

# GLACIOLOGICAL SURVEY OF THE AMERY ICESHELF

by W. Budd

\* Glaciologist, Antarctic Division, Department  
of External Affairs, Australia.

A comprehensive 3 years glaciological survey of the Amery ice shelf has now been completed by ANARE field parties. The first exploratory work on the surface and glaciological observations were carried out in 1962. A vehicle route was established from Mawson to the iceshelf and a dog team party travelled as far south as the Manning Nunataks, carrying out glaciological observations en route. A series of 9 pits was dug roughly on a N.S. line and generally 2 m. deep primarily to investigate the change in rate of snow accumulation with distance from the ice front. A 4 m. deep pit at depot E cf. Fig. (1) showed the past accumulation and its metamorphosis for the previous 7 years. Stakes were left here for remeasurement in 1963.

A strain grid was established at depot E and remeasurement over a period of 4 weeks provided the first deformation results for the iceshelf. On the return voyage to Australia the front of the iceshelf was re-charted and a feature of it re-astrofixed to obtain the rate of forward motion since 1957 and the subsequent change in position of the ice front.

For 1963 a plan was proposed for a comprehensive coverage of observations on the ice-shelf with the primary aim of setting out stake systems for remeasurement after one year, in 1964. This plan was carried out quite successfully using two dog teams supported by tractors.

Stakes were placed 2 miles (3.2 Km) apart on the iceshelf to determine the accumulation rates along its central flow line  $G_1$   $G_2$   $G_3$   $T_4$ , as shown in Fig. (1) and across the iceshelf at front and back E  $G_1$   $T_1$   $T_3$   $G_3$

$T_2$  respectively. At three positions down the central flow line,  $G_1$   $G_2$   $G_3$ , strain grids were established to measure primarily the longitudinal and transverse strain rates. Sun azimuth determinations and sunfixes were also carried out to measure absolute rotation and velocity.

Pits 2 m deep were dug at E  $T_1$   $T_2$   $T_3$   $T_4$  and  $G_1$   $G_2$   $G_3$  and several intermediate points along the longitudinal line. Cores were also taken at these points to the depth of 10 m and the boreholes were used to measure the temperature profile with depth to establish the annual mean air temperature at the surface.

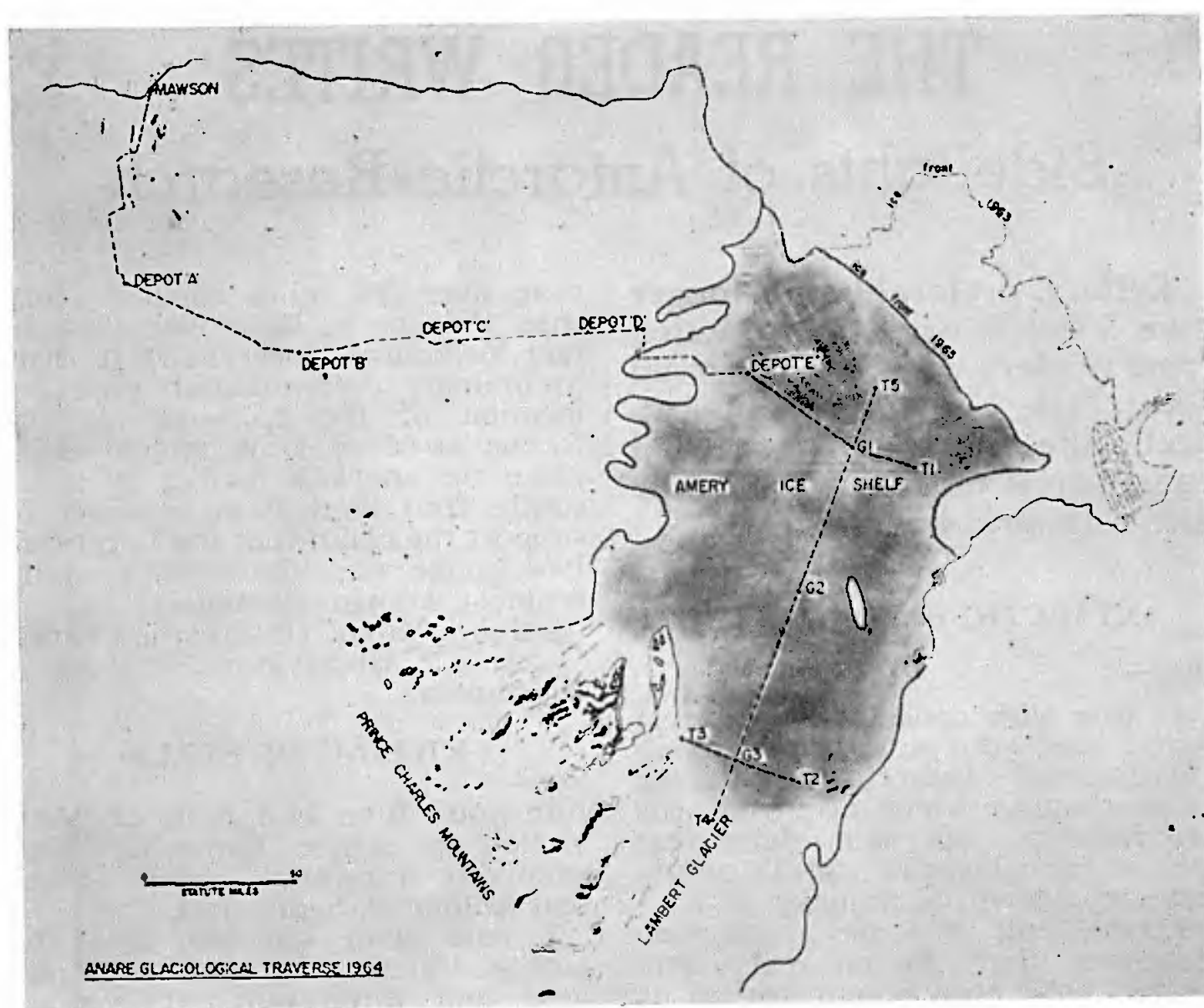
In 1964 the previous year's route was followed, using two weasels with cargo sleds, and a skidoo (motor toboggan) with dog sled.

The accumulation stakes were located and remeasured, the strain grids resurveyed, and astrofixes and azimuths were repeated. At two positions resection to rock features provided a check on the absolute velocity results of the astrofixes. Two further strain grids were established at  $T_4$  and a new point  $T_6$  (cf. map) to be remeasured at a later date. Pits 3 m deep were dug along the central flow line. Cores were examined to 6 m depth and the temperatures in the boreholes were measured.

A set of three precision digital aneroid barometers were used to determine the relative elevation profile over the route by a modified leap-frog technique. At numerous points along the central flow line the slopes were checked by theodolite.

An attempt to measure the iceshelf thickness by a radio altimeter device, successfully tested to 300 m depth near Mawson, was thwarted by irreparable damage to the power supply during a calibration run. It is hoped that thickness measurements

\* Attached to Meteorology Department, University of Melbourne.



will be made by this method in the future. Other plans include a visit to the iceshelf in 1967 to remeasure the strain grids and redetermine the movement and the velocity profile, establish a thickness profile with radio gauge, and commence a drilling programme to obtain the vertical distributions of temperature, density and crystal structure.

### EDITOR'S NOTE

(The above relatively non-technical account of an important glaciological research-project will, we feel, be of interest to the ordinary reader as well as to Mr. Budd's fellow-scientists. The author's more technical "preliminary results and conclusions" may be summarised as follows.)

The Amery Ice Shelf is very flat.

Its thickness is estimated to range from 190 m at the front to 400 m at

the mouth of the Lambert Glacier.

The annual mean surface temperature decreases from 19.1 C at T5 to 23.3 C at G3.

The ice shelf is not in a state of continual balance. On the contrary, the loss from a large break-out in 1963 (see "Antarctic" March 1965, pp. 24 and 31) was about one-fifth of the ice shelf area, estimated to be 40 years' growth. Prior to this event, from 1936 to January 1963, the ice shelf front showed a general forward movement and outward spreading.

Astrofixes carried out on the same feature in 1957 (Russian) and 1963 (Australian) gave a forward velocity of about 1500 metres per year at the ice front. Away from the front the velocity decreases at first very rapidly and then more gradually until it reaches about 300 m per year on the Lambert Glacier.