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WILKES GEOPHYSICAL OBSERVATORY WORK, ANTARCTICA 1962

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CONTENTS

SUMMARY

Operation of the seismic and magnetic observatories at Wilkes, Antarctica during 1962 is described.

1. INTRODUCTION

This Record describes geophysical observatory operations at Wilkes, Antarctica during 1962. The author was in charge of the seismic and magnetic observatories at Wilkes from 17th January 1962, when he relieved W.M. Burch, until 21st January 1963, when he was relieved by R. Whitworth. Previous observatory work at Wilkes has been described by Underwood (1960), Jones (1961), and Burch (1962). The setting up of the magnetic equipment was reported by Berkeley (1959).

Scientific results are published separately in the Bureau of Mineral Resources series of Seismological Bulletins, Reports (magnetic results), and Geophysical Observatory Reports.

Much more-detailed accounts of the work done are contained in the station log book.

2. MAINTENANCE AND MODIFICATIONS

Magnetic buildings

Stainless-steel cable and brass cable-fittings were installed to hold the variometer room against blizzard winds. The north and south walls were found to be bulging out at the top, where the original construction was deficient. An aluminium rod with an aluminium turnbuckle was installed at the level of the rafters; this helped to draw the walls back into position. The cracks in walls and roof were sealed with low-temperature putty. This needs to be done twice each year, in autumn and again before painting in the summer. The north and west walls and the roof were painted with bituminous aluminium so as to reflect some of the sun's heat. However, this material had an unsuitable grey cast and white exterior paint would probably have been better. The remaining walls were painted red.

Holes were cut in the walls of the absolute and variometer huts to allow orientation surveys. These holes were plugged with plastic tubes with screw lids which could be removed when necessary.

Early in 1962, the pool north of the magnetic buildings began to freeze, and it was not possible to pump it out. This had the unfortunate effects described in the discussion on the Z variometer (p. 3). In the spring a special effort was made to melt this ice as early as possible, and the water was pumped away as fast as it accumulated. Large boulders and then gravel were used to pack up the cribbing at the north side of the absolute hut, where wind and water had undermined the structure.

Seismic buildings

The hut previously used as a glaciology field store and cold laboratory (Burch, 1962, Plate 5, Building 27) was dug out of the drift, cleared of snow, and converted to house the Grenet short-period vertical seismometer and its recording drum. A partition and a trapdoor for use during blizzards were installed. Power lines for time marking and 110V-A.C.lighting and instrument power were wired to the hut from the science building. The latter are safeguarded by a D.C.-battery-fed inverter system which operates in the event of a power failure. Recording with the Grenet commenced about 24th April.

Parts of the exteriors of the seismic huts which could be reached were sealed and painted.

Inside the long-period seismic hut, the power-supply wiring was re-arranged and tidied during the installation of a power point for the seismic-drain heater. The Sunvic thermostat and its thermal relay were also installed.

Melt water continued to be a major problem at the seismic installations; the heated drain described by Burch (1962) was declared a fire hazard and was removed. A new one was constructed of 'jet heater' tubing and 'Pyrotenax' cable which was supplied by power from a stepdown transformer with about 10 amperes at 6 volts. The continuous slow draining of melt water from beneath the seismic hut down this drain eliminated the large disturbances to trace level that had previously accompanied pumping. This disturbance is now thought to be due to the cold air drawn into the room as the water was removed from below. Melt water, percolating from the surrounding snow drifts, also caused flooding of the Grenet hut, although this hut was not heated. In this case the water was bailed out with a bucket when necessary.

Time-mark apparatus

The 'Times Facsimile' electronic chronometer maintained a low rate throughout the year; the only stoppages were due to a blown fuse, an overvoltage on the power supply, a seizure in the digital clock, and some work being done on the system. During July the 'Simplex' programme machine was observed to be occasionally jumping two minutes at a time, owing to noise in the chronometer contacts. This was remedied by putting a 100 microfarad capacitor across the relay coil.

A second set of contact leaves was installed on the minute wheel of the electronic chronometer; the impulse from this was used to advance the programme machine at approximately 30 sec before the minute. The original leaves still made contact on the minute and provided time marks through a single relay. No trouble was experienced with the bead chain, but parts of the system had to be rewired and the whole system had to be tidied up and resoldered.

Science building and darkroom facility

A ceiling was constructed in the geophysical office from cardboard panels which became available during the year.

The rotary photo-dryer was used to dry records throughout the year, except in November when it failed owing to a completely-stripped final worm-wheel in the reduction gearbox. A new wheel was cut using the lathe, and the gearbox gave no more trouble.

3. MAGNETIC OBSERVATORY OPERATIONS

Control observations

QHM 492 and 494, BMZ 236, and the DTMCIW-28 declinometer were used as control instruments throughout the year. QHM 493 and long-range BMZ 121A were used by geophysicist D.J. Walker in the field; they were compared by him and the author during the winter.

Between 22nd March and 11th May 1962, the lamp mounted on the azimuth mark was displaced by an unknown (and possibly varying) amount, so that declination observations made between these dates are unreliable. The scale-value milliammeter used in previous years was returned to Australia for checking and calibration, but a few tests with the old and new meters in series indicated no significant error. During May erratic changes in the current made the standard-sensitivity D scale-value determination difficult to perform. The trouble was traced to a loose screw beneath a terminal on the Helmholtz coil; after this screw had been tightened no further trouble was experienced. A small lamp was mounted behind the electrical control panel to warm the potentiometers used for scale-value determinations.

Variometers and recorders

Both the drum-rotating motor and the drum-traversing motor of the rapid-run recorder gave trouble. In each case gumming of the oil in the gearbox caused a seizure. The motors were replaced by spares and only a few hours of records were lost. It is probably worthwhile to dismantle and clean this recorder every second year. No trouble was experienced with the clockwork drive of the standard recorder. The spots of the standard D variometer and the standard H variometer drifted up so that they did not fall on the recorder slit; they were reset using the mirror on the suspended movement.

On instructions from Head Office, an attempt was made to seal and evacuate the air from the standard Z variometer, but as there are joints between the several parts of the case of this instrument, the attempt failed. The Z variometer was dismantled and examined on 19th September. The knife edges and agates were carefully examined with a 40-power microscope, but no pitting or chipping was seen. All parts of the movement were found to be tight, as were the clamps of the agate plates. The baseline mirror, however, was loose and was cemented with Canada Balsam to its mount; after this no jumps were observed in the baseline. However, although the movement mirror and the sensitivity probes were cemented with a little balsam, the jumps in the traces, which have always been troublesome in this instrument, continued and by the end of the year the variometer had not settled down after this disturbance.

An analysis of the occurrence of these jumps was made during the year, and evidence suggests that at times of very low temperatures and especially following a sudden decrease in temperature, the ice in the frozen melt-water pool near the variometer room contracts, cracks, and the vibration jars the Z movement. However, no explanation is offered as to why a sudden vibration should cause a permanent change in the angle of the Z movement.

It was necessary to bring the rapid-run H spot down into the recorder slit after the disturbances caused by a large explosion at the 'ramp'. In this case it was convenient to lift the lamp slightly, and at the same time to shift it sideways so that the central mirror, No. 13, provided the recording spot when H was at its mean value.

Since 1959 the rapid-run D has occasionally 'run out of spots' during storms and disturbances (Underwood, 1960, p.5). Therefore, in December 1962 the magnet was re-oriented by a sufficient amount to bring it into acceptable orientation, by rotating it with respect to the movement mirror. This brought the spot from mirror No. 9 into recording position for usual values of D so that several degrees more of westerly declination can now be recorded during disturbances.

A special mirror-adjusting jig was constructed to ease the re-orientation adjustment.

Orientations

After the holes in the magnetic buildings had been cut, a survey was run and a line of known azimuth was established in the variometer rooms. The old quadrant strips are not in a convenient azimuth, so new strips were installed so that offsets could be more accurately measured. The existing standard orientation plates were surveyed using the 'method of strings' (McComb 1951, p.142). New metal orientation plates were made and installed in the rapid-run room. After these preparations, sets of orientation tests were done on all variometers and the results calculated (see Table 1). Corrections were applied to the observed ex-orientations for (a) error in the position of the test-magnet stops, (b) the deviation of instantaneous value from the mean, (c) declination error in H, and (d) the nominal direction of the stops from each variometer. A comparison was made with all previous orientation tests, but only the rapid-run D was re-adjusted.

TABLE 1

ORIENTATION RESULTS

Variometer	Date	Result	Action
Standard D	27.3.62 13.5.62 13.5.62	+31.1' +57.7' +46.8'	Nil
Standard H	27.3.62 13.5.62 13.5.62	+25.1' +53.6' +20.9'	Nil
Standard Z	27.3.62 27.3.62 13.5.62 13.5.62	+53.6' +51.9' +54.9' +55.2'	Nil
Rapid-run D	18.5.62	+16.5'	Reset mirror orientation 23.12.62
Rapid-run H	18.5.62 18.5.62	$+3^{\circ}27.9'$ $+3^{\circ}24.8'$	Nil
Rapid-run Z	18.5.62 18.5.62	-18.0' - 7.6'	Nil

Sign convention. + means north-end clockwise or low from perfect orientation.

4. SEISMIC OBSERVATORY OPERATIONS

Grenet seismograph

The Grenet seismometer was modified at the upper suspension point, so that friction at this point was reduced and the point of action of the spring tension was below the pivot point. Knife edges and knife-edge blocks are provided on this instrument for use in the 'upset' method of determining reduced length. The screw holes in these blocks were filed out so that they could be set in line with the cardan-hinge intersections. The seismometer was then tested by the methods outlined by Coulomb (1956).

The light source for the 'Buromin' recorder was extensively modified and it now uses GK 851K straight-filament globes, as supplied for the magnetic recorder lights. The recorder cylindrical lens was broken in two during setting up, but one half was mounted in a frame made up for the purpose and proved adequate for the single Grenet trace. As the old motor of the recorder was for 240V, a spare motor from the Lehner and Griffith recorder was installed. The bearings of the recorder support rollers gummed up and had to be cleaned.

The Sefram galvanometer was used throughout the year. During setting up, a top fibre was broken and was replaced with magnetometer fibre. The period was not altered by this, but the magnetic damping could not be properly adjusted.

Long-period seismograph set

The Lehner and Griffith recorder gave trouble only once, when one end of the axle of one support wheel touched the cover plate. This was fixed by adding a gasket under the cover plate.

No trouble was experienced with the galvanometers, nor with the seismometers. 'Drift' was less troublesome than previously reported, but 'oscillations', presumably due to convective overturn of the air in the vault or in the instrument case, still occurred occasionally.

Period, damping, and sensitivity-tests were performed as described by Underwood (1960). Computations to find the fundamental constants of the galvanometers by the method outlined in Byerly (1942, p.136), were made, but the method could not be extended to the seismometer constants owing to the lack of means to record the seismometer motions. The presence of the observer in the vault alters the temperature and upsets the normal performance of the set, so that this method of calibration is probably ineffective.

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