

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

STATE OF ALASKA

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Report of Investigations 84-25
PRELIMINARY GRAVITY DATA, HOLITNA BASIN,
SOUTH-CENTRAL ALASKA

By
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INTRODUCTION

The Holitna Basin is one of only a few areas in interior Alaska where oil and gas might be discovered. However, unlike Cook Inlet or the North Slope, this basin is in the initial stages of exploration. The thickness of the sedimentary section and the nature of the faults associated with the basin are unknown because of the lack of subsurface information from such sources as deep wells and seismic data.

To aid in the geologic interpretation of the basin, DGGS conducted a surface gravity survey that complements and extends gravity surveys obtained from the U.S. Geological Survey (USGS). This paper presents the reduced data in tabular form and the contoured free-air anomaly and terrain-corrected Bouguer anomaly maps (pls. 1 and 2).

GRAVITY-DATA ACQUISITION AND REDUCTION

Gravity data used in this study include 119 stations collected by the authors during the summer of 1983 and 265 stations previously obtained by D.F. Barnes (USGS). The latter data were provided as digitized gravity field data on magnetic tape from the USGS gravity library. Some USGS stations were re-occupied for comparison with the DGGS data.

Datum control for all gravity values was provided by the USGS Alaskan Gravity Base Station Network (Barnes, 1968; 1972) and was adjusted to the new absolute datum of the International Gravity Standardization Net 1971 (Morelli and others, 1974). The new field data were tied into this network by re-occupying base station 'SLEM' from this Gravity Base Station Network throughout the survey.

A LaCoste and Romberg gravity meter (G-507) was used to establish the new gravity stations. During the field surveys, the gravity meter appeared to function properly, and a maximum drift of 0.5 mgal per day indicates there were no apparent tares in the data.

Elevations for the new stations were determined using three altimeters (American Paulin Model T-5). Three readings were averaged at each station and corrected for diurnal barometric variations using data from a base-station micro-barograph (American Paulin Model SMB-5) that was operated throughout the surveys. Where possible, the gravity stations were located at U.S. Coast and Geodetic Survey Vertical Angle Benchmarks (VABM) for elevation control. Temperature and drift corrections that were also applied yielded elevations with an accuracy of ± 30 ft. Many types of elevation control were used to reduce the USGS data. Some elevations were calculated from field altimetry measurements and others were calculated from river gradients derived from topographic maps. The altimetry analysis indicates that 90 percent of the data is accurate to ± 50 ft (Barnes, 1977).

Gravity reductions were run on all data (including the data obtained from the USGS) using standard techniques, including a latitude correction defined by the new ellipsoid obtained from the 1967 Geodetic Reference System (International Association of Geodesy, 1971). A density of 2.62 gm/cc, which was used for the Bouguer correction over the entire area, was obtained by averaging the densities of 78 representative rocks from the area (standard deviation ± 0.16 gm/cc). Terrain corrections were calculated using a USGS computer program and digitized topographic data. Terrain corrections varied from 0 to 0.5 mgal in the basin to 30.52 mgal in the mountains. To check the accuracy of the computer corrections, hand-calculated terrain corrections were determined for some stations and compared to the computer corrections. The comparison was excellent, with a maximum difference between the two of 0.25 mgal. The precision of the Bouguer anomaly values is primarily dependent upon the elevation and is estimated at ± 3 mgal based on the 50-ft accuracy of the older data. Data for the new gravity stations are given in table 1; elevations represent the altimeter elevation. For comparison to other data sets, the complete Bouguer anomaly is given for a density of 2.67 gm/cc as well as the calculated density of 2.62 gm/cc.

A free-air anomaly map and a terrain-corrected Bouguer anomaly map were produced using both data sets (pls. 1 and 2). Because the new and old gravity values closely agree for those stations occupied by the USGS and DGGs, there were no problems contouring the data.

ACKNOWLEDGMENTS

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Table 1. Data for new gravity stations occupied in the Holitna Basin, Alaska.

<u>Station</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Elev. (ft)</u>	<u>Observed</u>	<u>FAA</u>	<u>CBA(2.62)</u>	<u>CBA(2.67)</u>
H 1	61 20.08	157 2.79	207	982000.62	-0.27	-7.17	-7.31
H 2	61 19.31	157 1.35	216	982001.60	2.54	-4.67	-4.81
H 3	61 18.03	157 1.07	215	982000.91	3.38	-3.80	-3.93
H 4	61 16.82	157 0.43	218	982000.84	5.13	-2.14	-2.28
H 5	61 16.21	157 1.66	215	982002.81	7.61	0.43	0.30
H 6	61 15.31	157 1.04	220	982002.59	9.00	1.67	1.53
H 7	61 14.51	157 3.08	219	982001.20	8.54	1.34	1.20
H 8	61 13.73	157 3.20	215	982001.16	9.12	1.95	1.82
H 9	61 12.38	157 3.01	221	981996.67	6.92	-0.38	-0.52
H 10	61 11.22	157 3.57	220	981997.62	9.24	3.17	3.03
H 11	61 10.32	157 4.21	230	981996.16	9.89	2.45	2.30
H 12	61 9.38	157 3.20	234	981995.67	10.97	3.24	3.09
H 13	61 8.76	157 2.08	236	981994.64	10.91	3.09	2.94
H 14	61 8.17	157 0.12	233	981992.24	8.99	1.26	1.11
H 15	61 7.77	156 58.44	242	981989.19	7.30	-0.73	-0.89
H 16	61 7.19	156 57.10	248	981988.55	7.96	-0.24	-0.40
H 17	61 6.85	156 55.32	249	981987.15	7.09	-1.16	-1.32
H 18	61 5.86	156 54.63	259	981985.87	8.01	-0.54	-0.70
H 19	61 4.99	156 54.43	262	981983.78	7.33	-1.28	-1.45
H 20	61 4.07	156 54.02	266	981983.54	8.64	-0.05	-0.22
H 21	61 3.17	156 55.60	273	981982.56	9.47	0.49	0.32
H 22	61 2.31	156 54.86	271	981979.56	7.38	-1.54	-1.71
H 23	61 1.41	156 55.14	280	981976.39	6.21	-3.02	-3.20
H 24	61 0.56	156 54.80	289	981977.44	9.21	-0.29	-0.47
H 25	60 59.72	156 54.23	290	981975.51	8.45	-0.99	-1.17
H 26	60 58.74	156 55.52	301	981971.51	6.73	-2.99	-3.18
H 27	60 57.75	156 56.94	313	981962.36	-0.02	-10.05	-10.25
H 28	60 56.78	156 55.77	324	981970.48	10.39	2.39	2.19
H 29	60 56.29	156 54.01	319	981970.14	10.20	0.55	0.34
H 30	60 55.21	156 53.20	325	981968.70	10.71	0.02	-0.18
H 31	60 54.09	156 52.73	331	981966.70	10.71	-0.20	-0.41
H 32	61 1.44	157 10.06	318	981973.35	6.71	-3.64	-3.84
H 33	61 4.28	157 14.20	275	981981.23	6.91	-2.05	-2.22
H 34	61 11.13	157 26.66	964	981946.83	28.56	-0.97	-1.58

Table 1 (con.)

<u>Station</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Elev. (ft)</u>	<u>Observed</u>	<u>FAA</u>	<u>CBA(2.62)</u>	<u>CBA(2.67)</u>
H 35	61 18.97	157 25.66	1014	981955.93	32.36	3.82	3.17
H 36	61 24.63	157 24.41	1047	981954.38	26.71	-5.95	-6.62
H 37	61 27.63	157 15.91	923	981963.43	20.30	-3.09	-3.68
H 38	61 43.36	157 22.46	2486	981864.15	48.11	-4.48	-6.06
H 39	61 38.82	157 27.10	1301	981948.11	26.35	-13.07	-13.90
H 40	61 34.79	157 16.51	1461	981931.63	30.02	-0.73	-1.66
H 41	61 32.27	157 24.72	1200	981951.12	28.15	-8.85	-9.61
H 42	61 17.15	157 15.49	1109	981952.21	39.90	7.29	6.58
H 43	60 54.62	157 3.47	1024	981923.21	31.73	-0.84	-1.49
H 44	60 49.86	156 53.96	350	981960.08	11.32	-0.23	-0.46
H 45	60 49.79	156 40.43	1434	981891.70	45.00	-0.29	-1.20
H 46	60 55.19	156 42.75	1785	981877.85	57.22	5.55	4.41
H 47	60 55.37	156 33.93	1550	981887.87	44.90	-0.66	-1.65
H 48	60 52.45	156 21.49	844	981931.16	25.53	-1.99	-2.53
H 49	61 0.30	156 1.61	1800	981871.77	45.99	-5.14	-6.29
H 50	61 6.25	155 54.89	1284	981911.02	29.08	-7.41	-8.23
H 51	61 17.61	155 38.72	1856	981885.72	43.08	-11.46	-12.64
H 52	61 21.96	155 47.11	656	981980.85	19.80	-2.03	-2.45
H 53	61 21.75	155 58.77	493	981991.90	15.78	-0.68	-1.00
H 54	61 15.87	156 0.71	768	981967.23	24.47	-0.66	-1.15
H 55	61 9.49	156 7.28	1233	981924.42	33.55	-4.23	-5.02
H 56	61 4.57	156 16.40	1351	981912.60	39.12	-1.63	-2.49
H 57	60 59.63	156 17.82	1063	981933.35	39.10	5.41	4.73
H 58	61 40.76	156 45.68	245	982007.00	-16.53	-24.72	-24.88
H 59	61 39.01	156 43.34	247	981997.21	-23.92	-32.18	-32.33
H 60	61 36.75	156 40.53	246	982021.92	3.55	-4.67	-4.82
H 61	61 33.99	156 37.24	313	981997.11	-11.47	-21.91	-22.11
H 62	61 31.74	156 35.43	282	982003.72	-4.92	-14.27	-14.45
H 63	61 28.84	156 31.47	331	982003.33	2.97	-8.07	-8.28
H 64	61 26.29	156 27.12	379	982004.03	11.42	-1.23	-1.47
H 65	61 23.61	156 23.16	574	981990.07	19.21	0.14	-0.23
H 66	61 20.49	156 17.57	581	981987.62	21.39	2.08	1.70
H 67	61 15.95	156 10.82	863	981961.60	27.68	-1.12	-1.67
H 68	61 15.33	156 21.59	511	981980.51	14.26	-2.76	-3.26

Table 1 (con.)

<u>Station</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Elev. (ft)</u>	<u>Observed</u>	<u>FAA</u>	<u>CBA(2.62)</u>	<u>CBA(2.67)</u>
H 69	61 10.07	156 20.65	756	981957.89	21.40	-3.78	-4.26
H 70	61 9.92	156 31.60	400	981978.95	9.18	-4.16	-4.42
H 71	61 0.31	156 40.77	828	981946.40	79.18	2.24	1.72
H 72	61 5.38	156 44.80	646	981964.97	24.13	3.03	2.62
H 73	61 11.03	156 48.65	1058	981946.84	37.53	6.21	5.53
H 74	61 15.20	156 52.24	280	981994.77	6.97	-2.33	-2.51
H 75	61 20.46	156 55.49	249	981997.34	-0.09	-8.40	-8.56
H 76	61 25.64	156 56.11	205	981991.15	-17.00	-23.84	-23.97
H 77	61 47.56	157 11.67	1287	981957.70	23.60	-7.79	-8.61
H 78	61 47.64	156 55.71	1096	981967.94	15.78	-15.53	-16.22
H 79	61 51.50	157 2.61	1807	981927.22	37.07	-13.61	-14.76
H 80	61 54.85	156 54.31	1470	981950.99	24.93	-19.63	-20.56
H 81	61 49.85	156 46.79	1277	981957.03	19.10	-18.42	-19.23
H 82	61 52.97	156 38.61	233	982023.26	-16.79	-24.47	-24.62
H 83	61 58.57	156 36.01	1163	981971.34	11.74	-24.73	-25.47
H 84	61 53.79	156 24.19	1031	981975.15	9.14	-23.57	-24.23
H 85	61 58.62	156 23.34	899	981985.95	1.44	-27.10	-27.68
H 86	62 2.01	156 25.75	1526	981950.08	20.31	-24.75	-25.73
H 87	62 2.06	156 1.04	297	982027.41	-18.03	-27.93	-28.12
H 88	61 59.70	155 47.61	1172	981970.80	10.63	-25.07	-25.81
H 89	61 55.85	155 42.16	419	982022.52	-3.66	-17.64	-17.90
H 90	61 50.59	155 30.79	1913	981932.69	53.65	-2.05	-3.27
H 91	61 30.36	155 30.80	713	981982.76	16.41	-7.38	-7.84
H 92	61 40.66	155 30.61	1180	981973.78	38.32	0.93	0.18
H 93	61 45.46	155 32.07	1406	981965.06	44.79	0.72	-0.18
H 94	61 47.36	155 43.35	2073	981911.68	51.77	-1.45	-2.77
H 95	61 53.68	155 50.72	359	982016.14	-12.95	-24.93	-25.16
H 96	61 41.20	155 53.09	457	982019.67	15.52	0.26	-0.03
H 97	61 36.59	155 52.81	638	982002.94	21.65	0.35	-0.06
H 98	61 30.94	155 53.66	813	981986.05	28.37	1.74	1.22
H 99	61 24.19	156 10.12	560	981989.71	16.80	-1.89	-2.25
H100	61 11.22	157 3.57	276	982012.26	29.15	20.91	20.74
H101	61 31.67	157 15.93	277	982007.36	-1.66	-10.48	-10.66
H102	61 22.58	157 14.35	286	982005.21	8.57	-0.92	-1.10

Table 1 (con.)

<u>Station</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Elev. (ft)</u>	<u>Observed</u>	<u>FAA</u>	<u>CBA(2.62)</u>	<u>CBA(2.67)</u>
H103	61 15.43	156 30.53	538	981978.18	14.35	-3.57	-3.91
H104	61 20.00	156 32.94	390	981995.80	12.23	-0.75	-1.00
H105	61 24.66	156 39.29	332	981960.35	-34.61	-45.58	-45.79
H106	61 29.34	156 44.53	259	982001.47	-6.29	-14.94	-15.10
H107	61 33.74	156 49.84	255	981980.04	-33.68	-42.20	-42.36
H108	61 38.62	156 53.32	255	981999.84	-20.05	-27.79	-27.95
H109	61 42.73	156 39.93	268	982013.64	-10.21	-19.17	-19.34
H110	61 38.61	156 31.96	289	981991.14	-25.54	-35.19	-35.38
H111	61 34.41	156 25.27	296	982008.13	-2.57	-12.46	-12.65
H112	61 29.70	156 19.06	397	982004.08	8.84	-4.42	-4.67
H113	61 46.84	156 5.90	368	982004.41	-15.23	-27.52	-27.75
H114	61 41.75	156 5.21	414	982000.15	-8.75	-22.49	-22.76
H115	61 36.51	156 3.64	452	982014.72	16.02	0.94	0.66
H116	61 43.25	156 10.88	473	981981.62	-23.62	-39.26	-39.57
H117	61 44.53	156 14.77	839	981965.06	-7.36	-31.15	-31.69
H118	61 46.92	156 20.90	277	982033.81	5.52	-3.72	-3.90
H119	61 48.67	156 11.67	326	982013.20	-12.70	-23.58	-23.79