DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENVIRONMENT & RESOURCE DIVISION

HIGHLAND LODE - LYNDOCH TALC DEPOSITS

Sec. 3127, Hd. Barossa, Co. Adelaide

(Client: H.A. Schoof)

by

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INDUSTRIAL MINERALS SECTION

REPT.BK.NO. 75/67
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ABSTRACT

Metasomatic replacement of mica schists of the Woolshed Flat Shale, part of the Precambrian Burra Group sequence, has produced the Highland Talc Lode.

The coarse grained flaky talc, similar to but higher in iron content than other deposits near Lyndoch, is classed as a general ceramic grade talc. Selective mining may produce a better quality product.

Reserves of 133 000 tonnes have been indicated by trenching and drilling. A further 87 000 tonnes is inferred outside the area tested. Additional trenching and drilling is required to substantiate these quantities.

Laboratory testing of bulk samples is recommended to investigate the problems of griding coarse grained flaky talc.

INTRODUCTION

The Highland Talc Lode is located on Section 3127, Hundred Barossa, County Adelaide, 5 km eastsoutheast of Lyndoch and 62 km northeast by road from Adelaide. This section lies within the District Council of Barossa, part of the Outer Metropolitan Planning Area, which is under Interim Development Control.

Access, from the main Adelaide to Tanunda Highway, is southeasterly along 2.5 km of unsealed graded road and then easterly for 0.7 km to the Karawirra Lode. The last 0.5 km northwards to Highland Lode is steep and accessible only to four wheel drive vehicles (see Fig. 1).

Following a request for assistance from Mr. H.A. Schoof, a stadia theodolite survey was carried out by the author and R.J. Harris (Field Assistant) in June, 1974. The accompanying plans (Figs. 2 and 3) are based on a contour plan prepared by J. Erklens (Survey Assistant).

A programme of trenching and drilling was undertaken in August, 1974 to test the southern portion of the lode, and establish sufficient reserves for mining operations to start. Geological logs of the 13 holes drilled comprise Appendix I.

Cuttings of talc from selected holes were submitted to the Australian Mineral Development Laboratories (AMDEL) for chemical analysis, these results are shown in Appendix II.

Appendix III contains a petrographic description of the country rock.

A representative bulk sample was submitted to AMDEL for ceramic testing. The results are compared with a bulk sample from the Karawirra Lode in Appendix IV.

MINERAL TENURE

Mr. H.A. Schoof holds the following leases as shown on Fig. 1:

- M.L. 4375 of 6.63 ha, granted on 11.6.74 for 7 years.
- M.L. 4428 of 2.48 ha, granted on 23.12.74 for 7 years.

REGIONAL GEOLOGY

The Lyndoch talc deposits are located in steep hills along the southeastern margin of the Barossa Valley. Mica schists and quartzites, within the area mapped, are part of the Woolshed Flat Shale, a unit of the Burra Group of Adelaidean sediments of Precambrian age.

The talc bodies have formed in zones of dislocation on the western limb of a major syncline, striking approximately north - south. The syncline is overturned with its axis dipping steeply eastward, with a pitch of 10° to the south (Whittle p.126 in Dickinson et al., 1951, see Fig. 1).

SITE GEOLOGY

Country Rock

The talc bodies are enclosed in grey bimica schists with quartzite interbands.

The schists, containing biotite and muscovite, outcrop poorly; only the harder more siliceous bands are exposed.

Three relatively narrow quartzite bands outcrop within the area mapped. The lowest is a pale pink to light grey ortho-quartzite (20 m in true width), strongly jointed and outcropping boldly. Friable sandstone layers mark the basal contact with the schists.

The two upper quartzite bands probably 8 m and 25 m thick occur as sub-outcrop and float, separated by a zone devoid of outcrop but assumed to be schist.

Sample L 18 (P 1552/74), from near the talc lode as shown on Fig. 3, represents an altered siltstone layer within the uppermost quartzite bed (see Appendix III).

Albite Rock

Albite rock, composed essentially of fine grained, white sodic feldspar ($Na\ Al\ Si_3\ O_8$) is genetically related to and always closely associated with the talc bodies (Stillwell and Edwards pp. 38-39 in Dickinson et al., 1951). At the Highland Lode, hard, solid, white albite rock has formed adjacent to and within the talc bodies.

The surrounding schists have been albitised with albite on joint planes and as blebs within the rock; the degree of albitisation decreasing away from the talc lode.

Brecciated albite-talc rock, approximately 25m by 15 m, outcrops in the northern part of the area. This moderately iron stained rock, composed mainly of fine grained albite, with irregular patches and stringers of talc, probably represents a zone of shearing.

The Talc Lode

Seven lenticular outcrops of talc trend north to northwest, the largest (Zone A) being 120 m long by 30 m wide (Fig. 3).

The talc generally outcrops strongly, being more resistant to erosion than the enclosing schists. The contacts are often obscured by float of weathered schists.

Near the surface, the talc is yellow brown with clayey patches and iron staining grading at depth to pale yellow or white. Small, irregular zones of albite and unaltered schists occur within the talc bodies.

Structure

South of the platform the strata strike northnorthwesterly with dips of 30° to 45° to the east (see Fig. 2). North of the creek, the strike is northeasterly, with dips of 30° to the southeast. These two areas are separated by a zone of dislocation, centred about an anticlinal drag fold pitching to the southeast. The crest of this drag fold, which is obscured by creek alluvium, has been truncated by faulting and crumpling.

This shearing and distortion probably provided access for hydrothermal solutions rich in soda.

A fault, striking northwesterly and dipping 80° southwesterly, is associated with the talc in Zone C (Fig. 3). The adjacent schists, in the platform and the old trench, are sheared and crumpled with numerous albite veins and stringers. However, the nature and extent of other faults as indicated by vein quartz cannot be determined due to paucity of outcrop.

GENESIS OF THE TALC

The talc has formed from magnesia rich biotite in the mica schists. The addition of soda from some external source has produced the associated albite (Offler, 1966). Talc and albite have developed in zones of strong fold distortion, the talc tending to be concentrated along minor faults. These zones are generally elongated parallel to the regional foliation. Invariably, the talc lodes are surrounded by an aureole of albite rich rock and an outer zone of partially albitised schists, intruded by albite veins and stringers.

The talc deposits at Lyndoch are assumed to have formed at the same time as the more extensive deposits at Gumeracha, probably at the time of the large scale feldspathization, responsible for the production of the Palmer granite. (Whittle, p.25 in Dickinson et al., 1951).

RESULTS OF EXPLORATION

A programme of trenching and drilling to delineate talc zones and establish reserves was supervised by the writer. Location of the trenches and holes are shown on the plan in Fig. 3 and the results shown on sections Fig. 4.

In M.L. 4428, 5 trenches were cut with a front-end loader (Plate No. IVBB009), to an average depth of one metre to outline talc Zones A and B; where contacts were obscured by weathered schist and float from the adjacent talc.

Thirteen holes designated HT 1 to 13, were drilled with an Atlas Copco pneumatic drill, using a bit 6.25 cm in diameter. The holes were logged by the writer and sampled at 1 m intervals. The logs, showing the intervals submitted for analysis by AMDEL, are detailed in Appendix I.

Holes HT 1 - HT 7 were drilled in or alongside Trench 1. Each hole was continued into country rock for at least one metre beyond the base of the talc, except for HT 6 which was abandoned due to loss of air circulation. Talc intersections ranged from 6.0 m to 11.8 m and averaged 9.7 m.

In Zone C, only HT 8 and HT 13 encountered significant talc (6.6 m and 8.5 m thick respectively). Reserves, southeast of HT 13 and northwest of HT 9 and HT 10, have not been delineated because the steep slope prevented setting up the drill rig (see Plate No.IVBB006).

26437

PLATE IVBB009 HIGHLAND TALC LODE

Looking southeast showing trenches to outline zones A and B. (November, 1974).

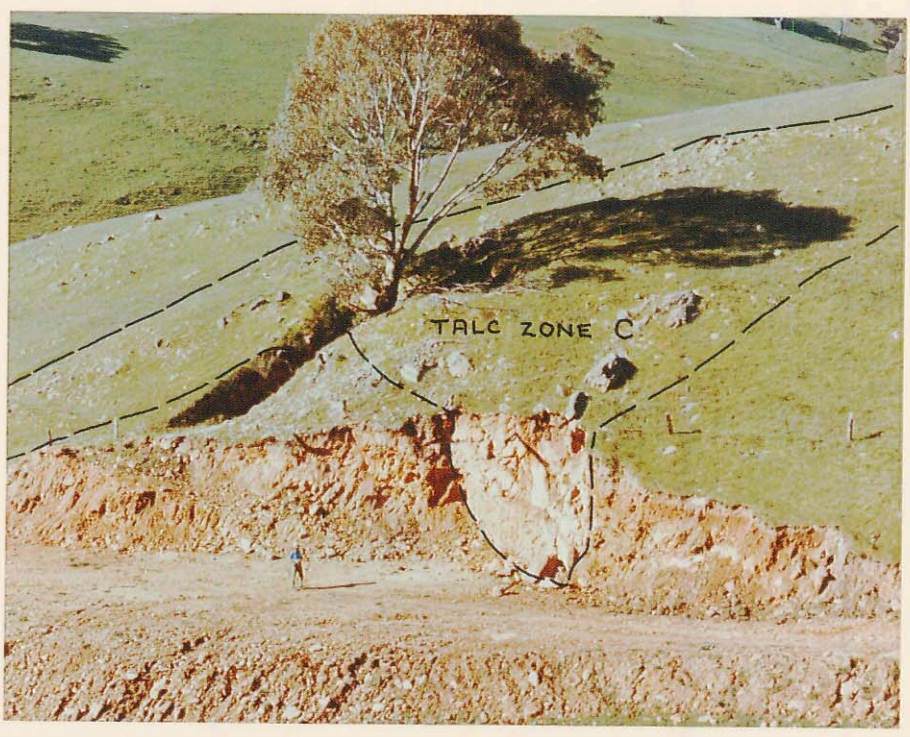

PLATE IVBB006 HIGHLAND TALC LODE 26435

Platform and old workings - looking east. (July, 1974).

QUALITY OF THE TALC

The coarse grained, flaky talc at Highland Lode is similar physically to that from the nearby Karawirra (Olliver, 1967) and Thomas Lodes (Scott, 1975). The near surface talc exhibits typical red-brown iron staining with small yellow-brown, weathered, clayey patches. However, the proportion of contaminants at Highland is generally high, notably the iron impurity which ranges from 2.80% to 6.71% and averages 4.40% Fe_2O_3 + Fe O for the 10 samples submitted (see Appendix II). In comparison Karawirra talc varied from 1.79% to 4.05% and averaged 2.41% and Thomas talc averaged 2.19%.

Better quality talc with more than 25% MgO, and total iron content less than 3.5% was encountered in holes HT 4, 7, 8 and 13. HT 1 is deleted because of high alumina content of 3.96%. Partial chemical analyses of best quality Highland talc, from 1.0 m to 11.0 m in hole HT 4, is compared with other deposits in South Australia (Dickinson et al., 1951) in Table I; full details are tabulated in Appendix II.

TABLE I

PARTIAL CHEMICAL ANALYSES OF S.A. TALCS

	Theo-retical Pure Talc	Tumby Bay	Mt Fitton	Gumer -acha	Karawirra Best quality Olliver (1967)	Highland Best inter-section (Hole HT4)
Silica SiO_2	63.50	61.26	62.16	61.90	61.0	59.79
Magnesia MgO	31.70	30.53	32.06	28.23	29.4	27.30
Water H_2O above 100°C	4.80	4.90	4.51	4.66	5.1	5.23
	100.00	96.69	98.73	94.79	95.5	92.32

The proportion of better quality talc in the entire lode cannot be determined from the limited number of holes drilled.

Bulk sample A 729/74 obtained by combining the intervals of talc below 1.0 m in each hole, to avoid surface contamination, is suitable as a general ceramic grade talc, where fired colour is not important. The range of possible uses depends upon gridability. Ceramic properties are compared with sample A 727/74 from the adit at Karawirra Lode, in Appendix IV.

A systematic laboratory invesigation by A.M.D.E.L. of the industrial uses of South Australian talcs (Spry et al., 1972) has indicated that low grade talc from Lyndoch could be used for: lower grade wall and floor tiles, rock wool, adsorbent and roofing material. Selected better quality talc would be suitable for medium grade ceramics, dusting and lower grade filling agents.

Coarse flaky talc from Tweedie Gully Lode at Lyndoch requires griding in a ball mill for approximately 2.5 times longer than Gumeracha talc(pers. comm. Mr. B.R. Kessell, Steetley Aust. Pty. Ltd.). Preliminary testing by A.M.D.E.L. has indicated that attrition grinding techniques could substantially reduce milling time.

RESERVES

Indicated reserves for Zones A, B and C in Table II were calculated from the geological sections in Fig. 4, using Simpson's General Formula and a specific gravity of 2.7 for micaceous talc. Calculated quantities have been reduced by 10% to allow for irregular inclusions of albite and schists

and weathered near surface material.

TABLE II:

INDICATED TALC RESERVES

Zone	Volume (m^3)	Tonnes Calculated	Tonnes Reduced
A	28 600	77 000	69 000
B	17 000	45 000	40 000
C	10 200	27 000	24 000
TOTAL	55 800	149 000	133 000

Inferred reserves of 87 000 tonnes, for the northern talc zones (not designated on Fig. 3), are based on the following data:-

(a) Area of observed talc - 3 600 m^2

(b) Average depth - 10 m

(c) Specific gravity - 2.7

(d) Rejection of albite and stained material - 10%

ENVIRONMENTAL IMPACT

Rowland Flat is 3 km northnorthwest of Highland Lode (Plate No. IVBB007). The lode is visible from the northern end of the town, and at locations, along the Sturt Highway between Rowland Flat & Tanunda (Plate No.IVBB010).

Mining activity would be clearly visible from these points due to the whiteness of the talc. However, the visual impact would be minimised by advanced planting of trees and progressive back-filling during mining operations.

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PLATE IVBB007 HIGHLAND TALC LODE

View northwards from Zone B. Rowland Flat left of centre, middle distance. (November, 1974).

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PLATE IVBB010 HIGHLAND TALC LODE

Trenches (centre) visible from road 0.8 km northeast of Rowland Flat - looking southwards. (November, 1974).

CONCLUSIONS

The Highland Talc Lode has been formed in a zone of structural deformation, by the metasomatic replacement of biotite in bimica schists of the Woolshed Flat Shale of Torrensian age.

The coarse grained flaky talc, although physically similar to other deposits at Lyndoch, is generally less pure with a high iron content. A relatively high grade talc could be obtained by selective mining of the talc encountered in holes HT 4, 7, 8 and 13.

Indicated reserves in Zones A, B and C total 133 000 tonnes, with an additional 87 000 tonnes inferred in the remainder of the lode.

RECOMMENDATIONS

A further ten vertical holes (designated HT 14 to 23 on Fig. 3) are recommended to complete the drilling programme south of the platform.

Trenching and drilling, to the north of the platform, is required to confirm the 87 000 tonnes of talc.

An investigation by AMDEL is recommended, to determine a more efficient method of milling the coarse grained varieties of talc characteristic of the Lyndoch deposits, to increase the somewhat limited use of this material.

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16th May, 1975
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APPENDIX I

Geological Logs of Holes

Logs of Percussion Holes - Highland Lode

Hole No.	DEPTH in metres	Description	Sample No.	Interval (metres)
HT1	0-3.5	TALC - yellow brown, coarse grained, flaky. Iron stained - becoming yellow, less stained with depth.	A717/74	0.0-6.0
	3.5-4.2	TALC - white, coarse grained.		
	4.2-6.2	TALC - yellow brown with a few narrow clay seams.		
	6.2-7.3	ALBITE ROCK - white to pale yellow, fine grained, hard with few narrow softer talc zones.		
	7.3-9.0	ALBITIZED SCHIST - dark grey fine grained, hard, siliceous in part with a few white albite chips.		
		END OF HOLE 9.0 m		
HT 2	0-0.3	TOPSOIL - black, clayey.		
	0.3-1.5	TALC - yellow brown, iron stained, weathered. Becoming lighter with depth.	A718/74	1.0-8.0
	1.5-7.3	TALC - pale yellow to white with occasional narrow darker bands.		
	7.3-8.2	TALC - yellow brown, gritty.		
	8.2-9.0	ALBITE ROCK - white, fine grained, hard.		
	9.0-11.2	TALC - pale yellow with some darker bands.	A719/74	9.0-11.0
	11.2-12.0	ALBITE ROCK - hard, fine grained.		
	12.0-12.5	TALC - brown, gritty.		
	12.5-14.0	ALBITISED SCHIST - dark grey, fine grained. Hard siliceous in part.		
		END OF HOLE 14.0 m		

HT 3		Angle Hole: Angle 45° Azimuth 38°.		
	0-3.4	TALC - yellow brown, iron stained, becoming pale yellow with depth.	A720/74	0.0-3.0
	3.4-5.8	ALBITISED SCHIST - dark grey, fine grained with brown weathered bands.		
	5.8-6.0	TALC - yellow brown with abundant grit.		
	6.0-7.0	ALBITISED SCHIST - dark grey, siliceous. Becoming hard with inclusions of albite.		
		END OF HOLE 7.0 m		
HT 4	0-2.3	TALC - yellow brown, iron stained becoming pale yellow past 1.0 m.		
	2.3-11.6	TALC - mainly white with occasional thin brown clayey and weathered bands.	A721/74	1.0-11.0
	11.6-13.0	ALBITISED SCHIST - grey to brown, weathered with albite inclusions. Becoming harder, grey past 12.2 m.		
		END OF HOLE 13.0 m		
HT 5	0-0.8	TALC - yellow brown coarse grained, iron stained.		
	0.8-1.5	SCHIST - grey, weathered, clayey.		
	1.5-3.0	TALC - pale yellow.		
	3.0-3.4	TALC & ALBITE ROCK - yellow brown + white albite inclusions.		
	3.4-5.8	TALC - pale yellow with few narrow darker bands.		
	5.8-6.3	ALBITISED SCHIST - dark grey + white albite grains.		

	6.3-11.8	TALC - yellow brown with some grit, becoming paler past 6.5 with occasional thin darker bands.	A722/74	7.0-11.0
	11.8-13.0	ALBITISED SCHIST - dark grey fine grained. Moderately hard, becoming very hard past 12.5 m.		
		END OF HOLE 13.0 m		
HT 6	0-1.7	TALC - yellow brown, iron stained, clayey.		
	1.7-2.0	SCHIST - grey brown weathered.		
	2.0-4.0	TALC - dark yellow brown, clayey. Becoming paler with depth.	A723/74	2.0-9.0
	4.0-9.0	TALC - pale yellow with occasional thin darker bands. NOTE: water encountered at 9.0 m.		
	9.0-10.0	ALBITISED SCHIST - (?) circulation lost due to water. Probably in schist as rock hard past 9.5 m.		
		HOLE ABANDONED AT 10.0 m		
HT 7	0-1.5	TALC - dark yellow brown, clayey with abundant grit.		
	1.5-2.6	TALC - pale yellow to white minor grit.	A724/74	1.0-4.0
	2.6-3.5	TALC - yellow brown to yellow.		
	3.5-8.8	TALC - mainly white with few narrow yellowish bands. Good quality.	A725/74	4.0-8.0
	8.8-10.0	ALBITISED SCHIST - grey with white albite grains, fine grained moderately hard, becoming harder past 9.5 m.		
		END OF HOLE 10.0 m		

HT 8	0-0.8	TALC - yellow brown with a few narrow brown clay seams.		
	0.8-3.5	TALC - yellow to pale yellow.	A726/74	1.0-3.0
	3.5-3.9	ALBITISED SCHIST - grey, fine grained, hard.		plus
	3.9-6.6	TALC - as at 0.8-3.5 becoming paler past 5.0 m.		4.0-6.0
	6.6-9.0	ALBITISED SCHIST - grey, fine grained, moderately hard with some white albite chips. Weathered in part, yellow-grey softer, becoming hard fresh past 8.5 m.		
		END OF HOLE 9.0 m		
HT 9	0-0.5	TALC - dark yellow brown, iron stained.		
	0.5-6.0	ALBITISED SCHIST - grey to brown, becoming harder, greyer with depth, some albite inclusions. Yellow weathered zone past 5.2 m.		
		END OF HOLE 6.0 m		
HT10	0-1.0	TALC - yellow brown, iron stained.		
	1.0-1.5	CLAY - yellow brown, soft - weathered schist (?).		
	1.5-2.8	TALC - pale yellow - white, minor grit.		
	2.8-3.9	SCHIST - yellow soft weathered.		
	3.9-4.2	TALC - yellow, slightly iron stained, gritty.		
	4.2-6.0	ALBITISED SCHIST - yellow to pale grey, weathered, moderately soft. Harder, grey past 5 m with numerous white albite fragments.		
		END OF HOLE 6.0 m		

HT11	0-1.3	TALC = yellow brown gritty.		
	1.3-4.5	ALBITISED SCHIST - yellow, very soft, clayey. Harder light grey past 3.0 m.		
	4.5-5.5	ALBITE ROCK - white, fine grained, hard with a few quartz inclusions.		
		END OF HOLE 5.5 m		
HT 12	0-0.3	TOPSOIL - dark brown, clayey.		
	0.3-2.8	ALBITISED SCHIST - yellow with white albite-fragments. Weathered, moderately hard with few quartz fragments.		
	2.8-3.2	CLAY - brown, soft, somewhat talcose.		
	3.2-4.1	ALBITISED SCHIST - as above.		
	4.1-5.5	QUARTZ - white to yellow + white, fine grained albite inclusions.		
	5.5-6.8	ALBITISED SCHIST - as above. NOTE: Hit water at 5.0 m.		
	6.8-8.7	TALC - yellow to pale yellow. Some contamination due to water in hole.		
	8.7-9.2	SCHIST? - hard rock, circulation lost.		
		HOLE ABANDONED AT 9.2 m		
HT 13		Angle hole: Angle 75° Azimuth250°.		
	0-0.8	TOPSOIL - red brown sandy clay & weathered schist fragments.		
	0.8-2.5	TALC - yellow, becoming paler past 2 m with occasional darker bands. Few narrow brown clay seams, minor grit.	A726/74	1.0-8.0
	2.5-4.4	TALC - pale yellow to white.		

4.4-8.5	TALC - yellow as at 0.8-2.5
8.5-11.6	ALBITISED SCHIST - brown to light grey, soft weathered becoming harder past 11.0 m. Numerous white quartz fragments.
11.6-14.0	ALBITISED SCHIST - grey, fine grained, hard with white flecks of albite.
	END OF HOLE 14.0 m

APPENDIX II

CHEMICAL ANALYSES

Extracted from AMDEL Report AN 2295/75

Analyses of Talc Cuttings - Highland Lode.

Analysis by : A.B. Timms

	THEORETICAL PURE TALC	TUMBY BAY DICKINSON, 1951	GUMERACHA (BEST QUALITY)	MT. FITTON (NO. 4)	KARAWIRRA (BEST QUALITY) OLLIVER, 1967	HIGHLAND LODE HOLE NO. INTERVAL (m) AND SAMPLE NO.									
						HT1 0.0-6.0 A717/74	HT2 1.0-8.0 A718/74	HT2 9.0-11.0 A719/74	HT3 0.0-3.0 A720/74	HT4 1.0-11.0 A721/74	HT5 7.0-11.0 A722/74	HT6 2.0-9.0 A723/74	HT7 1.0-4.0 A724/74	HT7 4.0-8.0 A725/74	HT8 & 13 * A726/74
SiO_2	63.50	61.26	61.90	62.16	61.0	58.92	60.12	65.03	57.74	59.79	61.51	58.35	59.78	61.34	61.35
Al_2O_3		1.76	1.88	0.61	0.43	3.96	5.23	2.89	3.42	1.57	4.55	3.50	3.60	1.81	1.85
Fe_2O_3		0.33	0.65	0.13	0.43	1.63	2.96	3.17	4.85	0.67	1.70	4.60	3.48	1.46	1.49
FeO		0.04	1.66	0.45	1.78	1.69	1.66	1.67	1.86	2.13	1.77	1.60	1.73	2.00	2.00
CaO		Nil	Nil	Nil	0.21	0.12	0.13	0.15	0.06	1.10	0.24	0.26	0.14	0.18	0.13
MgO	31.70	30.53	28.23	32.06	29.40	25.20	21.30	20.90	24.50	27.30	22.30	23.80	23.30	26.60	25.90
Na_2O		0.17	0.68	Nil	0.05	0.54	1.33	1.20	0.64	0.65	2.32	1.30	1.58	0.90	0.48
K_2O		0.10	Nil	Nil	0.03	0.20	0.34	0.17	0.11	0.04	0.10	0.14	0.13	0.07	0.16
TiO_2		-	0.07	0.02	0.39	0.37	0.35	0.20	0.22	0.22	0.23	0.29	0.22	0.24	0.48
MnO		-	-	-	0.02	0.02	0.03	0.05	0.01	0.03	0.03	0.14	0.03	0.04	0.02
P_2O_5		-	0.07	Nil	0.09	0.05	0.06	0.06	0.04	0.06	0.04	0.11	0.09	0.07	0.09
H_2O+	4.80	4.90	4.66	4.51	5.10	5.47	4.92	4.13	5.59	5.23	4.13	4.88	4.59	4.52	4.77
H_2O^-		0.22	0.03	0.11	0.66	0.82	0.83	0.30	0.50	0.16	0.31	0.47	0.28	0.05	0.18
Cl		0.30	Nil	Nil	Nil	-	-	-	-	-	-	-	-	-	-
	100.0	99.61	99.88	100.35	99.7	98.97	99.25	99.91	99.54	98.95	99.24	99.45	98.95	99.28	98.89

- not determined

* combined sample A726/74 comprises HT8 1.0-3.0 m
HT8 4.0-6.0 m
HT13 1.0-8.0 m

APPENDIX III

PETROGRAPHIC DESCRIPTION

Extracted from AMDEL Report MP 2286/75

Investigation and Report by : Dr. P.G. Moeskops

Sample No: P1552/74 TS33290 (L.18)

Rock Name:
Metamorphosed siltstone (probably hydrothermally altered as well)

Hand Specimen:
Dark grey weakly schistose siliceous rock containing 1-3 mm sized, light grey spots and patches.

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

	%
Quartz	60
Sericite and muscovite	25
Feldspar	5-10
Jarosite	2-3
Sphene	1-2
Tourmaline	1-2
Chlorite	1-2
Opaques	trace
Apatite	minor trace

The section is made up of irregular, semi-connected, 2-5 mm sized patches which are either quartz-rich or sericite-rich. Quartz-rich patches consist largely of an interlocking mosaic of anhedral to subhedral, 0.01-0.05 mm sized quartz grains in association with a small proportion of plagioclase and K-feldspar grains. Sericite-rich patches mainly consist of haphazardly arranged microcrystalline sericite flakes but also contain minor amounts of quartz, feldspar and muscovite. Muscovite occurs both as ragged, 0.1-0.5 mm sized anhedra and as larger (0.5-1.5 mm sized) ragged poikiloblasts containing quartz and occasional feldspar grains.

The section contains 2-3% jarosite (? after pyrite) forming irregular 0.2-0.5 mm sized patches which are evenly distributed throughout the section. Both sphene and tourmaline are present in accessory amounts. Sphene occurs evenly distributed 0.1-0.2 mm sized patches and tourmaline (pleochroic brown-green) is present mainly as minute prisms. Chlorite is present as 0.1-0.3 mm sized flakes and radial aggregates. Very fine-grained 'dusty' opaques and a few minute apatite prisms are present in trace amounts.

This rock appears to be a metamorphosed siltstone which has been affected by hydrothermal emanations which gave rise to talc development. The former presence of sulphides is suggested by the jarosite.

APPENDIX IV

CERAMIC EVALUATION

Evaluation of Bulk Samples from Highland and Karawirra Lodes

AMDEL Report MT 2294/75

Investigation by : M.D. Ware and Dr. R.N. Brown

Report by : M.D. Ware

1. INTRODUCTION

Sample A727/74 was from a similar area to a previously submitted sample with the Department No. A237/74. However, since sample A237/74 was possibly not entirely representative of the readily available material at the time the sample herein investigated was obtained and sample A237/74 rejected.

Material examined from the Highland Ore Body (A729/74) consisted of relatively coarse particles of brownish and whitish flakes. The sample from the Karawirra adit was made up of massive lumps of coarse greenish white flakes with occasional iron stained flakes.

2. PROCEDURE AND RESULTS

Representative samples of each material were obtained and ground by Sieb Technique to minus 200 mesh B.S.S. The mineralogy of each material, determined by X-ray diffraction analysis is given in Table 1. Individual samples were blended with 30 percent (by weight) of white plastic clay and pressed at 8 percent moisture into 2 inch square ¼ inch thick tiles.

Tiles were dried at 105°C for 24 hours and fired in an electric kiln at 1200°C and 1250°C with half an hour soak at each temperature. The fired tiles were cooled in the kiln over an 8 hour period prior to removal.

Parameters of drying and firing shrinkage and 24 hour cold water absorption were determined for each tile and together with quality observations are recorded in Table 2. The general firing behaviour of the white plastic clay used in the blends is given in Table 3.

A chemical analysis of sample A729/74 was determined by a combination of Direct Reading Emission Spectrography and wet chemical methods. Results are given in Table 4.

3. DISCUSSION

Sample A729/74 from the Highland ore body is iron stained talc with associated vermiculite, plagioclase and calcite in accessory proportions. Due mainly to the presence of the feldspar, the material sinters at a lower temperature than a pure talc and produces a satisfactory floor tile body at 1200°C. A fully vitrified tile could be produced by firing higher than 1250°C. The body pressed well at 3% moisture without any obvious delamination and fired to a sound hard body at 1200°C and above.

The chemical analysis indicates that the calcite detected by X-ray diffraction is present in very minor amounts, less than 0.5 percent and the feldspar is less than 10 percent possibly around 8 percent. The iron content is high at 3.6 percent the majority of which, judging by the colour of the material is present in the oxidised state.

Sample A727/74 from the Karawirra adit is a pure talc and would be suitable for higher fired, or porous, ceramic

bodies or for incorporation with other fluxing materials.

Sample A 727/74 from the Karawirra adit is a pure talc and is not suitable in the proportions tested for the manufacture of a floor tile. To promote sintering and decrease the water absorption of the body either the temperature would have to exceed 1250°C or a fluxing agent, such as feldspar, would have to be incorporated in the body.

This material would be suitable as a general ceramic grade talc where fired colour was not important and its use would depend upon its grindability.

TABLE 1: MINERALOGY

Sample A729/74 Highland Ore Body	
Talc	D
Vermiculite	A
Plagioclase (Albite)	A
Calcite	A
Sample A727/74 Karawirra Adit	
Talc only. (No other minerals detected by X-ray diffraction).	

D = Dominant. Used for the component apparently most abundant, regardless of its probable percentage level.

CD = Co-dominant. Used for two (or more) predominating components, both or all of which are judged to be present in roughly equal amounts.

SD = Sub-dominant. The next most abundant component(s) providing its percentage level is judged above about 20.

A = Accessory. Components judged to be present between the levels of roughly 5 and 20%.

Tr = Trace. Components judged to be below about 5%.

TABLE 2: PROPERTIES OF TALC TILES

Blend	Temperature °C	Total Shrinkage %	Water Absorption %	Quality
2	105	-0.15		Pressed and dried satisfactorily.
	1200	2.8	3.6	Yellow-brown. Sound, hard.
	1250	3.0	1.9	Brown, very hard, good ring.
3	105	-0.2		Pressed and dried satisfactorily.
	1200	2.8	7.2	Pink, sound.
	1250	2.6	4.6	Yellowish-brown, fair ring.

Blend 2 70% A729/74. Highland Ore Body
30% plastic clay.

Blend 3 70% A727/74. Karawirra Adit
30% plastic clay

TABLE 3: FIRING PROPERTIES OF WHITE PLASTIC CLAY

Reference: County Adelaide
Hundred Yatala
Section 5470

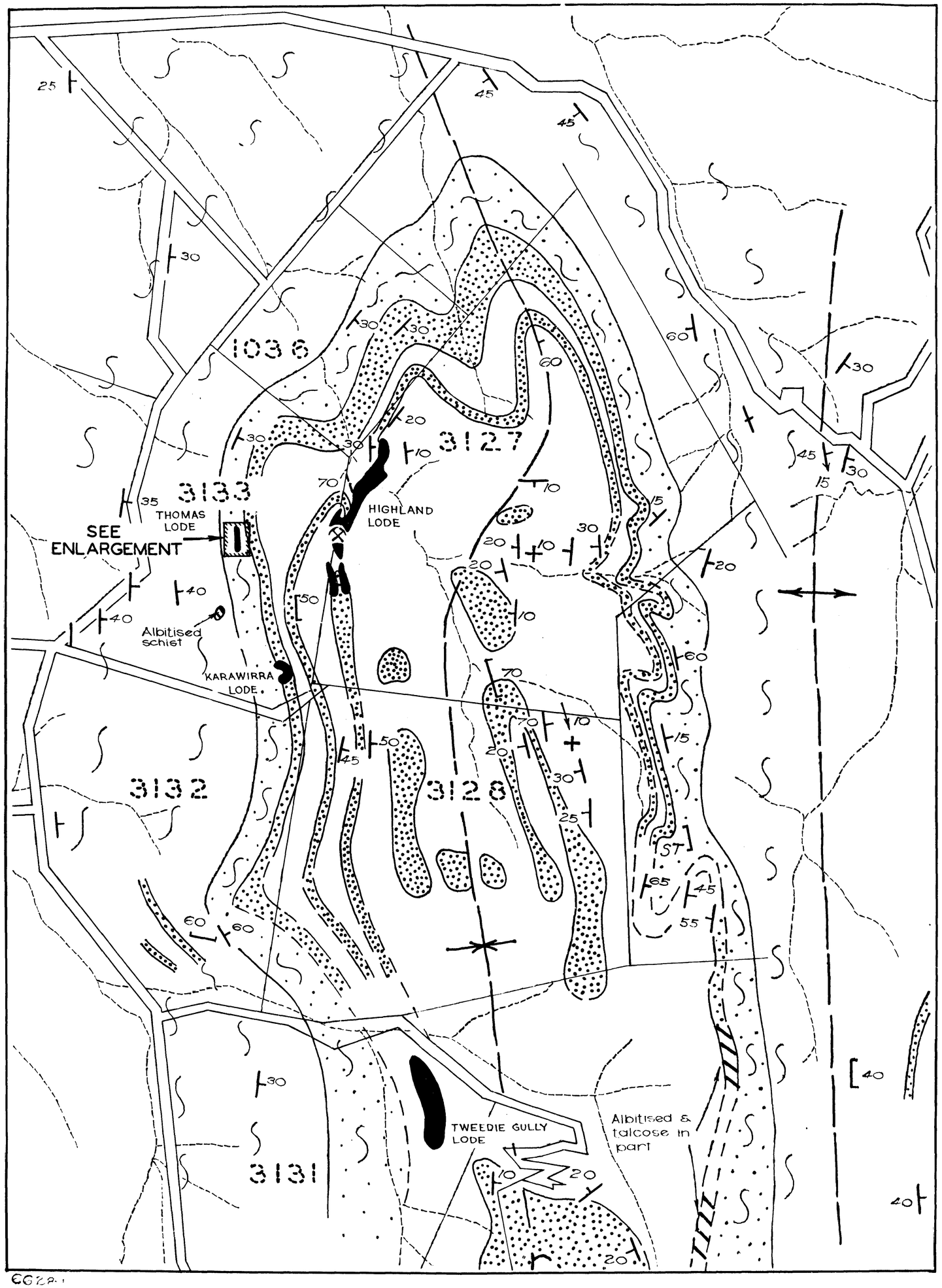
Clay Register No. R575

Temperature °C	% Shrinkage	% Water Absoprtion	Colour
105	4.0 (from 20% Water)		
1050	2.5	15.4	Light Cream
1100	5.1	10.7	Cream
1150	6.1	7.9	Cream
1200	8.2	4.9	Light Grey

TABLE 4: CHEMICAL ANALYSIS
Sample A729/74

SiO_2	63.0
Al_2O_3	3.5
Total Fe as Fe_2O_3	3.6
MgO	26.0
CaO	0.2
Na_2O	1.0
K_2O	0.1

GEOLOGICAL PLAN



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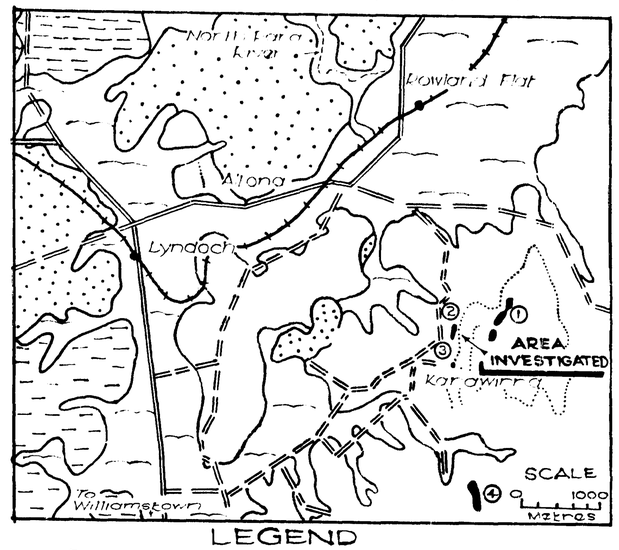
LOCATION & REGIONAL GEOLOGY



LEGEND

RECENT
- Alluvium

TERTIARY
- Sands gravels & clays

PROTEROZOIC - TORRENSIAN
- Phyllites & slates
- Schists with quartzites

- Talc bodies
- ① Highland lode
- ② Thomas lode
- ③ Karawirra lode
- ④ Tweedie Gully lode

LEGEND

- Geological boundary (Observed)
- " " (Inferred)
- Strike & dip of bedding (25) + Horizontal, × Vertical
- Strike & dip of cleavage (15)
- Pitch (10)
- Syncline
- Anticline
- Mine
- Quartzite
- Knotted mica schist
- Mica schist with thin calc silicates
- Creek
- Talc ore bodies

SCALE

0 200 400 600 800 1000

METRES

Modified from Whittle (1951) Plan No 49-402

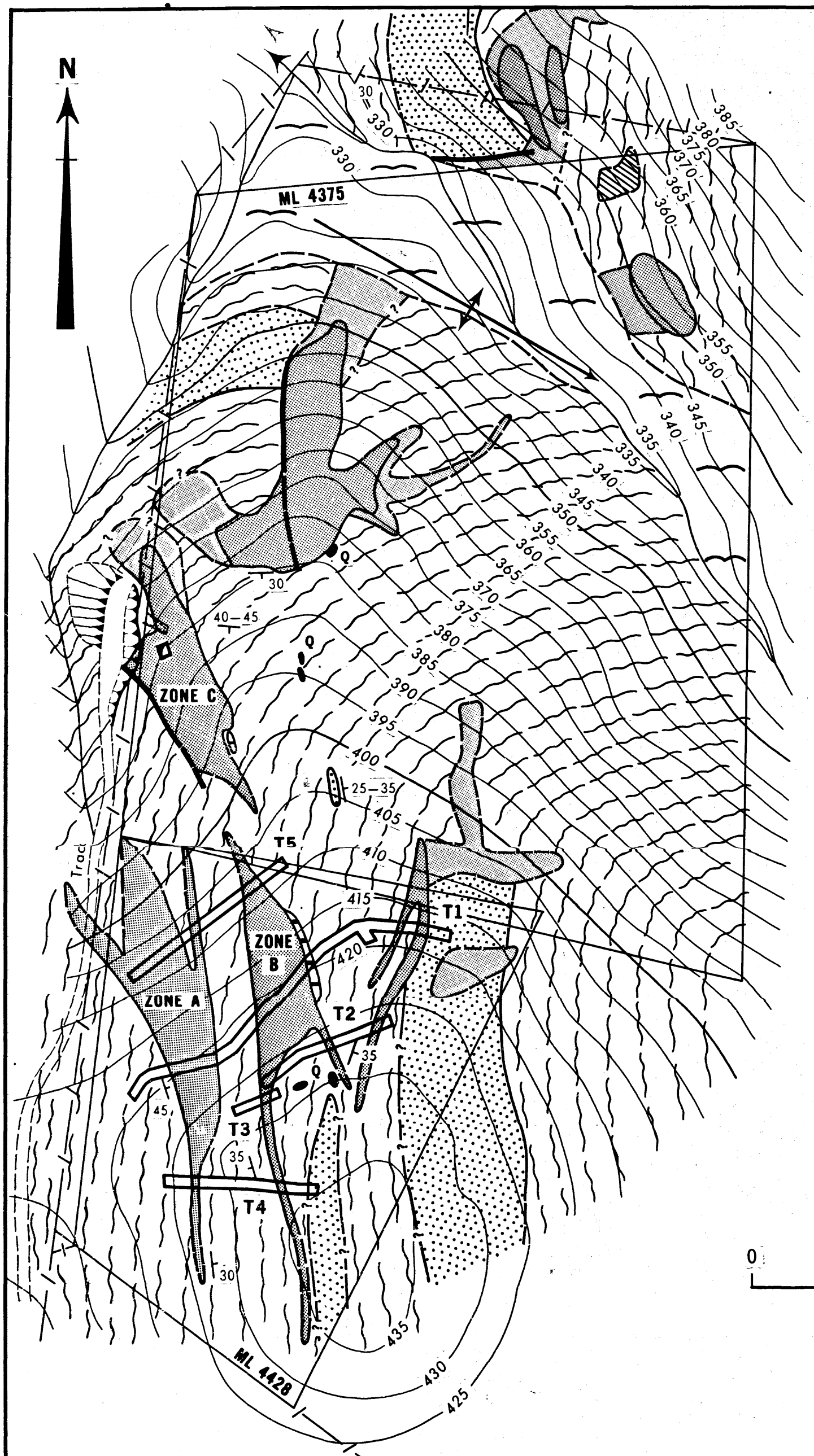
FIG. 1

DEPARTMENT OF MINES — SOUTH AUSTRALIA

LYNDOCH TALC DEPOSITS
PORTION OF THE HD. OF BAROSSA
GEOLOGICAL PLAN

INDUSTRIAL MINERALS SECTION	D.C Scott GEOLOGIST	Drn. DS	SCALE: 1: 10000
		Tcd. DS.	74-1041
Director of Mines		Ckd. A.F.	
		Exd.	DATE: 6th Dec 1974

6628 - 1



LEGEND

- Quartzite
- Bimica Schist (albitised near talc contacts)
- Talc observed
- Talc inferred
- Albite rock
- Albite talc rock
- Quartz
- Alluvium
- Contour interval 5 metres — 325
- Trench — T1
- Fault observed and inferred
- Fold axis (approximate) and pitch direction
- Strike and dip of bedding — 45

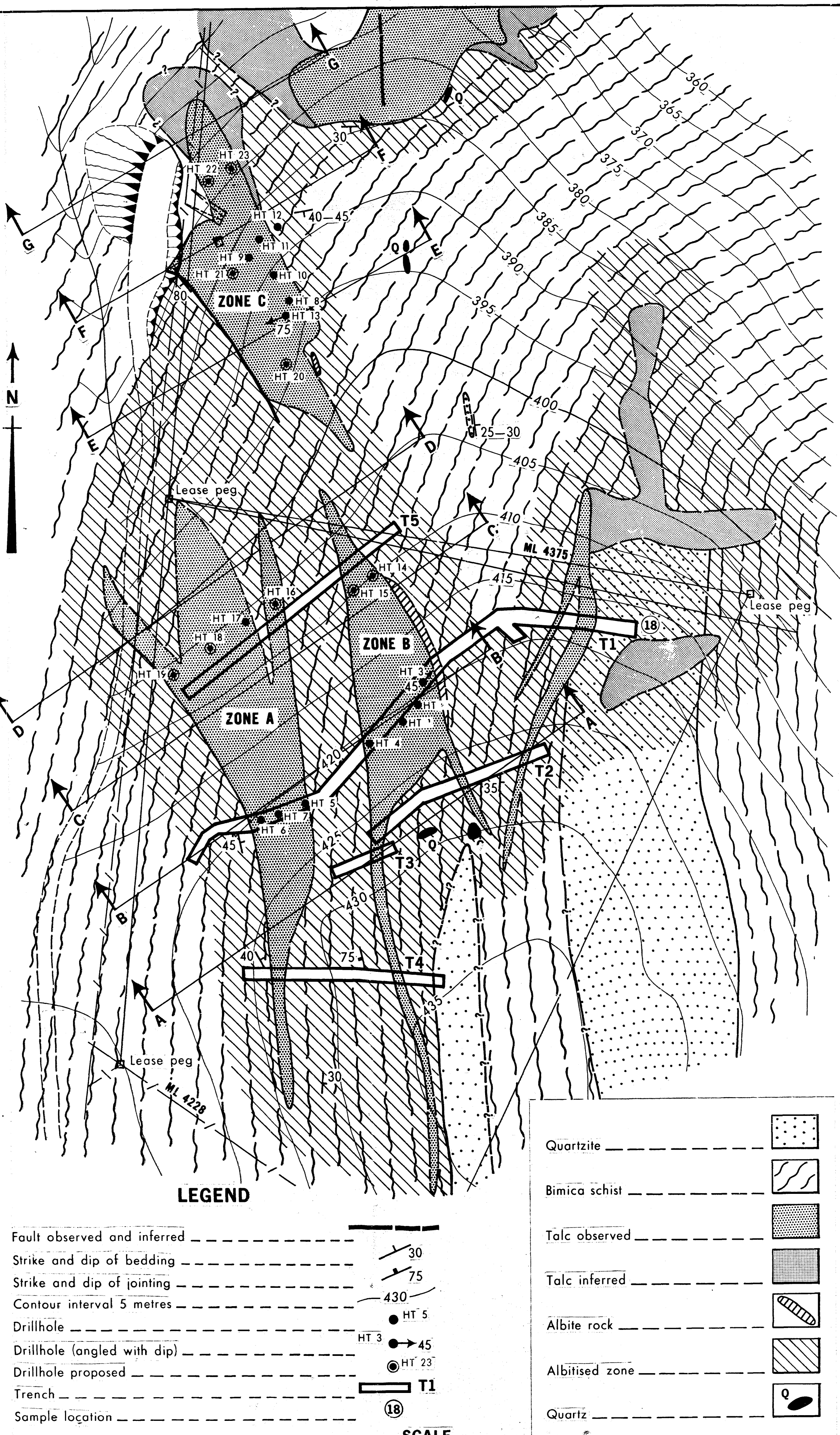
SCALE

0 50 100 150 200

METRES

MRR 142 DRN R.B.

75—399 S.A. Dept. of Mines



LEGEND

- Fault observed and inferred
- Strike and dip of bedding — 30
- Strike and dip of jointing — 75
- Contour interval 5 metres — 430
- Drillhole — HT 5
- Drillhole (angled with dip) — HT 3, 45
- Drillhole proposed — HT 23
- Trench — T1
- Sample location — (18)

- Quartzite
- Bimica schist
- Talc observed
- Talc inferred
- Albite rock
- Albitised zone
- Quartz — Q

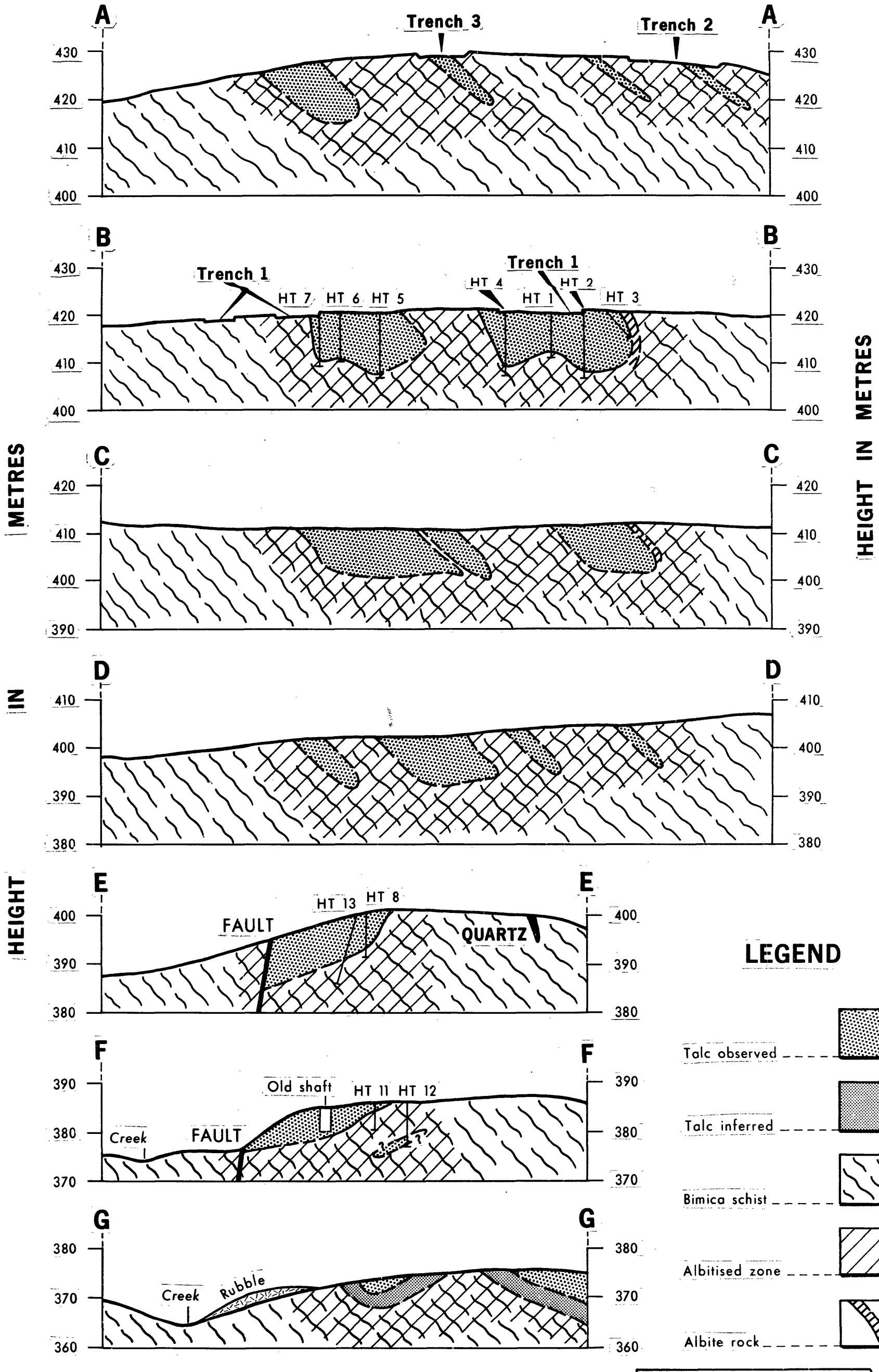
SCALE

METRES 0 20 40 60 80 100 METRES

MRR 142 DRN. R.B.

D.C. Scott, Geologist

75—400 S.A. Dept. of Mines



MRR 142 DRN. R.B.

D.C. Scott, Geologist

75—401 S.A. Dept. of Mines