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WILKES GEOPHYSICAL SURVEYS, ANTARCTICA 1962

by

D.J. WALKER

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ILLUSTRATIONS

<u>Note</u>. This Record supersedes Geophysical Progress Report No. 1964/25.

SUMMARY

Seismic, gravity, magnetic, and elevation measurements were made from Wilkes base, Antarctica, in an area, most of which was previously unexplored. Except for a small coastal group of islands the whole area traversed was over the Antarctic ice sheet.

A coastal dome of approximately 10,000 square miles in area was found to be attached to but set off from the normal ice sheet and bordered on the south by east and west flowing glaciers. The dome could be a suitable model for the glaciological study of a continental ice sheet. On the southern boundary of the dome, a large rock valley, approximately 40 miles wide and 6000 feet deep, occurring 90 miles from the coast, is postulated to be a major tectonic lineament marginal to the Antarctic mainland. This valley is overlain by ice which is 5000 feet thick at the northern and southern boundaries and 10,500 feet thick at its centre.

Gravity anomalies on the coastal outcrops are indicative of a shallow basement composed of metamorphic rocks, whereas inland the results indicate step faulting in rocks that show a varying degree of metamorphism and magnetic susceptibility.

The surface profile inland from the coastal glacier region shows little change in form from that previously assumed for the area but measurements indicate a far greater volume of ice cover. The deduced ice-bottom profile shows that for 750 miles south from the coast the ice-rock interface is below sea level, and in the area between 300 and 750 miles south an ice thickness of three miles was indicated with the rock greater than 6000 feet below sea level.

The obtaining of suitable seismic reflection results up to 300 miles from the coast by conventional seismic methods was aided by the development of a light-weight, mobile auger drill capable of depths up to 300 feet. Seismic records obtained further south showed that a more exhaustive test of seismic parameters, particularly into the nature of the near-surface noise, must be completed before suitable seismic records can be obtained. Seismic refraction profiles indicate the rate of increase of seismic P-wave velocity with depth in the near-surface.

1. INTRODUCTION

Seismic, gravity, and magnetic surveys planned by the Bureau of Mineral Resources (BMR) and conducted by the author in Antarctica in the vicinity of Wilkes base (latitude 66°15.5'S, longitude 110°31.9'E) and between Wilkes and the U.S.S.R. base, Vostok (latitude 78°27.0'S; longitude 106°52.0'E), near the South Geomagnetic Pole, were part of the programme of the Australian National Antarctic Research Expedition (A.N.A.R.E.) for the season 1962 to 1963.

The surveys may be considered in four parts :

1. A gravity tie between Melbourne and Wilkes including intermediate ports of call, namely Macquarie Island, Lewis Islet, and Chick Islet.

2. Gravity observations on the Windmill Islands group in the vicinity of Wilkes base made as time permitted during the first half of 1962, and using different modes of travel: helicopter, boat, and dog sledge.

3. A gravity survey on a 335-mile traverse from Wilkes to the Totten Glacier.

4. A traverse from Wilkes to Vostok and return (a distance of 1774 miles).

All the geophysical observations were made by the author, who was assisted by other members of the survey parties, particularly in the case of the seismic shooting.

The reduction of the results was done in the Geophysical Branch of the Bureau of Mineral Resources. The Division of National Mapping gave assistance in the reduction of the elevation data.

2. PREVIOUS SURVEYS IN THE AREA

Apart from hydrographic surveys to the Wilkes base area that were made by USA, U.S.S.R., and Australian expeditions, the only geological, geophysical, and glaciological surveys from Wilkes were those started during the International Geophysical Year (I.G.Y.) when the base was established by the USA. The main surveys may be listed as follows :

<u>During the I.G.Y. by the USA</u>

1. Surface geology of the Windmill Islands group.

2. Establishment of a glaciological sub-station S-2, 50 miles from Wilkes, and topographical and gravity surveys between Wilkes and S-2.

3. Gravity survey on Clark Peninsula near Wilkes.

4. A glaciological traverse to S-2, then south 100 miles, west 100 miles and back to Wilkes again along the same trail (Hollin, Cronk, & Robertson, 1961).

<u>During 1960-1961 by A.N.A.R.E.</u>

A glaciological traverse to S-2 and south 180 miles marking a trail with accumulation stakes and making glaciological surface observations.

<u>During 1961-1962 by A.N.A.R.E.</u>

1. A seismic and glaciological traverse following the same trail as the previous year to a position 110 miles south of S-2. Seismic reflections were obtained every 20 miles.

2. A seismic and glaciological traverse again following the same trail and extending it to 300 miles south of S-2. Glaciological surface data were collected, accumulation markers were laid, and fuel depoted; meteorological data and surface topography were measured along the route and reliable ice thickness measurements were obtained by seismic methods up to 200 miles south of S-2 (Jewell, 1962).

Geology

Very little is known of the geology of the Wilkes area other than that found by the USA expedition to Wilkes during the I.G.Y. and that learned by BMR geologists who, accompanying A.N.A.R.E., have visited the Windmill Islands and have from time to time examined the geology of other areas of the East Antarctic coast.

The geology of the Wilkes area is summarised by Crary (1960):

"The bedrock geology of the Windmill Islands .... consists of Precambrian metamorphic and igneous rocks. The metamorphics are very old rocks and appear to be remnants of a folded volcanic-sedimentary sequence, altered to biotite, hornblende, or magnetite-garnetiferous gneisses, containing intercalated bands of pegmatite.

"The igneous rocks consist of coarse to porphyritic diorite, quartz diorite, syenite, and granite. They are generally featureless except for some basic dikes and faulting. The ages of two gneiss samples and a quartz diorite from this region are 950 and 1120 million years, as determined by the A40/K40 method."

3. OBJECTIVES OF THE SURVEYS

There were four main objectives :

1. To make a gravity tie between Melbourne and Wilkes and any intermediate islands visited en route.

2. To use a combination of seismic, gravity, and magnetic exploration methods in the Wilkes area and on traverses inland from Wilkes to study :

   (a) Surface topography of the ice sheet.
   (b) Ice thicknesses.
   (c) Seismic P-wave velocity distribution in the ice sheet.
   (d) Structure and composition of subsurface ice and rock.
   (e) Crustal thicknesses.

3. To establish absolute magnetic stations in areas where no magnetic stations exist.

4. To modify and test a light-weight (half-ton) post-hole borer to be used for drilling holes in the ice sheet for temperature logging and seismic shooting.

4. MELBOURNE - WILKES GRAVITY TIE

The problems of making gravity measurements between Australia and Antarctica are discussed by Langron (1966).

On the outward journey of the M.V. Thala Dan to Wilkes during the summer of 1961/1962 Worden geodetic meter No. 140 was used to make a gravity tie between Lewis Islet and Wilkes base. Only one tie was made, by taking a series of readings at Lewis Islet on 30th December 1961 and another series of readings at Wilkes base on 16th January 1962.

An average daily drift rate calculated from measurements made at Wilkes during the period 16th January to 28th February 1962 was used to correct the observed gravity interval. No correction could be made for temperature effects.

During the return voyage to Melbourne in 1963 a series of single gravity ties was made between Lewis Islet, Chick Islet, Macquarie Island, and Melbourne by taking a number of readings at each station with Master Worden geodetic meter No. 548.

Drift rate corrections to the observed gravity intervals were made using an average daily drift rate derived from measurements made at the National Gravity Base Station in Melbourne immediately after the voyage. An estimated correction for temperature was also applied using a value derived from tests carried out on the meter in Melbourne.

The makers' calibration factors were used for the large dial in the absence of any other means of checking this. The ratio of large dial to small dial readings was not measured during the work.

For each gravity tie made during these two voyages the corrected gravity interval and approximate error were calculated (see Table 11).

Wilkes base station has a value of gravity derived from a tie made during the I.G.Y. by a La Coste 1a meter to the McMurdo Sound pendulum station (Thiel _et al_, 1959). The value is considered to be relatively accurate as the readings were taken at McMurdo Sound and Wilkes only a matter of hours apart.

The interval between this gravity value for Wilkes base and the pendulum value for the Melbourne base station was used for closure of the series of gravity intervals measured during the present survey. The closing error was adjusted throughout the observed intervals with respect to the time taken between observations. It was found that the closure adjustment for each interval was always less than the possible error calculated for that interval.

The adjusted gravity values for Macquarie Island, Chick Islet, and Lewis Islet are shown in Table 11. These values differ somewhat from those given by Langron (1966). Langron adjusted all Australian Antarctic observations for misclosure; he then compared the results with those of other measurements, but did not adjust the Australian data any further to agree with these.

5. WINDMILL ISLANDS GRAVITY SURVEY

Making use of helicopters, a dog sledge, and a motor launch being used out of Wilkes by marine biologists of the Department of Fisheries and Oceanography, Virginia, USA, a gravity survey on the islands in the vicinity of Wilkes was started in January 1962. Plate 4 shows the stations established and the calculated Bouguer anomaly contours for the Windmill Islands group, which formed the major part of this survey.

Expedition changeover period

Helicopters were used during the 1962 changeover period to establish gravity stations on the Balaena Islands, 20 miles north-east of Wilkes. These stations were tied to the gravity base station at Wilkes. Gravity meter drift was corrected for during the survey by re-reading a previous station every hour.

Elevations were taken for these stations using a micro-barometer in the field while a similar micro-barometer was being read throughout the day at Wilkes base. The reduction of the elevation data followed the standard methods for barometric levelling (Brombacher, 1944).

Journeys by launch (summer)

During February 1962, two journeys were made by motor launch to the southern islands of the Windmill Islands group, 10 to 20 miles from Wilkes. The gravity meter was taken ashore at suitable locations in a 12-foot boat, powered by outboard motor, and was read on rocks close to the waters edge. Correction for meter drift was made by taking a reading at Wilkes base station at the beginning and end of a day's survey. The gravity station elevation above the water level was noted each time, and as the tide gauge at Wilkes was being observed throughout the day, elevations of the gravity stations above mean sea level were determined.

Journeys by sledge (winter)

During the winter, a dog sledge journey was made across firm sea ice to the Donovan Islands. Gravity readings were taken at the tops of the islands, the heights of which are known from the I.G.Y. topographical survey of the area. Gravity meter drift was again corrected for by taking a reading at Wilkes base station at the beginning and end of the days survey.

6. TOTTEN GLACIER GRAVITY SURVEY

Traverses followed in the Totten Glacier area are shown in Plate 6.

The main object of the survey was to scout a route to the south-east of S-2 - the Wilkes glaciological sub-station - and to make a depot of fuel to be used the following spring on a longer traverse planned to extend beyond this area.

At two places an attempted crossing of the Totten Glacier was prevented by extensive crevassing and very soft snow, and finally, owing to the lateness of the season with its incessant bad weather, the party was obliged to return to Wilkes along the southern trail that had been marked by the 1960 glaciological traverse party (see Appendix 3).

Navigation

The traverse route was determined by using a carefully adjusted magnetic compass to give a heading reference and checking the heading at least every hour - when the sun was shining - by means of an astro compass. The stations were located by noting the miles distant along the traverse route from the two Weasel speedometers.

Meridian crossings of the sun were observed by theodolite on every day the sun was visible, and astro-fixes were made at stations T11, T26, T41, and T55. These observations were used to obtain a fix of the traverse route.

Elevations

Only one vehicle was available for barometric levelling, so six aircraft altimeters were read at the gravity stations from this one vehicle. Elevation readings were also taken at closer intervals in areas where the surface showed many undulations - especially on the slopes of the Totten Glacier. Elevations were read at 0.2-mile intervals on some sections of the route and readings were usually taken at the crests and the troughs of the obvious undulations. Surface wind speeds and directions and air temperature were measured frequently. Two micro-barometers were read morning and evening at camp stops.

From observations of a micro-barometer and a set of three aircraft altimeters taken every evening at Wilkes base while the traverse party was in the field, it was possible to compute heights for certain camp locations by comparing field and base elevation readings taken at the same time on days when meteorological conditions were suitable. These suitable days were found by studying the surface weather charts of the area for the period of the traverse and finding days when the horizontal pressure gradient between base and field station was negligible and when meteorological conditions were particularly stable. Temperature corrections were applied to the measured height intervals.

Corrected elevations for nine locations were obtained in this way and these, together with the I.G.Y. value for S-2 and elevations for the trail south of S-2 to Vostok (see section 7), which was taken as a base line, formed a primary elevation network. All other elevations were adjusted to this network after corrections were applied for air temperatures and diurnal pressure variations observed en route (Table 2 & Plates 5, 6, and 9).

Gravity

As gravity stations could be established along the traverse route without delaying the progress of the party, the gravity meter was read at 2½-mile intervals where accumulation marking stakes were being placed and approximately at 2- to 5-mile intervals elsewhere along the trail (Table 2 & Plate 7).

By observing meter drift rates at camp stops and at periods when the party was stopped for a time, a mean drift rate for the duration of the traverse was calculated. After correcting all readings for drift, final observed gravity values for each station were obtained by taking the means of all observations on outward and homeward journeys in both autumn and spring 1962 (see section 7) for the S-2 and southern trails, and adjusting the misclosure error in the loop east of the southern trail throughout the stations in the loop. A similar adjustment of misclosure errors was made to stations in the loop T21 - T26 - T21.

Seismic depth values obtained in 1961 (Jewell, 1962) along the Wilkes S-2 trail and the trail south of S-2 provide control data to calculate an ice thickness profile from gravity data. The results are shown in Plate 9.

Seismic

Unfortunately no seismic equipment could be taken on this traverse. Originally it had been intended that suitable gravity stations would be re-occupied in the following spring for seismic shooting for ice thickness, but this plan was later postponed in view of plans for a spring traverse to a different area. It is hoped that future traverses to the Totten Glacier area will be able to re-occupy suitably located gravity stations for seismic ice thickness measurements.

7. WILKES - VOSTOK SEISMIC, GRAVITY, AND MAGNETIC TRAVERSE

From September 17th 1962 to January 14th 1963 a six-man traverse party journeyed from Wilkes to the U.S.S.R. station Vostok for meteorological, glaciological, and geophysical studies (Appendix 4). The location of this traverse is shown in Plate 5. The party followed a marked trail from Wilkes to S-2 and south to the point 354 miles from Wilkes reached by Jewell (1962). It then followed a great circle route to Vostok and returned to Wilkes along the same trail.

An airdrop of 36 drums (44 imperial gallons per drum) of Arctic Diesel fuel made by the United States Air Force 9th Troup Carrier Squadron to the traverse party on November 5th 1962 at 572 miles from Wilkes made it possible for the party to reach Vostok before returning to Wilkes.

Navigation

The navigational method used was similar to that used during the Totten Glacier survey. However, the magnetic compass was checked by the astro compass every fifteen minutes, meridian crossings of the sun were observed almost every day, and astro fixes were made more frequently. Plate 5 shows the traverse location.

Elevations

Elevation observations were taken by reading two sets of three aircraft altimeters simultaneously at two stations up to three miles apart, and advancing them at the same rate so that the rear set of instruments was simultaneously re-occupying the position previously occupied by the forward set of instruments, while the forward set occupied a new location. In this way elevation intervals along the traverse route were obtained with greatly reduced errors due to diurnal pressure changes. This method is referred to as the 'modified leap frog method'.

The measured elevation intervals were corrected for temperature of the intermediate air column (Dooley, 1963), and it was found that the sum of the errors from all other sources that usually must be corrected for in barometric levelling were almost negligible for this traverse and were at least within the error due to inaccuracies in the temperature readings. The method is similar to that described by Ostenso and Bentley (Theil, Bentley, Ostenso, & Behrendt, 1959).

Table 9, a comparison of the performances of the altimeters used, shows that for equal changes of pressure and, for the same temperature and humidity, the mean elevation intervals measured by each set generally differed by much less than ten feet.

Plate 17 shows that the mean calibration curves for each set of instruments, obtained from figures provided by the manufacturer, follow each other well except between the heights of 6000 and 8000 feet. However, even over this interval the error introduced by not using the calibration corrections is only 1%. As this error is small compared with that due to corrections for air temperature, the instrument calibration corrections were not applied.

Observations of the speed and direction of the surface wind were taken in order to be able to apply a correction for horizontal pressure gradient but, when computed, this correction appeared to be excessively high. Subsequent study of the meteorological conditions during the traverse period showed that the winds recorded must have had a strong katabatic component, and hence this method of correcting for horizontal pressure gradient was considered too unreliable to use. Instead, corrections for horizontal pressure gradients were determined from the 700-millibar maps held by the Antarctic Analysis Centre of the Department of Meteorology in Melbourne. The correction by this method was found to be of the order of 30', which was of the same magnitude but opposite sign to the correction due to gravity.

geophysical results on the Antarctic continent show that these assumptions are reasonable in this area at distances greater than 250 miles from the coast.

The apparent rock-surface profile calculated from gravity data was adjusted to coincide with the seismic profile where it was considered that reliable seismic reflection data had been obtained.

Up to station V 181, the seismic depth values used were those obtained by Jewell in 1961 (Jewell, 1962). Between V 215 and V 464 (Vostok) the seismic data obtained wereof such poor quality that ice-bottom events could not be positively identified. Events were recorded frpm depths in the vicinity of the ice-bottom profile computed from gravity data, but the gravity data were not adjusted to these doubtful seismic depths.

Owing to the unexpected high plateau altitudes and the unexpected extremely low temperatures encountered on the traverse, the fuel consumption was slightly higher than had been allowed for and, in order to conserve fuel, the seismic and drilling equipment could not be taken all the way to Vostok. The ice thickness obtained by U.S.S.R. observers at Vostok is given as 3685 metres (12,090 feet). This value was obtained from radio communication with M. Prior, USA observer at Mirny, 1962, and was used to give a southern tie point for the gravity observations.

Bouguer anomalies were also computed, assuming all material above sea level was ice of density 0.88 g/cm^3.

By comparing the rock profile calculated from Bouguer anomalies with that obtained from the free air gravity ice thickness profile adjusted to the seismic ice thicknesses, a measure of the residual anomaly for the region between S-2 and a point 120 miles south of S-2 was obtained. This residual anomaly, shown in Plate 8, indicated that the density of basement rocks in the region between 30 miles and 50 miles south of S-2 was higher than normal for the area.

Crustal thicknesses (Table 12) were calculated using a method described by Woollard (1962, pp. 53-73).

<u>Seismic</u>

Seismic reflection shooting for ice thickness measurements was done at approximately 30-mile intervals from a location 72 miles north of Vostok to 288 miles from Wilkes (V 215). So as to take advantage of the milder weather conditions later in the season all the seismic shooting except one shot at shot-point V 333 was done on the return journey from Vostok (see Plate 18).

The 12-channel seismic system used on the Wilkes-Vostok traverse was mounted inside a Weasel. The Weasel 12-volt batteries were used as the power supply for the amplifiers, with a 6-volt tapping for the TIC oscillograph camera. A separate 12-volt portable accumulator was used to drive the dynamotor for the high-tension supply to the amplifiers and a separate 90-volt supply was used for the high-tension supply to the camera.

To save time, only one seismic cable (12 take-outs) was used, and this was laid in a straight line parallel to the trail (approximately north-south). By using both 5-c/s and 20-c/s geophones (all that were available) 4 geophones could be used on each channel - 5-c/s geophones on six take-outs and 20-c/s geophones on the other six. These were placed in a group as two series-pairs connected in parallel to the take-outs by separate jumper cables. Some tests were made to determine the best geophones and number of geophones to use but the only conclusion that could be drawn was to use all available geophones.

Shot-holes were drilled as deep as possible in the time available.

Some surface pattern shooting was tried near the coast and far inland but lack of time prevented any suitable tests being completed.

The seismic equipment did not have a magnetic recording unit and difficulty was experienced in keeping shot-holes open for more than about four shots, so that the amount of experimenting for optimum shooting techniques at any station was very limited.

Photographic processing of the records was done in a portable developing box.

Siesmic shots were usually taken in temperatures below minus 30°F but no instrument trouble was experienced other than that due to cold instruments and flat batteries.

Half-mile refraction profiles for seismic P-wave velocities were shot at stations V 357 (Table 6 & Plate 14) and V 439 (Table 7 & Plate 15).

Only those records from shots taken within 300 miles from the coast showed reliable ice-bottom reflections; records from further inland showed many events but none that could be positively identified as ice-bottom reflections. It is likely that most of these events are chance line-ups of seismic noise. Possible ice-bottom events on these poor records have been tentatively identified on the basis of ice thicknesses calculated from gravity data. These are shown in Plate 10, but the gravity ice thickness profile has not been adjusted to them.

Because the only reliable reflections are on records obtained within 300 miles from the coast, all the seismic depths shown in Plate 10, except at Vostok, are calculated using velocity information obtained in 1961 by Jewell (1962) at station V 181 (Jewell's station 200 miles south of S-2).

Reduction of the refraction shooting data to velocity-depth information followed the method described by Pratt (1960, pp. 20-36).

Magnetic

Horizontal and vertical components of the Earth's magnetic field were observed at seismic stations and at other locations where possible. Magnetic declination was observed by the navigators, who noted the differences in readings between the carefully compensated vehicle magnetic compass and the astro-compass, both mounted in the navigation Weasel. Table 5 lists the observed magnetic values and Plates 11, 12, and 13 (from van der Linden, 1965) show final magnetic contours obtained from a smoothed curve through the observed results.

The United States Hydrographic Office magnetic component contour maps, adjusted to the 1962.0 epoch, were used to aid in the contouring along the traverse route.

Drilling

A proline post-hole borer fitted with a hydraulic pump and motor for rotary drive and kelly lift used on the 1961/62 traverse was found to be unsatisfactory for boring seismic holes, mainly because of the repeated failure of the main borer ram seals, but also because of the lack of power provided by the hydraulic drive system.

Owing to bad weather, the modified leapfrog method had to be abandoned along two short sections of the traverse route between 70 and 124 miles south of S-2 and between 140 and 182 miles south of S-2. As elevations had been obtained during 1960 by H. Black as far as 180 miles south of S-2 (gravity station V 161) Black's elevation data were used (pers. comm.) for this first 180 miles, and the data obtained by modified leapfrog method were used between station V 161 and Vostok.

After tying the 1962 elevation data to Vostok (elevation 11,440 feet from the United States National Geographic Society Map, "Antarctica", Plate 65 of their Atlas published in February 1963), the misclosure error at station V 161 to Black's elevation value of that station was 100 feet. As Black's elevations were not taken by the modified leapfrog method and have an estimated accuracy of ± 100 feet at station V 161, the whole of this misclosure error was distributed throughout the first 180 miles south of S-2.

The final elevation data are plotted in Plate 10 and tabulated in Table 3.

Gravity

Between Wilkes and the point 354 miles from Wilkes, gravity stations were read every one or two miles, and from that point to Vostok, at 3-mile intervals. The gravity meter was carried inside a Weasel and was read each time on the snow surface beside the Weasel. The usual time taken to read the meter was about two minutes, so it is considered that the meter was never outside the Weasel long enough for its internal temperature to be affected greatly by the ambient temperature. The temperature inside the Weasel, while the gravity stations were being read, was usually between +65°F and +75°F. The gravity meter drift during the day was generally positive and less than 0.1 mgal/hr. At night, drift was generally negative and averaged 0.07 mgal/hr. Rate of change of drift was always much less than 0.1 mgal/hr^2.

A calibration factor of 0.11112(6) mgal/div. was obtained for Worden gravity meter 140 over the Melbourne Calibration Range before departure. This figure was used for the reduction of small dial readings for Antarctic work. A repeat calibration on the Melbourne Range on the 17th February 1964 gave a calibration factor of 0.11114 mgal/div. It should be noted, however, that the figure of 0.11112(6) mgal/div. was based on a former value for the Melbourne Calibration Range and this figure should now be adjusted to 0.11120 mgal/div.

An average meter drift rate was calculated for the outward and the homeward journeys as it was for the duration of the Totten Glacier survey. After being corrected for drift, the mean of the gravity intervals between seismic stations for the outward and the homeward journeys was taken to find final observed gravity values for the seismic stations. All other gravity values, after being corrected for drift, were then adjusted to this primary network.

The rock-surface profile was first calculated from the gravity data alone using a reliable seismic depth sounding taken at station V 215 (288 miles from Wilkes) as datum. For each gravity station a free air anomaly was calculated and the difference between this and the free air anomaly at station V 215 was interpreted as a difference in ice thickness between the two stations. Densities used were 2.67 g/cm^3 for rock and 0.88 g/cm^3 for ice. This method was used by Bentley and Ostenso on I.G.Y. traverses (Theil et al, 1959).

The method of determining the ice thickness profile from gravity data assumes that there are no density differences in the basement and that the area is in isostatic equilibrium. Consideration of previous

For 1962 a new type of ram seal was tried and found to be successful. The new seal had a life of 4000 feet, or 9 months, whichever is the limiting factor in Antarctic conditions.

The hydraulic drive system was removed and replaced by a mechanical rotary drive, which was made possible by the use of a Weasel gear box and other parts. Power was provided from the D4 Tractor power take-off (see Plate 25). Hydraulics for the main borer ram were taken direct from the tractor hydraulic system. Both the hydraulic lift and the rotary drive could be operated at the drill. A choice of four forward and four reverse gears was available, giving a range of rotational speed from 30 r.p.m. to 150 r.p.m.

The spare main-drive sprocket of the D4 Tractor was used as a base-plate and a plate with a locking jaw was used for an auger clamp (see Plate 26). Augers were 3 feet long and $3\frac{1}{2}$ inches in diameter, and four sizes of bits, $3\frac{7}{8}$, $3\frac{3}{4}$, $3\frac{5}{8}$, and $3\frac{1}{2}$ inches diameter, were tested. Generally, the $3\frac{1}{2}$-inch diameter bit was successful and gave the minimum of hole losses after pulling out.

There was a tendency for the drill stem to jam when drilling in hard ice with the $3\frac{1}{2}$-inch diameter bit, and the $3\frac{5}{8}$-inch diameter bit was preferable in these cases.

The deepest hole drilled was 279 feet but, generally, holes were down to 240 feet, of which 230 feet was left open after the augers were pulled out. A 240-ft hole could be easily drilled in four to five hours from setting up for drilling to being completely packed up after drilling. With only two men working, one operating the controls, and one putting on and taking off the augers, one 240-ft hole was drilled in a total time of 2 hours and 40 minutes.

A new sledge was built especially to take the drill and drilling equipment (see Plate 25). The sledge weight was approximately 23 cwt. The amount of equipment carried on the sledge varied from time to time, but the total weight of the sledge, drill, and equipment would have always been less than three tons.

8. ACCURACY OF RESULTS

Owing to the large and erratic drift rates for the gravity meters used, the possible error in the measured gravity intervals is large (Table 11). Part of the drift error is also due to temperature changes as the meters were not operated with temperature control. However, the final adjusted values for the stations observed between Wilkes and Melbourne are not considered unreasonable as the sum of the corrected gravity intervals is closed upon the Melbourne and Wilkes base station values and the closure error for each interval is less than the possible error calculated for that interval.

Windmill Islands gravity

The largest error in the computed Bouguer anomaly values shown in Plate 4 would be due to errors in elevation, which would be ± 1 foot for stations W7 to W26 and ± 10 feet for the other stations, so that the Bouguer anomaly values are correct to ± 0.1 mgal and ± 1.0 mgal respectively for these stations.

Some Bouguer anomaly values computed for stations observed by J. K. Sparkman during the I.G.Y. (Hollin, Crary, & Robertson, 1961, p. 60) in the vicinity of Wilkes base have been incorporated to aid in the contouring. These stations carry the prefix C in Plate 4.

Owing to the lack of data from the area of the Mitchell and Bailey peninsulas, the contouring in Plate 4 for this area is very approximate, but further south the anomaly pattern should be reliable.

The inland traverses

Because the data from the traverses to the Totten Glacier and to Vostok have been combined for interpretation it is convenient to discuss the accuracy of results of these two traverses together.

Location. Because of the number of astro-fix stations along the traverse routes, the frequency of observations on the astro-compass, and the use of a specially mounted and adjusted rear vision mirror on the navigation Weasel, which kept the driver on a very straight course, the accuracy of location of any gravity station is considered to be better than ± 500 yards.

Astro fixes were accurate to ± 0.1' latitude, and ± 0.5' longitude.

Elevations. Primary network stations of the Totten Glacier survey that were common to the southern trail stations on the Wilkes-Vostok survey were found to have the same elevation, to within 10 feet on both traverses; and elevations along the Wilkes to S-2 trail agreed with elevation data obtained during 1958 (Hollin et al, 1961, p. 28) to within 20 feet.

It is estimated that elevations along the Wilkes to S-2 trail and south for 50 miles from S-2 are correct to no worse than ± 50 feet. Elsewhere in the Totten Glacier survey, absolute station elevations should be correct to ± 50 feet, but could be inaccurate to ± 100 feet in areas most distant from the primary network stations. The primary network stations are T11, T14, T19, T23, T26, T39, T42, T49, T55, and T64.

The method used for elevation determination on the Wilkes-Vostok traverse is expected to yield elevations correct to ± 50 feet (Thiel et al, 1959, pp. 4-11); because of the mis-tie of 100 feet at station V 181 between the 1960 and the 1962 data, the inaccuracy in the final adjusted elevation here could be much greater, but is expected to be not more than ± 100 feet.

Gravity. The accuracy of reduced gravity is limited by the station elevation accuracy, but owing to the relatively large and erratic drift rates of the meter used, errors in observed gravity must also be considered.

Errors in small dial calibration factor are not expected to exceed one or two parts per 1000. As the maximum range of gravity measured on the Wilkes-Vostok traverse is about 600 milligals, calibration errors may be about one milligal. This is small compared with other errors present.

During the Totten Glacier survey the meter drift during the day averaged less than +0.1 mgal/hr with +0.25 mgal/hr the highest and 0.0 mgal/hr the lowest drift rates measured. During the night, drift rate averaged -0.07 mgal/hr, the highest rate being -0.23 mgal/hr and the lowest -0.003 mgal/hr. The variation of drift rate was always much less than 0.1 mgal/hr^2. The total meter drift for the time spent in the field was +4.65 milligals for 22 days - i.e. +0.21 mgal/day.

During the Wilkes-Vostok survey the average meter drift rate between 0730 hrs and 2300 hrs, when most gravity stations were read, was +0.09 mgal/hr, and for the whole survey was +13.05 milligals for 120 days, averaging +0.11 mgal/day.

From a study of the drift rate corrections applied to both the Totten Glacier and the Wilkes-Vostok survey observations and of the closure of the Totten Glacier loop on to the southern trail, it was inferred that accuracy in observed gravity for the Totten Glacier stations was better than ± 1.0 mgal.

On the Wilkes-Vostok survey the total error in observed gravity increases randomly with increasing distance from Wilkes. Gravity intervals between seismic stations were read while travelling in both directions, and after correcting for drift, the standard error between outward and homeward observations over intervals was found to be 2.3 milligals. These differences over seismic station intervals tended to cancel out over the total distance, however, so that the probable error in the final computed observed gravity over the Wilkes-Vostok trail is estimated to become gradually greater from ± 1 milligal at S-2 to ± 10 milligals at Vostok.

Calibration errors could introduce a systematic component which would not be revealed by the repeat readings; however, as indicated above, this is not expected to be large compared with drift errors.

Magnetic. Declination determinations should be accurate to ± 1°. In reducing horizontal and vertical magnetic intensity data, no diurnal corrections have been applied because the magnetic observatory at Wilkes base was too far away from the field stations to provide suitable control. Without considering diurnal fluctuation errors, the components were observed to ± 1 gamma, but owing to errors in temperature reading, the accuracy in the case of the horizontal component observations would be no better than ± 10 gammas.

Ice thickness. Between Wilkes and station V 215, the accuracy of ice thickness measurements by seismic reflection data is +130, - 500 feet (Jewell, 1962).

The accuracy to be expected for free air anomalies when considering the inaccuracies in elevation and observed gravity should be better than ± 10 milligals, and thus the ice thicknesses derived from gravimetric data in this region, where seismic control is at every 20 miles, should be correct to ± 500 feet, assuming there are no density differences in the basement and that the area is in isostatic equilibrium.

Between stations V 215 and Vostok no reliable seismic control is available and the possible error in calculated ice thicknesses in this region depends upon the state of isostatic equilibrium and intra-basement densities of the region.

9. DISCUSSION OF RESULTS

Seismic reflection shooting

Reflection quality was good on records obtained within 300 miles from the coast but it deteriorated markedly further south. This is shown in Plate 19 where the records from shot-point V 62, 108 miles from Wilkes, and shot-point V 215, 288 miles from Wilkes, are of so much better quality than records obtained further south (route distances from Wilkes are approximately equal to distances south from the coast). The record from shot-point V 244, 321 miles from Wilkes, shows a very poor quality reflection while records from locations further south show no events that can be positively identified as reflections from the ice-rock interface (Plates 19 to 21).

Unfortunately, no time was available during this survey to conduct many experiments to determine why record quality was so poor at distances greater than 300 miles from the coast but it was noted that increasing thickness of the firn layer with increasing distance from the coast (Table 10) seemed to coincide with the deterioration of record quality. Possibly the surface waves propagated in the soft firn layer by a seismic shot are of such frequency and amplitude to effectively mask any reflection event that may be present when recording in the frequency ranges used during this survey.

A comparison between records from V 62 (Plate 19) and from V 310 shots 1, 2, and 3 (Plate 20) shows a marked difference in the character of the background seismic noise for seismic shots taken with a similar charge and depth but at different distances from the coast. Shot-point V 62 is 108 miles from Wilkes whereas V 310 is 447 miles from Wilkes.

Time did not permit the drilling of more than one seismic shot-hole at any one location and usually only two or three shots could be obtained from this hole before it was completely destroyed. The different shots in the hole were usually of necessity at different depths. On the one occasion when the hole remained open to the same depth for a number of shots (at V 310, Plate 20), some tests were made to see the effect on the record quality of varying the geophone type and arrangement. The techniques used are shown on the titles of the records in Plate 20. Owing to the poor quality of all records obtained at V 310, however, no definite evidence was obtained favouring one particular geophone arrangement over the others.

Some limited experiments prior to and during the survey indicated that the better filter settings to use may be generally between 30 c/s and 120 c/s and for this reason records shot during the traverse were shot with a pass-band in this region. Only after the seismic shooting was completed, however, did the difference in the character of the surface noise between near-coastal and inland seismic shots become obvious and now it appears that some revised thinking on the best filter settings to use far inland is desirable. Probably the filters 48 c/s - 92 c/s as used at V 62 and V 215 would be satisfactory for shooting within 300 miles of the coast but it appears that to obtain readable reflection quality further inland more exhaustive tests on filtering are required.

Attempts were made at shot-points V 62, V 333 (505 miles from Wilkes), and V 429 (785 miles from Wilkes) to record ice-bottom reflections using patterns of charges placed at a depth of 4 feet. One-pound charges were placed in holes that had been dug with a shovel and were then covered over with snow completely filling the holes. Seven-hole patterns in an hexagonal array were shot at V 429, V 333, and V 62 and a thirteen-hole pattern in a star array was shot at shot-point V 333. No recognisable reflection events were obtained at shot-points V 429 and V 333 from these pattern shots, but at shot-point V 62, reflections were obtained from the same depths as were obtained from the 212-ft single hole shot at this location (see Plate 22). Of the reflections from the pattern shot at V 62, the shallower event was of similar intensity and clarity to that obtained by the single-hole shot, but the two clear events appearing at later times on the record from the single-hole shot were of considerably reduced amplitude on the record from the pattern shot.

Unfortunately, no definite information was obtained to show the best shooting depths, but at shot-point V 62 the 212-ft single hole gave a much better record than the near-surface seven-hole pattern (Plate 22). However, the pattern shot did give a record good enough to show that it should be possible to complete a satisfactory seismic survey in an area up to 100 miles from the coast near Wilkes using only surface shooting techniques.

From the quality of the records from V62 in Plates 19 and 22, it seems that a single hole much shallower than 212 feet would also yield a readable record in this area within 100 miles from the coast.

From record V244 in Plate 19, a 191-ft hole yielded only a poor quality record. Although it may be possible to improve record quality in this region, and also at distances greater than 300 miles from the coast, by using a higher filter pass-band to eliminate the seismic surface noise, and by using shot-hole and geophone arrays to discriminate against this and any other systematic noise, it seems that it may still be desirable to use holes up to 200 feet in depth in order to place the charge beneath the soft firn layers.

For traverses where temperature logging of bore holes is required in addition to seismic data the proline drill as used on the Wilkes-Vostok traverse would be quite suitable.

The record obtained at V62 (shown in Plates 19 and 22) is of special interest in that it shows more than one clear reflection. This record was shot only three miles north of where a deep rock valley was discovered in 1961 by seismic reflection shooting by Jewell (1962).

A migrated cross-section of the record shows that if the three main events are all primary wave reflections coming from different sections of the ice-rock interface beneath shot-point V62 then a dip of 60 degrees to the south for the ice-rock interface is probable.

In view of what is known of the geology and gravity anomalies of this part of Antarctica, an interpretation of this nature does not appear too unreasonable, and in the absence of any information to the contrary, it would appear that shot-point V62 is on the northern boundary of a very deep rock valley.

Velocity profiles

Because of the time required for the graphical integration involved in reducing seismic refraction data to velocity/depth relations, only 16 sample velocities were chosen for a first estimate of the velocity distribution. It is believed the results shown in Plate 16 reliably indicate the velocity distribution for at least the first 300 feet. Beyond this depth the shape of the curves remains uncertain.

The ice sheet

Topographic data show (Plate 6) that the ice sheet within 150 miles radius of Wilkes and to the seaward side of an east-trending valley 110 route miles from Wilkes is in the form of a dome, which could be a suitable model for more detailed study of the behaviour of ice sheets. The east-trending valley is a major surface depression that leads into the Totten Glacier in the east and the John Quincy Adams/Vanderford glacier system in the west. It apparently owes its existence to a steep-sided trough in the underlying rock, the depth of which is of the order of 7000 feet (ice thickness 10,500 feet) where it is crossed by the southern trail.

Unfortunately, the complexity of the Bouguer anomalies in this region did not permit an estimate of ice thicknesses to be made except along the Wilkes to S-2 trail and the trail south of S-2, where seismic data were available. It is hoped that future surveys in the area will be able to add seismic control to the gravity station network so that ice thicknesses and gravity anomalies may be caluclated (Plate 7 & Table 2).

Surface elevation data were obtained in much greater detail (with station intervals as close as 0.2 miles in some areas) on the slopes of the Totten Glacier and on the first 350 miles of the Wilkes-Vostok trail. In these areas the surface showed considerable undulation and, especially on the slopes of the glacier, appeared to show a distinct wave form with a wave-length of approximately 1½ miles and an elevation change between crest and trough of up to 30 feet. It is hoped that surface wind data obtained during survey in the area, together with rock profile information, may make it possible to investigate the cause and behaviour of these surface features, but no analysis of this question has been attempted for this report.

The surface profile inland from the coastal glacier region shows little change in form from that predicted by earlier assumed contours of the region (Bentley, 1962, p. 14), but measurements made on the Wilkes-Vostok traverse will provide a profile of positive control for the area.

Rock structure

Analysis of gravity and magnetic anomalies shows evidence that in the area between Wilkes and Vostok three major geologic units occur, showing different degrees of metamorphism and magnetic susceptibility, and separated by two distinct boundaries at 110 miles and 350 miles from the coast.

The rock section between 110 and 350 miles shows a high magnetic susceptibility and greater variations in Bouguer anomalies relative to the coastal and inland rocks. This is taken to indicate that the rocks in this zone are more highly metamorphosed than the coastal and inland rocks. From the large gravity gradients occurring at its northern and southern boundaries, it seems likely that step-faulting separates the rocks of this area from the coastal rocks, metamorphosed to a lesser degree, and the rocks further inland, which appear to have undergone the least amount of metamorphism. Gravity anomalies on the coastal outcrops near Wilkes base, by virtue of their small-scale complex pattern, are consistent with a shallow basement composed of metamorphic rocks (Plate 4).

In the area of the deep rock trough 110 route miles south of Wilkes (Plate 10), the residual gravity anomaly calculated (Plate 8) indicates a rock section of exceptionally high rock density on the northern edge of the trough. The possibility of there being rocks under the ice dome of higher density than those existing in the outcropping islands near Wilkes is also supported by the fact that the highest density rock sample found near Wilkes was from the nearby terminal moraine. This moraine presumably is composed by deposits carried outwards by ice flow from the 'dome' region.

The traverse route was north-south whereas the ice surface expression of the rock trough trends east-west, so that the 40 miles measured across the trough appears to be a true width at the point crossed.

The valley in the ice surface correlates well with the gravity 'low' and apparently owes its existence to the underlying rock trough.

Because of the very steep gravity gradients at the northern and southern boundaries of the rock trough, and the associated gravity ridges, which seem too large to extend only a short distance, it is postulated that the rock trough could be a major tectonic lineament marginal to the Antarctic continent.

If the region between Wilkes and Vostok is in isostatic equilibrium as it is expected to be, at least for distances greater than 200 miles from the coast, then estimates of crustal thickness can be made from the gravity data using a method described by Woollard (1962, pp. 53-73). In the results contained in Table 12, there is a resemblance between the crustal thickness profile from the Wilkes-Vostok area and that of the Mirny-Vostok area (Woollard, 1962, p. 71).

10. CONCLUSIONS

By using a combination of seismic, gravity, and magnetic surveying methods it has been possible to measure surface topography, ice thickness, and gravity and magnetic elements over an extensive area of East Antarctica. The amount of the ice cover was investigated by seismic and gravimetric techniques and the composition and structure of the underlying rock was postulated from gravimetric and magnetic component studies.

A reconnaissance survey 900 miles inland from Wilkes shows results that can be correlated with results from other inland Antarctic geophysical surveys, but shows also that a far greater volume of ice occurs in this region than had been previously assumed. The existence of a major tectonic lineament marginal to the Antarctic continent and possibly extending over hundreds of miles has been postulated, and further, more detailed study of the area by geophysical methods is suggested.

The area within a 150 mile radius of Wilkes has been surveyed in more detail and over a larger area than before. A surface domal structure of the ice has been established and shown to offer local opportunity for glaciological and associated geophysical ice sheet studies in relative miniature.

11. RECOMMENDATIONS

The survey techniques were found to be satisfactory, but the following recommendations for future surveys could be summarised as follows :

1. A faster method of travel is desirable to allow time spent on survey to be more productive of usable results.

2. Ice drilling is satisfactory with the drill developed for the Wilkes-Vostok traverse and should be used on survey where seismic reflection results are required at distances greater than 300 miles from the coast because seismic record quality is improved by using shot-holes.

3. Seismic pattern shooting should yield suitable reflection results in the area within 100 miles radius from Wilkes and more experimentation is required in the area - especially into seismic noise analyses and the use of multiple geophone patterns to eliminate this noise - if the pattern shooting technique becomes the most desirable seismic survey method from logistic considerations.

4. Reliable seismic reflection data were not obtained beyond 300 miles from the coast, presumably because amplifier filters were set at too low frequencies. Magnetic tape recording is desirable to allow for a greater latitude for experimentation.

5. Wet developing for processing seismic records is time consuming, wasteful, and difficult to do. Seismic instruments producing a monitor record without requiring wet developing are desirable.

6. Owing to large and erratic drift rates of the Worden gravity meter, observed gravity data have an unusually large error. A meter with temperature compensation and with a minimum possible drift rate is desirable for more accurate gravity surveys, but the benefit of using a better gravity meter would be lost unless more accurate elevations were also obtainable.

7. Owing to the proximity of the Wilkes area to the South Magnetic Pole there are difficulties in making observations of the magnetic horizontal component and declination; however, useful data were obtained for incorporation in regional maps. Results in the Wilkes area indicate, however, that the vertical magnetic component may be conveniently observed with the La Cour BMZ instrument and usable results may be obtained. The accuracy of magnetic Z determinations would be improved if diurnal corrections could be applied, and it is suggested that two Z variometers could be used in a leapfrog method in much the same way as barometers are used to eliminate diurnal pressure changes. Even though the horizontal field strength is small, observations of the three components are necessary for determination of the complete field. It might be better to measure north and east horizontal components rather than D and H; however, special instruments would have to be developed for this.

8. Elevations determined barometrically would be more accurate if more modern micro-barometers were used rather than aircraft altimeters. Air temperatures should be read accurately at both stations every time an interval is measured because the largest error is due to inaccurate knowledge of air column temperatures. These temperature errors are considerable at low air column temperature.

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APPENDIX 1

Table of work completed

The following is a summary of the field geophysical work done between December 1961 and March 1963 :

Seismic

Ice thickness measurements on a traverse from Wilkes to Vostok on which 20 seismic stations were established, 19 being between 288 miles and 815 miles from Wilkes at approximately 30-mile intervals. Two refraction profiles were obtained at 572 and 815 miles from Wilkes.

Gravity

1. Survey of Windmill Island area establishing 26 stations.
2. Traverse south-east of Wilkes in area north of Totten Glacier reading 84 gravity stations.
3. Traverse Wilkes to Vostok reading stations at approximately 1-mile intervals to distance 354 miles from Wilkes, then 3-mile intervals to Vostok. Total 464 stations.
4. Gravity tie Wilkes - Lewis Islet - Chick Islet - Macquarie Island - Melbourne.

Gravity data are filed under Nos. 62550 and 62551 in BMR Gravity Group.

Magnetic

La Cour QHM and BMZ readings on Wilkes-Vostok traverse.

H : 27 stations

Z : 35 stations

D : 45 stations

Elevations

1. Traverse south-east of Wilkes in area north of Totten Glacier. 423 stations.
2. Traverse Wilkes to Vostok. 490 stations.

Drilling

Mechanical drilling of holes for seismic and glaciological purposes.

29 holes drilled

Total footage 4461 ft

Greatest depth drilled 279 ft

APPENDIX 2

Geophysical equipment

Seismic

HTL 7000B Amplifiers - 12-channel system with TIC 25-trace, 6-inch oscillograph camera.

Geophones 26 TIC 20 c/s

30 SIE 5 c/s vertical component

6 SIE 5 c/s horizontal component

5 portable 1500-ft vector cables on breast reels.

SIE type SCD 2000A blaster.

Gravity

Worden No. 140 geodetic meter.

Master Worden No. 568 geodetic meter.

Magnetic

La Cour BMZ vertical component magnetometer
La Cour QHM horizontal component magnetometer (both magnetometers modified for Antarctic use).

Elevations

Two banks of three aircraft altimeters manufactured by National Instrument Co., Australia,
Two Askania micro-barometers model GB5.
Anemometer. U.S. Navy type AN/PMQ-3A
Thermometers. (Wecksler) +40°F to -120°F
(used by U.S. Weather Bureau)

Drilling

Proline (Adelaide, Australia) HDBA7 borer.
An auger drill which was modified to have mechanical drive and hydraulic lift and was capable of depths to 300 ft using a 3½ inch diameter bit.
Drill stem, 93 augers 3 ft x 3½" O.D. (weight 20 lb).
Drilling bits, 2 cutter and 4 cutter type - size range 3½" O.D. to 3⅞" O.D.

APPENDIX 3

Operational details of the Totten Glacier survey

Duration March 1st - March 23rd 1963.

Traverse party

A total of four men :

O.I.C. Navigator and radio operator
Geophysicist and navigator
2 mechanics

Equipment

2 D4 Caterpillar Tractors
1 Weasel
Large four-man caravan
Large Otago sledge, 10-ton capacity
1 small American sledge 1½-ton capacity
1 small Norwegian sledge 2½-ton capacity

Statistics

No. of days	23
No. of days lost through blizzard	7
No. of days stopped for work	1
No. of days travelling	15
Distance traversed	335 miles
Average miles covered on travel days	22.3
Average rate on good travel days (miles per hour)	2.9
Average rate all travel days (miles per hour)	2.73
Weasel fuel consumption petrol (miles per gallon)	3 approx.
D4 Tractor fuel consumption aviation turbine kerosene (miles per gallon)	2 approx.
No. of elevation stations read	423
No of gravity stations read	84
Average temperature while travelling	+11.3°F
Average wind speed while travelling	9 knots

APPENDIX 4

Operational details of the Wilkes-Vostok traverse

Duration September 17th - January 14th 1963

Traverse Party

A total of six men :

O.I.C., navigator and radio operator
Meteorologist and navigator
2 mechanics
Glaciologist
Geophysicist

Equipment

2 D4 Caterpillar Tractors
2 Weasels
Large four-man caravan and sledge
Small two-man caravan and sledge
Ice drill and sledge
2 American sledges 1½-ton capacity
4 Norwegian sledges 2½-ton capacity

Statistics

No. of days		120
No. of days lost through blizzard		25
No. of days stopped for work		22
No. of days travelling		73
Distance traversed		1774 miles
Average miles covered on travel days		24.3 miles/day
Average Weasel fuel consumption petrol		2 to 3 m.p.g.
Average D4 Tractor fuel consumption aviation turbine kerosene		1.3 m.p.g.
No. of elevation stations		490
No. of gravity stations		464
No. of H magnetic stations		27
No. of Z magnetic stations		35
No. of D magnetic stations		45
No. of seismic reflection stations		20
No. of seismic refraction profiles		2
No. of seismic shots		60
Explosive used		647 lbs
Electric detonators used (30-ft leads)		125
Linagraph 480 recording paper (15 cm x 200 ft) used		8 rolls
Acid fixer (1-gallon pkts) used		6 pkts
Dektol developer (1-gallon tins) used		13 tins
Firing line used		900 yds
Holes drilled		21
Total footage drilled		3636
Maximum temperature recorded (Jan 8th 1963 at 108 miles)		+29.1°F
Minimum temperature recorded (Oct 27th 1962 at 486 miles)		-82.2°F
Average temperature,	September 1962	-7.4°F
	October	-26.9°F
	November	-32.6°F
	December	-21.1°F
	January 1963	+15.3°F
Average wind speed,	September 1962	19 knots
	October	14 knots
	November	7 knots
	December	6 knots
	January 1963	12 knots

TABLE 1

Windmill Islands survey

Gravity reductions

Station	Latitude South	Longitude East	Elevation (feet)	Observed gravity (mgal)	Normal gravity (mgal)	Free air corr. (mgal)	Free air anomaly (mgal)	Bouguer Correction (mgal)	Bouguer anomaly (mgal)
				982	982		+		+
Wilkes	66°15.5	110°31.9	36	399.60	379.74	3.39	23.25	1.23	22.02
W1	66°01.1	111°04.3	50	385.35	363.68	4.70	26.37	1.70	24.67
W2	66°01.3	111°05.9	37	385.29	363.89	3.48	24.88	1.26	23.62
W3	66°00.1	111°07.1	127	380.81	362.56	11.95	30.20	4.33	25.87
W4	66°00.1	111°05.2	63	383.67	362.56	5.93	27.04	2.15	24.89
W5(ice)	66°01.2	111°08.2	62	385.29	363.78	5.83	27.34	0.69	26.65
W6(ice)	66°08.6	110°45.4	314	359.85	372.06	29.53	13.32	3.52	9.80
W7	66°13.09	110°38.65	77	393.54	377.05	7.24	23.73	2.62	21.11
W8	66°27.95	110°30.83	49	419.12	393.55	4.61	30.18	1.67	28.51
W9	66°22.20	110°26.70	7	414.96	387.16	0.66	28.46	0.24	28.22
W10	66°24.07	111°23.72	7	408.51	389.25	0.66	19.92	0.24	19.68
W11	66°25.83	110°24.40	8	412.36	391.22	0.75	21.89	0.27	21.62
W12	66°28.96	110°29.80	10	417.43	394.66	0.94	23.71	0.34	23.37
W13	66°29.64	110°32.99	10	419.09	395.42	0.94	24.61	0.34	24.27
W14	66°26.87	110°32.07	9	415.30	392.37	0.85	23.78	0.31	23.47
W15	66°27.72	110°35.07	10	414.31	393.31	0.94	21.94	0.34	21.60
W16	66°28.33	110°38.20	9	415.19	393.97	0.85	22.07	0.31	21.76
W17	66°25.06	110°41.00	7	410.69	390.36	0.66	20.99	0.24	20.75
W18	66°24.72	110°36.60	8	408.62	389.99	0.75	19.38	0.27	19.11
W19	66°24.83	110°33.15	8	409.16	390.10	0.75	19.81	0.27	19.54
W20	66°25.24	110°28.04	6	418.62	390.57	0.56	28.61	0.20	28.41
W21	66°23.72	110°30.79	7	412.51	388.86	0.66	24.31	0.24	24.07
W22	66°22.19	110°30.82	6	419.02	387.16	0.56	32.42	0.20	32.22
W23	66°22.35	110°33.93	5	418.82	387.33	0.47	31.96	0.17	31.79
W24	66°14.38	110°34.24	10	399.02	378.47	0.94	21.49	0.34	21.15
W25	66°11.05	110°24.87	30	394.14	374.79	2.82	22.17	1.02	21.15
W26	66°11.85	110°23.10	79	389.56	375.69	7.43	21.30	2.69	18.61

Note. All stations were established on rock except those indicated (ice), which were established on the plateau surface.

Date of survey : 17/1/62, 27/1/62, 8/2/62, 13/5/62. Meter : Worden no. 140

Calibration factor : 0.111126 mgal/div. Datum : Sea level

Density factor : Rock 2.67 g/cm^3
Ice 0.88 g/cm^3

TABLE 2

Totten Glacier survey

Gravity reductions

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thickness (feet)
		66°	110°		982,				
	Base peg	15.5	31.9	37	399.6	23.3	22.9	+36	0
T1	3.2 p	16.9	36.5	460	364.6	26.5	21.4	+460	0
84	4.9 S.1pole	17.0	40.2	860	332.5	32.0	22.4	+570	290
2	7.2 drums	17.4	45.1	1190	304.0	34.1	20.8	+520	670
3	10.4 bRpd	18.4	51.0	1510	275.9	34.9	18.1	+420	1090
83	12.4 d	19.1	55.0	1660	258.9	31.2	12.7	+100	1560
		66°	111°						
4	15.3 bBd	20.3	0.9	1850	245.8	34.7	14.1	+70	1780
82	17.9 d	21.0	6.0	2030	230.9	36.0	13.4	+40	1990
5	20.7 bR	21.9	11.2	2200	216.0	36.1	11.6	-100	2300
81	23.4 d	22.9	16.6	2360	202.2	36.1	9.8	+30	2330
6	25.7 bBd	23.9	21.0	2520	188.8	36.7	8.6	+190	2330
80	28.2 d	24.0	26.4	2670	176.8	38.8	9.1	+410	2260
7	30.6 bR	24.2	32.2	2810	163.3	38.2	7.0	+500	2310
79	33.4 dp	25.1	38.0	2960	147.1	35.1	2.1	+500	2460
8	35.6 bRp	25.9	42.0	3070	133.7	31.1	-3.0	+450	2620
9	40.6 bB	27.6	51.7	3320	100.6	19.7	-17.3	+200	3120
		66°	112°						
10	45.6 bB	28.9	1.8	3580	78.9	21.1	-18.8	+520	3060
11	50.8 pipe (S-2)	30.7	12.8	3830	50.2	13.8	-28.8	+440	3390
12	bB462	32.2	17.1	3960	39.4	13.6	-30.5		
13	bB464	34.8	25.3	4140	27.7	16.0	-30.1		
14	bB466	37.6	33.6	4240	17.4	12.1	-35.1		
15	bB468	40.5	41.8	4430	14.5	23.8	-25.5		
16	bB470	43.4	50.1	4520	16.7	31.2	-19.1		
17	bB472	46.2	58.5	4500	33.1	42.8	-7.3		
		66°	113°						
18	bB474	49.0	6.8	4290	43.7	30.6	-17.2		
19	bB476	51.8	15.2	4180	66.9	40.4	-6.2		
20	bB478	54.6	23.6	3960	102.5	52.1	8.1		
21	bB480	57.4	32.1	3710	131.9	55.0	13.7		
22	bR481	58.6	36.4	3540	130.0	35.8	-3.6		
		67°	113°						
29	bB482	0.1	40.6	3420	168.8	61.7	23.6		
23	bR483	1.5	44.8	3220	199.5	72.1	36.3		
24	bB484	2.8	49.0	3060	229.2	85.3	51.2		
28	bR485	4.2	53.4	2860	247.2	83.1	51.2		

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (ft)
T25	bB486	5.6	57.8	2620	272.2	83.9	54.7		
		67°	114°						
26	bRd487	7.1	2.2	2310	301.2	82.2	56.4		
		67°	113°						
27	bB488	9.1	59.8	2040	317.8	71.2	48.5		
		66°	113°						
30	N.M.	59.5	31.0	3700	126.4	46.3	5.1		
		67°	113°						
31	"	1.5	30.0	3590	166.4	73.8	33.9		
32	"	3.6	28.8	3470	183.1	76.9	38.2		
33	"	5.6	27.7	3290	210.1	84.8	48.1		
34	"	7.7	25.8	3040	238.5	87.4	53.5		
35	"	9.7	24.0	2840	253.6	81.6	50.0		
36	"	11.8	22.2	2610	276.1	80.2	51.1		
37	"	13.8	20.4	2420	289.9	73.9	47.0		
38	"	15.9	18.5	2050	307.4	54.3	31.5		
39	Camp	15.2	16.5	2210	298.7	61.5	36.8		
40	N.M.	13.5	14.4	2610	274.6	76.8	47.8		
41	"	11.6	14.4	2840	256.7	82.6	51.0		
42	"	11.0	12.8	2910	242.2	75.4	43.0		
43	Camp	10.1	10.0	3040	227.4	73.8	39.9		
		67°	112°		982,				
44	Camp	9.8	9.5	3060	227.1	75.7	41.6		
45	N.M.	8.1	4.9	3160	214.6	74.4	39.3		
46	"	7.0	2.1	3250	197.2	66.7	30.5		
		67°	112°						
47	"	5.6	58.8	3400	182.3	67.3	29.5		
48	"	3.8	54.0	3630	149.3	57.9	17.5		
49	Camp	1.3	47.0	3890	120.4	56.2	12.9		
50	N.M.	1.3	35.9	3860	127.8	60.8	17.8		
51	"	1.3	24.8	3750	155.2	77.8	36.1		
55	50bsd	13.3	11.9	2800	239.0	59.3	28.1	-3440	6240
56	48bBsd489	11.6	12.0	2920	239.8	73.2	40.7	-2930	5850
57	46bRsd490	9.9	12.1	3010	229.8	73.6	40.1	-2500	5510
54	45bBs491	9.0	12.2	3050	229.9	78.4	44.5	-2230	5280
58	43 s	7.3	12.3	3150	221.6	81.3	46.2	-2000	5150
53	40bBsd494	4.7	12.5	3260	207.7	80.5	44.2	-1770	5030
59	38 s	3.0	12.6	3380	191.2	77.2	39.5	-1360	4740
52	36 sB	1.3	12.7	3450	184.9	79.3	40.9	- 800	4250
60	35 sd	0.4	12.7	3490	177.4	76.5	37.7	- 740	4230
		66°	112°						
61	33 s	58.7	12.8	3600	158.8	70.1	30.0	- 560	4160

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
T62 30	sd	56.0	12.8	3650	136.4	55.4	14.7	-470	4120
63 29	sd	55.0	12.8	3690	132.4	56.2	15.1	-150	3840
64 28	s camp	54.0	12.8	3720	131.5	59.2	17.8	+200	3520
65 26	s	52.0	12.8	3820	117.6	56.9	14.4	+460	3360
66 25	s	51.1	12.8	3850	107.5	50.6	7.7	+510	3340
67 23	sd	49.4	12.8	3910	92.4	43.0	-0.5	+590	3320
68 21	bR496	47.8	12.8	3970	85.1	43.1	-1.1	+1020	2950
69 20	s	47.0	12.8	3950	83.5	40.5	-3.5	+1260	2690
70 18	s	45.4	12.8	3990	81.5	44.1	-0.4	+1290	2700
71 16	s	43.8	12.8	3950	76.0	36.5	-7.4	+1140	2810
72 14	s	42.1	12.8	3950	75.3	37.7	-6.3	+1280	2670
73 12	s	40.5	12.8	3990	66.9	34.8	-9.6	+1230	2760
74 10	s	38.8	12.8	3970	61.4	29.3	-14.9	+960	3010
75 8	s	37.2	12.8	3950	57.1	24.8	-19.2	+790	3160
76 6	s	35.6	12.8	3930	51.7	19.4	-24.4	+600	3330
77 4	s	34.1	12.8	3910	48.3	15.7	-27.8	+530	3380
78 2	s	32.5	12.8	3890	47.0	14.3	-29.0	+600	3290

For Bouguer corrections, a density of 0.88 g/cm^3 (that of ice) for material between surface and sea level is assumed.

Station description legend

First number : Miles (between Wilkes and S-2 : route miles from Wilkes (South of S-2 : route miles south)

Last number : Accumulation bamboo number

b : Bamboo accumulation marker

R : Red flag

B : Black flag

s : Stake accumulation marker

p : Small wooden peg or pegs

d : Fuel drum or drums

N.M. : No marker

TABLE 3

Wilkes - Vostok traverse

Gravity reductions

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
		66°	110°		982,				
0	Base peg	15.5	31.9	37	399.6	23.3	22.9	+37	0
V1	3.2 p	16.9	36.5	460	364.6	26.5	21.4	+460	0
2	10.4 bRdp	18.4	51.0	1510	275.9	34.9	18.1	+420	1090
3	15.3 bBd	20.3	0.9	1850	245.8	34.7	14.1	+60	1790
4	18.1 camp	21.0	6.5	2040	229.8	35.8	13.1	+40	2000
5	20.7 bR	21.9	11.2	2200	216.0	36.1	11.6	-100	2300
6	22.2 N.M.	22.5	14.5	2290	207.5	35.4	9.9	-30	2320
7	24.8 d	23.2	18.9	2460	194.6	37.7	10.3	+120	2340
8	25.7 bBd	23.9	21.0	2520	188.8	36.7	8.6	+200	2320
9	27.0 d	24.0	23.8	2590	181.5	36.0	7.1	+300	2290
10	29.6 sign	24.1	29.6	2750	168.9	38.3	7.7	+490	2260
11	30.6 bR	24.2	32.2	2810	163.3	38.2	7.0	+500	2310
12	33.2 d	25.1	37.4	2950	148.5	35.5	2.7	+510	2440
13	34.6 N.M.	25.5	40.3	3020	140.1	33.3	-0.3	+480	2540
14	35.6 bRp	25.9	42.0	3070	133.7	31.1	-3.0	+450	2620
15	37.1 N.M.	26.3	45.0	3160	124.2	29.7	-5.5	+340	2820
16	38.3 d	26.7	47.5	3210	117.7	27.4	-8.3	+280	2930
17	40.6 bB	27.6	51.7	3320	100.6	19.7	-17.3	+200	3120
18	42.3 d	27.9	55.2	3370	101.9	25.4	-12.1	+270	3100
19	43.3 d	28.1	57.5	3470	91.9	24.6	-14.1	+360	3110
		66°	112°						
20	44.7 d	28.5	0.2	3510	84.4	20.4	-18.7	+450	3060
21	45.6 bB	28.9	1.8	3580	78.9	21.1	-18.8	+520	3060
22	47.0 flag	29.2	4.7	3650	68.2	16.5	-24.1	+510	3140
23	48.8 d	29.9	8.0	3720	61.7	15.8	-25.6	+490	4210
24	50.0 N.M. (S-2)	30.3	10.6	3780	54.7	14.1	-27.9	+460	3320
25	50.8 pipe	30.7	12.8	3830	50.2	13.8	-28.8	+440	3390
26	S-2+1s	31.7	12.8	3870	51.3	17.6	-25.5	+600	3270
27	5 s	34.8	12.8	3920	49.6	17.2	-26.4	+520	3400
28	7 s	36.4	12.8	3940	54.6	22.4	-21.5	+710	3230
29	9 s	38.0	12.8	3960	59.4	27.2	-16.9	+890	3070
30	10 s	38.8	12.8	3970	61.4	29.3	-14.9	+960	3010
31	11 s	39.6	12.8	3980	63.9	31.8	-12.5	+1030	2950
32	13 s	41.3	12.8	3990	74.2	41.2	-3.2	+1440	2550
33	15 s	42.9	12.8	3950	74.7	36.2	-7.7	+1170	2780

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
V34	17 s	44.6	12.8	3950	77.4	37.1	-6.9	+1190	2760
35	19 s	46.2	12.8	3950	84.7	42.6	-1.3	+1370	2580
36	20 s	47.0	12.8	3950	83.5	40.5	-3.5	+1260	2690
37	22 s	48.6	12.8	3930	87.7	41.0	-2.7	+820	3110
38	24 s	50.3	12.8	3860	97.8	42.8	-0.2	+390	3470
39	25 s	51.1	12.8	3850	107.5	50.7	7.8	+510	3340
40	27 s	52.9	12.8	3770	128.0	61.6	19.6	+520	3250
41	30 s	56.0	12.8	3650	136.4	55.4	14.7	-470	4120
42	31 s	57.0	12.8	3640	144.0	61.0	20.5	-440	4080
43	32 s	57.8	12.8	3620	149.0	63.2	22.9	-600	4220
44	34 s	59.6	12.8	3550	169.4	75.0	35.5	-540	4090
		67°	112°						
45	35 s	0.4	12.8	3490	177.4	76.5	37.7	-740	4230
46	36 s	0.4	12.7	3450	184.9	80.3	41.9	-800	4250
47	37 s	2.2	12.6	3420	185.6	76.2	38.1	-1220	4640
48	39 s	3.8	12.6	3340	199.9	81.2	44.0	-1470	4810
49	40 s	4.7	12.5	3260	207.7	80.5	44.2	-1770	5030
		67°	112°		982,				
V50	S-2+41 s	5.6	12.4	3260	207.3	79.3	43.0	-1880	5140
51	42 s	6.4	12.3	3190	216.0	80.4	44.9	-1920	5110
52	44 s	8.2	12.2	3080	227.2	79.4	45.1	-2100	5180
53	45 s	9.0	12.2	3050	229.9	78.3	44.3	-2230	5280
54	47 s	10.8	12.1	2980	228.5	68.5	35.3	-2810	5790
55	49 s	12.4	12.0	2830	242.5	66.6	35.1	-3050	5880
56	50 s	13.3	11.9	2800	239.0	59.3	28.1	-3440	6240
57	51 s	14.2	11.9	2800	234.8	54.2	23.1	-3730	6530
58	53 s	15.9	12.0	2770	218.3	33.0	2.1	-4810	7580
59	54 s	16.8	12.1	2750	211.7	23.5	-7.1	-5330	8080
60	55 s	17.6	12.1	2730	203.7	12.8	-17.6	-5890	8620
61	56 s	18.5	12.1	2740	185.8	-5.2	-35.7	-6720	9460
62	57 s	19.4	12.2	2720	163.6	-30.2	-60.5	-7800	10520
63	58 s	20.2	12.2	2740	145.3	-47.5	-78.0	-7770	10510
64	59 s	21.1	12.3	2770	134.8	-56.2	-87.0	-7700	10470
65	60 s	22.0	12.3	2780	131.1	-59.8	-90.8	-7700	10480
66	61.2 N.M.	23.0	12.4	2780	131.8	-60.2	-91.1	-7640	10420
67	62 N.M.	23.7	12.5	2790	134.7	-57.1	-88.2	-7420	10210
68	63 N.M.	24.6	12.6	2800	139.2	-52.7	-83.8	-7140	9940
69	64 N.M.	25.6	12.8	2810	146.0	-46.0	-77.3	-6770	9580
70	65 N.M.	26.5	12.9	2820	152.1	-39.8	-71.2	-6410	9230
71	66 N.M.	27.3	13.0	2830	161.2	-30.8	-62.3	-5930	8760
72	67 N.M.	28.3	13.1	2850	175.8	-15.3	-47.0	-5160	8010

Station No.	Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
V73	68 N.M.	29.2	13.2	2870	180.9	-9.3	-41.2	-4840	7710
74	69 N.M.	30.1	13.3	2890	192.9	3.6	-28.5	-4160	7050
75	72.7 N.M.	33.0	13.7	3180	200.8	35.8	0.4	-2410	5590
76	73.7 N.M.	33.8	13.8	3190	201.0	35.9	0.4	-2320	5510
77	74.7 N.M.	34.7	13.9	3200	201.7	36.7	1.1	-2210	5410
78	75.7 N.M.	35.6	14.3	3240	199.8	37.6	1.5	-2090	5330
79	76.7 N.M.	36.4	14.6	3260	201.9	40.7	4.4	-1870	5130
80	77.7 N.M.	37.3	15.0	3280	202.0	41.8	5.3	-1740	5020
81	78.8 N.M.	38.3	15.4	3300	202.3	42.9	6.2	-1620	4920
82	79.7 N.M.	39.0	15.7	3250	210.2	45.3	9.2	-1420	4670
83	80 Camp	39.3	15.8	3230	213.9	46.8	10.9	-1370	4600
84	82.2 N.M.	41.2	15.6	3620	190.5	58.1	17.8	-900	4520
85	84 N.M.	42.8	15.3	3670	183.9	54.6	13.8	-1070	4740
86	86 N.M.	44.5	15.0	3750	172.2	48.6	6.9	-1330	5080
87	88 N.M.	46.2	14.7	3790	163.6	41.9	-0.3	-1650	5440
88	90 N.M.	47.9	14.4	3880	160.9	45.7	2.5	-1790	5670
89	92 s	49.7	14.0	3990	141.6	35.1	-9.4	-2050	6040
90	94 s	51.4	13.7	4020	141.7	36.1	-8.6	-2000	6020
91	98 b	54.8	13.1	4210	126.0	34.7	-12.2	-2100	6310
92	99 b	55.7	13.0	4240	129.9	40.6	-6.6	-1900	6140
93	100 b	56.6	12.8	4240	130.8	40.6	-6.6	-1890	6130
94	101 b	57.4	12.7	4270	126.1	37.7	-9.8	-2050	6320
95	102 b	58.3	12.5	4370	122.4	42.6	-6.1	-1900	6270
96	103 b	59.2	12.4	4440	118.4	44.2	-5.2	-1760	6200
		68°	112°						
97	104 b	0.1	12.2	4470	115.4	43.0	-6.7	-1780	6250
98	105 b	1.0	12.2	4490	115.2	43.7	-6.3	-1720	6210
99	106 b	2.0	12.2	4490	118.2	45.8	-4.2	-1650	6140
		68°	112°		982,				
V100	S-2+107b	2.9	12.2	4570	115.9	50.0	-0.9	-1400	5970
101	108 b	3.8	12.0	4680	108.6	52.1	-0.0	-1340	6020
102	109 s	4.8	11.8	4760	102.8	52.8	-0.2	-1300	6060
103	111 b	6.5	11.4	4770	99.6	48.7	-4.4	-1460	6230
104	112 b	7.4	11.2	4800	99.4	50.4	-3.1	-1400	6200
105	114 b	9.4	10.7	4920	88.8	49.0	-5.8	-1480	6400
106	115 b	10.2	10.5	4860	94.0	47.7	-6.4	-1520	6380
107	116 b	11.1	10.3	4800	101.5	48.7	-4.8	-1420	6220
108	117 b	12.1	10.1	4850	100.4	51.3	-2.7	-1360	6210
109	118 b	13.1	9.9	4950	93.2	52.4	-2.7	-1320	6270
110	119 b	13.9	9.7	5030	83.6	49.5	-6.5	-1500	6530
111	120 b	14.9	9.5	5070	76.6	45.2	-11.2	-1600	6670
112	121 bs	16.1	9.2	5140	70.8	44.8	-12.4	-1660	6800

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
113	124b	18.7	8.6	5260	56.0	38.5	-20.1	-1880	7140
114	125b	19.6	8.4	5220	52.0	29.9	-28.3	-2120	7340
115	126s	20.5	8.2	5200	48.0	23.1	-34.8	-2520	7720
116	127bs	21.3	8.0	5250	43.6	22.4	-36.0	-2620	7870
117	128N.M.	22.2	7.5	5290	41.6	23.3	-35.6	-2620	7910
118	129b	23.1	7.1	5300	43.1	24.9	-34.1	-2520	7820
119	130b	24.0	6.6	5400	37.1	27.4	-32.7	-2400	7800
120	131b	24.8	6.3	5460	30.1	25.1	-35.7	-2400	7860
121	132s	25.7	6.0	5470	26.4	21.5	-39.4	-2620	8090
122	133b	26.7	5.6	5460	25.5	18.6	-42.1	-2780	8240
123	134b	27.5	5.3	5460	26.0	18.3	-42.5	-2800	8260
124	135s	28.4	4.9	5470	26.0	18.3	-42.6	-2780	8250
125	136b	29.3	4.6	5510	25.9	21.0	-40.3	-2720	8230
126	137sb	30.1	4.3	5560	23.1	22.0	-39.9	-2600	8160
127	138s	31.0	4.0	5660	19.6	27.0	-36.0	-2440	8100
128	139s	31.9	3.6	5690	14.4	23.7	-39.6	-2500	8190
129	140s	33.1	3.2	5800	8.5	27.0	-37.6	-2350	8150
130	140.6 Camp	33.5	3.1	5810	10.7	29.7	-35.0	-2200	8010
131	142b	34.7	2.6	5810	12.1	29.9	-34.8	-2120	7930
132	144b	36.4	1.9	5860	15.2	36.0	-29.3	-1900	7760
133	147bs	39.5	1.2	6000	5.0	35.7	-31.1	-1860	7860
134	148sbd	40.3	1.0	6040	1.4	35.1	-32.2	-1920	7960
					981,				
135	149b	41.1	0.8	6070	996.9	32.5	-35.0	-2000	8070
136	150s	42.1	0.6	6120	993.0	32.4	-35.8	-2020	8140
137	151b	43.0	0.4	6140	992.0	32.3	-36.1	-2040	8180
138	152s	43.9	0.2	6170	988.3	30.5	-38.2	-2020	8190
139	153s	44.7	0.0	6280	979.7	31.5	-38.4	-2020	8300
		68°	111°						
140	154sb	45.6	59.8	6350	968.2	25.6	-45.1	-2280	8630
141	156b	47.2	59.3	6360	962.1	18.8	-52.0	-2540	8900
142	158b	48.7	58.9	6330	964.3	16.7	-53.8	-2640	8970
143	159s	49.6	58.6	6350	964.0	17.4	-53.3	-2620	8970
144	160bd	50.5	58.5	6390	961.6	17.9	-53.3	-2540	8930
145	162s	52.3	58.0	6480	956.3	19.2	-52.9	-2500	8980
146	163s	53.2	57.6	6500	954.7	18.5	-53.9	-2480	8980
147	164sb	54.1	57.1	6530	953.0	18.6	-54.1	-2520	9050
148	165s	55.0	56.7	6570	948.4	16.9	-56.2	-2560	9130
149	165.6Camp	55.7	56.4	6600	945.6	16.3	-57.2	-2580	9180

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
		68°	111°		981,				
V150	S-2+167s	56.8	56.7	6640	942.8	16.1	-57.8	-2580	9220
151	169s	58.5	57.0	6570	951.1	16.2	-57.0	-2580	9150
152	170s	59.3	56.6	6570	957.5	21.7	-51.5	-2400	8970
		69°	111°						
153	171s	0.2	56.3	6580	965.2	29.6	-43.7	-1880	8460
154	173s	2.0	55.5	6700	968.8	42.5	-32.1	-1200	7900
155	174s	2.8	55.2	6760	966.1	44.6	-30.7	-1160	7920
156	175s	3.7	54.3	6800	963.7	45.1	-30.6	-1160	7960
157	176s	4.5	53.5	6830	962.7	46.1	-29.9	-1120	7950
158	177s	5.4	54.2	6890	961.1	49.2	-27.5	-960	7850
159	178s	6.2	54.8	6930	957.6	48.7	-28.5	-1000	7930
160	179s	7.1	53.0	6970	952.3	46.3	-31.3	-1100	8070
161	180s	8.0	54.0	7000	949.7	45.6	-32.3	-1180	8180
162	181s	9.0	55.2	6990	950.1	44.0	-33.8	-1200	8190
163	182s	10.0	55.2	6990	951.5	44.4	-33.4	-1180	8170
164	183s	10.9	55.1	7010	951.3	45.2	-32.8	-1160	8170
165	184s	11.7	55.0	7030	949.5	44.5	-33.8	-1160	8190
166	185s	12.6	55.1	7080	946.2	45.0	-33.8	-1160	8240
167	186s	13.5	55.0	7110	943.0	43.7	-35.4	-1200	8310
168	187s	14.3	55.0	7150	940.3	43.9	-35.7	-1200	8350
169	188s	15.2	55.0	7170	938.3	43.0	-36.9	-1220	8390
170	189s	16.1	55.0	7180	937.3	42.0	-37.9	-1280	8460
171	190s	16.9	55.0	7190	936.4	41.2	-38.9	-1320	8510
172	191s	17.8	55.0	7190	935.6	39.5	-40.5	-1400	8590
173	192s	18.7	55.0	7220	933.8	39.7	-40.7	-1420	8640
174	193s	19.6	55.0	7240	931.8	38.7	-41.9	-1460	8700
175	194s	20.4	55.0	7240	931.0	37.0	-43.6	-1480	8720
176	195s	21.3	54.5	7250	929.9	35.9	-44.8	-1560	8810
177	196s	22.2	54.5	7260	929.4	35.5	-45.4	-1620	8880
178	197s	23.1	54.5	7270	929.7	35.9	-45.0	-1580	8850
179	198s	24.0	54.5	7270	931.2	36.6	-44.4	-1560	8830
180	199s	24.9	54.5	7260	932.6	36.0	-44.8	-1540	8800
181	200s	25.8	54.5	7240	936.2	36.9	-43.7	-1550	8790
182	201s	26.6	54.5	7200	942.2	38.3	-41.9	-1360	8560
183	202s	27.5	54.5	7140	950.1	39.8	-39.7	-1260	8400
184	203s	28.3	54.5	7220	947.1	43.4	-37.0	-1200	8420
185	204s	29.1	54.5	7320	939.2	44.1	-37.4	-1280	8600
186	205s	30.0	54.5	7380	932.8	42.5	-39.6	-1280	8660
187	206s	30.8	54.5	7410	931.8	43.5	-39.0	-1240	8650
188	207s	31.7	54.4	7430	931.0	43.7	-39.0	-1380	8810

Station No.	Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
189	208 N.M.	32.6	54.3	7450	931.4	45.2	-37.7	-1360	8810
190	209s	33.4	54.2	7480	930.4	46.2	-37.1	-1340	8820
191	210s	34.3	54.1	7500	929.7	46.5	-37.0	-1260	8760
192	211s	35.2	54.0	7520	929.2	46.9	-36.8	-680	8200
193	212s	36.0	53.9	7530	939.9	57.7	-26.2	-1060	8590
194	213s	37.0	53.8	7540	930.6	48.4	-35.5	-1000	8540
195	214s	37.9	53.6	7570	930.1	49.9	-34.4	-1020	8590
196	215s	38.8	54.5	7590	928.8	49.6	-34.9	-980	8570
197	216.1 N.M.	39.7	54.4	7620	927.9	50.5	-34.3	-980	8600
198	217s	40.5	53.3	7650	926.2	50.9	-34.3	-980	8630
199	218s	41.4	53.2	7680	923.7	50.5	-35.1	-980	8660
		69°	111°		981,				
V200	S-2+219s	42.3	53.1	7690	922.0	48.7	-36.9	-1060	8750
201	220s	43.2	53.0	7690	922.4	48.2	-37.4	-1080	8770
202	221 N.M.	44.0	53.0	7690	924.3	49.3	-36.3	-1000	8690
203	222s	45.1	53.0	7710	924.4	50.2	-35.7	-980	8690
204	223s	46.0	52.0	7710	925.0	49.9	-35.9	-1000	8710
205	224s	46.8	51.9	7710	927.3	51.5	-34.4	-920	8630
206	225s	47.7	51.9	7700	931.3	53.7	-32.0	-840	8540
207	226s	48.6	51.8	7680	937.2	56.9	-28.6	-700	8380
208	227s	49.5	51.7	7770	933.7	61.0	-25.5	-520	8290
209	228s	50.3	51.6	7930	920.8	62.3	-26.0	-420	8350
210	229s	51.1	51.5	8030	908.1	58.1	-31.3	-640	8670
211	230s	52.0	51.5	8080	898.3	52.1	-37.8	-900	8980
212	230.5 N.M.	52.4	51.4	8070	895.6	48.2	-41.7	-1080	9150
213	232s	53.7	51.3	8050	894.9	44.3	-45.3	-1260	9310
214	233s	54.6	51.2	8070	893.4	43.9	-45.9	-1280	9350
215	234s	55.4	51.2	8070	892.8	42.4	-47.4	-1330	9400
216	235s	56.3	51.1	8070	893.5	42.3	-47.6	-1320	9390
217	236s	57.2	51.0	8060	894.6	41.6	-48.2	-1320	9380
218	238s	58.8	50.9	8090	893.5	41.7	-48.4	-1300	9390
		70°							
219	240s	0.5	50.8	8110	896.1	44.6	-45.7	-1160	9270
220	241s	1.2	50.7	8110	901.3	49.0	-41.2	-980	9090
221	242s	2.2	50.6	8110	905.3	52.1	-38.2	-720	8830
222	244s	3.8	50.5	8160	910.6	60.6	-30.3	-360	8520
223	245s	4.7	50.5	8190	911.0	62.9	-28.3	-280	8470
224	246s	5.5	50.4	8220	911.6	65.6	-26.0	-200	8420
225	247s	6.4	50.3	8240	911.1	66.1	-25.7	-160	8400
226	249s	8.2	50.2	8290	908.9	66.8	-25.5	-140	8430
227	250s	9.0	50.1	8310	908.1	67.1	-25.5	-120	8430

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
228	251s	9.9	50.1	8320	907.3	66.3	-26.3	-140	8460
229	252s	10.8	50.0	8350	905.1	66.2	-26.8	-180	8530
230	253s	11.7	49.9	8360	902.6	63.8	-29.3	-260	8620
231	254s	12.6	49.8	8400	896.7	60.7	-32.8	-420	8820
232	255s	13.4	50.7	8440	889.5	56.6	-37.4	-560	9000
233	256s	14.3	49.6	8440	886.9	53.0	-41.0	-700	9140
234	257s	15.1	49.5	8400	888.4	50.0	-43.6	-840	9240
235	258s	16.0	49.4	8390	889.8	49.6	-43.8	-860	9250
236	259s	16.8	49.3	8370	890.8	47.9	-45.3	-940	9310
237	260s	17.7	49.2	8370	890.8	47.1	-46.1	-980	9350
238	261s	18.8	49.1	8380	890.4	46.6	-46.7	-1000	9380
239	262s	19.7	49.0	8390	888.7	45.0	-48.4	-1040	9430
240	263s	20.6	48.9	8400	886.8	43.2	-50.3	-1100	9500
241	264s	21.4	48.8	8400	887.5	43.0	-50.6	-1100	9500
242	265s	22.3	48.7	8410	888.3	44.0	-49.7	-1080	9490
243	266s	23.2	48.6	8440	885.8	43.5	-50.5	-1080	9520
244	267s	24.0	48.5	8450	883.9	41.7	-52.4	-1140	9590
245	268s	24.8	48.4	8450	884.0	41.0	-53.1	-1200	9650
246	269s	25.7	48.2	8450	884.6	40.9	-53.2	-1200	9650
247	270s	26.6	48.1	8450	885.9	41.2	-52.9	-1180	9630
248	271s	27.4	48.0	8470	885.6	42.0	-52.3	-1160	9630
249	272s	28.2	48.0	8500	883.5	42.0	-52.7	-1160	9660
		70°	111°		981,				
V250	S-2+273s	29.2	47.9	8530	880.5	40.9	-54.1	-1200	9730
251	274s	30.0	47.8	8550	877.4	38.9	-56.3	-1300	9850
252	275s	30.9	47.8	8560	874.9	36.5	-58.8	-1380	9940
253	276s	31.7	47.7	8600	870.8	35.3	-60.4	-1460	10060
254	277s	32.6	47.7	8630	864.0	30.6	-65.5	-1600	10230
255	278s	33.4	47.6	8650	860.0	27.7	-68.6	-1720	10370
256	279s	34.2	47.6	8630	860.3	25.3	-70.7	-1840	10470
257	280s	35.1	47.5	8600	862.2	23.7	-72.1	-1920	10520
258	281s	35.9	47.5	8590	866.3	25.9	-69.7	-1900	10490
259	282s	36.7	47.4	8600	871.1	30.9	-64.8	-1600	10200
260	283 N.M.	38.0	47.4	8610	868.1	27.7	-68.2	-1780	10590
261	284s	38.8	47.3	8690	858.4	24.7	-72.0	-1860	10550
262	285s	39.6	47.3	8700	851.3	17.8	-79.0	-2140	10840
263	286s	40.6	47.2	8700	846.5	12.1	-84.7	-2320	11020
264	287 N.M.	41.4	47.2	8700	842.8	7.7	-89.2	-2480	11180
265	288s	42.2	47.1	8700	840.1	4.2	-92.6	-2620	11320
266	289 N.M.	43.0	47.1	8690	837.8	0.1	-96.6	-2780	11470
267	290s	43.9	47.0	8690	835.6	-2.8	-99.6	-2920	11610
268	291 N.M.	44.7	46.9	8690	833.0	-6.2	-103.0	-3100	11790
269	292s	45.5	46.8	8700	829.5	-9.5	-106.4	-3260	11960

Station No.	Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
270	293 N.M.	46.4	46.7	8720	825.7	-12.2	-109.3	-3420	12140
271	294 s	47.2	46.6	8730	821.3	-16.5	-113.7	-3580	12310
272	295 s	48.0	46.5	8730	818.1	-20.5	-117.7	-3740	12470
273	296 N.M.	48.8	46.4	8730	815.1	-24.3	-121.5	-3880	12610
274	297s	49.7	46.3	8740	811.8	-27.4	-124.7	-4040	12780
275	298s	50.5	46.2	8750	807.9	-31.1	-128.5	-4160	12910
276	299s	51.4	46.1	8750	805.1	-34.8	-132.2	-4320	13070
277	300s	52.2	46.0	8740	804.2	-37.4	-134.7	-4420	13160
	509-								
278	41501b	54.8	45.0	8690	808.6	-40.0	-136.7	-4640	13330
279	02b	57.3	44.0	8720	812.8	-35.4	-132.5	-4460	13180
280	03b	59.9	43.0	8720	823.5	-27.1	-124.2	-4060	12780
		71°	111°						
281	04b	2.5	42.0	8740	836.0	-15.1	-112.4	-3480	12220
282	05b	5.1	40.9	8840	836.2	-7.9	-106.3	-3120	11960
283	06b	7.6	39.8	8880	831.9	-10.8	-109.7	-3220	12100
284	07b	10.2	38.7	8910	825.6	-16.7	-115.9	-3440	12350
285	08b	12.7	37.6	8910	825.1	-19.5	-118.7	-3580	12490
286	09b	15.3	36.5	8920	827.3	-18.7	-118.1	-3580	12500
287	10b	17.9	35.5	8930	827.2	-20.3	-119.7	-3580	12510
288	11b	20.4	34.5	8920	828.3	-22.4	-121.7	-3640	12560
289	12b	23.0	33.4	8910	831.1	-22.9	-122.1	-3620	12530
290	13b	25.6	32.2	8920	832.9	-22.5	-121.8	-3600	12520
291	14b	28.2	31.0	8920	832.9	-24.9	-124.2	-3660	12580
292	15b	30.7	29.9	8920	836.5	-31.3	-130.6	-3960	12880
293	Camp	31.6	29.5	8920	838.8	-22.1	-121.4	-3580	12500
294	16b	32.3	28.8	8930	840.8	-19.8	-119.3	-3420	12350
295	17b	35.9	27.6	8960	841.1	-20.0	-119.7	-3420	12380
296	18b	38.5	26.4	8980	847.1	-14.4	-114.4	-3160	12140
297	19b	41.1	25.3	9000	829.3	-32.6	-132.8	-3940	12940
298	20b	43.6	24.2	9020	824.4	-38.0	-138.4	-4120	13140
299	21b	46.2	23.0	9040	819.7	-43.1	-143.7	-4320	13360
	509-	71°	111°		981,				
V300	41522b	48.8	21.9	9040	815.2	-49.9	-150.5	-4600	13640
301	23b	51.3	20.8	9040	812.1	-55.3	-155.9	-4820	13860
302	24b	53.8	19.6	9050	811.0	-57.7	-158.5	-4920	13970
303	25b	56.4	18.5	9080	809.0	-59.2	-160.3	-5020	14100
304	26b	58.9	17.4	9110	805.6	-62.0	-163.4	-5100	14210
305	Camp	59.8	17.0	9120	804.2	-63.2	-164.8	-5160	14280

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
		72°	111°		981,				
306	27b	1.6	16.1	9140	802.3	-64.8	-166.5	-5220	14360
307	28b	4.3	14.9	9140	801.0	-68.6	-170.3	-5320	14460
308	29b	7.0	13.6	9170	800.7	-68.3	-170.4	-5380	14550
309	30b	9.7	12.3	9210	796.4	-71.3	-173.8	-5420	14630
310	31b	12.4	11.0	9180	798.6	-74.3	-176.5	-5580	14760
311	32b	14.9	9.9	9090	807.[illegible]	-75.6	-176.8	-5620	14710
312	N.M.	16.1	9.3	9090	812.6	-72.0	-173.2	-5540	14630
313	33b	17.5	8.7	9150	809.7	-70.5	-172.3	-5420	14570
314	N.M.	18.7	8.1	9210	805.7	-69.9	-172.4	-5400	14610
315	34b	20.0	7.5	9220	805.5	-70.2	-172.9	-5400	14620
316	35b	22.5	6.4	9240	805.9	-70.1	-173.0	-5380	14620
317	Camp	23.3	6.0	9250	805.0	-70.9	-173.8	-5380	14630
318	36b	25.0	5.2	9260	802.1	-74.2	-177.3	-5460	14720
319	37b	27.6	4.1	9260	795.4	-83.2	-186.3	-5800	15060
320	38b	30.1	2.9	9250	794.5	-87.3	-190.3	-6000	15250
321	39b	32.7	1.8	9250	794.2	-89.7	-192.7	-6140	15390
322	40b	35.2	0.7	9290	787.5	-94.9	-198.4	-6260	15550
		72°	110°						
323	41b	37.8	59.5	9290	786.7	-98.0	-201.4	-6420	15710
324	42b	40.4	58.3	9310	785.6	-99.5	-203.2	-6560	15870
325	43b	43.1	57.2	9310	789.5	-97.8	-201.4	-6520	15830
326	44b	45.7	56.0	9310	793.2	-96.4	-200.0	-6400	15710
327	45b	48.3	54.7	9330	798.5	-91.4	-195.2	-6200	15530
328	46b	50.3	53.5	9380	799.4	-87.5	-191.9	-5980	15360
329	47b	53.5	52.2	9430	797.3	-87.6	-192.6	-5880	15310
330	48b	56.1	50.9	9400	800.1	-89.8	-194.5	-5980	15580
331	49b	58.7	49.7	9390	803.0	-90.1	-194.7	-6000	15390
		73°	110°						
332	50b	1.4	48.4	9370	809.6	-87.6	-191.9	-5900	15270
333	Camp	2.3	48.0	9380	811.8	-85.3	-189.7	-5820	15200
334	51b	4.0	47.1	9400	815.2	-81.3	-186.0	-5680	15080
335	52b	6.4	45.7	9480	814.1	-77.0	-182.5	-5440	14920
336	53b	9.0	44.3	9530	811.4	-77.1	-183.2	-5320	14850
337	54b	11.5	42.9	9570	808.5	-78.4	-185.0	-5380	14950
338	55b	14.1	41.6	9600	806.8	-79.4	-186.3	-5400	15000
339	56b	16.6	39.2	9610	809.6	-77.7	-184.7	-5320	14930
340	57b	19.2	38.8	9590	814.8	-76.6	-183.3	-5200	14790
341	58b	21.7	37.4	9590	821.6	-71.9	-178.7	-5060	14650
342	Camp	23.4	36.5	9600	825.7	-68.3	-175.2	-4880	14480
343	59b	24.3	35.9	9620	827.3	-65.6	-172.7	-4780	14400
344	60b	27.0	34.3	9660	830.6	-60.7	-168.3	-4500	14160

Station		Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
No.	Description								
345	61b	39.8	32.7	9700	832.7	-65.3	-173.3	-4660	14360
346	62b	32.5	31.0	9740	831.1	-57.2	-165.7	-4280	14020
347	63b	35.0	29.5	9770	828.9	-58.7	-167.5	-4300	14070
348	64b	37.6	28.0	9770	832.9	-56.8	-165.5	-4200	13970
349	65b	40.1	26.5	9790	838.0	-51.8	-160.8	-3980	13770
		73°	110°		981,				
V 350	509– 41566b	42.6	25.0	9840	836.0	-51.1	-160.6	-3920	13760
351	67b	45.2	23.5	9860	832.9	-54.4	-164.2	-4000	13860
352	68b	47.7	22.0	9890	829.0	-57.5	-167.6	-4160	14050
353	69b	50.2	20.5	9910	827.5	-59.2	-169.5	-4260	14170
354	70b	52.8	19.0	9920	829.4	-58.4	-168.9	-4180	14100
355	71b	55.3	17.5	9960	831.7	-54.4	-165.3	-4000	13960
356	72b	57.8	16.1	9970	834.4	-52.8	-163.8	-3840	13810
357	73b	59.6	15.0	9980	837.2	-50.4	-161.5	-3780	13760
		74°	110°						
358	74b	2.1	13.7	9980	840.4	-49.3	-160.4	-3660	13640
359	75b	4.7	12.5	9990	844.1	-46.7	-157.9	-3560	13550
360	76b	7.2	11.2	9990	848.3	-44.5	-155.7	-3400	13390
361	77b	9.7	11.0	10000	851.8	-42.1	-153.4	-3320	13320
362	78b	12.3	8.7	10000	854.8	-41.0	-152.4	-3240	13240
363	79b	15.8	7.5	10010	855.7	-42.0	-153.5	-3240	13250
364	N.M.	16.7	6.5	10020	860.3	-37.2	-148.8	-3020	13040
365	81b	19.9	4.9	10040	862.2	-35.9	-147.6	-2980	13020
366	82b	22.4	3.6	10060	862.2	-36.0	-148.0	-2940	13000
367	83b	24.9	2.3	10070	865.0	-34.3	-146.4	-2840	12910
368	84b	27.4	1.0	10090	867.6	-31.7	-144.1	-2720	12810
		74°	109°						
369	85b	29.9	59.5	10100	870.1	-30.2	-142.7	-2600	12700
370	86b	32.4	58.1	10120	872.0	-28.3	-141.0	-2500	12620
371	Camp	34.0	57.1	10130	873.6	-27.1	-139.9	-2440	12570
372	87b	34.9	56.6	10140	873.8	-26.6	-139.5	-2400	12540
373	88b	37.5	55.0	10160	874.7	-25.9	-139.0	-2340	12500
374	89b	40.0	53.4	10180	874.7	-25.9	-139.3	-2320	12500
375	90b	42.6	51.8	10200	874.2	-26.6	-140.2	-2340	12540
376	91b	45.2	50.3	10220	874.7	-26.2	-140.0	-2340	12560
377	92b	47.8	48.7	10230	878.5	-23.4	-137.3	-2200	12430
378	93b	50.4	47.1	10240	882.8	-20.1	-134.1	-1960	12200
379	94b	53.0	45.5	10260	886.6	-16.5	-130.7	-1780	12040
380	95s	55.5	43.9	10280	889.3	-13.8	-128.2	-1640	11920

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
381	96s	58.1	42.2	10280	893.1	-11.9	-126.4	-1500	11780
		75°	109°						
382	97s	0.6	40.6	10300	895.3	- 9.8	-124.5	-1380	11680
383	98s	3.2	38.9	10320	898.3	- 6.8	-121.7	-1200	11520
384	99s	5.7	37.3	10350	901.5	- 2.7	-117.9	-1080	11430
385	100s	8.2	35.6	10370	902.7	- 1.5	-116.9	-1020	11390
	518-								
386	97501s	10.8	24.0	10400	901.8	- 1.5	-117.3	-1000	11400
387	02s	13.3	32.3	10410	902.4	- 1.8	-117.7	-1020	11430
388	03s	15.9	30.7	10420	902.7	- 2.4	-118.4	-1020	11440
389	Camp d	18.4	29.0	10420	903.6	- 3.5	-119.5	-1000	11420
390	04s	21.0	27.2	10440	905.4	- 1.7	-117.9	-960	11400
391	05s	23.6	25.4	10440	907.9	- 1.1	-117.3	-900	11340
392	06s	26.2	23.6	10450	910.5	- 0.6	-115.8	-800	11250
393	07s	28.8	21.8	10460	913.8	2.9	-113.6	-680	11140
394	08s	31.4	20.0	10480	917.6	6.6	-110.1	-580	11060
395	09s	33.9	18.2	10500	920.4	9.4	-107.5	-420	10920
396	10s	36.5	16.4	10530	921.7	11.6	-105.6	-320	10850
397	11s	39.1	14.6	10550	921.2	11.1	-106.3	-240	10790
398	12s	41.7	12.8	10570	920.6	10.6	-107.1	-240	10810
399	Camp d	44.3	11.0	10590	921.6	11.6	-106.3	-220	10810
400	13s	46.9	9.3	10600	924.8	13.9	-104.1	-180	10780
401	14s	49.6	7.5	10610	927.3	15.4	-102.8	-40	10650
402	15s	52.2	5.8	10640	930.9	19.9	-98.5	+120	10520
		75°	109°		981,				
	518-								
V403	97516s	54.8	4.0	10670	934.4	24.4	-94.4	+320	10350
404	17s	57.4	2.3	10700	934.7	25.7	-93.4	+440	10260
		76°	109°						
405	18s	0.1	0.5	10730	934.4	26.4	-93.1	+540	10190
		76°	108°						
406	19s	2.7	58.8	10760	934.2	27.0	-92.8	+600	10160
407	20s	5.3	57.0	10790	933.1	26.9	-93.2	+600	10190
408	21s	8.0	55.0	10810	934.0	27.8	-92.5	+640	10170
409	22s	10.6	53.0	10840	933.9	28.7	-92.0	+680	10160
410	23s	13.3	50.9	10860	933.0	27.9	-93.1	+720	10140
411	24s	15.9	48.8	10870	932.9	26.8	-94.2	+660	10210
412	25s	18.6	46.6	10890	935.7	29.7	-91.6	+800	10090
413	26s	21.2	44.5	10910	942.5	36.5	-85.0	+1140	9770

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
414	27s	23.9	42.4	10930	950.6	44.6	-77.0	+1500	9430
415	28s	26.5	40.3	10960	954.5	49.5	-72.5	+1800	9160
416	29s	29.2	38.1	10980	952.5	47.6	-74.7	+1720	9260
417	30s	31.8	36.0	10980	951.4	44.7	-77.5	+1600	9380
418	31s	34.3	34.0	10990	950.3	42.8	-79.5	+1600	9390
419	32s	36.9	32.0	11000	955.0	46.7	-75.8	+1780	9220
420	33s	39.4	30.0	11010	961.3	52.2	-70.4	+2000	9010
421	34s	41.9	28.0	11020	964.7	54.8	-67.9	+2180	8840
422	35s	44.4	26.0	11050	965.8	57.1	-65.9	+2260	8790
423	36s	47.0	24.0	11070	966.1	57.6	-65.7	+2320	8750
424	37s	49.5	22.0	11090	965.5	57.1	-66.4	+2300	8790
425	38s	52.0	20.0	11100	965.2	56.1	-67.5	+2280	8820
426	39s	54.5	18.0	11100	968.0	57.3	-66.3	+2300	8800
427	40s	57.1	16.0	11110	966.8	55.3	-68.4	+2260	8850
428	41s	59.6	14.0	11130	963.8	52.4	-71.5	+2140	8990
		77°	108°						
429	42s	2.1	12.0	11150	958.6	47.5	-76.7	+1940	9210
430	43s	4.7	9.7	11150	957.4	44.6	-79.5	+1820	9330
431	44s	7.3	7.3	11170	959.8	47.2	-77.2	+2000	9170
432	45s	9.9	5.0	11180	960.7	47.3	-77.2	+2020	9160
433	46s	12.5	2.6	11190	960.2	46.0	-78.6	+1960	9230
434	47s	15.2	0.3	11200	960.2	45.3	-79.4	+1940	9260
		77°	107°						
435	48s	17.8	57.9	11220	963.8	49.0	-75.9	+2040	9180
436	49s	20.4	55.6	11230	965.9	50.4	-74.7	+2180	9050
437	50s	23.0	53.5	11250	966.4	51.1	-74.2	+2220	9030
438	51s	25.6	50.9	11260	962.7	46.7	-78.7	+2100	9160
439	52s	28.2	48.5	11260	960.4	42.7	-82.7	+1980	9280
440	53s	30.7	45.9	11270	958.8	40.4	-85.1	+1920	9350
441	54s	33.2	43.2	11270	966.3	46.4	-79.1	+2080	9190
442	55s	35.7	40.6	11280	973.3	52.7	-72.9	+2360	8920
443	56s	38.2	37.9	11290	978.0	56.7	-69.0	+2600	8690
444	57s	40.7	35.3	11310	984.2	63.2	-62.7	+2920	8390
445	58s	43.3	32.7	11320	988.3	66.7	-59.4	+3020	8300
446	59s	45.8	30.0	11340	981.4	60.1	-66.1	+2820	8520
447	60s	48.3	27.4	11340	973.9	51.0	-75.3	+2500	8840
448	61s	50.8	24.7	11360	968.1	45.5	-80.9	+2220	9140
449	62s	53.3	22.1	11360	967.3	43.2	-83.3	+2140	9220

Station No.	Station Description	Lat.	Long.	Height (feet)	Obs. gravity (mgal)	FA (mgal)	BA (mgal)	Rock elevation (feet)	Ice thick. (feet)
450	63s	55.8	19.4	11360	958.2	32.5	-94.0	+1800	9560
451	64s	58.3	16.8	11380	943.9	18.5	-108.2	+1240	10140
		78°	107°						
452	65s	0.7	14.3	11390	939.6	13.7	-113.1	+840	10550
453	66s	3.1	11.8	11410	934.4	8.9	-118.1	+560	10850
454	67s	5.5	9.3	11420	927.3	1.3	-125.9	+320	11100
	518-	78°	107°		981,				
V455	97568s	7.9	6.8	11440	921.4	-4.2	-131.5	+60	11380
456	69s	10.3	4.3	11460	915.6	-9.6	-137.2	-180	11640
457	70s	12.7	1.8	11480	911.9	-12.9	-140.7	-240	11720
		78°	106°						
458	71s	15.1	59.3	11480	908.0	-18.2	-146.0	-440	11920
459	72s	17.5	56.8	11480	904.9	-22.7	-150.5	-620	12100
460	73s	20.0	54.3	11480	902.1	-27.0	-154.8	-800	12280
461	74s	22.4	52.8	11470	902.5	-29.0	-156.7	-880	12350
462	75s	24.8	52.4	11460	906.0	-27.8	-155.4	-900	12360
463	VostokN.M	27.0	52.0	11440	912.3	-24.8	-152.2	-650	12090
464	Vostok Base Peg.	27.0	52.0	11440	912.5	-24.6	-152.0	-650	12090

Note . Ice thickness at Vostok (taken from U.S.S.R. data) = 3685 metres = 12090 feet. (Radio communication with M. Prior, USA observer at Mirny, 1962)

For Bouguer corrections, a density of 0.88g/cm^3 (that of ice) for material between surface and sea level is assumed.

Station description legend

Between Wilkes and S-2, the number shows route miles from Wilkes.

Between S-2 and 300 miles south, the number shows route miles south of S-2 (this number is also painted on the accumulation stakes.

b : Bamboo (accumulation marker)
s : Stake (accumulation marker)
p : Small wooden peg or pegs
d : Fuel drum or drums
B : Black flag
R : Red flag
N.M. : No marker

TABLE 4

Densities of rocks from the Windmill Islands

The specimens were collected by R. Underwood during 1959 near Wilkes base. Densities were determined by Dr. G. Neumann and R. Underwood by comparing weight in air and weight submerged in water.

Legend: Specimens numbered 1 are from Robinson Ridge
Specimens numbered 2 are from Clark Peninsula
Specimens numbered 3 are from Penny Islet
*Specimen coated with paraffin before submersion.

No.	Type	Density (g/cm^3)	No.	Type	Density (g/cm^3)
3C	Quartzite reddish-brownish	2.6	2K	Felsite Multicoloured reddish, brownish greyish	3.41
2G	Basic igneous rock (Moraine pebble) Greenish	3.16	2N	Igneous rock Diorite? Containing white feldspar and dark mineral similar to horn-blende	2.79
2P	Conglomerate reddish	2.67	2D	Gneissic rock Containing dark greenish mineral (hornblende?)	3.06
3E	Basalt	2.97	2C	Gneissic rock Containing small garnets	2.95
3A	Quartz with green stain from copper	2.63	2C	Syenite porous by weathering	2.61
2J *	Sandstone brownish medium-grained	2.85	1A	Volcanic rock darkish, greenish fine-grained (Olivine?)	2.86
2L	Igneous rock Dark vein material	2.86		Pegmatite Composed of large crystals of feld-spar and mica	2.62

TABLE 5

Wilkes-Vostok traverse

Observed magnetic components

Station Miles	No.			Latitude S	Longitude E	(West) D observed (degrees)	H observed (gammas)	Z observed (gammas)	
Wilkes	D_1	H_1	Z_1	$66^\circ 15.5'$	$110^\circ 31.9'$	85.0 (mean)	9240(mean)	-64,900(mean)	
38	D_2			$66^\circ 26.8$	$111^\circ 48.0$	89.0	-	-	
51(S2)	D_3	H_2	Z_2	30.7	$112^\circ 12.8$	90.0	8107	64,358	D
81	D_4			56.0	12.8	91.0	-	-	
86	D_5	H_3	Z_3	$67^\circ 00.4$	12.8	89.0	7994	64,466	Q
104	D_6			15.9	12.8	91.0	-	-	
106	D_7			17.7	12.8	92.0	-	-	
108		H_4	Z_4	19.4	12.8	-	8582	65,354	Q
131	D_8	H_5	Z_5	39.3	16.0	95.0	8702	65,900	Q
157	D_9			$68^\circ 00.9$	13.0	94.0	-	-	
172	D_{10}	H_6	Z_6	14.9	09.5	93.5	8954	65,100	Q
187	D_{11}			28.4	05.0	95.0	-	-	
203	D_{12}			41.9	01.0	96.0	-	-	
209	D_{13}			47.0	$111^\circ 59.5$	97.0	-	-	
213	D_{14}			50.5	58.5	96.5	-	-	
223	D_{15}			59.3	56.5	95.5	-	-	
230	D_{16}	H_7	Z_7	$69^\circ 04.5$	53.0	99.0	9013	64,674	Q
239	D_{17}			12.5	55.0	96.0	-	-	
241			Z_8	14.3	55.0	-	-	64,417	Q
249	D_{18}			21.3	55.0	96.5	-	-	
254		H_8	Z_9	25.8	54.5	-	9136	64,303	Q
256	D_{19}			27.6	54.5	101.0	-	-	
274	D_{20}			43.2	53.0	99.0	-	-	
288		H_9		55.2	51.0	-	9018	-	Q
290			Z_{10}	57.2	51.0	-	-	64,772	Q
299	D_{21}			$70^\circ 04.7$	50.5	101.5	-	-	
306			Z_{11}	10.8	50.0	-	-	64,587	Q
321		H_{10}	Z_{12}	24.0	48.5	-	9287	64,298	Q
324	D_{22}			26.6	48.0	103.5	-	-	
325			Z_{13}	27.4	48.0	-	-	64,392	D
354	D_{23}	H_{11}	Z_{14}	52.2	46.5	103.5	9497	65,148	Q
357	D_{24}			54.9	45.5	104.5	-	-	
381	D_{25}			$71^\circ 15.3$	36.5	104.0	-	-	
387		H_{12}	Z_{15}	20.4	34.5	-	9746	64,132	Q
408	D_{26}			38.6	26.5	105.0	-	-	

Station		Latitude	Longitude	(West)	H observed	Z observed
Miles	No.	S	E	D observed (degrees)	(gammas)	(gammas)
417	H_{13} Z_{16}	71°46.2	111°23.0	-	10,056	63,599 Q
420	D_{27}	48.7	22.0	105.0	-	-
433	Z_{17}	71°59.8	17.0	-	-	63,787 D
447	H_{14} Z_{18}	72°12.4	11.0	-	10,046	63,550 D
451	D_{28}	15.6	09.5	105.0	-	-
460	Z_{19}	23.3	06.0	-	-	63,456 D
477	H_{15} Z_{20}	37.8	110°59.5	-	10,253	63,482 D
486	Z_{21}	45.7	56.0	-	-	63,290 D
487	D_{29}	46.6	55.5	107.5	-	-
505	Z_{22}	73°02.2	48.0	-	-	63,516 Q
509	D_{30}	05.6	46.0	108.0	-	-
510	H_{16} Z_{23}	06.4	45.5	-	10,521	63,180 Q
520	D_{31}	15.0	41.0	107.5	-	-
540	H_{17} Z_{24}	32.5	31.0	-	10,508	63,302 D
550	D_{32}	41.0	26.5	108.0	-	- D
572	D_{33} H_{18} Z_{25}	59.6	15.0	110.6	10,726	63,058 Q
576	D_{34}	74°03.0	14.0	109.5	-	-
605	H_{19} Z_{26}	27.4	01.0	-	10,984	62,928 D
611	D_{35}	32.5	109°58.0	111.5	-	-
615	D_{36}	35.7	56.0	112.0	-	-
635	D_{37} H_{20} Z_{27}	53.0	45.5	112.0	11,038	62,888 Q
650	D_{38}	75°05.7	37.5	113.0	-	-
665	H_{21} Z_{28}	18.4	29.0	-	11,391	62,592 Q
695	D_{39} H_{22} Z_{29}	44.3	11.0	113.5	11,597	62,356 Q
719	H_{23} Z_{30}	76°05.3	108°57.0	-	11,642	62,128 Q
725	Z_{31}	10.6	53.0	-	-	62,048 Q
730	D_{40}	15.0	50.0	114.5	-	-
749	H_{24} Z_{32}	31.8	36.0	-	11,452	61,943 Q
770	D_{41}	49.6	23.0	115.0	-	-
785	D_{42} H_{25} Z_{33}	77°02.1	12.0	115.0	12,031	62,044 D
815	H_{26}	28.2	107°48.5	-	12,448	- Q
825	D_{43}	36.6	40.0	116.2	-	-
851	Z_{34}	58.3	16.8	-	-	61,054 Q
860	D_{44}	78°05.1	10.0	117.0	-	-
Vostok	D_{45} H_{27} Z_{35} Vostok	27.0	106°52.0	117.3	12,500	61,034 Q

Q and D indicate whether the conditions were quiet or disturbed.

TABLE 6

Time-distance values for refraction shots at station V357

Shot	x (ft)	t (ms)	Shot	x (ft)	t (ms)	Shot	x (ft)	t (ms)	Shot	x (ft)	t (ms)
2	7	7	5	203	57	8	400	82	12	840	129
	13	10		210	58		410	82.5		860	132
	20	13		217	59		420	83		880	134
	26	17		223	60		430	85		900	136
	33	20		230	61		440	86		920	137
	39	23		236	-		450	87		940	139
	46	26		243	63		460	88.5		960	-
	52	28		249	64		470	89.5		980	-
	59	30		256	65		480	90.5		1000	-
	66	32		262	65.5		490	92		1020	-
	72	33		269	66		500	93		1040	-
	79	34		276	67		510	94		1060	-
3	72	34	6	269	66	10	510	94	14	940	139
	79	35.5		276	67		520	94.5		980	143
	85	37		282	68		530	95		1020	146
	92	38.5		289	68		540	97		1060	150
	98	40		295	68		550	98		1100	154
	105	-		302	69		560	99		1140	158
	112	42.5		308	71		570	101		1180	162
	118	44		315	71		580	102		1220	166
	125	45		322	73		590	103		1260	169
	131	46		328	73		600	104		1300	172
	138	47		335	74		610	104.5		1340	175.5
	144	48		341	75		620	105		1380	179
4	138	47	7	335	74.0	11	620	105	15	1410	182
	144	48		341	75.0		640	109		1525	191
	151	49		348	75.5		660	111		1639	200
	157	50		354	75.5		680	113		1754	209
	164	51		361	76.5		700	114.5		1868	218
	171	-		367			720	117		1983	227
	177	53		374	79		740	118		2097	236
	184	54		381	79.5		760	120		2212	246
	190	55		387	80.5		780	122		2326	255
	197	56		394	81.5		800	124		2441	264
	203	57		400	82		820	126		2555	273
	210	58		407	82.5		840	129		2670	282

TABLE 7

Time-distance values for refraction shots at station V439

Shot	x (ft)	t (ms)	Shot	x (ft)	t (ms)
5	100	49	2	2200	-
	150	58		2250	-
	200	66		2300	-
	250	74		2350	252
	300	80		2400	258
	350	86		2450	262
	400	92		2500	-
	450	97		2550	270
	500	103		2600	274
	550	108		2650	278
	600	113		2700	282
	650	118		2750	286

TABLE 8

Wilkes-Vostok traverse

Seismic velocity distribution in near-surface

Station V357			Station V439		
x (feet)	V_z (ft/s)	Z (feet)	x (feet)	V_z (ft/s)	Z (feet)
0	800	0	0	640	0
33	2280	8	20	1460	6
50	3000	15	40	2380	14
70	3800	22	60	3330	23
98	4830	33	80	4170	31
120	5700	44	100	4900	40
170	6500	56	150	5800	52
223	7150	70	200	6400	65
330	8000	93	250	7100	80
440	8590	115	300	7800	96
520	8910	131	370	8500	117
760	9660	174	450	9200	140
951	10200	217	580	10000	168
1163	10850	271	760	10700	206
1389	11340	318	1060	11500	261
2680	12660	541	2350	12500	419

x = surface distance from shot-point to emergent ray.

V_z = Maximum velocity attained by ray emerging at distance x from shot-point.

Z = Depth at which maximum velocity V_z was attained.

TABLE 9

Comparison of altimeter readings for similar temperature, pressure, and humidity conditions (22 Aug to 14 Sept 1962)

Green set			Red set			Green set			Red set		
1	2	3	1	2	3	1	2	3	1	2	3
36	39	34	46	38	40	13	12	12	13	14	17
70	72	73	74	81	73	77	76	76	82	79	79
35	36	33	28	34	34	1	1	4	1	3	1
57	50	53	58	57	51	24	25	31	22	22	28
36	40	34	40	36	40	41	41	52	36	37	44
97	94	87	98	98	93	147	146	144	149	150	146
25	27	24	21	24	25	126	127	124	130	134	125
24	27	24	31	28	30	71	65	73	65	63	74
21	18	18	20	23	18	343	340	342	347	358	351
29	29	33	18	23	19	108	109	115	104	105	106
28	25	24	33	31	32	11	9	9	8	7	12
4	7	6	9	9	7	4	3	5	6	4	6
575	583	574	583	568	571	2	5	1	4	4	0
21	28	26	23	16	21	217	226	218	219	228	218
32	33	35	34	30	31	5	1	1	3	5	1
37	42	41	37	37	35	2	0	1	6	2	1
23	21	24	32	26	30	1	1	3	4	4	1
4	4	7	0	3	3	16	17	16	17	16	15
29	26	28	25	23	30	22	21	22	22	26	24
15	14	15	15	13	13	13	12	8	8	9	7
10	9	9	8	8	9	43	48	44	52	52	47
41	39	44	42	41	43	0	0	2	3	1	0
15	14	15	15	11	14	16	14	14	7	15	7
193	191	198	195	193	199	14	17	12	17	15	19
37	37	36	33	35	38	31	25	36	27	25	28
545	520	540	545	532	538	26	28	25	28	26	28
72	72	67	50	48	63	4	5	4	6	11	7
20	20	21	33	39	31	67	66	61	62	67	63
53	55	48	53	55	43	6	7	10	6	1	5
56	60	63	74	71	62	1	2	6	1	1	1
82	79	84	100	92	80	8	6	3	9	8	6
12	13	13	22	18	18	14	13	12	15	13	10
6	2	2	9	10	1	4	3	2	5	6	2

Green set			Red set			Green set			Red set		
1	2	3	1	2	3	1	2	3	1	2	3
116	111	100	100	106	107	78	77	72	72	73	64
2	9	9	8	13	11	305	301	309	304	322	307
7	9	4	4	4	10	6	9	9	8	9	9
32	35	35	38	43	37	191	185	190	187	172	193
202	192	191	181	191	196	95	99	98	99	92	91
397	387	395	401	378	396	209	200	205	211	202	210
6	0	8	4	5	5	30	24	27	28	35	28

TABLE 10

Wilkes-Vostok traverse

Drilling Log

Stn. No.	Miles from Wilkes	Depth drilled (feet)	Open hole after drilling (feet)	Depths of relative hardness of firn drilled, estimated from downward pressure required on drill stem. Crumbly (feet)	Soft (feet)	Medium (feet)	Hard (feet)	Very hard (feet)
V 25	S-2	153	140				0-138	138-153
V 26	108	237	212				0-237	
V111	172	234	195				0-230	230-234
V157	230	243	235				0-243	
V215	288	240	230			0-100	100-240	
V244	321	201	191			0-140	140-201	
V277	354	243	235		0- 15	15- 60	60-243	
V288	387	120	110		0- 20	20-120		
V299	417	189	177		0- 20	20- 80	80-189	
V310	447	210	194		0- 20	20-100	100-210	
V323	477	180	166		0- 30	30- 80	80-180	
V335	510	141	130			0- 60	60-141	
V346	540	120	107		0- 50	50- 80	80-120	
V357	572	240	202		0- 30	30-120	120-240	
V368	605	120	103.5		0- 30	30-120		
V371	635	120	98.5		0- 50	50-120		
V389	665	120	103		0- 45	45-120		
V399	695	135	120.5		0- 70	70-135		
V407	719	135	115	0-40	40- 80	80-135		
V417	749	135	110	0-80	80-135			
V439	815	120	85	0-80	80-120			

Note. From 572 miles south to 815 miles, drilling was noticeably easier at each location. Crumbly firn was very soft and sugary. From the appearance of drill cuttings it seemed that the very hard firn was almost compacted to blue ice.

TABLE 11

Melbourne-Wilkes gravity ties

Station	Date	Temp (°F)	Time GMT hours	Observed gravity interval (mgal)	Total meter drift (mgal)	Drift-corrected gravity interval (mgal)
Lewis Islet	30/12/61		1400	+52.1	+2.7	+49.4 ± 2
Wilkes	16/ 1/62		1400			
Lewis Islet	2/ 2/63	+52	0442	+96.0	+1.5 (time)	+95.7 ± 1
Chick Islet	8/ 2/63		0348		-1.2 (temp)	
Chick Islet	8/ 2/63	+49	0348	-738.6	+6.5 (time)	-749.5 ± 6
Macquarie Island	6/ 3/63		0022		+4.4 (temp)	
Macquarie Island	6/ 3/63	+60	0022	-1695.1	+4.0 (time)	-1706.7± 6
Melbourne	22/ 3/63	+79	0436		+7.6 (temp)	
Melbourne				+2389.8		2410 ±15
Wilkes						

<u>Meter</u>: Worden No 140 (Geodetic) between Lewis Islet and Wilkes.
Master Worden 548 (Geodetic) between Lewis Islet and Melbourne

<u>Driftrates</u>: 0.16 ± 0.1 mgal/day for Lewis Islet-Wilkes tie
0.25 ± 0.15 mgal/day for Lewis Islet-Melbourne tie
0.4 ± 0.2 mgal/°F (same sign as temperature change)

Station	Latitude South	Longitude East	Elev. (feet)	Description	Adjusted * Base value (mgal)
Melbourne	37°47.2'	144°53.5'	114	National Gravity Base Footscray Laboratories of Bureau of Mineral Resources.	979,979.0 (Pendulum)
Macquarie Island	54°30.0'	158°57.2'	21	On concrete floor at Gravity base in Meteorology store hut.	981,690.0
Chick Islet	66°47.3'	120°59.7'	32	On rock under hut floor at N.W. corner	982,444.0

Station	Latitude South	Longitude East	Elev. (feet)	Description	Adjusted* Base value (mgal)
Lewis Islet	66°06.1'	134°22.3'	86	On rock at Astro Cairn	982,349
Wilkes	66°15.5'	110°31.9'	36	On rock near Brass Hex.1 metre from west wall of old seismograph hut.	982,399.6 (La Coste la -tied to McMurdo pendulum Stn)

* The values at Melbourne and Wilkes have been regarded as fixed, and the values at the other stations have been adjusted as described in the text.

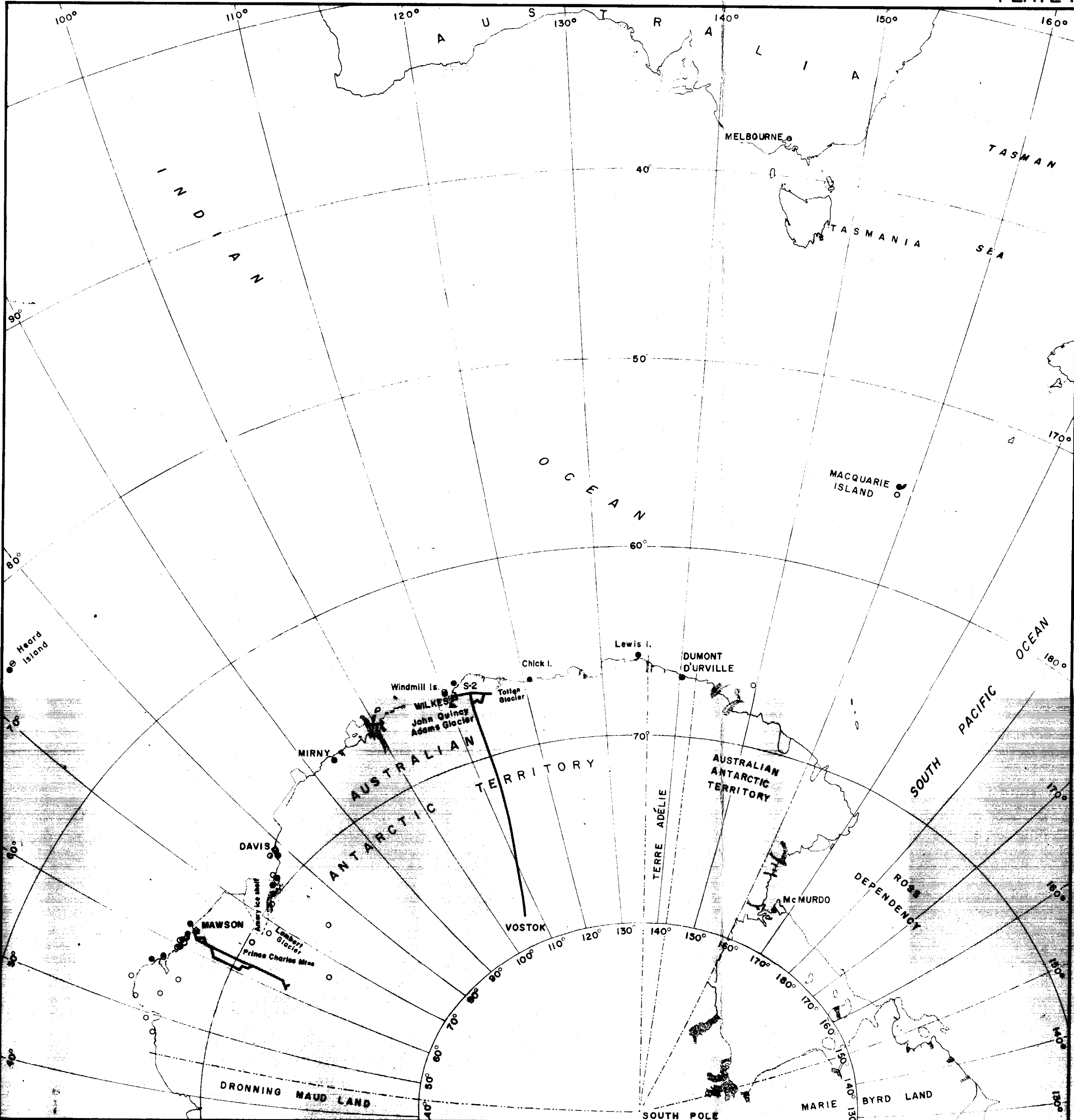
TABLE 12

Wilkes-Vostok traverse

Crustal thickness

Calculated from Bouguer anomaly by Woollard's method

Station miles	Ice thickness (feet)	Equivalent rock thickness (feet)	Equivalent rock elevation (metres)	Increment crustal thickness (km)	Crustal thickness (km)
Wilkes	0	0	+ 12	+ 0.08	32.1
51	3390	1120	+ 480	+ 3.23	35.7
111	10480	3460	-1290	- 8.77	21.9
152	6130	2010	+ 37	+ 0.25	32.3
193	8150	2680	+ 102	+ 0.69	32.8
234	8180	2700	+ 464	+ 3.17	35.6
274	8770	2880	+ 550	+ 3.74	36.3
314	9350	3500	+ 768	+ 5.22	38.0
354	13160	4340	- 24	- 0.17	31.8
393	12520	4130	+ 162	+ 1.10	33.3
433	14280	4700	- 140	- 0.95	30.9
480	15870	5230	- 405	- 2.76	28.8
519	15000	4940	- 140	- 0.95	30.9
561	14170	4670	+ 125	+ 0.85	33.0
599	13000	4280	+ 408	+ 2.78	35.2
641	11780	3880	+ 726	+ 4.94	37.7
680	11060	3640	+ 932	+ 6.34	39.3
719	10190	3360	+1208	+ 8.20	41.4
761	8840	2920	+1560	+10.62	44.2
800	9260	3050	+1520	+10.32	43.8
833	8300	2740	+1760	+11.98	45.7
863	11380	3750	+1160	+ 7.89	41.1
Vostok	12090	4010	+1020	+ 6.93	40.0



LEGEND

- ● GRAVITY STATION
- ○ FIELD MAGNETIC STATION
- ◘ MAGNETIC OBSERVATORY
- — ICE THICKNESS TRAVERSES

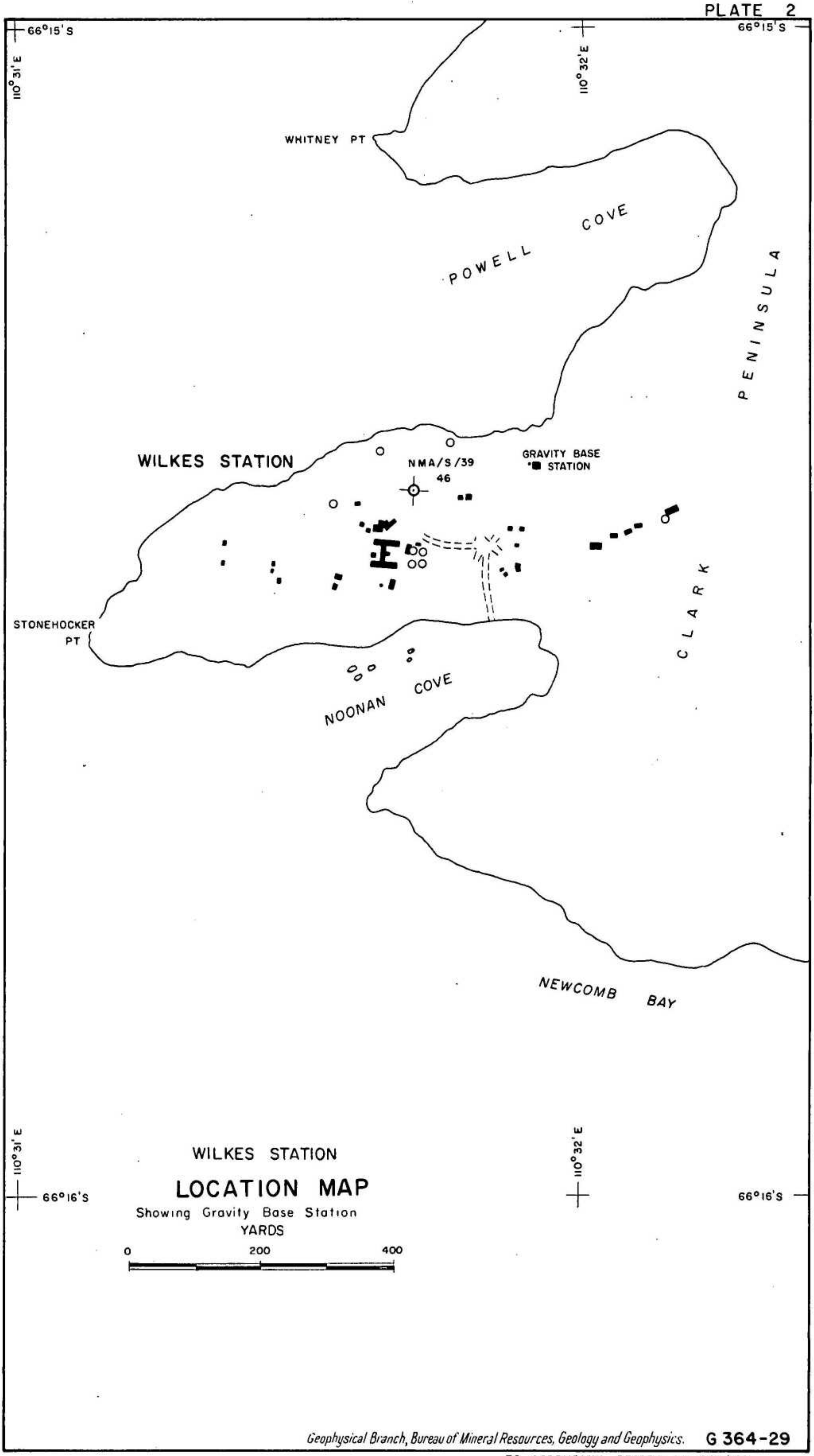
SCALE IN MILES

100 0 100 200 300 400 500 600 700 800

LOCALITY MAP

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G265-47-2

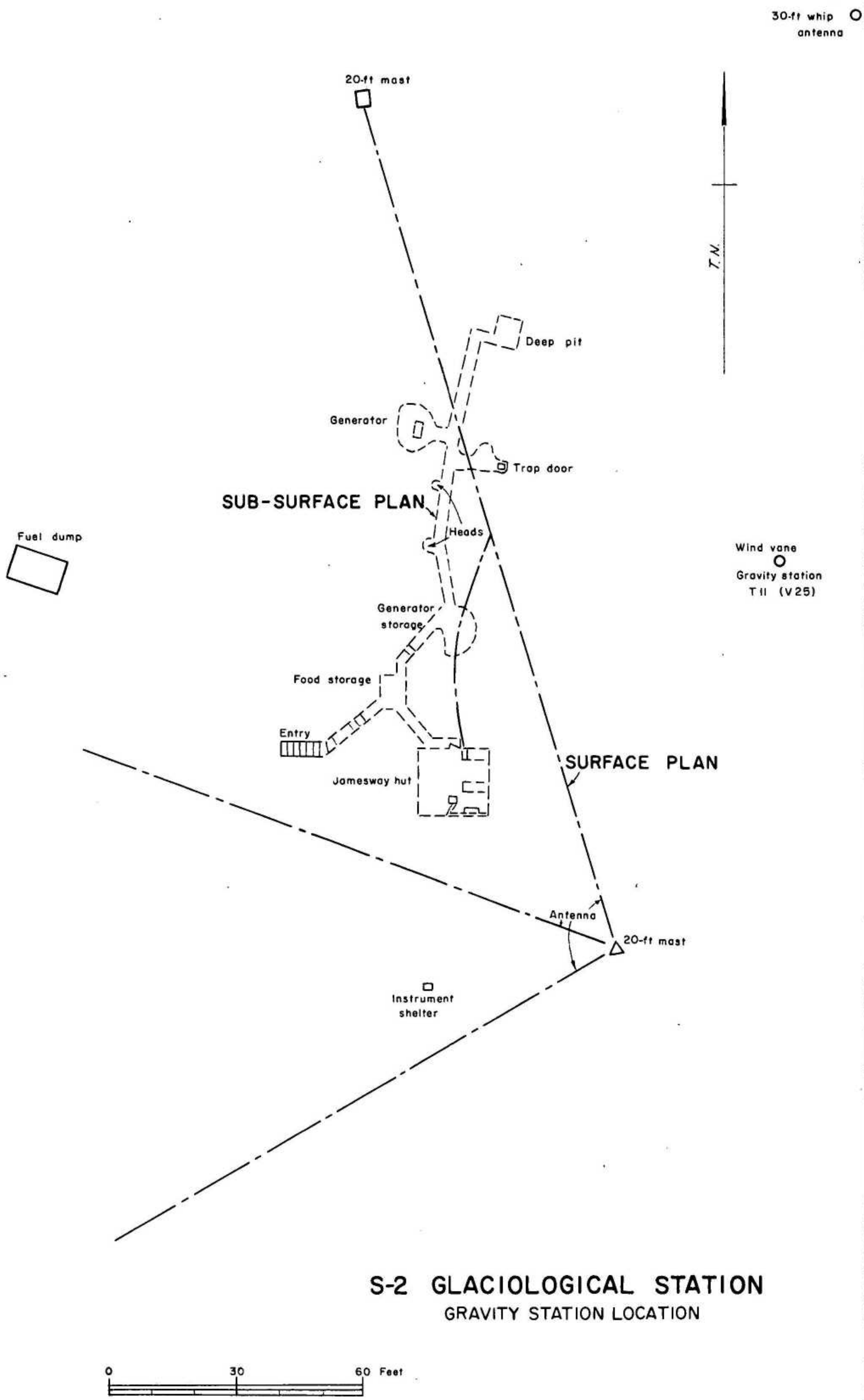
TO ACCOMPANY RECORD No. 1966/129



Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. G 364-29

TO ACCOMPANY RECORD No. 1966/129

PLATE 3



S-2 GLACIOLOGICAL STATION

GRAVITY STATION LOCATION

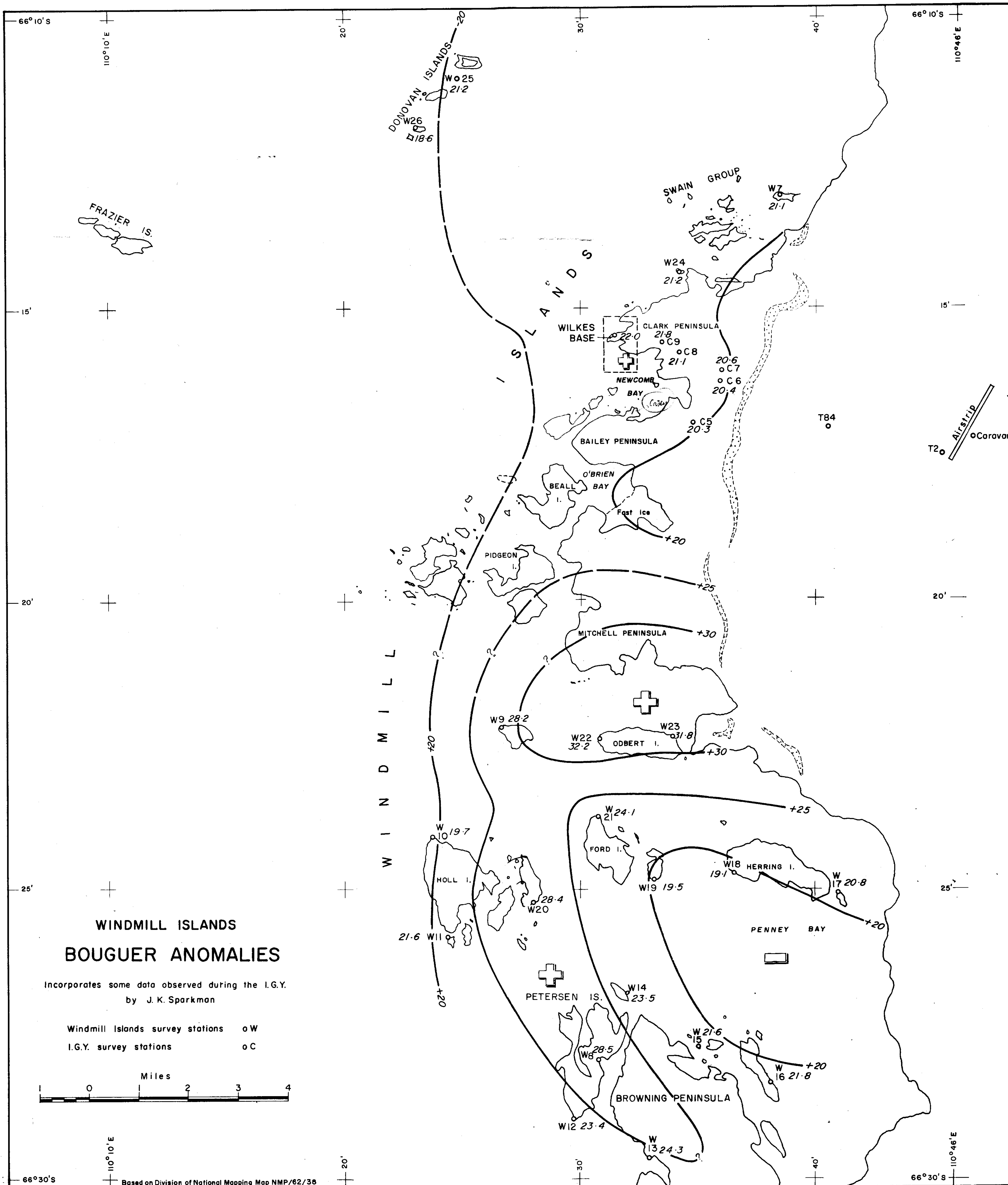
Surveyed in 1958 by D. EYRES

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics.

G 364-30

TO ACCOMPANY RECORD NO. 1966/129

PLATE 4



EXPLANATION: Relative Bouguer anomalies are based on the observed gravity value of WILKES base station which is tied to the McMurdo Sound Pendulum Station by a LaCoste 1a geodetic meter. For the calculation of Bouguer anomalies an average density of 2·67 g/cm³ has been adopted.

High anomaly

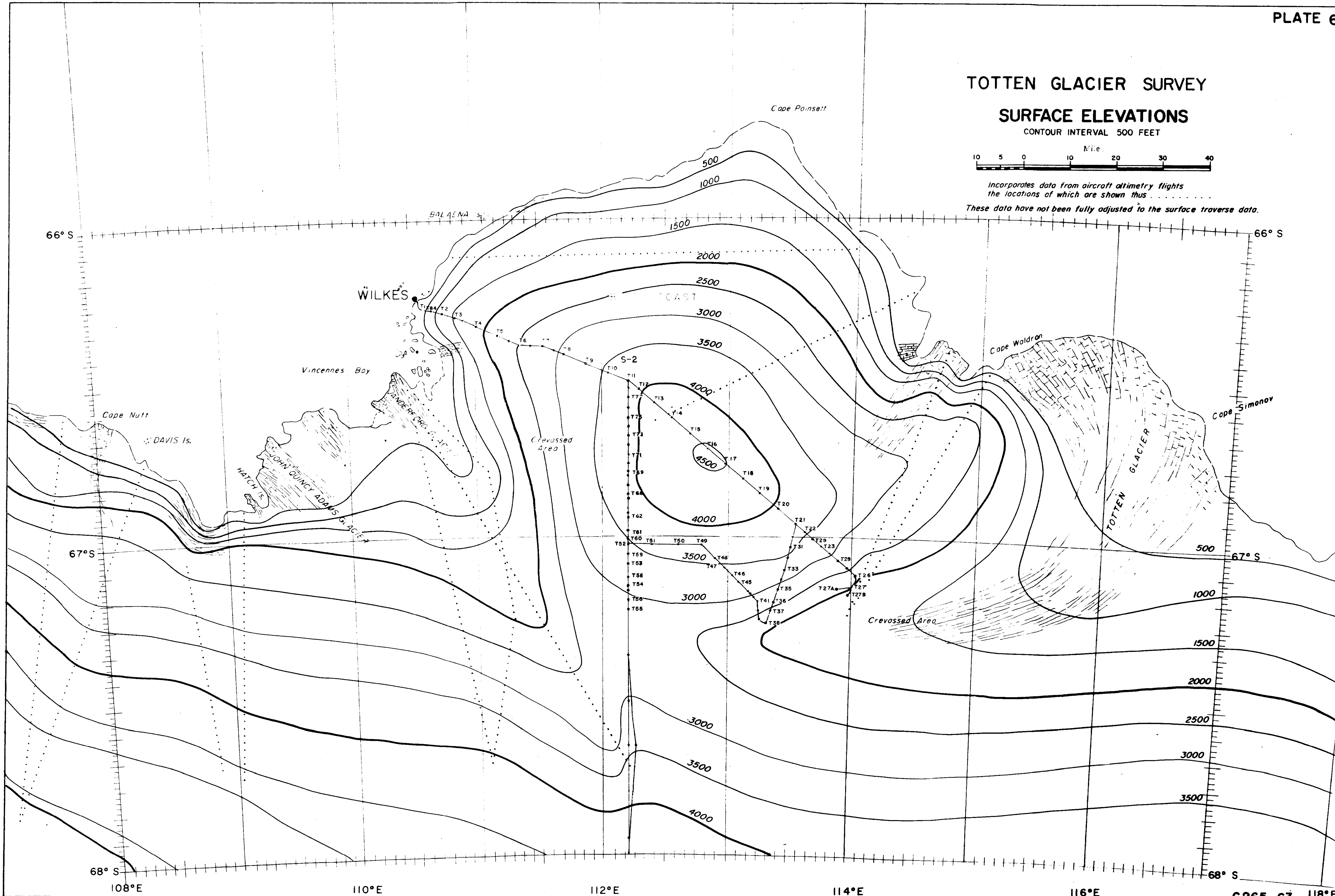
Low anomaly

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. G 364-28

To accompany Record No. 1966/129

PLATE 5

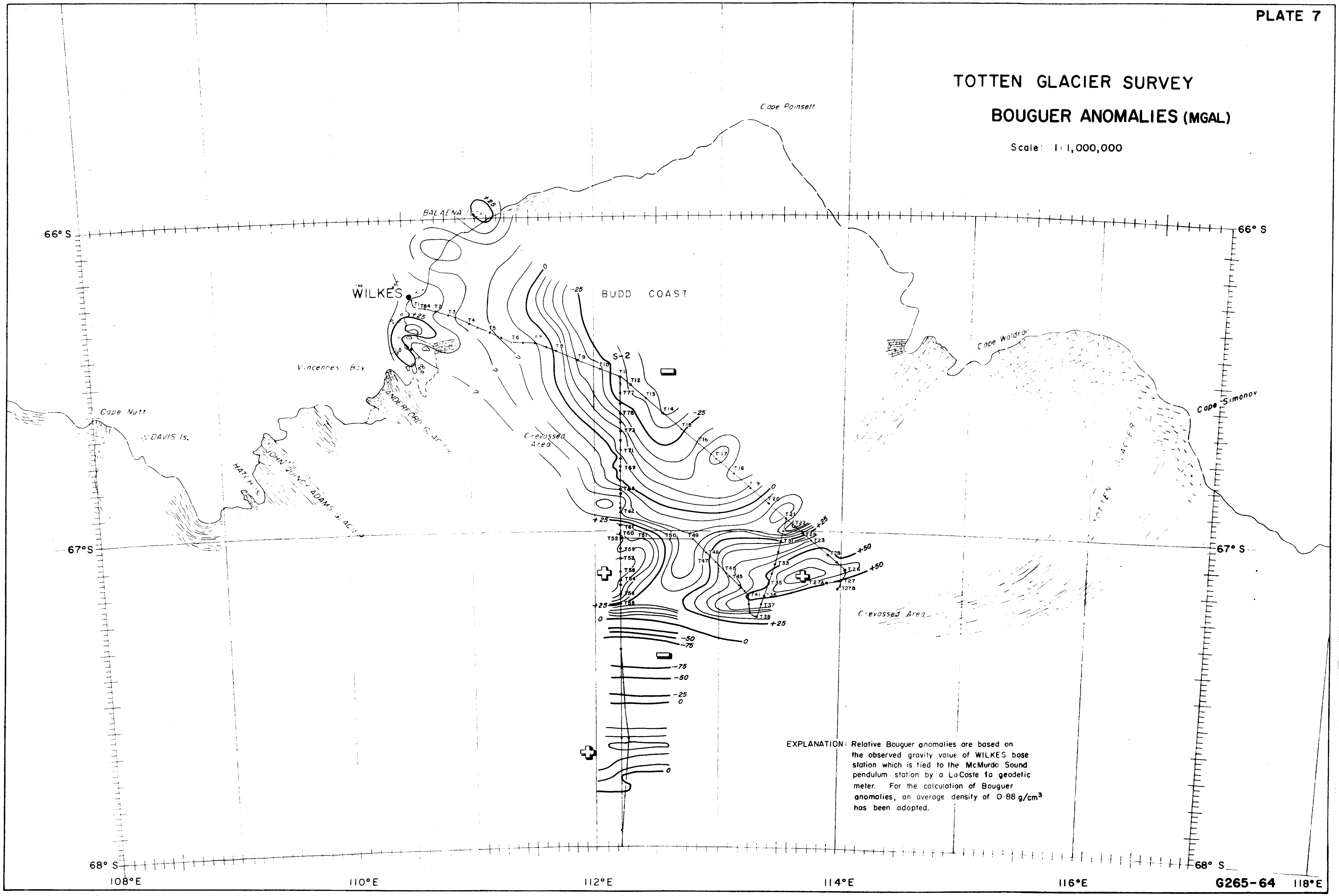
TO ACCOMPANY RECORD NO. 1966/129 GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS G265-54



(BASED ON G265-61)

TO ACCOMPANY RECORD NO. 1966/129

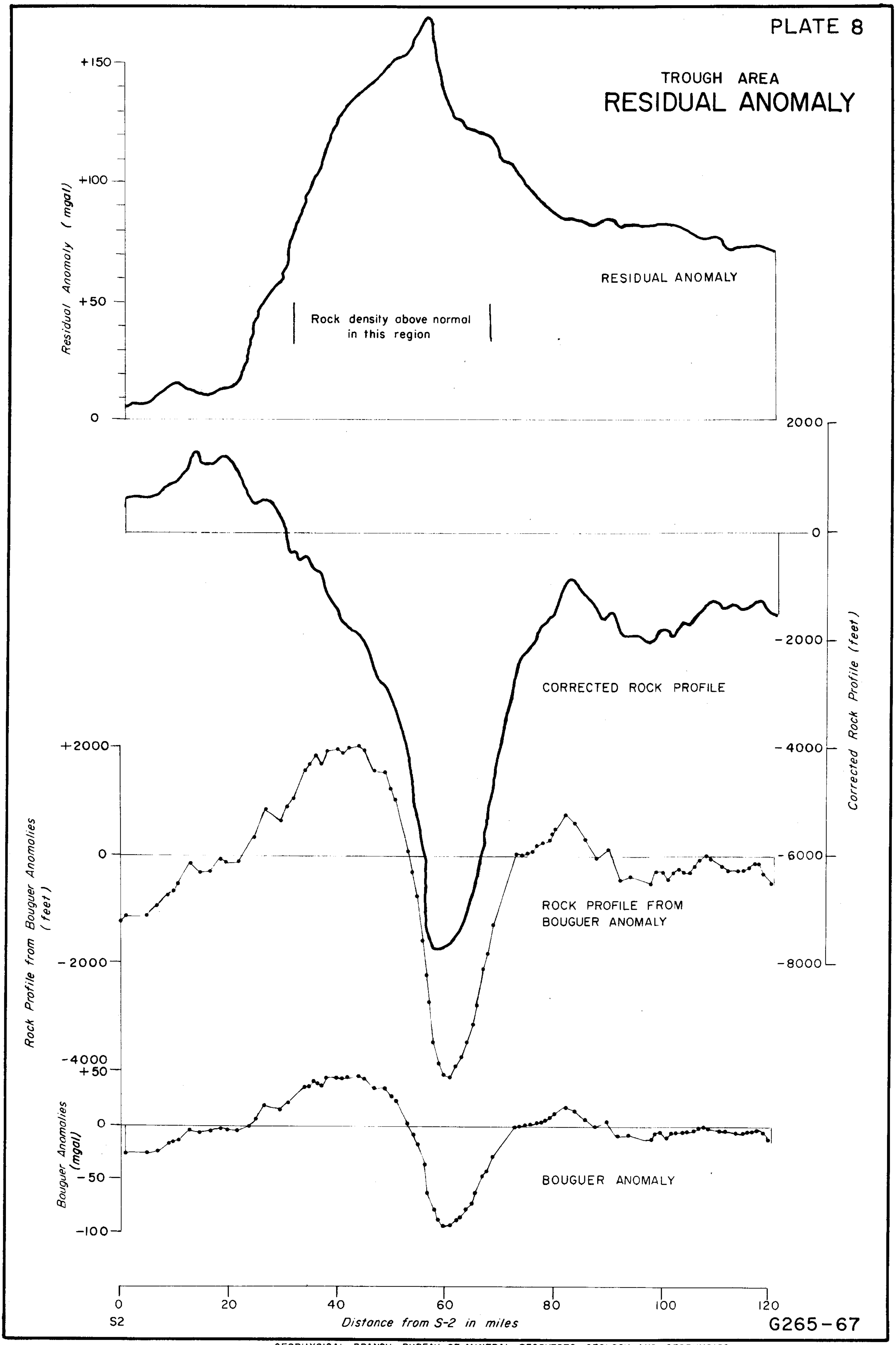
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS



(BASED ON G265-61)

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
TO ACCOMPANY RECORD No. 1966/129

TOTTAN GLACIER



GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

TO ACCOMPANY RECORD NO.1966/129


PLATE 9
BOUGUER ANOMALY (MGAL)
+50
0
-50
d = 0.88 g/cm³
BOUGUER ANOMALIES
ELEVATION IN FEET
+5000
+4000
+3000
+2000
+1000
0
-1000
-2000
-3000
-4000
-5000
S-1
S-2
WILKES
Ice-Rock Interface
10/100 N
ICE SURFACE PROFILE
Surface distance in miles
True course direction
ICE-ROCK INTERFACE from computed gravity values tied to seismic depth values.
Gravity data tied to seismic depth value 60 miles South of S-2
LEGEND
Rock depth from reliable seismic events showing approximate dip
T Prefix for gravity stations
S Prefix for glaciological stations established during the I.G.Y.
d Assumed density of material above sea level in g/cm³
HORIZONTAL SCALE IN MILES
VERTICAL TO HORIZONTAL EXAGGERATION 52.8:1
TOTTEN GLACIER SURVEY
CORRELATION OF SEISMIC AND GRAVITY DATA
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
TO ACCOMPANY RECORD No. 1966/129
G265-69

PLATE 10

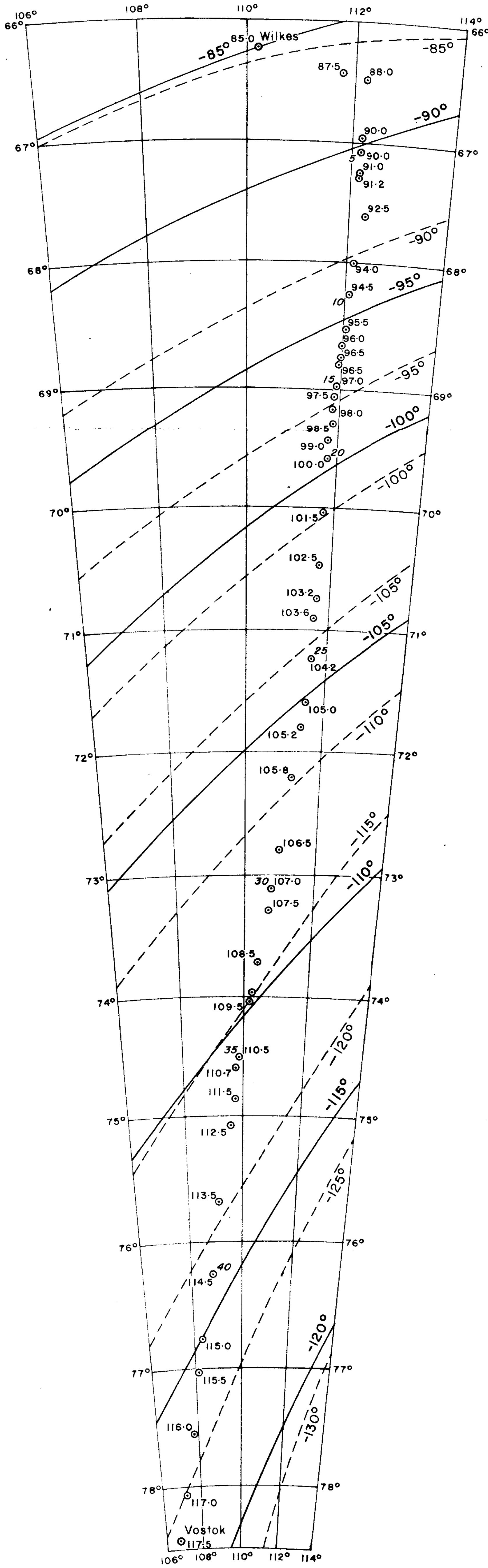
WILKES – VOSTOK TRAVERSE

CORRELATION OF SEISMIC, GRAVITY, & MAGNETIC DATA

TO ACCOMPANY RECORD NO. 1966/129

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS G265 – 68

PLATE 11



LEGEND

- - - Isogonic: from U.S. Hydrographic Office Map # H.O.1706S (1960·0) adjusted to 1962·0

—— Isogonic: estimated from smoothed survey results.

87·5⊙ West Declination in degrees (smoothed)

Declination Contours.

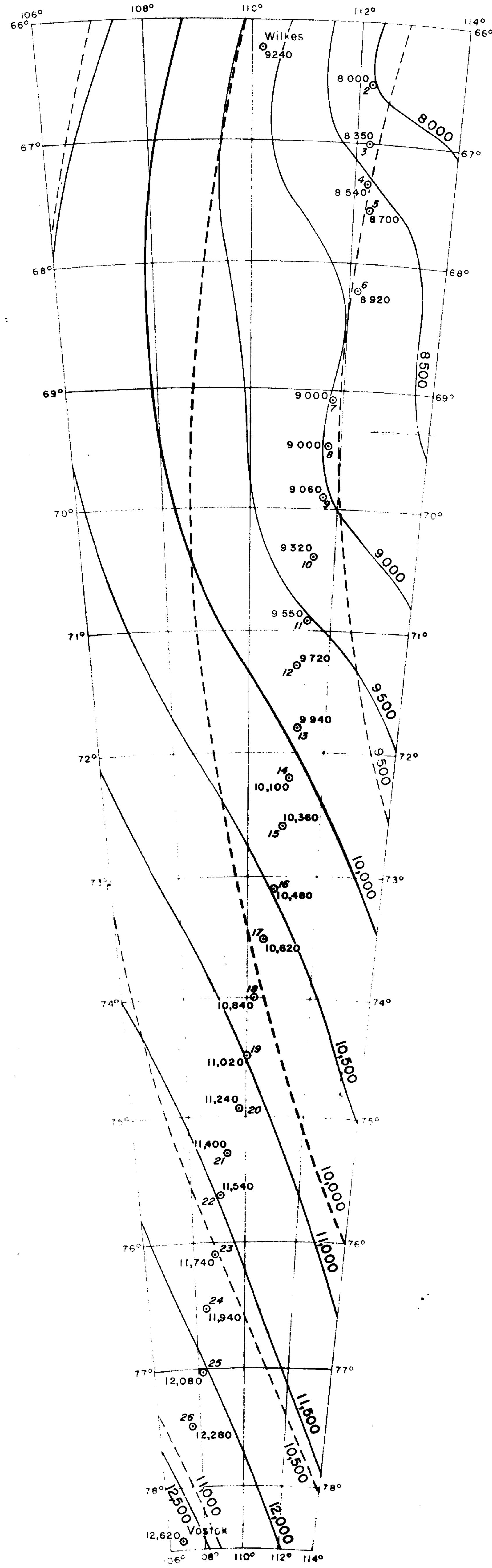
WILKES – VOSTOK 1962

MILES

20 0 20 40 60 80 100

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. TO ACCOMPANY RECORD No. 1966/129 G265-55

PLATE 12



LEGEND

- - - Contour in gammas from U.S. Hydrographic Office Map # 1701S adjusted to 1962·0

—— Contour in gammas from traverse

⊙ Station with value of Horizontal Intensity in gammas

Horizontal Intensity Contours

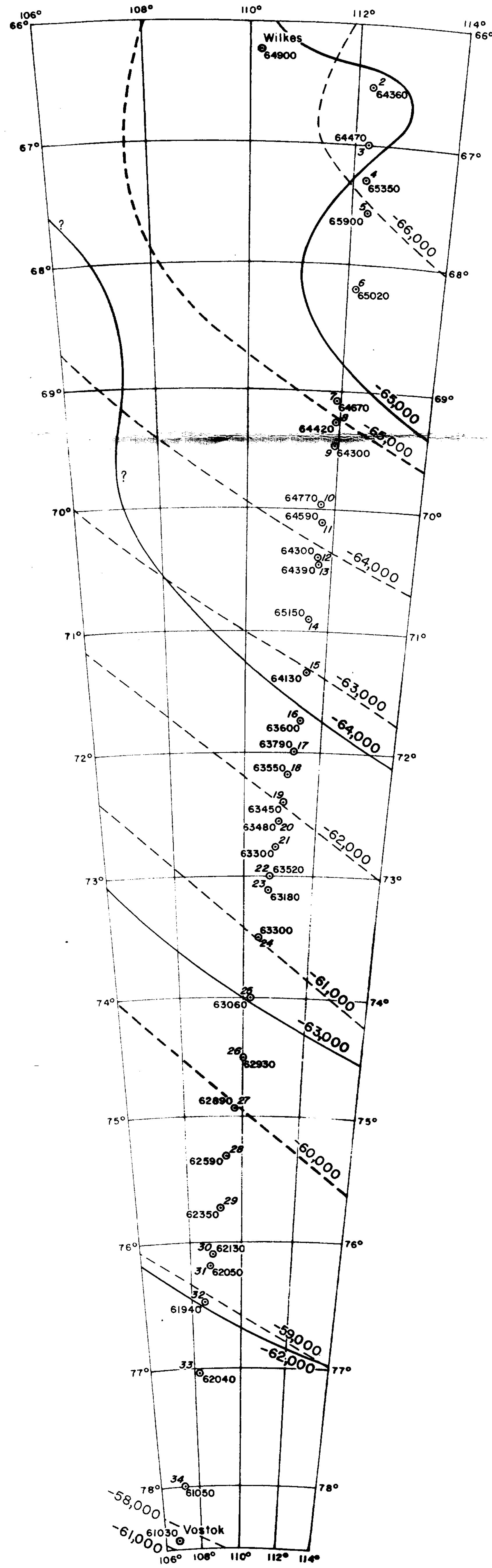
WILKES – VOSTOK 1962

MILES

20 0 20 40 60 80 100

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. TO ACCOMPANY RECORD No. 1966/129 G265-56

PLATE 13



LEGEND

- - - Contours of Vertical Intensity from U.S. Hydrographic Office Map # 1702S (1955·0) adjusted to 1962·0

—— Contours of Vertical Intensity from traverse

⊙ Station with value of Vertical Intensity in gammas.

Vertical Intensity Contours

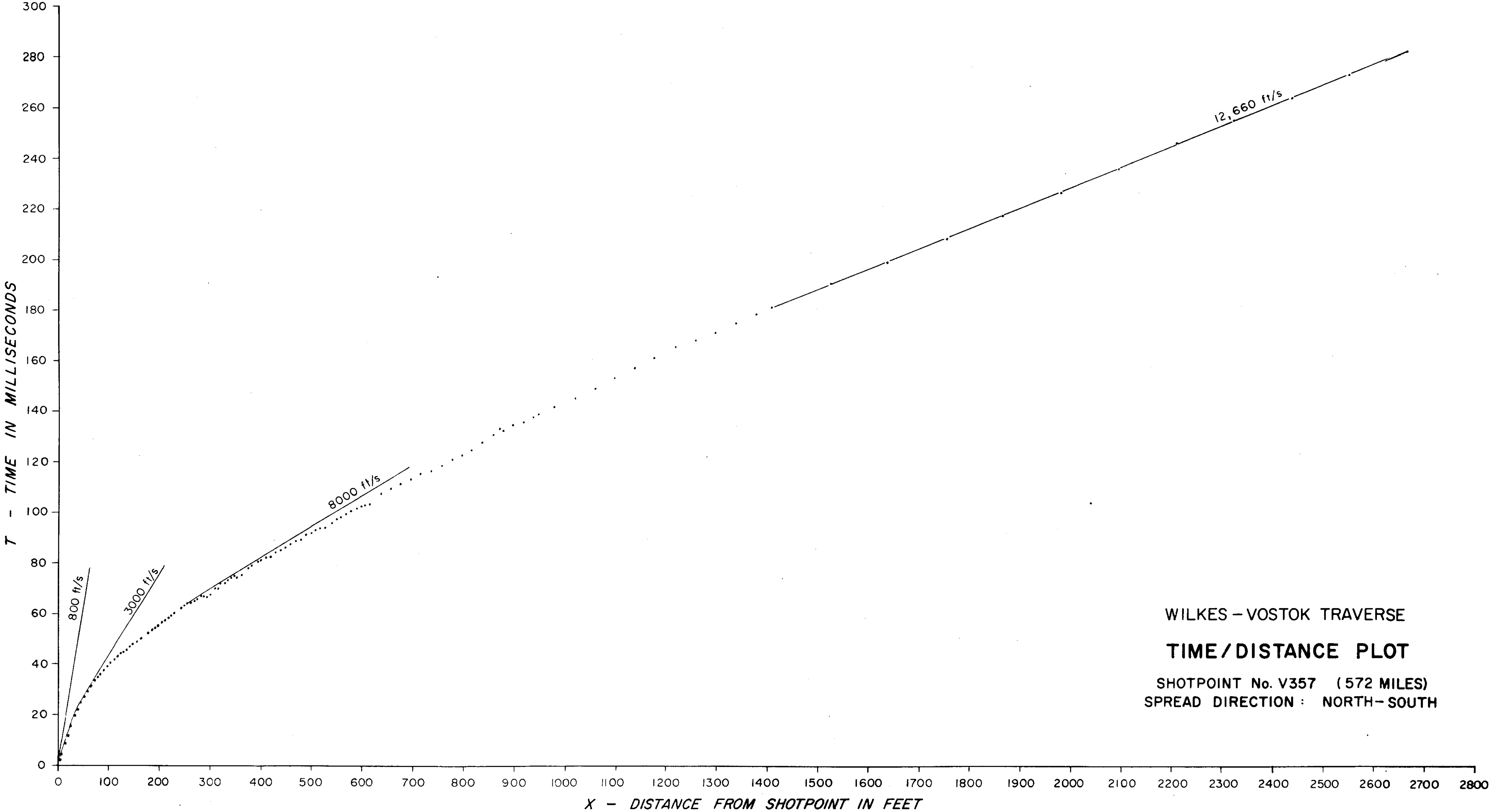
WILKES – VOSTOK 1962

MILES

20 0 20 40 60 80 100

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. TO ACCOMPANY RECORD No. 1966/129 G265-57

PLATE 14



WILKES – VOSTOK TRAVERSE

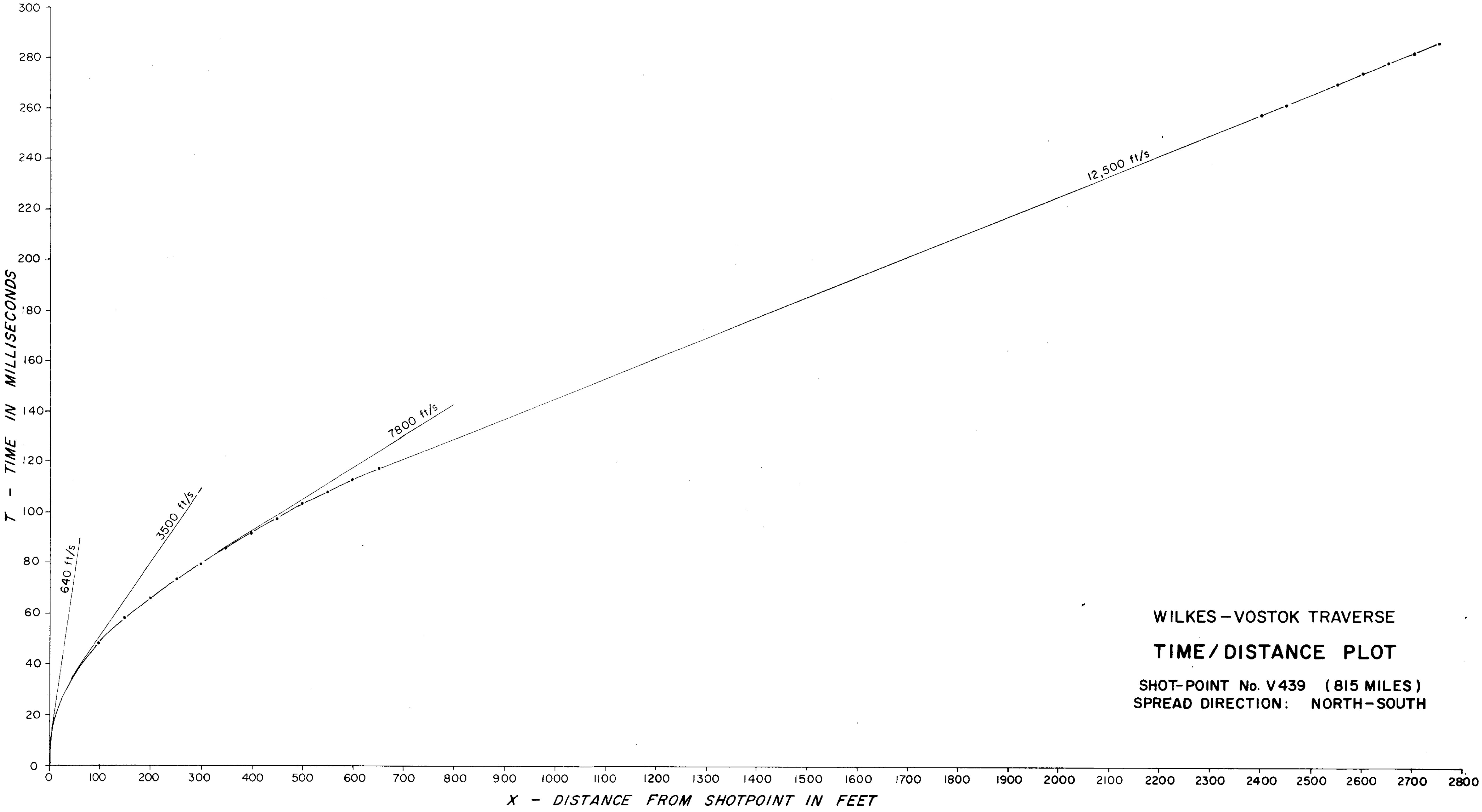
TIME / DISTANCE PLOT

SHOTPOINT No. V357 (572 MILES)
SPREAD DIRECTION : NORTH – SOUTH

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

G 265–70

TO ACCOMPANY RECORD NO. 1966/129



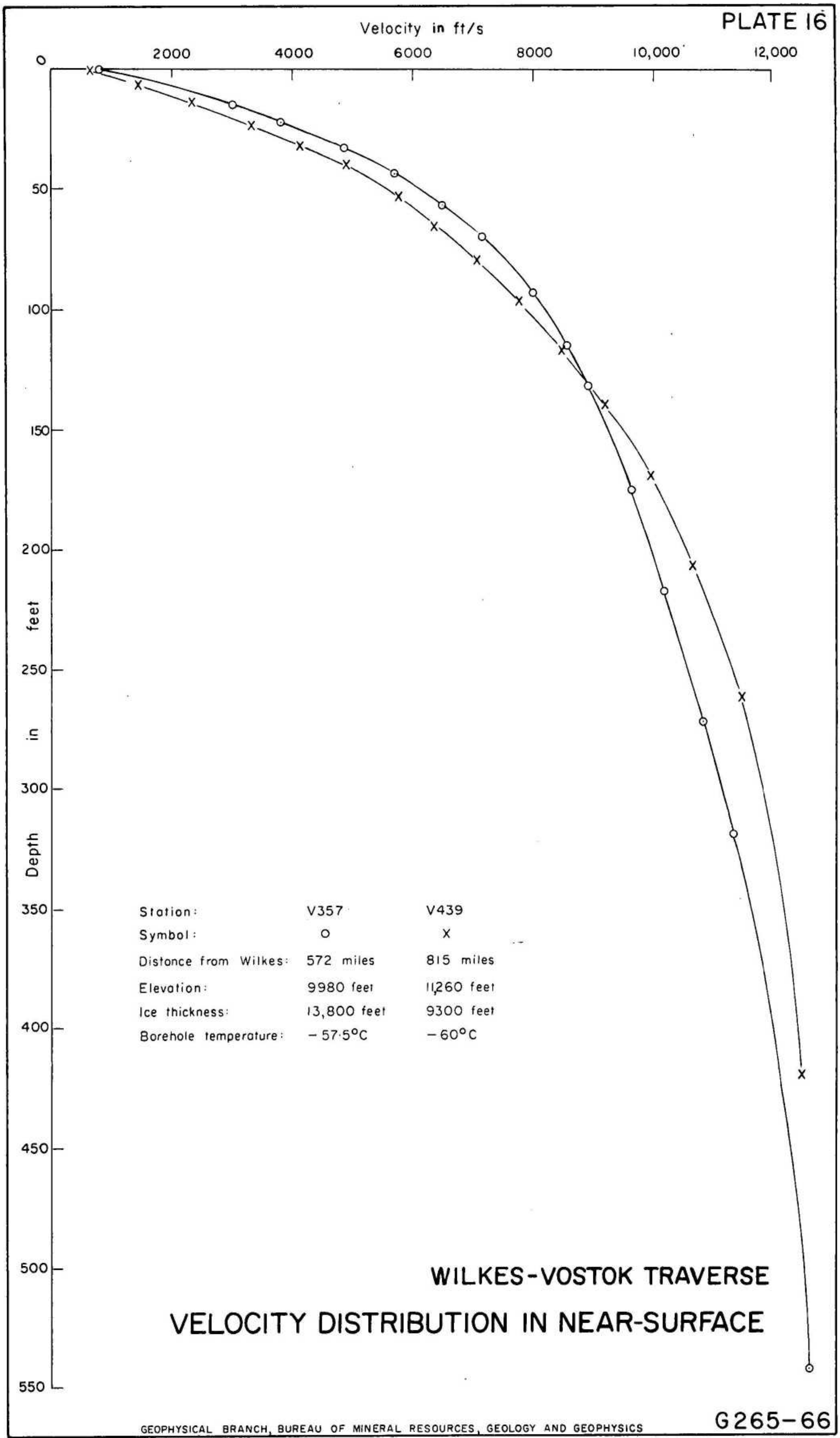
WILKES – VOSTOK TRAVERSE

TIME / DISTANCE PLOT

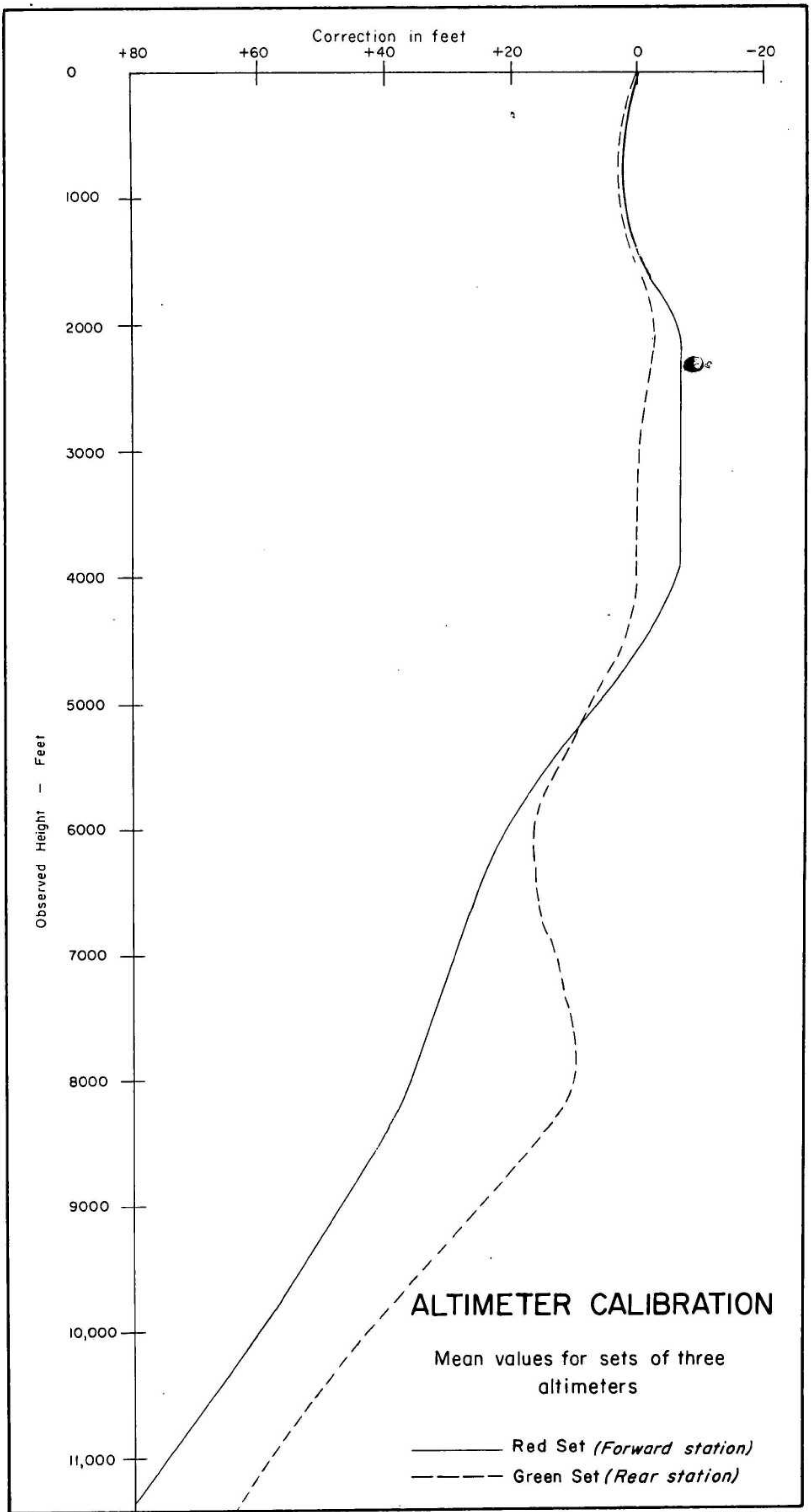
SHOT-POINT No. V439 (815 MILES)
SPREAD DIRECTION: NORTH-SOUTH

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
TO ACCOMPANY RECORD NO. 1966/129

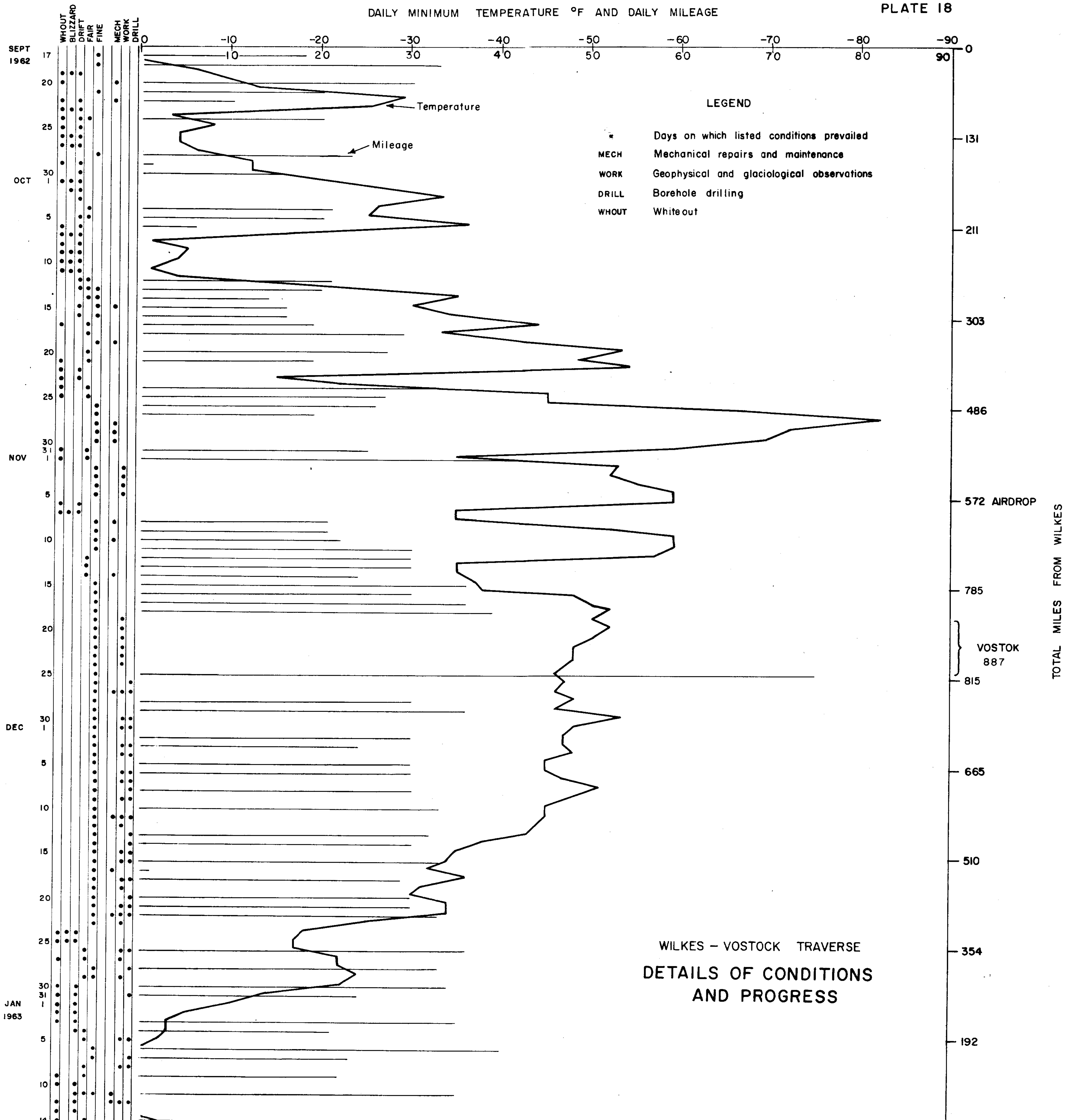
G265-73



TO ACCOMPANY RECORD No. 1966/129



Correction in feet
+80
+60
+40
+20
0
-20
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10,000
11,000
Observed Height - Feet
ALTIMETER CALIBRATION
Mean values for sets of three altimeters
Red Set (Forward station)
Green Set (Rear station)



WILKES – VOSTOCK TRAVERSE

DETAILS OF CONDITIONS AND PROGRESS

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS G 265-62
TO ACCOMPANY RECORD No.1966/129

PLATE 19

V62

V215

V244

V277

V288

SEISMIC REFLECTION RECORDS

SHOT-POINTS V62, V215, V244, V277 and V288

G265-74

TO ACCOMPANY RECORD No. 1966/129

PLATE 20

SEISMIC REFLECTION
RECORDS

SHOT-POINTS V299 and V310

G265-75

TO ACCOMPANY RECORD NO. 1966/129

SEISMIC REFLECTION RECORDS
SHOT-POINTS, V323, V335, V346, and V 357

G 265-76
TO ACCOMPANY RECORD NO. 1966/129

SEISMIC REFLECTION RECORDS

G 265-90

TO ACCOMPANY RECORD No. 1966/129

A.N.A.R.E. photograph by A. Battye

(A) Traverse train on plateau

A.N.A.R.E. photograph by A. Battye

(B) Vostok

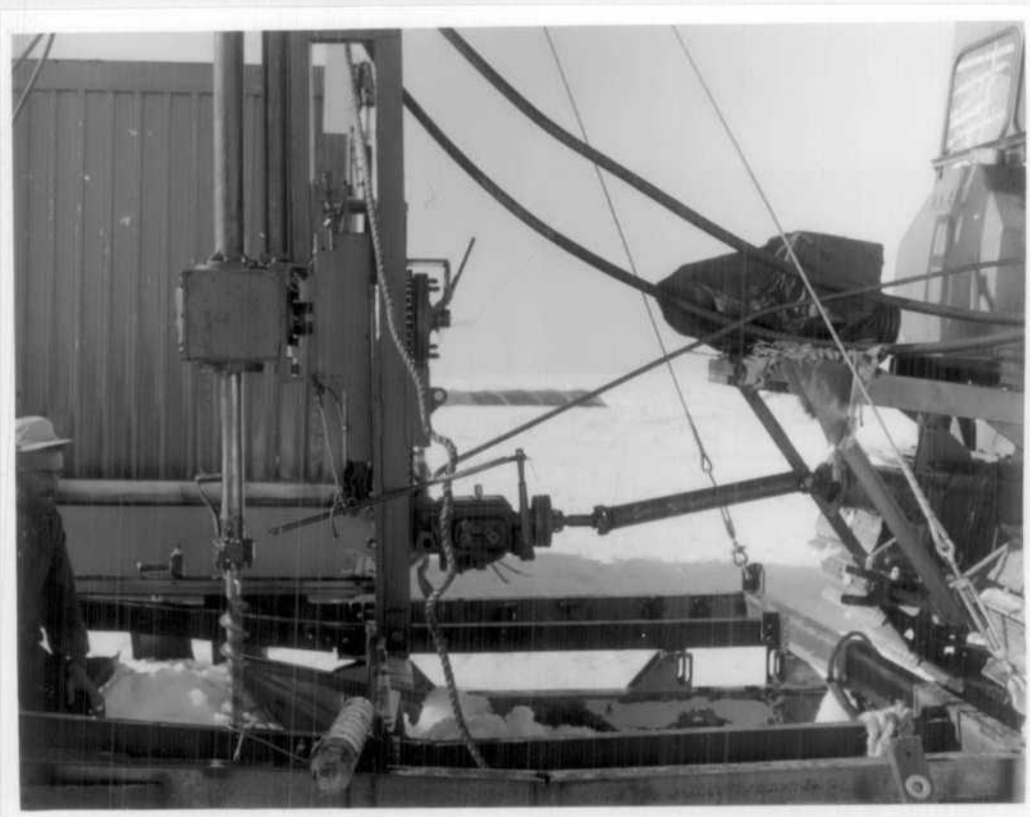
A.N.A.R.E. photograph by A. Battye

Seismic shooting on plateau

PLATE 25

A.N.A.R.E. photograph by A Battye

(A) Modified Proline drill and sledge



A.N.A.R.E. photograph by A Battye

(B) Drill set up for drilling

A.N.A.R.E. photograph by A. Battye

Drilling operation, showing clamping plate and D4 main-drive sprocket used as base plate

NB. Allen key used for quick release auger coupling pin at Kelly end