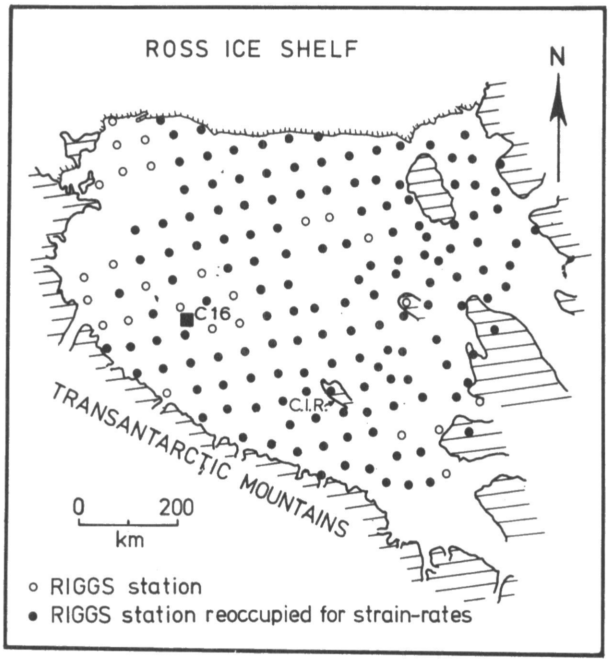

The Ross Ice Shelf, showing positions of strain rosettes. (C.I.R. is Crary Ice Rise.)

The field party consisted of M. Hyland, M. Jordan, D. MacAyeal, and R. Thomas from the the University of Maine at Orono. D. Chun and R. Wilson of USGS operated the Geoceiver, and S. Hansen of the University of Copenhagen drilled 11-meter holes for firn cores and temperature measurements. We are indebted to our cook, D. Johnson, for once more providing us with excellent meals, radio communications, vehicle maintenance, and general bonhomie.

The research was supported by National Science Foundation grant DPP 76-23047 A01.

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Ross Ice Shelf Geophysical Survey, 1977-1978

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The geophysical program of the Ross Ice Shelf Geophysical and Glaciological Survey during 1977-1978 (RIGGS IV) brought to completion work started during the 1973-1974 season and continued during the 1974-1975 and the 1976-1977 seasons (Bentley, 1976; Bentley *et al.*, 1974; Bentley and Jezek, 1977; Clough and Robertson, 1975). The University of Wisconsin geophysical crew (Greischar, Shabtaie, and Albert) arrived in McMurdo 8 December 1977. Before deployment to the field, a gravity tie was made to South Pole Station, the latest in a series of measurements to determine the secular increase of gravity (Bentley, 1971).

The geophysical program on the ice shelf began with gravity and radar sounding profiles and a seismic-surface-wave experiment soon after arrival of the field crew at station Q-13 (77°57′S.179°55′E.) (figure 1). During the last week of December, five remote field sites were occupied with support of the Twin Otter airplane (figure 2). Gravity measurements, radar sounding of ice thickness, and seismic sounding of water depth beneath the ice were made at all sites. In addition, studies of seismic and radio-wave velocities within the ice shelf were made at two of these sites and an electrical resistivity profile was completed at one (see table). Early in January, airborne radar sounding was made along 1,800 kilometers of flight lines (figure 1). The inertial navigation system of the Twin Otter operated well and sighting of survey sites from the air generally was successful, thus providing a strong tie to the ground-based sounding network.

When not flying, and after the surface-glaciological party had moved with the Twin Otter to station C-16 (81°12′S. 170°30′E.) (see figure 1) on 9 January 1978, the geophysical group continued more detailed experiments around Q-13 base camp. The measurements made near Q-13 included:

1. A seismic surface-wave experiment, carried out with shot sizes of 0.5 to 22 kilograms, shot depths of 1 to 5 meters, and shot-detector distances of 1.5 and 10 kilometers. This experiment was completed as an investigation of seismic-wave velocities in the upper 70 meters of the ice shelf independent of refraction shooting.

2. Continuous radar-sounding profiles along the axis of, and perpendicular to, an interesting surface topographical depression approximately 5 meters deep and 2 kilometers across, which is located 10 kilometers grid west of Q-13. The profiles indicate the depression is centered over a very large bottom crevasse or rift that extends upward to only 70 meters below the surface.

3. A gravity line 45 kilometers long, running grid east-west through Q-13. A negative anomaly of close to 34 milligals was found about 20 kilometers grid west of Q-13. Two additional gravity lines of approximately 10 kilometers each were completed to the grid NW. and grid SW. to see if the gravity low extended closer to Q-13.

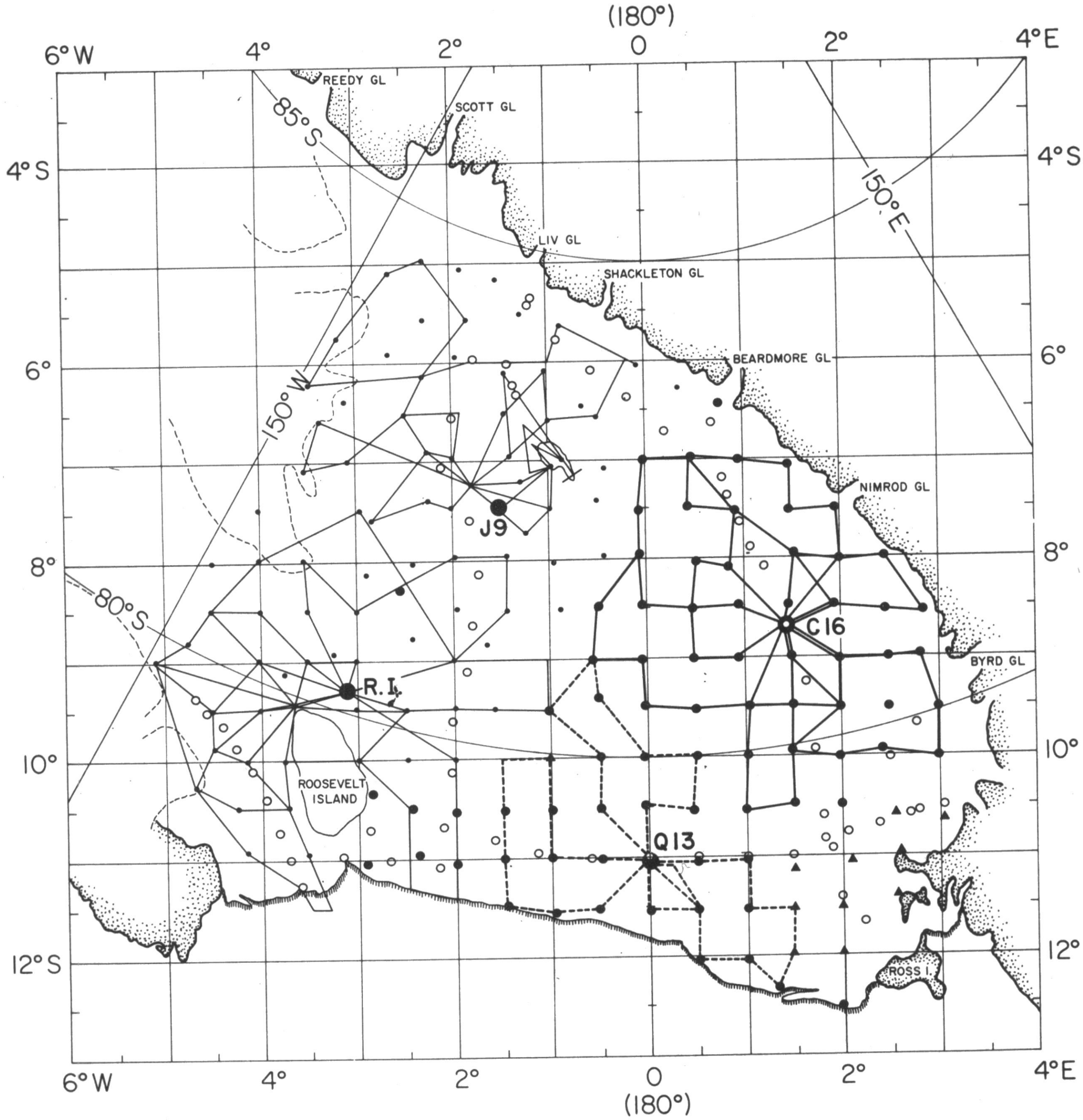

Figure 1. Location map for RIGGS. (Triangles and dotted lines, 1977-1978 stations and radar flight lines; heavy dots and lines, 1976-1977 stations and radar flight lines; light dots and lines, 1973-1975 stations and flight lines; open circles, previous stations (see Crary *et al.*, 1962); large black labeled circles, base stations).

4. An 800-meter electrical resistivity profile along a line perpendicular to a 1976-77 profile, which itself was extended to 700 meters this season. A substantial anisotropy in the apparent resistivities was detected.

5. Two radar wide-angle measurements of wave velocities in the ice shelf using both 35-megahertz and 50-megahertz radars.

6. A 350-kilogram seismic long refraction-reflection shot recorded at distances of 10 and 31 kilometers grid west of camp.

7. Seismic up-hole experiments in a 100-meter hole and in several holes of 5 meters or less.

8. Radar surface-wave measurements made for testing the effect of various antenna orientations.

On 16 January 1978, base camp operations were moved to C-16, where near-camp work continued as the opportunity arose. Measurements made near C-16 included: (a) a wide-angle experiment completed with the 35-megahertz radar along the same line as a 1976-77 experiment using the 50-megahertz radar; and (b) 30- and 300-kilograms seismic

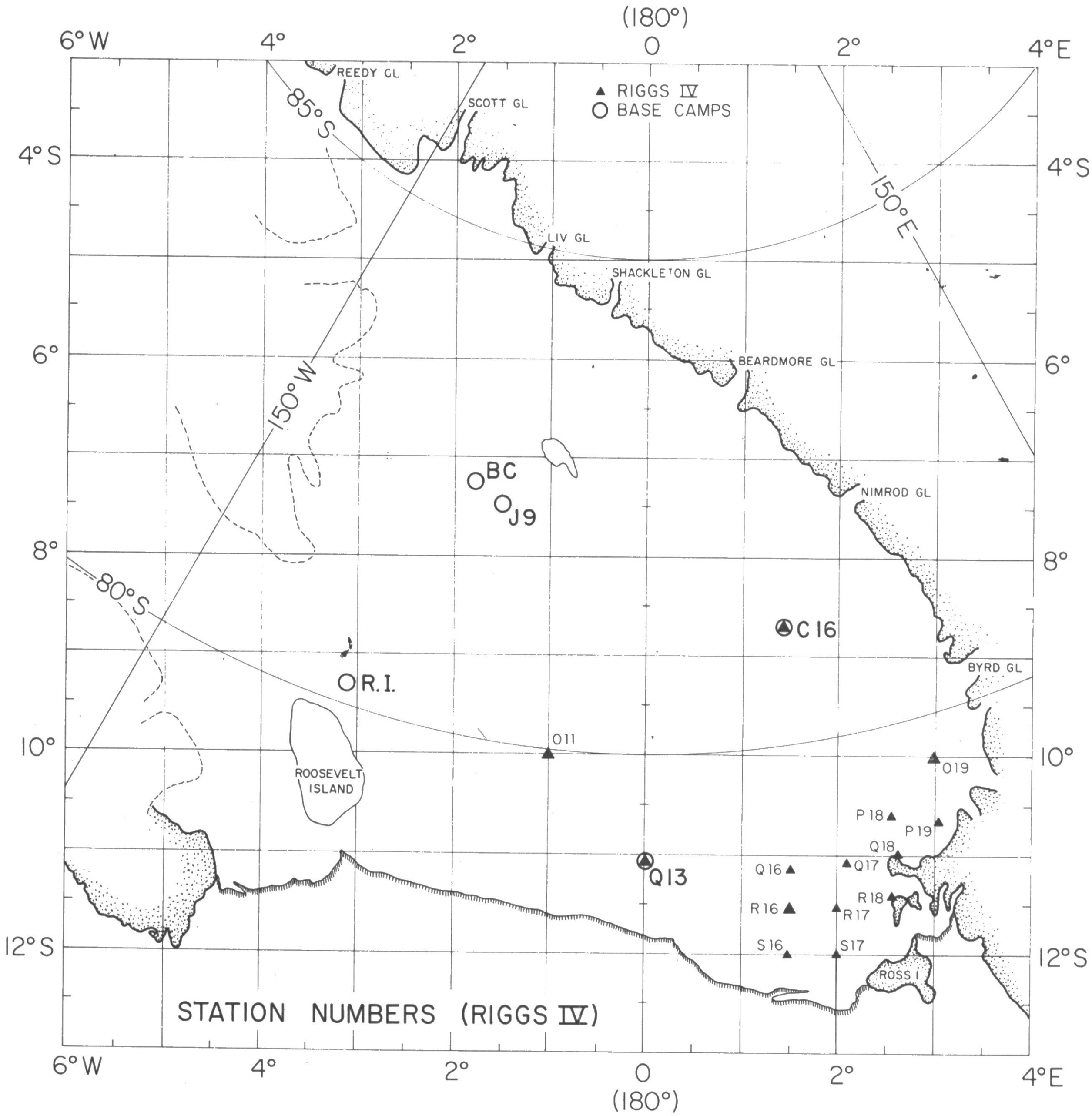

Figure 2. Identification of 1977-1978 stations, indicated by triangles. (Larger triangles denote sites of more than minimum program of measurements; circles denote base camps.)

reflection shots from the 100-meter core hole recorded at a distance of 2 kilometers.

Because station O-19, occupied in 1976-77, is located in an interesting area along the margin of the ice flowing from Byrd Glacier, it was reoccupied this season for additional measurements including determinations of seismic and radio-wave velocities in the ice shelf, radar-sounding profiles of the ice thickness, a gravity-gradient measurement, and an electrical resistivity profile. Soon after returning to base camp from O-19, the inertial navigation system on the Twin Otter failed, making it impossible to relocate stations occupied in 1976-77, as was necessary for the surface-glaciology program. Thereafter, the Twin Otter was used by the Wisconsin party to establish six new stations in the McMurdo area (figure 2). Positions were found within a radius of approximately 5 kilometers by sighting on geographical landmarks. Measurements of ice thickness, water depth, and gravity taken at these stations essentially completed the 55-kilometer (1/2°) grid of geophysical measurements covering the Ross Ice Shelf (figure 1).

We thank Steven Jones for the loan of the 35-megahertz radar. Logistic assistance in the field by W. Rierden and P. Marshall of the Ross Ice Shelf Project office is gratefully acknowledged.

This work was supported by National Science Foundation grant DPP 76-01415.

Ross Ice Shelf Project stations (see figure 2).

Station	Grid position	Date occupied	Ice thickness	Water depth	Gravity	Radio wave veloc.	Seismic wave veloc.	Electrical resist.
O-11	11°S.1°W.	30-31 December 1977	X	X	X	X	X	X
O-19	10°S.3°E.	19-20 January 1978	X	X	X	X	X	X
P-18	10.6°S.2.6°E.	23 January 1978	X	X	X			
P-19	10.7°S.3.0°E.	24 January 1978	X	X	X			
Q-16	11.2°S.1.5°E.	24 January 1978	X	X	X			
Q-17	11.1°S.2.1°E.	24 January 1978	X	X	X			
Q-18	11.0°S.2.6°E.	23 January 1978	X	X	X			
R-16	11 1/2°S. 1 1/2°E.	27-28 December 1977	X	X	X	X	X	
R-17	11 1/2°S.2°E.	26 December 1977	X	X	X			
R-18	11.4°S.2.6°E.	22 January 1978	X	X	X			
S-16	12°S.1 1/2°E.	27 December 1977	X	X	X			
S-17	12°S.2°E.	26 December 1977	X	X	X			

This is University of Wisconsin, Geophysical and Polar Research Center, Contribution 355.

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Antarctic ice core recovery

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As part of the Polar Ice Core Analysis Program (Langway and Herron, 1977), ice cores were obtained from sites Q-13 (78°57′24.4″S. and 179°55′22.3″E.), C-16 (81°11′36.6″S. and 170°29′52.2″E.), J-9 (82°22′S. and 168°40′W.), on the Ross Ice Shelf, and South Pole (90°S.). These cores and other samples were collected to permit further investigation of the seasonal variation in sea salt concentrations (Herron and Langway, 1978), delineation of aerosol sources by chemical analysis, and assessment of the factors influencing the variations in the physical characteristics of the ice at these and other selected sites. In addition to the ice cores, snow and ice samples were collected from the ice towers near the summit of Mt. Erebus and also on the Ross Ice Shelf for preliminary investigations of the dispersion of aerosols emitted in the Mt. Erebus plume toward the shelf. All phases of the field activities were completed between 16 November 1977 and 26 January 1978.

Between 16 November and 2 December the field team (E. Chiang, field leader; J. Cragin; G. Klouda) collected samples at the summit of Mt. Erebus and, in a complementary sampling effort, recovered nine five-meter hand-augered firn cores at radially increasing distances from Ross Island. Several samples of condensed vapor from the plume were collected from the inner rim of the Mt. Erebus crater, and a small ice tower (2.5 meters high x 1.5 meters in diameter) approximately 30 meters from the crater rim was sectioned for laboratory analysis of chemical composition and physical properties. The radial sampling was conducted with helicopter support out of McMurdo along three flight lines. The maximum distance of each line from Mt. Erebus varied from 75-85 nautical miles.

The field team was supported in the shallow drilling operations by the Polar Ice Coring Office (PICO), which provided the drill crews (T. Clark, S. Atwood, R. Tilsson, and P. Marshall) and the Army Cold Regions Research and Engineering Laboratory (CRREL) shallow drill (Rand, 1976). Coring operations were initiated on 2 December 1977 and were completed by 15 January 1978. The drilling operations at Q-13, and South Pole proceeded smoothly and, in general, the quality of the core obtained is excellent. Although 100