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RECORDS 1960 No. 121.

MACQUARIE ISLAND GEOPHYSICAL OBSERVATORY WORK, 1959

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CONTENTS

ABSTRACT

This Record describes the operation of the magnetic and seismic observatories of Macquarie Island during 1959.

The scientific results will be published in separate reports.

1. INTRODUCTION

The seismic observatory at Macquarie Island has been in operation since 1950 and the magnetic observatory since 1951. The author was geophysicist-in-charge of the two observatories during 1959, as a member of the Australian National Antarctic Research Expedition.

A description of the station and details of the observatory installations and routines may be found in previous Records by Oldham (1953), McGregor (1954), Tenni (1954), Robertson (1957), Cook (1957), Cleary (1958), Mann (1959), and Turpie (1959).

2. MAINTENANCE

2.1. Introduction

As mentioned in previous Records, all huts and equipment are subject to excessive corrosion due to the very damp atmosphere. Sand and sea spray whipped up by high winds are blown almost continuously through the camp.

2.2. Buildings

Painting was done as a joint effort by the party during September, October, and November, whenever weather permitted. The surfaces were first cleaned and scraped to remove loose paint and then an undercoat of pink primer was applied to particularly bare patches. Unfortunately paint was in extremely short supply and most of the buildings received only one coat, which was quite inadequate. It is recommended that if weather permits, the magnetic huts, particularly the west walls, should receive two coats of paint before each winter. The roofs of both magnetic huts received only one coat of pink primer and they require at least one more coat when more paint is available. The roofs of the seismic hut and store were given a good covering of "Proofcote", which should be adequate.

The north-east window and several other parts of the absolute hut were re-caulked. A small intermittent leak above the office window appeared to be rectified after the roof was tarred, but another still exists where the wooden section of the office adjoins the concrete seismic vault. So far, all efforts to locate its source and stop it have failed.

Quadrant timber was screwed to the opening edge of the variometer house door to prevent rain and snow being driven through the crack by the wind.

Several locks were defective at the beginning of the year, owing to broken springs. New springs were made from a sheet of phosphor bronze, and two springs that broke during the year were also replaced. The door of the absolute hut, which had been fractured when caught by a gust of wind, was repaired with a wooden brace, and the catch was re-centred. A brass hook for holding the door securely when open arrived from Melbourne at the end of the year.

2.3. Tools

The tools have been greatly affected by the damp, salt-laden atmosphere, and although still fairly serviceable, are not in good condition. During the year a shadow board enclosed in a heated box was constructed in the store-room. The tools were stored in this cupboard after being cleaned with emery paper and wiped with "Penetrene".

The same method was used successfully by the carpenter during the year, and is more convenient than the alternative of keeping them in an oil bath. They should be cleaned and wiped with "Penetrene" after use or about once a fortnight.

2.4 Power Cables

During the year a section of the old lead-covered cable supplying the seismic hut developed a serious leak and was replaced with a new plastic-coated cable. Part of the power cable to the magnetic hut was accidentally dug up by the bulldozer during levelling operations, and was repaired by the engineer.

2.5. Wireless Aerial

The WWV aerial was brought down several times by high winds in April and May. A new vertical aerial suspended by a wire running between Wireless Hill and Camp Hill was put up; this was modified to a T-shape later in the year.

2.6. Batteries

These gave no trouble during the year. Once a week they were checked with a hydrometer and topped up with distilled water when necessary.

2.7. Re-wiring of Seismic Vault

The wiring in the Seismic Vault was found to be in poor condition, with leads running across the floor and loose wires littering the pier. Accordingly, the entire wiring was replaced. The 6-volt seismic lamp and 240-volt motor connections were run across the ceiling and terminated in three-pin plugs on the wall above the bench. A distribution board was constructed for the lamp wiring, to allow each collimator to be connected or disconnected without interference to the others. The 750-watt strip heater, formerly lying on the bench, was mounted in the north-west corner of the vault and a protective frame was built around it. A 500-watt heater was installed similarly in the south-west corner. The heaters can be operated together or independently. A red lamp, mounted directly over the pier, gives improved illumination for record changing and minor adjustments.

2.8. Darkroom Reorganisation

The original arrangement was awkward owing to a large shelf above the sink, which made the sink bench virtually useless. The sink was rusty and leaked badly, and the shelves were badly corroded by acetic acid and fixer solutions. A new sink was installed and all corroded shelving was rebuilt. An aluminium draining board was built around the sink, and the whole installation was rebuilt to allow easier access to the sink bench. Wooden racks for drying the traces were constructed, and the room and shelves were painted throughout. Quadrant timber was fixed around the edges of the rubber floor.

2.9. Office Reoganisation

The wireless receiver was built into the left hand end of the desk, and the loud speaker was mounted on the wall beside it. A new cupboard was constructed at the right hand end, and a set of shelves was fitted on each side of the window. The office interior and fittings were painted.

2.10. Darkroom Water Supply

Some trouble was experienced with rust stains on traces, particularly when the level in the water tank became low. A new water tank was ordered from Melbourne.

2.11. Photographic Equipment Storage

An external cupboard was built against the east wall of the office, for storing solution bottles and miscellaneous photographic equipment.

2.12. Erosion

Stones were piled around the supporting sleepers of the absolute hut to counteract wind erosion. A considerable amount of water erosion occurred on the east side of the office and in front of the store, making the area dangerously slippery. Accordingly, the area was blocked with timber, and built up and levelled with soil and stones from the beach.

2.13. Miscellaneous Wiring

The power line to the darkroom and store, formerly taken from the seismic motor circuit, is now connected to the office supply. A red light was installed in the variometer control room to provide light during instrumental adjustments and record changes. It is wired to indicate when the red lights in the variometer room are switched on.

3. MAGNETIC OBSERVATORY

3.1. Introduction

The magnetic recording equipment consists of a set of normal-sensitivity La Cour variometers. Recording is photographic, with a drum speed of 15 mm/hour.

3.2. Scale Values

H and Z scale values were determined four times per month using Helmholtz-Gaugain coils. The scale value circuit gave no trouble during the year, but it was found advisable to clean the potentiometers with "Servisol" before use. As scale value measurements carried out during disturbed periods generally give erratic values, determinations were made only when it was fairly quiet magnetically. Values were very consistent for the whole year, the scatter being less than one per cent in both H and Z. In November a determination of the D scale value was made by direct observation of D with the DCK magnetometer during a disturbed period. This enabled a comparison to be made between the magnetometer and D variometer over a large range of D.

3.3. Baselines

Semi-absolute observations for baseline control were made four times each month. QHMs 178 and 179 were used for H, and gave reasonably consistent results. Intercomparisons carried out in December 1958 and December 1959 indicate preliminary instrumental corrections which have changed in agreement with the previously calculated drift. On several occasions between January and April, jumps in the H temperature-compensating strip caused small baseline changes. Observations of Z were made with BMZ 64. Intercomparisons in December 1959 indicate that during the year there was a change of 4 gammas in the preliminary instrumental correction. As in previous years, the Z baseline shows a fairly steady drift, increasing numerically by 3 gammas per month. Absolute measurements with DCK Kew-pattern magnetometer No. 158 were used to control the D baseline. Intercomparison results indicate some scatter in the preliminary instrumental corrections to the DCK magnetometer over the last few years.

3.4. La Cour Clockwork Drives

Three drives were kept of the station and used in rotation. Every two months the drive was changed and the old one stripped down, cleaned, oiled, and tested. In spite of this procedure, over thirty hours' record was lost owing to drive stoppage. The only apparent explanation is corrosion or deposits forming on the bearings.

3.5. La Cour Clock

The clock ran well for most of the year but the rate became erratic on several occasions. However, in November the drive weight ran off its cog and fell into the bottom of the case. After this the clock stopped several time for no apparent reason. The machanism was dismantled, cleaned and oiled but still stopped occasionally. The trouble was apparently due to the escapement, which was found to be out of line with the pendulum and which produced a noticeably uneven tick. The position of the pendulum relative to the escapement can be altered by bending the pendulum drive rod slightly. This was done, and after some adjustment, mainly by trial and error, the clock was successfully set going again. A stoppage also occurred when the minute-contact cam fouled the clock face. This was rectified by placing a small wedge under the clock face supports.

3.6 Humidity Effects

Large changes in humidity were found to affect trace intensity to a marked degree. On three occasions several hours' record was partly lost owing to trace fading caused by a sudden rise in humidity at the end of a cold spell. This effect was sometimes made worse by condensation of moisture on the glass surface of the recording system. It is possible to avoid most of this humidity effect by keeping a close watch on the weather and adjusting the intensity potentiometers accordingly.

4. SEISMIC OBSERVATORY

4.1. Introduction

The seismic equipment consists of a short-period Grenet seismometer as the vertical component, and two short-period Wood-Anderson instruments for the north-south and east-west components. Recording speed is 30 mm/min in each case. The microseismic activity is generally high, and considerably masks the records of teleseisms.

4.2. Adjustments to Instruments

The Wood-Anderson damping co-efficients were reduced to 0.3 in April in an endeavour to improve the instruments' sensitivity. With this low damping, the tilt-test method of measuring the co-efficient was found to be satisfactory. At the same time the levels and mean free periods of all components were checked. The static magnification of the north-south Wood-Anderson was measured also, as this value was required for the reduction of microseismic data. In July it was decided that, because of the high microseismic activity, greater damping would be more suitable for teleseismic recording; therefore the damping co-efficients of the Wood-Anderson instruments were increased to 0.85. As the tilt-test does not give sufficient over-swing for the higher damping, the air-blast method was used in the determination of the co-efficients. At the same time the levels and mean free periods were checked again.

4.3. Wood Anderson Focussing

Some trouble was experienced with the focus of the east-west Wood-Anderson. The collimator was dismantled and a new finer slit put in; but, although after several attempts a better spot was obtained, the focus was never entirely satisfactory.

4.4. Seismic Control Panel

The original control panel was a combination of six different panels with a complex mass of leads running between them. Trouble was also experienced with the intensity potentiometer, which was partly burnt out. A new control panel, with a ceramic-base potentiometer for intensity control, was constructed and installed on the east wall of the office. The circuit of the new board is virtually the same as that of the old combination, but in addition it incorporates the seismic battery-charging circuit and two warning pilot-lamps in parallel with the recording-lamp and time-mark sections of the circuit.

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