00	-4.32	-272.61	-250.50	
:	37	39	18.69	-107	31.90	8200.00	co	979337.26	980107.78	4.75	-279.68	-1.45	0.00	0.31	-276.07	-253.30	
:	38	39	18.83	-107	30.93	8880.00	co	979295.05	980107.99	5.75	-302.87	-1.38	0.00	21.77	-276.72	-252.13	
:	39	39	19.02	-107	30.56	9240.00	co	979270.19	980108.27	5.86	-315.15	-1.32	0.00	30.46	-280.15	-254.56	
:	40	39	19.10	-107	30.66	9390.00	co	979264.36	980108.39	9.44	-320.27	-1.30	0.00	38.60	-273.53	-247.81	
:	41	39	18.77	-107	31.58	8400.00	co	979322.78	980107.90	4.58	-286.50	-1.43	0.00	4.51	-278.84	-255.50	
:	42	39	18.30	-107	32.58	7880.00	co	979361.06	980107.20	8.15	-268.76	-1.48	0.00	-5.37	-267.46	-245.87	

ACKNOWLEDGEMENT

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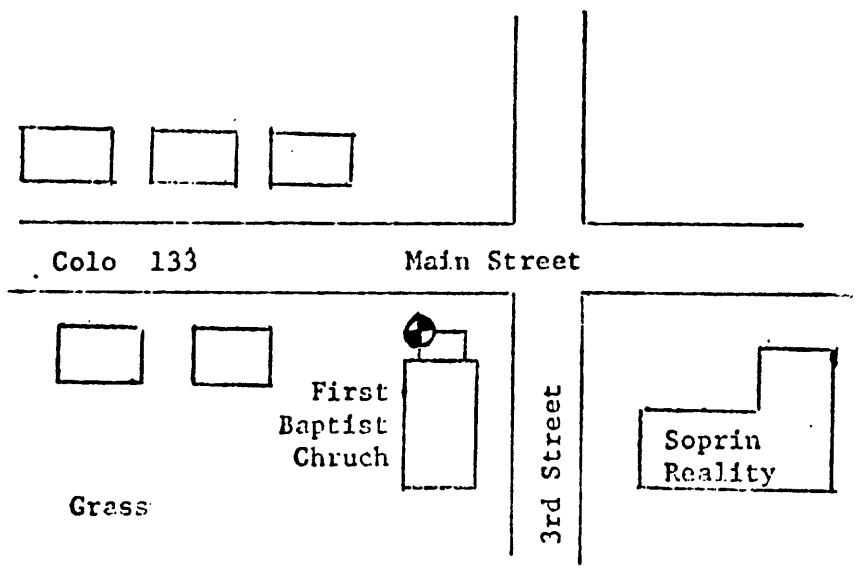
GRAVITY BASE STATION

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

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)



(1)

REFERENCE SOURCE

(1) 03405

ACIC HQ FORM FEB 69 0-415