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Title: Bouguer Gravity Anomaly Map of the Waterville, Maine 15-minute Quadrangle

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This report is preliminary and has not been edited or reviewed for conformity with Maine Geological Survey standards.

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BOUGUER GRAVITY ANOMALY MAP OF THE WATERVILLE, MAINE 15-MINUTE QUADRANGLE

by

Stephen S. Potts and William E. Doll

Between October and December, 1985, a gravity study was conducted within the Waterville, Maine 15-minute quadrangle. A total of 127 stations were occupied in the study. This represents a denser concentration of stations than previous studies in the area. Previous studies indicated a steep gravity gradient in the area of our study, referred to as the Central Maine Gravity Gradient (CMGG). The CMGG extends beyond the Waterville quadrangle, so more data will be needed in adjacent quadrangles before one can thoroughly and carefully model the features which produce the gradient. We present preliminary models which do not attempt to accurately represent features of the study area. They support the ideas of Phillips (personal communication, 1985), that the CMGG results from the combined effects of a near surface felsic body which outcrops to the north and northwest of our study area, and a mafic body which is beneath the southeast portion of the Waterville quadrangle, at about 5-10 km depth.

Our 127 gravity measurements were taken at spot elevations, including many road intersections, identified on the Hinckley, Clinton, Fairfield, and Waterville provisional 7.5-minute topographic maps. A Worden Prospector gravity meter (model 112, serial 890, dial constant 0.0867) was used in the experiment. All measurements were tied to a base station adjacent to the rear entrance of the Mudd Science Building on the Colby College campus. The Mudd base was tied to a base at the American Motor Inn (AMI) on Kennedy Memorial Drive in Waterville, which was used by the U.S. Geological Survey in work associated with the Maine Seismic Reflection experiment in 1984-85 (Snyder and Phillips, 1986). The AMI station has been tied to a base station at Augusta State Airport in Augusta, Maine. This provides a means of calculating the total gravity values.

Data were reduced at the U.S. Geological Survey offices in Reston, Virginia under the direction of Dr. Jeffrey Phillips. The computer program BOUGUER, written by R. H. Godson (unpublished, USGS Denver, 10/78), was used for the reduction. Measurements were corrected for tides, elevation, drift and terrain. Drift corrections assumed linear drift between the first and last base measurement on each day of field work. If more than two hours of field work was performed on a given day, field base stations were established and reoccupied every two hours. Bouguer anomalies were calculated using densities of 2.67 and 2.75 g/cc. The original data, as well as the reduced anomalies are presented in Appendix 1. We include Table 1 as an indication of the precision of our data. It lists the amount of drift measured at two hour intervals at three field base stations. This can be compared to the drift that was assumed in our station corrections, which used the main base at Colby College, and assumed linear drift between the first and last measurements of the day. The uncorrected drift is generally within about 1/3 mgal. Comparisons of our drift corrected data with those of previous studies (Snyder and Phillips, 1986; Simpson, Bothner and Hodge, 1979), at duplicate field stations indicate an even smaller error, on the order of 0.2 mgal.

TABLE 1

Drift Measurements at Remote Base Stations

Remote Base Station FAI3 10/26/85

Time	Meter Reading	Difference	Milligals Drift
0945	12998	---	-----
1115	13001	+3	+0.026 mgals
1320	12998	0	0.000 mgals
1525	13002	+4	+0.035 mgals
1720	13010	+12	+0.104 mgals

Remote Base Station CLI1 11/09/85

Time	Meter Reading	Difference	Milligals Drift
0925	12892	---	-----
1115	12892	0	0.000 mgals
1325	12904	+12	+0.104 mgals
1525	12898	+6	+0.052 mgals
1650	12865	-27	-0.234 mgals

Remote Base Station HIN1 11/23/85

Time	Meter Reading	Difference	Milligals Drift
1250	11532	---	-----
1425	11543	+11	+0.095 mgals
1615	11528	-4	-0.035 mgals

Once the data were reduced, a contoured Bouguer anomaly was produced, using the program MINC, a gridding program based on the principle of minimum curvature, written by Michael Webring (USGS Open-File Report 81-1224), and CONTOUR, a contouring program written by R. H. Godson and Michael Webring. This map, shown in Plate 1, assumes a density of 2.67 g/cc for the Bouguer correction.

Figure 1 is a reproduction of a portion of the gravity map of Simpson, Bothner and Hodge (1979) showing the Waterville 15-minute quadrangle (outlined) and adjoining quadrangles. As anticipated, our map in Plate 1 independently confirms the general form of the anomalies in the older map, Figure 1. Both clearly show a steep southeasterly trending gradient, which has been called the Central Maine Gravity Gradient (CMGG). An elongate gravity high with one peak is superimposed on this trend on our map. This differs from the earlier map which shows two peaks in the same region. Single station anomalies are also eliminated on our new map, and the contours are simpler and more continuous.

One of our purposes in collecting these data was to describe the structure which produces the Central Maine Gravity Gradient. Recent seismic reflection studies (Stewart et al., 1986) transect the Waterville quadrangle, and are supported by closely-spaced gravity and magnetic measurements (Snyder and Phillips, 1986). These data give a southeast trending cross sectional view of the structure. A more detailed gravity map can be used to define the lateral changes in the shapes of structures identified in the reflection data.

The CMGG is a very steep gradient with changes of 20-30 mgals over a distance of 10 to 15 km. As such, it dominates the regional field in our study area. It is thought to extend tens or hundreds of kilometers to the northeast and southwest of the Waterville quadrangle. As a result, our models will be inaccurate, because they do not adequately consider changes in density outside of the study area. To get a general characterization of the structure in the area, it was not necessary to subtract a regional field, since the CMGG is regional in character. The aim of our study was to determine the cause of the regional field. Preliminary analyses proposed that the CMGG was the result of a subcrustal or deep crustal step with a denser block of rocks being brought closer to the surface to the southeast of the gradient. This might be produced by faulting of pre-existing rocks, or by suturing. There is evidence in the seismic reflection data which suggests that a step in the Moho may occur beneath our study area, perhaps changing 8 km in depth over a distance of about 45 km (Stewart, oral communication, 1986). However, density changes at Moho depth produce anomalies at the surface which are much broader than the CMGG, and such contributions would be of secondary importance in explaining the gradient. For these reasons, a preferred model was developed which attributes the gradient to the combined effect of a felsic body to the northwest and a mafic body to the southeast (Phillips, oral communication, 1986). Indeed, two felsic bodies, the Rome/Norridgewock and Hartland plutons, are known to outcrop north and west of the Waterville quadrangle. Our work supports the existence of the mafic body that was proposed by Phillips. Because the felsic plutons are not located within the bounds of our study, we are unable to adequately represent their shape and depth in our structural models. As the shape of these low density bodies will

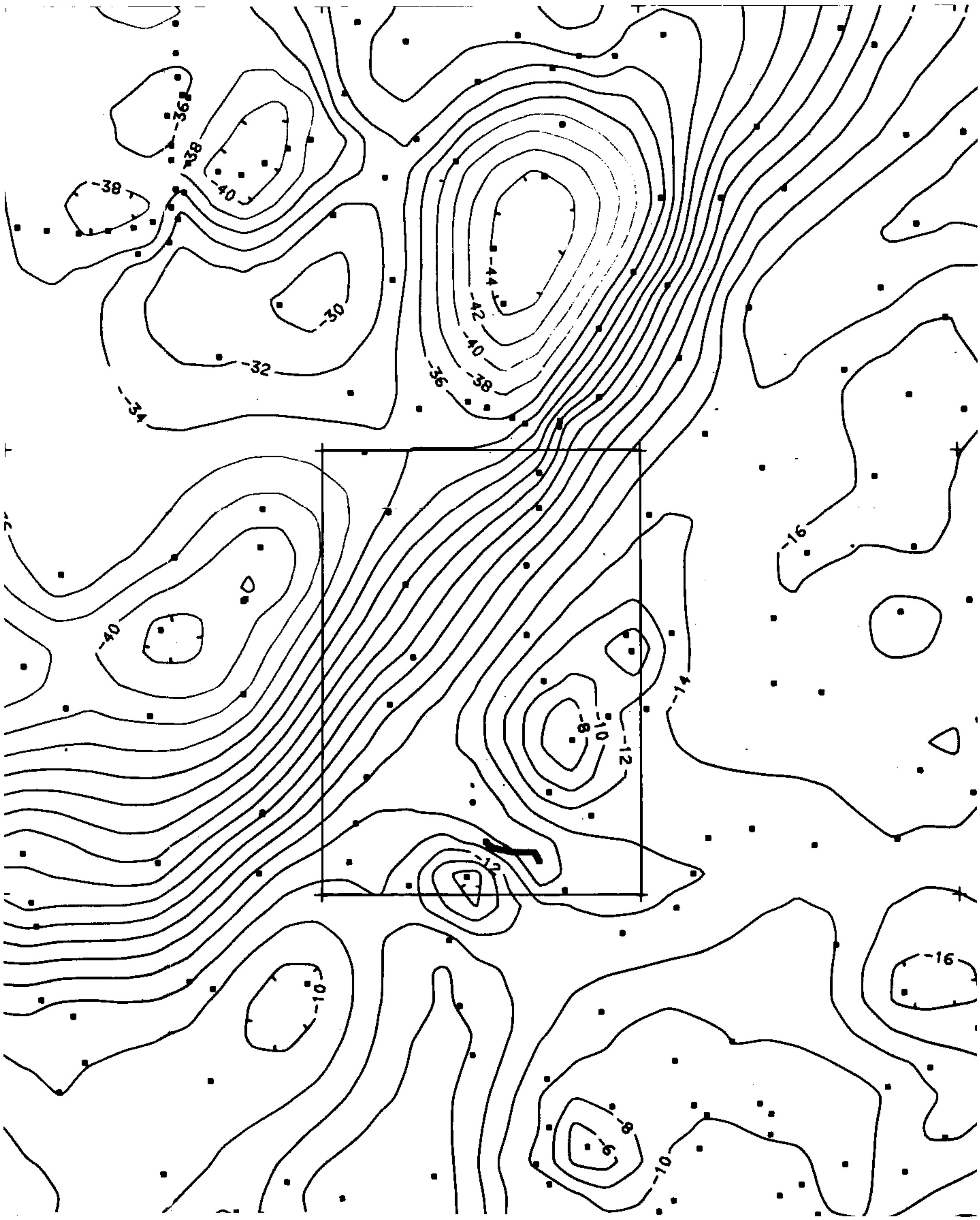

Figure 1. Bouguer anomaly map of the Waterville quadrangle and adjacent quadrangles (from Simpson, Bothner, and Hodge, 1979).

affect the anomalies produced by the denser bodies to the southeast, this limits the precision of our models. Despite this, we present the models as an indication of the types of structures which might be producing the anomalies. Two sets of profiles are presented: the first model assumes both a high density body southeast of the gradient and a low density body northwest of the gradient. The second model assumes that a single high density body southeast of the gradient is responsible for the anomaly, and that the felsic plutons north and west of the Waterville quadrangle are of negligible importance.

In order to model the three-dimensional shape of the denser body, we chose three parallel profiles (Plate 1) on the contoured Bouguer anomaly map and picked points from the map. The three profiles were perpendicular to the strike of the gradient. The structures were modeled by using a 2.5 dimensional program, GRAV2HD, supplied by J. H. Luetgert, USGS, Menlo Park. The 2.5 dimensional program limits the horizontal extent of the body on both sides of the profile, rather than assuming an infinite extent on both sides of the profile.

The preferred model is shown in Figure 2. The three transects A-A', B-B' and C-C' are those shown on Plate 1. The less dense bodies northwest of the gradient are assumed to have a density contrast of -.25 g/cc while the denser bodies have an assumed density contrast of +.23 g/cc. These values are reasonably compatible with the density measurements of rock samples that were collected along the seismic reflection line (Snyder and Phillips, 1986). Smaller density contrasts could be used if the thickness of the bodies were increased. Solid lines represent data derived from our Bouguer gravity map, while the dashed lines represent data points derived from the models. In all transects, the dense body seen in cross section is assumed to extend 6 km to the northeast of line A-A' and 100 km to the southwest of line C-C'. The denser body is assumed to lie between four and ten kilometers depth, as shown. A fourth profile, D-D' is also shown in Figure 2. This profile runs along the gradient, perpendicular to the other three profiles. The anomalous body extends 5 km on either side (northwest and southeast) of this profile. In all of these profiles, the differences between the field data and the models are within a few milligals. Any differences could be corrected with slight changes to the models, or by adding smaller near surface bodies.

An alternative model, which attributes the gradient to a single high density body is shown in Figure 3. This model followed the same three transects, A-A', B-B' and C-C'. In this case, a density contrast of +.25 g/cc was used. The cross sections are assumed to extend only 10 km on either side of profiles A-A' and C-C'.

Our models are generalized, because we have not been able to accurately represent the felsic plutons to the north and west, and the other features which are off the map, along the strike of the gradient. They do not incorporate a broad gradient, which might be caused by a shallowing of the Moho beneath our study area. Although such a feature might make the gradient a little more gentle, it would not account for most of the gradient. The evidence points to a high density body at 5-10 km depth, probably in conjunction with low density shallower bodies to the north and west, as the source of the CMGG, as suggested by Phillips (oral

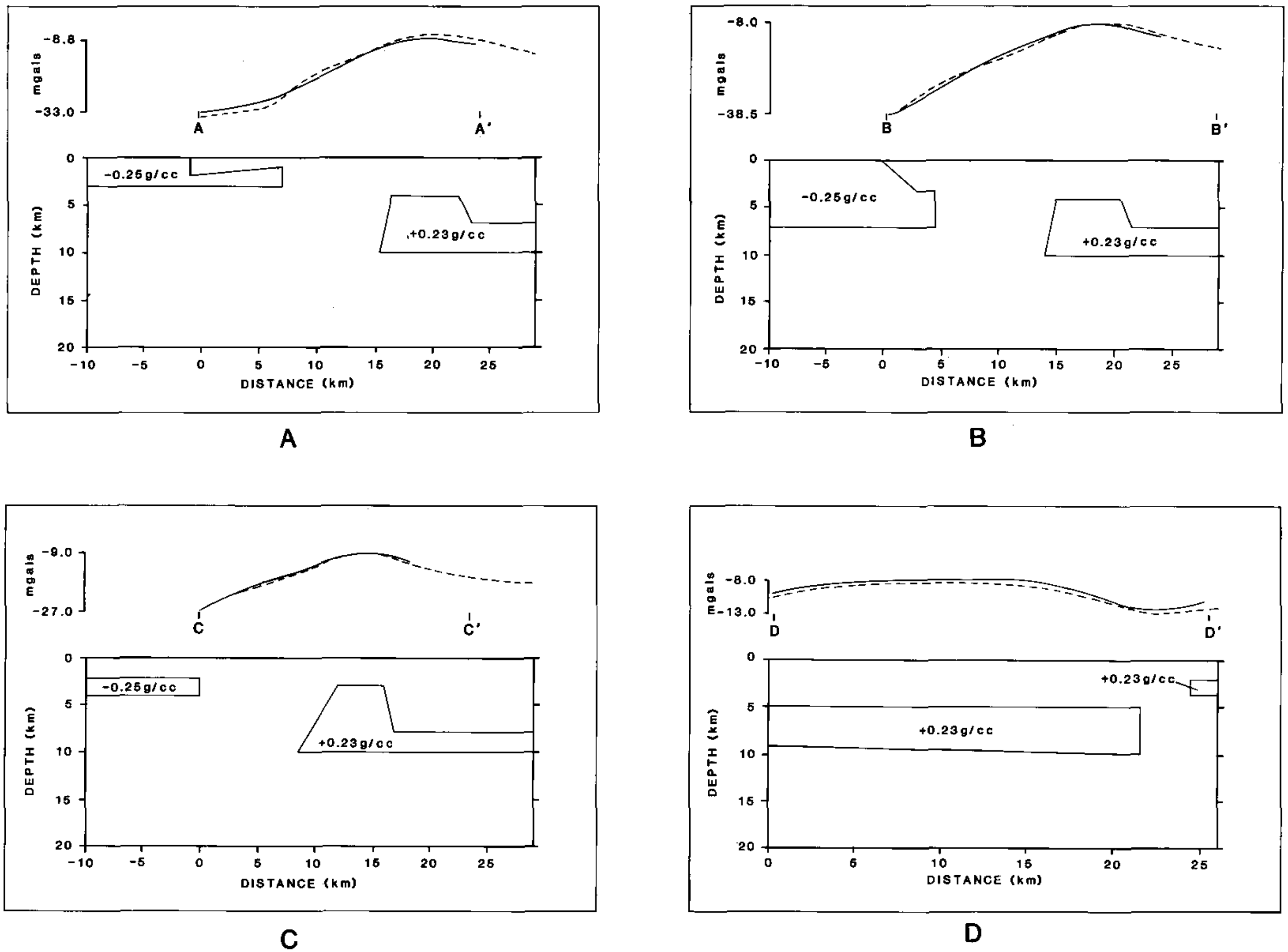

Figure 2. Preferred model - gradient attributed to a felsic body (-.25 g/cc) to the NW and a mafic body (+.23 g/cc) to the SE. Location of transects is shown on Plate 1. Solid lines represent data derived from Bouguer gravity map. Dashed lines represent data points derived from the models.

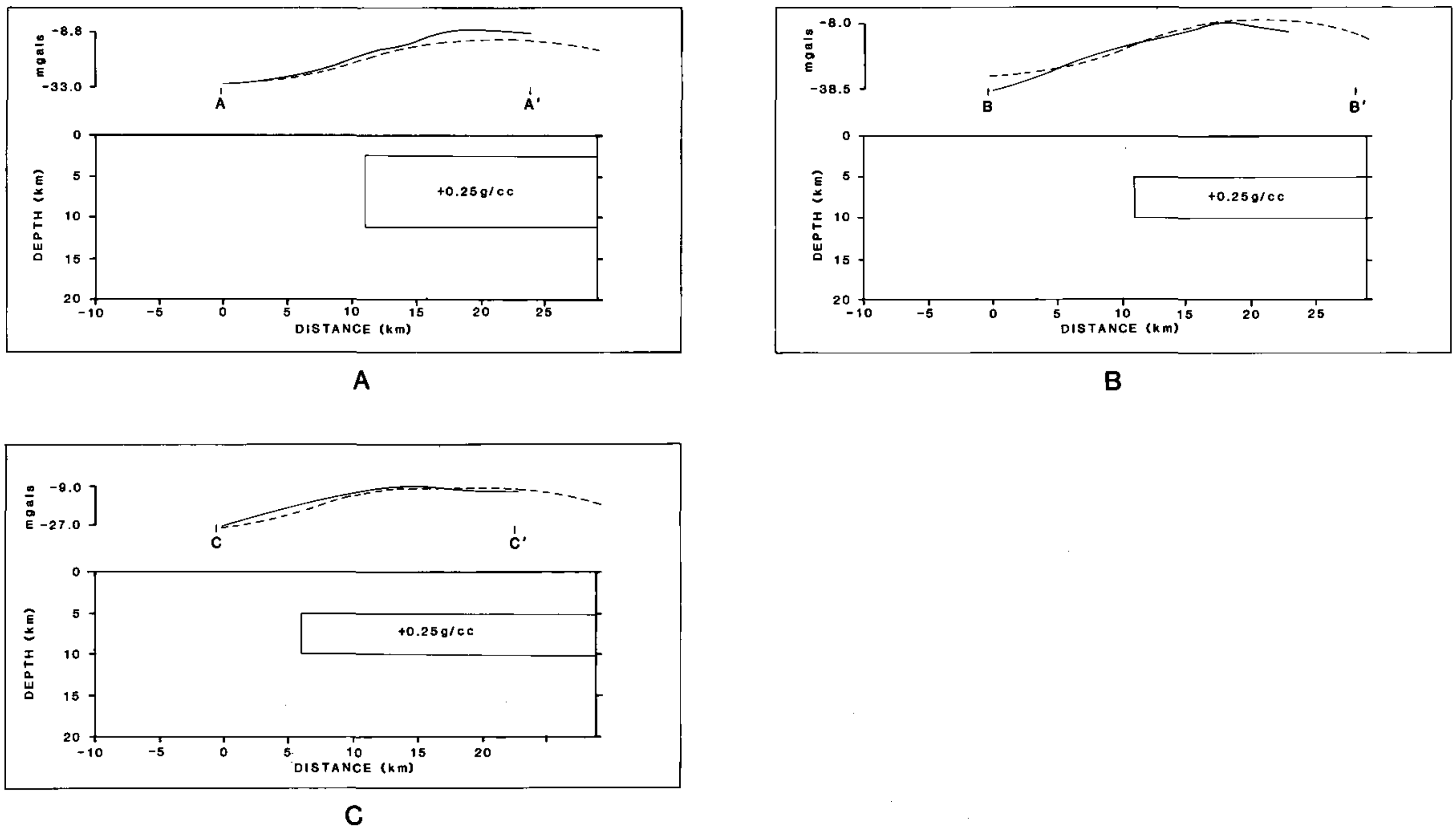

Figure 3. Alternative model - gradient attributed to a single high density body (+.25 g/cc). Location of transects is shown on Plate 1. Solid lines represent data derived from Bouguer gravity map. Dashed lines represent data points derived from the models.

communication, 1986). The shape of these bodies cannot be determined with the present gravity data set. As the interpretation of the seismic reflection data continues, the gravity data can be used to test some of the models which are proposed.

REFERENCES

Simpson, R., Bothner, W., and Hodge, D., 1979, Bouguer Gravity Map of the Bangor 1° x 2° Quadrangle, Maine: U.S. Geological Survey Open-File Report 79-755.

Snyder, S. L., and Phillips, J. D., 1986, Principal Facts for Gravity Stations Along Lines 4A and 4B of the Quebec-Western Maine Seismic Reflection Profile, West-central Maine: U.S. Geological Survey Open-File Report 86-460.

Stewart, D. B., Unger, J. D., Phillips, J. D., Goldsmith, R., Poole, W. H., Spencer, C. P., Green, A. G., Loiselle, M. C., and St-Julien, P., 1986, The Quebec-Western Maine Seismic Reflection Profile: Setting and First Year Results, _in_ Barazangi, M., and Brown, L., eds., Reflection Seismology: The Continental Crust: American Geophys. Union, Washington, D.C.

APPENDIX 1

Raw Data and Corrections

Explanation of Data Format

The gravity data is presented in separate blocks corresponding to the specific day on which it was collected. The min lat, max lat, min long, and max long refer to minimum and maximum limiting values of the latitude and longitude of the Waterville, Maine 15-minute quadrangle in degrees. The minelev and maxelev refer to minimum and maximum limiting elevations of the stations in feet above sea level. The gravity meter used is a Worden model. The meter scale factor is the dial constant by which the reading was multiplied to obtain a value in milligals. The local time is the Eastern time zone and is equal to Greenwich Mean Time minus four or five hours depending on whether daylight savings time was in effect. The dens 1 and dens 2 refer to the densities used in the calculation of the Bouguer anomalies. Bouguer anomaly d2 was calculated using a density of 2.75 gm/cm^3. Bouguer anomaly 2.67 was calculated using a density of 2.67 gm/cm^3. The base meter reading refers to the observation at the beginning of each collection period. The base gravity value of 980550.75 milligals is an absolute calculated by a tie to the USGS base station Water at the American Motor Inn in Waterville, Maine. The base id is Mudd and is located on the sidewalk behind the Mudd Science building at Colby College in Waterville, Maine. The lat, long, and elev specify the location of this base station. NN is the total number of stations excluding the base readings. Bin and bout refer to the observations made at the base at the beginning and end of each collection period and the time and date of these observations.

1WATERVILLE AREA GRAVITY waterville 9/20/85

minlat=44. 0. maxlat=45. 0. minlong= 68. 0. maxlong= 70. 0. minelev= 0. maxelev= 1000. units= feet ref= 5
gravity meter= Worden 1 meter scale factor=0.08670 local time=gmt- 4 hours dens1=2.67 dens2=2.75 options=00100
base meter reading=1173.60 base gravity value=980550.75
0base id = MUDD lat = 44 33.87 long = 69 39.78 elev = 275.0 nn = 4
bin = 1173.60 time(gmt) = 18 0 day = 263 year = 1985 tide = -0.061
bout = 1171.69 time(gmt) = 2025 day = 263 year = 1985 tide = -0.072

the next 4 station cards are corrected for drift at a rate of-0.073 per hour for a total drift of-0.18

station id	time gmt	meter read.	tide corr	drift corr	observed gravity	elev feet	latitude deg min	longitude deg min	theo.grav (1967)	free air anomaly	bouguer anom d2	bouguer anom2.67	n
WAT 3	1910	1264.50	-0.067	-0.08	980558.71	145.0	44 34.30	69 39.45	980580.28	-7.94	-13.03	-12.88	1
WAT 4	1930	1220.80	-0.069	-0.11	980554.94	185.0	44 35.10	69 40.58	980581.49	-9.15	-15.65	-15.46	2
WAT 5	1945	1117.30	-0.070	-0.13	980545.99	309.0	44 34.88	69 42.28	980581.16	-6.11	-16.97	-16.65	3
WAT 6	2000	1081.50	-0.070	-0.15	980542.90	342.0	44 33.93	69 42.90	980579.73	-4.66	-16.68	-16.33	4

1WATERVILLE AREA GRAVITY waterville 10/4/85

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base meter reading=1173.00 base gravity value=980550.75
0base id = MUDD lat = 44 33.87 long = 69 39.78 elev = 275.0 nn = 6
bin = 1173.00 time(gmt) = 18 0 day = 277 year = 1985 tide = -0.045
bout = 1172.10 time(gmt) = 2025 day = 277 year = 1985 tide = -0.056

the next 6 station cards are corrected for drift at a rate of-0.037 per hour for a total drift of-0.09

station id	time gmt	meter read.	tide corr	drift corr	observed gravity	elev feet	latitude deg min	longitude deg min	theo.grav (1967)	free air anomaly	bouguer anom d2	bouguer anom2.67	n
WAT 7	1850	1268.50	-0.046	-0.03	980559.06	102.0	44 32.08	69 39.27	980576.94	-8.28	-11.87	-11.76	1
WAT 8	1917	1225.30	-0.048	-0.05	980555.33	128.0	44 31.22	69 40.15	980575.64	-8.27	-12.77	-12.64	2
WAT 9	1930	1209.30	-0.049	-0.06	980553.95	142.0	44 30.28	69 40.88	980574.22	-6.92	-11.91	-11.76	3
WAT10	1942	1176.60	-0.050	-0.06	980551.12	209.0	44 30.50	69 42.25	980574.55	-3.78	-11.12	-10.91	4
WAT11	1950	1071.10	-0.051	-0.07	980541.98	344.0	44 31.07	69 43.68	980575.41	-1.09	-13.17	-12.82	5
WAT12	2007	1065.50	-0.053	-0.08	980541.50	358.0	44 31.67	69 42.87	980576.32	-1.15	-13.73	-13.36	6

1WATERVILLE AREA GRAVITY waterville 10/11/85

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base meter reading=1174.60 base gravity value=980550.75
0base id = MUDD lat = 44 33.87 long = 69 39.78 elev = 275.0 nn = 3
bin = 1174.60 time(gmt) = 18 0 day = 284 year = 1985 tide = -0.011
bout = 1174.30 time(gmt) = 20 0 day = 284 year = 1985 tide = -0.083

the next 3 station cards are corrected for drift at a rate of-0.049 per hour for a total drift of-0.10

station id	time gmt	meter read.	tide corr	drift corr	observed gravity	elev feet	latitude deg min	longitude deg min	theo.grav (1967)	free air anomaly	bouguer anom d2	bouguer anom2.67	n
WAT13	1855	1022.60	-0.048	-0.04	980537.58	452.0	44 36.37	69 41.82	980583.41	-3.32	-19.20	-18.74	1
WAT14	1915	1243.00	-0.060	-0.06	980556.69	200.0	44 36.38	69 39.80	980583.42	-7.92	-14.95	-14.74	2
WAT15	1940	1232.69	-0.074	-0.08	980555.81	265.0	44 35.27	69 37.95	980581.75	-1.02	-10.33	-10.06	3

1WATERVILLE AREA GRAVITY fairfield 10/26/85

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base meter reading=1179.60 base gravity value=980550.75
0base id = MUDD lat = 44 33.87 long = 69 39.78 elev = 275.0 nn = 30
bin = 1179.60 time(gmt) = 13 0 day = 299 year = 1985 tide = -0.016
bout = 1179.90 time(gmt) = 2135 day = 299 year = 1985 tide = -0.083

the next 30 station cards are corrected for drift at a rate of-0.005 per hour for a total drift of-0.04

station id	time gmt	meter read.	tide corr	drift corr	observed gravity	elev feet	latitude deg min	longitude deg min	theo.grav (1967)	free air anomaly	bouguer anom d2	bouguer anom2.67	n
FAI 3	1345	1299.80	0.001	0.00	980561.19	104.0	44 32.17	69 37.50	980577.07	-6.10	-9.75	-9.65	1
FAI 4	1358	1276.60	0.005	0.00	980559.19	125.0	44 31.75	69 37.30	980576.44	-5.50	-9.89	-9.76	2
FAI 5	1415	1224.60	0.010	-0.01	980554.68	157.0	44 30.97	69 37.10	980575.26	-5.81	-11.33	-11.17	3
FAI 6	1430	1162.30	0.013	-0.01	980549.29	263.0	44 31.42	69 35.93	980575.94	-1.92	-11.16	-10.89	4
FAI 7	1450	1193.40	0.017	-0.01	980551.99	264.0	44 31.93	69 35.73	980576.71	0.11	-9.17	-8.90	5
FAI 8	1500	1293.19	0.018	-0.01	980560.64	140.0	44 32.38	69 35.45	980577.39	-3.58	-8.50	-8.36	6
FAI 9	1533	1157.10	0.019	-0.01	980548.85	224.0	44 30.75	69 34.43	980574.93	-5.02	-12.89	-12.66	7
FAI10	1547	1137.60	0.018	-0.01	980547.16	230.0	44 30.05	69 35.42	980573.87	-5.09	-13.17	-12.93	8
FAI11	1600	1087.19	0.017	-0.01	980542.79	314.0	44 30.15	69 33.55	980574.03	-1.71	-12.74	-12.42	9
FAI12	1613	1169.10	0.014	-0.02	980549.89	214.0	44 30.88	69 32.85	980575.13	-5.11	-12.63	-12.41	10
FAI13	1628	1136.19	0.011	-0.02	980547.03	285.0	44 31.92	69 31.53	980576.69	-2.86	-12.87	-12.58	11
FAI14	1646	1030.10	0.006	-0.02	980537.83	411.0	44 30.48	69 30.45	980574.52	1.96	-12.48	-12.06	12
FAI15	1704	1221.19	0.001	-0.02	980554.39	196.0	44 32.67	69 32.32	980577.83	-5.00	-11.89	-11.69	13
FAI16	1736	1219.10	-0.012	-0.02	980554.20	162.0	44 31.53	69 33.25	980576.11	-6.67	-12.36	-12.20	14
FAI17	1750	1210.60	-0.018	-0.02	980553.46	191.0	44 32.02	69 32.85	980576.85	-5.42	-12.13	-11.94	15
FAI18	1757	1261.40	-0.021	-0.02	980557.86	165.0	44 33.23	69 32.97	980578.67	-5.29	-11.09	-10.92	16
FAI19	1807	1325.90	-0.025	-0.02	980563.45	120.0	44 33.47	69 34.32	980579.03	-4.30	-8.51	-8.39	17
FAI20	1818	1245.40	-0.030	-0.03	980556.47	174.0	44 33.13	69 32.18	980578.52	-5.69	-11.80	-11.62	18
FAI21	1830	1184.30	-0.036	-0.03	980551.16	242.0	44 33.08	69 30.10	980578.44	-4.52	-13.02	-12.77	19
FAI22	1843	1236.19	-0.042	-0.03	980555.66	210.0	44 33.65	69 32.15	980579.30	-3.90	-11.27	-11.06	20
FAI23	1853	1263.90	-0.047	-0.03	980558.06	199.0	44 34.45	69 32.07	980580.51	-3.74	-10.73	-10.53	21
FAI24	1910	1260.40	-0.054	-0.03	980557.75	180.0	44 34.27	69 30.75	980580.24	-5.56	-11.89	-11.70	22
FAI25	1945	1307.50	-0.068	-0.03	980561.82	131.0	44 34.85	69 31.38	980581.11	-6.97	-11.58	-11.44	23
FAI26	1955	1219.60	-0.071	-0.03	980554.20	249.0	44 34.88	69 30.45	980581.16	-3.55	-12.29	-12.04	24
FAI27	2005	1357.10	-0.074	-0.03	980566.12	133.0	44 35.43	69 32.60	980581.99	-3.36	-8.04	-7.90	25
FAI28	2013	1363.60	-0.076	-0.03	980566.68	105.0	44 36.00	69 31.50	980582.85	-6.30	-9.98	-9.88	26
FAI29	2028	1321.10	-0.080	-0.04	980562.99	143.0	44 36.13	69 30.57	980583.04	-6.61	-11.63	-11.48	27
FAI30	2038	1353.40	-0.081	-0.04	980565.79	143.0	44 37.20	69 30.28	980584.66	-5.42	-10.44	-10.30	28
FAI31	2055	1376.90	-0.083	-0.04	980567.83	142.0	44 36.48	69 32.72	980583.57	-2.39	-7.38	-7.23	29
FAI32	2102	1362.30	-0.084	-0.04	980566.56	169.0	44 36.88	69 32.73	980584.18	-1.72	-7.66	-7.48	30

1WATERVILLE AREA GRAVITY fairfield 11/1/85

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base meter reading=1184.80 base gravity value=980550.75
0base id = MUDD lat = 44 33.87 long = 69 39.78 elev = 275.0 nn = 7
bin = 1184.80 time(gmt) = 19 0 day = 305 year = 1985 tide = -0.054
bout = 1184.10 time(gmt) = 2115 day = 305 year = 1985 tide = -0.074

the next 7 station cards are corrected for drift at a rate of-0.036 per hour for a total drift of-0.08

station id	time gmt	meter read.	tide corr	drift corr	observed gravity	elev feet	latitude deg min	longitude deg min	theo.grav (1967)	free air anomaly	bouguer anom d2	bouguer anom2.67	n
FAI33	1925	1330.70	-0.057	-0.01	980563.41	154.0	44 34.13	69 35.07	980580.03	-2.13	-7.54	-7.39	1
FAI34	1940	1388.70	-0.059	-0.02	980568.45	74.0	44 34.17	69 34.28	980580.09	-4.68	-7.28	-7.21	2
FAI35	1955	1365.60	-0.062	-0.03	980566.45	105.0	44 34.42	69 33.95	980580.47	-4.14	-7.83	-7.72	3
FAI36	2005	1335.50	-0.063	-0.04	980563.85	128.0	44 33.58	69 34.85	980579.20	-3.31	-7.81	-7.68	4
FAI37	2015	1312.70	-0.065	-0.04	980561.87	141.0	44 32.85	69 35.77	980578.10	-2.96	-7.92	-7.77	5
FAI38	2025	1301.10	-0.066	-0.05	980560.87	145.0	44 32.65	69 36.37	980577.80	-3.29	-8.38	-8.23	6
FAI39	2045	1292.30	-0.070	-0.06	980560.12	178.0	44 33.62	69 36.92	980579.26	-2.40	-8.65	-8.47	7

1WATERVILLE AREA GRAVITY clinton,fairfield 11/9/85

minlat=44. 0. maxlat=45. 0. minlong= 68. 0. maxlong= 70. 0. minelev= 0. maxelev= 1000. units= feet ref= 5
gravity meter= Worden 1 meter scale factor=0.08670 local time=gmt- 5 hours dens1=2.67 dens2=2.75 options=00100
base meter reading=1185.69 base gravity value=980550.75
0base id = MUDD lat = 44 33.87 long = 69 39.78 elev = 275.0 nn = 38
bin = 1185.69 time(gmt) = 1345 day = 313 year = 1985 tide = 0.020
bout = 1185.80 time(gmt) = 2210 day = 313 year = 1985 tide = -0.067

the next 38 station cards are corrected for drift at a rate of-0.009 per hour for a total drift of-0.08

station id	time gmt	meter read.	tide corr	drift corr	observed gravity	elev feet	latitude deg min	longitude deg min	theo.grav (1967)	free air anomaly	bouguer anom d2	bouguer anom2.67	n
CLI 1	1425	1289.19	0.021	-0.01	980559.73	305.0	44 38.55	69 32.72	980586.69	1.72	-8.99	-8.68	1
CLI 2	1445	1351.40	0.019	-0.01	980565.13	203.0	44 37.52	69 32.78	980585.14	-0.92	-8.06	-7.85	2
FAI40	1500	1366.80	0.016	-0.01	980566.46	143.0	44 35.63	69 35.10	980582.29	-2.38	-7.40	-7.26	3
FAI41	1510	1355.80	0.014	-0.01	980565.51	168.0	44 36.78	69 34.77	980584.02	-2.72	-8.62	-8.45	4
FAI42	1515	1356.70	0.013	-0.01	980565.58	163.0	44 37.18	69 34.60	980584.63	-3.72	-9.44	-9.27	5
CLI 3	1525	1367.50	0.010	-0.02	980566.52	156.0	44 38.20	69 34.95	980586.17	-4.98	-10.46	-10.30	6
CLI 4	1535	1344.10	0.007	-0.02	980564.49	162.0	44 38.73	69 35.37	980586.97	-7.24	-12.93	-12.77	7
CLI 5	1545	1318.50	0.003	-0.02	980562.27	207.0	44 39.55	69 35.17	980588.20	-6.47	-13.74	-13.53	8
CLI 6	1552	1318.10	0.000	-0.02	980562.23	203.0	44 39.82	69 34.72	980588.61	-7.29	-14.42	-14.21	9
CLI 7	1600	1338.90	-0.003	-0.02	980564.03	218.0	44 38.77	69 34.07	980587.03	-2.49	-10.15	-9.93	10
CLI 8	1607	1309.50	-0.006	-0.02	980561.48	265.0	44 38.65	69 33.42	980586.85	-0.44	-9.75	-9.48	11
CLI 9	1625	1387.70	-0.014	-0.02	980568.25	167.0	44 38.43	69 32.02	980586.51	-2.55	-8.42	-8.25	12
CLI10	1640	1393.70	-0.021	-0.03	980568.77	124.0	44 38.12	69 30.08	980586.05	-5.61	-9.97	-9.84	13
CLI11	1646	1392.80	-0.024	-0.03	980568.69	158.0	44 38.55	69 30.37	980586.69	-3.15	-8.70	-8.53	14
CLI12	1700	1411.10	-0.032	-0.03	980570.27	145.0	44 39.28	69 30.18	980587.80	-3.89	-8.98	-8.83	15
CLI13	1710	1382.70	-0.037	-0.03	980567.81	182.0	44 39.08	69 31.07	980587.49	-2.57	-8.97	-8.78	16
CLI14	1720	1344.70	-0.042	-0.03	980564.51	241.0	44 40.07	69 31.67	980588.99	-1.82	-10.28	-10.03	17
CLI15	1730	1272.80	-0.047	-0.03	980558.27	332.0	44 41.07	69 32.05	980590.50	-1.00	-12.67	-12.33	18
CLI16	1737	1321.50	-0.051	-0.04	980562.49	238.0	44 41.98	69 32.10	980591.87	-7.00	-15.36	-15.11	19
CLI17	1745	1289.40	-0.055	-0.04	980559.70	281.0	44 42.65	69 32.23	980592.88	-6.75	-16.62	-16.33	20
CLI18	1750	1272.50	-0.058	-0.04	980558.24	315.0	44 43.33	69 32.23	980593.90	-6.04	-17.11	-16.79	21
CLI19	1845	1340.60	-0.083	-0.05	980564.12	243.0	44 42.82	69 30.67	980593.14	-6.16	-14.69	-14.45	22
CLI20	1900	1329.10	-0.088	-0.05	980563.12	268.0	44 43.80	69 30.13	980594.61	-6.29	-15.70	-15.43	23
CLI21	1910	1302.00	-0.091	-0.05	980560.77	308.0	44 44.30	69 30.87	980595.37	-5.63	-16.45	-16.13	24
CLI22	1917	1254.60	-0.093	-0.05	980556.66	378.0	44 44.73	69 31.03	980596.02	-3.80	-17.08	-16.70	25
CLI23	1925	1255.20	-0.095	-0.05	980556.71	345.0	44 44.35	69 32.15	980595.44	-6.28	-18.40	-18.05	26
CLI24	1940	1219.19	-0.098	-0.05	980553.59	377.0	44 44.63	69 33.05	980595.87	-6.82	-20.06	-19.68	27
CLI25	1950	1275.30	-0.099	-0.06	980558.46	282.0	44 43.80	69 33.20	980594.61	-9.64	-19.54	-19.25	28
CLI26	1955	1270.19	-0.100	-0.06	980558.01	302.0	44 43.18	69 33.35	980593.68	-7.26	-17.87	-17.56	29
CLI27	2005	1237.00	-0.100	-0.06	980555.14	362.0	44 42.28	69 33.55	980592.32	-3.14	-15.86	-15.49	30
CLI28	2012	1225.30	-0.100	-0.06	980554.12	351.0	44 41.25	69 33.70	980590.77	-3.63	-15.96	-15.61	31
CLI29	2040	1219.90	-0.099	-0.06	980553.66	364.0	44 40.50	69 34.03	980589.64	-1.74	-14.53	-14.16	32
CLI30	2047	1309.19	-0.097	-0.06	980561.40	299.0	44 39.80	69 33.10	980588.58	0.94	-9.56	-9.25	33
CLI31	2105	1335.30	-0.094	-0.07	980563.68	182.0	44 40.72	69 35.15	980589.97	-9.18	-15.57	-15.38	34
CLI32	2112	1317.50	-0.092	-0.07	980562.13	186.0	44 41.07	69 35.37	980590.50	-10.87	-17.40	-17.21	35
CLI33	2120	1299.10	-0.089	-0.07	980560.54	206.0	44 42.12	69 35.07	980592.08	-12.16	-19.40	-19.19	36
CLI34	2125	1309.60	-0.087	-0.07	980561.46	176.0	44 43.03	69 34.78	980593.45	-15.44	-21.63	-21.45	37
CLI35	2132	1284.90	-0.085	-0.07	980559.32	184.0	44 44.20	69 34.80	980595.22	-18.59	-25.06	-24.87	38

1WATERVILLE AREA GRAVITY fairfield 11/22/85

minlat=44. 0. maxlat=45. 0. minlong= 68. 0. maxlong= 70. 0. minelev= 0. maxelev= 1000. units= feet ref= 5
gravity meter= Worden 1 meter scale factor=0.08670 local time=gmt- 5 hours dens1=2.67 dens2=2.75 options=00100
base meter reading=1195.50 base gravity value=980550.75
0base id = MUDD lat = 44 33.87 long = 69 39.78 elev = 275.0 nn = 4
bin = 1195.50 time(gmt) = 1845 day = 326 year = 1985 tide = -0.074
bout = 1196.30 time(gmt) = 2035 day = 326 year = 1985 tide = -0.073

the next 4 station cards are corrected for drift at a rate of 0.038 per hour for a total drift of 0.07

station id	time gmt	meter read.	tide corr	drift corr	observed gravity	elev feet	latitude deg min	longitude deg min	theo.grav (1967)	free air anomaly	bouguer anom d2	bouguer anom2.67	n
FAI43	1915	1359.60	-0.078	0.02	980564.95	148.0	44 35.25	69 35.95	980581.72	-2.84	-8.04	-7.89	1
FAI44	1930	1289.80	-0.079	0.03	980558.89	223.0	44 35.72	69 37.43	980582.43	-2.56	-10.40	-10.17	2
FAI45	1940	1221.19	-0.079	0.03	980552.94	323.0	44 36.73	69 37.20	980583.95	-0.64	-11.98	-11.65	3
FAI46	2010	1363.40	-0.077	0.05	980565.25	117.0	44 34.38	69 36.98	980580.40	-4.15	-8.26	-8.14	4

1WATERVILLE AREA GRAVITY hinckley 11/23/85

minlat=44. 0. maxlat=45. 0. minlong= 68. 0. maxlong= 70. 0. minelev= 0. maxelev= 1000. units= feet ref= 5
gravity meter= Worden 1 meter scale factor=0.08670 local time=gmt- 5 hours dens1=2.67 dens2=2.75 options=00100
base meter reading=1193.19 base gravity value=980550.75
0base id = MUDD lat = 44 33.87 long = 69 39.78 elev = 275.0 nn = 19
bin = 1193.19 time(gmt) = 1720 day = 327 year = 1985 tide = -0.047
bout = 1192.80 time(gmt) = 2135 day = 327 year = 1985 tide = -0.060

the next 19 station cards are corrected for drift at a rate of-0.011 per hour for a total drift of-0.05

station id	time gmt	meter read.	tide corr	drift corr	observed gravity	elev feet	latitude deg min	longitude deg min	theo.grav (1967)	free air anomaly	bouguer anom d2	bouguer anom2.67	n
HIN 1	1750	1153.19	-0.057	-0.01	980547.28	269.0	44 40.47	69 41.02	980589.59	-17.01	-26.46	-26.19	1
HIN 2	1805	1063.30	-0.061	-0.01	980539.48	375.0	44 41.75	69 41.65	980591.52	-16.77	-29.95	-29.56	2
HIN 3	1815	1043.50	-0.064	-0.01	980537.76	392.0	44 42.87	69 41.80	980593.21	-18.58	-32.35	-31.95	3
HIN 4	1825	927.20	-0.067	-0.01	980527.68	567.0	44 43.42	69 42.27	980594.04	-13.04	-32.96	-32.38	4
HIN 5	1835	1114.00	-0.069	-0.01	980543.88	307.0	44 44.30	69 42.75	980595.37	-22.62	-33.40	-33.09	5
HIN 6	1845	1000.30	-0.072	-0.02	980534.02	488.0	44 44.57	69 41.47	980595.77	-15.86	-33.01	-32.51	6
HIN 7	1855	1001.20	-0.074	-0.02	980534.09	485.0	44 44.00	69 40.93	980594.92	-15.21	-32.25	-31.75	7
HIN 8	1905	1110.40	-0.076	-0.02	980543.56	334.0	44 43.12	69 40.38	980593.59	-18.61	-30.35	-30.01	8
HIN 9	1910	1196.30	-0.076	-0.02	980551.01	210.0	44 42.27	69 40.48	980592.31	-21.55	-28.92	-28.71	9
HIN10	1920	1141.40	-0.078	-0.02	980546.25	295.0	44 41.37	69 40.77	980590.95	-16.95	-27.32	-27.02	10
HIN11	1935	1175.50	-0.079	-0.02	980549.21	255.0	44 39.58	69 40.77	980588.25	-15.06	-24.02	-23.75	11
HIN12	1950	1152.90	-0.080	-0.03	980547.25	184.0	44 40.88	69 42.92	980590.21	-25.65	-32.12	-31.93	12
HIN13	2000	1036.00	-0.080	-0.03	980537.12	314.0	44 41.45	69 43.68	980591.07	-24.42	-35.45	-35.13	13
HIN14	2010	877.40	-0.079	-0.03	980523.37	548.0	44 42.08	69 43.87	980592.02	-17.11	-36.36	-35.80	14
HIN15	2015	808.50	-0.079	-0.03	980517.40	686.0	44 42.82	69 43.82	980593.14	-11.22	-35.32	-34.62	15
HIN16	2025	953.50	-0.078	-0.03	980529.97	502.0	44 43.23	69 43.00	980593.75	-16.57	-34.21	-33.69	16
HIN17	2035	932.30	-0.077	-0.04	980528.14	524.0	44 43.58	69 43.98	980594.28	-16.87	-35.27	-34.74	17
HIN18	2045	884.40	-0.075	-0.04	980523.99	558.0	44 43.02	69 44.97	980593.44	-16.97	-36.57	-36.00	18
HIN19	2100	1046.90	-0.072	-0.04	980538.08	237.0	44 41.70	69 45.03	980591.45	-31.07	-39.40	-39.16	19

1WATERVILLE AREA GRAVITY waterville 12/6/85

minlat=44. 0. maxlat=45. 0. minlong= 68. 0. maxlong= 70. 0. minelev= 0. maxelev= 1000. units= feet ref= 5
gravity meter= Worden 1 meter scale factor=0.08670 local time=gmt- 5 hours dens1=2.67 dens2=2.75 options=00100
base meter reading=1201.40 base gravity value=980550.75
0base id = MUDD lat = 44 33.87 long = 69 39.78 elev = 275.0 nn = 8
bin = 1201.40 time(gmt) = 19 0 day = 340 year = 1985 tide = -0.085
bout = 1200.50 time(gmt) = 2125 day = 340 year = 1985 tide = -0.035

the next 8 station cards are corrected for drift at a rate of-0.012 per hour for a total drift of-0.03

station id	time gmt	meter read.	tide corr	drift corr	observed gravity	elev feet	latitude deg min	longitude deg min	theo.grav (1967)	free air anomaly	bouguer anom d2	bouguer anom2.67	n
WAT16	1920	1197.90	-0.081	0.00	980550.45	224.0	44 31.35	69 41.02	980575.84	-4.31	-12.18	-11.95	1
WAT17	1930	1184.40	-0.079	-0.01	980549.29	237.0	44 31.50	69 41.83	980576.06	-4.48	-12.81	-12.57	2
WAT18	1945	1084.40	-0.075	-0.01	980540.62	355.0	44 31.40	69 44.43	980575.91	-1.90	-14.37	-14.01	3
WAT19	2005	1009.00	-0.069	-0.01	980534.10	325.0	44 32.48	69 44.08	980577.54	-12.88	-24.29	-23.96	4
WAT20	2015	1154.40	-0.065	-0.01	980546.71	282.0	44 32.70	69 42.55	980577.87	-4.64	-14.55	-14.26	5
WAT21	2030	1149.40	-0.059	-0.02	980546.28	312.0	44 32.25	69 40.57	980577.19	-1.57	-12.53	-12.21	6
WAT22	2050	1231.19	-0.051	-0.02	980553.39	136.0	44 30.87	69 39.65	980575.11	-8.93	-13.71	-13.57	7
WAT23	2100	1204.30	-0.047	-0.02	980551.06	158.0	44 30.08	69 40.17	980573.92	-8.00	-13.55	-13.39	8

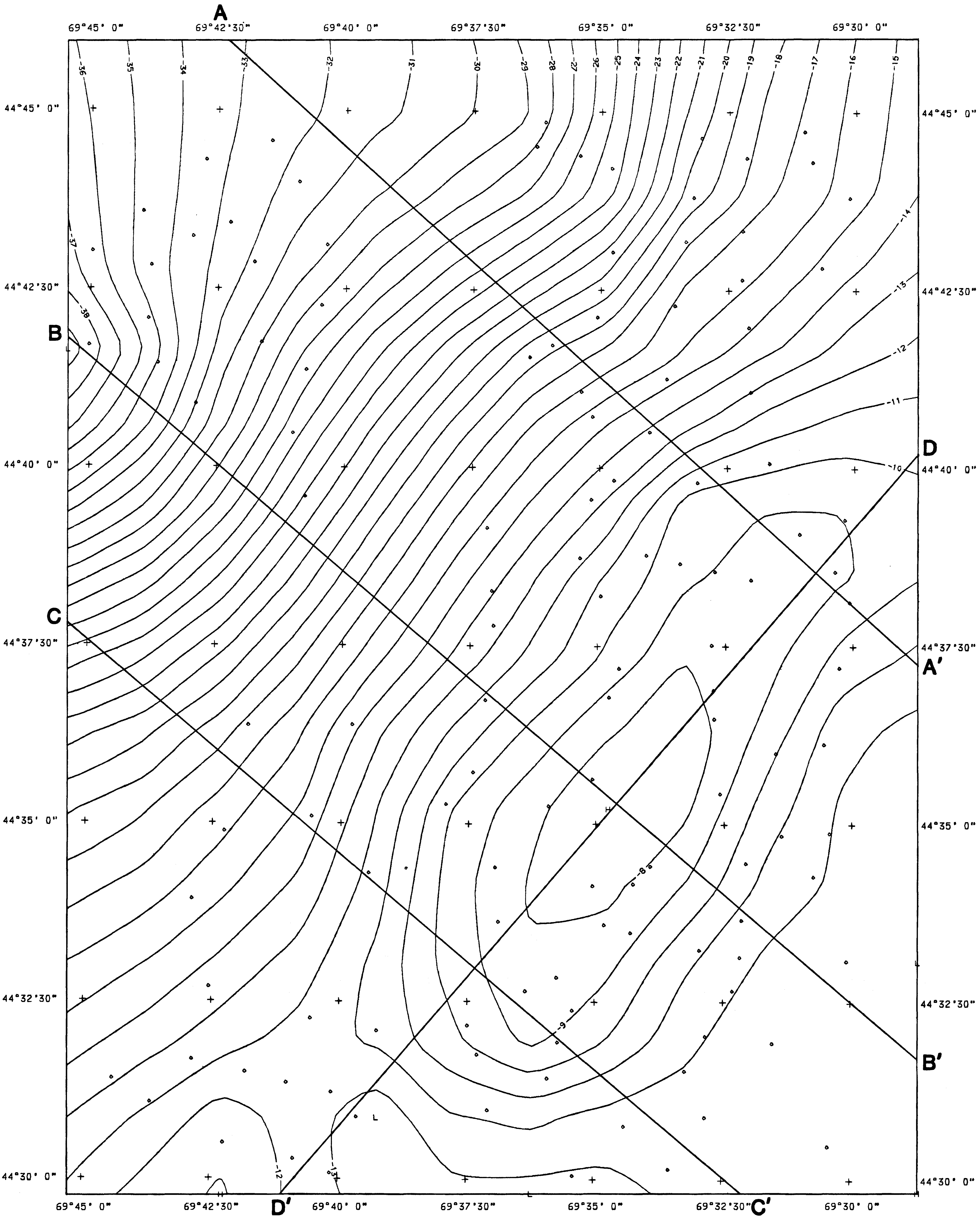
1WATERVILLE AREA GRAVITY clinton 12/7/85

minlat=44. 0. maxlat=45. 0. minlong= 68. 0. maxlong= 70. 0. minelev= 0. maxelev= 1000. units= feet ref= 5
gravity meter= Worden 1 meter scale factor=0.08670 local time=gmt- 5 hours dens1=2.67 dens2=2.75 options=00100
base meter reading=1200.19 base gravity value=980550.75
0base id = MUDD lat = 44 33.87 long = 69 39.78 elev = 275.0 nn = 8
bin = 1200.19 time(gmt) = 1720 day = 341 year = 1985 tide = -0.082
bout = 1200.50 time(gmt) = 2015 day = 341 year = 1985 tide = -0.074

the next 8 station cards are corrected for drift at a rate of 0.012 per hour for a total drift of 0.03

station id	time gmt	meter read.	tide corr	drift corr	observed gravity	elev feet	latitude deg min	longitude deg min	theo.grav (1967)	free air anomaly	bouguer anom d2	bouguer anom2.67	n
CLI36	1745	1333.20	-0.087	0.00	980562.27	165.0	44 39.15	69 37.20	980587.60	-9.81	-15.61	-15.44	1
CLI37	1800	1307.30	-0.090	0.01	980560.02	205.0	44 38.27	69 37.10	980586.27	-6.97	-14.17	-13.96	2
CLI38	1815	1257.69	-0.091	0.01	980555.71	273.0	44 37.78	69 37.05	980585.53	-4.14	-13.73	-13.46	3
CLI39	1840	1304.30	-0.093	0.02	980559.75	207.0	44 41.55	69 36.40	980591.22	-12.00	-19.27	-19.06	4
CLI40	1850	1304.50	-0.092	0.02	980559.77	203.0	44 41.72	69 35.95	980591.48	-12.62	-19.75	-19.54	5
CLI41	1910	1295.19	-0.091	0.02	980558.96	180.0	44 44.38	69 35.43	980595.49	-19.60	-25.93	-25.74	6
CLI42	1915	1272.80	-0.090	0.02	980557.01	183.0	44 44.50	69 36.28	980595.67	-21.44	-27.87	-27.69	7
CLI43	1945	1268.60	-0.084	0.03	980556.65	183.0	44 44.85	69 36.12	980596.20	-22.34	-28.76	-28.58	8

PLATE 1



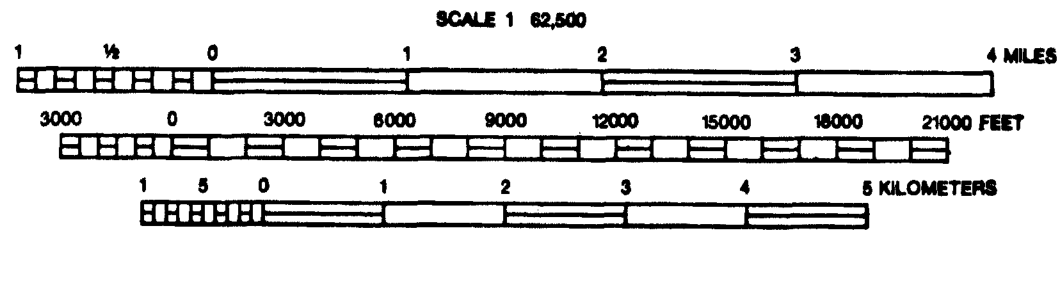
BOUGUER GRAVITY ANOMALY MAP OF THE WATERVILLE, MAINE 15-MINUTE QUADRANGLE

by
Stephen S. Potts and William E. Doll

1987

Maine Geological Survey
DEPARTMENT OF CONSERVATION
Walter A. Anderson, State Geologist

Open-File No. 87-21



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