DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept.Bk.No. 79/122

PENRICE MARBLE DEPOSIT
1977-1978 DRILLING PROGRAM

Sections 303, 349, 1740, 1741,
hundred of Moorooroo, county Light.

- I.C.I. Australia Ltd. -

GEOLOGICAL SURVEY

By

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Geologist

MINERAL RESOURCES SECTION

DECEMBER, 1979. D.M. No. 73/77

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ABSTRACT

Since 1950, recorded production from I.C.I.'s Penrice marble deposit near Angaston, has totalled 13 083 395 t. High grade marble is used at the company's Osborne plant, lower grade stone is sold for cement manufacture and roadstone, with small tonnages of best quality material used for whiting, foundry flux, glass and tile manufacture.

The steeply dipping marble bed forms part of a lower Cambrian sedimentary sequence with siltstone, schist, quartzite, calc-silicate and other marble horizons. The bed contains a high grade marble core flanked by narrow zones having a calcium carbonate content less than 95%.

A 6 hole core drilling program was conducted within the quarry to define geological boundaries below present workings and marble grades at depths significantly below previous investigations. Existing plans have been updated to include current workings and the marble boundary modified.

Measured reserves of marble total 12 400 000 t, comprising 4 600 000 t in 4 and 5 Levels within the present quarry and 8 800 000 t to 3 Level in an area to the north. Large additional reserves could be obtained by widening the quarry, but this would necessitate mining substantial quantities of low grade marble and schist above 3 Level. Significant reserves also exist south of the present quarry.

INTRODUCTION

I.C.I. Australia Ltd mines marble from their Penrice quarry on sections 303, 349, 1740 and 1741, hundred of Moorooroo, county Light, 2 km north of Angaston (see Fig. 1). The stone, used in the Company's plant at Osborne, must have a minimum calcium carbonate ($CaCO_3$) content of 95%. Planned production increase

requires a 15 year assured supply, approximating 15 000 000 t.

The quarry was inspected on 19 January, 1977 together with J.G. Olliver (Supervising Geologist) and D.A. Young (Technical Officer). The deposit was mapped by stadia theodolite from 7 to 10 February, 1977 by R.J. Harris (Technical Assistant) and the author, and updated by a subsequent survey on 14 March, 1978.

Plans and sections were drafted incorporating data from previous investigations and a 6 hole diamond core drilling program drawn up for the quarry area. Four holes were drilled between 3 May and 26 July, 1977 and the remainder between 30 May and 27 June, 1978. A total of 905.55 m was drilled.

Core was logged and sampled at the Department of Mines and Energy core laboratory at Glenside, samples being submitted to the Australian Mineral Development Laboratories (Amdel) for testing. Results of chemical analysis are detailed in Appendix III and summarised with the logs in Appendix I. Petrographic descriptions of 10 samples are listed in Appendix II. Test results of 14 holes drilled in 1948 and not contained in Departmental records comprise Appendix IV.

TENURE, PRODUCTION AND WORKINGS

Mineral tenure over the deposit comprises Private Mine 86 of about 18 ha held by the District Council of Angaston and Private Mine 120 of 95 ha by I.C.I. Australia Ltd proclaimed on 29 March, 1973 and 31 May, 1973 respectively (see Fig. 1).

Marble production totals 13 083 395 t based on returns submitted to the Department of Mines and Energy from 1950 to the end of 1978.

Except for the high grade marble used for chemical manufacture at Osborne, production usage prior to 1976 has not been differentiated on Table 1. Miscellaneous production in 1978 comprised

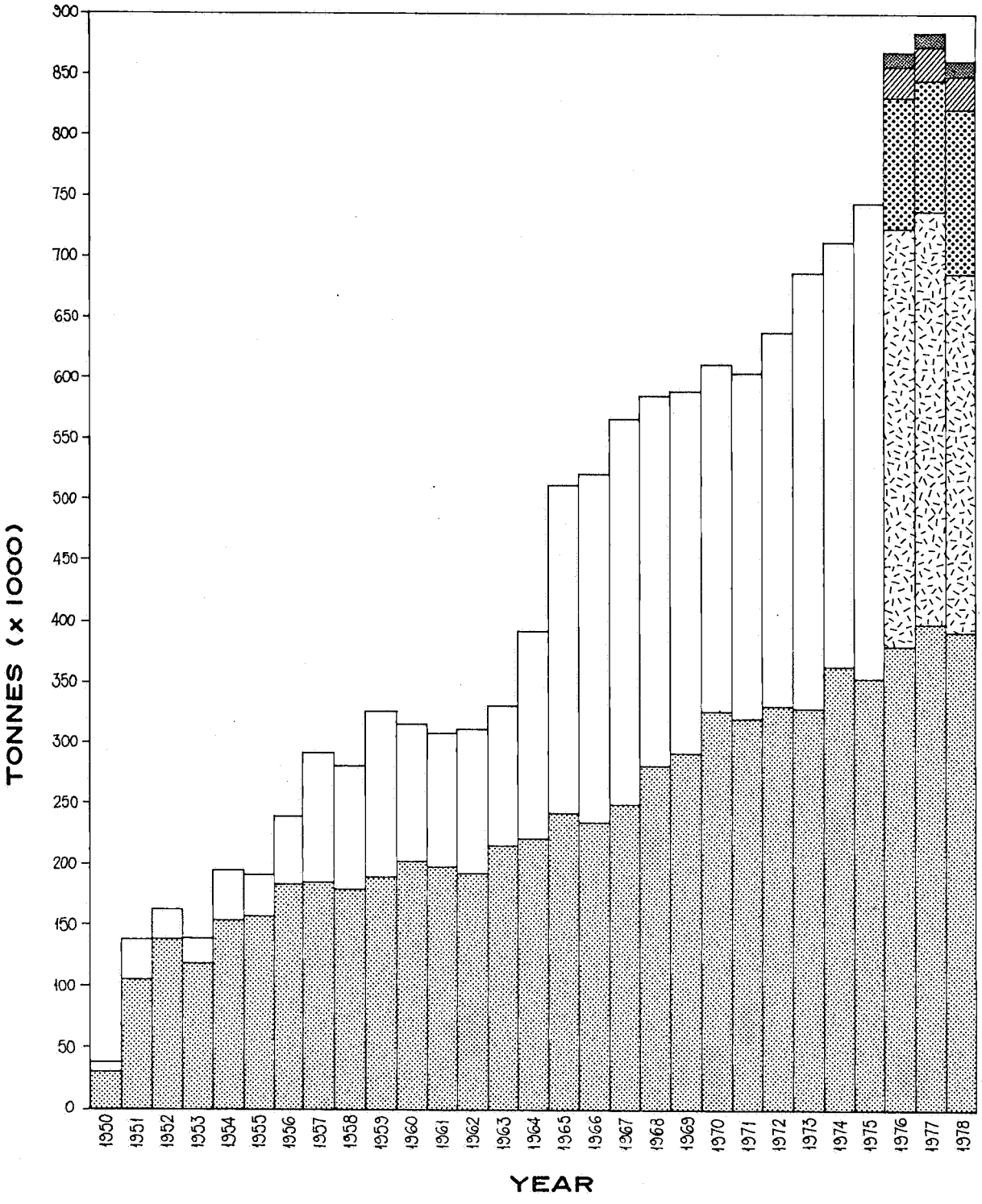

TABLE 1

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE —
COMPILED D. C. Scott	PENRICE MARBLE DEPOSIT	DATE 24-9-79
DRN N. S. CKD	(I.C.I. AUSTRALIA LTD)	PLAN NUMBER
	PRODUCTION AND USAGE 1950-78	S 14314

1437

6 940 t used for glass and tile manufacture in Victoria and 2 210 t for foundry flux. Only marble for chemical manufacture is used by I.C.I., the remainder is sold.

Mine workings are shown in Plates 1-3 and are described by Falconer and Watkins (1979) together with a flow sheet of the quarry plant. Marble for whiting is obtained by Minerals Pty. Ltd by hand selection of best quality stone, broken from large boulders, on the quarry floor (see Pl. 4).

PREVIOUS INVESTIGATIONS

The first detailed mapping of the Angaston marble beds was undertaken by Campbell (1945) for I.C.I. Australia Limited. Particular attention was given to the present location and a drilling program recommended.

Fifty nine diamond core holes were drilled between June, 1945 and November, 1948 under the supervision of Miles (1949), the location of these (Nos. 1-59) and subsequent holes is shown on Figures 2 and 3.

Later investigations were undertaken by Cramsie (1965 and 1967) and Tarvydas (1968) to define the quality of marble mined in the quarry. Ten holes (Nos. 101-110) were drilled between March, 1964 and September, 1966 to outline zones of low grade marble in the southern portion of the quarry.

GEOLOGICAL SETTING

Regional Geology

The detailed geology of the Angaston district is described by Campbell (op. cit) and is summarised below.

The marble beds in the district form part of a lower Cambrian sedimentary sequence. The sequence comprises beds of white, pink, pale brown and grey marble interbedded with greywacke, siltstone, mica schist, quartzite and calc-silicate horizons. Overall strike

of the generally steeply dipping beds is north-south with strong localised folding (see Fig. 1 based on Coates and Thompson, 1959).

This sequence contains three main marble horizons, designated the Stockwell, Penrice and Angaston beds by Campbell, however on ADELAIDE (Thomson, 1969) they are not differentiated and comprise the Angaston Marble. The Penrice bed is the thickest, attaining a maximum thickness of 750 m southeastwards from Penrice, but reaches only 280 m in the quarry area.

Site Geology

The Penrice quarry is on the near-vertical eastern limb of a southerly pitching anticline which has been overturned in places. The marble, enclosed in mica schists and other rocks detailed in Figure 2, has an average thickness of 220 m within the quarry, thinning from a maximum of 280 m near the southern end to 180 m near the northern face and averages 200 m in the northern area.

The marble bed comprises a high grade central zone, generally flanked by narrower zones with a $CaCO_3$ content less than 95% and up to 85 m thick. This boundary, shown on Figures 2-7 is based on analyses of core from the current and previous drilling programs.

Lower grade zones are usually darker due to a higher per centage of contaminant minerals and transitional calc-silicate beds adjacent to the country rock contact.

Contamination is also caused by steeply dipping ironstone lodes, which vary from narrow veinlets a few cm thick up to 7 m, observed in old workings near the southeastern end of the quarry. The ironstone lodes diminish with depth. In particular, the prominent lode which extends across the floor of the quarry is absent in hole 112 and only 0.35 m thick in hole 114.

The ironstone is considered to have formed at the time of Tertiary weathering (Miles, op. cit.) and is of the infilled fissure type. Hematite/limonite derived from pyrite weathered out of the marble, has been deposited or has replaced brecciated marble in fracture zones and joints (see P318/77 Appendix II).

The marble boundary has been modified on Figures 2 and 3 from previous investigations. This includes a large lens of mainly low grade marble on the eastern side of the deposit, separated by a zone of calc-silicate schist which is partially exposed in the quarry face and was encountered in the drilling program.

DIAMOND DRILLING PROGRAM

Six diamond core holes were drilled outwards from the quarry floor into the enclosing schists, at sites shown on Figures 2 and 3 and in cross-sections Figures 4-6. The holes define the geological boundaries below the present workings and the quality of the marble at depths significantly lower than those previously tested.

Logs of the holes are detailed in Appendix I with partial chemical analyses summarised from full analysis in Appendix III. A summary of these logs, with depths to the nearest metre, is shown in Table 2.

TABLE 2

SUMMARY OF LOGS

Hole No.	Interval (m)	Description	$CaCO_3$ (%)
111	0-68	Marble - White to pale grey	97.9
	68-99	Marble - Pale grey to grey	87.3
	99-113	Schist - Biotite, chlorite	-
	113-153	Marble - Pale grey	82.8
	153-162	Schist - Biotite	-
112	0-137	Marble - White to pale pink or grey	96.6
	137-142	Marble - Pale pink to grey	94.2
	142-158	Schist - Calc-silicate, quartz	-
113	0-79	Marble - White to pale grey or brown	96.7
	79-131	Marble - Pale grey to grey	93.7
	131-150	Schist - Calc-silicate	-
	150-182	Marble - Pale grey	88.8
	182-185	Schist - Biotite	-
114	0-99	Marble - White to pale grey with 0.35 m Ironstone band at 78 m	96.5
	99-139	Marble - Pale grey to grey	92.0
	139-146	Schist - Biotite, quartz	-
115	0-41	Marble - White to pale pink and grey	96.7
	41-68	Marble - Pale grey to grey	91.8
	68-98	Schist - Calc-silicate with impure marble bands	-
	98-120	Marble - Pale grey	95.3
	120-124	Schist - Biotite	-
116	0-99	Marble - White to pale grey and brown	97.1
	99-108	Marble - Pale grey to white	93.2
	108-131	Schist - Biotite	-

Tro-pari tests were taken on holes 111 and 112, however the azimuth readings showed variations up to 85° from the initial bearing probably due to ironstone lodes. Since the inclination readings had only minor variations (see logs in Appendix I), these time consuming tests were discontinued and the attitudes of holes 113-116 are shown as straight lines on the cross-sections (Fig. 4-6).

RESULTS OF TESTING

Petrographic Examination

Ten samples submitted to Amdel, are representative of rock types encountered in the drilling program and are listed in Table 3. Full petrographic descriptions are detailed in Appendix II.

TABLE 3

DESCRIPTION OF SAMPLES

Sample No.	Hole No.	Depth (m)	Description
P310/77	111	1.50	Marble - Pale pink, coarse grained. Best quality, minor quartz and iron staining. Few small solution caverties.
P311/77	111	36.30	Marble - Pale grey, medium grained. Good quality with minor quartz and mica impurity.
P312/77	111	112.50	Schist - Calc-silicate, quartz. Grey, fine grained. Strongly banded with abundant mica.
P313/77	111	154.00	Schist - Feldspar, mica. Dark grey with white feldspar, carbonate veins.
P314/77	116	114.00	Schist - Quartz, biotite. Grey to dark grey. Fine grained with carbonate filled joints.
P315/77	115	53.60	Marble - Grey. Fine grained. Impure with calc-silicate, mica and quartz.
P316/77	115	62.2	Marble - Grey. Medium to coarse grained. Impure with quartz, calc-silicate rich bands.
P317/77	115	78.8	Marble - Grey. Fine grained. Impure, numerous calc-silicate bands. Sample represents carbonate band within a calc-silicate schist.
P318/77	114	78.5	Ironstone - Black to dark. Fine grained, containing iron oxides/hydroxide and some coarse grained calcite.
P319/77	113	59.1	Marble - Pink, very coarse grained. Good quality, containing minor fine grained quartz, phlogopite. This band within clean white marble.

The main impurities in the marble are quartz and calc-silicates with lesser amounts of mica and iron sulphide, often weathered to iron oxide/hydroxide. All marble samples contain a low, variable percentage of magnesium carbonate, probably as dolomite.

High grade marble, containing less than 5% of the above impurities, is coarse grained, white to pale shades of pink, grey or brown, whilst lower grade material is generally darker and finer grained.

The transitional contact between the marble and schist is indicated by the calc-silicate and carbonate rich bands P313/77 and P317/77 respectively.

Chemical Analysis

Quarter core samples were forwarded to Amdel for analysis from the core now stored at the Departmental Glenside core library. Sample intervals were based on physical variations in the marble or lengths up to 14 m in uniform zones.

Samples were analysed using classical wet methods to correspond with the Company's testing procedures. Analyses in Appendix III are divided into acid soluble ($CaCO_3$, $MgCO_3$, Fe_2O_3 and Al_2O_3) and insoluble fractions, the latter would contain mainly quartz and insoluble calc-silicate minerals.

The high/low grade boundaries - based on a 95% $CaCO_3$ cut-off - together with average $CaCO_3$ content in each zone, are shown in the logs and Figures 2-7.

Assays of holes drilled in the northern zone in 1948 are not listed in Departmental records. These were obtained from Mr. G.M. Neuenkirchen (Quarry Manager) and are detailed in Appendix IV together with summary logs from Miles (op. cit.). Holes 48 and 49 were not tested and the log of hole 59 is missing.

RESERVES

Marble reserves totalling 12 400 000 t, classed as measured, have been determined for the present quarry from cross-sections E-E' to K-K' (Figs 4-6) and a proposed separate quarry to the north from cross-sections L-L' to P-P' (Fig. 6) based on the following data:

- specific gravity of marble 2.7.
- bench height 14 m.
- bench width 8 m.
- batter slope 45°.
- areas of sections listed in Table 4 for the quarry and north of the quarry. The latter areas are based on a proposed quarry development to mine all the marble to 3 Level (Pers. comm. M. Neuenkirchen).

The gap between the present quarry and the proposed northern quarry is shown on Figure 3 and the longitudinal section (Fig. 7).

TABLE 4

MARBLE RESERVES

Quarry Section	Areas of Sections (m^2)	
	4 Level	5 Level
E-E'	1 900	1 300
F-F'	1 900	1 200
G-G'	2 600	2 000
H-H'	2 100	1 400
I-I'	1 400	800
J-J'	1 500	800
K-K'	200	-
Volume (m^3)	1 050 000	680 000
Reserves (t)	2 800 000	1 800 000

North of Quarry

Section	1 Level	2 Level	3 Level
L-L'	500	1 700	2 600
M-M'	1 800	3 000	3 000
N-N'	3 100	3 000	3 000
O-O'	3 900	3 700	3 700
P-P'	-	1 300	1 100
Volume (m^3)	900 000	1 100 000	960 000
Reserves (t)	2 400 000	2 900 000	2 500 000

These reserves include small tonnages of ironstone and highly ironstained marble which would have to be rejected. Marble within the quarry in 4 and 5 Levels is all high grade. In contrast, the northern area contains approximately 15% low grade material. Additional drilling would be required to confirm this estimate.

Additional large tonnages could be obtained from the quarry by mining below 5 Level. This would necessitate widening the quarry and mining substantial quantities of low grade marble and country rock above 3 Level.

Significant reserves also exist south of the quarry. A quarry development plan would have to be designed to minimise the visual impact from the nearby Penrice-Nurioopta road.

CONCLUSIONS

White to pale grey and brown crystalline marble is mined from the I.C.I.'s Penrice quarry, near Angaston. From 1950 to 1978, production has totalled 13 083 395 t.

A high grade marble zone is enclosed in transitional impure marble and schist beds of Lower Cambrian age. The strata dip steeply eastwards with localised overturning and tight folding.

The marble is used in chemical manufacture at the Company's Osborne plant and also for cement, roadstone, whiting, foundry flux, glass and tile manufacture.

Existing plans have been updated to include subsequent workings and the geological boundaries modified, especially within the quarry based on results of the drilling program.

Reserves of 12 400 000 t of marble, classified as measured, exist in 4 and 5 Levels in the quarry and from three Levels of a proposed northern quarry. Significant additional reserves could be obtained by widening the present quarry and mining below 5 Level. Large reserves also exist south of the quarry. A development plan would be required to reduce the visual impact in this environmentally sensitive area prior to estimation of mineable reserves.

DCS:GU

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Plate 1: Penrice Marble Deposit - Feb. 1979

View of workings from southern end of quarry. Four Level is being deepened from 9 m to 14 m below 3 Level in vicinity of power shovel, centre foreground. Barossa Valley is in top left hand corner.

Plate 2: Penrice Marble Deposit - Feb. 1979

Present workings taken from within area of the proposed northern quarry. The creek will separate the quarries in middle distance (see Fig. 3).

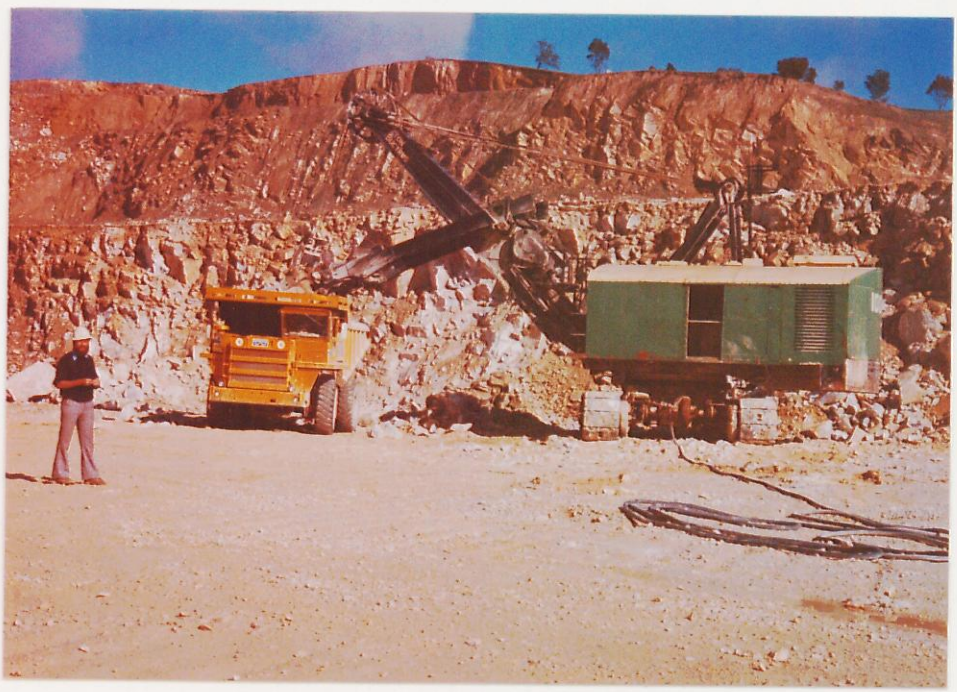


Plate 3: Penrice Marble Quarry - May 1978

Quarry in southwestern corner of 4 Level. Face appears brownish due to iron staining on large, jointed marble blocks.

Plate 4: Penrice Marble Deposit - May 1978

Whiting grade marble is obtained by Minerals Pty. Ltd. by hand sorting best quality material, broken from large blocks, by the drop hammer on the right.

APPENDIX I

Geological logs of holes

PROJECT

PENRICE MARBLE DEPOSIT

HOLE NO. 111 SURVEY DATA

TYPE OF HOLE DIAMOND DRILL -BQ

MACHINE NO. 2 INCLINATION 25°

BORE SERIAL NO. DD 621/77 AZIMUTH 090°

DEPTH 161.90 m

PLAN REFERENCE 79-616A

ASSAY REFERENCE AC69/79

COORDINATES

ELEVATION 337.4 m

DATE COMMENCED 16/6/77

DATE COMPLETED 29/6/77

DRILLER K. KALMAR

LOGGED BY D.C. SCOTT

200—4.78 J5695 O

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS %						
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	Interval	Sample No.*	$CaCO_3$	$Fe_2O_3+Al_2O_3$	Acid Insol.
0.00	1.05	1.05	0.00	0.00	1.05	No core	0.00	1.05	1.05	-	98.2+		
1.05	1.80	0.75	0.72	1.05	4.00	Marble - Pale pink with brown iron stained zones. Coarse grained. Few short bands with biotite, tremolite inclusions. Core partly broken. Sample P310/77	1.05	4.00	2.95	A1257	98.2	0.33	0.45
1.80	4.00	2.20	1.96										
4.00	4.55	0.55	0.00				4.00	4.55	0.55	-	98.2+		
4.55	5.10	0.55	0.51	4.00	4.55	Core Loss							
5.10	6.25	1.15	1.16										
6.25	7.50	1.25	1.25	4.55	10.85	Marble - As above with a few short white bands up to 15cm.	4.55	10.85	6.30	A1258	98.3	0.39	0.45
7.50	9.90	2.40	2.29										
9.90	12.40	2.50	2.49										
12.40	15.50	3.10	1.43	10.85	13.36	Marble - Brown to pale brown with occasional short grey band. Coarse grained. Vuggy, porous near 13.36 with abundant iron staining, soft.	10.85	13.36	2.51	A1259	98.5	0.50	0.44
15.50	18.40	2.90	2.78										
18.40	21.50	3.10	3.00										
21.50	24.50	3.00	2.96	13.36	14.95	Core Loss	13.36	14.95	1.59	-	98.3+		
24.50	27.50	3.00	2.98										
27.50	30.30	2.80	2.72	14.95	17.48	Marble - As at 10.85 - 13.36	14.95	17.48	2.53	A1260	98.1	0.59	0.67
30.30	33.20	2.90	2.90	17.48	20.05	Marble - Pale brown with white bands up to 20 cm. Coarse grained. Clean with minor iron staining.	17.48	20.05	2.57	A1261	97.8	0.54	0.41
33.20	33.30	2.10	2.08										
35.30	37.65	2.35	2.36	20.05	24.90	Marble - Mainly white with occasional pale grey and brown zone. Coarse grained. Minor biotite and very occasional pyrite crystal. Weak banding @ 60°.	20.05	24.90	4.85	A1262	98.3	0.36	0.44
37.65	38.65	1.00	0.98										
38.65	41.45	2.80	2.80										
41.45	44.05	2.60	2.54	24.90	33.95	Marble - White. Coarse grained. Minor iron staining on joints. Occasional calc-silicate inclusions up to 3 mm and small pyrite crystals.	24.90	30.00	5.10	A1263	98.0	0.23	0.48
44.05	46.45	2.40	2.32				30.00	35.95	5.95	A1264	98.0	0.24	0.05
46.45	47.30	0.80	0.80										
47.30	50.05	2.75	2.75	35.95	36.80	Marble - Grey to pale grey. Coarse grained. Less pure with biotite and tremolite. Sample P311/77	35.95	36.80	0.85	A1265	97.4	0.23	0.66
50.05	53.05	3.00	2.98										
53.05	55.70	2.65	2.64										
55.70	58.65	2.95	2.96	36.80	47.30	Marble - Very pale brown, white interbands up to 0.5 m. Coarse grained.	36.80	47.30	10.50	A1266	97.7	0.27	0.80
58.65	61.70	3.05	3.06										
61.70	64.45	2.75	2.70										
64.45	67.35	2.90	2.86	47.30	68.38	Marble - White. Coarse grained. Very occasional short pale grey band.	47.30	57.00	9.70	A1267	97.7	0.24	0.98
67.35	70.10	2.75	2.74				57.00	68.36	11.36	A1268	97.4	0.25	1.18
70.10	73.10	3.00	3.02										
73.10	76.05	2.95	2.92	68.38	74.50	Marble - Pale grey interbanded with white. Medium to coarse grained. Weak, variable banding @ 55° - 65°.	68.36	74.50	6.14	A1269	94.7	0.52	3.25
76.05	79.05	3.00	3.03	74.50	78.42	Marble - Grey with pale grey interbands. Medium to coarse grained. Impure with few short siltstone bands up to 5 cm.	74.50	78.42	3.92	A1270	91.0	0.72	6.75
79.05	81.95	2.90	2.87										
81.95	83.60	1.65	1.65										
83.60	86.65	3.05	3.01	78.42	83.33	Marble - As at 68.36 - 74.50. Banding @ 55°.	78.42	83.33	4.91	A1271	92.7	0.58	5.40
86.65	89.65	3.00	2.96										

CORE RECOVERY LOG

FROM	TO	INTERVAL	RECOVERY
89.65	92.70	3.05	2.97
92.70	95.70	3.00	3.00
95.70	98.75	3.05	3.07
98.75	100.90	2.15	2.10
100.90	102.20	1.30	1.27
102.20	103.95	1.75	1.72
103.95	104.95	1.00	0.94
104.95	106.70	1.75	0.80
106.70	107.30	0.60	0.57
107.30	108.30	1.00	0.97
108.30	109.50	1.20	1.20
109.50	109.90	0.40	0.36
109.90	110.60	0.70	0.13
110.60	113.75	3.15	3.05
113.75	116.70	2.95	2.90
116.70	119.75	3.05	3.04
119.75	122.85	3.10	3.06
122.85	125.90	3.05	3.03
125.90	128.90	3.00	2.98
128.90	131.95	3.05	3.00
131.95	134.30	2.35	0.78
134.30	137.30	3.00	3.04
137.30	140.45	3.15	3.07
140.45	143.55	3.10	3.02
143.55	146.70	3.15	3.10
146.70	148.60	1.90	1.87
148.60	151.20	2.60	2.52
151.20	152.80	1.60	1.67
152.80	153.25	0.45	0.34
153.25	155.90	2.65	2.63
155.90	157.40	1.50	1.30
157.40	158.10	0.70	0.64
158.10	160.45	2.35	2.30
160.45	161.90	1.45	1.43
		TOTAL	154.05
			95.2%

LOG OF DRILL HOLE

FROM	TO	LITHOLOGICAL DESCRIPTION
83.33	87.70	Marble - Grey. Medium to fine grained. Numerous short calcareous siltstone inclusions up to 0.3 m. Few pyrite and mica veins up to 4 mm.
87.70	98.96	Marble - Grey to pale grey. Medium grained. Occasional dark grey siltstone inclusion up to 5 cm.
98.96	105.00	Schist - Quartz, biotite, chlorite. Dark grey-green medium to fine grained. Paler carbonate rich bands @ 65°-75°.
105.00	105.50	Core Loss
105.50	110.00	Schist - As above. Schisted @ 75°-80°.
110.00	110.60	Core Loss
110.60	112.58	Schist - As above - Carbonate less abundant. Sample P312/77
112.58	113.90	Marble - Pale grey. Medium to fine grained. Dark tremolite rich bands up to 5 cm. @ 80°. Spotted with biotite and pyrite inclusions up to 3 mm.
113.90	118.25	Marble - Pale grey and white interbands. Medium to fine grained. Spotted as above. Occasional calc-silicate rich band up to 5 cm @ 70° - 75°.
118.25	123.92	Marble - White with few short pale grey bands. Medium to coarse grained. Tremolite biotite "spots". Weak variable banding @ 65° - 75°.
123.92	127.34	Marble - Grey to pale grey. Medium grained. Less pure.
127.34	132.55	Marble - White with numerous grey bands up to 5 cm Medium to coarse grained. Banding @ 60° - 70°.
132.55	134.00	Core Loss
134.00	139.69	Marble - As at 123.92 - 127.34
139.69	144.60	Marble - White with occasional pale grey band. Coarse grained.
144.60	148.33	Marble - Grey and white interbanded. Medium to coarse grained.
148.33	153.45	Marble - Mainly white with few 5 cm grey bands. Medium to fine grained.
153.45	155.12	Schist - Dark grey - green. Fine grained. Calc-silicate, biotite with numerous pink carbonate veins. Schisted @ 65°. Sample P313/77
155.12	161.90	Schist - Biotite, tremolite. Dark grey with short paler interbands. Fine grained. Few short carbonate rich bands up to 15 cm. Strongly foliated @ 60°-65°.

161.90 m End of Hole

TRO-PARI TESTS

Depth (m)	Inclination
18	24°
45	22°
75	25°
105	26°
135	24°

ASSAYS

FROM	TO	Interval	Sample No.*	$CaCO_3$	Fe_2O_3+ Al_2O_3	Acid Insol.
83.33	87.70	4.37	A1272	62.0	3.31	33.0
87.70	93.00	5.30	A1273	88.4	1.04	8.70
93.00	98.96	5.96	A1274	90.3	0.91	7.00
98.96	100.45	1.49	A1275	54.9	3.81	37.8
110.60	112.58	1.98	A1276	14.6	7.55	72.6
112.58	113.90	1.32	A1277	95.3	0.78	2.40
113.90	118.25	4.35	A1278	91.1	0.91	6.65
118.25	123.92	5.67	A1279	94.1	0.60	3.80
123.92	127.34	3.42	A1280	79.7	1.51	16.7
127.34	132.55	5.21	A1281	93.3	0.62	4.30
132.55	134.00	1.45	-	92.5+		
134.00	139.69	5.69	A1282	91.9	0.78	5.80
139.69	144.60	4.91	A1283	95.8	0.32	2.60
144.60	148.33	3.73	A2166	95.1	0.44	4.95
148.33	153.45	5.12	A2167	96.9	0.32	1.68
153.45	155.12	1.67	A2168	4.65	7.35	84.1

Note: *Full sample No. A1257/77
-Core Loss
+$CaCO_3$% average from adjacent intervals

Marble Grades (%$CaCO_3$)		
0.00 -	68.36	97.9%
68.37 -	98.96	87.3%
112.58 -	153.45	92.8%

PROJECT
Penrice Marble Deposit

HOLE NO. 112 | SURVEY DATA | PLAN REFERENCE 79-616A | DATE COMMENCED 31.5.77
TYPE OF HOLE Diamond drill - BQ | ASSAY REFERENCE AC69/79 | DATE COMPLETED 10.6.77
MACHINE NO. 2 | INCLINATION 25° | DRILLER K. Kalmar
BORE SERIAL NO. DD.620/77 | AZIMUTH 270° | COORDINATES | LOGGED BY D.C. Scott
DEPTH 157.60m. | ELEVATION 337.4m

200—4.78 J5695 O

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS %						
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	Interval	Sample No*	$CaCO_3$	$Fe_2O_3 + Al_2O_3$	Acid Insol.
0.00	1.80	1.80	1.50	0.00	3.23	Marble - White to pale brown. Coarse grained. Brown iron stained zones @ 0.40, 0.55 & 3.00-3.23m associated with joints.	0.00	3.23	3.23	A1234	98.2	0.25	0.42
1.80	3.23	1.43	1.25										
3.23	4.20	0.97	0.00										
				3.23	4.20	Core Loss	3.23	4.20	0.97	-	97.9+		
4.20	6.55	2.35	2.50	4.20	7.45	Marble - As above with lesser iron staining.	4.20	7.45	3.25	A1235	97.6	0.26	0.49
6.55	7.75	1.20	1.10	7.45	12.67	Marble - White to pale grey. Coarse granined with few narrow fine grained calcareous siltstone bands up to 3cm. Weak wavy banding @ 65°-75° to core axis.	7.45	9.15	1.70	A1236	96.0	0.59	2.10
7.75	9.15	1.40	1.45				9.15	12.67	3.52	A1237	97.4	0.46	1.14
9.15	10.40	1.25	1.20										
10.40	13.30	2.90	2.83	12.67	14.73	Marble - Brown to pale pink. Coarse grained with	12.67	14.73	2.06	A1238	97.1	0.58	0.82
13.30	14.45	1.15	1.15										
14.45	16.40	1.95	1.90			few fine grained siltstone inclusions up to 15mm.							
16.40	17.75	1.35	1.32										
17.75	20.40	2.65	2.60	14.73	23.00	Marble - White and pale grey. Coarse grained. Minor iron staining. Occasional pyrite crystal up to 2mm.	14.73	23.00	8.27	A1239	97.0	0.42	1.60
20.40	22.10	1.70	1.65										
22.10	25.15	3.05	2.95										
25.15	27.50	2.35	2.30	23.00	27.71	Marble - Pale pink - Coarse grained.	23.00	27.71	4.71	A1240	97.7	0.32	0.81
27.50	29.03	1.53	1.45	27.71	37.60	Marble- Pale brown + few brown zones. Coarse grained. Occasional small grey patch with fine grained pyrite.	27.71	37.60	9.89	A1241	98.1	0.27	0.57
29.03	31.60	2.57	2.61										
31.60	33.90	2.30	2.28										
33.90	35.40	1.50	1.53										
35.40	37.14	1.74	1.74	37.60	51.10	Marble - Pale grey to white. Coarse grained. Grey zones up to 20cm with pyrite crystals.	37.60	51.10	13.50	A1242	97.6	0.24	0.51
37.14	40.25	3.11	3.05										
40.25	43.35	3.10	2.90	51.10	61.26	Marble - White to pale grey. Coarse grained. Occasional brown staining on joints.	51.10	61.26	10.16	A1243	97.9	0.28	0.91
43.35	46.30	2.95	2.94				61.26	67.38	6.12	A1244	95.7	0.34	2.20
46.30	49.35	3.05	3.04										
49.35	50.70	1.35	1.36										
50.70	53.80	3.10	3.05	61.26	77.38	Marble - White with grey interbands up to 0.5m	67.38	77.38	10.00	A1245	97.3	0.26	1.31
53.80	54.80	1.00	0.96										
54.80	56.60	1.80	1.77			Small pyrite crystals common in grey bands.	77.38	87.38	10.00	A1246	96.0	0.31	1.96
56.60	59.05	2.45	2.38										
59.60	59.05	2.45	2.38										
59.05	60.55	1.50	1.50	77.38	101.33	Marble - White. Coarse grained. Minor iron staining near joints. Very occasional grey band up to 15cm @ 50°-65°.	87.38	101.33	13.95	A1247	95.5	0.40	1.92
60.55	61.75	1.20	1.17				101.33	108.00	6.67	A1248	94.6	0.52	2.60
61.75	64.20	2.45	2.34										
64.20	67.30	3.10	3.15										
67.30	68.95	1.65	1.60	101.33	115.78	Marble - Pale grey to grey. Coarse grained. Less pure with biotite and occasional pyrite crystals. Weak variable banding @ 55°-75°.	108.00	115.78	7.78	A1249	93.6	0.47	3.12
68.95	70.65	1.70	1.77										
70.65	74.20	3.55	3.42										
74.20	77.20	3.00	2.95										
77.20	79.95	2.75	2.73	115.78	125.16	Marble - As at 67.38 - 101.33 + few short pale	115.78	125.16	9.38	A1250	96.2	0.37	1.66

CORE RECOVERY LOG

FROM	TO	INTERVAL	RECOVERY
79.95	82.95	3.00	3.00
82.95	85.50	2.65	2.64
85.50	88.65	3.15	2.93
86.65	91.45	2.85	2.90
91.45	94.40	2.95	2.91
94.40	97.45	3.05	3.08
97.45	100.35	2.90	2.87
100.35	103.40	3.05	3.10
103.40	106.40	3.00	2.95
106.40	109.40	3.00	3.00
109.40	112.40	3.00	3.00
112.40	114.80	2.60	2.40
114.80	115.65	0.85	0.37
115.65	117.75	2.10	2.10
117.75	118.90	1.15	0.95
118.90	121.80	2.90	2.87
121.80	124.30	2.50	2.50
124.30	127.35	3.05	2.85
127.35	130.40	3.05	3.05
130.40	133.45	3.05	3.00
133.45	134.00	0.55	0.54
134.00	136.30	2.30	2.30
136.30	139.25	2.95	2.70
139.25	139.80	0.55	0.56
139.80	141.40	1.60	0.38
141.40	142.25	0.85	0.82
142.25	144.95	2.70	2.57
144.95	146.50	1.55	1.47
146.50	149.05	2.45	2.42
149.05	149.80	0.75	0.68
149.80	150.80	1.00	0.91
150.80	151.80	1.00	0.96
151.80	154.45	2.65	2.63
154.45	156.90	2.45	2.35
156.90	157.60	0.70	0.68
Total			151.83
			96.3%

LOG OF DRILL HOLE

FROM	TO	LITHOLOGICAL DESCRIPTION
115.78	125.16	(Cont.) grey zones up to 0.3m
125.16	128.30	Marble - Grey. Medium granined. Impure with biotite and pyrite crystals. Banding @ 55°-60°.
128.30	136.75	Marble - Pale pink to brown. Medium grained. Impure with darker, brown fine grained bands @ 65°.
136.75	139.90	Marble - Pale pink with few short grey bands up to 10cm. Medium to fine grained. Biotite, pyrite common in grey zones. Banding @ 70°.
139.90	141.00	Core Loss - Core ground, core tube not seated.
141.00	141.81	Marble - As at 136.75 - 139.90
141.81	151.75	Schist - Calc-silicate, biotite, quartz. Grey-green. Fine grained with few narrow carbonate filled veins, brecciated in part. Variable banding @ 50°-75°.
151.75	154.46	Schist - Quartz rich. Green with dark grey patches up to 10cm. Fine grained, hard.
154.46	157.60	Schist - As at 141.81 - 151.75. Schisted @ 50°-60°.

157.60m End of Hole

TRO-PARI TESTS

Depth (m)	Inclination
20	24°
40	24°
70	23°
100	22°
130	22°

ASSAYS

FROM	TO	Interval	Sample No*	$CaCO_3$	Fe_2O_3+ Al_2O_3	Acid Insol.
125.16	128.30	3.14	A1251	97.4	0.28	0.52
128.30	134.00	5.70	A1252	96.1	0.39	1.11
134.00	136.75	2.75	A1253	96.7	0.22	2.05
136.75	139.90	3.15	A1254	94.2	0.39	3.45
139.90	141.00	1.10	-	94.3+		
141.00	141.81	0.81	A1255	94.5	0.37	5.20
141.81	143.81	2.00	A1256	25.5	3.86	66.8

Note:* Full sample No. A1234/77
-Core loss
+$CaCO_3$% average from adjacent intervals

Marble Grades (%$CaCO_3$)

0.00	136.75	96.6%
136.75	141.81	94.2%

PROJECT
PENRICE MARBLE DEPOSIT

HOLE NO. 113 | SURVEY DATA | PLAN REFERENCE 76-616A | DATE COMMENCED 14.6.78
TYPE OF HOLE DIAMOND DRILL - BQ | ASSAY REFERENCE AC 69/79 | DATE COMPLETED 26/6/78
MACHINE NO. 2 | INCLINATION 35° | DRILLER J. JENSEN
BORE SERIAL NO. DD 638/78 | AZIMUTH 090° | COORDINATES | LOGGED BY D.C. SCOTT
DEPTH 184.80 m | ELEVATION 328.3 m

200—4.78 J5695 O

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS %						
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	Interval	Sample No. *	$CaCO_3$	Fe_2O_3+ Al_2O_3	Insoluble
0.00	1.50	1.50	0.48										
1.50	3.00	1.50	0.70	0.00	0.56	Marble - White. Very coarse grained. Clean, minor small pyrite "spots".	0.00	0.56	0.56	A2219	95.6	0.32	2.35
3.00	4.50	1.50	1.00										
4.50	5.00	0.50	0.50	0.56	1.50	Core Loss	0.56	1.50	0.94	-	95.6+		
5.00	7.50	2.50	2.10	1.50	2.00	Marble - As above.							
7.50	9.00	1.50	1.00	2.00	2.66	Core Loss	1.50	2.00	0.50	A2220	95.6	0.23	2.29
9.00	11.00	2.00	2.00	2.66	3.52	Marble - As above with minor brown staining near joints.	2.00	2.66	0.66	-	96.1+		
11.00	13.50	3.50	3.48				2.66	3.52	0.86	A2221	96.7	0.18	1.53
13.50	15.15	1.65	1 65	3.52	4.00	Core Loss	3.52	4.00	0.48	-	96.3+		
15.15	16.50	1.35	1.30	4.00	5.65	Marble - White to pale grey. Coarse grained. Minor	4.00	5.65	1.65	A2222	95.9	0.20	2.25
16.50	19.65	3.15	3.15										
19.65	22.70	3.05	3.02			specks of pyrite, biotite.							
22.70	25.75	3.05	3.03	5.65	6.00	Core Loss	5.65	6.00	0.35	-	96.0+		
25.75	28.75	3.00	3.00	6.00	7.50	Marble - As at 4.00 - 5.65	6.00	7.50	1.50	A2223	96.1	0.19	2.05
28.75	31.70	2.95	2.90	7.50	8.00	Core Loss	7.50	8.00	0.50	-	96.0+		
31.70	34.20	2.50	2.51	8.00	46.35	Marble - White to pale grey. Coarse grained.	8.00	16.50	8.50	A2224	95.9	0.20	2.60
34.20	37.30	3.10	3.10			Clean with occasional small pyrite, biotite	16.50	21.00	4.50	A2225	96.5	0.20	1.63
37.30	40.35	3.05	3.07			specks up to 1.5 mm. Minor brown staining in	21.00	27.00	6.00	A2226	97.9	0.22	0.79
40.35	43.40	3.05	3.02			joints and bands up to 10 cm. Occasional	27.00	34.00	7.00	A2227	97.1	0.30	1.06
43.40	46.50	3.10	3.08			very weak, wavy banding.	34.00	41.00	7.00	A2228	96.3	0.36	1.42
46.50	49.60	3.10	3.15				41.00	46.35	5.35	A2229	96.6	0.26	1.13
49.50	52.45	2.85	2.82	46.35	67.90	Marble - Pale brown with white interbands up	46.35	54.00	7.65	A2230	96.8	0.21	1.94
52.45	55.60	3.15	3.10			to 0.7 m. Very coarse to coarse grained. Few	54.00	62.00	8.00	A2231	96.7	0.25	1.28
55.60	58.65	3.05	3.01			short pale grey bands @ 60°-65° to core axis.	62.00	67.90	5.90	A2232	97.1	0.24	1.13
58.65	61.75	3.10	3.04			See sample P319/77							
61.75	64.75	3.00	3.06	67.90	75.84	Marble - White. Very coarse grained. Clean	67.90	75.84	7.94	A2233	97.2	0.22	0.86
64.75	67.85	3.10	3.07			very occasional pyrite specks. Few pale brown zones							
67.85	71.00	3.15	3.10			up to 15.00 cm.							
71.00	74.15	3.15	3.12										
74.15	76.20	2.05	2.01										
76.20	79.35	3.15	3.13	75.84	78.68	Marble - As at 46.35 - 67.90	75.84	78.68	2.84	A2234	97.6	0.17	0.67
79.35	82.50	3.15	3.06	78.68	111.05	Marble - Pale grey with grey bands up to 20 cm.	78.68	86.00	7.32	A2235	94.8	0.32	3.15
82.50	84.80	2.30	2.32				86.00	93.00	7.00	A2236	95.7	0.33	2.15
84.80	87.70	2.90	2.87			Medium to coarse grained. Calc-silicate inclusions	93.00	100.00	7.00	A2237	94.8	0.32	3.25
87.70	90.70	3.00	3.00			more common, less pure. Banding @ 65° - 75°.	100.00	107.00	7.00	A2238	95.1	0.47	2.50
90.70	93.70	3.00	2.96	111.05	112.68	Marble - Grey brown. Medium grained. Core broken	107.00	111.05	4.05	A2239	90.2	0.92	6.80
93.70	96.75	3.05	3.01			with iron staining on fracture surfaces. Impure.	111.05	112.68	1.63	A2240	80.7	2.61	14.5
96.75	99.85	3.10	3.05										

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS %						
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	Interval	Sample No.*	$CaCO_3$	Fe_2O_3+ Al_2O_3	Acid Insol.
							112.68	120.47	7.79	A2241	94.1	0.61	3.30
99.85	102.95	3.10	3.12	112.68	120.47	Marble - White to pale grey. Medium to coarse grained. Grey calc-silicate rich bands @ 65°. Abundant iron staining on joints.							
102.95	106.00	3.05	3.06										
106.00	109.15	3.15	3.10										
109.15	112.30	3.15	3.09	120.47	122.87	Marble - Grey-medium grained with darker impure bands @ 65°, finer grained.	120.47	122.87	2.40	A2242	90.3	0.94	6.55
112.30	115.35	3.05	3.08										
115.35	118.40	3.05	3.05	122.87	129.30	Marble - Pale grey, with grey, interbands up to 0.4 m. Medium grained. Strongly banded @ 65° - 70°.	122.87	129.30	6.43	A2243	95.1	0.42	2.70
118.40	121.35	2.95	2.96										
121.35	122.85	1.50	1.42										
122.85	126.00	3.15	3.11										
126.00	126.90	0.90	0.84	129.30	131.47	Marble - Grey with pale grey bands. Medium to fine grained. Impure with abundant calc-silicate in darker bands @ 65° - 70°.	129.30	131.47	2.17	A2244	89.9	1.05	6.65
126.90	130.00	3.10	3.12										
130.00	133.10	3.10	3.11										
133.10	135.45	2.35	2.32	131.47	133.20	Schist - Quartz,amphibole, biotite. Dark grey with paler carbonate rich bands up to 20 cm. Fine to medium grained. Banding wavy, variable @ 45° - 65°.	131.47	133.20	1.73	A2245	55.6	6.10	34.7
135.45	138.50	3.05	3.07										
138.50	141.55	3.05	3.05										
141.55	144.60	3.05	3.02										
144.60	147.70	3.10	3.07										
147.70	150.85	3.15	3.12	133.20	150.03	Schist - Amphibolitic. Dark grey with few short carbonate rich bands up to 5 cm. Medium to fine grained. Banding @ 55° - 65°.							
150.85	154.00	3.15	3.07										
154.00	157.05	3.05	30.1										
157.05	160.15	3.10	3.08										
160.15	163.05	2.90	2.98	150.03	157.24	Marble - Pale grey with grey bands up to 10 cm. Medium grained. Impure with calc-silicate inclusions. Banding @ 65° - 70°.	150.03	157.24	7.21	A5607+	89.9	0.72	6.50
				157.24	158.20	Schist - Amphibolitic. Dark grey. Fine grained. Numerous carbonate inclusions and pyrite stringers. Banding @ 65°.	157.24	158.20	0.96	A5608	54.4	6.23	37.0
163.05	166.00	2.95	2.90	158.20	178.18	Marble - Pale grey to white. Medium grained with few calc-silicate rich bands up to 5 cm increasing with depth. Wavy banding @ 55° - 75°.	158.20	166.00	7.80	A5609	94.5	0.55	2.80
166.00	169.15	3.15	3.10				166.00	173.00	7.00	A5610	90.7	1.09	5.85
169.15	172.30	3.15	3.12				173.00	178.18	5.18	A5611	91.1	1.25	5.20
172.30	175.40	3.10	3.10	178.18	180.55	Marble - Pale grey. Medium grained. Less pure with a few short schist bands up to 10 cm.	178.18	180.55	2.37	A5612	78.3	2.46	16.4
175.40	178.55	3.10	3.12										
178.55	181.60	3.05	3.01	180.55	182.46	Marble - Pale grey to grey. Medium to fine grained, with short schist inclusions, silicous, harder in part.	180.55	182.46	1.91	A5613	79.4	1.97	15.8
181.60	183.85	2.25	2.18										
183.85	184.40	0.95	0.89	182.46	184.80	Schist - Dark grey with grey quartz rich bands. Fine grained. Amphibole and biotite occasional sulphide blebs up to 2 cm.							
		TOTAL	181.24										
			98.3%										
						184.80 m End of Hole							

Note:* Full sample No. A2219/77

Marble Grades	($\%CaCO_3$)
0.00 - 78.68	96.7%
78.68 - 131.47	93.7%
150.03 - 182.46	88.8%

-Core loss

+$CaCO_3$% average from adjacent intervals.

PROJECT
Penrice Marble Deposit

HOLE NO. 114
TYPE OF HOLE Diamond drill - BQ
MACHINE NO. 2
BORE SERIAL NO. DD 635/78

SURVEY DATA
INCLINATION 25°
AZIMUTH 270°
DEPTH 145.85m

PLAN REFERENCE 79-616A
ASSAY REFERENCE AC 69/79
COORDINATES
ELEVATION 328.2m

DATE COMMENCED 30/5/78
DATE COMPLETED 12/6/78
DRILLER J. Jensen
LOGGED BY D.C. Scott

200—4.78 J5695 O

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS %						
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	Interval	Sample No*	$CaCO_3$	Fe_2O_3+ Al_2O_3	Acid Insol.
0.00	1.00	1.00	0.83	0.00	2.00	Marble - White, minor pale grey bands. Coarse to very coarse grained. Weak banding @ 55°-65° to core axis. Pyrite, limonite inclusions.	0.00	2.00	2.00	A2246	95.6	0.39	1.94
1.00	1.40	0.40	0.37										
1.40	4.00	2.60	1.20				2.00	3.00	1.00	-	95.9+		
4.00	5.50	1.50	1.15	2.00	3.00	Core Loss							
5.50	7.00	1.50	0.62	3.00	5.50	Marble - As above. Minor pyrite inclusions	3.00	5.50	2.50	A2247	96.2	0.39	1.42
7.00	8.00	1.00	0.43	5.50	5.83	Core Loss	5.50	5.83	0.33	-	96.4+		
				5.83	6.45	Marble - As at 3.00 - 5.50	5.83	6.45	0.62	A2248	96.7	0.40	1.29
8.00	9.00	1.00	0.86	6.45	7.52	Core Loss	6.45	7.52	1.07	-	96.8+		
				7.52	9.46	Marble - As at 3.00-5.50	7.52	9.80	2.28	A2249	96.9	0.45	0.77
9.00	10.50	1.50	0.65	9.46	9.80	Marble - Pale grey. Coarse grained with occasional grey mica flakes.	9.80	10.50	0.70	-	96.8+		
				9.80	10.50	Core Loss							
10.50	12.00	1.50	1.35	10.50	12.38	Marble - White. Very coarse grained. Minor pale grey zones up to 5cm. Brown iron staining on joints.	10.50	12.38	1.88	A2250	96.8	0.31	0.85
12.00	15.00	3.00	1.30	12.38	13.90	Core Loss	12.38	13.90	1.52	-	97.0+		
15.00	16.50	1.50	1.40										
16.50	19.40	2.90	2.60	13.90	20.00	Marble - White to pale pink. Coarse grained. Clean,	13.90	20.00	6.10	A2251	97.2	0.26	0.92
19.40	22.00	2.60	1.80			minor weak banding @ 40°-45°	20.00	20.45	0.45	-	97.1+		
22.00	25.10	3.10	3.00										
25.10	28.15	3.05	3.05	20.00	20.45	Core Loss							
28.15	31.20	3.05	3.02	20.45	29.90	Marble - White with a few short pale brown bands up to 0.5m. Coarse grained. Weak banding @ 45° - 50°.	20.45	22.00	1.55	A2252	97.1	0.28	0.96
31.20	32.22	1.02	0.95										
32.22	35.20	2.98	2.96				22.00	29.90	7.90	A2253	96.4	0.38	0.98
35.20	38.25	3.05	3.02										
38.25	41.00	2.75	2.70	29.90	30.12	Marble - Brown. Medium to coarse grained. Minor siderite, some iron stained vughs up to 5cm.	29.90	30.12	0.22	A2254	96.9	0.34	1.35
41.00	44.10	3.10	3.10				30.12	36.00	5.88	A2255	96.9	0.27	1.18
44.10	47.10	3.00	3.02										
47.10	50.20	3.10	3.10	30.12	31.95	Marble - White. Very coarse grained. Clean.	36.00	43.00	7.00	A2256	96.8	0.24	1.25
50.20	53.25	3.05	3.05	31.95	32.20	Marble - Brown. Some iron staining, core broken - fracture zone.	43.00	50.00	7.00	A2257	97.4	0.34	0.52
53.25	56.30	3.05	3.04				50.00	57.00	7.00	A2258	97.8	0.33	0.34
56.30	59.35	3.05	3.06										
59.35	62.45	3.10	3.06	32.20	62.60	Marble - White with short pale brown zones up to 0.5m.	57.00	62.60	5.60	A2259	97.4	0.29	0.71
62.45	65.45	3.00	2.95	62.60	63.66	Marble - Pale grey to grey with some short pale brown zones up to 0.2m. Medium grained. Numerous small calc-silicate inclusions, some pyrite.	62.60	63.66	1.06	A2260	89.8	1.02	6.85
65.45	68.45	3.00	2.96										
68.45	71.50	3.05	3.02				63.66	71.00	7.34	A2261	96.8	0.59	0.93
71.50	74.50	3.00	3.03										
74.50	77.40	2.90	2.75	63.66	78.15	Marble - White to pale brown. Medium to coarse grained Occasional short grey band up to 0.3m. @ 50°.	71.00	78.15	7.15	A2262	95.9	1.25	1.48
77.40	78.50	1.10	1.05										
78.50	81.30	2.80	2.81										
81.30	84.30	3.00	2.92										

DEPARTMENT OF MINES AND ENERGY-SOUTH AUSTRALIA

HOLE NO. 114 PROJECT Penrice Marble Deposit

CORE RECOVERY LOG

FROM	TO	INTERVAL	RECOVERY
84.30	87.40	3.10	3.05
87.40	90.45	3.05	3.00
90.45	93.60	3.15	3.06
93.60	96.65	3.05	3.05
96.65	99.70	3.05	3.00
99.70	102.80	3.10	3.08
102.80	106.00	3.20	3.12
106.00	109.05	3.05	3.05
109.05	111.90	2.85	2.88
111.90	114.70	2.80	2.77
114.70	117.80	3.10	3.06
117.80	120.90	3.10	3.05
120.90	123.90	3.00	3.01
123.90	126.20	2.30	2.20
126.20	129.30	3.10	3.04
129.30	132.30	3.00	3.02
132.30	133.65	1.35	1.38
133.65	136.70	3.05	3.06
136.70	139.80	3.10	3.08
139.80	142.85	3.05	3.04
142.85	145.85	3.00	3.02
		TOTAL	137.20
			94.1%

LOG OF DRILL HOLE

FROM	TO	LITHOLOGICAL DESCRIPTION
78.15	78.50	Ironstone - Dark brown to black. Medium to fine grained, with siderite, limonite, hematite. Strongly banded @ 55°. Vughy. See sample P318/77.
78.50	92.42	Marble - White to pale grey. Coarse grained, with short brown iron stained zones up to 20cm.
92.42	117.71	Marble - Pale grey with white interbands. Medium to coarse grained. Occasional small calc-silicate and sulphide inclusions. Weakly banded @ 45° - 50°.
117.71	119.23	Marble - Grey to pale grey. Medium to fine grained, with calc-silicate and pyrite rich bands @ 40° - 45°.
119.23	125.60	Marble - Pale grey to white. Medium to coarse grained. Few short calc-silicate rich bands up to 5cm. @ 50°
125.60	135.32	Marble - Pale grey to grey. Medium grained. Numerous short calc-silicate rich bands, wavy banding @ 40° - 55°.
135.32	139.26	Marble - White to pale grey. Coarse grained. Minor calc-silicate inclusions. Weak banding @ 45°-50°.
139.26	145.85	Schist - Quartz, biotitie, tremolite. Dark grey with a few pale grey quartz rich zones. Few small carbonate filled veins. Schisted @ 45° - 55°.
		145.85m. End of Hole

ASSAYS %

FROM	TO	Interval	Sample No*	$CaCO_3$	Fe_2O_3 Al_2O_3+	Acid Insol.
78.15	78.50	0.35	A2263	85.5	5.19	1.60
78.50	85.00	6.50	A2264	95.5	0.82	1.66
85.00	92.42	7.42	A2265	96.4	0.33	1.66
92.42	99.00	6.58	A2266	95.6	0.40	1.81
99.00	106.00	7.00	A2211	93.5	0.63	4.35
106.00	114.00	8.00	A2212	95.2	0.46	2.45
114.00	117.71	3.71	A2213	94.7	0.54	2.60
117.71	119.23	1.52	A2214	75.6	2.76	19.0
119.23	125.60	6.37	A2215	93.2	0.71	3.70
125.60	135.32	9.72	A2216	88.2	1.42	8.55
135.32	139.26	3.94	A2217	94.9	0.60	2.50
139.26	140.00	0.74	A2218	33.0	4.29	57.5

Note:* Full sample No. A2246/77
-Core loss
+$CaCO_3$ % average from adjacent intervals.

Marble	Grade ($CaCO_3$)
0.00 - 99.00	96.5%
99.00 - 139.26	92.0%

PROJECT Penrice Marble Deposit

HOLE NO. 115 | SURVEY DATA | PLAN REFERENCE 79.616B | DATE COMMENCED 14.7.77

TYPE OF HOLE Diamond drill - BQ | ASSAY REFERENCE AC69/79 | DATE COMPLETED 27.7.77

MACHINE NO. 2 | INCLINATION 25° | DRILLER K. Kalmer

BORE SERIAL NO. DD 606/78 | AZIMUTH 090° | COORDINATES | LOGGED BY I.C. Scott

DEPTH 124.45m | ELEVATION 337.8m

200—4.78 J5695 O

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS %						
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	Interval	Sample No*	$CaCO_3$	Fe_2O_3 Al_2O_3 +	Acid Insol.
0.00	1.00	1.00	0.00	0.00	1.00	Core Loss	0.00	1.00	1.00	-	96.6+		
1.00	2.15	1.15	1.13										
2.15	3.20	1.05	1.01	1.00	9.38	Marble - White to very pale pink. Coarse grained. Good quality with minor iron staining on joints. Occasional biotite, pyrite grains.	1.00	2.04	1.04	A2190	96.6	0.32	1.74
							2.04	9.38	7.34	A2191	96.6	0.27	2.00
3.20	5.80	2.60	2.66										
5.80	6.60	0.80	0.75										
6.60	9.75	3.15	3.05	9.38	21.81	Marble - Pale grey, few pales pink interbands. Coarse grained. Few biotitie and sulphide crystals up to 2mm.	9.38	16.00	6.62	A2192	96.6	0.33	1.54
9.75	11.35	1.60	1.50				16.00	21.81	5.81	A2193	96.8	0.37	1.56
11.35	12.50	1.15	1.16										
12.50	14.70	2.20	2.27	21.81	34.62	Marble - Mainly white + few short pale grey bands. Coarse grained.	21.81	28.00	6.19	A2194	97.3	0.32	0.52
14.70	17.75	3.05	3.03				28.00	34.62	6.62	A2195	96.8	0.22	0.98
17.75	20.90	3.15	3.11										
20.90	23.95	3.05	3.05	34.62	41.36	Marble - Pale pink + white bands up to 0.7m. Medium grained. Few quartz rich interbands up to 2cm @ 55°, these bands soft, friable.	34.62	41.36	6.74	A2196	96.6	0.24	1.41
23.95	26.90	2.95	2.93										
26.90	29.80	2.90	2.90										
29.80	32.80	3.00	2.97										
32.80	35.75	2.95	2.88	41.36	43.95	Marble - Pale grey. Coarse grained. Numerous quartz rich inter-bands up to 8cm, pale yellow, soft, friable, core broken.	41.36	43.95	2.59	A2197	90.0	0.95	7.50
35.75	38.90	3.15	3.09										
38.90	41.50	2.60	2.54										
41.50	43.90	2.40	2.23										
43.90	46.75	2.85	2.84	43.95	52.90	Marble - White + few narrow pale grey bands. Medium to coarse grained. Occasional biotite, pyrite crystals. Banding @ 55° - 60°.	43.95	49.00	5.05	A2198	94.8	0.57	3.30
46.75	47.30	0.55	0.55				49.00	52.90	3.90	A2199	95.6	0.42	2.35
47.30	50.35	3.05	3.04										
50.35	53.45	3.10	3.05	52.90	54.34	Marble - Grey. Medium to fine grained. Impure with abundant biotite, calc-silicate inclusions. Banding variable @ 60°- 80°. See sample P315/77	52.90	54.34	1.44	A2200	71.0	3.99	23.1
53.45	55.40	1.95	1.95										
55.40	58.45	3.05	3.06										
58.45	61.40	2.95	2.94	54.34	61.14	Marble - Pale grey. Medium to coarse grained. Few short dark grey bands @ 60° -65°. Few quartz rich bands up to 2cm.	54.34	61.14	6.80	A2201	92.9	0.82	4.30
61.40	64.45	3.05	3.00	61.14	62.52	Marble - Grey. Medium to coarse grained. Impure with abundant quartz rich bands. Core broken, friable. See sample P316/77	61.14	62.52	1.38	A2202	90.7	1.33	5.30
64.45	67.05	2.60	2.56										
67.05	70.10	3.05	3.02	62.52	68.08	Marble - Grey to pale grey. Medium to coarse grained. Numerous dark grey, impure bands up to 10cm, with biotite, calc-silicate and sulphide crystals.	62.52	68.08	5.56	A2203	91.6	1.28	5.15
70.10	72.80	2.70	2.70	68.08	69.70	Marble - Grey to dark grey. Medium grained. Impure	68.08	69.70	1.62	A2204	69.3	4.33	23.2

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS %						
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	Interval	Sample No*	$CaCO_3$	Fe_2O_3 + Al_2O_3	Acid Insol.
72.80	75.95	3.15	3.09			with abundant calc-silicate, biotite rich bands up to 10m @ 55° - 70°.							
75.95	78.95	3.00	3.02										
78.95	81.20	2.25	2.12	69.70	89.60	Schist - Calc-silicate, biotite. Dark grey to grey. Fine grained. Few narrow sulphide bands and carbonate rich zones up to 15cm @ 60° - 75°. See smaple P317/77							
81.20	84.20	3.00	3.03										
84.20	87.25	3.05	3.06										
87.25	88.05	0.80	0.85										
88.05	90.65	2.60	2.57										
90.65	93.70	3.05	2.90	89.60	98.20	Schist - As above with few impure marble interbands up to 0.55m. abundant calc-silicate inclusions.							
93.70	96.80	3.10	3.04										
96.80	99.80	3.00	3.01	98.20	99.27	Marble - Grey to pale grey. Medium to fine grained. Impure, abundant calc-silicate inclusions. Banding @ 65°.	98.20	99.27	1.07	A2205	91.4	1.05	6.15
99.80	103.00	3.20	3.16										
103.00	106.05	3.05	3.02										
106.95	109.10	3.05	2.98	99.27	110.76	Marble - Mainly white + pale brown zones up to 0.6m. Coarse grained. Minor impurites	99.27	105.00	5.73	A2206	95.5	0.46	2.25
109.10	112.10	3.00	3.04				105.00	110.76	5.76	A2207	96.2	0.36	1.74
112.10	115.30	3.10	3.07										
115.30	117.10	1.80	1.78	110.76	118.23	Marble - White to pale grey. Fine grained. Occasional calc-silicate band up to 0.20m.	110.76	115.00	4.24	A2208	95.3	0.35	2.45
117.10	118.70	1.60	1.61				115.00	118.23	3.23	A2209	95.4	0.39	3.00
118.70	119.85	1.15	1.03										
119.85	120.65	0.80	0.65										
120.65	122.30	1.65	1.56	118.23	119.50	Marble - Yellow to pale grey. Fine grained. Impure.	118.23	119.50	1.27	A2210	93.7	0.97	4.30
122.30	122.95	0.65	0.65										
122.95	123.80	0.85	0.76	119.50	124.45	Schist - Biotite, quartz, minor calc-silicate. Dark grey. Fine grained. Carbonate in veins and joints. Schisted @ 45° - 60°. Contact with marble sharp @ 45°.							
123.80	124.05	0.25	0.21										
124.05	124.45	0.45	0.38										
		TOTAL	121.62 97.7%			124.45m End of Hole							

Note: * Full sample No. A2190/77
- Core loss
+ $CaCO_3$% average from adjacent intervals

Marble Grade (%$CaCO_3$)

0.00 - 41.36	96.7%
41.36 - 68.08	91.8%
98.20 -119.50	95.3%

PROJECT

PENRICE MARBLE DEPOSIT

HOLE NO. 116 SURVEY DATA

TYPE OF HOLE DIAMOND DRILL - BQ

MACHINE NO. 2 INCLINATION 25°

BORE SERIAL NO. DD605/78 AZIMUTH 270°

DEPTH 131.00 m

PLAN REFERENCE 79-616B

ASSAY REFERENCE AC69/79

COORDINATES

ELEVATION 337.8 m

DATE COMMENCED 4/7/77

DATE COMPLETED 12/7/77

DRILLER K. KALMAR

LOGGED BY D.C. SCOTT

200—4.78 J5695 O

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS %						
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	Interval	Sample No.*	$CaCO_3$	$Fe_2O_3 + Al_2O_3$	Acid Insol.
0.00	3.36	3.36	0.00	0.00	3.36	No Core - Probably rubble on quarry floor.	0.00	3.36	3.36	-	96.1+		
3.36	5.50	2.14	2.05	3.36	5.00	Marble - Pale grey. Coarse grained with biotite and minor pyrite inclusions.	3.36	5.00	1.64	A2169	96.1	0.23	1.81
5.50	8.40	2.90	2.79										
8.40	11.40	3.00	2.97										
11.40	14.40	3.00	2.98	5.00	9.19	Marble - White with few brown, ironstained bands up to 10 cm Coarse grained. Very occasional biotite, epidote inclusions.	5.00	9.19	4.19	A2170	96.6	0.32	1.75
14.40	17.45	3.05	3.03										
17.45	20.45	3.00	3.02										
20.45	23.50	3.05	3.06	9.19	14.00	Marble - White. Coarse grained. Very occasional brown iron staining on joints.	9.19	14.00	4.81	A2171	96.4	0.30	1.95
23.50	25.95	2.45	2.47				14.00	15.08	1.08	A2172	96.0	0.18	1.49
25.95	28.70	2.75	2.76										
28.70	31.60	2.90	2.90	14.00	15.08	Marble - Grey. Medium to coarse grained. Less pure with biotite, tremolite inclusions. Weak, very banding @ 55°-65°.	15.08	20.00	4.92	A2173	95.8	0.25	1.91
31.60	34.35	2.75	2.68				20.00	24.10	4.10	A2174	96.7	0.26	1.41
34.35	37.40	3.05	3.06	15.08	24.10	Marble - White to pale grey. Coarse grained.	24.10	29.00	4.90	A2175	97.8	0.21	1.09
37.40	40.45	3.05	3.03	24.10	33.64	Marble - Pale brown. Medium to coarse grained. Pale grey interbands and some highly ironstained joints.	29.00	33.64	4.64	A2176	98.0	0.19	0.80
40.45	43.50	3.05	3.05										
43.50	44.70	1.20	1.18	33.64	62.80	Marble - White. Coarse grained. Mainly clean with few pale brown bands up to 0.25 m. Occasional small pyrite crystal and biotite.	33.64	39.00	5.36	A2177	97.9	0.20	0.97
44.70	46.05	1.35	1.29				39.00	45.00	6.00	A2178	97.6	0.19	0.56
46.05	47.95	1.90	1.85				45.00	51.00	6.00	A2179	97.3	0.20	0.83
47.95	49.95	2.00	1.94				51.00	60.00	9.00	A2180	97.7	0.23	0.76
49.95	52.95	3.00	2.98	62.80	66.43	Marble - Pale brown with short grey bands. Medium to coarse grained. Banding @ 60°-65°.	60.00	62.80	2.80	A2181	97.2	0.22	1.53
52.95	55.90	2.95	2.94				62.80	66.43	3.63	A2182	96.9	0.25	1.60
55.90	58.40	2.50	2.45	66.43	71.00	Marble - Grey and pale grey interbands @ 55°-60°. Medium grained, with biotite, epidote.	66.43	71.00	4.57	A2183	96.7	0.38	1.08
58.40	61.50	3.10	3.03				71.00	81.00	10.00	A2184	97.5	0.26	1.01
61.50	62.95	1.45	1.46				81.00	90.62	9.62	-	97.1+		
62.95	65.40	2.45	2.37	71.00	90.62	Marble - Pale pink and white. Medium to coarse grained. Occasional biotite rich band up to 5 cm @ 60°.	90.62	90.08	8.46	A2186	96.8	0.39	1.01
65.40	65.90	0.50	0.56										
65.90	69.10	3.20	3.00										
69.10	71.10	2.00	2.03										
71.10	71.30	0.20	0.20	90.62	99.08	Marble - Mainly white to pale pink. Few short grey bands @ 50°-55°. Medium grained.							
71.30	74.35	3.05	3.02										
74.35	76.95	2.60	2.51										
76.95	79.75	2.80	2.84										
79.75	82.55	2.80	2.77	99.08	104.25	Marble - As at 90.62 - 99.08. Dark grey to green bands more common.	99.08	104.25	5.17	A2187	94.6	0.51	3.25
82.55	85.85	3.30	3.16										
85.85	86.85	1.00	0.98										
86.85	90.00	3.15	3.08										
90.00	92.55	2.55	2.53	104.25	106.65	Marble - White + brown iron stained zones. Medium grained. Few calc-silicate bands @ 55° - 60°.	104.25	106.65	2.40	A2188	95.4	0.41	2.45
92.55	94.65	2.15	2.10										

CORE RECOVERY LOG				LOG OF DRILL HOLE			ASSAYS %						
FROM	TO	INTERVAL	RECOVERY	FROM	TO	LITHOLOGICAL DESCRIPTION	FROM	TO	Interval	Sample No.*	$CaCO_3$	Fe_2O_3+ Al_2O_3	Acid Insol.
94.65	97.40	2.75	2.72										
97.40	100.10	2.70	2.71	106.65	107.72	Marble - As above + numerous dark green calc-silicate bands.	106.65	107.72	1.07	A2189	81.6	12.53	12.2
100.10	103.20	3.00	2.98										
103.10	106.20	3.10	3.12										
106.20	107.30	1.10	1.10										
107.30	110.20	2.90	2.87	107.72	108.33	Schist - Biotite, quartz. Grey. Fine grained. Few narrow medium grained calc-silicate interbands @ 60°.							
110.20	113.20	3.00	2.86										
113.20	116.25	3.05	2.92										
116.25	118.80	2.55	2.59	108.33	131.00	Schist - Biotite, quartz. Grey to dark grey. Fine grained. Occasional carbonate rich band up to 5 cm @ 60°. Carbonate filled joints. Jointed @ 40° and 50°. Sample F314/77							
118.80	121.85	3.05	2.94										
121.85	123.55	1.70	1.65										
123.55	126.50	2.95	2.90										
126.50	127.45	0.95	0.83										
127.45	131.00	3.55	3.38										
		TOTAL	125.69			131.00 m End of Hole							
			95.9%										

Note:* Full Sample No. A2169/77

Marble Grade ($\%CaCO_3$)		
0.00 -	99.08	97.1%
99.08 -	107.72	93.2%

\- Core Loss

\+ $CaCO_3$% average from adjacent intervals.

APPENDIX II

Petrographic descriptions

Amdel report GS 4666/78

By

Dr. Brian Steveson

EXAMINATION OF MARBLES AND OTHER ROCKS FROM PENRICE QUARRY

Sample: P310/77; TS50541

Location:
ICI Penrice Marble Quarry

Rock Name:
Marble

Hand Specimen:
The sample is a massive and compact buff coloured rock which is clearly coarse-grained. The hand specimen contains what are apparently weathered out cavities up to about 3 mm in size.

Thin Section:
The thin section consists virtually entirely of calcite with less than 1% of small quartz grains.

The quartz is present as round to subround grains up to 0.05 mm in size and these therefore appear to be relics of detrital material of some kind (?). The calcite forms large crystals generally of the order of 1 to 3 mm. These crystals are irregular and anhedral in shape and are commonly fairly complexly interlocked. The texture of the marble is completely homogeneous and there are no variations in texture or crystal size from place to place in the thin section.

The section contains some cavities which are presumably an integral part of the rock and represent places where ferruginous material has been removed, as indicated in the description of the hand specimen.

The sample is, therefore, a essentially monomineralic calcite marble.

Sample: P311/77; TS50542

Location:
ICI Penrice Marble Quarry

Rock Name:
Marble

Hand Specimen:
A massive and compact pale grey rock with a medium-grained texture.

Thin Section:
Quartz comprises 1 to 2% of the volume of this rock and there are one or two small flakes of muscovite but the remainder of the sample consists wholly of an aggregate of calcite crystals.

Quartz grains range in size from 0.06 to approximately 0.2 mm and many show at least subround outlines. This texture therefore suggests that the quartz may be unrecrystallized relicts of detrital grains. One flake of muscovite was identified in the thin section.and this is equant but rather ragged in shape and 0.35 mm in length.

In one place in the thin section there is an aggregate of muscovite and ?quartz. Within this aggregate are small crystals of calcite some of which appear to be poikilitically enclosed. The whole aggregate is about 1 mm in length and 0.5 mm in width. The colourless mineral is only tentatively identified as quartz and positive identification would require X-ray diffraction. The aggregate appears to be some metamorphic derivative of a pre-existing mineral now represented by an aggregate of muscovite and ?quartz and partly invaded by calcite.

The whole of the remainder of the thin section consists of granular aggregates of quartz and calcite which has an average crystal size of about 0.7 mm. This material is homogeneous and structureless.

The sample is a monomineralic aggregate of medium-grained calcite crystals with rare impurities, mainly quartz and muscovite.

Sample: P312/77; TS50543

Location:
ICI Penrice Marble Quarry

Rock Name:
Banded Calc-silicate

Hand Specimen:
The sample is a fine-grained grey rock with a banding apparently defined by varying proportions of dark mica.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	55-60
Muscovite	15
Calcite	10
Biotite	10
Scapolite	<10
Opaques	2
Sphene	1-2

This is a heterogeneous and banded rock and the proportions above are averages for the whole of the thin section. The bulk of the sample is distinctly fine-grained and consists essentially of a mosaic of quartz with minor amounts of most of the other minerals. In other parts of the thin section the average crystal size is of the order of 0.2 to 0.4 mm and calcite and scapolite are more abundant. In all parts of the thin section the biotite has a pale brown colour and may be a relatively magnesian variety or even phlogopite.

In the finer-grained parts of the rock quartz forms equant anhedral crystals about 0.05 to 0.08 mm in size and these form an essentially homogeneous and granular mosaic. Intergrown with the quartz are crystals of biotite, calcite and muscovite (in decreasing order of abundance) and smaller blade-like crystals of sphene. In one or two places in this part of the rock there are unusually large muscovite crystals and these may represent a coarse-grained, pre-metamorphic phase which has now been recrystallized.

In the coarser-grained parts of the rocks scapolite and calcite are more abundant and both minerals form crystals as much as 1 mm in size. Scapolite characteristically is sieved with small crystals of quartz and in many places identification of the scapolite is rendered rather difficult. The large scapolite crystals occur in a continuous aggregate of coarse-grained calcite with which biotite and opaques are particularly associated. The latter two minerals generally form crystals or aggregates of the order of 0.2 to 0.4 mm in size. There is no clear distinction between the coarser-grained and finer-grained parts of the rock but, rather, there is a gradation and intermixing of the two lithologies.

The sample is therefore a calcium and magnesium-rich metamorphic rock probably derived from a thinly bedded marly sediment of some kind. The metamorphic assemblage now consists of quartz-calcite-biotite-muscovite-scapolite.

Sample: P313/77; TS50544

Location:
ICI Penrice Marble Quarry

Rock Name:
Mica Schist

Hand Specimen:
The bulk of the rock is an extremely fine-grained schist which is dark grey in colour. The thin section also contains a relatively broad vein system containing cream and brown minerals.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Altered feldspar	35-40
Biotite	30
Quartz	20
Chlorite	7-10
Muscovite	5
Tourmaline	Trace

Apart from the mica schist the thin section also contains part of a cross-cutting vein which contains quartz, plagioclase and calcite.

The schist is a fairly typical somewhat altered pelitic schist consisting of a granular array of quartz and feldspar and well aligned flakes of mica. The sample therefore has a characteristic and lepidoblastic texture. Biotite is the principal mica but it has been chloritized and the extent of chloritization varies somewhat from place to place in the thin section but not, apparently, in any systematic way. The mica flakes are generally about 0.2 to 0.6 mm in length and in most places the three micas occur together and there is no specific banding of the rock on the basis of variations in the ratio of biotite to muscovite.

The intervening material has an average crystal size of about 0.3 mm and consists of simply-shaped crystals of quartz and pseudomorphs after feldspar. In many places the shapes of the crystals are defined by adjacent cleavage surfaces of mica. The feldspar pseudomorphs now have a dark and brown appearance probably due to iron-staining but in some cases the feldspar can still be seen despite the pervasive alteration. For the most part no twinning can be seen in the feldspar and it is not possible to indicate whether this is a sodic or a potassic variety.

In the secondary material, however, plagioclase can be readily identified and many crystals show polysynthetic twinning. Much of the material in this vein is distinctly fine-grained and it may have been sheared. This is particularly the case where the texture and grain size of the vein varies rapidly from place to place. Calcite is present as one or two large crystals isolated within fine-grained and sheared quartz. In other places in the vein quartz forms elongate crystals with numerous inclusions and such textures are typical of a relatively low temperature vein material.

The sample is interpreted therefore as being a pelitic schist (probably a metasediment): this has undergone some alteration with the chloritization of biotite and a pervasive alteration of original feldspar. This alteration may well have been associated with the intrusion of secondary minerals localized particularly in broad veins. These veins may have been localized by shearing within the schist.

Sample: P314/77; TS50545

Location:
ICI Penrice Marble Quarry

Rock Name:
Biotite Schist

Hand Specimen:
The sample is fairly massive and compact and is a fine-grained grey rock.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	40
Biotite	35
Muscovite	15
Scapolite	10
Calcite	5
Opaques	2
Apatite?	2
Sphene	Trace

This is a fairly homogeneous rock and it has a fine-grained granular texture. The biotite flakes are neither particularly elongate nor well-aligned so that the sample has only a weakly developed lepidoblastic texture. Presence of calcite and scapolite as pro-grade metamorphic phases indicates a somewhat calcic composition for the sample.

The average crystal size of the principal phases in the rock is less than 0.08 mm and there are many crystals less than 0.05 mm in size. The principal minerals form equant anhedral crystals with well defined and smooth outlines and in many places the rock has a particularly granular to even granoblastic texture. Some scapolite shows a little alteration and is sometimes turbid and there are patches of a weakly birefringent slightly altered mineral tentatively identified as apatite. It is possible that this mineral could be ?orthopyroxene but the crystals are too small to provide a positive identification. Muscovite and calcite both show a slight tendency to be concentrated in some bands in the rock but this is not a particularly well developed texture. Where muscovite is abundant it sometimes forms poikiloblastic flakes as much as 0.5 mm in size, but this is distinctly exceptional. The rock contains a few cross-cutting veinlets of secondary altered material and in some places there is a tendency for fine-grained opaques to occur in narrow discontinuous bands.

The sample is a fine-grained metamorphic rock probably derived from some kind of calcic and aluminous sediment. The pro-grade metamorphic mineral assemblage consists of quartz-biotite-scapolite-muscovite-calcite. The biotite is a rather pale variety and is probably magnesium-rich and has a composition close to that of phlogopite.

Sample: P315/77; TS50546

Location:
ICI Penrice Marble Quarry

Rock Name:
Marble

Hand Specimen:
The sample is a massive and compact grey rock with fine-grained texture. In the cut surface of the drill core there is shadowy banding shown by slightly different colours.

Thin Section:
The bulk of the thin section is a monomineralic aggregate of calcite but in one place there is a band which contains several impurities. These, in decreasing order of abundance, are scapolite, quartz, muscovite, opaques and apatite. These minerals together comprise perhaps 5 to 7% of the volume of the sample.

The calcite which comprises most of the rock is generally coarse-grained and forms equant but rather irregular crystals. In many places these crystals show a slightly undulous extinction probably as a result of strain.
In the bulk of the rock there are a few widely dispersed flakes of muscovite and crystals of quartz. Most of the impurities are, however, concentrated in one ill defined band which is about 5 to 8 mm in width. In this part of the rock the impurities comprise up to 15% of the marble. Scapolite and quartz form equant anhedral to subhedral crystals up to 0.5 mm in size but the other minerals are finer-grained than this. The mica is colourless to a very pale brown and has been interpreted as being muscovite but it may contain some magnesium also. In general the impurities in the marble form discrete crystals rather than compact aggregates and there is no preferred orientation of the flakes of mica.

The sample is, therefore, a fairly pure marble with a medium-grained and granular texture. There are ill defined bands containing up to about 10 to 15% of impurities and the most abundant of these are scapolite and quartz.

Sample: P316/77; TS50547

Location:
ICI Penrice Marble Quarry

Rock Name:
Marble

Hand Specimen:
The sample is a coarse-grained grey rock. In some places the sample shows a very weak banding particularly where there appear to be slightly weathered out minerals.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Calcite	90
Quartz	7
Scapolite	2
Biotite	1

This is similar to other marbles in this collection in that it consists for the most part of a granular mosaic of calcite with irregularly distributed contaminant minerals.

The crystal size of the calcite commonly ranges from about 0.4 to 2 mm and most of the crystals are irregular and interlocked in shape.

Quartz is the most abundant contaminant mineral and it generally forms crystals at least 0.5 mm in size and in some cases as much as 1.5 mm. Many of these crystals have elongate but rounded outlines which do not appear to be derived from original detrital grains. Many of the quartz grains contain numerous inclusions (principally of calcite) and to some extent the identification of this mineral is best regarded as being somewhat tentative. It is possible that in rocks of this composition monticellite or humite might be present. These minerals would be difficult to recognize by optical means alone. Quartz is also present as rather small crystals not more than 0.1 mm in size and many of these could well be derived from detrital material.

Scapolite occurs in a few places where it is distinguished by a moderate birefringent. Both scapolite and a very pale brown biotite/phlogopite are present as crystals generally 0.3 to 0.5 mm in size.

The sample is clearly a coarse-grained metamorphic rock and is best regarded as a somewhat impure marble. The impurities are not randomly distributed throughout the rock but tend to occur in poorly defined zones.

Sample: P317/77; TS50548

Location:
ICI Penrice Marble Quarry

Rock Name:
Impure Marble

Hand Specimen:
A massive and compact grey rock showing indefinite thin laminar bands.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Calcite	80
Biotite/Phlogopite	10
Scapolite	5
Quartz	2
Opaques	1-2

This sample is a less pure marble than others in this collection and it tends to show a slightly better developed foliation.

Calcite crystals are generally about 0.3 to 0.6 mm in size and the sample is somewhat finer-grained than many other marbles in this collection. In addition, there is a tendency for the calcite crystals to have their long axes with an indefinite parallel orientation. The principal contaminant mineral is a pale brown mica (probably phlogopite) but this mineral shows a random orientation of the cleavage traces. Phlogopite flakes are generally about 0.2 to 0.4 mm in size and many are subequant in shape in the plane of the thin section. The mica shows a pleochroic scheme from almost colourless to a bright orange colour.

Scapolite is fairly widely distributed throughout the rock but is characterized by the abundance of inclusions within the crystals. The presence of these inclusions (mainly of calcite) makes it rather difficult to identify the scapolite since a reliable interference figure cannot be obtained. The scapolite crystals are generally at least 0.2 mm in size and sometimes more than 0.5 mm. There is no particular spatial association between the biotite and the scapolite.

Quartz is present as rather small crystals many of which do not exceed 0.1 mm in size. These small crystals are randomly distributed throughout the volume of the rock.

The sample is, therefore, an impure marble showing a banding defined largely by the orientation of the long axes of the calcite crystals. As in the case of the rock described above, it is possible that there are relatively rare silicate minerals in the rock (humite group or monticellite) and it may be necessary to dissolve the calcite and carry out an X-ray diffraction analysis of the insoluble residue in order to obtain a positive identification of the silicate contaminants.

Sample: P318/77; TS50549

Location:
ICI Penrice Marble Quarry

Rock Name:
Altered Mineralised Marble

Hand Specimen:
The sample is massive and compact and is a dark brown colour. In some places relatively large crystals of carbonate can be seen but for the most part the rock appears to consist of iron oxide/hydroxide material.

Thin Section:
The thin section contains calcite and opaques but the proportions of these minerals varies significantly from place to place and the rock has a distinctly banded appearance.

In some places in the thin section, particularly where calcite is abundant, one can see relict textures where the opaques appear to have replaced the calcite along cleavage zones. In these parts of the rock it is clear that the original was a coarse calcite marble which has now been extensively veined and replaced by opaque material. Elsewhere in the rock opaques are much more abundant (up to 80% of the volume of the sample) and calcite merely appears as small isolated patches within large aggregates of opaques. In this part of the rock individual calcite crystals are generally not more than 0.2 mm in size and patches of calcite are up to about 0.7 mm. In one place in the thin section there is a band of clear calcite which is about 8 mm in width. This consists of large crystals generally 1 to 3 mm in size which are equant anhedra. There are crevices in this part of the rock which are lined with opaques and these may represent slightly friable ferruginous material which has been eroded out during the preparation of the section.

In summary, therefore, this is essentially a calcite rock which appears to have been mineralized (probably by pyritic material) and subsequently has undergone weathering. The sample now consists of a heterogeneous banded mosaic of calcite and widely varying opaque and semi-opaque material.

Sample: P319/77; TS50550

Location:
ICI Penrice Marble Quarry

Rock Name:
Calcite Marble

Hand Specimen:
The sample is a massive pink rock which clearly is a rather pure marble.

Thin Section:
Quartz comprises possible 1 to 2% of the volume of this rock and there are trace amounts, only, of scapolite and phlogopite. The remainder of the sample consists of coarse-grained clear calcite.

The calcite crystals show considerable evidence of strain and deformation and in some places it is difficult to distinguish exactly where crystal boundaries are; however, most of the crystals are more than 0.5 mm in size and distinctly identifiable fine-grained material only occurs in a few thin zones between large crystals.

Quartz is widely distributed and characteristically forms rounded grains up to 0.2 mm in size and ranging down to about 0.06 mm. Scapolite and phlogopite are represented by only one or two crystals in the thin section and none of these is more than about 0.15 mm in size. The identification of scapolite is tentative as indicated in the description of the two samples above.

The sample is a rather pure calcite marble containing up to 2% of widely dispersed fine-grained quartz and traces of phlogopite and scapolite.

APPENDIX III

Chemical analyses

Amdel amended report AC 69/79

by

D.K. Rowley

ANALYSIS
%

SAMPLE MARK	ACID SOLUBLE $CaCO_3$	$MgCO_3$	Fe_2O_3	Al_2O_3	ACID INSOLUBLE
1234/77	98.2	0.77	0.24	0.01	0.42
35	97.6	0.89	0.25	0.01	0.49
36	96.0	1.01	0.50	0.09	2.10
37	97.4	1.01	0.43	0.03	1.14
38	97.1	0.91	0.53	0.05	0.82
39	97.0	1.01	0.29	0.13	1.60
40	97.7	0.87	0.30	0.02	0.81
41	98.1	0.91	0.24	0.03	0.57
42	97.6	0.94	0.22	0.02	0.51
43	97.9	0.98	0.24	0.04	0.91
44	95.7	1.15	0.20	0.14	2.20
45	97.3	1.08	0.19	0.07	1.31
46	96.0	1.30	0.14	0.17	1.96
47	95.5	1.44	0.17	0.23	1.92
48	94.6	1.74	0.23	0.29	2.60
49	93.6	1.89	0.20	0.27	3.12
50	96.2	1.49	0.22	0.15	1.66
51	97.4	1.69	0.27	0.01	0.52
52	96.1	2.15	0.33	0.06	1.11
53	96.7	0.91	0.20	0.02	2.05
54	94.2	1.01	0.26	0.13	3.45
55	94.5	0.56	0.27	0.10	4.25
56	25.5	2.95	2.18	1.68	66.8
57	98.2	0.73	0.31	0.02	0.45
58	98.3	0.75	0.36	0.03	0.45
59	98.5	0.38	0.48	0.02	0.44
60	98.1	0.61	0.54	0.05	0.67
61	97.8	0.94	0.53	0.01	0.41
62	98.3	0.91	0.34	0.02	0.44
63	98.0	1.10	0.22	0.01	0.48
64	98.0	0.89	0.21	0.03	0.85
65	97.4	1.31	0.22	0.01	0.66
66	97.7	0.91	0.22	0.05	0.80
67	97.7	1.10	0.17	0.07	0.98
68	97.4	1.10	0.19	0.06	1.18
69	94.7	1.37	0.25	0.27	3.25

ANALYSIS
%

SAMPLE MARK	ACID SOLUBLE				ACID INSOLUBLE
	$CaCO_3$	$MgCO_3$	Fe_2O_3	Al_2O_3	
A1270/77	91.0	1.32	0.27	0.45	6.75
71	92.7	1.34	0.31	0.27	5.40
72	62.0	1.01	0.56	2.75	33.0
73	88.4	1.30	0.40	0.64	8.70
74	90.3	1.37	0.42	0.49	7.00
75	54.9	1.96	1.11	2.70	37.8
76	14.6	3.30	1.75	5.80	72.6
77	95.3	1.49	0.63	0.15	2.40
78	91.1	1.25	0.45	0.46	6.65
79	94.1	1.37	0.28	0.32	3.80
80	79.7	1.34	0.50	1.01	16.7
81	93.3	1.74	0.37	0.25	4.30
82	91.8	1.66	0.36	0.42	5.80
83	95.8	1.39	0.13	0.19	2.60
A2166/77	95.1	1.18	0.16	0.28	3.25
67	96.9	1.18	0.18	0.14	1.68
68	4.65	3.55	4.55	2.80	84.1
69	96.1	1.49	0.19	0.04	1.81
70	96.6	1.13	0.23	0.09	1.75
71	96.4	1.15	0.20	0.10	1.95
72	96.0	1.71	0.17	0.01	1.49
73	95.8	1.15	0.17	0.08	1.91
74	96.7	1.15	0.19	0.07	1.41
75	97.8	0.96	0.19	0.02	1.09
76	98.0	0.89	0.18	0.01	0.80
77	97.9	1.03	0.17	0.03	0.97
78	97.6	0.94	0.18	0.01	0.56
79	97.3	0.96	0.17	0.03	0.83
80	97.7	0.96	0.17	0.06	0.76
81	97.2	0.98	0.19	0.03	1.53
82	96.9	0.95	0.24	0.01	1.60
83	96.7	1.76	0.33	0.05	1.08
84	97.5	0.91	0.22	0.04	1.01

ANALYSIS
%

SAMPLE MARK	-ACID SOLUBLE- $CaCO_3$	$MgCO_3$	Fe_2O_3	Al_2O_3	ACID INSOLUBLE
A2186/77	96.8	1.39	0.32	0.07	1.01
87	94.6	1.39	0.31	0.20	3.25
88	95.4	1.13	0.26	0.15	2.45
89	81.6	2.95	1.18	1.35	12.2
90	96.6	1.13	0.21	0.11	1.74
91	96.6	1.13	0.18	0.09	2.00
92	96.6	1.18	0.24	0.09	1.54
93	96.8	1.22	0.31	0.06	1.56
94	97.3	1.15	0.28	0.04	0.52
95	96.8	1.22	0.17	0.05	0.98
96	96.6	0.96	0.18	0.06	1.41
97	90.0	1.10	0.37	0.58	7.50
98	94.8	1.22	0.23	0.34	3.30
99	95.6	1.25	0.22	0.20	2.35
200	71.0	1.34	0.74	3.25	23.1
01	92.9	1.30	0.26	0.56	4.30
02	90.7	1.69	0.47	0.86	5.30
03	91.6	1.51	0.48	0.80	5.15
04	69.3	2.65	1.03	3.30	23.2
05	91.2	1.54	0.46	0.59	6.15
06	95.5	1.20	0.37	0.09	2.25
07	96.2	1.08	0.29	0.07	1.74
08	95.3	1.20	0.28	0.07	2.45
09	95.4	0.94	0.33	0.06	3.00
10	93.7	0.87	0.78	0.19	4.30
11	93.5	1.42	0.27	0.36	4.35
12	95.2	1.30	0.31	0.15	2.45
13	94.7	1.47	0.32	0.22	2.60
14	75.6	1.79	0.51	2.25	19.0
15	93.2	1.74	0.48	0.23	3.70
16	88.2	1.13	0.72	0.70	8.55

SAMPLE MARK	ANALYSIS % ACID SOLUBLE $CaCO_3$	$MgCO_3$	Fe_2O_3	Al_2O_3	ACID INSOLUBLE
A2217/77	94.9	1.01	0.43	0.17	2.50
18	33.0	3.95	1.39	2.90	57.5
19	95.6	1.13	0.18	0.14	2.35
20	95.6	1.03	0.15	0.08	2.29
21	96.7	0.91	0.14	0.04	1.53
22	95.9	0.91	0.16	0.04	2.25
23	96.1	0.98	0.14	0.05	2.05
24	95.9	0.98	0.15	0.05	2.60
25	96.5	1.01	0.18	0.02	1.63
26	97.9	0.80	0.20	0.02	0.79
27	97.1	0.96	0.23	0.07	1.06
28	96.3	1.15	0.22	0.14	1.42
29	96.6	1.20	0.19	0.07	1.13
30	96.8	1.01	0.15	0.06	1.94
31	96.7	1.03	0.21	0.04	1.28
32	97.1	0.96	0.21	0.03	1.13
33	97.2	0.89	0.19	0.03	0.86
34	97.6	0.82	0.15	0.02	0.67
35	94.8	1.10	0.17	0.15	3.15
36	95.7	1.10	0.18	0.15	2.15
37	94.8	1.20	0.22	0.10	3.25
38	95.1	1.22	0.24	0.23	2.50
39	90.2	1.25	0.29	0.63	6.80
40	80.7	1.13	0.55	2.05	14.5
41	94.1	1.21	0.28	0.33	3.30
42	90.3	1.25	0.32	0.62	6.55
43	95.1	1.27	0.21	0.21	2.70
44	89.9	1.59	0.37	0.68	6.65
45	55.6	2.55	1.05	5.05	34.7
46	95.6	1.25	0.22	0.17	1.94
47	96.2	1.10	0.28	0.11	1.42
48	96.7	1.25	0.33	0.07	1.29
49	96.9	1.20	0.40	0.05	0.77
50	96.8	1.25	0.30	0.01	0.85

ANALYSIS
%

SAMPLE MARK	ACID SOLUBLE				ACID INSOLUBLE
	$CaCO_3$	$MgCO_3$	Fe_2O_3	Al_2O_3	
A2251/77	97.2	0.91	0.24	0.02	0.92
52	97.1	0.96	0.25	0.03	0.96
53	96.4	1.74	0.35	0.03	0.98
54	96.9	0.73	0.29	0.05	1.35
55	96.9	0.98	0.25	0.02	1.18
56	96.8	1.03	0.23	0.01	1.25
57	97.4	1.06	0.32	0.02	0.52
58	97.8	1.06	0.31	0.02	0.34
59	97.4	1.10	0.27	0.02	0.71
60	89.8	1.54	0.81	0.21	6.85
61	96.8	1.10	0.57	0.02	0.93
62	95.9	1.32	1.20	0.05	1.48
63	85.5	0.61	5.00	0.19	1.60
64	95.5	1.30	0.75	0.07	1.66
65	96.4	1.20	0.27	0.06	1.66
66	95.6	1.30	0.24	0.16	1.81
A5607/78	89.9	1.71	0.47	0.25	6.50
08	54.4	1.25	1.28	4.95	37.0
09	94.5	1.31	0.31	0.24	2.80
10	90.7	1.64	0.89	0.20	5.65
11	91.1	1.74	0.78	0.47	5.20
12	78.3	1.89	0.76	1.70	16.4
13	79.4	1.81	1.05	0.92	15.8

APPENDIX IV

Assays and summary logs of Bores 43-59

BORE NO. 43

SUMMARY LOG	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Insol.
Marble-High grade	0.00	8.63	96.2	1.21	0.70	1.97
Cavity	8.63	9.55	NO SAMPLE			
Marble-High grade	9.55	20.63	95.8	1.24	0.99	1.69
	20.63	25.76	97.0	1.15	0.48	1.40
	25.76	34.62	97.5	1.09	0.49	0.83
	34.62	42.90	96.2	1.24	0.59	1.86
Marble-Low grade with impure bands	42.90	46.02	94.3	1.15	1.09	3.30
	46.02	56.69	92.0	1.00	1.67	5.18
	56.69	63.50	70.8	2.52	5.82	20.66
	63.50	72.47	73.5	1.88	4.70	19.75
	72.47	78.23	96.0	1.76	0.37	1.97
	78.23	96.62	94.0	1.70	1.38	2.86
	96.62	98.65	90.0	1.51	1.71	6.61
Gneiss- Sandy	98.65	102.03	NO SAMPLE			

END OF BORE 102.03m

BORE NO. 44

SUMMARY LOG	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Insol.
Marble-Marginal grade	0.00	18.29	94.2	3.33	1.04	1.53
	18.29	21.34	93.5	3.57	1.44	1.18
Marble-High grade	21.34	29.87	97.2	1.44	0.50	0.92
	29.87	45.42	97.5	1.06	0.40	0.97
	45.42	51.82	95.0	1.85	0.90	2.04
	51.82	53.93	96.2	1.24	0.56	1.54
	53.93	64.16	95.5	1.27	0.74	2.37
Marble-Low grade	64.16	65.23	90.0	1.66	2.02	6.06
Schist-Quartz, biotite.	65.23	76.33	NO SAMPLE			

END OF BORE 76.33m

BORE NO. 45

SUMMARY LOG	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Insol.
Marble-High grade	0.00	13.94	97.3	1.06	0.40	1.13
Cavity	13.94	14.10	NO SAMPLE			
Marble-High grade	14.10	17.68	97.0	1.24	0.47	1.31
	17.68	26.82	97.3	1.27	0.46	1.08
	26.82	47.85	96.7	1.18	0.78	1.34
	46.85	68.58	97.0	1.36	0.71	1.08
	68.58	71.93	96.0	1.36	0.88	1.50
	71.93	94.49	95.2	1.27	1.18	2.37
	94.49	104.85	95.8	1.33	0.83	1.90
Marble-Marginal to Low grade	104.85	124.97	94.7	1.72	0.88	2.73
	124.97	125.88	84.0	1.18	1.69	12.99
Quartzite	125.88	131.75	NO SAMPLE			

END OF BORE 131.75m

BORE NO. 45A

SUMMARY LOG	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Insol.
Marble-High grade	0.00	13.16	97.0	1.12	0.50	1.19
	13.16	30.48	96.8	1.06	0.62	1.43
	30.48	53.59	96.0	1.97	0.73	1.15
Marble-Marginal	53.59	70.10	93.8	3.63	1.28	1.14

END OF BORE 70.10m

BORE NO. 46

SUMMARY LOG	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Insol.
Marble-High grade	0.00	9.12	96.8	1.61	0.53	1.13
	9.12	31.07	97.3	1.58	0.43	0.78
	31.07	52.73	96.5	1.39	0.58	1.32
	52.73	61.04	97.3	1.09	0.43	1.14
	61.04	75.54	97.5	1.09	0.52	0.86
	75.54	181.81			NO SAMPLES	

END OF BORE 181.81 m

BORE NO. 47

SUMMARY LOG	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/203 Al203	Insol.
Marble-High grade	0.00	24.38	97.5	1.30	0.43	0.85
	44.38	46.63	96.0	1.51	0.68	1.97
	46.63	71.45	97.0	1.36	0.48	1.11
	71.45	93.02	96.3	1.30	0.56	1.90
Marble-Low grade	93.02	95.05	80.0	1.30	2.55	16.28
Marble-High grade	95.05	109.73	96.5	1.76	0.46	1.36
END OF BORE 109.73m						

BORE NO. 47A

SUMMARY LOG	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	$Fe/Al2O_3$	Insol.
Marble-High grade	0.00	10.77	97.3	1.12	0.50	0.86
Cavity-with some marble and clay filling	10.77	30.48			NO SAMPLES	
END OF BORE 30.48 m						

BORE NO. 51

SUMMARY LOG	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Insol.
Mica Schist - weathered	0.00	19.81	NO SAMPLES			
Marble-High grade	19.81	38.10	97.0	1.15	0.41	1.35
Amphibolite	38.10	39.27	NO SAMPLES			
Marble-High grade	39.27	45.90	96.0	1.03	0.37	2.55
Amphibolite	45.90	47.17	NO SAMPLES			
Marble-Mainly High grade.	47.17	59.13	94.5	1.09	0.54	3.89
	59.13	60.35	97.0	0.73	0.41	1.76
	60.35	73.23	96.2	0.88	0.71	2.12
	73.23	85.52	97.0	1.27	0.36	1.19
END OF BORE 85.52m						

BORE NO. 52

SUMMARY LOG	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Insol.
Marble-High grade	0.00	5.13	97.0	1.12	0.33	1.44
	5.13	20.42	97.0	1.15	0.27	1.48
	20.42	22.25	96.7	1.18	0.37	1.64
	22.25	34.59	96.3	1.54	0.45	1.47
	34.59	47.55	95.5	1.61	0.77	2.10
Marble-Low grade	47.55	51.21	92.5	1.42	1.11	4.77
	51.21	59.27	93.3	1.27	1.42	3.84
Marble-High grade	59.27	72.77	96.8	1.27	0.60	1.12
	72.77	82.45	95.5	2.15	0.60	1.56
	82.45	90.22	97.0	1.73	0.35	0.83
	90.22	100.33	96.0	1.21	0.71	1.89
Marble-Low grade	100.33	109.63	93.5	1.70	0.94	3.58
			END OF BORE 109.63m			

BORE NO. 53

SUMMARY LOG	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Insol.
Marble-Mostly High grade	0.00	11.13	97.0	1.70	0.62	0.95
	11.13	17.43	93.5	1.67	2.00	2.69
	17.43	37.85	95.5	2.06	0.72	1.88
	37.85	46.33	96.0	1.76	0.63	1.80
	46.33	56.69	94.8	1.39	0.97	2.74
	56.69	64.92	96.3	1.15	0.70	1.76
	64.92	77.42	95.3	1.45	1.00	2.16
Gneiss-Micaceous	77.42	78.08	17.3	3.12	8.36	71.14
Marble-Low grade	78.08	83.61	87.5	2.06	2.62	7.95
	83.61	89.92	91.7	1.51	1.82	5.00
	89.92	97.51	89.7	1.54	2.73	5.79
	97.51	99.11	95.7	1.27	1.06	2.04
	99.11	100.89	77.0	1.27	5.38	16.26
	100.89	103.33	95.5	1.85	0.81	1.84
Gneiss-Shaly, Micaceous	103.33	110.95	NO SAMPLES			
			END OF BORE 110.95m			

BORE NO. 55.

SUMMARY LOG	DEPTH (m) DEPTH	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Insol.
Gneiss-Sandy	0.00	14.88	NO SAMPLES			
Marble-Marginal to very impure	14.88	22.86	94.5	1.33	0.58	3.66
	22.86	29.57	86.5	1.51	1.20	10.88
	29.57	42.67	79.0	1.61	1.74	17.54
Gneiss-Calcareous	42.67	52.22	49.0	2.88	5.20	43.18
Marble-Low grade	52.22	55.63	90.5	1.12	1.34	6.90
	55.63	67.97	91.8	1.21	1.39	5.21
	67.97	73.61	92.0	1.30	1.68	4.92
		END OF BORE 73.61m				

BORE NO. 56

SUMMARY LOG	DEPTH (m) DEPTH	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Insol.
Gneiss	0.00	10.87	NO SAMPLES			
Marble-High grade	10.87	22.33	95.8	1.21	0.47	2.64
	22.33	36.76	95.5	1.12	0.42	2.87
	36.76	47.47	94.5	1.09	0.45	3.68
	47.47	57.66	97.0	1.12	0.28	1.42
	57.66	65.51	96.0	1.24	0.48	1.81
Marble-Low grade	65.51	73.05	93.5	1.36	1.44	3.59
		END OF BORE 73.05m				

BORE NO. 58

SUMMARY LOG	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Insol.
Marble-High grade	0.00	18.21	96.5	1.30	0.61	1.47
	18.21	32.87	96.5	1.21	0.68	1.75
Marble-Low to Marginal grade	32.87	50.09	92.5	1.42	1.70	4.40
	50.09	53.80	87.5	1.36	1.46	9.72
	53.80	55.80	94.2	1.27	0.72	3.86
	55.80	66.62	90.5	1.33	1.49	6.64
	66.62	80.77	93.0	1.42	1.52	3.98

	80.77	89.23	89.0	1.51	2.39	7.12
	89.23	94.03	91.5	1.73	1.88	4.99
	94.03	96.52	87.5	2.21	2.90	7.54
Schist-Micaceous	96.52	101.35	END OF BORE 101.35m		NO SAMPLES	

BORE NO. 59

SUMMARY LOG*	DEPTH (m) FROM	TO	ASSAYS (%) $CaCO_3$	$MgCO_3$	Fe/Al_2O_3	Inosl.
Marble-High grade	0.00	9.70	98.0	0.96	0.57	0.40
	9.70	16.23	96.5	2.00	0.72	0.62
	16.23	33.91	97.5	1.30	0.51	0.96
	33.91	38.30	97.5	1.73	0.62	0.33
	38.30	61.16	96.0	1.51	0.66	2.06
	61.16	70.84	96.2	1.57	0.56	1.84
Marble-Low grade	70.84	87.90	92.7	1.24	1.02	4.82
	87.90	96.80	92.5	1.42	0.98	5.09
			END OF SAMPLING 96.80m*			

* NOTE: Original log missing - Summary log assumed
- Total depth not known

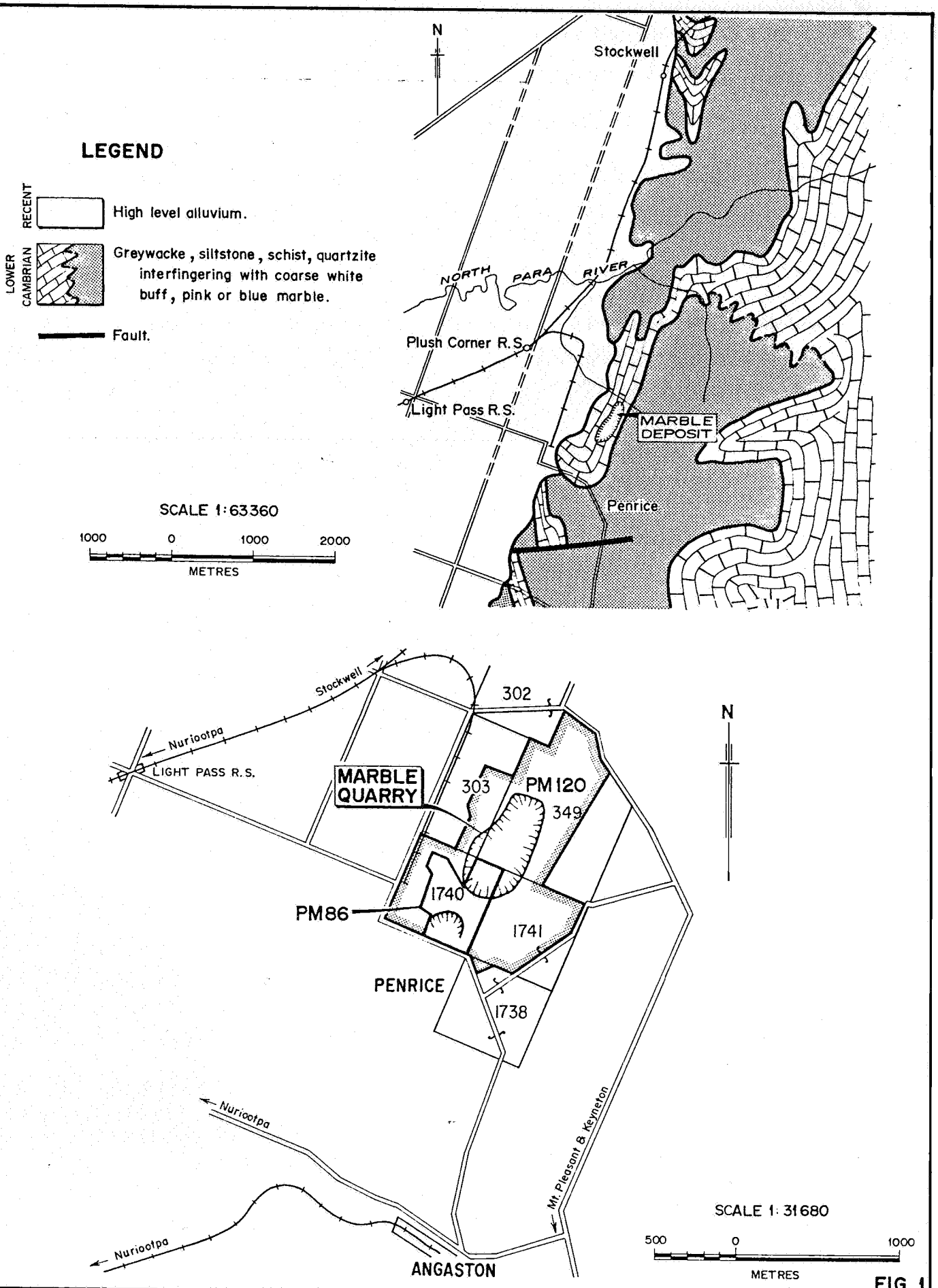
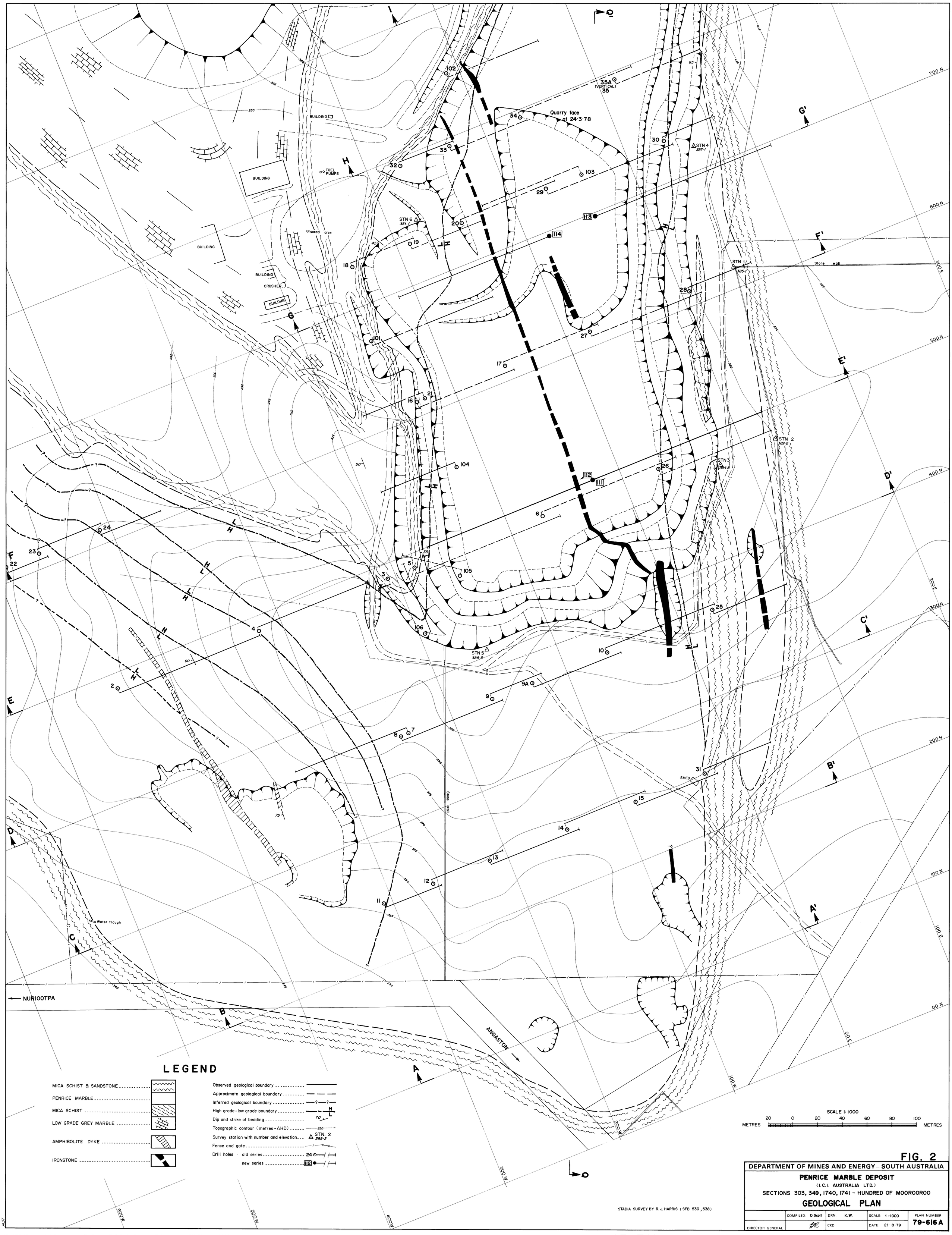


FIG. 1

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE as shown
COMPILED D.C.Scott	PENRICE MARBLE DEPOSIT	DATE 24-9-79
DRN N.S. CKD	(I.C.I. AUSTRALIA LTD)	PLAN NUMBER
	REGIONAL GEOLOGY & LOCALITY PLAN	S 14312

1437



LEGEND

- MICA SCHIST & SANDSTONE
- PENRICE MARBLE
- MICA SCHIST
- LOW GRADE GREY MARBLE
- AMPHIBOLITE DYKE
- IRONSTONE

- Observed geological boundary
- Approximate geological boundary
- Inferred geological boundary
- High grade–low grade boundary (H / L)
- Dip and strike of bedding (70)
- Topographic contour (metres–AHD) (350)
- Survey station with number and elevation (STN. 2 389·2)
- Fence and gate
- Drill holes : old series (24) / new series (112)

SCALE 1:1000

20 0 20 40 60 80 100 METRES

STADIA SURVEY BY R. J. HARRIS (SFB 530, 538)

FIG. 2

DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA

PENRICE MARBLE DEPOSIT

(I.C.I. AUSTRALIA LTD.)

SECTIONS 303, 349, 1740, 1741 – HUNDRED OF MOOROOROO

GEOLOGICAL PLAN

	COMPILED D.Scott	DRN K.W.	SCALE 1:1000	PLAN NUMBER 79-616A
DIRECTOR GENERAL		CKD	DATE 21·8·79	

4537

Northern limit of reserve calculations

Southern limit of reserve calculations

DUMP

CREEK

STN. 14 361·4

STN. 13 359·8

STN. 12 369·4

STN. 11 370·2

STN. 10 352·6

STN. 9 351·0

STN. 8 360·9

STN. 7 352·6

59 58 57 56 55 53 52 51 49 48 47A 47 46 (VERTICAL) 45 45A 44 43 42 41 40 39 38 37 36

115 116

P P' Q Q' O O' N N' M M' L L' K K' J J' I I' H H'

1600 N 1500 N 1400 N 1300 N 1200 N 1100 N 1000 N 900 N 800 N

700 E 600 E 500 E 400 E 300 E 200 E 100 E 100 W 200 W 300 W

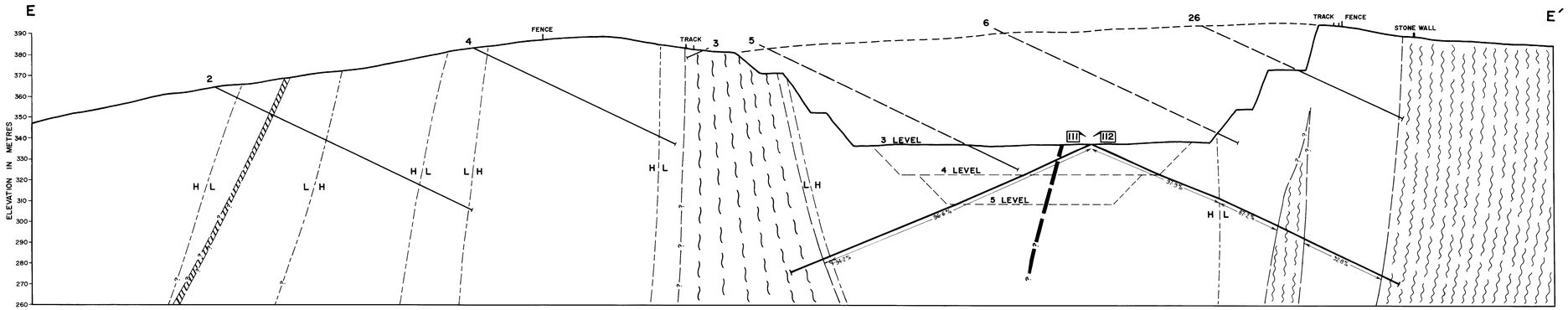
FIG. 3

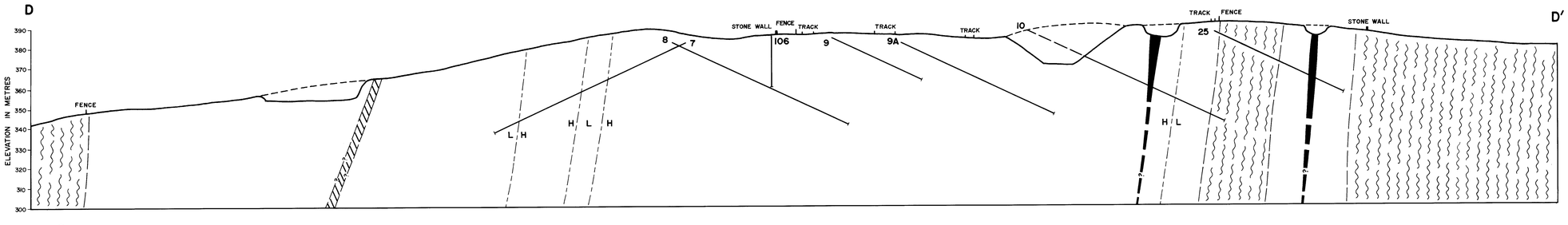
DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

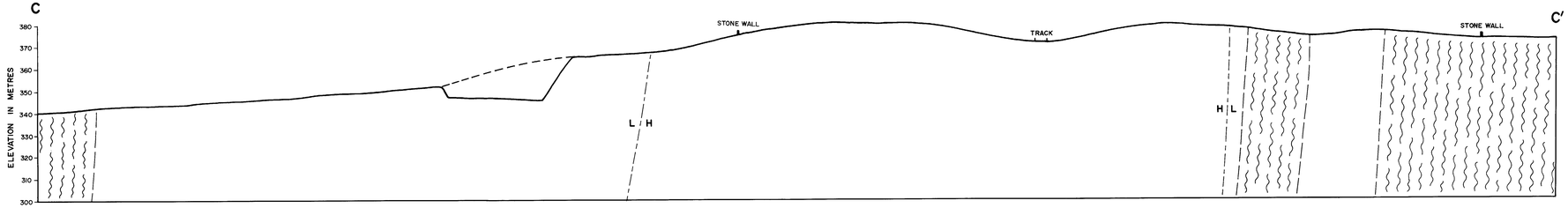
PENRICE MARBLE DEPOSIT

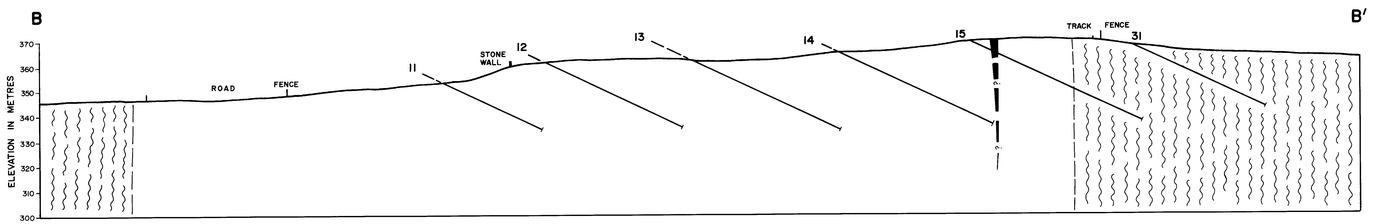
PLAN Nº 79-616B

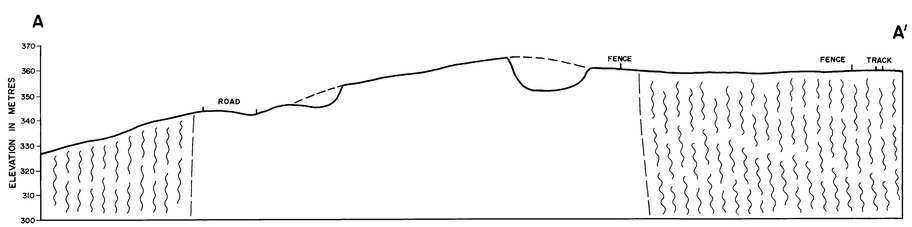
(ADJOINS PLAN 79-616A)











LEGEND

Proposed quarry outline used in reserve calculations.
SEE ALSO FIG. 2 (79-616A)

NOTE : Old series drillholes all projected.
New series drillholes 113 & 114 projected
(also show average percentage $CaCO_3$ in each zone).

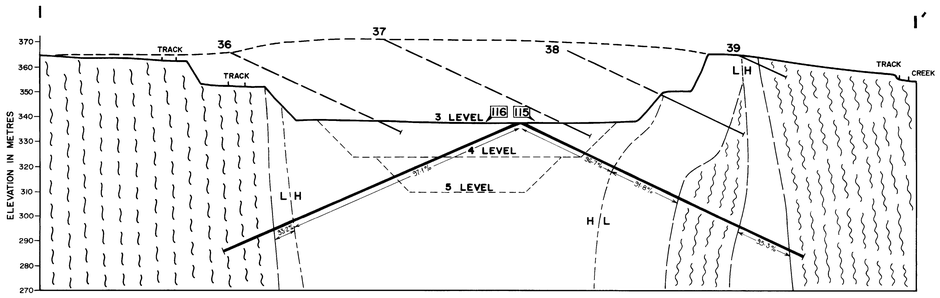
SCALE 1:1000
METRES
20 0 20 40 60 80 100

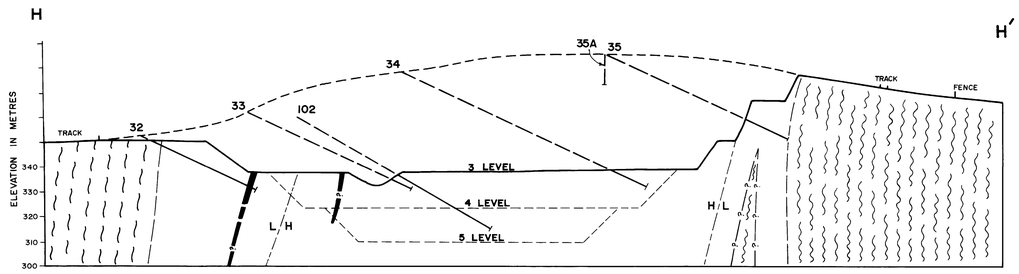
600W 500W 400W 300W 200W 100W 00 100E 200E

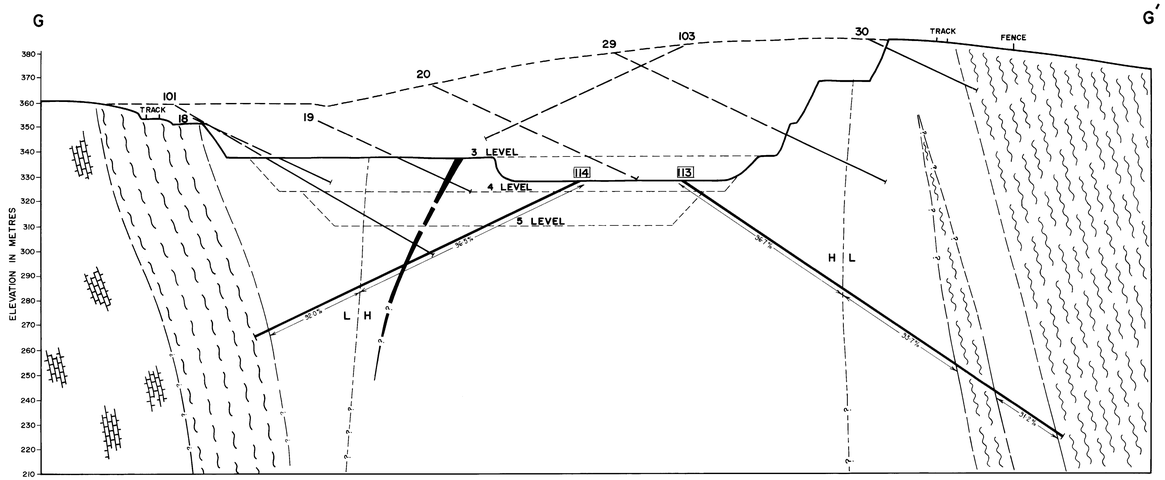
FIG. 4

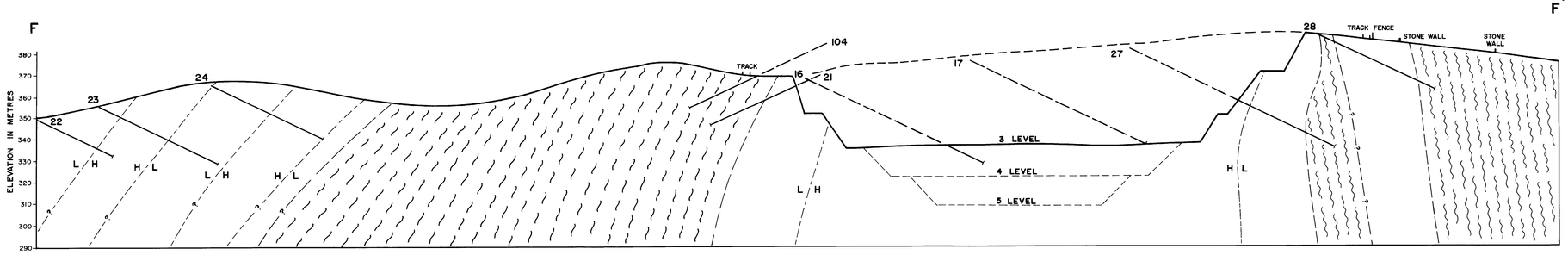
DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA				
PENRICE MARBLE DEPOSIT (I.C.I. AUSTRALIA LTD.)				
SECTIONS 303, 349, 1740, 1741 – HUNDRED OF MOOROOROO				
GEOLOGICAL CROSS SECTIONS A-A' TO E-E'				
	COMPILED D. Scott	DRN K. W.	SCALE 1:1000	PLAN NUMBER 79-617
DIRECTOR GENERAL		CKD	DATE	

1427









SCALE 1:1000

METRES

20 0 20 40 60 80 100

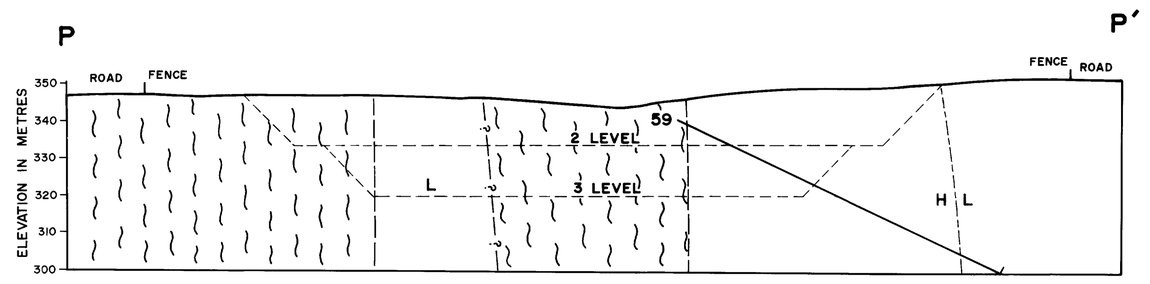
For legend see Fig. 4 (79-617)

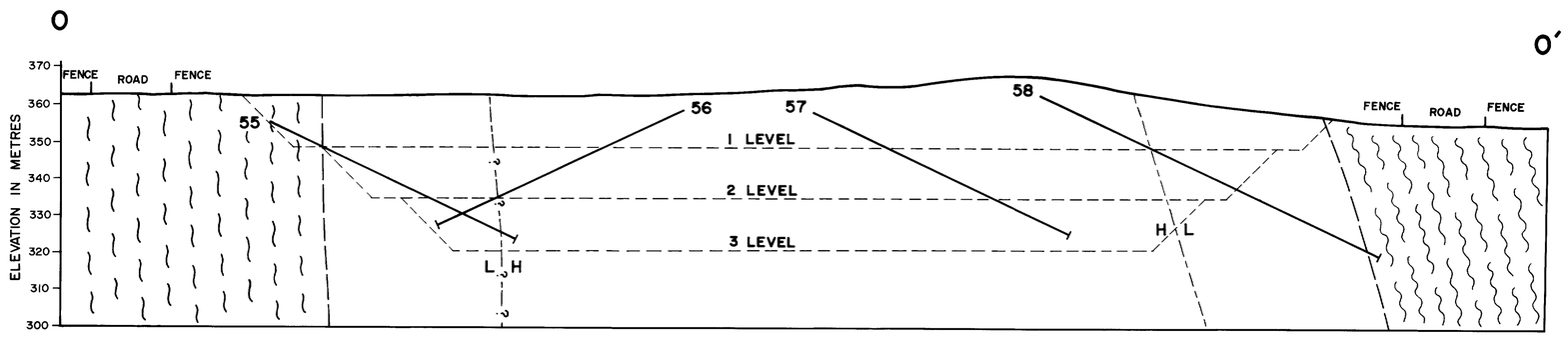
FIG. 5

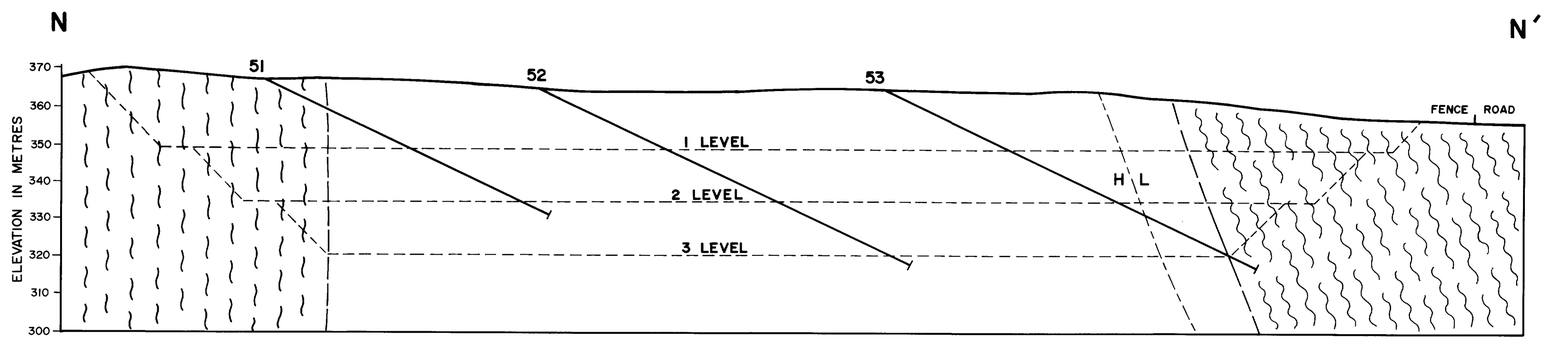
DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA				
PENRICE MARBLE DEPOSIT (I.C.I. AUSTRALIA LTD.) SECTIONS 303, 349, 1740, 1741 – HUNDRED OF MOOROOROO				
GEOLOGICAL CROSS SECTIONS F-F' TO I-I'				
	COMPILED D. Scott	DRN. K. W.	SCALE 1:1000	PLAN NUMBER
DIRECTOR GENERAL		CKD.	DATE	**79-618**

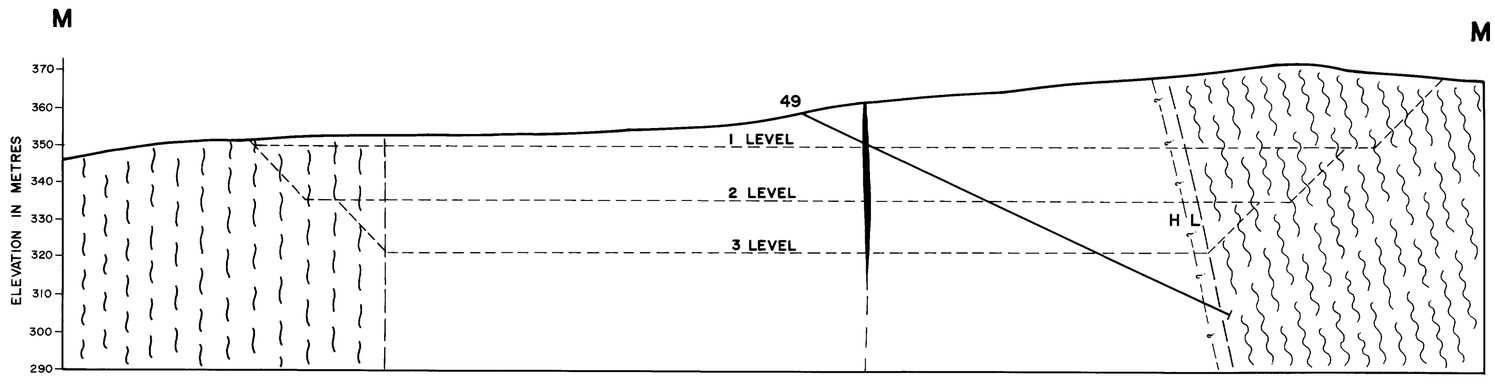
500W 400W 300W 200W 100W 00 100E 200E 300E

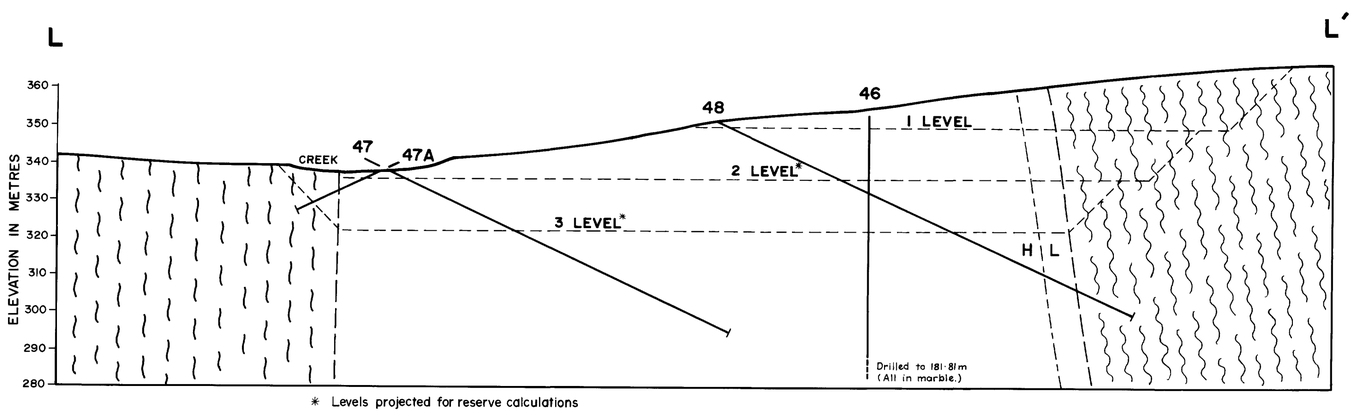
1837



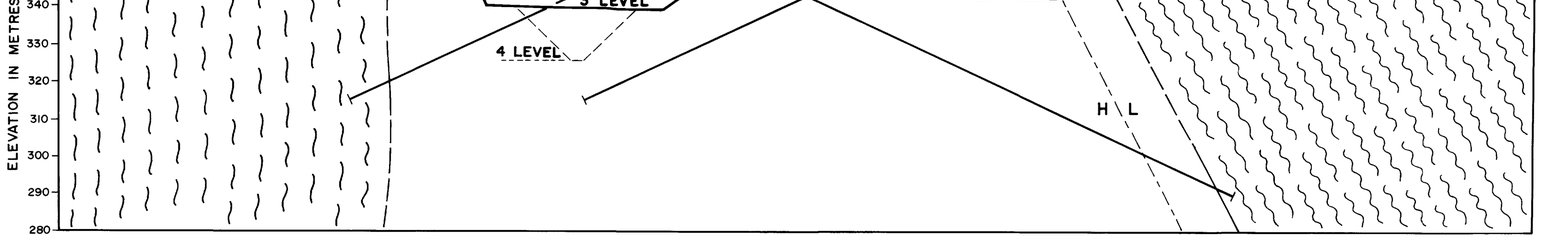


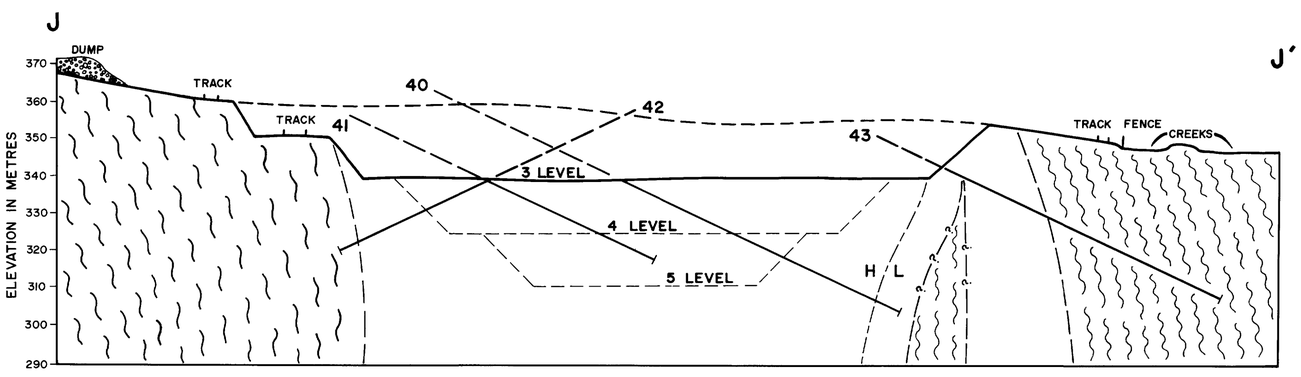






* Levels projected for reserve calculations





SCALE 1:1000

METRES

20 0 20 40 60 80 100

For legend see Fig.4 (79-617)

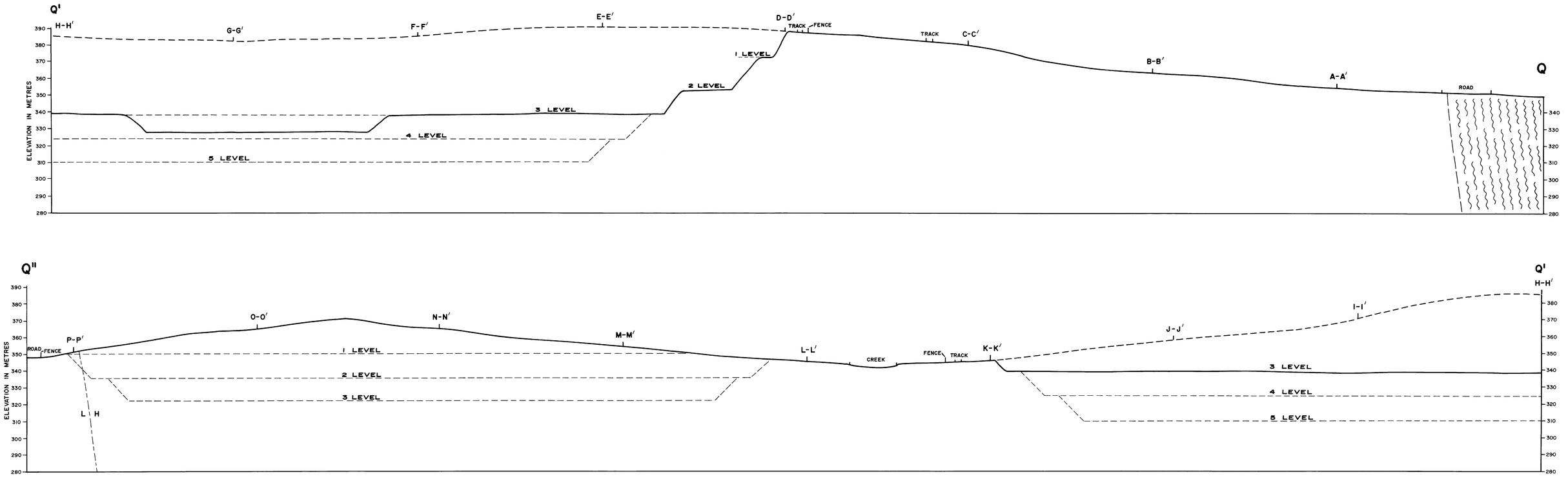
500 E 600 E

FIG. 6

00 E 100 E 200 E 300 E 400 E

DEPARTMENT OF MINES AND ENERGY – SOUTH AUSTRALIA				
PENRICE MARBLE DEPOSIT (I.C.I. AUSTRALIA LTD.) SECTIONS 303, 349, 1740, 1741 – HUNDRED OF MOOROOROO **GEOLOGICAL CROSS SECTIONS J-J′ TO P-P′**				
	COMPILED D. Scott	DRN K.W.	SCALE 1:1000	PLAN NUMBER **79-619**
DIRECTOR GENERAL		CKD	DATE	

1437



SCALE 1:1000

METRES

20 0 20 40 60 80 100

For legend see Fig. 4 (79-617)

FIG. 7

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PENRICE MARBLE DEPOSIT

(I.C.I. AUSTRALIA LTD.)

SECTIONS 303, 349, 1740, 1741 – HUNDRED OF MOOROOROO

LONGITUDINAL SECTION Q-Q'-Q"

	COMPILED D. Scott	DRN K.W.	SCALE 1:1000	PLAN NUMBER 79-620
DIRECTOR GENERAL		CKD	DATE	