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Seismic survey, Surrey Lagoon area, Herrick.

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A seismic survey of an area south-west of Surrey Lagoon [EQ741488] was undertaken at the request of the Economic Geology Section. Six seismic spreads of various lengths and shot point distances with a geophone interval of 15 m and a 50 m weathering spread with geophone intervals of 2 and 5 m were fired (fig. 1). The seismic results and geological interpretation are summarised in Table 1.

Contours on the upper surface of the bedrock, as calculated from the seismic data, are shown in Figure 1. Bedrock is defined as material exhibiting a seismic velocity of 3000 m/s or greater. In the area surveyed the bedrock is thought to be unweathered granite as granite crops out along the ridge south of Spreads 5 and 6 and along the banks of the Ringarooma River south of Spread 4 and east of Spread 2.

Correlation of the seismic velocity layers between the various spreads was difficult due to the varying thickness of the upper velocity layer and steep slopes on the bedrock surface. On the river-flats, which are covered by a thick layer of tailings derived from tin mines upstream, it was difficult to transmit sufficient energy into the ground to enable the recording of the bedrock surface: even with shot depths of more than 2 m the explosives blew out to the surface thus wasting energy needed for the propagation of the seismic waves.

The weathering spread indicated two velocity layers were present in the tailings: a surface layer (V_0 = 400 m/s) overlying a second layer (V_1 = 800-1000 m/s). The surface layer was not recorded in the six longer spreads because of the extended interval between the shot point and the first geophone needed to detect the bedrock. It was, however, recorded when middle shot points were fired where the interval between the shot point and the first geophone was 15 m. This surface layer was ignored when making calculations of depths so that if it occurs on all the river flats, which seems possible, the depths to bedrock will tend to be too great.

CONCLUSION

Because of the complex nature of the subsurface material in the Surrey Lagoon area, bedrock contours deduced from the seismic work can at best only serve as a guide to drilling. A bore should be drilled at the intersection of Spreads 1 and 5 and another at the intersection of Spreads 2 and 4 to reach hard granite.

As well as providing a control for the seismic work, these bores will indicate the depth of the interface between the Tertiary sediments and the weathered granite which have similar seismic velocities and so cannot be differentiated by seismic methods.

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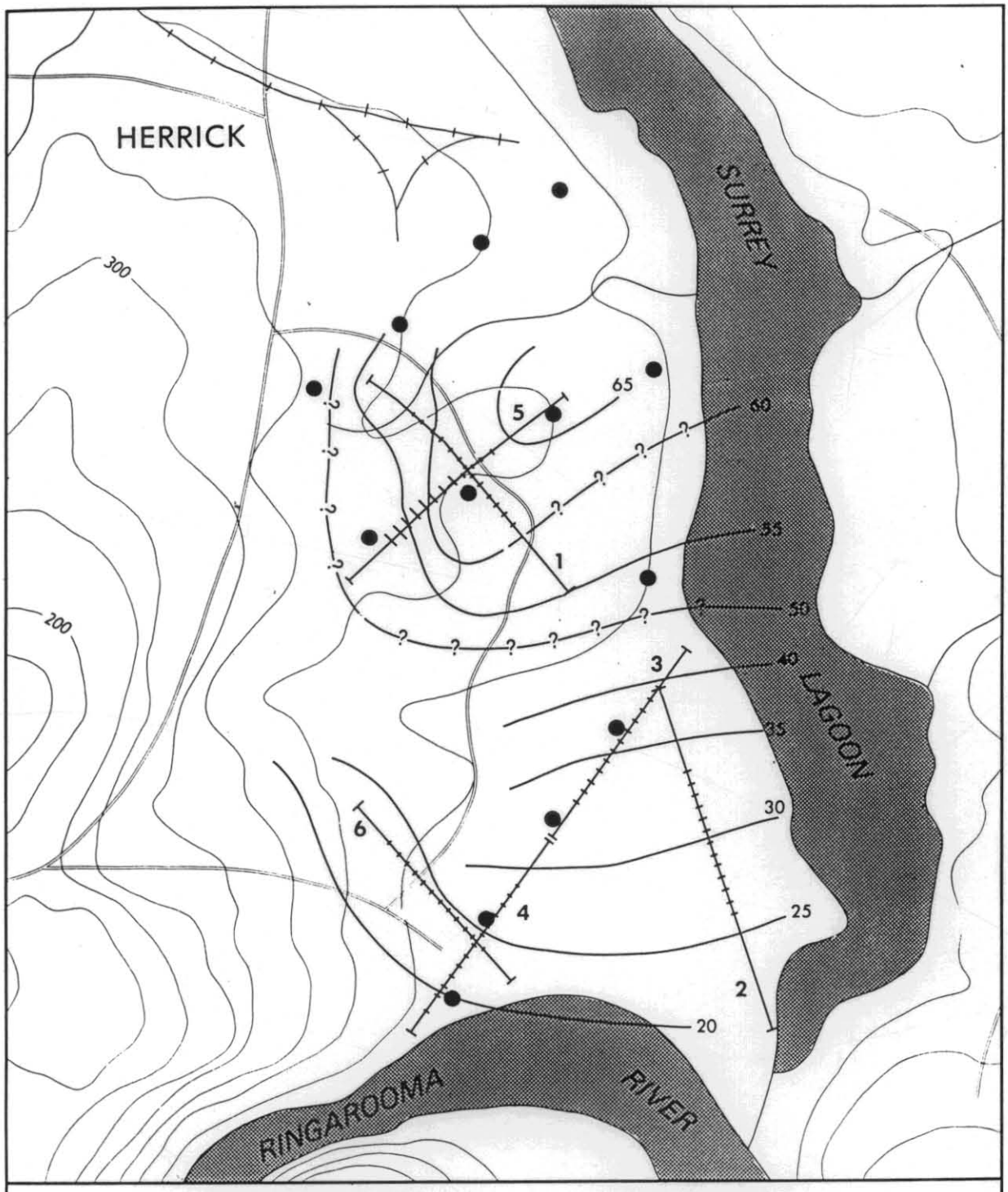

SEISMIC SPREADS - HERRICK

0 100 200 300 400 500 metres

Contour interval = 25 feet

● Borehole

30 Bedrock contour

1 Seismic spreads

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Figure 1

5 cm

Table 1. *SEISMIC RESULTS, SURREY LAGOON*

Spread	Direction	Length of spread (m)	Shot Point distance (m)	Velocity layers (m/s)	Calculated depth to interface (m)	Shape of time velocity plot	Geological interpretation	Remarks
1	E-W	394	92 and 46	*West end* V_0 = 1200 V_1 = 1600 V_2 = 5000	V_0/V_1 = 7.4-11.5 V_1/V_2 = 58-63		V_0 Unconsolidated surface sand and gravel and Tertiary sediments above water table. V_1 Tertiary sediments, decomposed and weathered granite. V_2 Hard granite.	V_1 of 1600 m/s present at west end of spread but not at the east end. This layer thickens towards east.
			92	*East end* V_0 = 1200-1300 V_1 = 1500-2200 (Av. 1600) V_2 = 6000+	V_0/V_1 = 7.2-11.5 V_1/V_2 = 63-65	very stepped	As above except V_1 of 2200 probably weathered granite with layers of hard and soft granite.	
5	N-S	265	50	*North end* V_0 = 1100 V_1 = 1600-1700 V_2 = 3500	V_0/V_1 = 11-13 V_1/V_2 = 55-61	V_0/V_1 interface symmetrical	V_0 Superficial sand and Tertiary clay. V_1 Tertiary sediments sand, weathered and decomposed granite.	Correlation between Spread No. 1 and 5.
				South end V_0 = 1100 V_1 = 1500 V_2 = 4500-5500	V_0/V_1 = 11-13 V_1/V_2 = 62-68	V_1/V_2 deepens to the north. V_2 velocities averaged.	V_2 Hard unweathered granite.	
2	E-W	400	100 and 50	*West end* V_0 = 1300 V_1 = 3200-4000	V_0/V_1 = 27-35	V_0/V_1 shallows to the east.	V_0 <1000 m/s probably tailings from tin mining upstream.	Intermediate layer of 2000-2200 appearing from east end.
			140 and 50	*East end* V_0 = 800-1100 V_1 = 2000-2200 V_2 = 3200+	V_0/V_1 = 23-25 V_1/V_2 = 27-36	stepped at mid S.P.	V_0 >1000 alluvial and Tertiary sediments. V_1 Tertiary sediments and weathered and decomposed granite. V_2 unweathered granite.	

Table 1. *(continued)*

Spread	Direction	Length of spread (m)	Shot Point distance (m)	Velocity layers (m/s)	Calculated depth to interface (m)	Shape of time velocity plot	Geological interpretation	Remarks
2	E-W	400		*Mid SP (W)* V_0 = 400 V_1 = 1300-1500 V_2 = 2500(?)	V_0/V_1 = 7-9 V_1/V_2 = 27-30			
				Mid SP (E) V_0 = 400 V_1 = 1500 Artificial V_2 = 3200	V_0/V_1 = 6-8 V_1/V_2 = 28-31			
3	N-S	265	50	*North end* V_0 = 1000 V_1 = 1500 V_2 = 2700-4500 (Av. 3200)	V_0/V_1 = 11-13 V_1/V_2 = 28-40	V_0/V_1 deepens to the north.	V_0 Tailing and alluvial. V_1 Tertiary sediments and/or decomposed granite. V_2 Granite. V_3 Very hard granite.	
			50	*South end* V_0 = 800 V_1 = 1000 V_2 = 4000 V_3 = 11 000	V_0/V_1 = 12-17 V_1/V_2 = 31-33 V_2/V_3 = 68-72	V_0 layer thickens to the south.		
4	N-S	265	50	*North end* V_0 = 700-800 V_1 = 1500-2000 V_2 = 5000 (Av. 3500)	V_0/V_1 = 17-18 V_1/V_2 = 19-30	V_0 layer thickens to north compared with south. V_1/V_2 steep slope up to south.	V_0 Tailings and alluvial sediment. V_1 Tertiary and weathered granite. V_2 Unweathered granite.	This spread has a steep slope on the V_1/V_2 interface. V_2 velocities averaged. Weathering spread showed 2 layers of V_0 = 400 m/s(av.) V_1 = 900 m/s. As the 400 m/s surface layer was ignored calculated depths and are exaggerated.

Table 1. *(continued)*

Spread	Direction	Length of spread (m)	Shot Point distance (m)	Velocity layers (m/s)	Calculated depth to interface (m)	Shape of time velocity plot	Geological interpretation	Remarks
4	N-S	265	50	*South end* V_0 = 1000 V_1 = 2500 (Av. 3500)	V_0/V_1 = 20-23	No slow layer of 400-800 m/s at south end but present in mid S.P. V_0/V_1 deepens to the north.		
				Mid SP (N) V_0 = 500 V_1 = 1500 V_2 = 2500(?)	V_0/V_1 = 6-8 V_1/V_2 = 21-24			
				Mid SP (S) V_0 = 500 V_1 = 1500 Artificial V_2 = 3000	V_0/V_1 = 6-8 V_1/V_2 = 21-23			
6	E-W	270	50	*West end* V_0 = 800-1000 V_1 = 2000-2500 V_2 = 19 000	V_0/V_1 = 16-22 V_1/V_2 Not calculated	Large step between geophone 1 and 3 of V_1 = 800 and V_2 = 3000 m/s.	V_0 Tailings and alluvial sediment. V_1 Granite. V_2 Very hard granite.	Difficult to correlate the velocity layers because of surface topography and V_0 and V_1 irregularities. The west end V_1 velocity is low because of the slope on the granite interface.
				East end V_0 = 800 V_1 = 3000-3500	V_0/V_1 = 19-22	Very irregular and stepped.		