



Seismic survey in the Chigwell area

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Abstract

Seismic spreads have been fired along the margin of a track, extending up a steep ridge at Chigwell, to determine the depth to unweathered dolerite. On the lower parts of the slope unweathered rock appears to be 15–30 m or more below the surface, while at some locations on the upper part of the slope it may be as close as 2.5 m below the surface.

INTRODUCTION

At the request of V. M. Threader, Consulting Geologist, a refraction seismic survey has been undertaken in the Chigwell area. The survey is part of an assessment of the area to determine its suitability for the development of a quarry to produce crushed blue metal. The location of the seismic traverses are shown on Figure 1. Dolerite has been mapped on much of the hill, with Permian rocks occurring on the lower, north-west facing slopes.

SEISMIC TRAVERSE

The survey consisted of eight seismic spreads of 12 geophones with a spacing of 7.5 metres. Shots were fired at each end. Six spreads were fired along a track extending up a ridge, while the other two were laid out around the contour on the lower part of the slope. The track up the ridge is quite steep, ranging up to 22.5° in slope angle, with an angle of 15° or greater being the average. The slope flattens on the western end of spread 6.

The results are summarised below, with seismic velocities and interpreted thicknesses being indicated. The interpreted profile under each spread is shown Figure 2.

Material with a velocity of 450 m/s to 2000 m/s is likely to be soil and clay (perhaps with boulders) or very weathered rock. Velocities of between 2000 and 3500 m/s are likely to represent variably weathered and/or jointed rock, while velocities in excess of this range are likely to consist of largely unweathered rock.

Spreads around the lower slopes (1, 2, 3 and 8) suggest that there are considerable depths of low velocity material below the surface, while under spreads 4, 5, 6 and 7 (or parts of them) higher velocity material appears to be closer to the surface.

Spread 8 appears to have extended over Permian rocks on the western end but there is no obvious contact indicated from the seismic results. No outcrops (either Permian or dolerite) are obvious on the slopes in the vicinity of the seismic spreads, so that the extent of Permian rocks is really unknown. However velocities of greater than about 3500–4000 m/s are likely to indicate dolerite.

CONCLUSION

The seismic survey has indicated that considerable depths of weathered or very jointed rock overlies relatively unweathered rock. The more competent rock is likely to be closer to the surface higher up the hill than towards the base.

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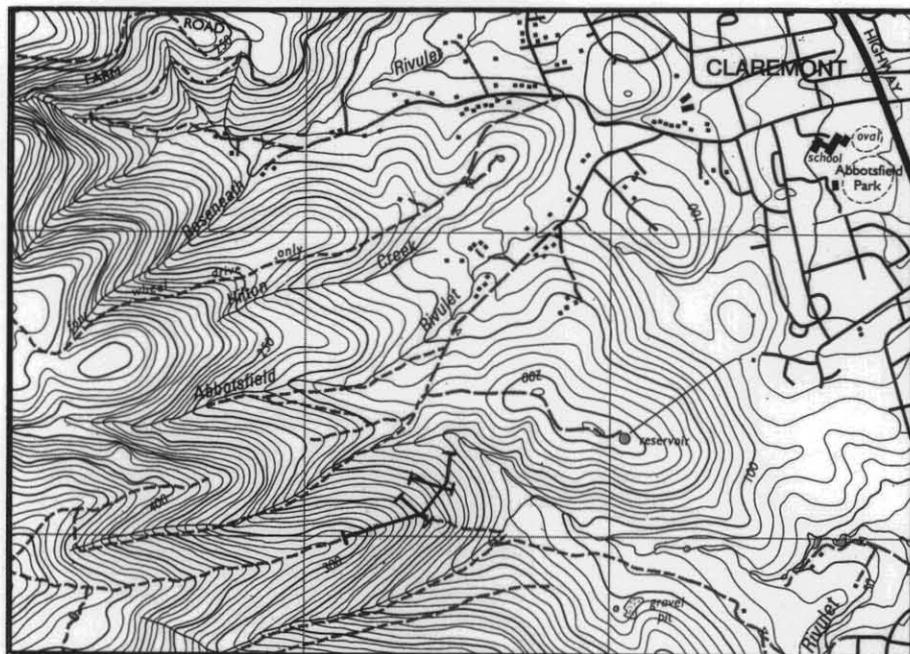


Figure 1. Location of seismic spreads.

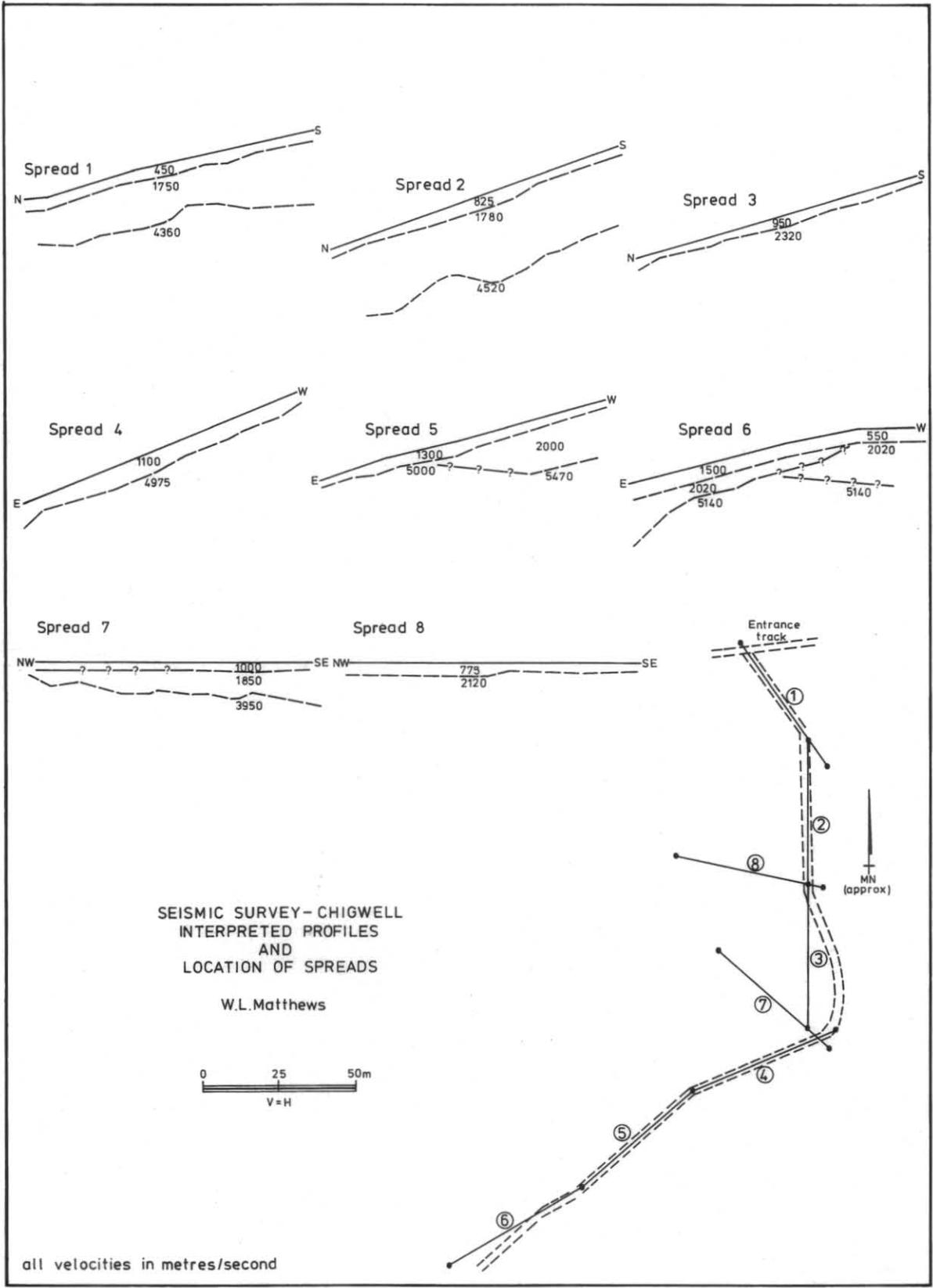


Figure 2.

5 cm

APPENDIX 1

Interpretation of seismic spreads

Spread 1

Surface layer	450 m/s	2.4-4 m thick
Intermediate layer	1750 m/s	11-19 m thick
Lower refractor	4360 m/s	15-23 m below surface.

Spread 2

Surface layer	825 m/s	2-5 m thick
Intermediate layer	1780 m/s	16-28 thick
Lower refractor	4520 m/s	20-30 below surface

Spread 3

Surface layer	950 m/s	1.5-4 m thick
Lower refractor	2315 m/s	

Material with a velocity of 3000 m/s or greater would be at depths of 20-25 m or greater (on each end of the spread).

Spread 4

Surface layer	1110 m/s	5-7.5 m thick
Lower refractor	4975 m/s	

There appears to be a pinnacle of unweathered (or less jointed) rock under the eastern end of this spread and just off the end of Spread 3.

Spread 5

Surface layer	1300 m/s	1.5-4 m thick
Intermediate layer	2000 m/s	0-16 m thick (this layer appears to wedge out on each end of spread).
Lower refractor	5000-5470	2.5-17.5 m below surface

Spread 6

Surface layer	500 m/s	W end
	1500 m/s	E end
		3.5-5 m thick
Intermediate layer	2020 m/s	3-19.5 m thick
Lower refractor	5140 m/s	8-25 m below surface

Spread 7

Surface layer	1000 m/s	2-2.5 m thick
Intermediate layer	1850 m/s	5-11 m thick
Lower refractor	3950 m/s	7.5-12.5 m below surface

Spread 8

Surface layer	775 m/s	2-4 m thick
Lower refractor	2120 m/s	

North-west end of spread is on Permian rocks (boulders occur on surface). Material with a velocity of 3000-3500 m/s is likely to be more than 2025 m below the surface (on the ends).

APPENDIX 2

Time/Distance data

Spread 1

Geophone	Time	Distance
<i>North</i>		
0	14	0
1	18.5	7.5
2	22	15
3	29.5	22.5
4	30.5	30
5	30.5	37.5
6	36	45
7	35	52.5
8	37.5	60
9	41	67.5
10	43	75
11	50??	82.5
12	77	90

South

0	12	0
1	14	7.5
2	19.5	15
3	24	22.5
4	29.5	30
5	33	37.5
6	37	45
7	40	52.5
8	43.5	60
9	45	67.5
10	45.5	75
11	47	82.5
12	50	90

Spread 2

North

0	5	0
1	9.5	7.5
2	15	15
3	21	22.5
4	25	30
5	30	37.5
6	35	45
7	41	52.5
8	43.5	60
9	45	67.5
10	46	75
11	49.5	82.5
12	50	90

South

0	5	0
1	8	7.5
2	10	15
3	15	22.5
4	17.5	30
5	20	37.5
6	26.5	45
7	29	52.5
8	40.5	60
9	41	67.5
10	47.5	75
11	50	82.5
12	49.5	90

Spread 3

Geophone	Time	Distance
<i>North</i>		
0	7	0
1	7.5	7.5
2	11	15
3	16	22.5
4	17	30
5	21	37.5
6	26	45
7	28	52.5
8	29.5	60
9	31.5	67.5
10	32.5	75
11	36	82.5
12	39	90

South

0	7	0
1	9	7.5
2	13	15
3	18.5	22.5
4	19	30
5	22	37.5
6	26	45
7	28	52.5
8	30.5	60
9	34	67.5
10	36.5	75
11	37	82.5
12	42	90

Spread 4

West

0	6	0
1	6	7.5
2	8.5	15
3	10	22.5
4	13	30
5	14.5	37.5
6	15	45
7	18	52.5
8	22.5	60
9	22.5	67.5
10	23	75
11	24.5	82.5
12	26	90

East

0	14	0
1	7.5	7.5
2	15	15
3	19	22.5
4	21.5	30
5	21	37.5
6	22	45
7	24	52.5
8	25	60
9	26.5	67.5
10	27.5	75
11	29	82.5
12	30.5	90

Spread 5

Geophone	Time	Distance
<i>West</i>		
0	2.5	0
1	5.5	7.5
2	8	15
3	13	22.5
4	16	30
5	20	37.5
6	23	45
7	28	52.5
8	28	60
9	30	67.5
10	30	75
11	32.5	82.5
12	32.5	90
<i>East</i>		
0	4	0
1	5	7.5
2	9	15
3	10	22.5
4	12	30
5	13.5	37.5
6	19	45
7	22	52.5
8	24	60
9	26	67.5
10	30	75
11	30	82.5
12	36?	90

Spread 6

Geophone	Time	Distance
<i>West</i>		
0	14	0
1	14	7.5
2	18	15
3	20	22.5
4	20.5	30
5	23.5	37.5
6	25	45
7	32	52.5
8	26	60
9	30	67.5
10	33	75
11	34.5	82.5
12	41.49?	90
<i>East</i>		
0	6	0
1	6	7.5
2	11	15
3	15	22.5
4	18	30
5	19	37.5
6	21.5	45
7	26	52.5
8	29.5	60
9	31	67.5
10	31.5	75
11	33.5	82.5
12	37.5	90

Spread 7

Geophone	Time	Distance
<i>North-west</i>		
0	5	0
1	8	7.5
2	9	15
3	13	22.5
4	16	30
5	19	37.5
6	20.5	45
7	23	52.5
8	24.5	60
9	32	67.5
10	29	75
11	32.5	82.5
12	43.5?	90
<i>South-east</i>		
0	3	0
1	7	7.5
2	11	15
3	16	22.5
4	21	30
5	23	37.5
6	23	45
7	24	52.5
8	26	60
9	28	67.5
10	28	75
11	29	82.5
12	32?	90

Spread 8

Geophone	Time	Distance
<i>North-west</i>		
0	9	0
1	11	7.5
2	15	15
3	20	22.5
4	24	30
5	28.5	37.5
6	30.5	45
7	32.5	52.5
8	33.5	60
9	40	67.5
10	43	75
11	46.5	82.5
12	50	90
<i>South-east</i>		
0	6	0
1	11.5	7.5
2	14	15
3	16.5	22.5
4	20	30
5	23	37.5
6	28	45
7	35	52.5
8	37	60
9	40	67.5
10	43	75
11	48	82.5
12	52	90