COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1963/151

DARWIN
SEISMIC OBSERVATORY SITES
SEISMIC REFRACTION SURVEYS, NORTHERN TERRITORY 1963

by

J.T.G. ANDREW

RECORD No. 1963/151

DARWIN SEISMIC OBSERVATORY SITES SEISMIC REFRACTION SURVEYS, NORTHERN TERRITORY 1963

by

J.T.G. ANDREW

CONTENTS

ILLUSTRATIONS

SUMMARY

A seismic survey was carried out at two proposed seismic observatory sites near Darwin, NT. At the Winnellie site the seismic velocities measured in the bedrock are low for a good observatory site. One traverse at the Manton Dam site shows a high-velocity quartzite that should be suitable for a seismic observatory location.

1. INTRODUCTION

The Bureau of Mineral Resources has carried out seismological recording at a site near Darwin, NT, since March 1961, using Willmore portable seismographs. The site was chosen mainly on the grounds of convenience and makes use of an existing vault previously used for storage of ammunition by the Royal Australian Army. It is not suitable for a permanent station, as it is too close to the sea (50 yards or so at high tide), and thus records noise from waves breaking.

Consideration has been given to establishment of a permanent station near Darwin. Some impetus has been given to this proposal by the offer of the United States Government to provide a set of standard seismographs (as used in their VELA UNIFORM world-wide networks) for operation at Darwin.

The very few outcrops of rock of suitable quality for seismograph-pier foundations within a few miles of Darwin have been reserved for quarrying. Electrical power is not generally available more than a few miles from Darwin, however, and a distant site would generally require either long power lines or installation and maintenance of generating equipment.

From these and other considerations, two possible sites were selected for testing, one at Winnellie about 6 miles east of Darwin, and the other at Manton Dam, about 43 miles south-east of Darwin. Electrical power is generated at Manton Dam for pumping water to Darwin. Preliminary enquiries from Department of Works indicated that enough power could be made available to operate the seismological equipment.

The survey at Winnellie was done by the Bureau on 15th March and 1st April 1963 and the survey at Manton Dam on 3rd and 4th April 1963. The party consisted of J.T.G. Andrew (party leader), J. Ashley and F. Maranzana (geophysicists), and C.J. Braybrook (geophysical assistant). W.A. Wiebenga (senior geophysicist) and B.G. Cook (geophysicist) visited the party on 15th March and 3rd April respectively. No topographic survey has been made at the sites.

2. METHODS AND EQUIPMENT

The seismic refraction method was used at both sites, as the main purposes of the survey was to determine seismic velocities. The depths to bedrock were determined only at the end of the spreads from intercept times at Manton Dam, though the method of differences (Dyson and Wiebenga, 1957) was used on one spread at Winnellie.

An SIE 12-channel seismograph was used with 20-c/s TIC geophones. Spreads with geophone spacings of 10, 15, and 20 ft were used.

3. WINNELLIE OBSERVATORY SITE

Geology

The geology of the Winnellie site has been investigated (Ruxton, 1963). The site is located on a Lower Proterozoic indurated siltstone, on a steep rise between marshland to the south and a flat platform, underlain by Cretaceous porcelanite, to the north.

Results

Plate 2 shows the layout of traverses, the seismic velocities determined, and the depths to bedrock. Table 1 shows the velocities determined and the interpretation of the velocities in geological terms.

TABLE 1

Seismic velocity (ft/sec)	Rock type
1000 - 2000	Soil, clay, with rock fragments
3000 - 3500	Decomposed rock
8700 - 9000	Slightly weathered siltstone

The greatest depth to siltstone is 20 feet at W11.

Conclusions

The siltstone is relatively shallow in the area of survey, but the velocity is low for a good seismic observatory site.

4. MANTON DAM OBSERVATORY SITE

Geology

No geological investigation of the area has been made. During the seismic survey it was observed that at the top of the hillside on which the site is situated there is an outcrop of quartzite with strike approximately parallel to Traverse C. Traverse A extends up the slope of the hill from its base; Traverse B is along the slope of the hill (see Plate 3).

Results

Plate 3 shows the layout of traverses, the seismic velocities, and the depths to bedrock. Table 2 shows the velocities determined and the interpretation of these velocities in geological terms.

TABLE 2

Seismic velocity (ft/sec)	Rock type
2000	soil with rock fragments
4000	decomposed rock
8000 - 8500	weathered rock
13,000	slightly weathered quartzite

The greatest depth to bedrock is 20 feet at A1.

Conclusions

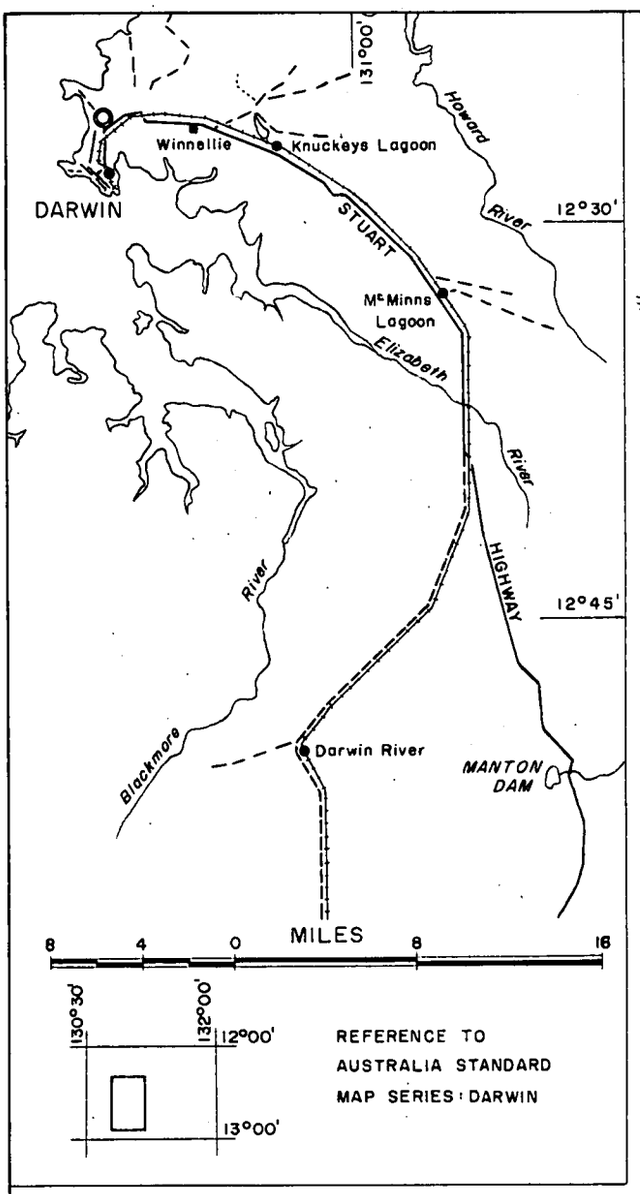
The geophysical survey indicates that the best location for a seismic observatory will be on the 13,000-ft/sec-velocity material beneath Traverse C. As this velocity was not measured on Traverse A or B, the rock must have a steep dip of 60 degrees or more.

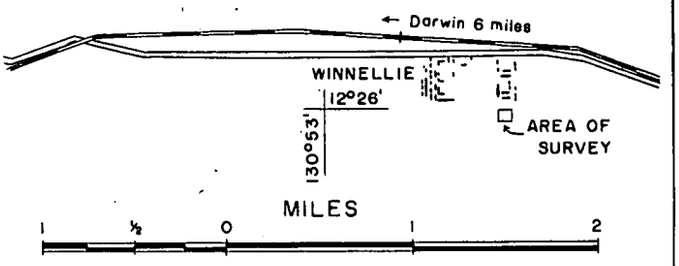
5. REFERENCES

DYSON, D.F. and WIEBENGA, W.A. 1957 Final report on geophysical investigations of underground water at Alice Springs, NT 1956. Bur. Min. Resour. Aust. Rec. 1957/89

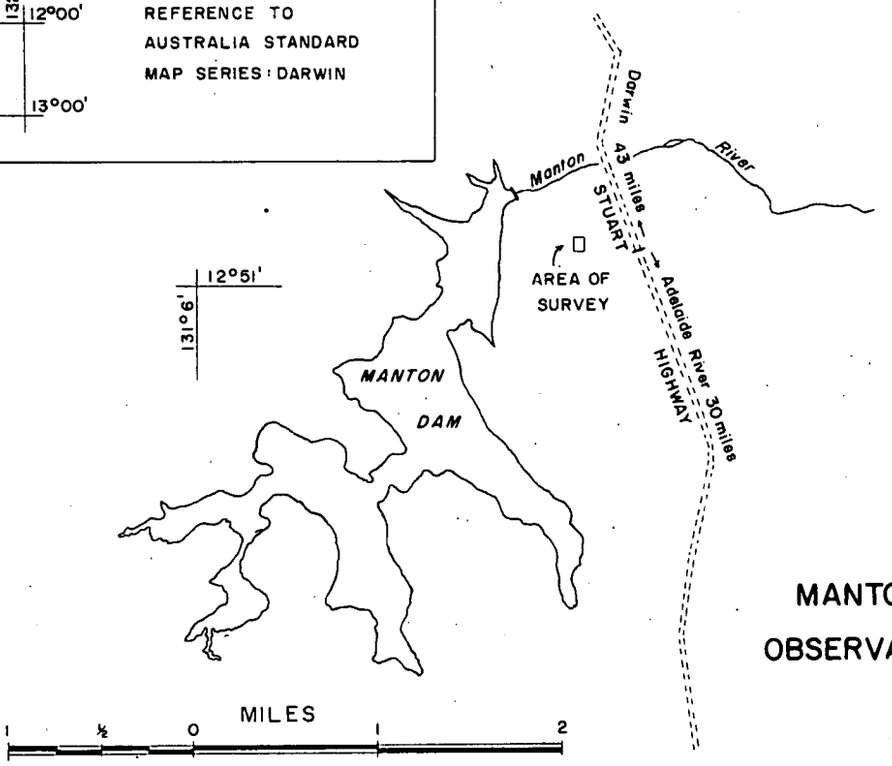
RUXTON, B.P. 1963 Personal communication

PLATE I

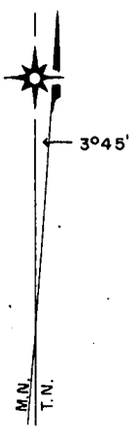




WINNELLIE OBSERVATORY SITE



MANTON DAM
OBSERVATORY SITE



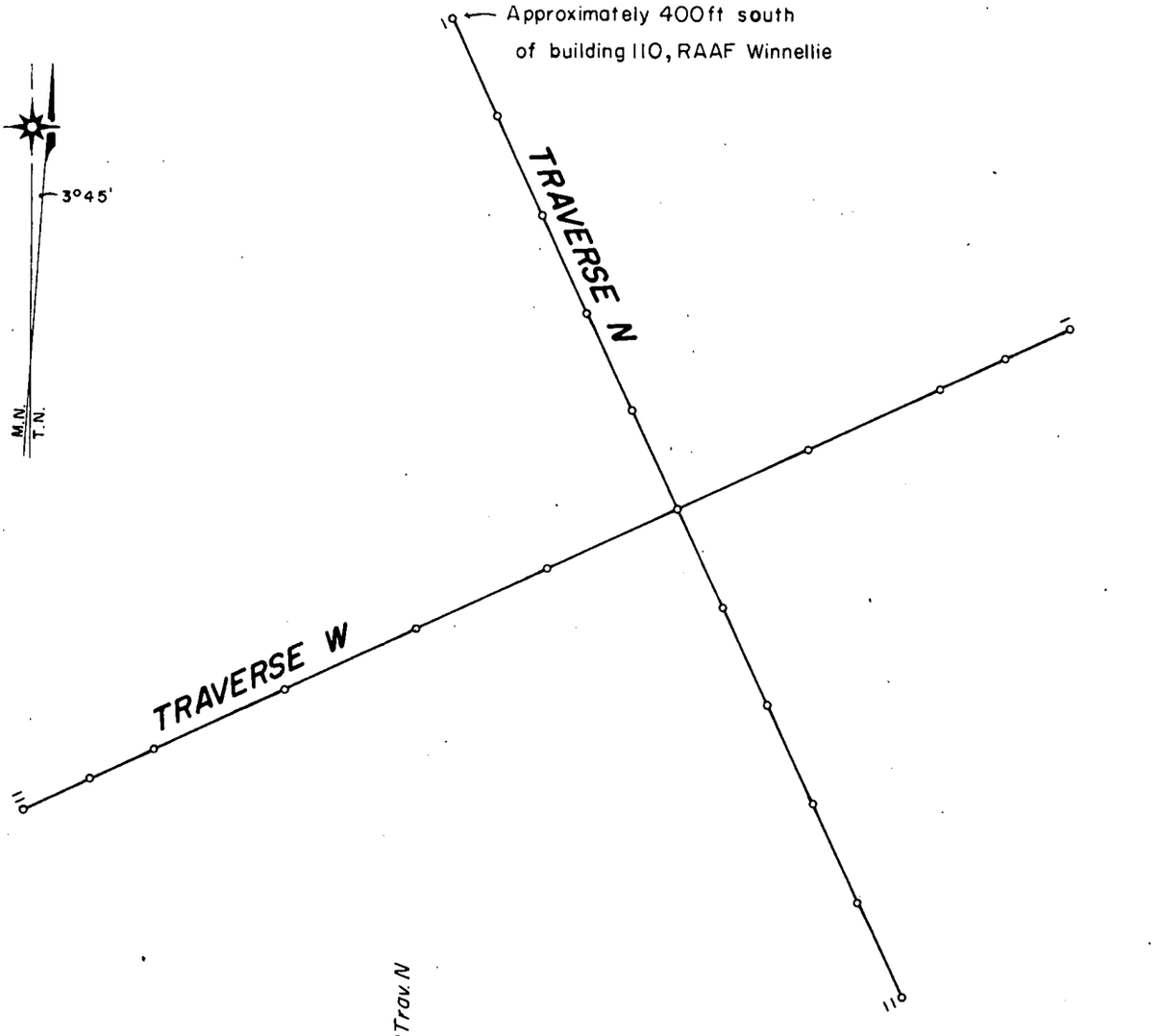
WINNELLIE and MANTON DAM
OBSERVATORY SITES

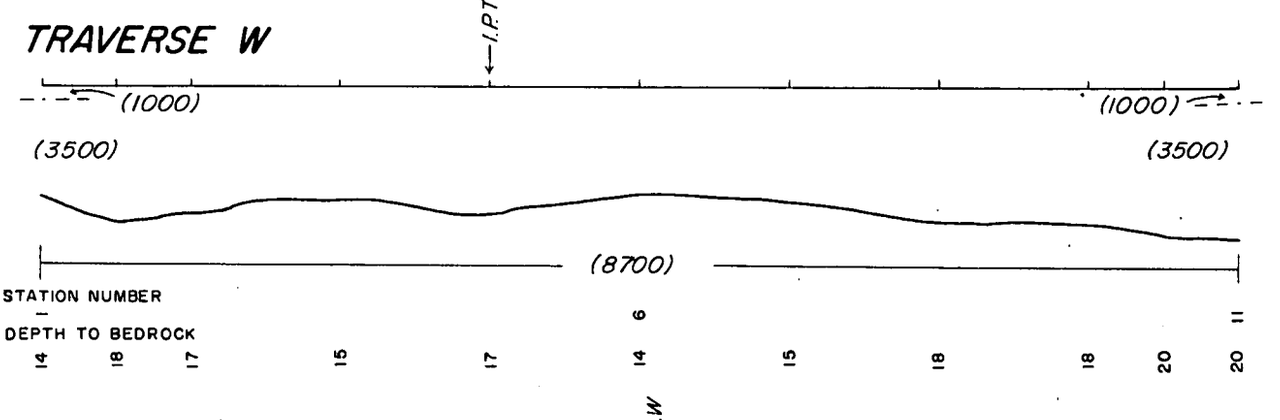
LOCALITY MAP

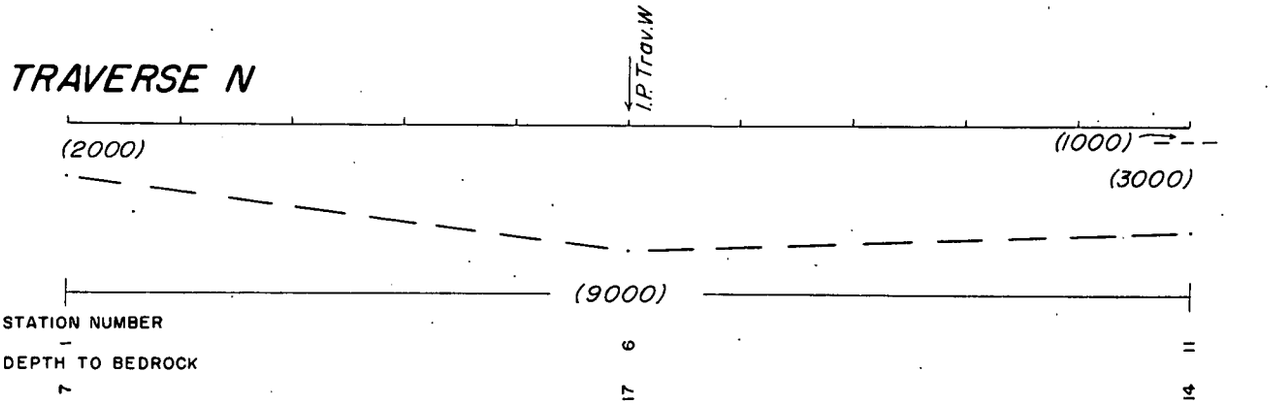
TO ACCOMPANY RECORD No 1963/151

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS D52/B5-15

PLATE 2







(1000) Seismic velocity 1000 ft / sec

WINNELLIE OBSERVATORY SITE

SEISMIC TRAVERSES, VELOCITIES, AND CROSS-SECTIONS

TRAVERSES W and N

FEET

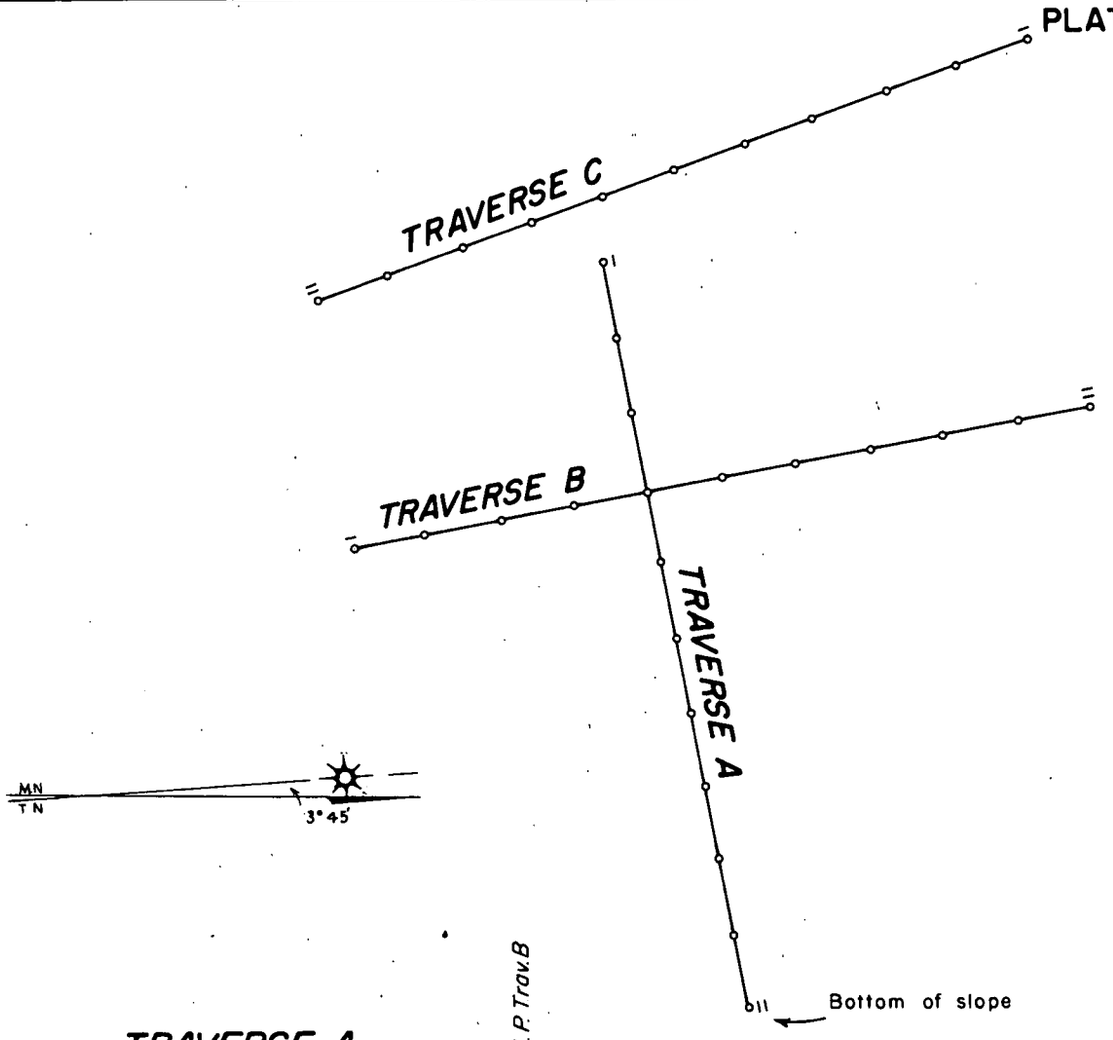
25 15 5 0 25 50

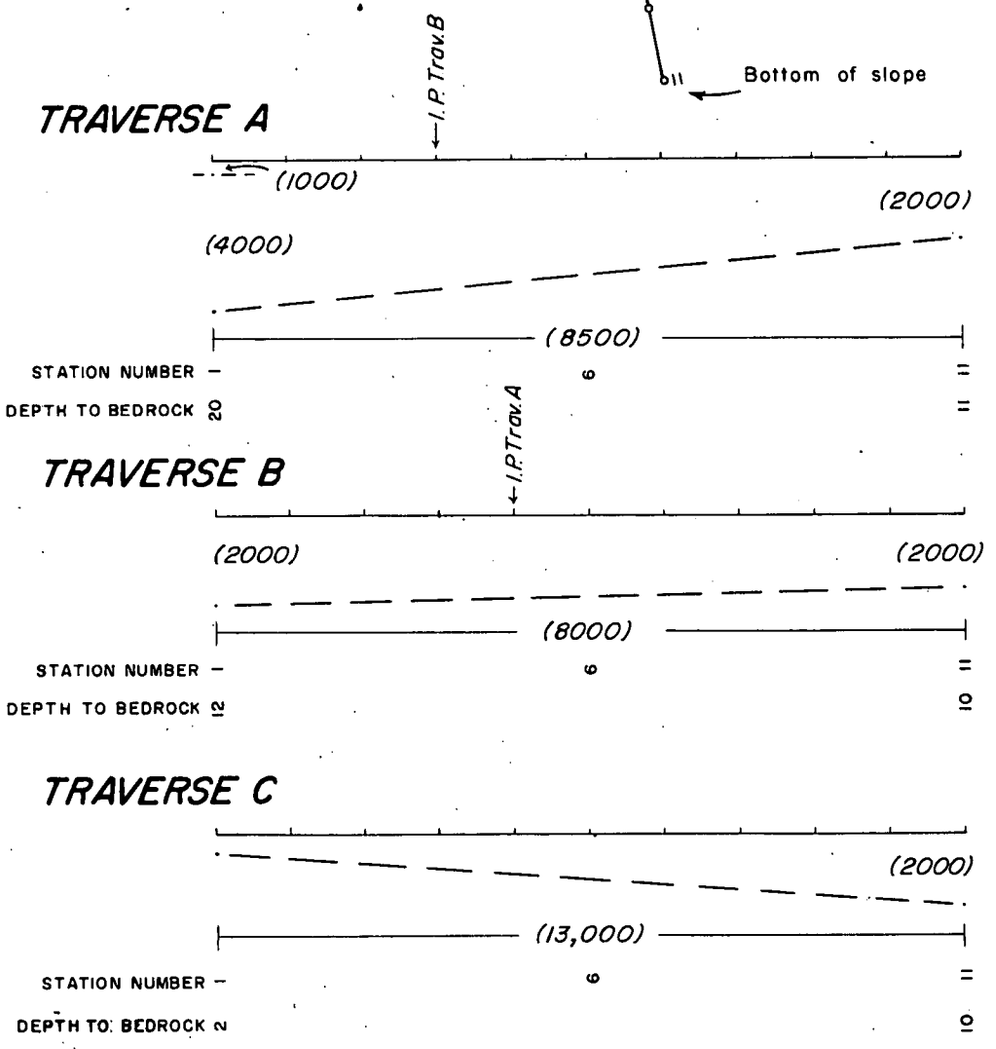
TO ACCOMPANY RECORD No 1963/151

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS D52/B5-16

WINNELLIE AND MANTON DAM OBSERVATORY SITES, N.T., 1963

PLATE 3





(1000) Seismic velocity 1000 ft/sec

MANTON DAM OBSERVATORY SITE

SEISMIC TRAVERSES, VELOCITIES, AND CROSS-SECTIONS

TRAVERSES A, B and C

FEET

25 15 5 0 25 50

TO ACCOMPANY RECORD No 1963/151

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS D52/B5-17

WINNELLIE AND MANTON DAM OBSERVATORY SITES, N.T., 1963