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1984/44. Seismic survey at the Craigow dam, Cambridge

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Abstract

A refraction seismic survey has indicated that a cut-off to competent bedrock is not a practical solution to the leakage problem from the Craigow dam because of the thickness of the overlying material.

The placement of a clay blanket in the storage area, particularly where deep excavations were made to obtain material to construct the dam wall, is the favoured solution.

INTRODUCTION

As a result of a geological examination and some auger drilling at the Craigow dam [EN361593], it was suggested that a seismic refraction survey may aid in determining the depth of unconsolidated material over hard bedrock in the zone where the leakage from the dam is suspected (Matthews, 1984). The Department of Agricultural Science of the University of Tasmania requested that this work be undertaken.

SURVEY LAYOUT

Four seismic spreads comprising twelve geophones with a geophone spacing of 7.5 m were fired in the positions shown on Figure 1. As there was insufficient overlap between spreads 1 and 2 in the zone of particular interest, a further spread was fired in this area.

INTERPRETATION

From plots of the information obtained from the field data, it is possible to determine the approximate seismic velocities of the various materials beneath the surface where a survey is undertaken and to indicate the approximate positions of the interfaces between the layers with different seismic velocities. These seismic velocities can be associated with rock types that are likely to be present.

Three general groups of seismic velocities were indicated in the Craigow survey (fig. 1). The material with a velocity range of 400-550 m/s is unconsolidated and unsaturated material up to about three metres thick. This is the material in which the test pits downstream from the dam wall have been dug. The material with the velocity of 5180-6120 m/s is almost certainly dolerite, as the other rock type in the area (Triassic sandstone and shale) is unlikely to have such a high seismic velocity.

There is some doubt as to what constitutes the material with the intermediate velocity of 1475-1575 m/s. It could be any one or a combination of three materials;

(1) Saturated unconsolidated Tertiary to Quaternary age sediments.

(2) Deeply weathered Triassic sediments; sandstone and shale.

(3) Deeply weathered dolerite.

There are suggestions that this material may have a slightly higher velocity range in the southern part of Spread 2. If this is a higher value, then it may make the first of the above alternatives a less likely prospect. Test pits dug to investigate a possible further irrigation dam upstream near Cross Rivulet have penetrated deeply weathered Triassic sandstone and shale, and this may extend to the valley of the present dam. Dolerite occurs on each abutment of the dam, so this rock cannot be ruled out as possibly underlying the whole of the dam wall.

IMPLICATIONS OF SEISMIC SURVEY

The permeability of weathered Triassic sediments and dolerite can be large enough to allow significant leakage, while Tertiary to Quaternary sediments can contain sand or gravel horizons which may result in water loss. It will not be economic to attempt to install a cut-off to solid bedrock to prevent leakage through the material with the intermediate seismic velocity because of the thickness of the material.

CONCLUSIONS

A cut-off to competent bedrock is not a solution to the leakage from the dam. Without deeper pits or drill holes, it will not be possible to indicate whether the material with the intermediate seismic velocity becomes less permeable with depth and if a deeper cut-off than at present is practical. To prove this would involve considerable expense.

Ensuring that the storage area has an adequate clay blanket appears to be the solution with the most likelihood of success, as well as having good prospects of being the cheapest method. Drill holes and test pits in the storage area to date have encountered good thicknesses of clay at most points. It may be only where the deepest excavations were made to construct the dam wall that would require the placement of a clay blanket.

REFERENCE

MATTHEWS, W.L. 1984. Investigation of a leaking dam at Cambridge. *Unpubl.Rep.Dep.Mines Tasm.* 1984/24.

[22 June 1984]

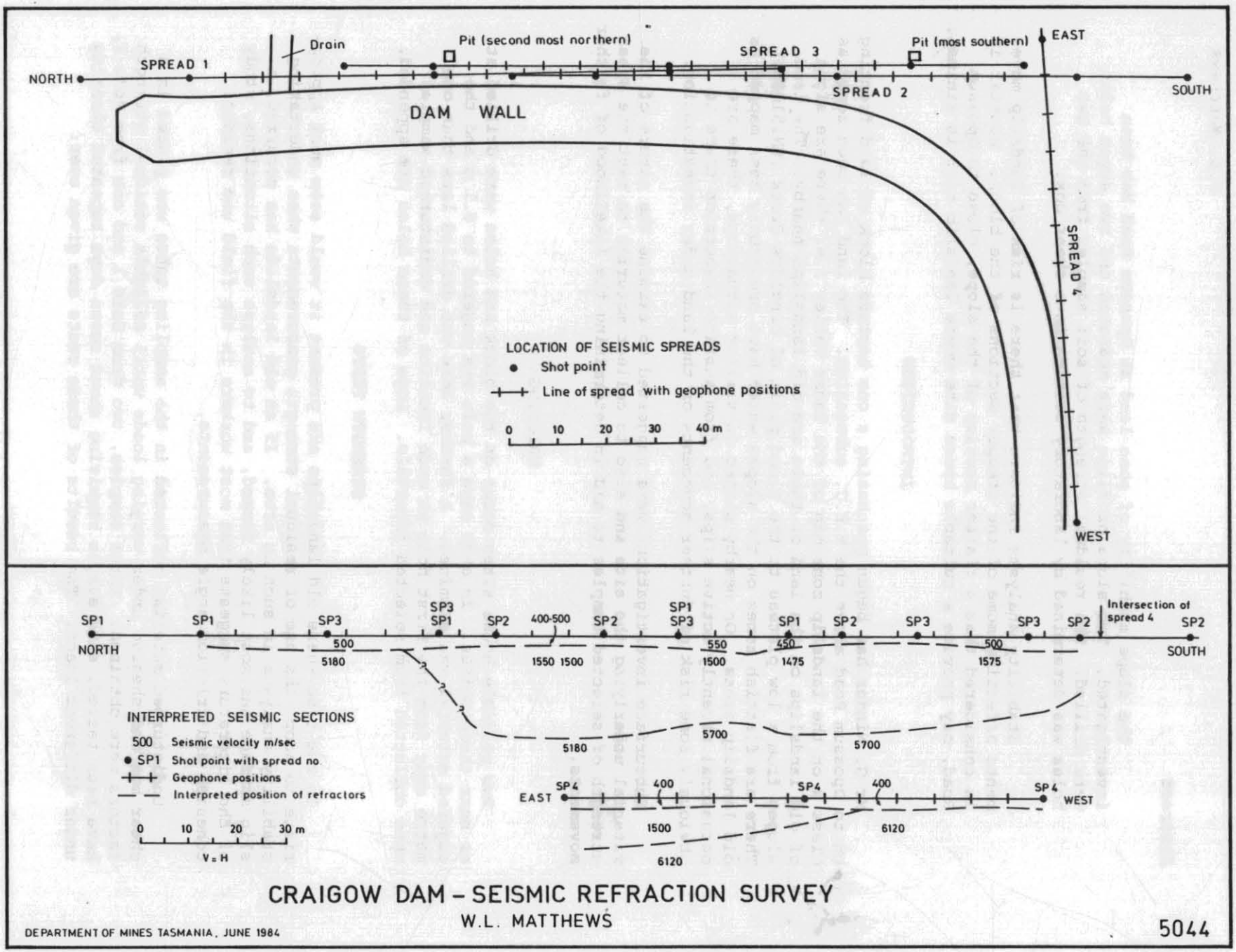

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Figure 1

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