

TR17-34-42

6. Seismic survey and diamond drilling at Pontville stone quarry.

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Etna Stone Pty Ltd operate a quarry in Triassic quartz sandstone at Pontville. The company property is located east of the Jordan River on the spur of a low flat-topped hill. The proprietors of the company wished to prove additional sandstone reserves to enable them to tender for a contract requiring 850 m³ of unfractured facing stone free of colour variation.

Surveyor G. Benn has prepared a map (fig. 13) showing the position of the existing quarry and an old defunct quarry adjacent to which a new quarry site is proposed. Examination of a pegged area of 900 m² north of the old quarry was requested.

SEISMIC SURVEY

Although geophysical study cannot determine the actual number of joints per metre it was hoped that joint direction, joint regularity and relative intensities of jointing across the area could be determined. The area covered by the survey included the old quarry and about 20 m east and west of the pegged allotment.

Seismic methods

Two distinct approaches were employed:

- (1) A circular spread with a central shot and external shots, one radius outside and at quadrature.
- (2) In line spreads, for determination of weathering profile, critical distance with off line shooting to locate any rock discontinuities and correlate joint intensities and directions.

Results

The seismic profile for the area was as follows:

Material	Seismic Velocity (m/s)
Soil	300
Weathered sandstone	900
Sandstone	1900-1980

The survey suggests an average soil thickness of about 30 cm over the area. Some localised regions have no soil cover while others have soil up to one metre in thickness. Weathered rock occurs to an average depth of 3-3.5 m with a maximum depth of 4.5 m. Relatively fresh sandstone occurs below this depth although this rock is not of excellent quality. Seismic velocities of 3000 m/s represent above average rocks and velocities of 4000 m/s indicate very solid sandstones. Material with a velocity of 2000 m/s could be related to either a quite high overall joint density or partial weathering with removal of some rock cement and therefore the rock is not of top quality.

The survey indicates two principal joint directions, one at about 096° and the other at about 171-176°, the first direction being predominant. A representation of the relative intensities of the joints is shown in Figure 14.

The least fractured rocks occur about the NW-SE diagonal from the centre

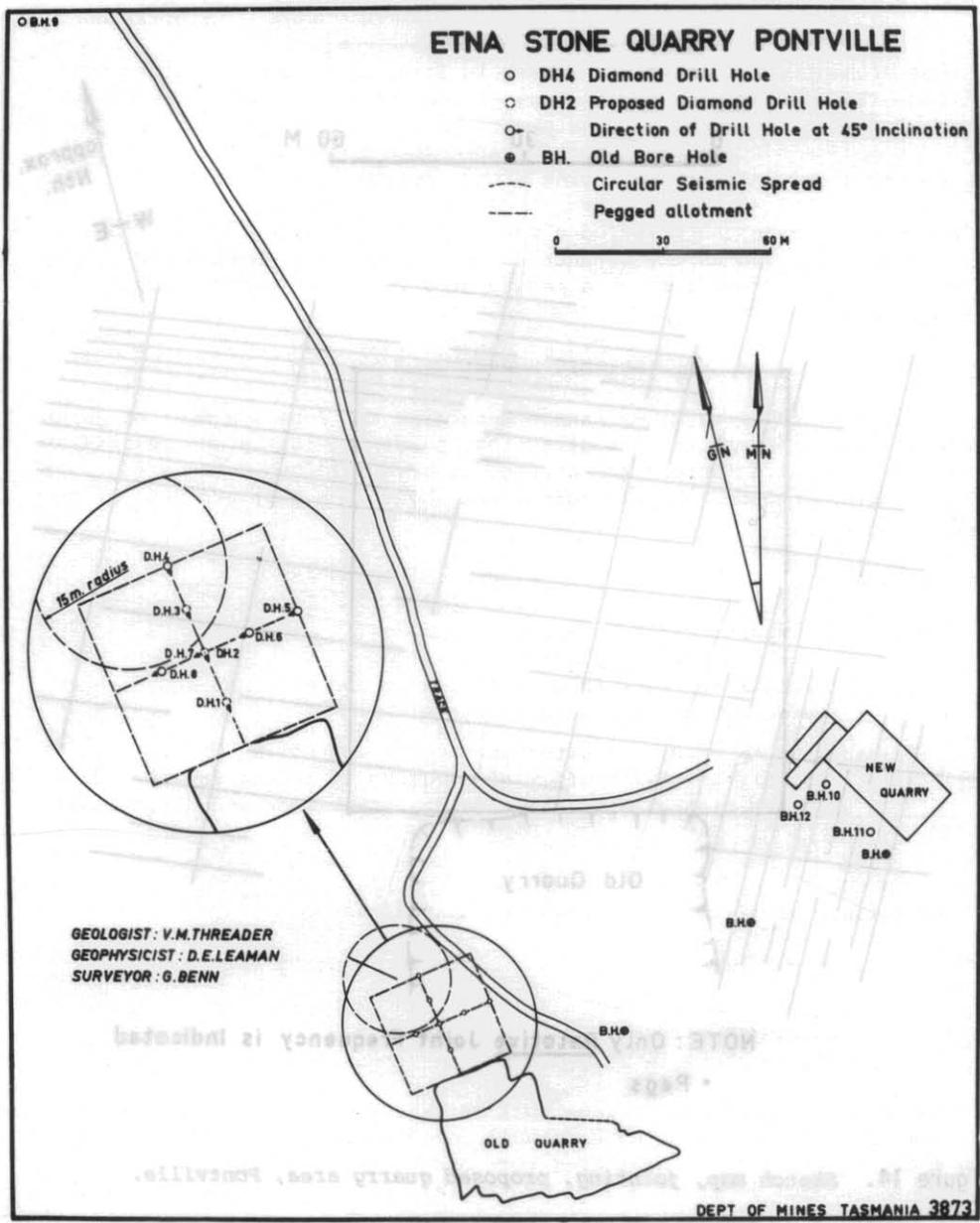
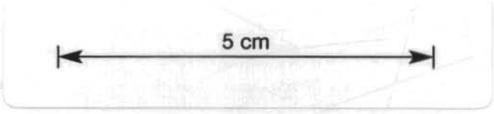


Figure 13.



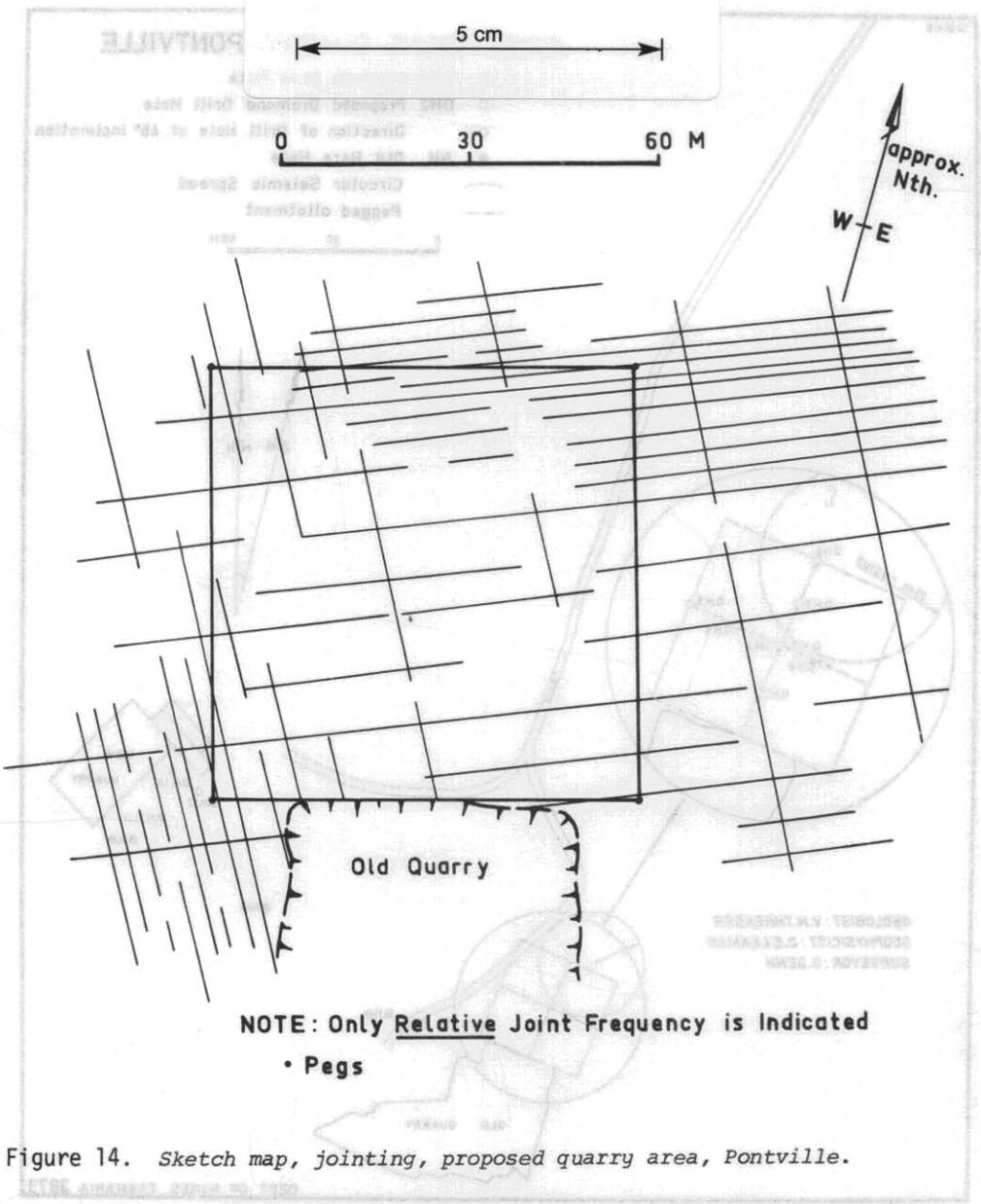


Figure 14. Sketch map, jointing, proposed quarry area, Pontville.

Figure 13.

of the pegged square to the south-east corner and toward the old quarry. Therefore, exposures in the old quarry can be regarded as typical of the joint frequency and rock quality of the best material of the surrounding area.

DIAMOND DRILLING

The principal joint directions measured in the two quarries are NE-SW in the range 078-098° with a steep northerly dip and NW-SW in the range 158-188° with a steep easterly dip (the first mentioned joint direction is predominant). The whiteness of the stone in the old quarry is probably due to leaching of cement and consequent weakening of the stone. It is possible that the better quality stone, which occurs below the weathered stone indicated by the seismic survey, will be more highly and irregularly coloured.

Drilling programme

The recommended drilling programme comprised two lines of four holes in two directions across the pegged area aligned with the principal joint directions (fig. 13). Each hole was inclined at 45°, in the direction indicated, to intersect the greater number of joints and drilled to 10.5 m (a vertical depth of 7.5 m) to effect a complete coverage on each line.

The volume of the pegged area to a depth of 7.6 m is 7080 m³ which was more than sufficient to provide the required quantity of stone, allowing for overburden and quarrying losses provided that the desired quality was proved.

Results

Four holes (No 4, 5, 6 and 8) of the proposed grid were drilled with such poor results that the remainder of the programme was abandoned. Four more holes (No. 9, 10, 11 and 12) were drilled at the locations chosen by the owner. This drilling did not add significantly to the reserves of quality stone as all the cores were irregularly iron stained, highly jointed, and in places very friable.

The location of the drill holes are illustrated in Figure 13 and the core logs are given in Table 1.

CONCLUSIONS

Sufficient drilling has been carried out on this property to preclude the possibility of locating any appreciable quantity of high quality sandstone. The Rhyndaston area adjacent to the south portal of the railway tunnel is a likely area for the requirements of the company, as the sandstone outcrops appear to be coarsely bedded.

Table 1. DIAMOND DRILL LOGS FOR THE PONTVILLE STONE QUARRY

Hole No.	Depth (m)	Recovery (%)	Description	Joints (m)	Bedding Planes (m)
4	0-1.63	66	White friable sandstone with ironstone banding 0.15-0.35, 0.96-1.08 m.	0.68, 0.84	0.15, 0.45, 1.50
	1.63-2.14	100	White friable sandstone with ironstone banding 2.17-2.20 m.	1.69, 1.83, 1.95	1.87, 1.93, 2.01, 2.14
	2.14-3.82	99	A (2.14-2.58 m). White friable sandstone.	2.14, 2.58	
			B (2.58-3.52 m). Silty white sandstone, very friable, with ironstone staining from 2.78-2.80 m. Crumbly in parts.	2.61, 2.67, 2.69, 2.81, 3.14, 3.37,	2.60, 2.66, 2.73, 2.81, 2.88, 2.92, 2.97, 3.06, 3.14, 3.45, 3.59
	3.82-5.24	75	White friable sandstone.	4.23, 4.71, 4.88, 4.92, 5.18, 5.20	3.92, 4.63, 4.82, 4.94, 5.22
	5.24-6.95	86	A (5.24-6.73 m). White friable sandstone.	5.35, 5.44, 5.52, 5.55, 5.67, 6.17, 6.42, 6.71	5.62, 5.66, 5.85, 6.19, 6.68
B (6.73-6.95 m). White silty sandstone.			Extremely broken and crumbled.		
6.95-7.17	100	White silty sandstone, friable.		7.04, 7.07, 7.14	
5	0-1.62	38	White, very weathered and broken sandstone, with ironstone staining 0-0.81 m.	0.45, 0.50	
	1.62-3.25	93	White friable sandstone with ironstone staining 2.16-2.57, 3.07-3.25 m.	1.65, 1.77, 2.24, 2.54, 2.58, 2.62, 2.65, 2.77, 2.85, 2.89, 2.99, 3.20	1.88, 2.08, 2.19, 2.32, 3.05

Table 1. (continued)

Hole No.	Depth (m)	Recovery (%)	Description	Joints (m)	Bedding Planes (m)
6	0-1.63	61	White friable sandstone.	0.30, 1.25, 1.41, 1.63	0.40, 0.85
	1.63-3.31	86	White friable sandstone, very broken between 1.75-1.80 m.	2.73, 3.31	1.75, 1.80, 2.76
	3.31-4.89	93	A (3.31-4.41 m). Friable sandstone grading from white to pale yellow. B (4.41-4.89 m). Pale brown silty sandstone, very friable and completely crumbled.	3.51, 3.96	3.77, 4.41
	4.89-6.29	41	White friable sandstone.	5.10, 5.21, 5.31, 5.73, 6.29	4.89, 5.52, 6.01
	6.29-7.77	49	White friable sandstone with ironstone staining from 6.52-7.77 m.	6.59, 6.80, 6.87, 6.91, 6.99, 7.07, 7.12, 7.19, 7.77	7.67
	7.77-9.17	64	White friable sandstone with ironstone staining throughout. Base of core very badly broken.	7.94, 8.13, 8.31, 9.09, 9.12, 9.15, 9.17	8.35, 8.47, 8.50, 8.57, 8.62, 9.03, 9.17
	8	0-1.32	40	White friable sandstone.	1.32
8	1.32-5.89	100	White friable sandstone	1.40, 1.46, 1.53, 1.88, 1.98	3.35, 4.27, 5.90
	5.89-8.43	100	White sandstone with ironstone banding.	7.85, 9.71	5.99, 6.01, 6.23, 6.26, 6.61, 7.01, 7.47, 8.23
	8.43-9.45	100	White clayey sandstone with some ironstone banding. Fairly thin bedded.	9.45	9.45

Table 1. (continued)

Hole No.	Depth (m)	Recovery (%)	Description	Joints (m)	Bedding Planes (m)
8	9.70-10.98	92	White sandstone.	9.75, 10.24, 10.28 10.36, 10.53	9.45, 9.81, 10.26, 10.98, 10.58
9	0-1.78	74	White friable sandstone, very crushed 0.60-0.71 m and 1.24-1.41 m.	0.32, 0.37, 1.07 1.35	0.0, 1.00, 1.21, 1.45
	1.78-3.10	85	White friable sandstone with ironstone staining 2.44-2.48 m.	2.32, 2.58, 2.74	2.20, 2.50, 2.60, 2.66, 2.72, 3.10
	3.10-4.60	88	White friable sandstone, very well jointed and bedded.	3.16, 3.25, 3.37, 3.44, 3.58, 3.91, 3.97, 4.13, 4.24, 4.32, 4.40, 4.52	3.58, 4.01, 4.05, 4.15, 4.24, 4.36, 4.39, 4.52, 4.54, 4.58
	4.60-6.15	94	White friable sandstone with ironstone staining from 5.64-6.15 m.	5.00, 5.07, 5.12, 5.57, 5.64, 5.74, 5.98, 6.07	4.74, 4.83, 4.85, 5.10, 5.15, 5.42, 5.65, 5.83, 5.94, 6.08
	6.15-7.73	80	A (6.15-7.37 m). White friable sandstone with heavy ironstone staining. B (7.37-7.73 m). White silty very friable sandstone, broken down into small angular fragments.	6.46, 6.60, 6.91, 6.94, 7.01, 7.05, 7.24	6.32, 6.48, 6.66, 6.72, 6.82, 6.83, 7.37
	7.73-9.03	100	White friable sandstone, silty towards the base and with ironstone staining throughout.	7.76, 7.81, 7.85, 7.99, 8.34, 8.39, 8.47, 8.54, 8.57, 8.60, 8.71, 8.74, 8.80	8.00, 8.21, 8.67, 8.86

Table 1. (continued)

Hole No.	Depth (m)	Recovery (%)	Description	Joints (m)	Bedding Planes (m)
10	0-1.81	100	White friable sandstone, stained by ironstone all through.	0.15, 0.23, 0.45, 0.50, 0.77, 1.05, 1.30, 1.54, 1.81	0.63, 1.81
	1.81-3.28	97	White friable sandstone, stained by ironstone in irregular spots.	2.41, 2.59, 2.64, 2.76, 3.13, 3.28	
	3.28-4.93	94	Pale yellow, friable sandstone. No bedding but frequent jointing.	3.43, 3.51, 3.58, 4.00, 4.11, 4.25, 4.38, 4.48, 4.93	
	4.93-5.87	100	As above.	5.17, 5.24, 5.32, 5.44, 5.53, 5.61, 5.85, 5.87	
	5.87-8.37	56	White friable sandstone with bands of ironstone staining.	6.90, 7.42, 7.75, 8.37	6.17, 7.59
	8.37-9.92	100	White friable sandstone with scattered mud pellets and heavy ironstone staining.	8.73, 8.88, 9.11, 9.37	9.01, 9.04, 9.09, 9.25, 9.60, 9.64, 9.71, 9.75, 9.77, 9.92
11	0-1.87	95	White friable sandstone, with ironstone staining throughout.	0.09, 0.11, 0.19, 0.32, 0.34, 0.39, 0.49, 0.62, 0.75, 0.89, 1.12, 1.17, 1.35, 1.47, 1.55, 1.75, 1.79, 1.87	1.02, 1.44
	1.87-3.50	99	White friable sandstone with very slight ironstone stain.	1.92, 1.99, 2.22, 2.36, 2.42, 3.18, 3.34, 3.50	3.21

Table 1. (continued)

Hole No.	Depth (m)	Recovery (%)	Description	Joints (m)	Bedding Planes (m)
11	3.50-6.57	94	White friable sandstone with very slight ironstone stain.	3.73, 4.05, 4.47, 4.60, 4.93, 5.33, 5.74, 5.89, 6.44, 6.57	4.04
12	0-7.93	59	White friable sandstone with ironstone staining between 0.64-1.06, 1.59-2.02 and 5.78-6.13 m.	Very frequent, averaging 10 cm, 1 block 55 cm, 1 block 48 cm.	0.59, 1.57, 1.63, 2.01, 2.07, 2.17, 2.88, 3.48
	2.81-8.33	20			
	4.33-2.03	100			
	3.30-4.03	24			
	1.81-3.30	23			
10	0-1.87	100			

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Table 1. (continued)