UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

PRINCIPAL FACTS FOR GRAVITY STATIONS IN THE WINCHESTER MOUNTAINS STUDY AREA AND VICINITY, COCHISE AND GRAHAM COUNTIES, ARIZONA

by

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Table of Contents

STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines 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 report presents the data from a gravity survey of the Winchester Mountains Roadless Area (FP 03-122) in the Coronado National Forest, Cochise County, Arizona. The Winchester Mountains Roadless Area was classified as a further planning area during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

Introduction

A gravity study was made of the Winchester Mountains and vicinity (Fig. 1) in 1981. The data were obtained as part of a U.S. Geological Survey (USGS) program to evaluate the mineral-resource potential of wilderness areas.

Data Collection

The 39 station survey was made using LaCoste-Romberg meter G-551.[1] The stations were referenced to the International Gravity Standardization Net 1971 (Defense Mapping Agency Aerospace Center, 1974) at base station ACIC 3193-1 Wilcox, Arizona. A complete base description is included at the end of this report.

Elevation Control

Station elevations were obtained from surveyed bench marks, spot elevations, and contour interpolations between the 50 foot (15.5 m) contour interval on the 1:62,500 scale USGS Winchester Mountains topographic map. Elevation accuracy is assumed to vary from 6 inches (0.2 m) for bench marks to about one-half a contour interval, 25 feet (8 m), for contour interpolations, resulting in a maximum error in the Bouguer anomaly of less than 2 milligals (mgal) at an assumed density of 2.67 g/cm^3.

[1] Use of brand names in this report is for descriptive purposes only, and in no way constitutes endorsement by the U.S. Geological Survey.

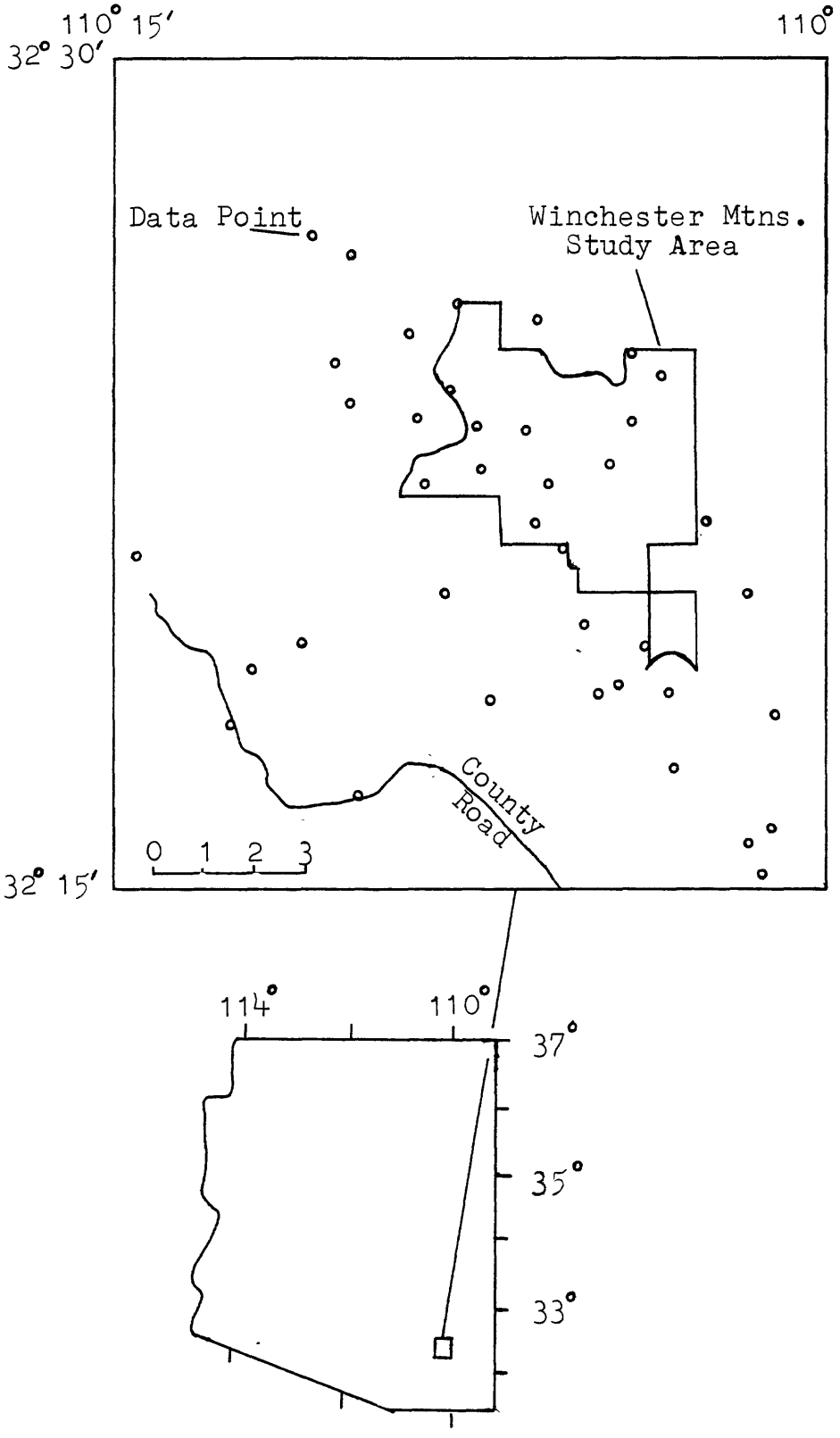


Fig. 1. Area of the gravity survey for the Winchester Mountains Study Area and vicinity, Cochise and Graham Counties, Arizona.

Data Reduction

Programs existing on the USGS Honeywell[1] computer were used to reduce the gravity data. An unpublished program by D. A. Dansereau and R. R. Wahl (U.S. Geological Survey, 1975) was used to calculate earth-tide and linear meter-drift corrections. The theoritical gravity value was calculated using the 1967 formula of the Geodetic Reference System (International Association of Geodesy, 1967). An unpublished program by R. H. Godson (U.S. Geological Survey, 1978) was used to compute terrain corrections for a circular area from each station out to 166.7 km using the method of Plouff (1977). The program uses mean elevation data on a 15 second grid for corrections from 0 to 5 km; 1 minute terrain data for corrections from 5 to 21 km; and 3 minute terrain data for corrections from 21 to 166.6 km. This program also calculates earth curvature corrections and complete (terrain-corrected) Bouguer anomaly values. Corrections for terrain ranged from 0.68 mgal to 25.38 mgal. Two complete Bouguer anomaly values per station were obtained assuming average rock densities of 2.67 g/cm^3 and 2.45 g/cm^3. The corrections and anomaly values are listed in Appendix B.

REFERENCES

Defense Mapping Agency Aerospace Center, 1974, World Relative Gravity Reference Network, North America, Part 2: Defense Mapping Agency Aerospace Center Reference Publication 25, with supplement updating gravity values to the International Gravity Standardization Net 1971, 1635 p.

International Association of Geodesy, 1967, Geodetic Reference System. International Association of Geodesy Special Publication 3, 74 p.

Plouff, D., 1977, Preliminary documentation for the FORTRAN program to compute gravity terrain corrections based on topography digitized on a geographic grid: U.S. Geological Survey Open-File Report 77-535.

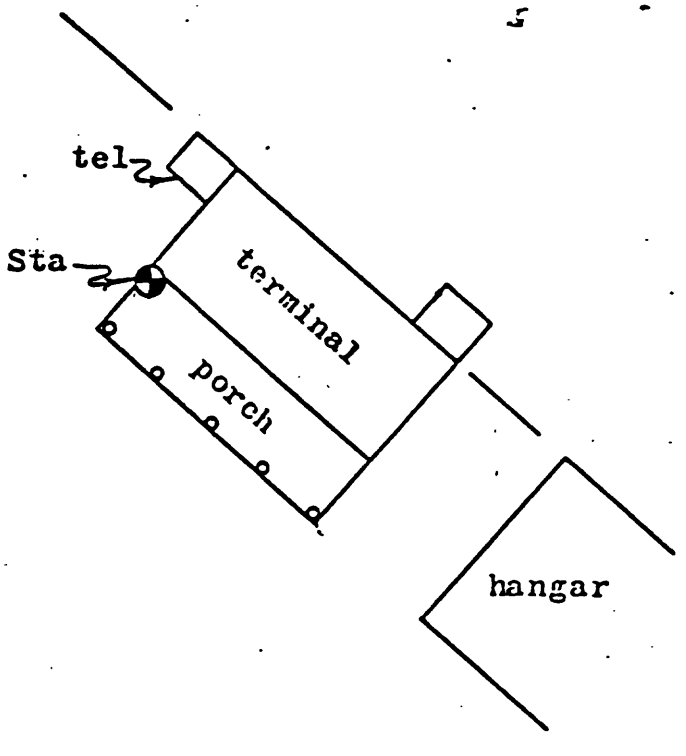
GRAVITY BASE STATION

LATITUDE	STATION DESIGNATION
32° 14.57'N (1)	
LONGITUDE	
109° 53.53'W (1)	WILCOX
ELEVATION	**COUNTRY/STATE**
1275.0 METERS (1)	USA/Arizona

REFERENCE CODE NUMBERS		ADOPTED GRAVITY VALUE	
ACIC 3193-1		g= 979 083.11 mgals	
		ESTIMATED ACCURACY	DATE
		± 0.1 mgals	MONTH/YEAR 9/69

DESCRIPTION AND/OR SKETCH

Station site is located at Cochise County Airport, on NW corner of terminal porch. (1)



(1)

REFERENCE SOURCE

(1) 03035

ACIC HQ FORM FEB 69 0-415

Appendix B: Principal Facts of Gravity Data

Explanation of headings

Identification	
proj	Project name.
sta id	Gravity station identification
Location	
latitude	North latitude in degrees, minutes, and hundredths of minutes.
longitude	West longitude in degrees, minutes, and hundredths of minutes.
elev (in feet)	Station elevation in feet.
st	State where station is located.
Gravity	
observed	Observed gravity in milligals.
theoretical	Theoretical gravity in milligals.
Corrections	
terrain	Terrain correction out to 166.7 km in milligals.
Bouguer	Elevation 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.
spec fields	Not used.

BOUGUER GRAVITY DATA

winchester
ron martin, sept.1981
Meter ID: a-551 Date: 09/30/81

STATION IDENTIFICATION proj	sta-id	LOCATIONS LATITUDE deg	min	LONGTITUDE deg	min	ELE (in ft)	ST	GRAVITY OBSERVED	THEORETICAL	CORRECTIONS TERRAIN	BOUGUER	CURV	SPECIAL	ANOMALIES FREE AIR	COMPLETE-BOUGUER d1=2.67	d2=2.45	SPEC FIELDS
win :	wm-16	32	23.25	-110	6.27	7631.0	az	978859.96	979515.05	25.38	-260.27	-1.49	0.00	62.40	-173.98	-154.51	
win :	wm-17	32	24.28	-110	3.27	5410.0	az	979020.55	979516.46	5.58	-184.52	-1.45	0.00	12.84	-167.56	-152.69	
win :	wm-18	32	24.69	-110	3.90	5471.0	az	979018.63	979517.02	7.42	-186.60	-1.46	0.00	16.10	-164.54	-149.66	
win :	wm-19	32	25.36	-110	5.88	5260.0	az	979043.31	979517.93	2.87	-179.40	-1.44	0.00	20.03	-157.94	-143.28	
win :	wm-20	32	25.63	-110	7.67	6025.0	az	978992.96	979518.30	6.92	-205.50	-1.50	0.00	41.22	-158.85	-142.37	
win :	wm-21	32	24.01	-110	7.76	6304.0	az	978971.28	979516.09	7.57	-215.01	-1.51	0.00	47.97	-160.98	-143.76	
win :	wm-23	32	23.64	-110	3.98	6700.0	az	978929.87	979515.59	17.13	-228.52	-1.52	0.00	44.28	-168.62	-151.08	
win :	wm-24	32	22.90	-110	4.40	6975.0	az	978909.29	979514.58	14.57	-237.90	-1.52	0.00	50.56	-174.29	-155.76	
win :	wm-25	32	22.66	-110	5.72	7099.0	az	978903.39	979514.25	16.45	-242.13	-1.51	0.00	56.64	-170.55	-151.83	
win :	wm-26	32	23.33	-110	7.29	6360.0	az	978962.48	979515.16	6.91	-216.92	-1.51	0.00	45.37	-166.16	-148.73	
win :	wm-27	32	22.59	-110	7.10	6254.0	az	978967.33	979514.16	5.99	-213.31	-1.51	0.00	41.25	-167.57	-150.36	
win :	wm-28	32	22.35	-110	8.37	6325.0	az	978960.97	979513.83	10.87	-215.73	-1.51	0.00	41.90	-164.47	-147.47	
win :	wm-29	32	21.29	-110	5.49	7424.0	az	978877.19	979512.38	22.43	-253.21	-1.50	0.00	62.85	-169.44	-150.30	
win :	wm-30	32	21.62	-110	5.88	7160.0	az	978903.23	979512.84	16.49	-244.21	-1.51	0.00	63.63	-165.60	-146.71	
win :	wm-31	32	21.89	-110	2.52	5275.0	az	979027.66	979513.20	3.18	-179.92	-1.44	0.00	10.52	-167.66	-152.97	
win :	wm-32	32	19.49	-110	3.78	6956.0	az	978907.58	979509.94	18.01	-237.25	-1.52	0.00	51.70	-169.05	-150.86	
win :	wm-33	32	17.20	-110	3.14	6460.0	az	978948.89	979506.82	17.17	-220.33	-1.51	0.00	49.52	-155.16	-138.30	
win :	wm-34	32	18.74	-110	4.37	6010.0	az	978985.57	979508.91	7.96	-204.98	-1.50	0.00	41.80	-156.72	-140.36	
win :	wm-35	32	19.73	-110	4.89	6575.0	az	978942.81	979510.27	13.56	-224.25	-1.52	0.00	50.80	-161.41	-143.92	
win :	wm-36	32	15.24	-110	1.17	4825.0	az	979061.56	979504.16	1.75	-164.57	-1.39	0.00	11.16	-153.04	-139.51	
win :	wm-37	32	16.20	-110	1.06	4700.0	az	979068.20	979505.46	1.69	-160.30	-1.37	0.00	4.75	-155.24	-142.06	
win :	wm-38	32	16.00	-110	1.56	4875.0	az	979060.58	979505.19	3.78	-166.27	-1.40	0.00	13.85	-150.04	-136.54	
win :	wm-39	32	18.26	-110	0.80	4821.0	az	979056.40	979508.27	1.36	-164.43	-1.39	0.00	1.52	-162.94	-149.39	
win :	wm-40	32	18.61	-110	3.27	5100.0	az	979045.41	979508.74	3.10	-173.95	-1.42	0.00	16.28	-155.99	-141.79	

BOUGUER GRAVITY DATA

wilderness
spring 81 rm
Meter ID: g-159 Date: 07/09/81

STATION IDENTIFICATION			LOCATIONS					GRAVITY		CORRECTIONS				ANOMALIES		
proj		sta-id	LATITUDE deg	min	LONGITUDE deg	min	ELE (in ft)	ST	OBSERVED	THEORETICAL	TERRAIN	BOUGUER	CURV	SPECIAL	FREE AIR	COMPLETE-BOUGUER d1=2.67	d2=2.45	SPEC FIELDS
win	:	wm-1	32	25.09	-110	8.68	5710.0	az	979007.65	979517.56	2.75	-194.75	-1.48	0.00	27.04	-166.44	-150.50	
win	:	wm-2	32	24.63	-110	10.28	5323.0	az	979031.29	979516.94	2.05	-181.55	-1.45	0.00	14.92	-166.02	-151.11	
win	:	wm-3	32	23.84	-110	9.92	5527.0	az	979016.73	979515.86	2.71	-188.51	-1.46	0.00	20.62	-166.64	-151.21	
win	:	wm-4	32	23.58	-110	8.54	5752.0	az	979001.88	979515.50	3.04	-196.18	-1.48	0.00	27.28	-167.35	-151.31	
win	:	wm-5	32	26.84	-110	10.68	5108.0	az	979047.66	979519.95	1.50	-174.22	-1.42	0.00	8.08	-166.07	-151.72	
win	:	wm-6	32	26.46	-110	9.94	5285.0	az	979035.87	979519.43	1.27	-180.26	-1.44	0.00	13.44	-166.99	-152.12	
win	:	wm-7	32	20.38	-110	1.76	4766.0	az	979061.30	979511.15	2.37	-162.55	-1.38	0.00	-1.64	-163.21	-149.89	
win	:	wm-8	32	16.74	-110	9.68	4793.0	az	979049.66	979506.20	0.76	-163.48	-1.38	0.00	-5.78	-169.88	-156.36	
win	:	wm-9	32	18.05	-110	12.52	4345.0	az	979088.80	979507.98	0.87	-148.20	-1.32	0.00	-10.55	-159.19	-146.95	
win	:	wm-10	32	21.02	-110	14.35	4027.0	az	979115.56	979512.02	2.05	-137.35	-1.26	0.00	-17.72	-154.29	-143.04	
win	:	wm-11	32	19.50	-110	10.96	4524.0	az	979068.16	979509.95	0.96	-154.30	-1.35	0.00	-16.33	-171.01	-158.27	
win	:	wm-12	32	19.07	-110	11.99	4395.0	az	979079.96	979509.37	0.68	-149.90	-1.33	0.00	-16.07	-166.62	-154.22	
win	:	wm-13	32	18.56	-110	6.96	5149.0	az	979033.55	979508.67	1.57	-175.62	-1.43	0.00	9.09	-166.38	-151.92	
win	:	wm-14	32	20.38	-110	7.90	5239.0	az	979028.60	979511.15	1.63	-178.69	-1.44	0.00	10.13	-168.36	-153.66	
win	:	wm-15	32	18.60	-110	4.80	5479.0	az	979019.38	979508.73	2.06	-186.87	-1.46	0.00	25.89	-160.38	-145.03	