DEPARTMENT OF MINES
SOUTH AUSTRALIA

Report

on

AUGER BORING OF JOE'S HILL TALC DEPOSIT

Pt. Sec. 321, Hundred Belvidere and Pt. Sec. 87, Hundred Dutton

(T. E. Christianos)

by

J. G. Olliver
Geologist

NON METALLICS SECTION

GEOLOGICAL SURVEY

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Plan No.	Title
64-1001	Joe's Hill Talc Deposit Part Section 321, [illegible] Belvidere [illegible] Hundred [illegible] Geological [illegible]

Rept. Bk. No. 59/131
G.S. No. 3027
D.M. 56/64

30/11/64.

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ABSTRACT

At Joe's Hill, boring has penetrated a zone of clayey talc which contains unpredictable pockets of economically recoverable talc. The talc and the associated jasper beds have formed from a dolomitic country rock. The average talc content within the lode is 75%. It is recommended that the pockets of cleaner, higher quality talc be selectively mined as a large scale open cut operation does not appear to be feasible.

INTRODUCTION

The deposits of talc in the locality known as Joe's Hill were first brought to notice when a number of hand auger holes were bored by Mr. E.A. Linke on Section 321, Hundred of Belvidere and Section 87, Hundred of Dutton, three miles north of Truro and 60 miles by road northeast of Adelaide. A shaft was subsequently sunk and other samples were submitted to the Australian Mineral Development Laboratories for petrological examination (See Appendix III).

Mr. T.E. Christianos was granted right of entry to test the talc deposit under geological supervision following an inspection by the Warden (J.W. Thoroughgood) and the writer on the 12th February, 1964.

The sites for 32 Gemco auger holes were pegged and the accompanying Plan No. 64-1001 prepared from a stadia theodolite survey by J. Erkelens (Surveyor). Complete geological logs of the boreholes are appended.

Selected samples were submitted to Australian Mineral Development Laboratories for determination of magnesia content (MgO), the results of which are also appended. Outcrop samples were examined by D. Smale (Mineralogist, A.M.D.L.) and the borehole samples by D.F. Ayres (Mineralogist, A.M.D.L.) (See

Appendix III).

PREVIOUS REPORTS

Dickinson, S.B. et al. (1951): Talc Deposits in South Australia. Geol. Surv. of S.A. Bull no. 26.

Johns, R.K. (1962): Truro Talc Deposit. Mining Review no. 113 p. 72.

Nixon, L.G.B. (1961): Mt. Fitton Talc Deposits No. 4, No. 3 and Leslie Deposits. Mining Review no. 112, p. 5-13.

REGIONAL GEOLOGY

The talc has formed in carbonate host rocks of Lower Cambrian age, near the boundary with the underlying Upper Proterozoic shales and glacial sediments (See Locality Plan No. 64-1001).

Cambrian sandstones and siltstones, which outcrop to the west, are succeeded by blue-black carbonaceous slates and sandstones and siltstones of the Kanmantoo Group. The strata have been folded into a series of synclines and anticlines with axes trending north-south.

Mineralisation is widespread in the area. Barite lodes occur in the Proterozoic rocks while Cambrian sediments contain workable deposits of talc, asbestos and phosphate.

Recent alluvium mantles the floor of the valley in which the township of Dutton is located.

RESULTS OF BORING

The results of boring are summarised below and represented graphically on the cross sections (plan no. 64-1001).

Borehole No.	Loam (feet)	Talc (feet)	Waste (feet)
28H	0-4	4-38	38-40
28J	0-6	6-9	9-
28L	0-3	-	3-39
		39-51	-
28O	0-11	11-54	-
28P	0-3	-	3-27
30B	0-9	9-33	-
30D	0-9	9-33	-
30F	0-4	4-33	-
30H	0-6	6-12	12-39
		39-99	-
Shaft	0-5	5-10	-
30K	0-4	4-51	-
30L	0-3	3-8	8-9
30N	0-6	6-40	-
30P	0-6	6-33	33-39
32H	0-12	-	12-30
32J	0-12	-	12-42
32L	0-4	4-93	93-100
32N	0-12	12-72	-
32P	0-6	6-27	27-36
34L	0-3	-	3-21
34N	0-6	6-51	51-57
34O	0-3	3-30	30-33
34P	0-3	3-9	9-18
34T	0-6	-	6-30
36L	0-6	-	6-15
36N	0-4	4-63	-
36P	0-19	19-40	-
38L	0-6	-	6-24
		24-33	-
38N	0-9	9-33	-
38P	0-9	-	9-33
40L	0-6	-	6-24
40N	0-6	6-36	-
40P	0-3	-	3-24
		24-33	-

Waste comprises layers within or enclosing the talc body which are contaminated with clay or jasper fragments. The maximum depth of talc was 89 ft. - from 4 to 93 feet in borehole no. 32L. Overburden represented by variegated brown clay-loam generally contains scattered talc flakes up to $\frac{1}{2}$" in diameter

Quartz sand and pebbles are abundant near the jasper beds.

THE TALC DEPOSIT

Chalcedonic and talcose quartzite are the only rock types which outcrop in the area mapped. The strike and dip of the strata could not be measured because of poor outcrop. However from borehole data a moderate dip to the south is apparent (see cross sections Plan No. 64-1001). The talc deposit is located on the eastern side near the crest of a major anticline and a southeasterly dip is expected.

All geological boundaries indicated on the cross sections were established by drilling and are approximately only as the boreholes were sampled at 3 ft. intervals.

The talc has formed between the jasper bed and soft green amphibolites and mica schists. The probably limits of the talc lode are indicated on the accompanying Plan No. 64-1001.

The field term jasper, used by Broadhurst (in Dickinson et al. 1951) to describe similar rocks in the Tumby Bay talc deposits is retained. Stillwell (op. cit.) on microscopic evidence defined the rocks as jasperiods - fine grained quartz aggregates or chalcedony derived from the replacement of calcareous rocks. D. Smale in Appendix III uses the synonymous term - chert.

Lenses of jasper within the talc and the transitional nature of the boundaries suggest that both formed at the same time from the action of siliceous solutions on an original dolomitic marble, the magnesia (MgO) in the talc being derived from the replaced host rock. The report of D. Smale (Mineralogist) on the samples collected from outcrops of jasper states:-

> "The most readily apparent feature of the petrogenesis of these rocks is that the talc has been derived from a pre-existing rock, as shown by the shape of the talc flakes and their expansion during a silicification. Though some of the quartz is detrital, most has probably been dissolved and re-deposited; some could have coexisted with the talc, provided that the environment was one in which talc was particularly insoluble. The chert could have been deposited at the surface from rising solutions deriving their silica from a lower layer. Recrystallization without solution is unlikely to account for the "frayed" ends of the talc flakes, or the emplacement of quartz between individual cleavage flakes."

The jasper in outcrop contains patches of pink feldspar and is intruded in places by veins of white quartz.

GRADE OF TALC

Partial chemical analyses of the higher grade samples from Joe's Hill are compared with analyses of talc from other deposits in South Australia in the following table.

	Theoretical Pure Talc	Tumby Bay	Gumeracha	Mt. Fitton	Joe's Hill		
					Shaft 5'-10'	Bore 30F 6'-24'	280 12'-48'
Magnesia (MgO)	31.70	30.53	28.23	32.06	29.6	27.0	26.5
Silica (SiO_2)	63.50	61.26	61.90	62.16			
Water above 100°C	4.80	4.90	4.66	4.51			
	100.00	96.69	94.79	98.73			

Major chemical impurities in the talc include alumina (Al_2O_3) iron oxides (FeO and Fe_2O_3) and minor soda (Na_2O) potash (K_2O) and moisture (water below 100°C).

Full details of semi-quantitative chemical assays for magnesia (MgO) are appended with the calculated maximum talc content, assuming that no other minerals containing MgO are present. The weighted mean magnesia content of the talc samples is 23% MgO which is equivalent to a 70 to 75% talc content. Samples classed as talcose clay were not included in this average.

The colour of the talc, which is dependent on the nature and quantity of aluminous clay and iron oxides present, varies from white to shades of grey, brown, orange, yellow and occasionally red. The colours are darker in the more clayey transitional zones between the talc and the jasper.

The major mineral contaminants in the talc are clay aggregates and fragments of jasper varying in size from sand to 3 inch pebbles, either disseminated or concentrated in layers.

Accessory minerals include muscovite (white mica), rutile (titanium dioxide TiO_2), sphene (titanium silicate $TiSiO_5$) and opaque iron oxides.

Aggregates and individual fibres of white asbestos up to ½ inch long were recorded in the following boreholes

30B	from	21	to	33	feet
30H		12	"	99	"
32L		75	"	78	"
40L		12	"	21	"
40N		15	"	24	"
40P		6	"	9	"

Third grade talc is being quarried at the Truro talc deposit, two miles south of Joe's Hill, by selective mining of the purer, less stained layers (Johns 1962).

RESERVES

Boring has proved 200,000 cubic yards of talc as indicated on the accompanying cross sections Plan No. 64-1001. The base of the talc was reached in only a few boreholes. Therefore the limits of the talc lode at depth are not generally known. Overburden and waste material which includes jasper bars and clayey patches within the talc body are estimated at 60,000 cubic yards.

CONCLUSIONS

At Joe's Hill, talc has formed from the action of siliceous solutions on an originally dolomitic marble, the magnesia (MgO) in the talc being supplied by the dolomite. The associated jasper beds are believed to have developed at the same time.

Boring has proved 200,000 cubic yards of clayey talc with 60,000 cubic yards of waste, although the talc body probably extends to the east and south beyond the area tested.

The talc content of the economic part of the deposit is estimated at 75% and this can best be exploited by selective

mining in the following areas:

(1) Adjacent to the shaft and Borehole No. 30K.

(2) Adjacent to borehole No. 28H.

(3) Adjacent to borehole No. 30F.

(4) The hollow in which borehole No. 28O was bored.

and (5) The zone from borehole No. 32N to Borehole No. 36N.

The occurrence of other pockets of high quality talc between the boreholes cannot be predicted.

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NON METALLICS SECTION

JGO:AGK
30/11/64

APPENDIX I

GEOLOGICAL LOGS OF BOREHOLES

LOG OF GEMCO BOREHOLE NO. 28H

PROJECT: Joe's Hill Talc Deposit.

SECTION: 321 **HUNDRED:** Belvidere **COUNTY:** Light

R.L.: 1417.2 feet **DEPTH:** 40 feet **DRILLER:** T.Briggs

LOGGED BY: J.G. Olliver **DATE:** 11/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Red-brown clay loam with scattered talc flakes.
3	6	Minor clay loam over light brown slightly clayey talc.
6	12	Light brown slightly clayey talc with flakes up to ¼ inch in diameter.
12	27	Light brown to orange clayey talc flakes and fragments of white soapstone with brown staining. Fragments of quartz in samples 24 to 30 ft. and 33 to 36 " 26.5% MgO from 6 to 27 feet.
27	36	Light brown talc flakes, darker and with more clay than above.
36	40	As for 27 to 36 feet with weathered grey schist at the base.

HOLE STOPPED AT 40 Feet.

LOG OF GEMCO BOREHOLE NO. 28J

PROJECT: Joe's Hill Talc Deposit

SECTION: 321 HUNDRED: Belvidere COUNTY: Light

R.L.: 1428.9 feet DEPTH: 9 feet DRILLER: T.Briggs

LOGGED BY: J.G. Olliver DATE: 11/5/64

DEPTH (FEET)		DESCRIPTION
From	To	
0	3'	Brown clay loam.
3	6	Light brown clay with talc flakes.
6	9	White talc with brown staining (21% MgO) at base light brown (iron stained) coarse aplitic sandstone - containing pink feldspar and vugghy quartz.

Rig stalled - Hole stopped at 9 feet.

LOG OF GEMCO BOREHOLE NO. 28L

PROJECT:	Joe's Hill Talc Deposit				
SECTION:	32l	HUNDRED:	Belvidere	COUNTY:	Light
R.L.:	1441.0 feet	DEPTH:	51 feet	DRILLER:	T.Briggs
LOGGED BY:	J.C. Olliver			DATE:	11/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Brown clay-loam with minor talc flakes.
3	6	Light orange clayey talc with fragments of white talc stone and pinkish white talcose quartzite.
6	9	Pale brown to white soft fine clay stone (2.3% MgO).
9	27	White soft fine claystone, talcose in parts with variegated brown staining. Occasional fragments of quartz.
27	33	As for 9 to 27 feet but darker in colour.
33	36	As for 9 to 27 feet but lighter and less clay.
36	39	As for 9 to 27 feet.
39	42	Orange talc flakes with some quartz fragments.
42	45	Light orange talc flakes.
45	51	Flaky talc stained brown, yellow, orange and rarely pink and purple. Darker and more clayey with depth. Occasional quartz fragments.

HOLE STOPPED AT 51 FEET.

LOG OF GEMCO BOREHOLE NO. 28Q

PROJECT: Joe's Hill Talc Deposit
SECTION: 321 HUNDRED: Belvidere COUNTY: Light
R.L.: 1452.0 feet DEPTH: 54 feet DRILLER: T. Briggs
LOGGED BY: J.G. Olliver DATE: 19/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	11	Dark brown talcose loam.
11	48	White to cream talc, clayey (26.5% MgO) Quartzite fragments up to 3 inches from 39 to 42 feet and 45 to 48 feet.
48	54	Grey clayey talc with abundant quartzite fragments.

HOLE STOPPED AT 54 feet

LOG OF GEMCO BOREHOLE NO. 28P

PROJECT: Joe's Hill Talc Deposit
SECTION: 321 HUNDRED: Belvidere COUNTY: Light
R.L.: 1438.7 ft. DEPTH: 27 feet DRILLER: T. Briggs
LOGGED BY: J.G. Olliver DATE: 19/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Red-brown sandy clay with angular grey quartzite pebbles up to 4 inches.
3	24	Orange gritty to gravelly sand, talcose. Paler with depth.
24	27	Orange gravelly sand, quartzite pebbles up to 2 inches.

RIG STALLED - HOLE STOPPED AT 27 Feet.

LOG OF GEMCO BOREHOLE NO. 30B

PROJECT: Joe's Hill Talc Deposit

SECTION: 321 HUNDRED: Belvidere COUNTY: Light

R.L.: 1400.3 feet DEPTH: 33 feet DRILLER: T.Briggs

LOGGED BY: J.G. Olliver DATE: 21/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	6	Brown clay loam.
6	9	Light brown clayey talc flakes.
9	12	Pale brown talc, less clay than above with some white patches.
12	21	Light to pale orange clayey talc.
21	27	Light orange clayey talc with occasional white asbestos fibres up to ½ inch long.
27	30	As above but small bundles of white asbestos fibres.
30	33	Light orange talcose clay with more asbestos and some quartzite fragments.

HOLE STOPPED AT 33 Feet.

LOG OF CENCO BOREHOLE NO. 30D

PROJECT: Joe's Hill Talc Deposit

SECTION: 321 HUNDRED: Belvidere COUNTY: Light

R.L.: 1402.0 feet DEPTH: 33 feet DRILLER: T.Briggs

LOGGED BY: J.C. Olliver DATE: 21/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	6	Dark brown loam with minor talc flakes.
6	9	Yellow-brown clay with minor talc flakes.
9	12	Dark red-purple very clayey talc flakes (20.5% MgO).
12	15	As above over yellow-brown talcose clay.
15	18	Yellow very clayey talc with purple patches and yellow-brown clay seams.
18	27	Orange clayey talc flakes.
27	33	Pale orange clayey talc flakes with hard white pellets of talcose sandstone.

HOLE STOPPED AT 33 Feet

LOG OF GEMCO BOREHOLE NO. 30F

PROJECT: Joe's Hill Talc Deposit

SECTION: 321 **HUNDRED:** Belvidere **COUNTY:** Light

R.L.: 1407.2 feet **DEPTH:** 33 feet **DRILLER:** T. Briggs

LOGGED BY: J.G. Olliver **DATE:** 21/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Brown loam with minor talc flakes.
3	6	Minor loam over pale brown talc flakes.
6	24	Cream to white talc flakes with some pebbles up to 2 inches from 9 to 12 feet - (27% MgO)
24	27	Pale fawn clayey talc flakes.
27	33	Light orange clayey talc flakes - darker with depth and some seams of brown clay at the base.

HOLE STOPPED AT 33 Feet.

LOG OF GEMCO BOREHOLE NO. 30M

PROJECT: Joe's Hill Talc Deposit

SECTION: 321 HUNDRED: Belvidere COUNTY: Light

R.L.: 1413.5 feet DEPTH: 99 feet DRILLER: T. Briggs

LOGGED BY: J.G. Olliver DATE: 6/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Brown loam.
3	6	Light brown clay with talc flakes.
6	12	Pale brown clayey talc flakes (22% MgO)
12	21	Light grey-brown clayey silt with white talc flakes and white asbestos fibres. Less talc with depth. (11.5% MgO)
21	24	Light brown silt with asbestos fibres and minor talc.
24	33	Pale brown silt with more asbestos than above and less talc.
33	39	Pale grey brown silt with less asbestos and more talc with depth. (20.5% MgO from 21 to 39 feet).
39	99	Pale yellow-brown clayey talc flakes (21% MgO) with occasional hard ferruginised fragments and scattered minor asbestos fibres. Fragments of quartz in 60 to 66 feet and 84 to 87 feet.

HOLE, STOPPED AT 99 Feet.

LOG OF GEMCO BOREHOLE NO. 30K

PROJECT: Joe's Hill Talc Deposit
SECTION: 321 HUNDRED: Belvidere COUNTY: Light
R.L.: 1424.4 feet DEPTH: 51 feet DRILLER: T.Briggs
LOGGED BY: J.G. Olliver DATE: 21/3/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Brown loam.
3	6	Loam over talc flakes.
6	9	Light orange clayey talc with seams of clay.
9	18	Cream to light orange clayey talc flakes. (25% MgO).
18	21	Cream talc flakes (23% MgO)
21	51	Pale orange to pale yellow and brown at depth clayey talc flakes (26% MgO) Fragments of quartzite from 21 to 39 feet.

HOLE STOPPED AT 51 Feet.

LOG OF GEMCO BOREHOLE NO. 30L

PROJECT: Joe's Hill Talc Deposit
SECTION: 321 HUNDRED: Belvidere COUNTY: Light
R.L.: 1428.3 feet DEPTH: 9 feet DRILLER: T.Briggs
LOGGED BY: J.G. Olliver DATE:

DEPTH (FEET) From	To	DESCRIPTION
0	3	Brown loam with minor talc flakes.
3	6	Yellow-brown very clayey talc over fine white talc.
6	9	Light brown clayey talc with hard felspathic sandstone at base.

RIG STALLED - HOLE STOPPED AT 9 Feet.

LOG OF GEMCO BOREHOLE NO. 30N

PROJECT: Joe's Hill Talc Deposit

SECTION: 321 **HUNDRED:** Belvidere **COUNTY:** Light

R.L.: 1437.9 feet **DEPTH:** 40 feet **DRILLER:** T.Briggs

LOGGED BY: J.G. Olliver **DATE:** 14/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	6	Brown loam with talc flakes at base.
6	9	Cream fine talc flakes.
9	12	Orange-brown talc flakes with clay and quartz pebbles.
12	15	Light brown talc flakes with grit and pebbles.
15	18	Light orange clayey talc flakes.
18	21	Cream clayey talc flakes.
21	30	Pale brown to white clayey talc flakes with minor quartz grit and gravel.
30	33	Pale pink-brown very fine talc flakes - very clayey with some white patches.
33	36	White fine talc with some light brown patches.
36	40	Light pink-brown talc flakes with white patches and sand, grit and gravel.
		17% MgO from 15 to 40 feet

HOLE STOPPED AT 40 Feet.

LOG OF GEMCO BOREHOLE NO. 30P

PROJECT: Joe's Hill Talc Deposit

SECTION: 321 **HUNDRED:** Belvidere **COUNTY:** Light

R.L.: 1451.5 FEET **DEPTH:** 39 feet **DRILLER:** T.Briggs

LOGGED BY: J.G. Olliver **DATE:** 14/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	6	Brown clay loam with minor talc flakes.
6	9	Orange very clayey talc.
9	12	Pale orange clayey and slightly sand talc.
12	15	Pale brown clayey talc.
15	27	Cream to light yellow clayey talc (25% MgO) with some darker brown patches and quartzite pebbles up to 3 inches.
27	33	Yellow talc, more clayey than above with brown patches of clay and quartzite pebbles.
33	39	Pale brown talcose clay with white patches and minor quartzite grit and pebbles.

HOLE STOPPED AT 39 Feet.

LOG OF GEMCO BOREHOLE NO. 32H

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1406.9 feet DEPTH: 30 feet DRILLER: T. Briggs

LOGGED BY: J.G. Olliver DATE: 5/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	9	Brown clay loam over light brown clay.
9	12	Dirty brown talcose clay.
12	30	Grey brown green and yellow clay - minor talc flakes from 12 to 15 feet.

HOLE STOPPED AT 30 Feet.

LOG OF GEMCO BOREHOLE NO. 32J

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1411.7 feet DEPTH: 42 feet DRILLER: T. Briggs

LOGGED BY: J.G. Olliver DATE: 5/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	5	Red-brown clay loam.
5	12	Yellow clayey silt with minor sand and talc flakes.
12	42	Dirty green-grey mica schist.

HOLE STOPPED AT 42 Feet.

LOG OF GEMCO BOREHOLE NO. 32L

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1413.1 feet DEPTH: 100 feet DRILLER: T. Briggs

LOGGED BY: J.C. Olliver DATE: 5/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Red-brown to brown clay loam with talc flakes.
3	6	Mid-brown very clayey talc flakes.
6	15	Light brown to white clayey talc flakes - pinkish at base.
15	18	Light yellow clayey talc. (24% MgO from 6 to 18 feet).
18	42	Pale to light red clayey talc flakes with fragments of quartzite up to 3 inches from 30 to 33 feet.
42	51	Cream clayey talc.
51	60	Pale orange to red clayey talc. (25.5% MgO from 18 to 60 feet).
60	75	Yellow clayey talc (23% MgO) with quartzite fragments from 63 to 72 feet.
75	93	Light yellow-brown clayey talc. (20.5% MgO) with less talc and more clay with depth. Hard fragments containing white asbestos fibres from 75 to 78 feet.
93	100	Light yellow-brown talcose clay.

LIMIT OF RIG - HOLE STOPPED AT 100 Feet.

LOG OF GEMCO BOREHOLE NO. 32N

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 **HUNDRED:** Dutton **COUNTY:** Eyre

R.L.: 1422.8 feet **DEPTH:** 72 feet **DRILLER:** T. Briggs

LOGGED BY: J.G. Olliver **DATE:** 11/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	9	Brown loam, abundant talc flakes from 6 to 9 feet.
9	12	Yellow brown talcose clay.
12	15	White to brown clayey talc flakes.
15	18	Light yellow-brown clayey talc with quartzite fragments up to 1 inch.
18	42	White and brown clayey talc with quartzite fragments in intervals 21 to 24 feet and 39 to 42 feet (23% MgO from 12 to 42 feet).
42	54	Cream to white clayey talc flakes (23% MgO).
54	60	Pale orange clayey talc. (24% MgO).
60	72	Green to grey fine talc flakes, darker and more clayey with depth.

HOLE STOPPED AT 72 Feet.

LOG OF GENCO BOREHOLE NO. 32P

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1440.5 feet DEPTH: 36 feet DRILLER: T. Briggs

LOGGED BY: J.G. Olliver DATE: 14/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	6	Brown loam over clayey talc.
6	18	Cream very clayey talc with white and brown patches and quartzite pebbles.
18	21	Cream clayey talc with sand and grit.
21	24	Cream clayey talc with abundant sand to 2 inch pebbles. (12% MgO).
24	27	As above with more talc (18.5% MgO)
27	36	Cream clayey sand with grit, gravel and talc. Less talc with depth.

HOLE STOPPED AT 36 Feet.

LOG OF GEMCO BOREHOLE NO. 34L

PROJECT: Joe's Hill Talc Deposit
SECTION: 87 HUNDRED: Dutton COUNTY: Eyre
R.L.: 1403.1 feet DEPTH: 21 feet DRILLER: T. Briggs
LOGGED BY: J.G.Olliver DATE: 14/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Brown loam.
3	21	Variegated brown and green sandy clay.

HOLE STOPPED AT 21 Feet.

LOG OF GEMCO BOREHOLE NO. 34N

PROJECT: Joe's Hill Talc Deposit
SECTION: 87 HUNDRED: Dutton COUNTY: Eyre
R.L.: 1412.0 feet DEPTH: 57 feet DATE: 14/5/64
LOGGED BY: J.G. Olliver DRILLER: T.Briggs

DEPTH (FEET) From	To	DESCRIPTION
0	6	Brown loam with minor talc flakes and quartzite pebbles.
6	24	White clayey talc with brown patches to light brown clayey talc. (17% MgO).
24	42	White to cream clayey talc flakes (20% MgO)
42	51	Pale orange clayey talc (darker with depth (21.5% MgO)
51	57	Light grey-brown talcose clay. (13% MgO).

HOLE STOPPED at 57 Feet.

LOG OF GEMCO BOREHOLE NO. 340

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 **HUNDRED:** Dutton **COUNTY:** Eyre

R.L.: 1420.3 feet **DEPTH:** 33 feet **DRILLER:** T. Briggs

LOGGED BY: J.G. Olliver **DATE:** 29/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Minor loam over light brown clayey talc.
3	6	Pale brown clayey talc.
6	24	White to cream clayey talc with minor brown patches. (22.5% MgO).
24	33	Light orange to yellow clayey talc, more clay with depth and a few pieces of 1 inch quartzite from 27 to 33 feet.

HOLE STOPPED AT 33 Feet.

LOG OF GEMCO BOREHOLE NO. 34P

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1429.5 feet DEPTH: 18 feet DRILLER: T.Briggs

LOGGED BY: J.G. Oliver DATE: 14/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Minor loam over light red clay containing abundant talc flakes and some talc pebbles.
3	6	Light brown very clayey talc with a few quartzite fragments.
6	9	Pale brown very clayey talc - less clay than above with a few quartzite fragments. (17% MgO).
9	12	Light brown sandy and very clayey talc.
12	15	Light brown clayey sand with grit and quartzite fragments up to 3 inches and abundant talc flakes.
15	18	Dark red-brown clayey sand with grit, gravel and minor talc.

RIG STALLED - HOLE STOPPED AT 18 Feet.

LOG OF GEMCO BOREHOLE NO. 34T

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1443.5 feet DEPTH: 30 feet DRILLER: T. Briggs

LOGGED BY: J.G. Olliver DATE: 11/3/64

DEPTH (FEET) From	To	DESCRIPTION
0	6	Brown loam with 3 inch quartzite fragments.
6	12	Light brown clayey sandstone with fragments of quartz up to 2 inches - Minor talc.
12	21	Cream sandy and clayey talc with minor grit and quartz fragments up to 1 inch. (14% MgO).
21	30	Cream sand, grit and gravel - minor talc flakes. (4.5% MgO).

HOLE STOPPED AT 30 Feet.

LOG OF GEMCO BOREHOLE NO. 36L

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1396.4 feet DEPTH: 15 feet. DRILLER: T.Briggs

LOGGED BY: J.G.Olliver DATE: 21/3/64

DEPTH (FEET) From	To	DESCRIPTION
0	6	Brown clay loam with minor talc flakes.
6	12	Green gritty clay.
12	15	Green weathered schist.

HOLE STOPPED AT 15 Feet.

LOG OF GEMCO BOREHOLE NO. 36N

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1400.5 feet DEPTH: 63 feet DRILLER: T.Briggs

LOGGED BY: J.G. Olliver DATE: 63 feet

DEPTH (FEET) From	To	DESCRIPTION
0	4	Brown loam.
4	6	Light orange clayey talc.
6	30	White to cream clayey talc (26% MgO).
30	42	Light yellow to light orange clayey talc (21% MgO).
42	34	Cream to white clayey talc (23.5% MgO).
34	63	As above but darker with depth and fragments of quartzite. Less talc with depth. (17.5% MgO).

HOLE STOPPED AT 63 Feet.

LOG OF GEMCO BOREHOLE NO. 36P

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1413.5 feet DEPTH: 40 feet DRILLER: T.Briggs

LOGGED BY: J.G.Oliver DATE: 19/3/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Light brown gravelly loam.
3	6	Light brown clayey sand with pebbles up to 2 inches and scattered talc flakes.
6	19	Brown clayey and gritty sand.
19	24	White fine clayey talc with some quartzite fragments up to 1 inch. (20.5% MgO).
24	40	Light orange clayey talc with sand and gravel. Less talc with depth as colour becomes darker.

HOLE STOPPED AT 40 Feet.

LOG OF GEMCO BOREHOLE NO. 38L

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1387.9 feet DEPTH: 33 feet DRILLER: T.Briggs

LOGGED BY: J.G. Olliver DATE: 21/3/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Brown clay loam with minor talc flakes.
3	6	As above over yellow brown clay minor talc.
6	18	Yellow-brown to green weathered mica schist. Minor talc flakes at 15 to 18 feet.
18	21	Brown talcose schist.
21	24	Khaki very clayey talc.
24	33	Variegated clayey talc.

HOLE STOPPED AT 33 Feet.

LOG OF GEMCO BOREHOLE NO. 38N

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1391.3 feet DEPTH: 33 feet DRILLER: T.Briggs

LOGGED BY: J.G. Olliver DATE: 21/3/64

DEPTH (FEET) From	To	DESCRIPTION
0	6	Brown clay loam with talc flakes, more abundant with depth.
6	9	Light brown clayey talc with seams of brown clay.
9	15	White clayey talc (26% MgO)
15	33	Cream to pale orange clayey talc with white patches and minor quartzite fragments. (21% MgO).

HOLE STOPPED AT 33 Feet.

LOG OF GEMCO BOREHOLE NO. 38P

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 **HUNDRED:** Dutton **COUNTY:** Eyre

R.L.: 1404.5 feet **DEPTH:** 33 feet **DRILLER:** T. Briggs

LOGGED BY: J.G.Olliver **DATE:** 21/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Brown loam.
3	6	Mottled brown clayey sand with minor talc flakes.
6	9	Pink-brown clayey and sandy talc with fragments of white talcose sandstone.
9	18	White to cream sandy and very talcose clay with hard quartzite fragments.
18	30	Cream clayey and silty talc with abundant quartzite fragments.
30	33	As above with less talc.

HOLE STOPPED AT 33 Feet.

LOG OF GEMCO BOREHOLE NO. 40L

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1379.9 feet DEPTH: 24 feet DRILLER: T. Briggs

LOGGED BY: J.C. Olliver DATE: 21/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	6	Brown clay loam with scattered talc flakes.
6	12	Pale brown to white talcose sandstone with layers of grey quartzite.
12	18	Pale brown clayey talc with sand and gravel, and blue grey clay containing asbestos fibres at base.
18	21	Mottled blue-grey brown and yellow clay with abundant talc and minor asbestos.
21	24	Brown clay with minor talc flakes.

HOLE STOPPED AT 24 Feet.

LOG OF GEMCO BOREHOLE NO. 40N

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 HUNDRED: Dutton COUNTY: Eyre

R.L.: 1383.7 feet DEPTH: 36 feet DRILLER: T. Briggs

LOGGED BY: J.G.Olliver DATE: 21/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	6	Brown clay loam with talc flakes at depth.
6	12	Orange clayey talc flakes - less clay with depth.
12	15	Light brown clayey talc with quartzite pebbles.
15	24	Pale orange clayey talc with white patches and scattered asbestos fibres.
24	30	Pale orange to white clayey talc with seams of clay.
30	33	Pale yellow clayey talc - abundant quartzite fragments.
33	36	As above but pale orange.

HOLESTOPPED AT 36 Feet.

LOG OF GEMCO BOREHOLE NO. 40P

PROJECT: Joe's Hill Talc Deposit

SECTION: 87 **HUNDRED:** Dutton **COUNTY:** Eyre

R.L.: 1394.8 feet **DEPTH:** 33 feet **DRILLER:** T.Briggs

LOGGED BY: J.G. Olliver **DATE:** 21/5/64

DEPTH (FEET) From	To	DESCRIPTION
0	3	Brown loam.
3	9	Mottled light brown clayey sand with minor blue-grey clay containing asbestos fibres from 6 to 9 feet.
9	18	Yellow-brown sandy clay.
18	24	White to pale brown talcose sandy claystone - more talc with depth.
24	30	Pale orange clayey talc flakes.
30	33	Orange-brown clayey talc with a few quartzite fragments.

HOLE STOPPED AT 33 feet.

APPENDIX II

RESULTS OF PARTIAL CHEMICAL ANALYSES

Sample No.	Borehole	Depth (feet)	% MgO	Calculated max. % Talc.
A 2205/64	28H	6-27	26.5	82
A 2206/64	28J	6-9	21	66
A 2207/64	28L	6-9	2.5	8
A 2155/64	28O	12-48	26.5	82
A 2208/64	30D	9-12	20.5	65
A 2209/64	30F	6-24	27	84
A 2210/64	30H	6-12	22	69
A 2241/64		12-21	11.5	36
A 2242/64		21-39	20.5	65
A 2211/64		39-99	21	66
A 2153/64	Shaft	5-7	29	91
A 2154/64	Shaft	7-10	30	95
A 2212/64	30K	9-18	25	77
A 2213/64		18-21	23	73
A 2214/64		21-51	26	81
A 2215/64	30N	15-39	17	54
A 2216/54	30P	15-27	25	77
A 2217/64	32L	6-18	24	75
A 2218/64		18-60	25.5	79
A 2219/64		60-75	23	73
A 2220/64		75-93	20.5	65
A 2222/64	32N	12-42	23	73
A 2156/64		42-54	23	73
A 2223/64		54-60	24	75
A 2224/64		60-72	17.5	55
A 2225/64	32P	21-24	12	38
A 2226/64		24-27	18.5	58
A 2227/64	34N	6-21	17	54
A 2204/64		24-42	20	63
A 2228/64		42-51	21.5	68
A 2229/64		51-57	13	40
A 2230/64	34O	6-24	22.5	71
A 2231/64	34P	6-9	17	54
A 2232/64	34T	12-21	14	44
A 2233/64		21-30	4.5	14
A 2234/64	36N	6-30	26	82
A 2235/64		30-42	21	66
A 2236/64	36N	42-54	23.5	74
A 2237/64		54-63	17.5	55
A 2238/64	36P	21-24	20.5	65
A 2239/64	38N	9-15	26	81
A 2240/64		15-33	21	66

APPENDIX III

PETROLOGICAL DESCRIPTIONS

by

D. E. Ayres, Mineralogist (A.M.D.L.)
and D. Smale, " "

Description of samples collected from the shaft and submitted on 17th August, 1962.

There is very little but talc in any of the three specimens.

P1212/62: No.2: 5' depth

In this specimen there are traces of rutile, carbonate, and an alkali feldspar, and occasional grains of limonite-stained clay material. Occasional flakes of muscovite may be present. Impurities are unlikely to exceed 0.5 per cent.

P1213: No.1: 8' depth

Of the three samples this is the least pure, though still containing probably at least 99 per cent talc. Limonite has stained most of the talc flakes to a small extent, and small fragments of limonite-stained clay material are commoner than in the other two specimens. There are present traces of rutile, carbonate, and spinel or garnet.

P1214: No.3: 19' depth

This is very similar to P1212/62. It contains traces of rutile, carbonate, and an alkali feldspar, and occasional grains of limonite-stained clay material. Occasional flakes of muscovite may be present. Impurities would be unlikely to exceed 0.5 per cent.

Report by: D. Smale (Mineralogist)

Description of Borehole Samples

The samples were sieved through 100 and 200 mesh (BSS) screens and examined by oil immersion mounts.

P247/64: Shaft 5-7 feet

This is a clean, white sample. The + 100 mesh fraction (more than 30% of the sample) is predominantly talc with a few quartz grains. In + 200 mesh fraction, the major constituent is talc (70%). Muscovite and fine grained (?) clay aggregates are minor constituents whilst rutile is present in trace amounts.

P248/64: Shaft 7-10 feet

This is a much cleaner talc sample. Talc (95%) is a major constituent whilst muscovite is present in minor amount. Accessories are minute opaques and sphene. Rare talc flakes in this sample are tinged yellow.

P249/64: Bore 28O, 12-48 feet

This is a brown-coloured sample consisting predominantly of talc (80%) with minor muscovite and ?clay aggregates. Rutile and cryptocrystalline silica are accessories. The talc is heavily iron-stained with either minute opaque inclusions present or yellowish stains on the surface of the flakes.

P253/64: Bore 32N, 42 - 54 feet.

The + 100 mesh fraction (approximately 2/3 of the sample) consists of quartz fragments and clay lumps with stained talc flakes (70%) giving a mid-brown colour.

The + 200 mesh fraction is also brown coloured and consists predominantly of talc (85%) which is more heavily iron-stained than P249. Muscovite occurs in minor amount and minute opaques are included in many talc flakes.

P254/64: Bore 34N, 24 - 42 feet

As for P253, the + 100 mesh fraction represents about 2/3 of the sample which is lighter coloured than above. Talc (50%) with quartz grains up to ¼ inch and clay aggregates are present.

The +200 mesh fraction is essentially talc (85%) which is heavily iron stained. Muscovite is a minor constituent. Aggregates of fine opaques and sparse quartz are accessory constituents.

Report by: D.E. Ayres (Mineralogist)

Description of talc-silica rocks collected from outcrop at Joe's Hill Talc Deposit

P197/64: JHT1: TS13929

This is mainly fine quartzite or chert, with 5 to 10 per cent of talc scattered through the rock in flakes 0.3 to 3 mm long. About 75 per cent of the rock consists of chert, much with a grain size of 0.01 to 0.05 mm, though finer material with a grain size of 0.001 to 0.01 mm forms mottling patches 0.1 to 0.7 mm across. Strained quartz grains 0.1 to 1 mm across are scattered irregularly through the rock, forming 10 to 15 per cent of it. They have apparently been broken in addition to being strained, but the chert has crystallized around them, and the rock is thoroughly cemented.

Elongated vugs are not uncommon, generally up to 1 mm across and 5 mm long, forming about 5 per cent of the volume of the rock. They are surrounded by a banded chalcedonic rim with a regular thickness of 0.02 mm. The shape of the vugs suggests that something may have been leached from them. Rare vugs appear to have been filled probably by amorphous silica, coloured light brown by minute specks considerably less than 1 micron across (probably nearer 0.1 micron); they may consist of ferruginous material, though the possibility of their being titaniferous cannot be discounted.

Most of the talc grains have been severely deformed; the chert has crystallized around them, and sometimes between individual cleavage flakes. Very fine-grained ferruginous material forms less than 1 per cent of the rock.

P198/64: JHT2: TS13930

This is a talc-quartz rock, consisting of approximately equal quantities of talc and quartz. The talc has a rather distinctive form; though some of it occurs as flakes, much appears to be in somewhat rounded grains about 0.15 mm across. The larger flakes may be as much as 10 mm long. Cleavage flakes of the rounded grains and edges of the larger flakes have been expanded, and quartz has crystallized between them. Much of the quartz is chalcedonic, and varies in grain size as the talc. Fine-grained ferruginous material forms less than 1 per cent of the rock.

The softness of the hand specimen is due to the fine intermixing of quartz and talc; thus the apparent hardness, at least of the finer parts, is intermediate between those of quartz and talc.

It can be clearly seen that there have been two dominant effects in the history of this rock:

1. Brecciation of the original talc rock;
2. silicification, in which individual cleavage flakes were forced apart by the crystallization of quartz between them.

P199/64: JHT3: TS13931

This is a chert-talc-quartz rock consisting of approximately equal quantities of silica and talc. As in the preceding specimen the talc has been considerably deformed, and between the individual cleavage flakes varying amounts of silica have been deposited. Within some of the larger, more expanded flakes (which were probably up to 10 mm long) the silica is in the form of quartz, with a grain size of 0.02 to 0.25 mm. There can be no question that the grains have crystallized in situ, as they all are considerably elongated parallel to the talc flakes, although the crystallographic orientation of

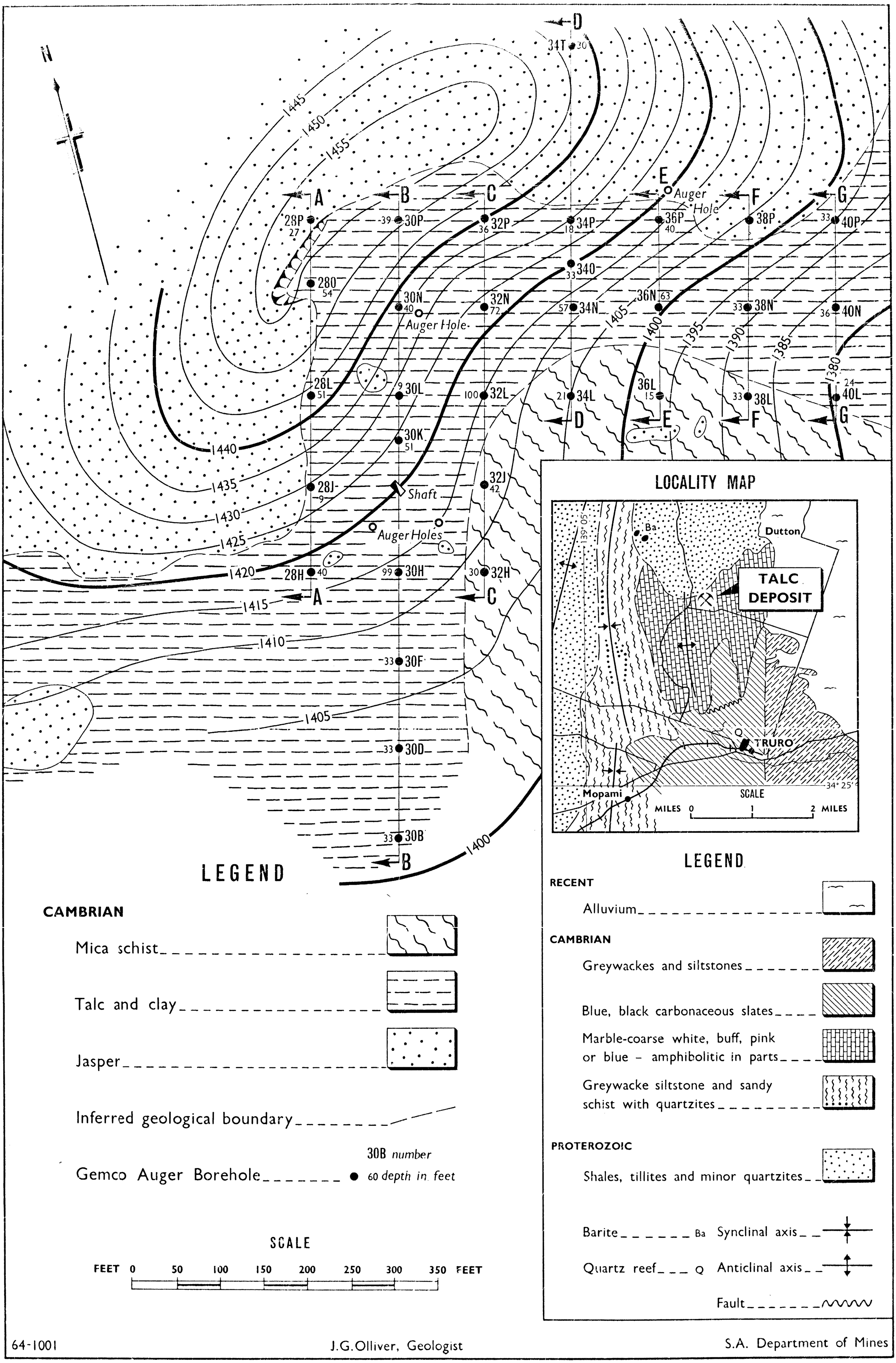
the grains bears no relation to this direction. In most of the rock, however, the silica is in the form of chert. The talc flakes in the chert have been expanded very little, and are generally fairly small (0.2 to 1 mm long); possibly in this part of the rock brecciation has been the main effect.

In the hand specimen it can be seen that a few of the large talc flakes are relatively pure, and likewise there are some patches of almost pure chert varying in size up to more than 10 mm across. Vugs are fairly common 0.1 to 3 mm across; finer ones are not common, however.

P200/64: JHT4: TS13932

This is similar to JHT1; about 10 to 15 per cent consists of talc, and the rest is quartz. In general the grain size of the quartz is 0.01 to 0.5 mm, but about 30 per cent of it is chert with a grain size of only 0.002 to 0.01 mm. The finer material produces a mottling effect, the mottle-size being about 0.25 mm. Much of the quartz is chalcedonic, forming irregular vein-like bodies, or juxtaposed with some of the larger talc flakes. The talc flakes are generally 0.1 to 1 mm long; some have obviously been expanded by the quartz, but not to the same extent as in the two preceding specimens. Fine-grained opaques form 1 to 2 per cent of the rock.

Report by: D. Smale (Mineralogist).



LOCALITY MAP

LEGEND

CAMBRIAN

Mica schist

Talc and clay

Jasper

Inferred geological boundary

Gemco Auger Borehole — 30B *number* ● 60 *depth in feet*

SCALE

FEET 0 50 100 150 200 250 300 350 FEET

LEGEND

RECENT

Alluvium

CAMBRIAN

Greywackes and siltstones

Blue, black carbonaceous slates

Marble-coarse white, buff, pink or blue – amphibolitic in parts

Greywacke siltstone and sandy schist with quartzites

PROTEROZOIC

Shales, tillites and minor quartzites

Barite Ba

Quartz reef Q

Synclinal axis

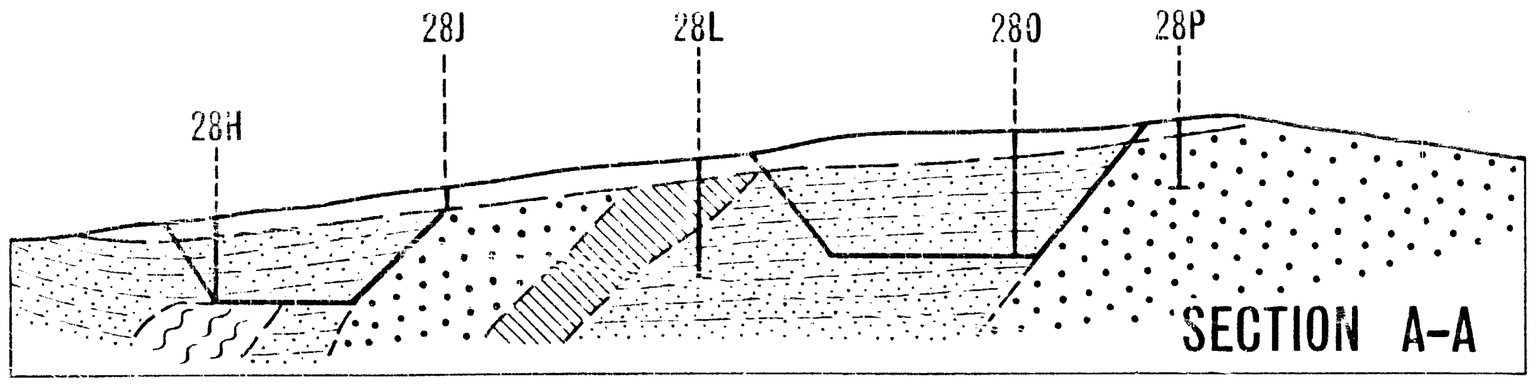
Anticlinal axis

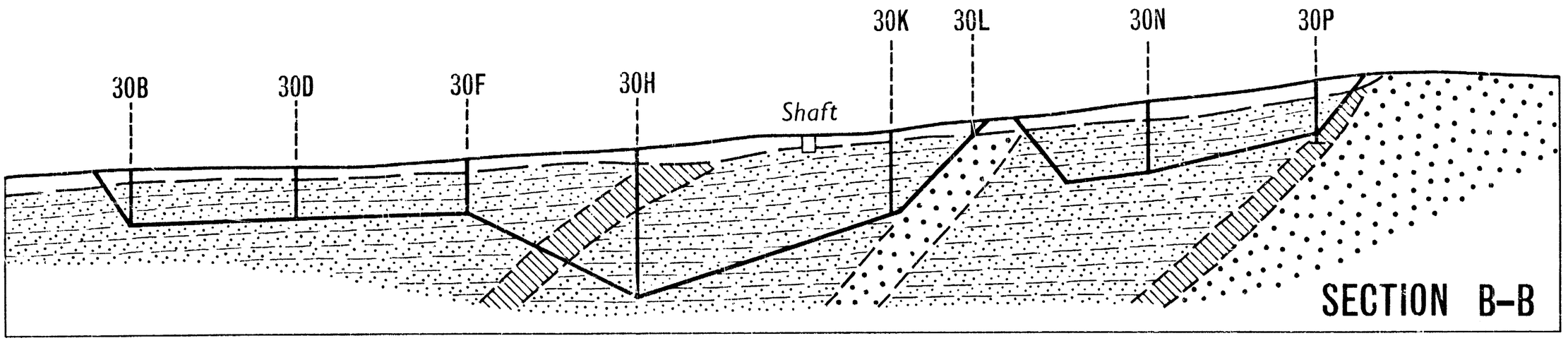
Fault

64-1001

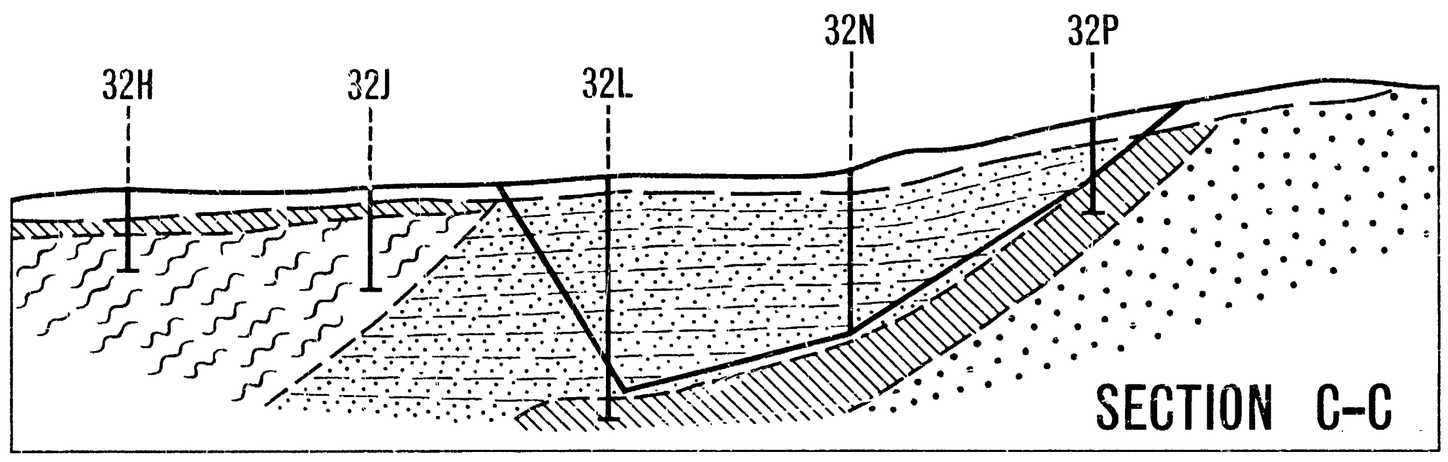
J.G.Olliver, Geologist

S.A. Department of Mines





VERTICAL SCALE IN FEET



LEGEND

RECENT

Loam with talc flakes

CAMBRIAN

Mica schist

Talc and clay (probable limits)

Talcose clay

Jasper

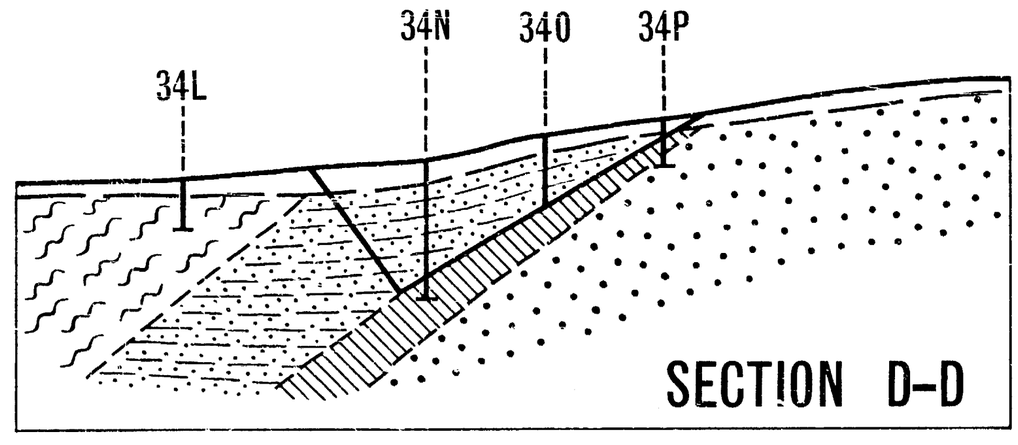
Geological boundaries

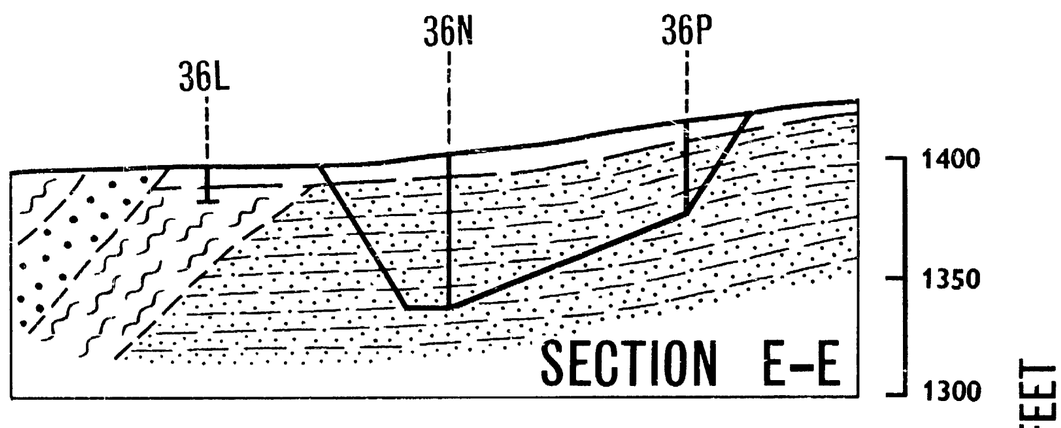
Approximate

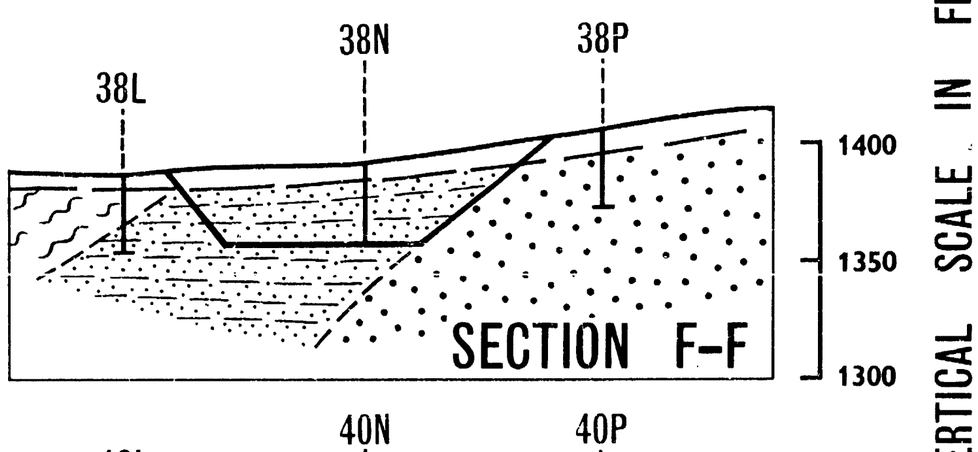
Inferred

Gemco Auger Borehole

Area of calculated reserves







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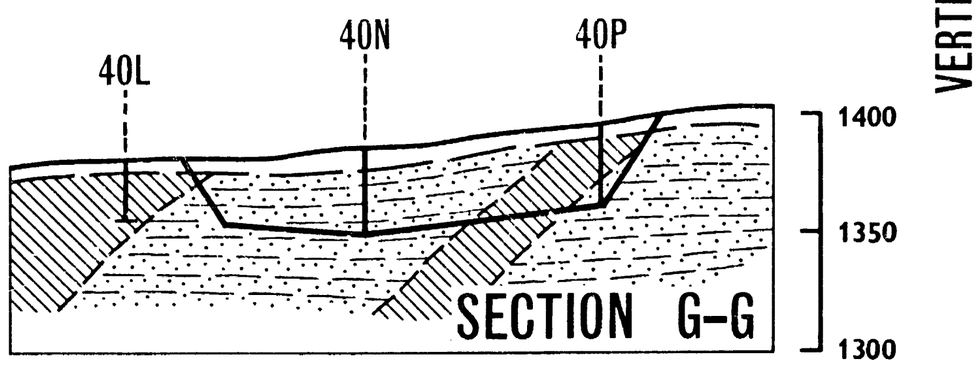

SCALE

FEET 0 50 100 200 300 FEET

64 – 1001A

J.G. Olliver, Geologist

S.A. Department of Mines