

COMMONWEALTH OF AUSTRALIA

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DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES,  
GEOLOGY AND GEOPHYSICS.

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RECORDS

1958, No. 27.



PRELIMINARY REPORT ON ICE-THICKNESS MEASUREMENTS,  
MAWSON, 1957-58.

by

M. J. GOODSPEED.

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## 1. INTRODUCTION

The work described in this report was carried out by staff of the Bureau of Mineral Resources, Geology and Geophysics, with the assistance of members of the Australian National Antarctic Research Expedition, 1957-58. The seismic, gravimetric and barometric equipment were provided by the Bureau and the seismic cab and generator, the shot-hole drill and all other logistic material were provided by the A.N.A.R.E.

One object during this field trip was to obtain a continuous series of ice thickness measurements extending as far into the continent as possible. For this reason the route ran due south for most of its length. Relatively minor deviations were necessary at the beginning of the traverse, to clear crevassed surfaces near the ranges in the immediate vicinity of Mawson and at the southerly end of the traverse in an attempt to clear further bad country there. A map showing the relation of the traverse to Mawson and other Antarctic stations is included (Fig.1.).

## 2. EQUIPMENT

The equipment used for the ice-thickness measurements consisted of the following:-

- (i) Seismic oscillograph equipment - 12-channel commercial equipment manufactured by Texas Instruments Incorporated (formerly Houston Technical Laboratories); the equipment was mounted in an insulated, heated cab, containing also developing tanks and radio transceiver equipment. The cab was spring-mounted on a separate sledge together with the 1.5KV.A generator used for heating and charging batteries.
- (ii) Ice drill - hydraulically powered flight auger manufactured by Goldfields Diamond Drilling Company, Victoria. Three-bladed drag bits were used. The drill had a capacity of about 200 feet. It was permanently mounted, together with the deisel engine which powered the hydraulic motor, on a separate sledge.
- (iii) Gravimeter - a Worden Geodetic Gravimeter was used. This was transported in a freely sprung cradle outside one of the sleeping caravans.
- (iv) Barometers - two Askania Microbarometers, Model GB5, were used. These were transported in warm compartments.

## 3. TECHNIQUES

### (i) Levelling.

Levelling was carried out at five-mile intervals along the traverse. One barometer was carried in the weasel which scouted the route ahead of the main trains. On leaving each camp, the weasel would be allowed to run five miles before the trains moved. On radio confirmation that the weasel had arrived at the five-mile point, simultaneous barometric readings were made at the train and at the weasel, and air temperature noted. The weasel then marked the five-mile point with a stake and proceeded a further five miles while the trains moved up to the first stake. The distance between camps and shot points was, in general, an integral number of these five-mile intervals.

### (ii) Gravity.

Gravimetric observations for ice thickness were made at each of the five-mile levelled points, including the seismic shot points.

(iii) Seismic.

The normal interval between seismic shot points was twenty miles. This interval was reduced in some cases where there were rapid changes in ice-depth or altitude, and was increased to twenty-seven miles in one case where only minor changes were indicated. In the case of two intervals where the distance between seismic shot points was forty miles on the outward journey, the twenty-mile stations were shot on the return journey.

Reflection shot holes were drilled to 100 feet, this depth being acceptable both for glaciological temperature measurements and for the seismic work. An average of about six feet was lost in these holes due to uncleared cuttings.

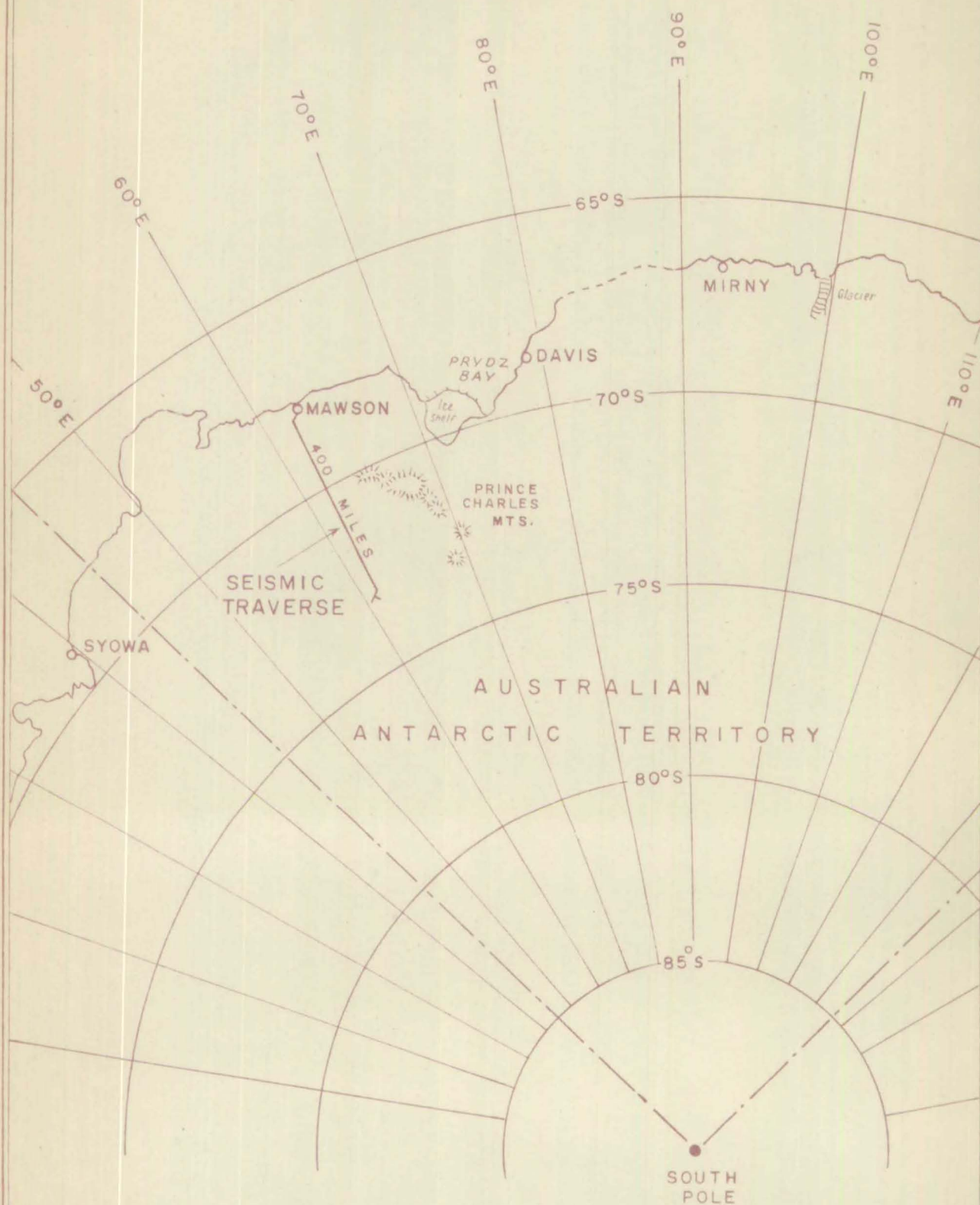
Geophones were buried at depths of one to two feet in the snow. They were normally laid in L-form, six geophones in a line east from the hole and six south of the hole. The nearest geophone was normally six hundred feet from the shot-hole, with the others at intervals of one hundred feet.

The normal charge used in reflection shooting was 1 lb. RDX/T.N.T., though in unusually calm conditions good reflections could be obtained in about eight thousand feet of ice using only 4 oz. charges.

In addition to the reflection shooting, refraction shooting was carried out at two locations, to obtain values for seismic velocities in ice. Experimental shots using patterns of charges, both buried in the snow and supported above the surface, and also some shear-wave shots, were carried out.

3. RESULTS

A preliminary profile based on "on-the-spot" appraisal of the seismic records and examination of the barometric readings is included (Fig.2). Full analysis of the results is proceeding.



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ROUTE OF SEISMIC TRAVERSE



# PLATE 2

High peak fixed  
 during survey  
 11,200 ft.  
 (aircraft altimeter)

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### PROVISIONAL PROFILE

