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Seismic survey, proposed quarry sites, Cairns Bay.

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The Esperance Municipality proposes to acquire land south of Cairns Bay for quarrying. There are two existing quarries in the region examined; one large and unused near Waterloo Bay and the second about midway between Cairns Bay and Waterloo Bay. Weathered dolerite is exposed in both quarries and along the foreshore. The region examined seismically extends about 100 m inland from the shore and from the southern, large quarry at the end of the road to the derelict house about 800 m south of Cairns Bay.

LOCATION OF SPREADS

Each spread was 95 m long and included twelve geophones with a spacing of 7.5 m.

Spread 1: orientated NNW-SSE with the southern end extending into part of the large disused quarry; parallel to road.

Spread 2: orientated N-S, parallel to the road on the bank.

Spread 3: orientated WNW-ESE with the eastern end at the roadway. The northern end of spread 1, southern end of spread 2 and eastern end of spread 3 was a common point.

Spread 4: orientated N-S, parallel to the road on the bank.

Spread 5: orientated WSW-ESE with the eastern end at the roadway.

Spread 6: orientated NW-SE with the eastern end at the roadway. The northern end of spread 2, southern end of spread 4 and the eastern end of spreads 5 and 6 was a common point. Spread 5 overlapped spread 3 by 25 m. The spreads cover, in some detail, the wooded knoll area between the cleared areas adjacent to the old quarry and the old house respectively at the northern and southern ends of the region examined. The discussion below refers to four zones; the old quarry, the southern cleared area, the wooded knoll and the northern cleared area near the old house.

RESULTS OF THE SURVEY

	Layer	Velocity (m/s)	Thickness (m)
<i>Spread 1:</i>	1	350-375	1.2-3.5
	2	1400	
	3	3800-5200	

This spread covers the roadside of the southern cleared area and extends to the old quarry. The velocity values indicate that massive rock or rock which is jointed but relatively unweathered and unrippable occurs at 1.2 to 3.5 m depth.

	Layer	Velocity (m/s)	Thickness (m)
<i>Spread 2:</i>	1	375-400	1.8-2.2
	2	600-900	7.0-11.0
	3	>3800	

This spread indicated an irregular thickening of weathered cover on the wooded knoll. Unrippable rock occurs at a depth of 9-13 m.

	Layer	Velocity (m/s)	Thickness (m)
<i>Spread 3:</i>	1	300-400	2.0-3.1
	2	900-2200	9.0-18.0
	3	>5000	

Spread 3, fired diagonally across the wooded knoll spur, demonstrated the variability in rock quality and thickness. A relatively uniform soil layer is underlain by up to 18 m of decomposed dolerite with the amount of weathered material increasing in thickness uphill.

	Layer	Velocity (m/s)	Thickness (m)
Spread 4:	1	350-500	1.7-3.0
	2	1450-1500	7.5-16.0
	3	4100-5800	

This spread, fired along the roadside bank near the northern cleared area toward the old house, shows material comparable to that in the northern end of the old quarry. There is less variation in quality and thickness as compared to spread 3 which is largely in similar material.

	Layer	Velocity (m/s)	Thickness (m)
Spread 5:	1	370-375	1.0-2.0
	2	450-1000	-14.0
	3	>4500	

Fired diagonally across the northern side of the wooded knoll this spread indicated a great thickness of very decomposed material directly overlying quite firm rock.

	Layer	Velocity (m/s)	Thickness (m)
Spread 6:	1	300-650	2.0-7.0
	2	1300	-10.0
	3	>3000	

Spread 6 shows a lesser thickness of weathered rock upslope across the northern cleared area.

Seismic velocities of 300-500 m/s are typical of soils, or very weathered rock while velocities of 900-2000 m/s represent rock which is deeply weathered but which retains much of its texture. Velocities in excess of 2500 m/s mean that the rock is jointed, partly weathered and just rippable. Velocities in excess of 4000-5000 m/s imply that the rock is in good condition, quite hard and massive.

Dolerite weathers erratically and patches normally show extreme properties. The weathering does not often extend vertically in layers as implied in the interpretations and it must be noted that the interpreted layers are approximations only. Thus for example in spread 4 where layer 2 of weathered rock is said to be 7.5-16 m thick the interpretation is intended to convey the notion that an irregular thickness of this rock is present but it need not be in the form of a distinct layer. Should a quarry face be opened in this material it would be found that there was much variation but the average properties and thickness would be as quoted.

COMMENTS

Relatively unweathered rock occurs at depths of more than 7 m north of the small depression in the southern cleared area. It appears that the base of weathering extends below sea level. As the material is intended for use as road 'gravel' weathered rock is required.

Deeply weathered rock is present from the wooded knoll to the old house and a suitable quarry could be developed in this region. The rock is very variable but on average it should be comparable to that in the old quarry. Those parts which are more deeply weathered will make an excellent 'gravel'.

Negligible crushing of other material is envisaged. It should be noted that the dolerite is coarse-grained and subject to rapid breakdown on exposure in the climate of this area. This will aid in the production of fine material and limit the need for crushing.

In view of the admitted variability of the material the best site for a quarry is considered to be in the region of the northern part of the wooded knoll and the southern part of the northern cleared area containing the old house. Some backhoe pits are suggested in this zone as confirmation. It is likely that the whole of this section of the area will be found suitable if the suggested portion is proved to be adequate. The volume of deeply weathered rock implied by this survey exceeds 180000 m³. The only area to be avoided is that immediately north of the old quarry.

[20 August 1973]