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A GRAVITY SURVEY OF THE VICINITY OF OTTAWA

BY

SVEND SAXOV

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
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ABSTRACT

A detailed gravity survey of an area of about 400 square miles in the vicinity of Ottawa has been completed. Calibration factors for the various gravimeters employed are assessed and the adopted values of gravity for a short range calibration base line reported.

The gravity measurements are presented in the form of Bouguer anomalies plotted on a geological base map prepared by the Geological Survey of Canada. Correlation of the gravity anomalies with the geology and with the magnetic anomalies are discussed. The results of local traverses over certain major faults are also given, and are compared with results obtained with the torsion balance some years ago.

INTRODUCTION

The geology of the area in the vicinity of Ottawa presents a number of features of interest to the geophysicist, which are capable of investigation by gravimetric methods. Interesting and definite relations were established some 20 years ago between results obtained with the torsion balance[1]—namely, differential curvature, gravity gradients, and deduced gravity anomaly—and the Gloucester and Hazeldean faults, which showed that the structures can be traced by gravity methods and that the throw of the Gloucester fault can be estimated fairly well from the gravity results. Measurements with a magnetometer also showed that the line of maximum vertical intensity corresponded fairly well with the fault plane at Hazeldean (South). Since then a careful study[2] of the geology of the area has been made, and a report which includes a map in two sheets, showing the geology in considerable detail, has been published.

Apart from their usefulness for geodetic purposes, it seems likely that the results of a systematic gravimeter survey of this area might record appreciable effects associated with the surface geology, which would possibly serve as a guide in the interpretation of other gravity surveys where the geology is not so well known. Gravimeter determinations were therefore planned at one-mile intervals over the area, covering it as uniformly as possible. Most of the observations were made in June and August of 1950.

The Ottawa sheet of the National Aeromagnetic Series covering the same area as the geological map was published[3], and a number of detailed gravimeter observations were made along traverses crossing certain prominent magnetic anomalies. In addition, detailed gravimeter traverses were made over the Gloucester and Hazeldean fault zones for comparison with torsion balance results obtained in 1928 and 1929.

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[1] Miller, A. H., *Geol. Surv., Canada*, Mem. 165, pp. 197-209, 1931, also *Publications of the Dominion Observatory*, vol. XI, No. 6, 1940.
[2] Wilson, Alice E., *Geol. Surv., Canada*, Mem. 241, 1946.
[3] *Geol. Surv., Canada*, 1950, Sheet 31G.

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OBSERVATION AND REDUCTION OF DATA

(a) The Regional Gravity Measurements

Although a number of gravity observations had recently been made in Ottawa and vicinity, additional measurements were required to obtain a detailed gravity map of the area. These were completed during the summer of 1950, with observations approximately one mile apart where possible. The stations are all located at easily identifiable places, for example, cross-roads, railway stations, schoolhouses and other permanent points. This should facilitate future measurements.

Several observers, using different gravimeters, contributed to the work. A. H. Miller measured several stations using the Humble gravimeter in 1945, and the Atlas gravimeter in 1948 and 1949. During the first two weeks of June 1950, M. Beer measured almost one-third of the stations with the Atlas gravimeter. G. D. Garland, M. J. S. Innes and M. S. Reford all made measurements during the summer of 1950, using North American Gravimeter No. 85 and Worden Gravity Meters Nos. 42 and 44. Approximately two-thirds of the stations were determined by the writer with the North American Gravimeter No. 85 during the first ten days of August 1950. In September additional stations were laid out to complete the gravity network and at the same time obtain checks on several stations previously measured.

Each field trip was begun and concluded with an observation at the Dominion Observatory gravimeter station. Although no field trip extended beyond one day, some were long enough to render repeat readings at one or more stations desirable for the determination of instrumental drift.

(b) The Performance of the Gravimeters

Five different gravimeters were employed at various times for different portions of the regional gravity measurements in this report. It was therefore important that the performance of the various instruments be examined and their calibrations matched to ensure a homogeneous set of values. This was accomplished by observing concurrently with three of the gravimeters, the North American and the two Worden instruments, at a series of 17 stations extending along the highway through Ottawa from Prescott, Ontario, to Maniwaki, Quebec. These gravity stations lie approximately on a north-south line over which the change in gravity is about 124 mgals., sufficiently large to provide relative calibration factors to an accuracy of about one-tenth of one per cent.

The observations were made in a series of closed loops to permit an accurate estimate of "zero" drift for each instrument. Differences in gravimeter scale readings, corrected for drift, are listed in columns (2), (4) and (6) of Table I, while the corresponding differences in gravity are given in columns (3), (5) and (7).

The gravity differences provided by the North American Gravimeter No. 85 (col. 3), are based upon an adopted[1] calibration factor of 0·2315 mgals. per division. These differences were accepted as standard to provide relative calibrations of 0·10254 mgals. per division and 0·11185 mgals. per division for the Worden gravimeters, No. 42 and No. 44 respectively.

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[1] Innes, M. J. S. and Thompson, L. G. D., *Publications of the Dominion Observatory*, vol. XVI, No. 8, 1953.

TABLE I

Gravimeter Data and Adjusted Values of Gravity for Prescott-Maniwaki Base Line.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Station	North American Gravimeter No. 85 k=0·2315 mgals/div.		Worden Gravimeter No. 42 k=0·10254 mgals./div.		Worden Gravimeter No. 44 k=0·11185 mgals./div.		P_1 (3) – (5) (mgals.)	P_2 (3) – (7) (mgals.)	P_3 (5) – (7) (mgals.)	Differences in Gravity from Prescott (weighted mean)	Observed Gravity (gals.)
	Reading in scale divisions	Gravity differences	Reading in scale divisions	Gravity differences	Reading in scale divisions	Gravity differences					
		mgals.		mgals.		mgals.					
Prescott, Ont.	0·0	0·00	0·0	0·00	0·0	0·00	—	—	—	0·00	980·56653
Bedell, Ont.	37·6	8·70	85·6	8·78	77·6	8·68	−0·08	0·02	0·10	8·74±0·02	980·57527
Kemptville, Ont.	66·6	15·42	150·8	15·46	137·8	15·41	−0·04	0·01	0·05	15·44±0·01	980·58197
North Gower, Ont.	191·9	44·42	432·9	44·39	397·5	44·46	0·03	−0·04	−0·07	44·41±0·01	980·61094
Manotick, Ont.	233·0	53·94	525·0	53·83	481·5	53·86	0·11	0·08	−0·03	53·86±0·02	980·62039
Black Rapids, Ont.	254·4	58·89	575·4	59·00	527·7	59·02	−0·11	−0·13	−0·02	58·98±0·04	980·62551
Hogs Back, Ont.	257·1	59·52	581·1	59·59	533·1	59·63	−0·07	−0·11	−0·04	59·58±0·02	980·62611
Ottawa (steps) Ont.	239·3	55·40	540·2	55·39	495·9	55·47	0·01	−0·07	−0·08	55·41±0·02	980·62194
Chelsea, P.Q.	230·0	53·25	519·4	53·26	476·4	53·29	−0·01	−0·04	−0·03	53·26±0·01	980·61979
Cascades, P.Q.	262·8	60·84	593·8	60·89	544·7	60·92	−0·05	−0·08	−0·03	60·89±0·01	980·62742
Wakefield, P.Q.	295·4	68·39	666·8	68·37	611·9	68·44	0·02	−0·05	−0·07	68·39±0·01	980·63492
Farrelton, P.Q.	359·3	83·18	811·0	83·16	743·6	83·17	0·02	0·01	−0·01	83·17±0·01	980·64970
Low, P.Q.	369·6	85·56	834·6	85·58	765·0	85·57	−0·02	−0·01	0·01	85·57±0·01	980·65210
Gracefield, P.Q.	454·9	105·31	1026·6	105·27	940·3	105·17	0·04	0·14	0·10	105·26±0·02	980·67179
Bouchette, P.Q.	501·6	116·16	1131·6	116·03	1037·0	115·99	0·13	0·17	0·04	116·05±0·03	980·68258
Messines, P.Q.	495·2	114·64	1118·4	114·68	1025·0	114·65	−0·04	−0·01	0·03	114·66±0·01	980·68119
Maniwaki, P.Q.	536·1	124·11	1210·1	124·08	1109·7	124·12	0·03	−0·01	−0·04	124·10±0·01	980·69063
Mean square of the Differences						0·0039	0·0064	0·0030			
Root mean square of the Differences						±0·06	±0·08	±0·05			

The differences between the various sets of measurements, columns (8), (9) and (10), are quite small and vary from 0·01 to 0·13 mgals. The root mean square difference between successive pairs are ±0·06, ±0·08 and ± 0·05 mgals. The probable error of each instrument therefore, in measuring the same gravity difference, is somewhat smaller than these amounts, and it seems safe to conclude that the relative calibrations have been well determined and that all instruments are capable of providing values of gravity, consistent with each other.

As no similar looping program was carried out with the Humble and Atlas gravimeters, the consistency of the gravity results with these instruments was determined by repeating some of the observations with the North American gravimeter. Comparisons were made at both Humble and Atlas gravimeter sites over the full gravity range of the survey. No systematic differences for either instrument were observed and the maximum difference was found not to exceed 0·3 mgals.

(c) The Prescott-Maniwaki Base Line

Column (11) in Table I gives the mean difference in gravity from Prescott, Ontario, for each of the 17 stations. These differences have been weighted inversely as the standard deviations of the three instruments. The weights assigned are 2, 2 and 5 for the North American No. 85, Worden No. 44 and Worden No. 42, respectively. The final values of gravity are given in column (12) and are based upon an adopted value of 980·622 cm./sec^2. for the national reference pier in the Dominion Observatory.

As has been shown, this group of stations is well connected and will provide a useful baseline for checking the behaviour and calibration factors of gravimeters in the future. Its usefulness as such will increase as measurements are repeated and more refined values of gravity obtained. To facilitate the re-location of the stations at a later date, sketches are given in the Appendix indicating their positions relative to features which may be easily identified.

(d) The Elevations

Known elevations such as bench marks and points along railway lines, as well as those from the topographic map were used for most of the gravity stations. However, it was not possible to locate all gravity stations at points of known elevations and it was therefore necessary to employ one or two aneroid altimeters. By repeating measurements it was possible to obtain an elevation correct to within 5 feet or less. Comparison of deduced barometric elevations, with either elevations given on the map or those estimated from the elevation contours, shows that the adopted elevations are usually correct within 5 feet and that the maximum error for any of the stations is not likely to exceed 15 feet. Five feet in elevation corresponds to a difference of approximately one-third of a milligal in the Bouguer anomaly and to one-half a milligal in the Free Air anomaly.

(e) Principal Facts for Gravity Stations

The principal facts concerning the gravity stations are collected in the table given in Appendix B. The stations are listed according to increasing latitude. The longitudes and latitudes were scaled from topographic maps on a scale of one mile to an inch. The

value of observed gravity for each station given in column (6) is quoted to four decimal places, and as has been shown in the previous sections, most values are likely to have that accuracy.

The Free Air and Bouguer anomalies are listed in the last two columns of the table. They have been computed in the usual manner and are based upon the International Gravity Formula for gravity[1] at sea level and an assumed mean density of 2·67 gms./cc. for the surface rocks.

No systematic correction for the terrain effects has been made but these effects have been calculated for 3 stations. Inspection of the topographic contours on the Ottawa one-mile sheet shows generally that the topography is fairly level and uniform, and the terrain correction for these areas is not likely to exceed 0·2 mgals. Large differences in elevation, however, occur only for a small portion of the surveyed area northwest of Hull, where the Precambrian Shield enters in a southeasterly direction. For this reason terrain corrections were evaluated for stations No. 278, 280 and 286, and found to be 2·6, 1·9 and 0·3 mgals. respectively. The corrections, if applied to the gravity values for the stations concerned, reduce by about one-half the anomaly difference between these stations.

SUMMARY OF GEOLOGICAL STRUCTURAL RELATIONSHIPS

The area under consideration is an interesting one as it occupies the border zone between two of the chief physiographic divisions of eastern Canada, the Ottawa-St. Lawrence Lowland underlain by flat-lying Palæozoic formations, and the more rugged Laurentian Highlands of the Precambrian Shield. The geology and structural

[1] Swick, C. H., *U.S. Coast and Geod. Surv.*, Special Publication No. 232, 1942.

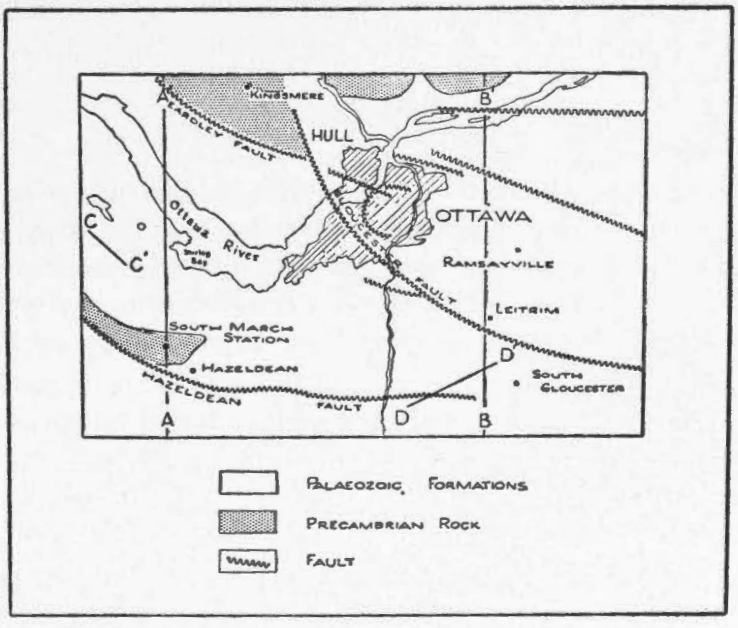

FIGURE 1. Map of Ottawa area showing main structural elements and location of gravity profiles.

relationships have been well examined and described by A. E. Wilson[1] of the Geological Survey of Canada, and these are illustrated on the geological map[2] (in pocket) on which the gravity results have also been plotted.

The most important structural elements of the area whose gravitational effects are examined in a later section, are a number of large fault-blocks of Palæozoic rocks which occupy the greater part of the area, and two small wedge-shaped or triangular exposures of Precambrian rocks. The latter, which according to A. E. Wilson, have been brought to their present position by faulting and are, therefore, in fault contact with and partially bounded by the Palæozoic formations, lie the one to the northwest from the city of Hull and the other to the west in March and Nepean townships.

Two major faults or fault zones, the Gloucester and the Hazeldean (*see* also Figure 1) cut across the Palæozoic rocks in broad arcs throughout the central part of the area. The former trends to the southeast while the latter trends in an easterly direction. The northwestern extensions of these, together with the Eardley fault which intersects the Gloucester fault west of Hull, form the contacts between the Palæozoic formations and the Precambrian rocks mentioned in the previous paragraph. Movements along these faults have been such that the rocks within the central area between the Hazeldean fault to the southwest and the Gloucester and Eardley faults to the north can best be described as a large fault block varying from about 5 miles in width near Gloucester station to a maximum of about 12 miles over most of the region to the west. The block is tilted to the northeast, thus exposing rocks which are progressively younger in that direction.

A large block, bounded on three of its sides by faults, lies directly east of the city of Ottawa. It forms the down-thrown side of the Gloucester fault and is so tilted to the southeast that the throw of the fault varies from about zero near Hull to nearly 1,200 feet 2 miles northeast of South Gloucester where the oldest and youngest Ordovician strata have been brought into juxtaposition. These relationships may be more clearly understood from an examination of the geological sections shown in Figures 2 and 3.

RESULTS

(a) Density Measurements

To interpret the variations in the Bouguer gravity anomalies the densities of the underlying rocks in the vicinity of the gravity stations must be known. The densities of about 80 specimens collected from the various geological formations in the Ottawa district are summarized in Table II. The mean densities, standard deviations of mean values and the number of specimens sampled from each formation are given.

It is difficult, if not impossible, to know how representative these results may be of the actual formation densities. Although the standard deviations provide some measure of their uncertainty, lacking sufficient data for more precise computation, the means have been calculated without regard to the volumes of different rock types in each of the formations. Nevertheless, the results appear sufficiently precise to permit certain generalities to be noted. The Ordovician rocks appear to have the most consistent

[1] Geology of the Ottawa-St. Lawrence Lowland, Ontario and Quebec, *Geol. Surv., Canada*, Mem. 241, 1946.
[2] Prepared by the Geological Survey of Canada.

TABLE II.

Densities of Rocks — Ottawa and District.

Era	Period	Sub-Epoch	Formation	Subdivisions	Number of Samples	Mean Density	Standard Deviation	Remarks
Palæozoic	Ordovician	Lorraine	Carlsbad	Gray shale and sandy rusty shale	12	2·62	± 0·07	
		Gloucester	Billings	Black shale with a few feet of brown shale at base	8	2·62	± 0·01	
		Trenton and Black River	Ottawa	Limestone	10	2·69	± 0·03	
		Chazy	Rockcliffe	Shale and sandstone lenses	10	2·49	± 0·12	All samples
					7	2·43	± 0·06	Sandstones
					3	2·63	± 0·02	Shale
		Beekmantown	Oxford	Dolomite	13	2·72	± 0·05	
			March	Interbedded sandstone and dolomite	4	2·58	± 0·07	
	Ordovician or Cambrian		Nepean	Sandstone	4	2·52	± 0·03	
Precambrian			Syenite Buckingham	Syenite, limestone, quartzites and metamorphic rocks; associated granite and granite gneiss	27	2·66	± 0·10	from all samples
					5	2·66	± 0·11	from Ste. Rose de Lima, Que.
			Grenville		16	2·64	± 0·10	from King Mountain, Que.
					3	2·71	± 0·01	from Hazeldean, Ont.

densities with deviations ranging from 0·01 to 0·07 gms./cm³. The Oxford dolomites and Ottawa limestone are the heaviest, having mean densities of 2·72 gms./cm³. and 2·69 gms./cm³. respectively. The lightest rocks are the sandstones which have mean densities of 2·43 gms./cm³. for the Rockcliffe formation, 2·58 gms./cm³. for March formation and 2·52 gms./cm³. for Nepean sandstone. Intermediate to these density groups are the shales which have densities of about 2·62 gms./cm³. regardless of age.

The mean density for all Precambrian rocks tested is 2·66 gms./cm³. It will be shown in a later section that the densities of the underlying Precambrian rocks in this area are most likely more variable than suggested by the table.

(b) General Features of the Gravity Field

The gravity stations, their numbers and corresponding Bouguer anomalies in units of tenths of milligals (1 x 10^{-4}c.g.s. units) are drawn on the enclosed map. Contours of equal anomaly are shown at one-milligal intervals. The anomalies have a range of 30 mgals., increasing from a minimum of −39 near Kingsmere, northwest from Hull, to a maximum of nearly −9 mgals. near South Gloucester. These two areas of contrasting anomaly are probably the most outstanding features of the gravity map. The coincidence of the more negative anomalies over the Precambrian granitic rocks to the northwest, together with the fact that low densities were found for these rocks (*see* Table II) strongly suggest that the granite itself is at least partly responsible for the gravity minimum. The Precambrian rocks near South March station are granite gneisses with considerably higher densities and correspondingly larger gravity anomalies.

Because of this large control by the Precambrian rocks, correlations between the Palæozoic formations and the anomalies are not too obvious. At first it might appear, for instance, that the gravity high near South Gloucester is largely controlled by the dolomites and limestones of the Oxford (Beekmantown) formation which were found to have densities (2·72 gms./cm³.) considerably higher than most of the rock specimens measured. However, if it can be assumed that the mean density of this formation is about 0·1 gms./cm³. greater than the mean density of the surrounding rocks, and that its thickness does not exceed[1] 300 feet, then its maximum gravitational effect is estimated[2] not to increase the total anomaly by more than four tenths of a milligal. Since the lower Palæozoic formations (March and Nepean) have considerably lower densities, it is necessary to conclude that the Gloucester high is largely controlled by the underlying Precambrian rocks.

There is, however, some correlation between the anomalies and the Palæozoic rocks where the latter are thick enough. This is particularly noticeable northeast of the Gloucester fault where the anomalies are generally more negative than they are to the south. The variation in the vertical displacement of the Gloucester fault is also evident from the gravity data. Where its throw is greatest to the southeast, the contours tend to parallel the fault. Near Ottawa, however, where the throw is considerably less, the gravity contours cut directly across the fault zone and are nearly normal to it.

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[1] Well records on file with the Geological Survey of Canada, show thicknesses as great as 260 feet for the Oxford formation in the Ottawa district. Near South Gloucester, the Oxford is likely to be considerably less thick. *(See Geol. Surv., Canada,* Mem. 241, 1946, p. 34.)

[2] On the basis of the simple Bouguer formula for an extensive plateau.

In addition to the gravity features discussed above, less pronounced minima and maxima occur at several places within the map area. For example, a gravity minimum with an amplitude of about 2 mgals. occurs about a mile south of Eagleson Corners. An unusually thick mantle of overburden or drift might account for much of this anomaly, since 100 feet of drift suitably distributed is capable of producing an anomaly of about one mgal. Although no direct evidence is available, it is noticed that the gravity stations supporting this anomaly are situated in a low-lying area south of the escarpment of the Hazeldean fault zone, where depths to the bedrock surfaces are probably much greater than usual. Other gravity maxima and minima of similar amplitudes occur along the Ottawa River.

(c) Gravity and Magnetic Profiles

Other features of the gravity field will be studied from the profiles, whose positions are shown on the location map (*see* Figure 1). Geological sections for the profiles have been taken from the Geological Survey of Canada Maps 413A, and 414B. Variations in the intensity of the total magnetic field also shown in profile have been obtained from the aeromagnetic map[1] for the Ottawa area.

(i) Profile A – A′

This profile, which shows the data for a north-south line through South March station is illustrated in Figure 2. The anomalies rise from comparatively low and uniform values over the block of Palæozoic sediments lying south of the Hazeldean fault to a maximum over the Precambrian ridge in March township. On the basis of the thicknesses shown and the densities given in Table II, the mean density of the Palæozoic section is 2·65 gms./cm³., or 0·06 gms./cm³. lower than the densities obtained for the Precambrian rocks. The trend of the gravity anomalies is therefore consistent with the measurements of density, but it is interesting to note that the increase in the anomaly is quite small[2] over the fault zone with the steepest gradient about half a mile further north. Although other causes may contribute, the low gradient over the fault is thought to be due to the local effect of low density sandstone (Nepean) which lies immediately north of the fault and in contact with the more dense limestone (Black River) to the south. This is the interpretation given by A. H. Miller[3] to explain the gravity gradients he observed with a torsion balance in 1929. His profile which is about 3 miles to the east is shown in Figure 3. For comparison, the results of detailed gravimeter measurements made by the writer in 1950 along the same line are plotted. The indications of the two types of instruments are in remarkably good agreement as the peaks of the gradient profile occur at the places where the gravity curve is the steepest. Miller showed that the unusual form of the gradient curve, including the minimum directly over the fault, agreed with the calculated profile and the assumed geological section.

It is also interesting to note that, with the exception of the Precambrian rocks, the mean densities used by Miller agree to within 2 per cent of those in Table II. To make the calculated gradient curve coincide with the observed values he found it was necessary

[1] *Geol. Surv., Canada*, Geophysics Paper No. 8, 1950.
[2] Theoretically the gravity anomaly due to a vertical fault reaches half its peak value directly over the fault.
[3] Miller, A. H., *Geol. Surv., Canada*, Mem. 165, 1931.

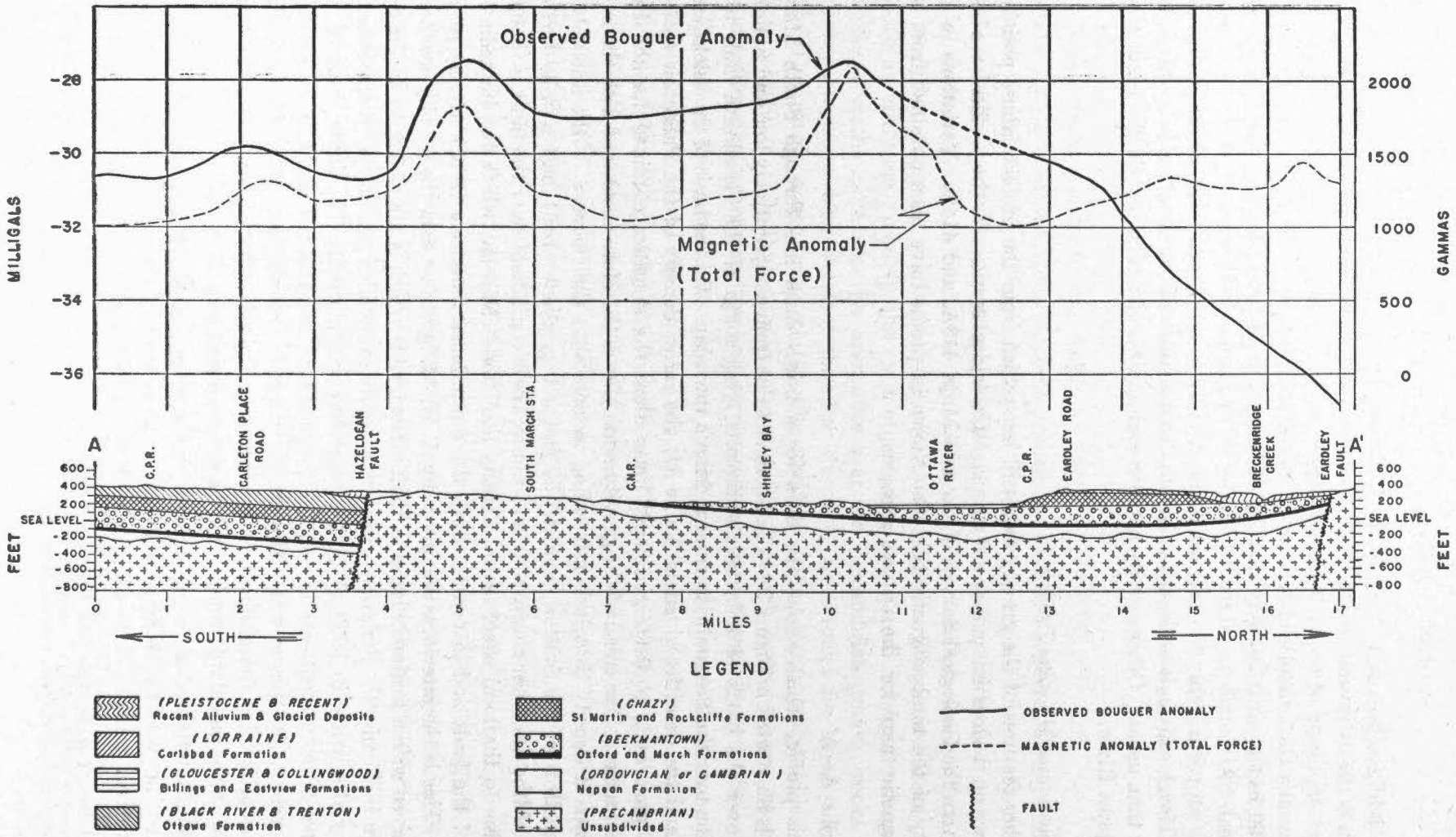


FIGURE 2. Gravity and magnetic profile and structure section (after A. E. Wilson) for the line A – A'.

to assume a mean density of 3·0 gms./cm³. for the Precambrian rocks. On the basis of a vertical displacement of 600 feet for the Hazeldean fault and the mean densities from Table II, the calculated anomalous effect of the fault is only about 0·5 mgals. On the other hand, if a density of 3·0 gms./cm³. is assumed for the Precambrian rocks, the calculated effect becomes about 2·6 mgals., which is in much closer agreement with the observed values.

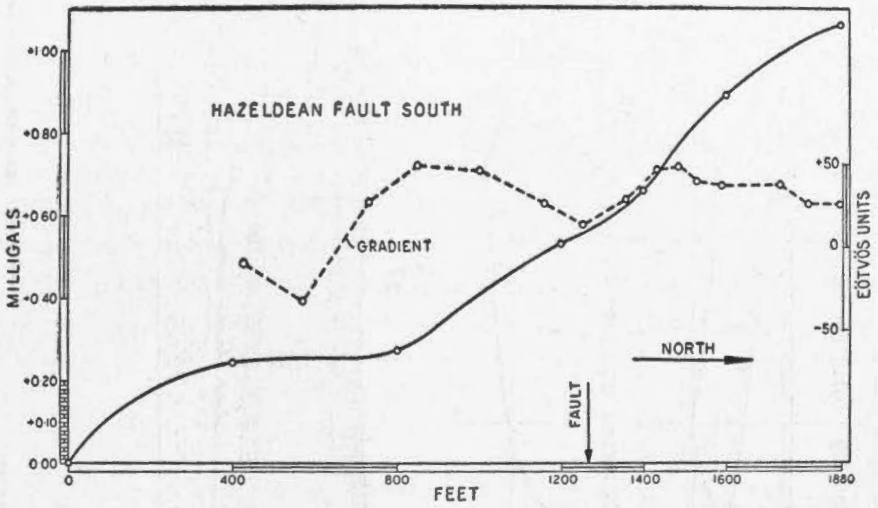


FIGURE 3. Relative Bouguer gravity anomalies and gravity gradients along a profile over the Hazeldean fault at Hazeldean South, Ontario.

Along the remainder of profile A – A′, there is little or no correspondence between the magnitude of the anomalies and the geological section, and it must be concluded that the cause is due to topographical or lithological variations, or both, within the Precambrian. North of Shirley Bay, on the Ottawa River, the gravity curve reaches a second peak having about the same amplitude as the high near South March station. From the Ottawa River, gravity decreases at a uniform rate of more than 2 mgals./mile, and this gradient is maintained to the northern limit of the profile.

It might be considered that the steep gradient reflects a general thickening of the Palæozoic formations toward the Eardley escarpment where they are down-faulted against the Precambrian rocks, and to an accumulation of unconsolidated sediments south of the fault. However, calculations based upon thicknesses illustrated show that the maximum deficiency from these sources is less than 2 mgals. Another factor that may decrease the Bouguer anomaly in this area is an unusually great thickness of sandstone at the base of the Ordovician. According to A. E. Wilson the thicknesses of the basal sandstones are quite variable depending upon the irregularities in the Precambrian floor upon which they were laid down. Their greatest recorded thickness is about 500 feet. An equal thickness for the Nepean sandstones south of the Eardley escarpment would account for another milligal of the gravity low, so that the maximum deficiency we can assign to possible variations in the Palæozoic column (from that shown in the section) is less than 3 mgals. The greatest part of the negative anomaly, therefore, must arise from a rather rapid decrease in density within the Precambrian rock masses.

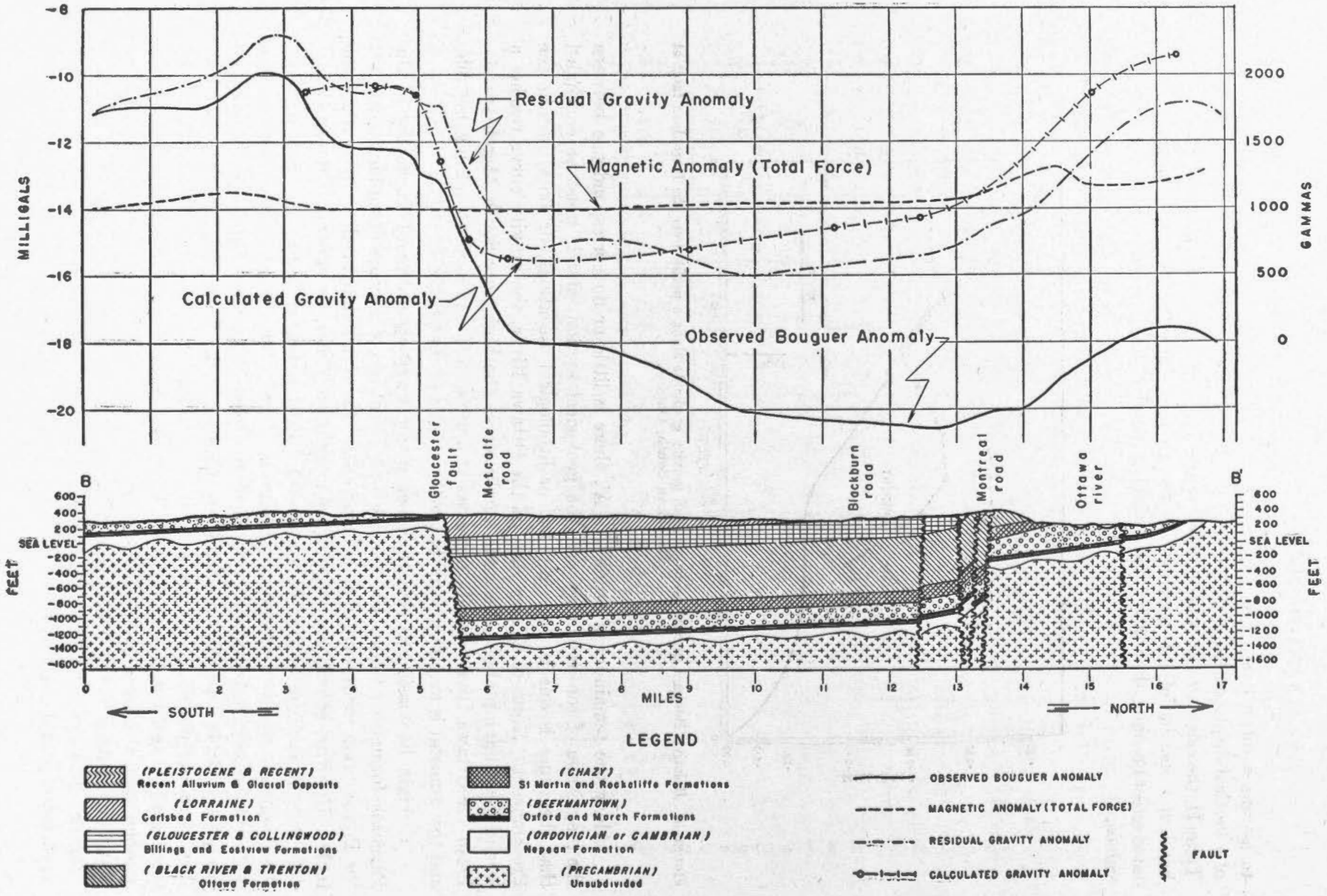


FIGURE 4. Gravity and magnetic profile and structure section (after A. E. Wilson) for the line B – B'.

(ii) Profile B – B′

The gravitational low over the large down-faulted block extending eastward from Ottawa (Figure 4) is apparently due to the density contrast between the block of sedimentary rocks and the denser rocks (Precambrian rocks with a thin veneer of lower Ordovician sediments) which lie south of the fault. The effect of the fault-block appears as a local anomaly superimposed upon a broader regional trend decreasing to the north. Assuming a uniform regional gradient of 0·4 mgals./mile, this local effect has been estimated and is illustrated as the residual profile in Figure 4.

The theoretical gravitational effect of an extensive body having the same cross-section as the fault-block is shown for comparison. The calculations are based upon the densities given in Table II with the exception of those listed for the Precambrian rocks. For the latter a density of 2·9 gms./cm³. was assumed to bring the residual and calculated profiles into near coincidence over the Gloucester fault zone. While this may seem large for the Precambrian rocks, higher densities than these are obtained for basic granite gneisses in other parts of the Canadian Shield. The fit between the two curves is reasonable and shows that the greater part of the variation in gravity may be explained by a deficiency caused by the Palæozoic rocks and uniform anomaly gradient decreasing to the north.

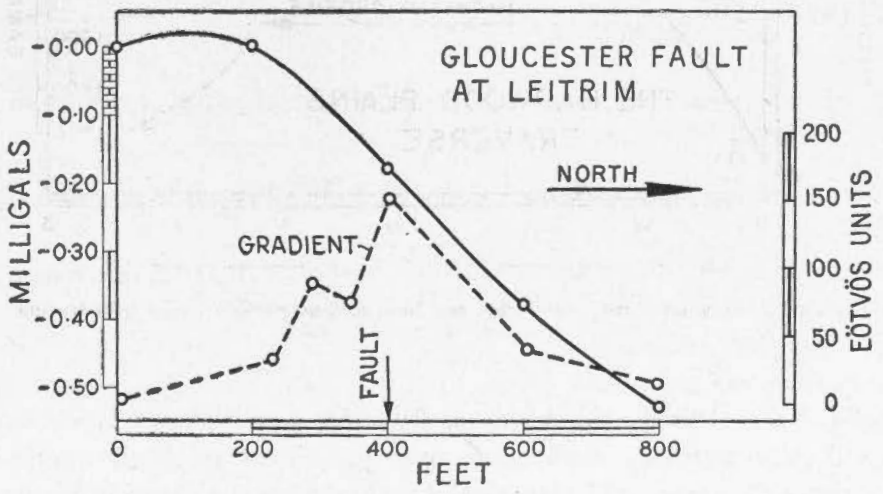


FIGURE 5. Relative Bouguer gravity anomalies and gravity gradients along a profile over the Gloucester fault near Leitrim, Ontario.

Figure 5 shows the gravimeter and torsion balance[2] results for a detailed north-south traverse over the Gloucester fault zone at Leitrim, about a mile to the east of profile B – B′. The vertical displacement (or throw) of the fault here is estimated to be about 1,500 feet. In contrast to the Hazeldean fault, the distribution of density is such that a gradient maximum is produced over the fault. This was observed with the torsion balance and confirmed by the form of the gravity profile.

[1] Miller, A. H. and Innes, M. J. S., *Publications of the Dominion Observatory*, vol. XVIII, No. 2, 1955.
[2] Miller, A. H., loc. cit.

(iii) Comparison of Gravity and Magnetic Data

Total magnetic field intensities have been plotted in Figures 2 and 4 for comparison with the gravity anomalies. The profiles in Figure 2 are strikingly similar largely because the two maxima occur at the same points. The general tendency is for both gravity and magnetic anomalies to be more positive over the exposed Precambrian rocks on the upthrow side of the Hazeldean fault, or where the Palæozoic mantle is less deep. The rather sharp maximum north of Shirley Bay may be the expression of rapid variations in the magnetic properties within the Precambrian floor or to a buried ridge of heavy Precambrian rocks. In contrast, variations in magnetic intensity along the line B – B′ (*see* Figure 4) are quite small, as might be expected considering the greater thicknesses of sedimentary cover along this line. It is noted, however, that small magnetic maxima coincide in position with points of higher gravity anomaly. Generally then, the magnetic data would appear to reflect structures within the Precambrian rocks in much the same way as the gravity results.

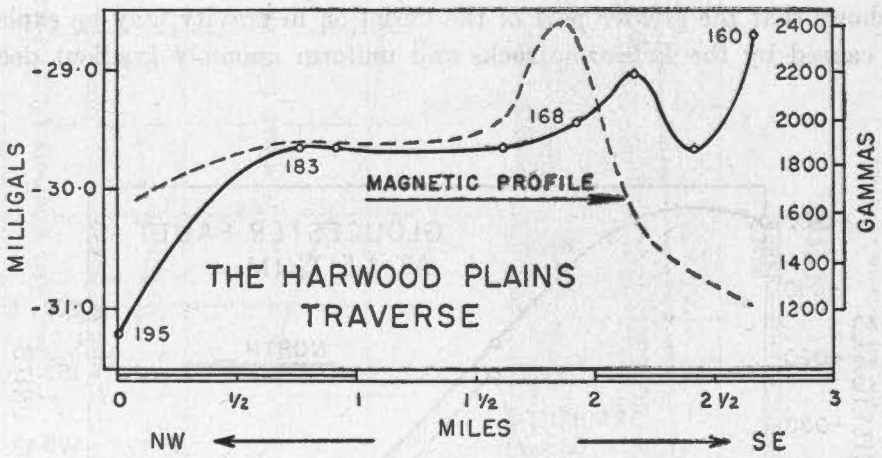


FIGURE 6. Bouguer gravity anomalies and total field magnetic anomalies for the line C – C′ near Harwood Plains.

To examine more closely the correspondence between the two types of anomalies, detailed gravimeter traverses were made over prominent magnetic anomalies shown within the Ottawa map area. The location of the traverses are shown in Figure 1 and also on the gravity map. The Harwood Plains traverse (C – C′) crosses a narrow east-west trending magnetic high with a relief of about 1,200 gammas (*see* Figure 6). This high extends from an area of exposed Precambrian rocks to the west, and is therefore probably related to a more magnetic phase of the gneissic basement rocks. The Bouguer gravity anomaly profile for this traverse is shown, together with the total field magnetic anomaly, as recorded at a height of 1,000 feet. It must be pointed out that the exact position of the peak of the magnetic profile is uncertain, as a spacing of flight lines for the aeromagnetic survey was rather wide (about a mile). However, there is a small gravity maximum of about 0·7 mgal. relief approximately corresponding to the peak of the magnetic curve. This would appear to indicate that both effects are due to a more basic band of the Precambrian gneisses, which is denser and more magnetic than its surroundings.

A similar traverse (D – D′) was made along the road extending southwesterly from Johnston Corners, across a roughly circular magnetic high of about 1,000 gammas relief. The Bouguer anomalies and also the magnetic profile are given in Figure 7. Although the regional gravity increase to the northeast has not been removed, the local maximum of about 1 milligal near mile 1·5 is evident. The peak of the magnetic curve is indicated to be somewhat to the northeast of this point, but as before, its position is uncertain because of the spacing of flight lines. It is probable that both maxima are related to a phase of the basement rocks. The profile does cross a possible extension of the Hazeldean fault, at the point indicated on Figure 7 but no definite indication of the fault can be seen on the gravity profile.

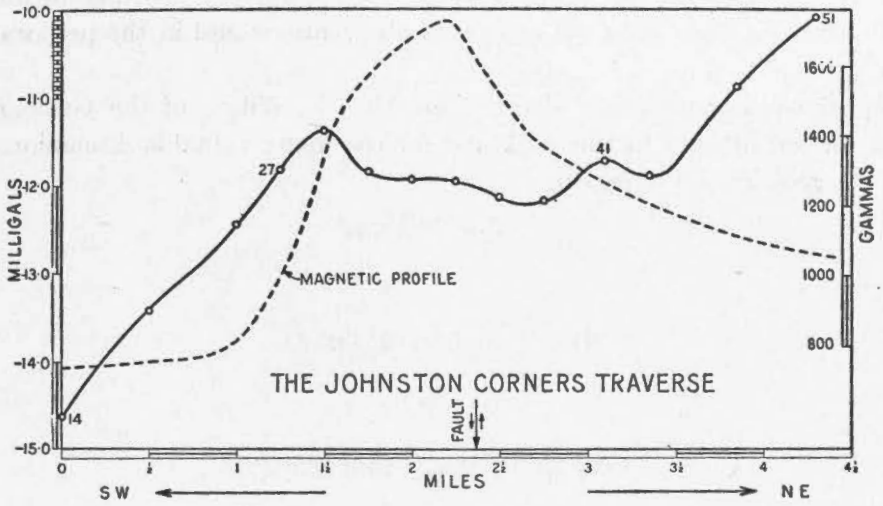


FIGURE 7. Bouguer gravity anomalies and total field magnetic anomalies for the line D – D′ near Johnston Corners.

In conclusion, therefore, it may be noted that relatively minor gravity anomalies are to be found in association with the strongest magnetic highs of the area; and although the correlation between the two is only of a very general character, it is probable that both are due to more basic phases of the Precambrian gneisses underlying the sedimentary rocks.

SUMMARY

It has been shown that the major features of the Bouguer anomaly field as observed throughout the Ottawa district are made up of 2 parts: (1) large scale regional effects due to density changes within the underlying Precambrian rocks, (2) the effect of variations in the thickness of the Palæozoic rocks, regarded as local effects with amplitudes no greater than 6 mgals. Prominent local effects were found in the case of certain major normal faults which cross the area, and which had been previously investigated with the torsion balance.

Gravity observations over areas of positive magnetic anomaly showed a correlation, suggestive of the presence of denser, more magnetic phases in the Precambrian basement.

The gravity values for a base line between Prescott, Ontario, and Maniwaki, Quebec, suitable for the calibration of gravimeters to one part in a thousand, are given.

ACKNOWLEDGMENTS

A six months' fellowship from the Canadian Council for Reconstruction through UNESCO enabled the writer to obtain a closer knowledge of Canadian geophysical research. The Dominion Observatory at Ottawa kindly invited the writer to take part in its work and made it possible for him to see gravity investigations being carried out in various regions of Canada. Two and a half months were spent participating in field work in the middle west and in the Maritimes, and the rest of the time was spent on the work reported upon here.

The writer wishes to thank Dr. C. S. Beals, Dominion Astronomer, and Mr. A. H. Miller, former chief of the Gravity Division, for many helpful suggestions during the investigation. Thanks are also due to Dr. M. J. S. Innes and other members of the Gravity Division for their help with the field observations and in the preparation of the report.

Finally, the writer wishes to thank Miss Alice E. Wilson of the Geological Survey of Canada, for her interest in the work and for the many valuable discussions held with her about the geology of the region.

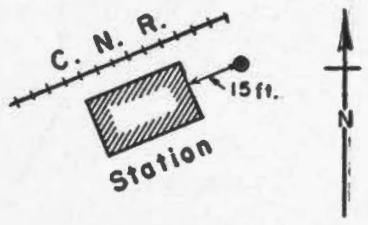
APPENDIX A

Description of Sites

of

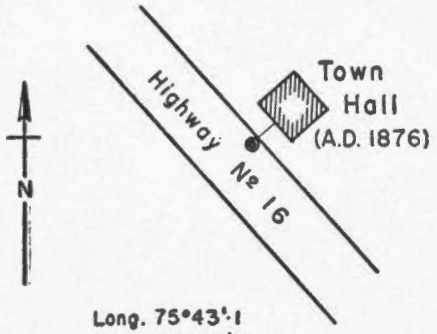
Gravimeter Base Stations

PRESCOTT, ONT.



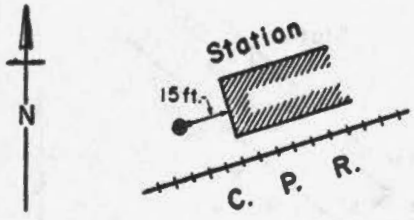
Long. 75°31'5
Lat. 44°42'·8
Elev. 311 ft.
g 980 56653 gals

NORTH GOWER, ONT.



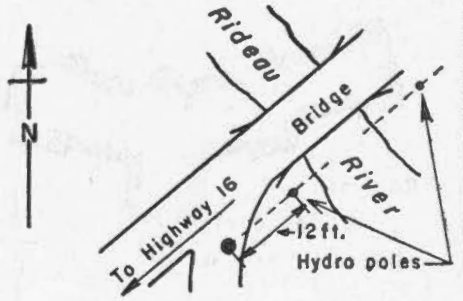
Long. 75°43'·1
Lat. 45°07'·9
Elev. 300 ft.
g 980 61094 gals

BEDELL, ONT.



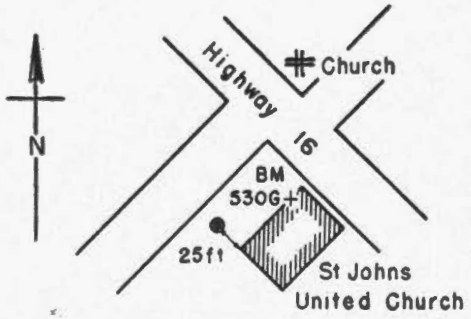
Long 75°37'·9
Lat 44°59'·8
Elev 334 ft.
g 980 57527 gals.

MANOTICK, ONT.



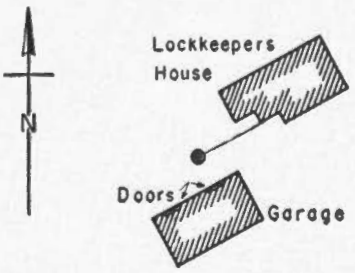
Long. 75°41'·1
Lat. 45°13'·6
Elev. 275 ft.
g 980 62039 gals

KEMPTVILLE, ONT.



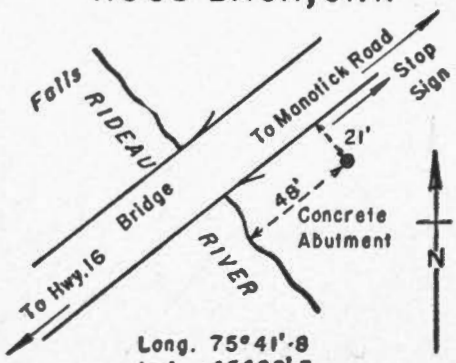
Long 75°38'·6
Lat. 45°00'·8
Elev 319 ft
g 980·58197 gals

BLACK RAPIDS, ONT.



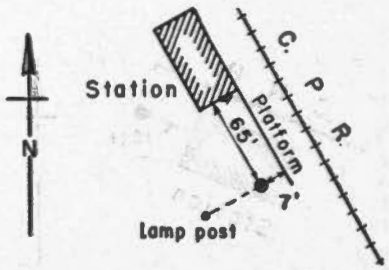
Long. 75°42'·0
Lat. 45°19'·3
Elev. 255 ft.
g 980·62551 gals

HOGS BACK, ONT.



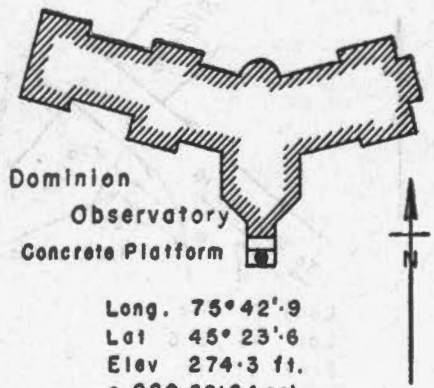
Long. 75°41'·8
Lat. 45°22'·3
Elev. 250 ft.
g 980·62611 gals

CASCADES, QUE.



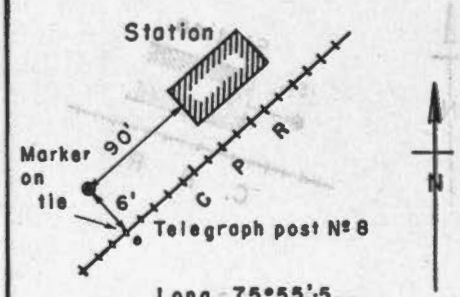
Long 75° 52'·6
Lat 45° 35'·5
Elev 330 ft.
g 980 62742 gals

OTTAWA, ONT.



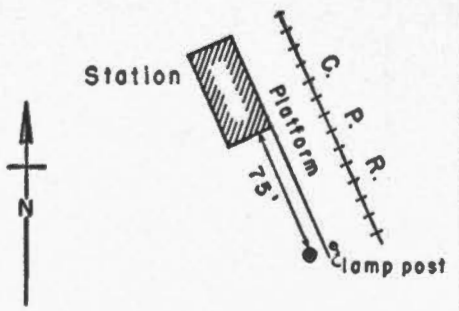
Long. 75°42'·9
Lat 45° 23'·6
Elev 274·3 ft.
g 980·62194 gals

WAKEFIELD, QUE.



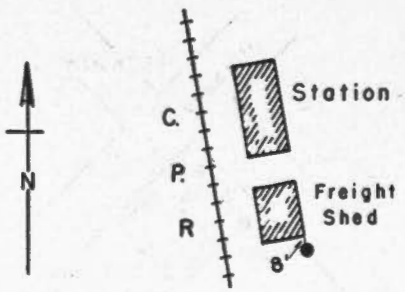
Long 75°55'·5
Lat 45°38'·5
Elev 330 ft
g 980·63492 gals

CHELSEA, QUE.



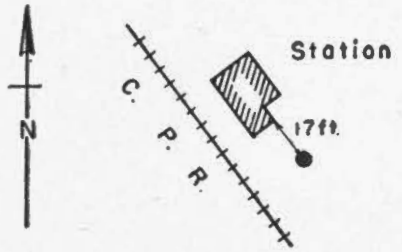
Long. 75°47'·1
Lat. 45°30'·3
Elev 369 ft.
g 980·61979 gals

FARRELTON, QUE.



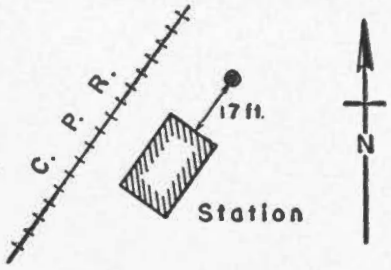
Long 75°54'·9
Lat 45°44'·9
Elev 345 ft
g 980·64970 gals

LOW, QUE.



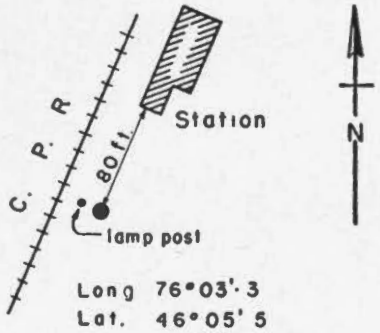
Long. 75°57'·3
Lat. 45°48'·6
Elev. 411 ft.
g 980·65210 gals

MESSINES, QUE.



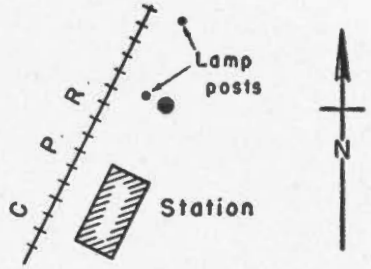
Long. 76°01'·4
Lat. 46°14'·4
Elev. 571 ft.
g 980·68119 gals

GRACEFIELD, QUE.



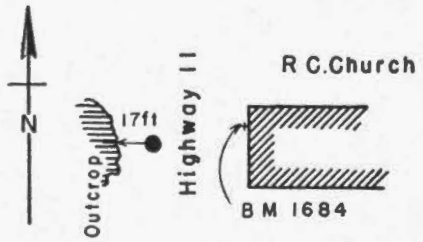
Long 76°03'·3
Lat. 46°05' 5
Elev. 508 ft.
g 980 67179 gals

MANIWAKI, OUE.



Long 75°58' 6
Lat. 46°22' 4
Elev. 569 ft.
g 980·69063 gals

BOUCHETTE, QUE



Long 75°57'·6
Lat. 46°12' 1
Elev. 531 ft
g 980·68258 gals

APPENDIX B

Principal Facts

for

Gravity Stations near Ottawa, Ontario

PRINCIPAL FACTS FOR GRAVITY STATIONS NEAR OTTAWA, ONTARIO

Station		Longitude		Latitude		Elevation	Observed Gravity	Gravity Anomalies	
No.	Name							Free Air	Bouguer
		°	′	°	′	Ft.			
1	Dominion Observatory	75	42·9	45	23·6	274·3	980·6220	−0·0171	−0·0265
2		75	43·6	45	14·1	308	·6135	− ·0082	− ·0187
3		75	40·2	45	14·2	286	·6218	− ·0021	− ·0118
4	Little Island	75	42·5	45	14·6	256	·6185	− ·0088	− ·0175
5		75	38·9	45	14·7	313	·6208	− ·0013	− ·0120
6		75	53·2	45	14·8	330	·6029	− ·0178	− ·0290
7		75	50·9	45	15·0	319	·6055	− ·0165	− ·0274
8		75	35·5	45	15·0	353	·6199	− ·0011	− ·0109
9		75	54·7	45	15·1	390	·5983	− ·0171	− ·0304
10		75	47·7	45	15·1	305	·6104	− ·0130	− ·0234
11		75	41·8	45	15·1	276	980·6187	−0·0075	−0·0169
12		75	44·2	45	15·2	296	·6142	− ·0102	− ·0203
13		75	52·7	45	15·3	338	·6033	− ·0173	− ·0288
14		75	40·9	45	15·3	301	·6197	− ·0044	− ·0146
15	Manotick Station	75	37·3	45	15·3	327	·6213	− ·0004	− ·0115
16		75	32·4	45	15·3	292	·6215	− ·0035	− ·0134
17		75	58·4	45	15·4	450	·5937	− ·0166	− ·0319
18		75	53·8	45	15·4	352	·6014	− ·0181	− ·0301
19		75	57·1	45	15·5	414	·5976	− ·0162	− ·0303
20	Stittsville Station	75	55·2	45	15·5	398	·5981	− ·0772	− ·0308
21		75	36·9	45	15·6	327	980·6220	−0·0001	−0·0112
22		75	49·6	45	15·6	310	·6072	− ·0165	− ·0271
23		75	51·2	45	15·7	318	·6051	− ·0180	− ·0288
24	Fallowfield Station	75	46·2	45	15·7	305	·6138	− ·0106	− ·0210
25		75	42·6	45	15·7	284	·6182	− ·0082	− ·0178
26	Greeley	75	33·6	45	15·8	311	·6229	− ·0010	− ·0116
27		75	39·5	45	15·8	330	·6215	− ·0006	− ·0118
28	Greeley	75	33·8	45	15·9	307	·6233	− ·0011	− ·0116
29		75	31·0	45	15·9	299	·6222	− ·0030	− ·0132
30	Old Stittsville	75	56·2	45	16·0	413	·5980	− ·0167	− ·0307
31		75	42·8	45	16·0	298	980·6172	−0·0083	−0·0184
32		75	42·1	45	16·0	291	·6195	− ·0067	− ·0166
33		75	51·5	45	16·1	315	·6045	− ·0195	− ·0302
34		75	48·2	45	16·2	390	·6058	− ·0113	− ·0246
35		75	44·7	45	16·2	327	·6145	− ·0085	− ·0196
36		75	35·7	45	16·2	347	·6226	− ·0015	− ·0103
37		75	56·9	45	16·3	413	·5973	− ·0178	− ·0318
38		75	45·6	45	16·3	320	·6131	− ·0107	− ·0216
39		75	52·1	45	16·5	322	·6038	− ·0202	− ·0311
40		75	59·9	45	16·6	428	·5965	− ·0176	− ·0322
41		75	37·7	45	16·6	350	980·6217	+0·0002	−0·0117
42		75	46·9	45	16·7	338	·6113	− ·0114	− ·0229
43		75	31·6	45	16·7	274	·6258	− ·0029	− ·0123
44		75	55·0	45	16·8	343	·6042	− ·0182	− ·0299
45		75	45·1	45	16·8	312	·6154	− ·0100	− ·0206
46		75	40·1	45	16·8	301	·6234	− ·0030	− ·0132
47	South Gloucester	75	34·2	45	16·8	336	·6231	− ·0000	− ·0114
48		75	50·3	45	16·9	382	·6038	− ·0151	− ·0281
49		75	43·3	45	16·9	300	·6187	− ·0079	− ·0181
50		75	52·9	45	17·0	318	·6049	− ·0201	− ·0310

PRINCIPAL FACTS FOR GRAVITY STATIONS NEAR OTTAWA, ONTARIO—*Continued*

Station		Longitude		Latitude		Elevation	Observed Gravity	Gravity Anomalies	
No.	Name							Free Air	Bouguer
		°	′	°	′	Ft.			
51	Johnston Corners	75	36·2	45	17·1	387	980·6218	+0·0031	−0·0101
52		75	45·5	45	17·2	308	·6168	− ·0095	− ·0200
53		75	30·1	45	17·2	286	·6258	− ·0026	− ·0123
54		75	55·3	45	17·3	328	·6056	− ·0190	− ·0302
55		75	33·0	45	17·3	291	·6269	− ·0011	− ·0110
56		75	52·2	45	17·5	358	·6052	− ·0169	− ·0291
57		75	41·7	45	17·5	268	·6243	− ·0062	− ·0153
58		75	57·3	45	17·6	376	·6011	− ·0194	− ·0322
59		75	38·2	45	17·6	329	·6235	− ·0015	− ·0127
60	Hazeldean	75	53·6	45	17·7	340	·6063	− ·0177	− ·0293
61		75	44·4	45	17·7	302	980·6189	−0·0087	−0·0190
62		75	47·4	45	17·8	313	·6148	− ·0127	− ·0237
63		75	40·7	45	17·8	295	·6237	− ·0047	− ·0148
64		75	36·7	45	17·8	398	·6222	+ ·0034	− ·0102
65		75	34·8	45	17·8	387	·6233	+ ·0035	− ·0097
66		75	31·6	45	17·9	266	·6282	− ·0031	− ·0122
67	Gloucester Station	75	38·4	45	18·0	356	·6224	− ·0006	− ·0127
68		75	50·0	45	18·1	368	·6095	− ·0125	− ·0251
69	Merivale Station	75	44·1	45	18·1	298	·6204	− ·0082	− ·0184
70	Eagleson Corners	75	52·8	45	18·2	364	·6076	− ·0149	− ·0273
71		75	46·1	45	18·3	303	980·6161	−0·0124	−0·0227
72		75	33·6	45	18·3	322	·6269	+ ·0002	− ·0108
73		75	30·7	45	18·3	264	·6265	− ·0056	− ·0146
74		75	30·4	45	18·4	265	·6254	− ·0068	− ·0158
75		75	56·8	45	18·5	322	·6071	− ·0199	− ·0309
76		75	55·0	45	18·5	306	·6085	− ·0200	− ·0304
77		75	42·6	45	18·5	297	·6229	− ·0064	− ·0165
78		75	38·8	45	18·5	370	·6224	− ·0001	− ·0127
79		75	51·5	45	18·7	354	·6086	− ·0157	− ·0277
80		75	59·9	45	18·9	389	·6018	− ·0194	− ·0327
81		75	48·1	45	18·9	312	980·6151	−0·0134	−0·0241
82		75	41·2	45	18·9	302	·6240	− ·0055	− ·0157
83		75	35·5	45	18·9	297	·6279	− ·0020	− ·0121
84		75	44·5	45	19·0	314	·6185	− ·0100	− ·0207
85		75	38·0	45	19·0	328	·6249	− ·0022	− ·0128
86		75	32·2	45	19·0	274	·6261	− ·0061	− ·0154
87		75	55·7	45	19·2	356	·6096	− ·0152	− ·0273
88		75	37·5	45	19·2	324	·6267	− ·0011	− ·0122
89		75	59·1	45	19·3	342	·6051	− ·0212	− ·0328
90		75	53·1	45	19·3	295	·6118	− ·0189	− ·0290
91		75	46·7	45	19·4	316	980·6134	−0·0155	−0·0263
92	Merivale	75	43·1	45	19·4	302	·6226	− ·0075	− ·0178
93		75	37·1	45	19·4	315	·6270	− ·0020	− ·0127
94		75	34·2	45	19·4	278	·6276	− ·0048	− ·0143
95	Bells Corners	75	49·7	45	19·5	301	·6130	− ·0175	− ·0277
96		75	50·2	45	19·6	294	·6132	− ·0180	− ·0280
97		75	36·5	45	19·6	322	·6264	− ·0022	− ·0132
98		75	30·9	45	19·6	267	·6252	− ·0086	− ·0177
99		75	58·2	45	19·7	304	·6102	− ·0203	− ·0307
100		75	39·4	45	19·7	380	·6211	− ·0022	− ·0152

PRINCIPAL FACTS FOR GRAVITY STATIONS NEAR OTTAWA, ONTARIO—*Continued*

Station		Longitude	Latitude	Elevation	Observed Gravity	Gravity Anomalies	
No.	Name					Free Air	Bouguer
		° ′	° ′	Ft.			
101	.....	75 42·2	45 19·8	279	980·6234	−0·0095	−0·0190
102	Leitrim.....	75 36·1	45 19·8	337	·6241	− ·0034	− ·0148
103	Bells Corners Station.....	75 48·7	45 19·9	284	·6158	− ·0168	− ·0265
104	.....	75 56·0	45 20·0	318	·6132	− ·0164	− ·0273
105	.....	75 51·4	45 20·0	280	·6146	− ·0186	− ·0281
106	.....	75 45·1	45 20·0	287	·6179	− ·0146	− ·0244
107	.....	75 33·2	45 20·0	276	·6252	− ·0084	− ·0178
108	South March Station.....	75 54·9	45 20·2	283	·6139	− ·0193	− ·0289
109	.....	75 36·3	45 20·2	319	·6249	− ·0049	− ·0158
110	.....	75 53·7	45 20·3	226	·6158	− ·0228	− ·0305
111	.....	75 41·1	45 20·3	336	980·6228	−0·0056	−0·0170
112	.....	75 38·0	45 20·3	326	·6246	− ·0047	− ·0158
113	.....	75 59·1	45 20·4	410	·6045	− ·0170	− ·0310
114	.....	75 50·4	45 20·4	219	·6196	− ·0199	− ·0274
115	.....	75 43·6	45 20·4	287	·6209	− ·0122	− ·0220
116	.....	75 36·9	45 20·4	313	·6243	− ·0064	− ·0170
117	.....	75 34·7	45 20·4	289	·6260	− ·0069	− ·0168
118	.....	75 47·2	45 20·5	254	·6179	− ·0185	− ·0271
119	.....	75 41·3	45 20·6	317	·6225	− ·0080	− ·0188
120	.....	75 37·2	45 20·6	305	·6248	− ·0069	− ·0173
121	.....	75 31·5	45 20·6	264	980·6262	−0·0094	−0·0184
122	.....	75 43·9	45 20·7	288	·6206	− ·0128	− ·0227
123	.....	75 42·0	45 20·7	272	·6248	− ·0102	− ·0195
124	.....	75 40·0	45 20·7	321	·6256	− ·0048	− ·0157
125	Graham Bay Station.....	75 48·4	45 20·8	222	·6200	− ·0198	− ·0274
126	.....	75 41·7	45 20·9	297	·6237	− ·0092	− ·0193
127	.....	75 36·6	45 20·9	295	·6252	− ·0079	− ·0180
128	.....	75 59·9	45 21·0	390	·6083	− ·0160	− ·0293
129	.....	75 57·1	45 21·0	337	·6118	− ·0175	− ·0290
130	.....	75 54·4	45 21·0	246	·6166	− ·0212	− ·0296
131	.....	75 52·6	45 21·0	222	980·6188	−0·0213	−0·0289
132	Graham Bay.....	75 49·1	45 21·0	232	·6191	− ·0200	− ·0279
133	.....	75 45·9	45 21·1	274	·6175	− ·0179	− ·0272
134	.....	75 33·5	45 21·1	270	·6261	− ·0096	− ·0188
135	.....	75 30·1	45 21·1	253	·6279	− ·0094	− ·0180
136	.....	75 51·0	45 21·2	211	·6205	− ·0210	− ·0282
137	.....	75 42·4	55 21·2	286	·6227	− ·0117	− ·0215
138	.....	75 38·8	45 21·2	309	·6243	− ·0080	− ·0185
139	.....	75 38·6	45 21·2	310	·6239	− ·0082	− ·0188
140	South March.....	75 56·0	45 21·3	256	·6174	− ·0200	− ·0287
141	.....	75 31·8	45 21·4	261	980·6267	−0·0103	−0·0192
142	.....	75 59·1	45 21·5	334	·6110	− ·0193	− ·0307
143	.....	75 44·3	45 21·5	311	·6187	− ·0138	− ·0244
144	.....	75 35·1	45 21·5	277	·6273	− ·0084	− ·0178
145	Strathearn Station.....	75 55·3	45 21·6	226	·6196	− ·0211	− ·0288
146	.....	75 47·5	45 21·6	256	·6199	− ·0179	− ·0266
147	.....	75 32·2	45 21·6	261	·6268	− ·0105	− ·0194
148	.....	75 40·9	45 21·8	267	·6267	− ·0104	− ·0195
149	.....	75 53·0	45 21·9	196	·6208	− ·0232	− ·0298
150	City View.....	75 44·0	45 21·9	322	·6192	− ·0128	− ·0238

PRINCIPAL FACTS FOR GRAVITY STATIONS NEAR OTTAWA, ONTARIO—*Continued*

Station		Longitude	Latitude	Elevation	Observed Gravity	Gravity Anomalies	
No.	Name					Free Air	Bouguer
		° ′	° ′	Ft.			
151	.....	75 37·1	45 21·9	282	980·6271	−0·0087	−0·0183
152	.....	75 58·4	45 22·0	332	·6131	− ·0182	− ·0295
153	.....	75 34·0	45 22·0	262	·6281	− ·0098	− ·0187
154	.....	78 46·3	45 22·1	264	·6210	− ·0169	− ·0259
155	Ellwood.....	75 39·9	45 22·1	288	·6250	− ·0105	− ·0203
156	.....	75 30·7	45 22·1	259	·6284	− ·0099	− ·0187
157	Britannia Bay.....	75 48·0	45 22·4	219	·6234	− ·0191	− ·0266
158	.....	75 39·2	45 22·4	304	·6250	− ·0095	− ·0199
159	.....	75 35·9	45 22·4	276	·6285	− ·0087	− ·0181
160	.....	75 57·5	45 22·6	310	·6161	− ·0182	− ·0287
161	Ramsayville Station.....	75 34·0	45 22·6	242	980·6301	−0·0106	−0·0188
162	.....	75 32·6	45 22·6	237	·6294	− ·0117	− ·0198
163	.....	75 45·2	45 22·7	260	·6213	− ·0178	− ·0267
164	.....	75 40·0	45 22·7	289	·6250	− ·0114	− ·0212
165	.....	75 42·4	45 22·8	251	·6252	− ·0149	− ·0234
166	Wychwood.....	75 50·4	45 22·9	205	·6237	− ·0208	− ·0278
167	Woodroffe.....	75 46·5	45 22·9	223	·6248	− ·0181	− ·0257
168	Harwoods Plains.....	75 58·2	45 23·0	282	·6177	− ·0198	− ·0294
169	.....	75 56·8	45 23·0	222	·6218	− ·0213	− ·0289
170	.....	75 49·4	45 23·0	207	·6240	− ·0205	− ·0276
171	.....	75 37·7	45 23·0	280	980·6270	−0·0107	− ·0202
172	.....	75 31·1	45 23·0	243	·6299	− ·0112	− ·0195
173	Deschênes Mills.....	75 48·3	45 23·2	203	·6260	− ·0192	− ·0260
174	Billings Bridge.....	75 40·6	45 23·2	208	·6296	− ·0151	− ·0222
175	Laurentian View.....	75 44·0	45 23·4	240	·6247	− ·0174	− ·0255
176	Hawthorne Station.....	75 35·7	45 23·5	221	·6239	− ·0111	− ·0186
177	.....	75 47·5	45 23·6	201	·6272	− ·0188	− ·0256
178	Westboro Station.....	75 45·6	45 23·6	219	·6244	− ·0200	− ·0274
179	Ottawa.....	75 41·9	45 23·6	218	·6273	− ·0171	− ·0245
180	.....	75 36·6	45 23·6	248	·6300	− ·0115	− ·0200
181	.....	75 33·1	45 23·6	247	980·6300	−0·0116	−0·0201
182	.....	75 30·9	45 23·7	253	·6312	− ·0101	− ·0187
183	.....	75 59·0	45 23·8	246	·6208	− ·0213	− ·0297
184	Aylmer.....	75 50·9	45 23·8	276	·6194	− ·0199	− ·0293
185	Gatineau Country Club.....	75 49·8	45 23·8	280	·6202	− ·0186	− ·0282
186	Ottawa.....	75 41·1	45 23·8	205	·6285	− ·0174	− ·0244
187	.....	75 34·9	45 23·8	252	·6314	− ·0101	− ·0187
188	.....	75 40·1	45 23·9	213	·6298	− ·0155	− ·0228
189	.....	75 55·2	45 24·0	249	·6230	− ·0191	− ·0276
190	Aylmer.....	75 51·8	45 24·0	197	·6252	− ·0217	− ·0284
191	.....	75 48·4	45 24·0	297	980·6207	−0·0169	−0·0270
192	Ottawa.....	75 44·8	45 24·0	201	·6253	− ·0213	− ·0281
193	.....	75 38·9	45 24·0	268	·6275	− ·0128	− ·0219
194	.....	75 37·4	45 24·1	256	·6293	− ·0123	− ·0210
195	Malwood Station.....	75 59·9	45 24·2	223	·6212	− ·0236	− ·0312
196	.....	75 47·6	45 24·3	288	·6219	− ·0169	− ·0268
197	Ottawa.....	75 41·4	45 24·4	224	·6271	− ·0179	− ·0256
198	.....	75 31·0	45 24·4	242	·6336	− ·0098	− ·0180
199	Bate Island.....	75 45·4	45 24·5	197	·6260	− ·0218	− ·0285
200	Ottawa West Station.....	75 43·5	45 24·5	185	·6265	− ·0224	− ·0287

PRINCIPAL FACTS FOR GRAVITY STATIONS NEAR OTTAWA, ONTARIO—*Continued*

Station		Longitude		Latitude		Elevation	Observed Gravity	Gravity Anomalies	
No.	Name							Free Air	Bouguer
		°	′	°	′	Ft.			
201		75	33·7	45	24·5	256	980·6313	−0·0109	−0·0196
202		75	51·0	45	24·6	347	·6167	− ·0171	− ·0289
203		75	57·6	45	24·7	282	·6195	− ·0205	− ·0301
204		75	49·8	45	24·7	356	·6169	− ·0162	− ·0284
205		75	48·5	45	24·8	334	·6177	− ·0176	− ·0290
206		75	45·8	45	24·8	193	·6269	− ·0217	− ·0282
207		75	52·6	45	24·9	360	·6176	− ·0154	− ·0277
208	Ottawa	75	43·9	45	25·0	179	·6262	− ·0240	− ·0301
209	Ottawa	75	43·0	45	25·0	174	·6276	− ·0231	− ·0290
210	Ottawa	75	40·0	45	25·0	193	·6307	− ·0182	− ·0247
211	Blackburn Station	75	33·9	45	25·0	229	980·6340	−0·0115	−0·0193
212	Val Tetreau	75	44·6	45	25·1	188	·6264	− ·0231	− ·0295
213		75	56·8	45	25·2	378	·6147	− ·0170	− ·0299
214	Cyrville	75	38·0	45	25·2	222	·6316	− ·0148	− ·0224
215		75	35·7	45	25·2	219	·6346	− ·0122	− ·0196
216		75	53·9	45	25·3	218	·6248	− ·0221	− ·0296
217		75	32·0	45	25·3	230	·6358	− ·0101	− ·0179
218		75	52·7	45	25·4	405	·6147	− ·0149	− ·0286
219	Ottawa	75	42·0	45	25·4	238	·6248	− ·0204	− ·0285
220		75	51·1	45	25·5	453	·6123	− ·0128	− ·0283
221	Hull	75	43·2	45	25·5	179	980·6294	−0·0216	−0·0277
222		75	49·0	45	25·6	358	·6171	− ·0172	− ·0294
223		75	31·0	45	25·8	265	·6350	− ·0082	− ·0173
224		75	57·9	45	25·9	330	·6184	− ·0189	− ·0301
225	Hull	75	42·6	45	26·0	160	·6294	− ·0241	− ·0295
226	Ottawa	75	40·6	45	26·0	235	·6279	− ·0185	− ·0265
227		75	36·6	45	26·1	263	·6323	− ·0116	− ·0206
228		75	54·1	45	26·2	400	·6144	− ·0168	− ·0304
229		75	52·9	45	26·2	453	·6125	− ·0137	− ·0291
230	Blackburn	75	33·0	45	26·2	273	·6347	− ·0085	− ·0178
231		75	59·7	45	26·3	254	980·6240	−0·0211	−0·0297
232	Ottawa, Nat. Res. Council	75	41·8	45	26·3	182	·6296	− ·0222	− ·0284
233		75	51·9	45	26·4	439	·6129	− ·0149	− ·0298
234		75	45·8	45	26·4	311	·6198	− ·0201	− ·0307
235	Simmons	75	49·2	45	26·5	365	·6169	− ·0181	− ·0305
236	Hull	75	44·0	45	26·5	224	·6254	− ·0228	− ·0304
237	Eastview	75	38·9	45	26·5	226	·6316	− ·0165	− ·0242
238		75	58·9	45	26·8	330	·6209	− ·0178	− ·0291
239		75	55·2	45	26·8	378	·6163	− ·0179	− ·0307
240		75	36·9	45	26·8	317	·6305	− ·0094	− ·0202
241		75	32·0	45	26·8	302	980·6389	−0·0024	−0·0127
242		75	42·7	45	26·9	156	·6316	− ·0236	− ·0289
243		75	54·2	45	27·0	363	·6165	− ·0194	− ·0318
244		75	35·2	45	27·0	210	·6393	− ·0109	− ·0181
245		75	53·0	45	27·1	388	·6147	− ·0189	− ·0322
246	Rockcliffe	75	40·7	45	27·2	246	·6320	− ·0152	− ·0236
247		75	51·3	45	27·3	391	·6147	− ·0190	− ·0323
248		75	39·4	45	27·3	198	·6353	− ·0160	− ·0233
249		75	30·2	45	27·3	291	·6407	− ·0024	− ·0123
250		75	48·3	45	27·5	376	·6176	− ·0179	− ·0307

PRINCIPAL FACTS FOR GRAVITY STATIONS NEAR OTTAWA, ONTARIO—*Concluded*

Station		Longitude	Latitude	Elevation	Observed Gravity	Gravity Anomalies	
No.	Name					Free Air	Bouguer
		° ′	° ′	Ft.			
251		75 33·9	45 27·5	245	980·6418	−0·0059	−0·0143
252		75 56·0	45 27·6	333	·6175	− ·0221	− ·0335
253		75 46·0	45 27·6	335	·6214	− ·0180	− ·0294
254		75 54·3	45 27·7	348	·6172	− ·0212	− ·0330
255		75 44·5	45 27·7	179	·6309	− ·0234	− ·0295
256	Gatineau Point	75 41·9	45 27·7	160	·6348	− ·0212	− ·0267
257		75 37·4	45 27·7	161	·6404	− ·0156	− ·0210
258		75 49·4	45 27·8	410	·6146	− ·0181	− ·0321
259		75 35·6	45 27·8	159	·6443	− ·0120	− ·0174
260	C.P.R. Bridge	75 43·5	45 27·9	148	·6341	− ·0233	− ·0284
261		75 32·2	45 27·9	200	980·6452	−0·0074	−0·0142
262		75 52·7	45 28·0	356	·6152	− ·0228	− 0·349
263		75 51·5	45 28·1	354	·6149	− ·0253	− ·0355
264	(Orleans)	75 32·0	45 28·1	220	·6446	− ·0063	− ·0138
265	Ironside Station	75 44·7	45 28·4	185	·6322	− ·0226	− ·0289
266		75 40·2	45 28·4	157	·6379	− ·0195	− ·0248
267		75 47·0	45 28·5	345	·6201	− ·0197	− ·0315
268		75 43·8	45 28·6	167	·6326	− ·0244	− ·0301
269	Orleans	75 31·0	45 28·6	205	·6480	− ·0052	− ·0122
270	Breckenridge Station	75 57·2	45 28·7	219	·6284	− ·0236	− ·0310
271	Talon Station	75 42·0	45 28·7	179	980·6352	−0·0206	−0·0267
272	Gatineau	75 38·4	45 28·9	148	·6448	− ·0142	− ·0192
273	East Templeton	75 37·3	45 28·9	152	·6462	− ·0124	− ·0176
274		75 53·2	45 29·0	347	·6162	− ·0242	− ·0360
275		75 45·1	45 29·0	195	·6310	− ·0237	− ·0303
276		75 40·5	45 29·0	180	·6382	− ·0179	− ·0241
277		75 33·0	45 29·0	146	·6495	− ·0098	− ·0148
278		75 51·9	45 29·1	390	·6118	− ·0247	− ·0380
279		75 57·8	45 29·2	223	·6288	− ·0236	− ·0312
280		75 48·8	45 29·3	343	·6146	− ·0266	− ·0383
281		75 44·9	45 29·3	145	980·6354	−0·0244	−0·0294
282	Gatineau Station	75 39·0	45 29·3	181	·6420	− ·0145	− ·0206
283		75 55·9	45 29·4	331	·6182	− ·0243	− ·0356
284		75 42·1	45 29·4	180	·6361	− ·0206	− ·0267
285		75 54·5	45 29·5	331	·6168	− ·0259	− ·0371
286	Kingsmere	75 50·6	45 29·5	810	·5920	− ·0056	− ·0332
287		75 40·6	45 29·5	180	·6390	− ·0179	− ·0240
288		75 56·9	45 29·6	210	·6300	− ·0242	− ·0314
289		75 38·0	45 29·6	199	·6441	− ·0111	− ·0179
290		75 34·8	45 29·6	177	·6457	− ·0116	− ·0176
291	East Templeton Station	75 36·4	45 29·7	159	980·6466	−0·0125	−0·0180
292		75 48·9	45 30·0	337	·6154	− ·0274	− ·0389
293		75 45·8	45 30·0	357	·6195	− ·0214	− ·0336
294		75 56·0	45 17·9	312	·6053	− ·0217	− ·0323
295		75 54·0	45 18·1	364	·6069	− ·0155	− ·0279
296		75 53·0	45 18·8	330	·6096	− ·0171	− ·0283
297	Ottawa, Victoria Museum	75 41·3	45 24·8	228	·6253	− ·0200	− ·0278
298	Hull	75 44·1	45 25·9	225	·6252	− ·0220	− ·0297
299	Eastview	75 39·7	45 26·2	206	·6318	− ·0176	− ·0246
300		75 46·7	45 26·7	332	·6191	− ·0193	− ·0306
301	Rockcliffe	75 40·7	45 26·8	231	980·6311	−0·0169	−0·0248
302		75 40·3	45 27·2	197	·6364	− ·0154	− ·0221