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A marine seismic survey at the fish meal plant wharf, Triabunna

by W. R. Moore

At the request of Gutteridge, Haskins and Davey, consulting engineers to Fish Protein Concentrates (Tas.) Pty Ltd of Triabunna, a further refraction seismic survey was carried out in the proposed wharf area. The previous seismic survey comprised one spread which covered the now-constructed wharf embankment (Leaman and Moore, 1974). The current survey comprised three spreads, covering the proposed wharf and caisson area, which were fired from this embankment, and an additional fan spread (fig. 1).

The aim of the investigation was to find if the massive unweathered dolerite now exposed over approximately three-quarters of the quarry face, excavated to provide material for the embankment, underlies the proposed wharf area. The previous seismic spread indicated that dolerite extended 180 metres to seaward and was hard and unweathered.

Survey details

All the shots were fired from the embankment where the geophone cable was anchored. The other end of the cable was kept in position by a boat. This boat moved away on firing and the cable was left to drift for a short period of time, but the positions of the geophones as shown on Figure 1 are considered reasonably accurate. In the fan spread and east–west spread a buoy, the position of which was known, was used to anchor the geophone cable. The geophone interval was 50 feet (15 m). Although this interval was considered too great for the area investigated, no attempt was made to loop the cable and shorten this geophone distance because the cable would have been too difficult to tow and probably would have become entangled with boulders from the embankment.

Shots were fired in the middle and at both ends at varying distances from the two north–south spreads and the east–west cross spread. Two shots were fired in a fan spread off the edge of the embankment. In the shallow water at the northern end of the embankment the shots were laid on the sea floor, and in deeper water were floated at a controlled depth.

After the completion of the marine seismic survey a 200 feet east–west seismic spread was undertaken from the weathered zone exposed in the western end of the quarry to the slipway road. A Bison signal enhancement seismograph, Model 1570B, was used with readings taken at five, ten and twenty feet intervals from both ends of the spread. This survey was undertaken to check the velocities of the weathered dolerite and the depth of weathering.

Seismic velocities

Spread 1 (N–S)

V_0 4000 feet/second (1300 metres/sec)
V_1 18,000–23,000 feet/second (5500–7000 metres/sec)

Spread 2 (E–W)

V_0 3000–3500 feet/second (1000–1070 metres/sec)
V_1 15,000–20,000 feet/second (4600–6100 metres/sec)

Spread 3 (N–S)

V_0 3000–3500 feet/second (1000–1070 metres/sec)
V_1 15,000–18,000 feet/second (4600–5500 metres/sec)

Fan spread

V_0 4000 feet/second (1300 metres/sec)
V_1 20,000 feet/sec (6100 metres/sec)

Signal enhancement seismograph spread

V_0 3000 feet/second (1000 metres/sec)
V_1 12,000–20,000 feet/second (4000–6100 metres/sec)

Geological interpretation

Marine seismic

The upper layer with a V_0 velocity of 3000 feet/second is a combination of water and water-saturated sediment (mud and silt). Except for two shots fired in Spreads 1 and 3 on the southern and eastern ends of these spreads in deeper water, an intermediate layer was recorded. This intermediate layer, with a velocity of 6000 to 7000 feet/second, was recorded on one geophone. It possibly represents a sediment layer that is less water saturated than in other areas, between the slow surface layer of 3000 feet/second and the fast bottom layer with a velocity of 16,000 to 23,000 feet/second.

For the remainder of the shots the V_0 upper layer has a calculated thickness of six to nine metres with water depth varying from 1.5 to seven metres. The silt and mud do not appear to exceed five metres and probably average less than two metres in thickness.

The uniformly high velocities for the lower V_1 layer indicate that the area is underlain by dolerite. There is no evidence of any great depth of weathering or large patches of weathering in this dolerite. The dolerite would be very similar in character to that now exposed in the quarry face and on the shore rock platform.

Signal enhancement seismic spread

The upper V_0 layer with a velocity of 3,000 feet per second present in this spread is considered to be the thin soil, clay and rubble layer capping the weathered dolerite, as exposed in the cutting leading to the quarry. The depth of this surface layer was calculated to be 1.2 to 1.8 feet.

The weathered and horizontally jointed dolerite gave an average velocity of 12,000 feet/second from the eastern end of the spread, whereas higher velocities of 20,000 feet/second were recorded from the western end. The interface of the two layers has a slope down to the west with shallowing occurring to the east. The western velocity curve has a stepped profile generally associated with well jointed dolerite.

The spread confirms the appearance of this weathered dolerite as a deeper but locally restricted zone associated with the concave section of the hill, with no weathering in the dolerite exposed in the shore platform area and a thin weathered zone exposed along the crest of the hill.

Conclusions

Such a zone of weathering in the dolerite is unlikely to be present on the marine rock platform where it would be susceptible to wave action in the vicinity of the wharf.

[16 October 1972]

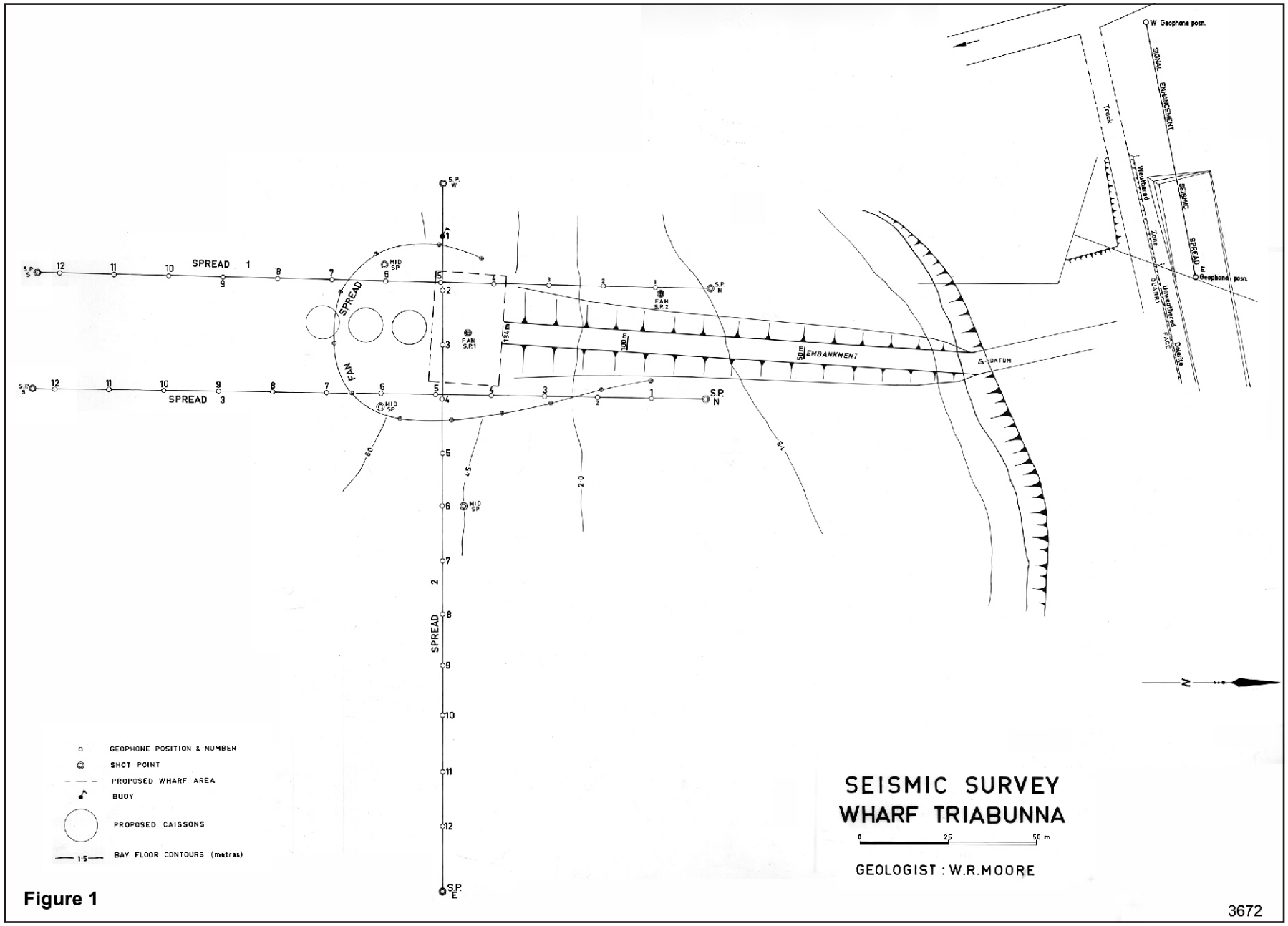
W Geophone posn.
SIGNAL EMBANKMENT
Track
SEISMIC SPREAD 4
Geophone posn.
Weathered
Unweathered
Quarry face
SPREAD 1
SPREAD 3
SPREAD 2
FAN
FAN S.P.1
FAN S.P.2
MID SP
S.P. W
S.P. N
S.P. E
S.P. S
134m
100m
50m
EMBANKMENT
DATUM
GEOPHONE POSITION & NUMBER
SHOT POINT
PROPOSED WHARF AREA
BUOY
PROPOSED CAISSONS
BAY FLOOR CONTOURS (metres)
SEISMIC SURVEY
WHARF TRIABUNNA
0
25
50 m
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Figure 1