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ANNUAL REPORT

E.L.25/88 (DIP RANGE)

for

MINERAL HOLDINGS AUSTRALIA PTY. LTD.

89-3047
Vol 1 of 2

89-3047

EL25/88	
Author	Initials
LETTER	
9.11.'89	
REFERS	
Resubmit to	Date

November 1989

Vic Threader and Associates Pty. Ltd.
Kingston Beach.

C O N T E N T S

Abstract

Location and Access

Geology

Exploration

 Previous

 Current

 Future

Figures

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2. Regional Geology (L. & M. after Gee)
3. Location of Quartzite in Mineral Lease area
4. Sections along strike and dip of Quartzite
5. Prospecting for silica in E.L.25/88
6. Grain size analyses of sand (3 localities)
7. Detail of proposed exploration (1989-90)

Abstract

A Precambrian quartzite deposit has been previously investigated as a potential feedstock for silicon manufacture. The area was rejected on the grounds of insufficient reserves. Further investigation has indicated that the Dip Range contains a significant reserve of silica sand suitable for glass manufacture and of quartzite suitable for ferrosilicon. The resource may also yield a higher quality quartzite fraction suitable for silicon manufacture. Additional exploration and testing required to determine the reserves of these products and gauge the potential for beneficiation is itemised.

Location and Access

Dip Range lies about 6 km. south of Montumana on the Bass Highway and some 20 km. from Pt. Latta. It is reached by a steep access four-wheel drive track but a better grade road has now been constructed along the valley of Hogarth Creek.

Geology

An Upper Proterozoic sedimentary sequence referred to as the Rocky Cape Group occupies the area. (Gee 1971)

The stratigraphy is summarised thus:

	<u>Thickness</u>
Jacob Quartzite	1130 m.
Irby Siltstone	760
Detention Sub Group	1400
Cave Quartzite	
Port Slate	
Bluff Quartzite	
Cowrie Siltstone	2440+

The Detention sub group are the rocks of interest and their boundaries are indicated on Fig.2 (the thickness is 1000m. as measured in Fig.3).

Gee describes this unit as a uniformly fine grained orthoquartzite with a granular to glassy texture depending on the degree of cementation. He states that it consists of 99% quartz grains with a quartz cement. Some accessory minerals are also present including haematite.

In some road cuttings up to 10% feldspar or 4% mica was observed (Sisters Hills area, to the north of the E.L.).

The influence of rock type on slope development is clearly evident in Dip Range where resistant cap rock (silcrete) has created a series of Hogsbacks, of which the main "quartzite" ridge is a prime example. Recognition of this landform is a useful indicator in exploration in the area.

Exploration

Previous: This area has been held by Mineral Holdings Australia Pty. Ltd. since 1960.

Surface sampling led to a joint venture agreement with B.H.P. to investigate Maynes Creek Prospect. This and Pokes Road Prospect are remnants of the Jacob Quartzite member which has been elsewhere eroded from the sequence. They occur outside (respectively east and south) of the reduced area of E.L.43/70 (north). B.H.P. carried out a limited percussion drilling programme and blasted a bulk sample from the SW end of the Maynes Creek Prospect. The grain size and chemical purity of the samples did not meet their requirements and the company withdrew from the venture.

In 1981-82, Longworth and McKenzie carried out a programme of costeaning, percussion drilling, hammer seismic traverses and diamond drilling for Kaiser Aluminium under a joint venture agreement with M.H.A.

Summary Logs of Percussion Holes on Investigation Sites

<u>Site No.</u>	<u>B.H. No.</u>	<u>Depth (m)</u>	<u>Description</u>	<u>Reasons for Termination</u>
1	1	12	White sand	Rods jamming
	2	15	White sand	Target depth
	3	9	White sand with some chips at surface	Rods jamming
	4	15	White sand	Target depth
2	5	15	White sand, mixed with sandstone chips below 12	Target depth
	6	7	White sand (very rapid drilling)	Too soft
	7	15	" " " " "	Target depth
	8	15	" " " " "	" "
	9	15	" " " " "	" "
	10	15	" " " " "	" "
	11	15	Cream to brown sand and some siltstone	" "
3	15	15	0-5 white quartzite, remainder white and yellow sand	" "
	16	15	White sand	" "
	17	15	White sandstone/quartzite	" "
	18	12	0-2.5 White sandstone 2.5-7.5 White sand 7.5-12 Brown quartzite	Too hard
4	19	15	0-2.5 White sand 2.5-15 White and brown sandstone/ quartzite	Target depth
	20	15	0-1.5 White sand 1.5-15 White and brown sandstone/ quartzite	" "
	21	14.25	0-1 White and brown sandstone and quartzite	Bit collapsed
	22	15	0-1 White sand 1.5-15 Brown and white sandstone	Target depth
	23	12	White and brown sandstone	Too hard
	24	15	0-2.7 White sand 2.7-15 White and brown sandstone	Target depth
	25	9	Light brown sand	Rods jammed
	5	26	12	White sand
27		6	" "	Bit breaking
6	12	15	White and brown sand and sandstone/siltstone	Target depth
	13	12	White sand, light brown sand from 3-6m.	Too wet
	14	15	White and brown quartzite	Target depth

Hammer seismic spreads were conducted by L. & M. in an effort to determine the depth of weathering. Their conclusions were that

the method did not produce consistent results but it did show that the weathering was widespread.

Diamond Drilling: In stage 3 of the L. & M. exploration programme, a limited diamond drilling programme was undertaken to "(1) Define the physical and chemical variations with depth in the quartzite/sandstone and (2) Provide a basis for realistic estimates of reserves."

Summary of Diamond Drillhole Logs:

	<u>Samples</u>
1. 0 - 10.5 sand and sandstone (60% recovery)	1, 2
10.5 - 11.7 brown/black sandstone	3
11.7 - 30.2 light brown highly silicified quartzite	4 - 9
30.2 - 36.1 iron-stained silicified silty sandstone	
2. 0 - 6.7 fine white sandstone	
6.7 - 17.7 thinly bedded brown and green shaley micaceous sandstone	
3. 0 - 6.5 Fine to medium white variably silicified sandstone - 85% friable	
6.5 - 27.6 Glassy thinly bedded extremely strong quartzite with micaceous material on bedding planes.	1,2,3,4,5,6,7
27.6 - 31 Grading down into interbedded quartzite and siliceous mica schist.	8,9
4. 0 - 1.4 Sand and slope wash	
1.4 - 2.3 black schist	
2.3 - 9.5 brown-grey quartzite with frequent bands of mica schist.	
9.5 - 11.2 black schist	
11.2 - 36.1 thinly bedded micaceous quartzite	

Longworth and McKenzie concluded that:

1. There has been deep weathering and variable secondary silicification.
2. Below the leached zone, the rocks are thinly bedded and decrease in purity with increasing depth, as illustrated in plots of Al_2O_3 and S_1O_2 against depth.

As a result of this work, L. & M. reported to Kaiser Aluminium that "no further exploration effort is recommended on the agreement area for silica of the specified physical and chemical quality."

Discussion: The purpose of the exploration by Kaiser Aluminium was to search for a lump silica resource for the production of ferrosilicon or silicon metal (see specification) and analytical testing was confined to sandstone and quartzite samples in the diamond drill holes.

In general, the Detention Quartzite was reported to be variably weathered to depths of 15m. and resilicified at the surface to produce a silicified (quartzite) cap and an underlying silica sand which grades down into impure sandstone and interbedded schist.

The L. & M. investigation can be summarised as a concentrated surface and near surface examination along two ridges. Most of this work was concentrated on the band of quartzite which extends from the Hogarths Creek cliffs to a similar outcrop 1300m. to the northeast.

It is considered that the exploration to date has not adequately defined the resource, and that with selective mining and sand beneficiation this deposit would have the potential to provide both lump quartzite and silica sand for silicon, ferrosilicon and glass manufacture. More exploration is required to confirm this.

June 1987. Three percussion holes were drilled along I.S.2 by Monier Ltd. Depths were: 12m, 9m, 9m in sand. Samples were taken at 3m. intervals and the company states that the material is suitable as an export quality glass sand. The mean Fe_2O_3 content of "as mined" material was stated to be 167 ppm (.0167%) in nine samples, and mean grain size distribution is indicated in curve A figure 6.

August 1987. An access road was constructed by M.H.A. to gain

access to cliffs of quartzite which were exposed in the gully of Hogarths Creek. These cliffs could contain 0.5 million t. of quartzite, but this has yet to be proven (or disproven) by drilling. A site has been bulk sampled at the westerly end of this quartzite exposure for testing by Temco and Pioneer Silicon.

Quartzite also crops out as cliffs at the northern end of the main ridge and the resource could probably be of the order of one million tonnes.

Current Exploration: During 1989-90 traverses were run through (1) freehold land in the northern portion of the E.L. to examine a large silicate exposure and (2) ridges in the southeastern portion to search for a quartzite and sand resource on the line of continuation of the quartzite ridge. Colluvial sand samples were collected from both these areas (samples B and C respectively).

Five pits were dug with a P.C.200 30t excavator in the northern part of the licence area to test the depth to and thickness of colluvial sand below a prominent silcrete ridge. All pits bottomed in schist at 2m or less and were not sampled. It was inferred that the colluvial sand only occurred at the base of the outcrop and was not an economic resource.

Six excavator pits were dug in the lease area along the ridge crest to test the practicability of this method of mining. The mean soil thickness was .5m and sand thickness 0.5 - 1.0m. All pits bottomed in sandstone which was too hard for the machine to penetrate.

A sand sample was collected from a percussion hole drilled at IS.1 by Monier Ltd. (sample A figure 6).

Further Exploration: The following four-step programme is proposed in order to allow a full assessment of the resource:

1. Resampling of the area by percussion drilling to determine the following:

- a) the ratio of sand to quartzite
- b) grain size distribution of the sand
- c) chemical purity of the sand
- d) amenability of the sand to beneficiation
- e) ratio of quartzite of acceptable quality to other rock types
and the amenability of the sequence to selective mining.

2. Drilling and sampling along the south side of the Hogarths Creek access road to establish the full extent of the quartzite bed (discontinuous exposure of quartzite was observed over 250m. along the road cutting).

3) Field mapping and sampling to search for continuity of the quartzite along the strike of the bed.

4. Percussion drilling into the Hogarths Creek cliffs is required to ascertain the vertical and lateral extent of the resilicification, the size of which was not fully appreciated until the new access road was built. The known depth of this resource is twice that of other Dip Range "quartzites", which suggests a greater degree of access for percolating ground water, perhaps by faulting along the line of Hogarths Creek. Diamond drilling angled at -40° (Section B in Fig.5) would ultimately be required to obtain more accurate data on the sequence at depth. Some of this exploration relates to development of the resource within CML 8M/89. Exploration in E.L.25/88 during the year 1989-90 will be to further define the sand and quartzite resource

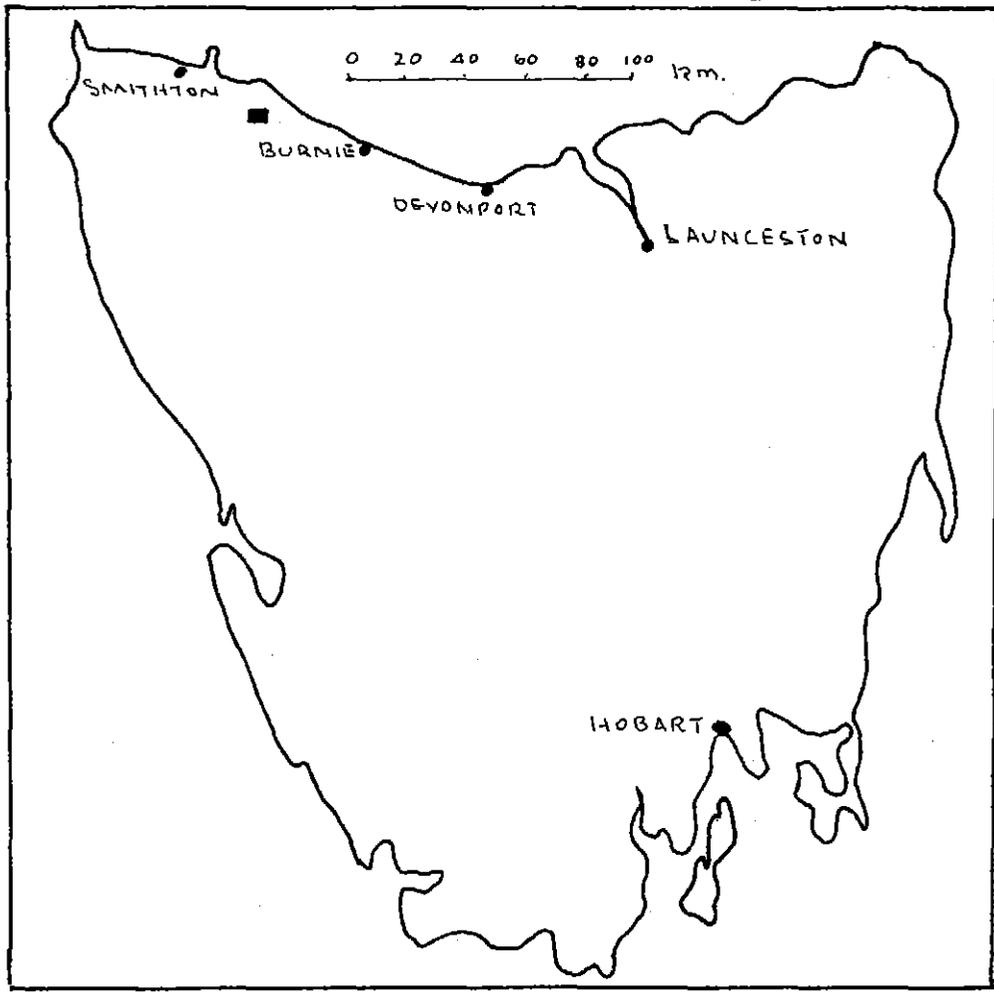
along its south-eastern extension (figure 7). The resource within the mineral lease will be fully developed for mining provided the metallurgical testing proves satisfactory.

Sources of Information

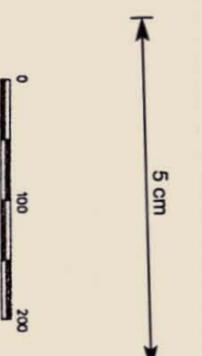
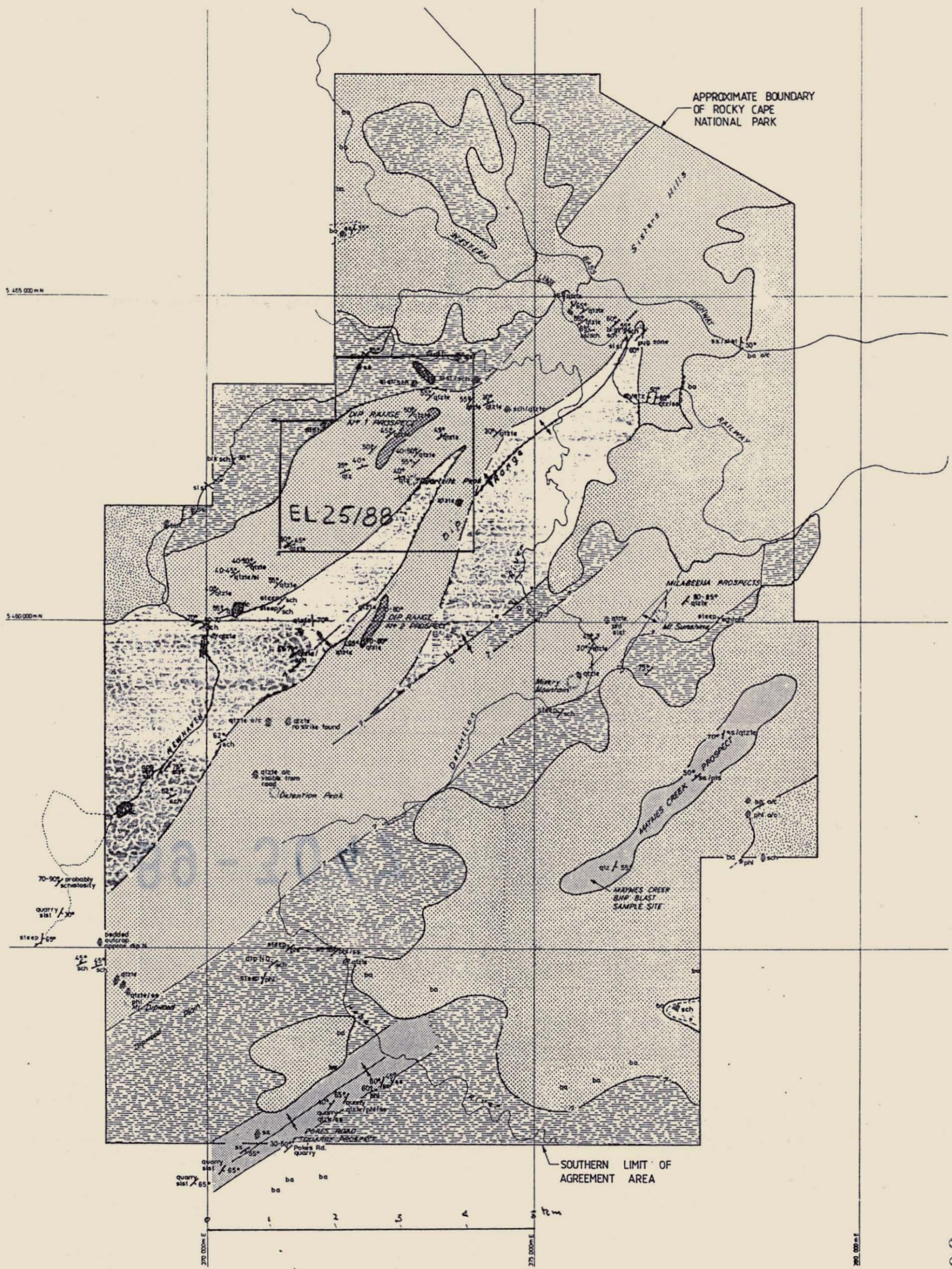
The regional geology is drawn from mapping of the Burner (1 : 63360 - 1967) Sheet by D. Gee and the Smithton (1 : 50 000 - 1982) Sheet by P. Lennox et al which are part of the Tasmanian Geological Atlas - Department of Mines.

Exploration data has been drawn from reports by the consulting firm of Longworth and McKenzie (TCR 81-1640) who carried out the programme for Kaiser Aluminium Company and Mineral Holdings Australia and from the results of recent exploration.

FIGURE 1



5 cm



LEGEND

- SILCRETE
- BASALT

TERTIARY

- IRBY SILTSTONE
- DETENTION SUBGROUP
- COWRIE SILTSTONE

PRECAMBRIAN

- KEITH METAMORPHICS
- UPPER PROTEROZOIC**
- ROCKY CAPE GROUP
- JACOB QUARTZITE
- IRBY SILTSTONE
- DETENTION SUBGROUP
- COWRIE SILTSTONE

- ANTICLINE
- SYNCLINE
- FAULT

GEOLOGICAL BOUNDARIES

- POSITION ACCURATE
- POSITION APPROX.
- POSITION INFERRED

LEGEND

- | | | | |
|-------|---------------------------------|-----|---------|
| qtz | QUARTZ | phl | PHYLITE |
| qzite | QUARTZITE | sch | SCHIST |
| silt | SILTSTONE | sh | SHALE |
| sic | SILCRETE | shy | SHALY |
| ss | SANDSTONE | | |
| ba | BASALT | | |
| sl | SLATE | | |
| bl | BLUE | | |
| blk | BLACK | | |
| gy | GREY | | |
| N D | DIP NOT DETERMINABLE | | |
| 55° | MEASURED STRIKE AND DIP OF BEDS | | |
| γ | FOLIATION STRIKE AND DIP | | |
| | OUTCROP - NO STRIKE OR DIP | | |
| | QUARRY | | |

This drawing is the property of Kaiser Aluminum and is to be used only for the purposes stated. It is not to be reproduced or used in any other manner without the written consent of Kaiser Aluminum. The title of this drawing is: EL 25188. The scale is: 1:50,000. The date is: 1970. The author is: C. J. J. S. The checker is: A. S. SHOWN. The approver is: C. J. J. S.

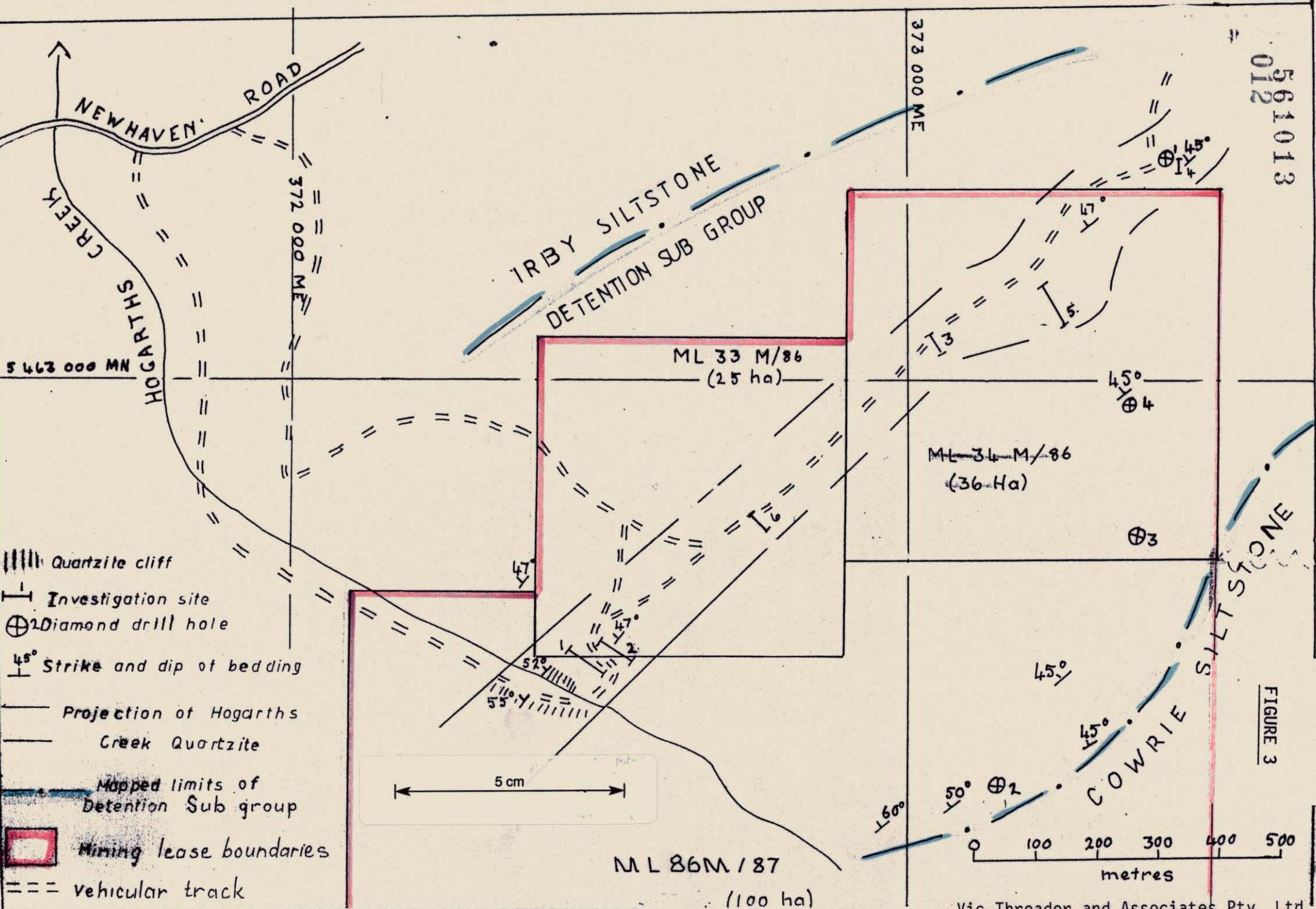
EL BOUNDARY & INTERPRETED REGIONAL GEOLOGY
 STAGE 3 - GEOLOGICAL INVESTIGATION
 SILICA DEPOSIT E.L. 43/70
 KAISER ALUMINIUM

Contracting Geotechnical Engineers: J. Edgar St. Clair New 2065, The 828 0122
 located at the intersection of Victoria Road, Invercargill, 4871.
 LONDON/AMSTERDAM/BRUSSELS/FRANKFURT/GENEVA/HELSINKI/OTTAWA/ST. LOUIS
PXT 250
 Fig. 1

561012

FIGURE 2

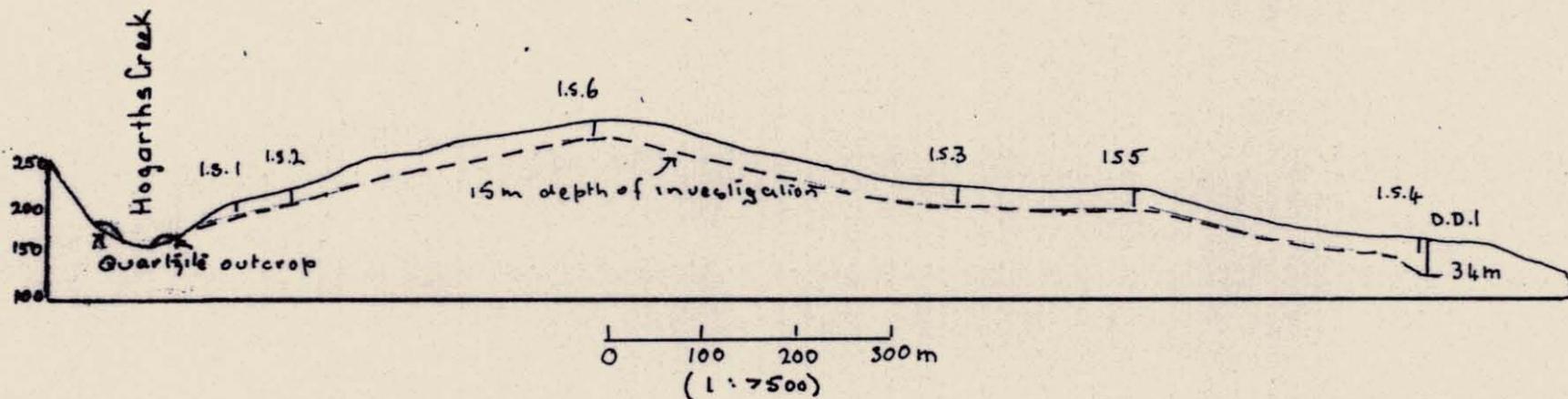
561013
012



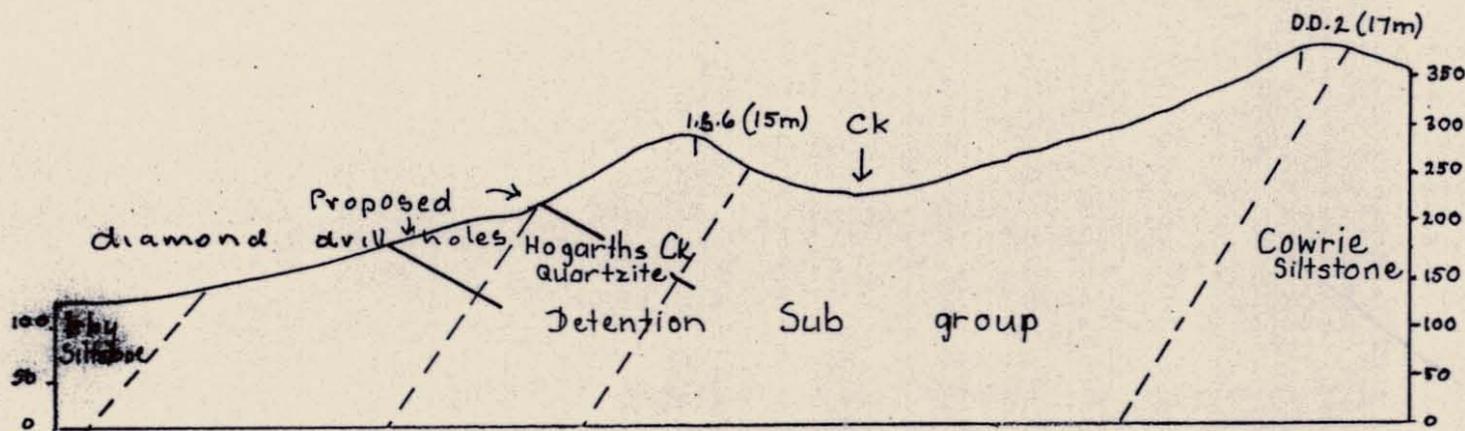
- Quartzite cliff
- Investigation site
- Diamond drill hole
- Strike and dip of bedding
- Projection of Hogarths Creek Quartzite
- Mapped limits of Detention Sub group
- Mining lease boundaries
- vehicular track

FIGURE 3

013



Strike Section through Hogarths Creek Quartzite cliffs, Investigation Sites (I.S.) and D.D.1.



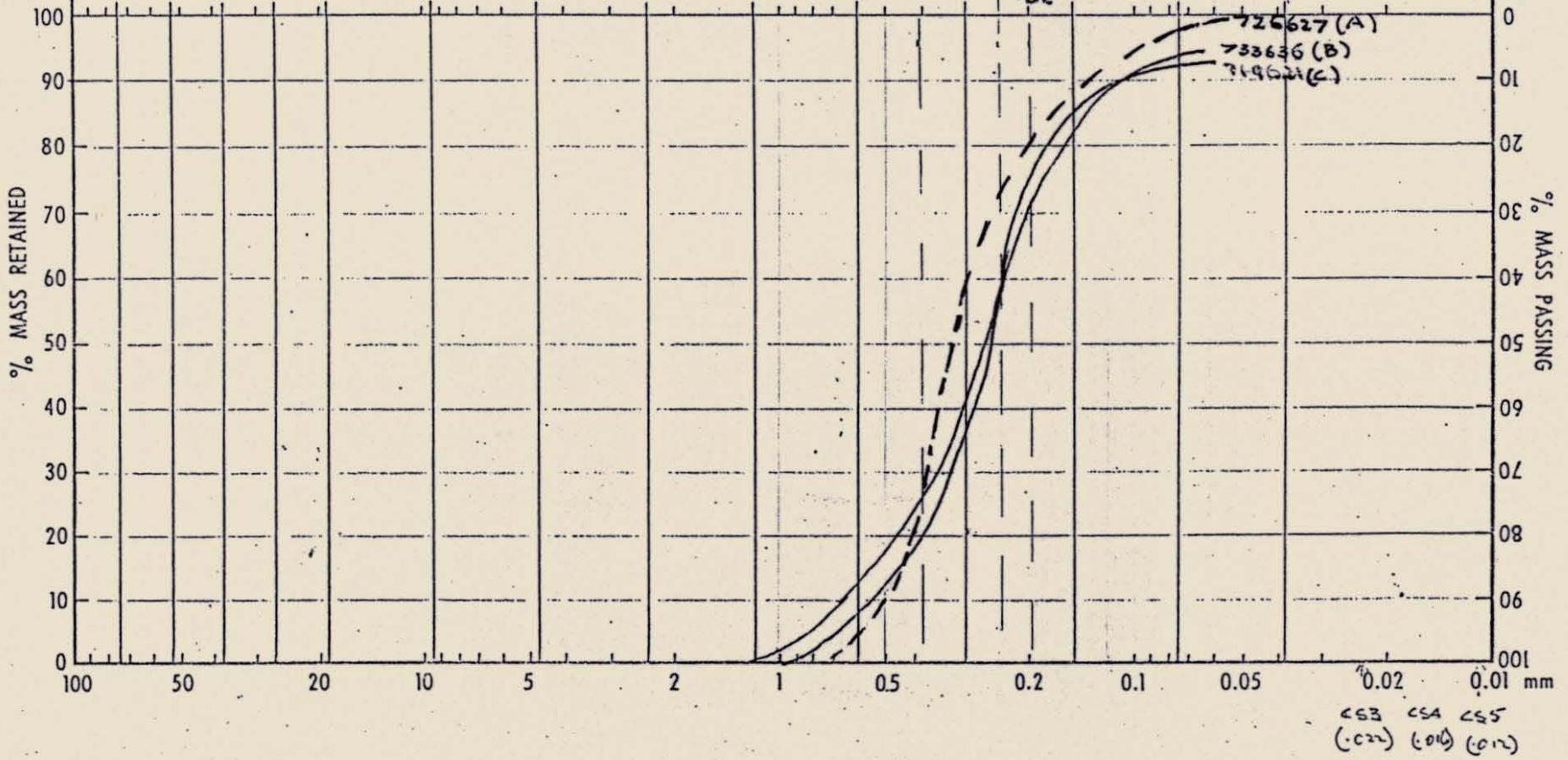
Dip section through I.S.6 and D.D.2 (showing stratigraphic thickness of Detention subgroup and projection of Hogarth's Creek Quartzite)

561014

FIGURE 4

M 1324

REFERENCE No.	LAB. SERIAL No.	LOCALITY					SEDIMENT ANALYSIS PARAMETERS							
		DIP RANGE SILICA SAND					M =	V =	Sk =	K =				
COARSE AGGREGATE			FINE AGGREGATE				A77-1957 (concrete)							
COARSE AGGREGATE			FINE AGGREGATE		BINDER		N.A.A.S.R.A. (road materials)							
COBBLE	PEBBLE		GRANULE	SAND					SILT					
				V. COARSE	COARSE	MEDIUM	FINE	V. FINE						
-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6 φ		
75	53	37.5	26.5	19	9.5	4.75	2.36	1.18	0.6	0.3	0.15	0.075	0.038	Aust. Stand. Sieve



561016

FIGURE 6

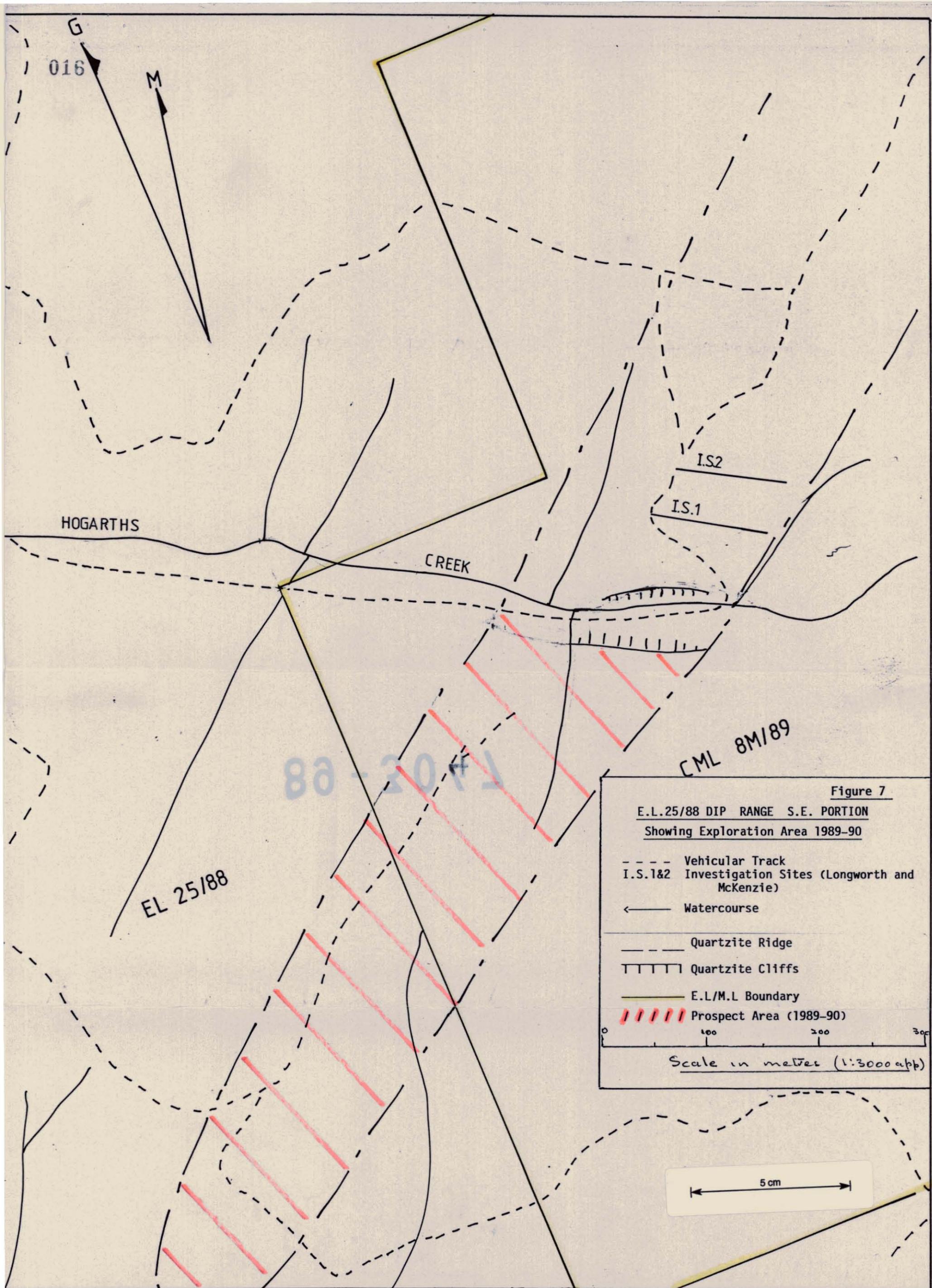


Figure 7

E.L. 25/88 DIP RANGE S.E. PORTION
 Showing Exploration Area 1989-90

- Vehicular Track
- I.S.1&2 Investigation Sites (Longworth and McKenzie)
- ← Watercourse
- Quartzite Ridge
- TTTTT Quartzite Cliffs
- E.L./M.L. Boundary
- ||||| Prospect Area (1989-90)

Scale in metres (1:3000 approx)

5 cm

561018

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REPORT

ON

STAGE 3 - PRELIMINARY DRILLING

OF E.L. 43/70

FOR

KAISER ALUMINUM

89-3047A

Vol 2 of 2

MINES DEPT. 1981/07

PXT250
JUNE 1981

LONGWORTH & MCKENZIE PTY. LIMITED



89-3047A

LONGWORTH & MCKENZIE PTY. LIMITED
CONSULTING ENGINEERS



REF: PXT250/RJC/sed
24th June, 1981

The General Manager,
Finance and Planning,
Kaiser Aluminum & Chemical Corp. (Aust.) Ltd.,
7th Floor, A.M.P. Centre,
50 Bridge Street,
SYDNEY NSW 2000

Attention: Mr. C. W. Blandy

Dear Sir,

RE: REPORT ON STAGE 3 - PRELIMINARY DRILLING PROGRAMME

Please find attached our report on the above.

In summary the exploration programme has shown the prospects drilled (and the Detention Sub-group generally) to have a physically unsuitable weathered zone of variable strength sandstone overlying a limited thicknesses of chemically unsuitable but extremely strong quartzite which in turn overlies beds of inferior rock types such as phyllite and quartz schist.

No further exploration work for silica sources is proposed within E.L. 43/70.

We trust this report meets your requirements, should you require clarification of any feature of the report please do not hesitate to contact us.

Yours faithfully,
LONGWORTH & MCKENZIE PTY. LIMITED

Dr. L. de. AMBROSIS

561020

REPORT
ON
PRELIMINARY DRILLING PROGRAMME

STAGE 3

SILICA PROSPECT E.L. 43/70

TASMANIA

FOR

KAISER ALUMINUM

REF: PXT250

JUNE, 1981

LM

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APPENDICES

APPENDIX A - SEISMIC DATA AND ANALYSIS

APPENDIX B - BORE HOLE LOGS AND CORE PHOTOGRAPHS

APPENDIX C - SAMPLE ANALYSES

FIGURE NO 1 - E.L. BOUNDARY & INTERPRETED REGIONAL GEOLOGY

2 - DIAMOND DRILL HOLE AND SEISMIC TRAVERSE LOCATIONS

3 - DIP RANGE No. 1 NORTH SEISMIC TRAVERSE LOCATIONS

4 - DDH No. 1 Al_2O_3 & SiO_2 vs DEPTH

5 - DDH No. 3 Al_2O_3 & SiO_2 vs DEPTH

6 - K_2O & Al_2O_3 vs DEPTH - DDH No. 1 & DDH No. 3

1.0 SUMMARY

Stage's 1 and 2 have previously been reported. This report contains the findings of Stage 3 (Preliminary Drilling Programme at Dip Range No. 1 North and Quartzite Peak).

The quartzite units were found to be interbedded with mica schists, siliceous fine grained beds, and poor quality silicified limonitic sandstone units.

The quartzite beds within the prospects drilled were found to be overlain by an extensive weathered zone of variable depth. The surface and subsurface weathered beds are composed of white variably cemented (laterally and vertically) units of relatively pure ($\text{Al}_2\text{O}_3 < 1\%$) sandstone. The sub-weathered zone quartzite appears in drill core as a light brown to blue grey, glassy, extremely strong quartzite which frequently is thinly bedded. These bedding planes are prone to contain a variable thickness of micaceous material and the quartzite showed a general trend to decrease in silica quality with depth. From chemical analyses only a small percentage of this quartzite may be considered to have ($\text{Al}_2\text{O}_3 < 1\%$).

2.0 INTRODUCTION

This report provides the details of the Stage 3 Preliminary Drilling Programme on silica deposits within the northern half of Exploration Licence 43/70 near Wynyard in northern Tasmania.

The area (known as the Agreement Area) covered by this multi-staged investigation is shown in Figure No. 1 and is the subject of an agreement between Mineral Holdings Australia (MHA) the holder of the E.L. 43/70 and Kaiser Aluminum (KA) who have undertaken the investigation of silica deposits within the Agreement Area. Longworth & McKenzie Pty. Limited (L&M) have been engaged by Kaiser Aluminum to proceed with the investigation programme.

Within this part of northern Tasmania the occurrence of very large reserves of high grade quartzite have been reported in various official publications.

A number of quartzite prospects had been identified during preliminary investigations of this area by personnel associated with MHA. Surface samples had been collected, but only on one prospect (Maynes Creek) had any subsurface investigation been carried out. At the Maynes Creek deposit, BHP collected a bulk sample from surface outcrops and performed some percussion drilling, the cuttings of which were chemically analysed.

A preliminary visit by J.H. Callender (KA), C.L. Adamson (L&M) and K. Pinner (MHA) in January 1981, identified the Dip Range No. 1 area as the prime prospect for the Stage 2 investigation. During the Stage 2 investigation (11th March to 5th April, 1981) the Agreement Area was investigated by a reconnaissance mapping survey to identify other promising prospects in addition to those already identified by MHA; while the prime prospect (Dip Range No. 1 area) was investigated in detail by costeaning, blasting and percussion drilling. Surface samples were also collected from other sites (Quartzite Peak and Mt. Sunshine) by blister blasting.

The major conclusions contained within the Stage 2 report may be summarized as follows:-

- 1) Although the surface chemical characteristics of the quartzites are promising from the surface and limited subsurface exploration it had not been possible to establish the likely stratigraphic variations in chemical and physical properties.
- 2) On the basis of surface and near sub-surface exploration Quartzite Peak and Dip Range No. 1 North were identified as the prime sites for further work.

As a result of the recommendation in the Stage 2 report and subsequent site visit by Dr. J.J. Deric and J.H. Callender (KA) a limited drilling programme was mobilized to drill cored holes at Dip Range No. 1 North and Quartzite Peak (locally known as Shakespear). The object of this programme was to:-

- 1) Define physical and chemical variations with depth in the quartzite/sandstone.
- 2) Provide a basis for realistic estimates of reserves.

3.0 GEOLOGIC SETTING

3.1 General Geology

The eastern half of the Agreement Area has been mapped on a scale of 1:63,360. This mapping is published in the Table Cape and Burnie geological maps, both of which are covered in reports by R.D. Gee (1971 and 1977).

Apart from Quaternary alluvium and Tertiary basalt and sediments, some of which have been converted to silcrete, the rocks of the Agreement Area are predominantly composed of relatively undeformed Precambrian clayey, silty and sandy sediments. These contain the quartzite and sandstone units which are the targets of the exploration programme.

Gee (1971 p.9) in his report on the Table Cape 1:63,360 geological map summarises the Proterozoic sequence as follows:

KEITH METAMORPHICS	Not relevant
ROCKY CAPE GROUP	
Jacob Quartzite	1130 m
Irby Siltstone	760 m
Detention Sub-group	
Cave Quartzite)	
Port Slate)	1400 m
Bluff Quartzite)	
Cowrie Siltstone	2400 +m

Initial prospecting established that the rocks of interest are the Jacob Quartzite and the quartzite beds within the Detention Sub-group.

3.2 Geology Of The Agreement Area

The geologic setting shown in Figure No. 1 is a combination of the factual information recorded during the Stage 2 field reconnaissance survey, data from Geological Survey Mapping and the interpreted regional geology based on the above information.

The rock types mapped in the Agreement Area consist of the relatively undeformed Precambrian Keith Metamorphics and the Rocky Cape Group. These are overlain to a large extent by deeply weathered Tertiary basalt, Quarternary sediments and isolated deposits of silcrete (ref. Figure 1).

The units of interest within the Area are the sandy beds of the Detention Sub-group and the Jacob Quartzite. Regionally the strike of these beds is fairly constant at NE - SW. The Jacob Quartzite crops out along strike in the southern and southwestern part of the Area in the Pokes Road Quarry area and again at the Maynes Creek Prospect.

The quartzite of the Detention Sub-group forms the largest unit in the Area, cropping out along strike diagonally across the central portion of the Agreement Area.

Gee (1971, p.10) states, of the Detention Sub-group, that it contains about 10% siltstone, of which the Port Slate is the thickest bed, but that siltstone lenses from a few metres to 80 metres thick occur irregularly. Most of Gee's observations were probably made along the coast but from the current exploration it appears that his general description would apply to the Agreement Area.

Within the Agreement Area the Detention Sub-group has been eroded to produce a rugged topography. The ridge lines are strike controlled but have been dissected at frequent intervals to give a hummocky appearance.

The ridges show scattered semi-continuous white silicified outcrops of quartzite, but the surface is generally composed of sandy and peaty soils.

From surface exposures of the silicified quartzite the Detention Sub-group appears to be a relatively massive unit with occasional thinly bedded quartzite beds. After the Stage 2 investigation it was considered that the near surface rock was a variably silicified (with depth and along strike) sandstone ranging from a poorly cemented sand to a highly silicified quartzite. However, the drilling undertaken during this stage of the exploration programme showed these surface and near surface variations in physical state to be an effect of weathering resulting in surface leaching of silica and a somewhat erratic secondary silicification of the scattered ridge surface outcrops and valley bluffs reported in the Stage 2 report. The nature of the quartzite below this weathered zone is described in Section 5.

The Jacob Quartzite has been eroded to form a less rugged form with bedding strike outcrop control not being as distinct as with the Detention Sub-group. In the Maynes Creek Deposit this increased susceptibility to erosion in the Jacob Quartzite may be explained by the frequent occurrence of interbedded phyllitic siltstone units.

From the work undertaken on E.L. 43/70 it has not been possible to elucidate the details of the geological structure within the Agreement Area. The general strike of the beds within the E.L. is NE to SW and the majority of the dips measured are to the NW at angles generally between 45° and 70°. Some restricted areas of SW dips have been recorded, but owing to the limited number of outcrops the true significance of these anomalous dips has not been determined. With respect to the Stage 3 drilling programme the areas of particular interest were Dip Range No. 1 North and Quartzite Peak.

Dip Range No. 1 North lies at the northern end of the Dip Range No. 1 prospect (Ref. Figure No.1). This prospect was seen as the most promising location after the Stage 2 costeaning had located near surface high quality, but physically variable sandstone and quartzite in IS4 close to a massive quartzite bluff on the adjacent valley side.

Quartzite Peak forms part of a high ridge line which lies south of Dip Range No. 1 but runs parallel to it. A prominent quartzite bed is exposed across the top and slopes of Quartzite Peak and adjacent portions of the ridgeline.

This outcrop extends for approximately 1 kilometre and forms the longest outcrop observed within E.L. 43/70. The width of this bed measured from surface outcrop was estimated to have a minimum width of 15m with a maximum probable width of 30 metres. Due to the exposed nature of Quartzite Peak no costeaning was carried on this bed during the Stage 2 investigation however, the resistant nature of this bed to weathering indicated its physical suitability and chemical analyses of blister blasted samples were also encouraging. This bed was called the Shakespeare Quartzite Bed and was the target for drilling on Quartzite Peak. Environmentally, Quartzite Peak is extremely prominent, being visible from tens of kilometres in either direction along the Bass Highway.

4.0 NATURE OF THE INVESTIGATION

4.1 Field Activities

4.1.1 General

The Stage 3 site work was carried out by geologists R.J. Carr (L&M) and T. Rath (KA) between the 8th of April and 8th of June, 1981. The programme consisted of hammer seismograph traverses and the diamond drilling of four cored holes. This work was carried out at and between Dip Range No. 1 North and Quartzite Peak (see Figure No. 2 & 3).

The hammer seismograph programme was undertaken prior to drilling, firstly to provide information on the subsurface conditions to assist in the siting of drill holes and secondly to provide a basis for the lateral extrapolation of units identified by drilling.

Environmentally, due to the visibility of Quartzite Peak and the central portion of Dip Range No. 1 drill site access was limited to existing access tracks and locally to ridge lines. Cuts for drill site pads were kept to a minimum and restoration was carried out on hole completion.

The field activities were hampered by adverse weather during the seismic work and the latter stages of drilling. DDH No. 4, in particular, was drilled under extremely difficult access conditions caused by continuous rain.

DIAMOND DRILL HOLE AND SEIZMIC TRAVERSE LOCATIONS

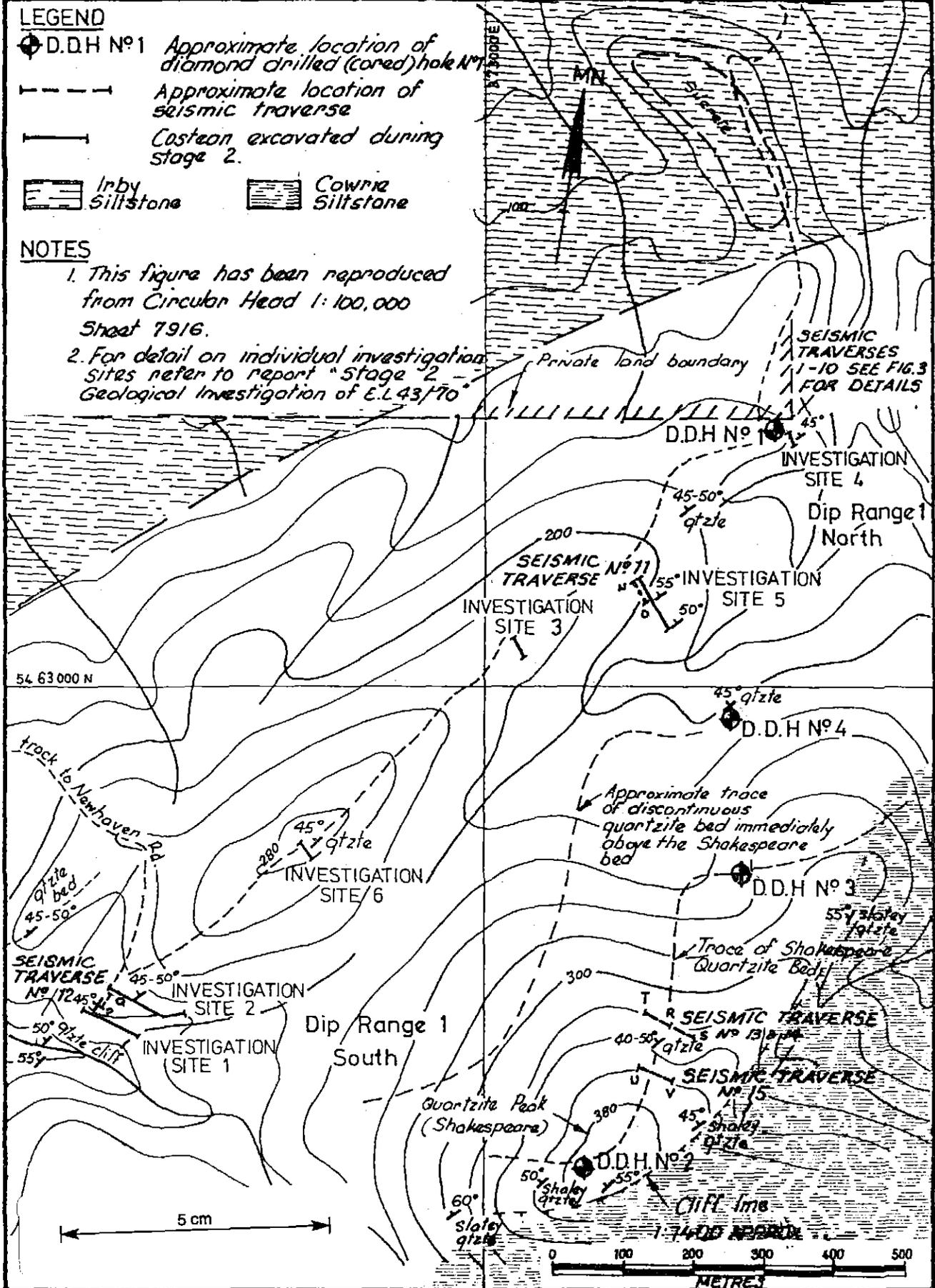
FIGURE NO 2
561032

LEGEND

- ◆ D.D.H. No 1 *Approximate location of diamond drilled (cored) hole No 1*
- - - - *Approximate location of seismic traverse*
- — — *Costean excavated during stage 2.*
-  *Inby Siltstone*
-  *Cowrie Siltstone*

NOTES

1. This figure has been reproduced from Circular Head 1:100,000 Sheet 7916.
2. For detail on individual investigation sites refer to report "Stage 2 Geological Investigation of E.L.43/70"



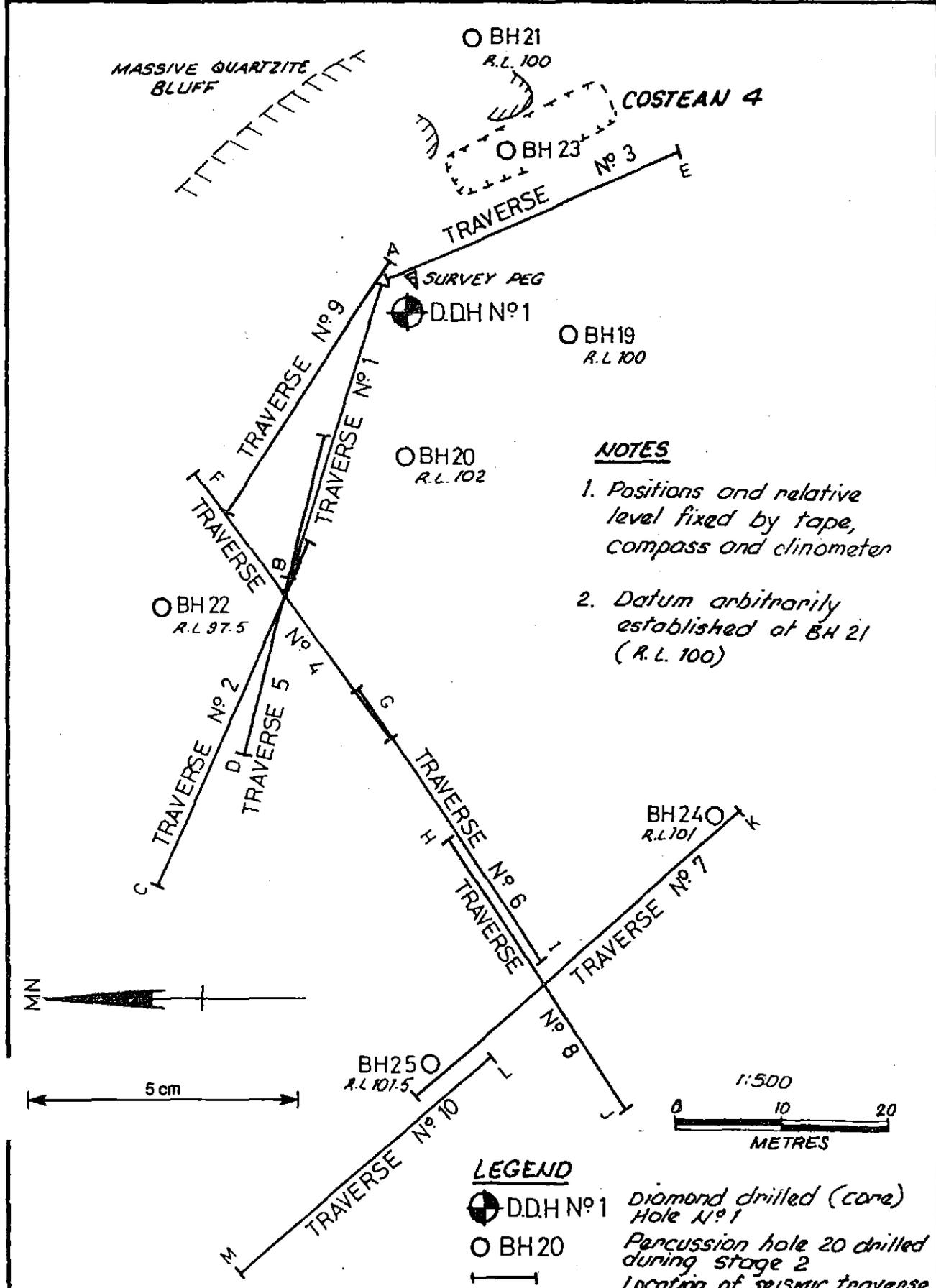
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PXT 250

DIP RANGE N°1 NORTH SEISMIC TRAVERSE LOCATIONS

FIGURE N° 3
561033



- NOTES**
1. Positions and relative level fixed by tape, compass and clinometer
 2. Datum arbitrarily established at BH 21 (R.L. 100)

- LEGEND**
- ⊕ D.D.H N°1 Diamond drilled (core) Hole N°1
 - BH 20 Percussion hole 20 drilled during stage 2
 - Location of seismic traverse

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4.1.2 Seismic Traverses

From shallow subsurface exploration undertaken in Stage 2 and the random surface outcrops, the physical state of the surface cover and rock was known to vary widely. Hammer seismograph traverses were undertaken to attempt to quantify this variation.

The subsurface variations observed during costeaning (see Stage 2 report) indicated that velocity inversions could be expected and in association with the lateral variations in silicification would make interpretation of results difficult.

Some 15 seismic traverses were carried out using a Nimbus seismograph. Ten traverses were run at Dip Range No. 1 North, one at each of Investigation Sites 1 and 5 and three on Quartzite Peak. The length of these traverses varied from 30 to 40 metres with the total meterage being 490 metres.

The field recorded data was computer analysed by the Hawkins method. Where the field data indicated that the subsurface profile differed from the modelled layered case (traverses 3,4,and 6) quantitative analysis was not performed, however field data is presented to allow qualitative interpretation. To facilitate the identification of subsurface quartzite layers the seismic velocity of the surface silicified quartzite was also measured.

The field recorded seismic data and the results of computer analysis are contained within Appendix A.

4.1.3 Diamond Drill Holes

Four diamond drill holes were drilled at the locations shown in Figure No. 2.

The holes were drilled using a Gemco trailer mounted rig towed into position by a D7 Dozer. This type of drill rig is limited to the drilling of vertical holes. Initially the core size drilled was NQ (47.6mm), however in DDH No. 1 the standard NQ diamond bit effectively refused to drill (with the rig fully anchored down) in extremely strong quartzite at a depth of 13.3 metres. Subsequently a thin walled core barrel with impregnated diamond bits was used in the remainder of DDH No. 1 and 2,3 and 4. The core diameter produced by the thin wall system was 35.6 mm.

The use of the thin walled tube and impregnated bit gave drilling rates between 5m/day for the extremely hard quartzite and 13m/day for the interbedded siliceous shists and quartzites.

DDH No. 1 (at Dip Range No. 1 North) was located to intersect quartzite at depth, to correlate with massive quartzites bluff in the adjacent river valleys sides and surface results from IS4 (Stage 2 investigation).

DDH No. 2 (on top of Quartzite Peak) was located at the southern edge of the visible outcrop of the Shakespeare Quartzite Bed.

DDH No. 3 was located to penetrate the Shakespeare Quartzite Bed. The location was chosen to minimise the visual impact of the drilling activities.

DDH No. 4 was located to intersect the next apparent semi-continuous quartzite bed above the Shakespeare Quartzite Bed.

The geological logs and core photographs are contained in Appendix B.

4.2 Laboratory Testing

Representative samples were split from the core of DDH No. 1 and No. 3. These samples were returned to A.C.I. Technical Centre Sydney for testing.

Samples from DDH No. 1 at depths 4.9, 8.9, 11.1, 12.1, 14.16, 16.1, 18.17, 20.17 and 22.17m were chemically analysed by full X-ray fluorescence and thin sections were prepared for petrological analyses.

Samples from DDH No. 3 at depths 10.25, 12.0, 15.0, 17.12, 19.2, 23.9, 27.0, 28.5 and 30.9m were chemically analysed by full X-ray fluorescence. The sample from depth 28.5 metres was also tested by X-ray diffraction to identify the micaceous component.

The results of the above analysis are contained within Appendix C.

5.0 SUMMARY OF FIELD RESULTS AND INTERSECTED STRATIGRAPHY

5.1 Hammer Seismograph

From measurements on the silicified surface quartzite the target, subsurface quartzite velocity was expected to vary between 2500m/sec to 3500 m/sec.

It was expected that the steeply dipping (+45°) bedding of the Detention Sub-group would dominate the seismic response. However, in all traverses the near subsurface weathering effects proved to be the dominant feature detected by the seismograph.

The lateral variations in depth of the first silicified zones within the weathered zone resulted in some traverses being quantitatively un-interpretable based on the conventional layered model. The poor fit of some points on the line of best fit in a number of traverses may also be partly attributable to irregular silicified surfaces.

Correlations between D.D.H. No. 1 (see section 5.2) and the traverses at Dip Range No. 1 indicate that the depth of the first layer picked up by the seismograph did not necessarily correlate to the full depth of the primary weathering. Additionally due to the effect of velocity inversions the first recorded highly silicified largely continuous layer obscured subsequent layers below it.

While the depth of the weathered zone could not be interpreted from the seismograph the traverses did show the weathering to be wide spread.

Hammer seismograph traverses at Quartzite Peak (No's 13,14 and 15) although again masked by the subsurface weathering effects did show that a high velocity material continued at depth to the south east of the Shakespeare Bed outcrop on Quartzite Peak, thus inferring that the Shakespeare Bed may have been thicker than its surface outcrop suggested.

Traverses No. 11 and 12 at Stage 2 Investigation Sites No. 1 and 5 again reinforced the existence of quite deep poorly cemented sandstones (weathered zone) in some locations as previously reported in the Stage 2 report.

5.2 Diamond Drilling

Prior to undertaking the drilling programme, on the basis of the Stage 2 work, the Detention Sub-group quartzite was regarded as a variably silicified sandstone unit.

Diamond drill hole No. 1 at Dip Range No. 1 intersected some 10.56 metres of the white variably silicified sandstone (which typifies surface exposures). Of this 10.56 metres some 0.3 metres was top soil and sand, 4.05 metres was core loss (sand) and 2.465 was classified as having a tactile strength from extremely weak to moderately strong. Collectively these represented some 65% of this 10.56 metres. Immediately below this weathered and leached zone a brown black stained silicified sandstone unit occurs slightly above the water table. This medium grained sandstone contained numerous joint and fracture planes which are infilled with black oxide deposits. Petrological examinations showed the individual interlocking quartz grain boundaries to be etched with a limonitic stain.

- 17 -

Beneath the sandstone a light brown to grey, glassy, highly silicified thinly bedded, very strong quartzite extends from 11.7 metres to 30.2 metres. Within the bedding planes fine beds of yellow micaceous minerals occurred, these became thicker and more prevalent with depth.

Taking into account the dip of the bedding (approximately 45°) the true thickness of this quartzite bed is approximately 13 metres. The quartzite unit is underlain by an iron oxide stained silicified silty sandstone. The hole was terminated in this rock type at 36.12m.

Having established the general subsurface stratigraphy at Dip Range No. 1 North, the next target, the Shakespeare Quartzite Bed on Quartzite Peak was drilled. DDH No. 2 was drilled on the south eastern edge of the Shakespeare Quartzite Beds surface outcrop to establish its subsurface extent. From the seismic work (see Section 5.1) it was expected that this bed may have been wider than surface outcrop indicated. DDH No. 3 was drilled through the bed to establish its thickness and nature with depth.

The core of DDH No. 2 consisted of 6.75m of white fine to medium grained sandstone underlain by a thinly bedded brown, green, shaley, micaceous sandstone. This borehole was terminated at 17.7m in the above material.

Core from DDH No. 3, which intersected the Shakespeare Quartzite Bed, consisted of some 6.53 metres of white, medium to fine grained, variably silicified sandstone. Of this core approximately 85% of the strata was sand or had its strength appraised at less than moderately strong.

Below the weathered quartzite layer a light grey glassy, extremely strong quartzite bed extended from 6.53m to 27.6m before grading into an interbedded quartzite and siliceous mica schist. The quartzite was a thinly bedded sequence containing micaceous material within the bedding planes. The true thickness of this quartzite bed would be approximately 15 metres. However, if the leached zone is included (ie. down dip this zone would not be weathered due to the cover of younger sediments) the thickness of this bed increases to 18.4 metres.

DDH No. 4 penetrated the next prominent semi-continuous surface outcrop stratigraphically above the Shakespeare Quartzite Bed. This hole intersected some 1.4 metres of sand and slope wash overlying a black schist to 2.3m. The schist was in turn underlain by a brown grey quartzite with frequent bands of schistose micaceous material. At 9.5 metres another black mica schist bed was intersected. This was underlain at 11.2 metres by a thinly bedded in part micaceous quartzite. This hole was terminated at 36.01 metres where the quartzite had deteriorated to a brown silicified sandstone with a micaceous matrix.

Core from DDH Nos 1 and 3 was sampled for analysis. However, DDH No's 2 & 4 were visably substandard and not sampled.

DDH Nos 1 to 4 selectively penetrated most of the major quartzite beds of the Dentention Sub-group, viz:- from close to its base (DDH No. 2) adjacent the Cowrie Siltstone south west of Quartzite Peak through to the upper parts of the sequence (DDH. No. 1) adjacent the Irby Silstone (Ref. Figure No. 2).

On the basis of these diamond drill holes the following general observations may be made:-

- 1) The quartzite beds within the Detention Sub-group have suffered deep weathering and variable secondary silicification producing surface rocks which vary from a sandstone with little or no cement to a highly silicified glassy quartzite.

The depth of this primary weathering zone varies in the diamond drill holes from approximately 6.5 to 10 metres. However from Stage 2 percussion hole drilling this sequence is known to extend deeper than 15 metres in other portions of Dip Range No. 1. (Ref. Stage 2 report).

- 2) The quartzite below the leached zone is largely a thinly bedded sequence and much of this bedding structure is lost in surface outcrops through weathering effects and presumably secondary silicification.
- 3) At the sites drilled, quartzite below the leached zone shows a general tendency to decrease in purity with depth. The frequency of micaceous material occurring in bedding planes increases with depth as does the number of thin micaceous beds.

6.0 SUMMARY OF ANALYTICAL RESULTS

The results of full x-ray fluorescence on samples from DDH No. 1 and DDH No. 3 are contained within Appendix C and the relevant chemical trends are shown graphically in Figures No. 4, 5 and 6.

Figure No. 4 is a plot of drill hole depth vs alumina and silica percentage by mass for the samples analysed from DDH No. 1. The range of alumina and silica content in the surface samples collected at Dip Range No. 1 North during Stage 2 and the analysis from percussion hole No. 22 are also plotted.

The cross hatching and shading represent the interpreted expected range of results, while the general trends with depth are shown in heavy dashed lines.

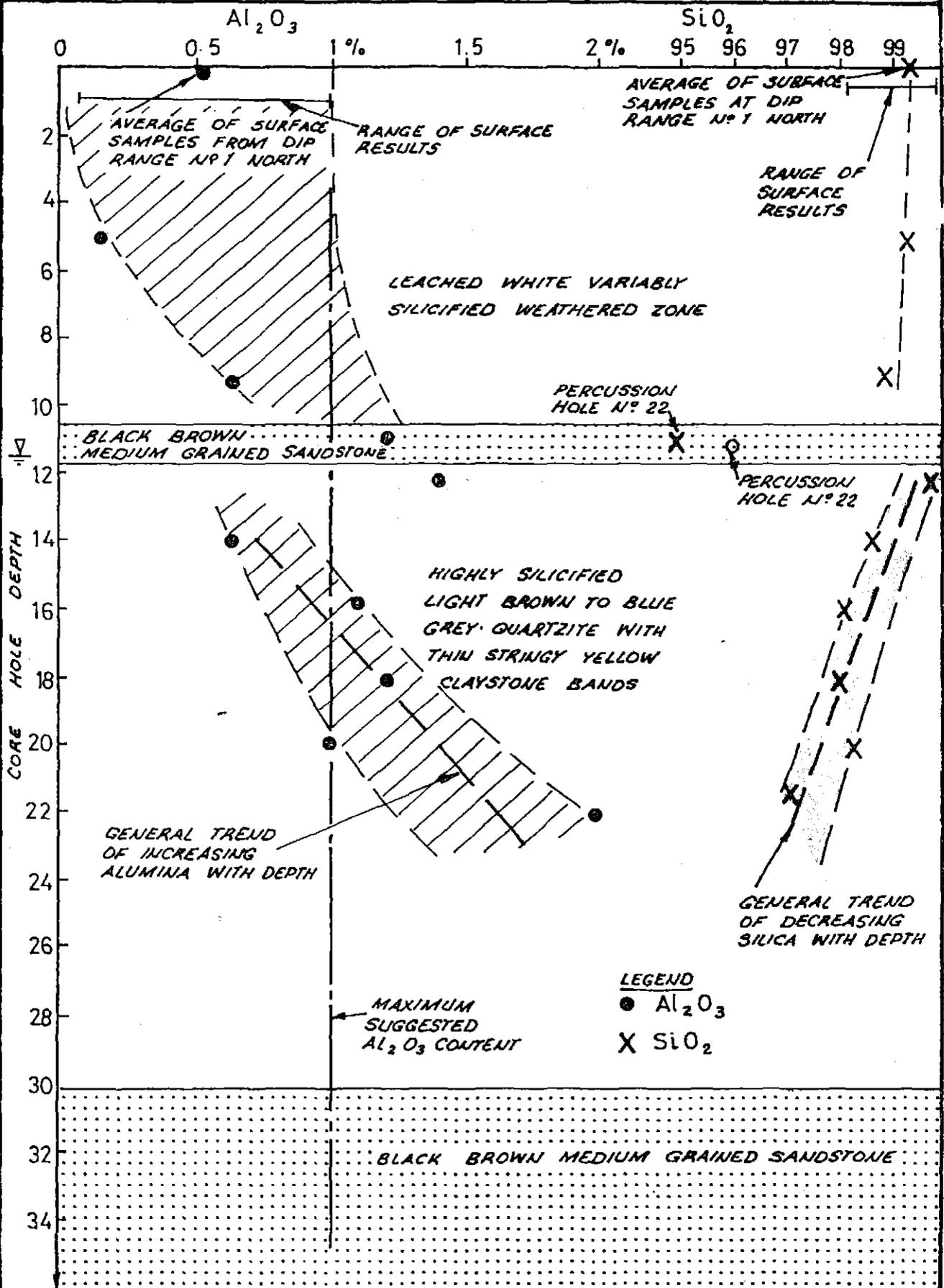
Figure No. 4 shows increasing alumina with depth. Within the upper leached zone the alumina content increases from an approximate average of 0.5% to approximately 1% at ten metres. Again in the lower highly silicified light brown to blue grey quartzite the alumina content increases with depth.

Within the black to brown silicified sandstone which lies just above the water table at 11.7m both the alumina and iron content are high. The high iron content correlates with the limonitic staining observed around grain boundaries during the petrographic analysis and the black to brown joint infill material recorded on the drill hole log.

Figure No. 5 gives a similar plot for the analytical results from DDH No. 3. The general trend again shows an increasing alumina content with depth both in the visually apparent upper leached zone and the lower quartzite unit. Figure No. 5 also shows the expected large increase in alumina in the mica shists which occur at a depth of 27.6 metres. There is also a dramatic increase in the magnesium

D.D.H N° 1 Al₂O₃ & SiO₂ vs DEPTH

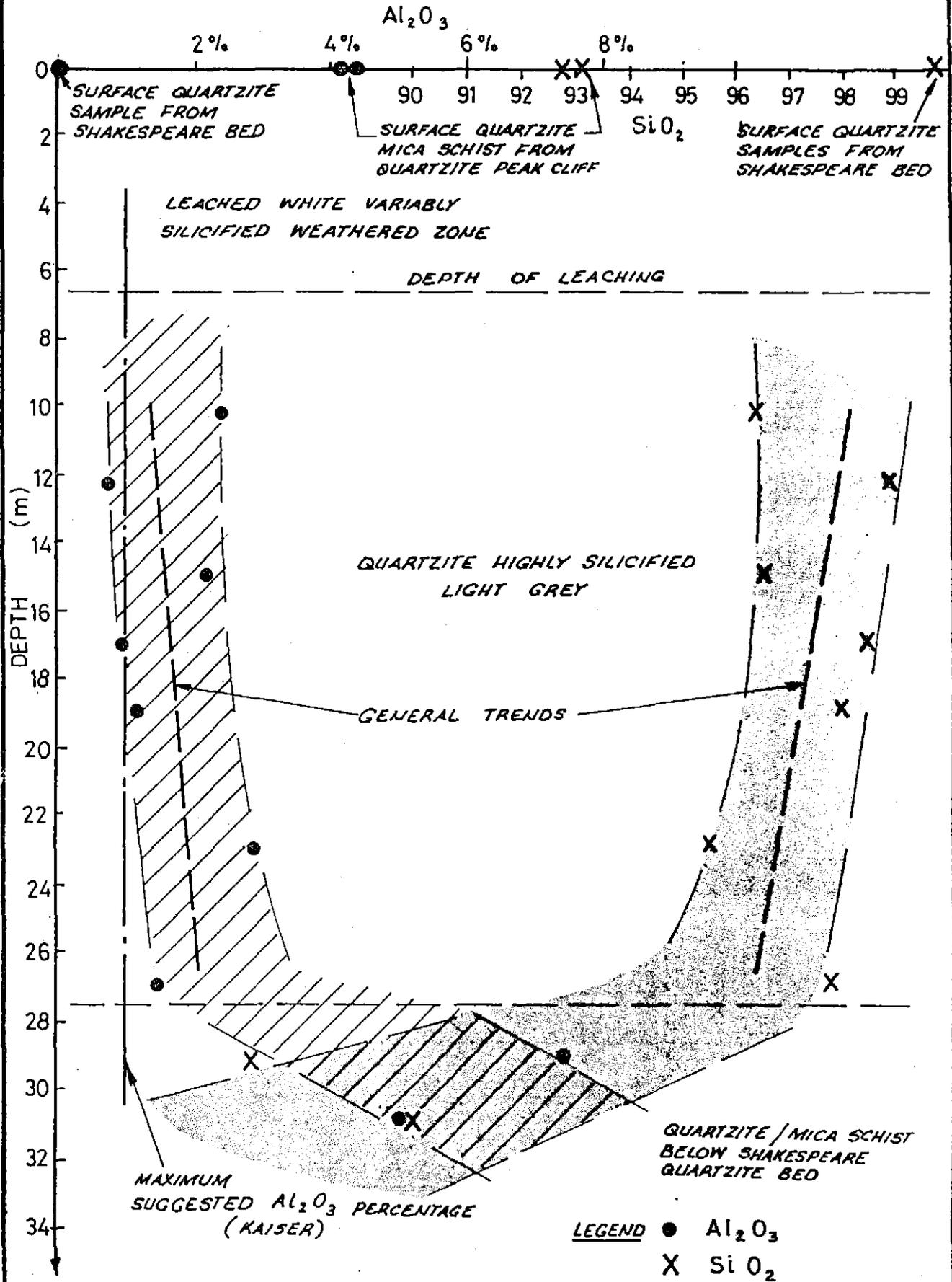
FIGURE N° 4
561043



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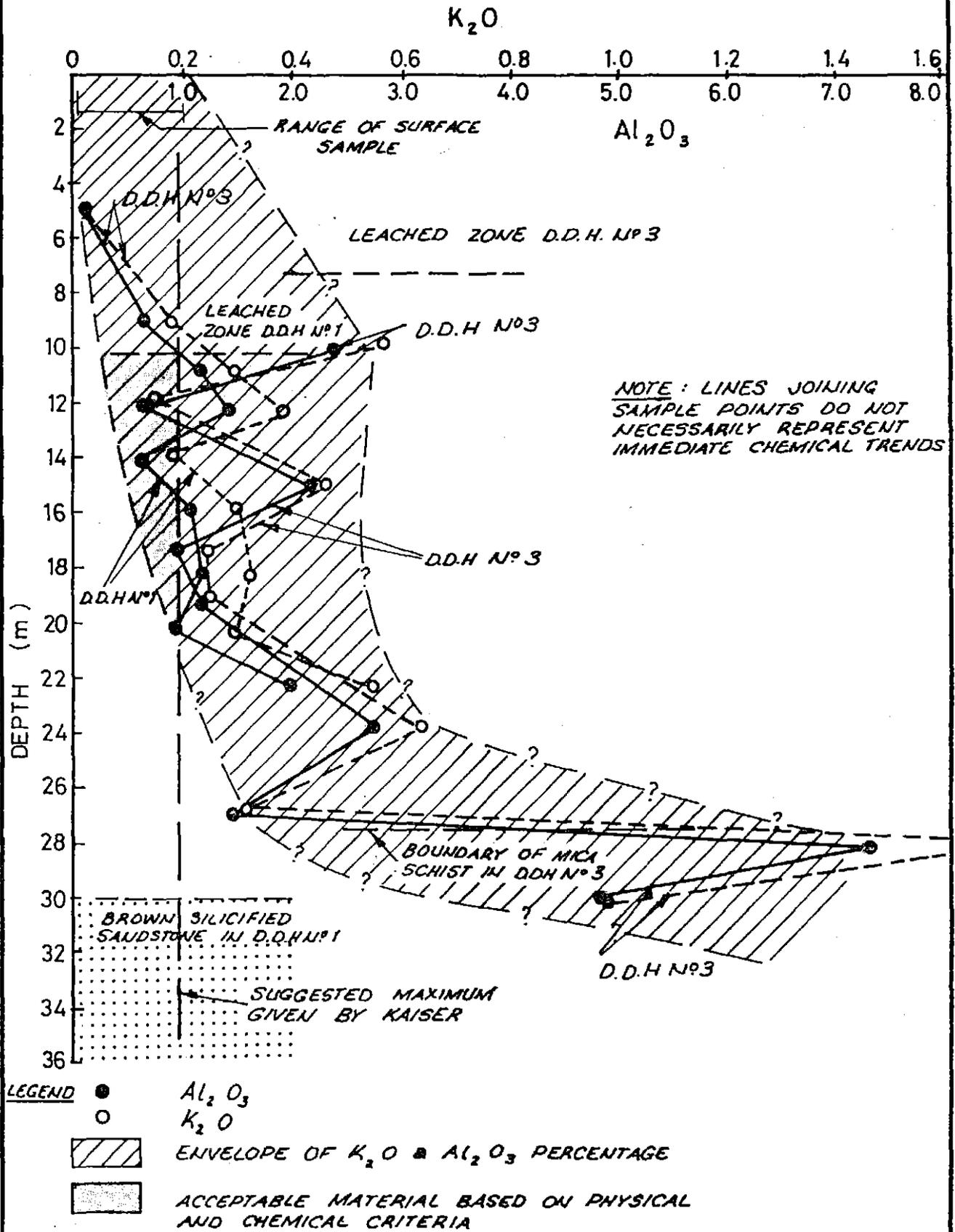
content of the rock below 27.6 metres and this correlates well with the presence of biotite mica in the schist (X-ray diffraction result). It is interesting to note that the alumina content etc. of this lower unit approach that found in the siliceous mica schist on the cliff face at Quartzite Peak.

Figure No. 6 gives gives a plot of alumina and potash for DDH NO. 1 and 3. There exists a continuous correlation between the two in the ratio by mass of approximately 5:1 Al_2O_3 : K_2O respectively. Thus the mineralogical assemblage causing the contamination of the silica may be expected to be generally of the same type, but increasing in quantity with depth. Based on visual, petrographic and limited X-ray diffraction results, this assemblage appears to be made up of muscovite, kaolinite and some feldspars in the quartzite units with the addition of biotite in the lower schistose units.

In summary then the silica content may generally be said to decrease with depth both in the upper leached zone and lower quartzite units. Correspondingly there is a increase in impurities with depth, the major contaminant being alumina.

K₂O & Al₂O₃ vs DEPTH D.D.H N^{os} 1 & 3

FIGURE N^o 6



7.0 DISCUSSION AND CONCLUSIONS

The quartzite of the Detention Sub-group and the Jacob Quartzite within the Agreement Area (based on the results of this multi staged programme) are interbedded with schists and other deleterious siliceous fine grained sediments. Surface outcrops of these sediments are generally obscured by sandy slope wash from the quartzite units. This surface cover, in conjunction with the quartzite outcrops, gives the quartzite the false appearance of being present in massive units.

The results of tactile appraisal and chemical analysis of the near surface quartzite sandstones indicate the near subsurface profile (to a depth in excess of 15 metres in some areas) to be a weathered derivative of deeper quartzite units.

Based on the Stage 2 mapping and costeaning work this variable surface weathering is a widespread feature of the quartzites of the Detention Sub-group and the Jacob Quartzite. As described in the Stage 2 report the rock within this weathered zone varies in character with depth and along strike from a white very poorly cemented sandstone to a white glassy silicified quartzite.

While generally the quality of the silica in the upper zone is good, it is conservatively estimated (based on the Stage 2 costeaning and the diamond drill hole results) that at least 50% of this surface zone would be physically unsuitable for the production of ferro silicon (based on the T.E.M.Co standards ref. Stage 2 report).

Below this leached zone the quartzite proper appears as a light brown to grey glassy, extremely strong, largely thinly bedded unit. The bedding planes and to a lesser extent the rock matrix contain variable quantities of micaceous material. The frequency of the occurrence of the fine micaceous bedding planes within the

quartzite appears to increase with depth. The chemical analyses are consistent with this observation. The impurities in the quartzite tend to grade from the lighter coloured micas (muscovite) and kaolinite to the darker biotite micas with depth as the quartzite grades into schists.

Chemically, figures 4, 5 and 6 show that only a small percentage of quartzite won from this lower zone would be good quality (< 1% Al_2O_3) material.

Finally, in addition to the poor chemical quality of the quartzite beds drilled by DDH No. 1, 3 and 4 the general thin width of the units detracted from the deposit. Large quantities of overburden (both in terms of rock between the quartzite beds and spoil from the weathered zone) would have to be moved and stockpiled to recover the required tonnage of quartzite.

In summary, the Detention Sub-group quartzites have been shown by drilling in the Dip Range area to be unsuitable, and based upon the Stage 2 reconnaissance survey there exists no reason to believe that conditions elsewhere within the Agreement Area would be different. The surface outcrop of Jacob Quartzite at Maynes Creek was tested by B.H.P. and failed on physical specifications (Stage 2 report) and the reconnaissance mapping showed the central portion of the Maynes Creek deposit to be interbedded with weathered phyllitic schist beds.

Based on the foregoing it is not considered that the quartzite units within the Agreement Area contain a sufficient mineable tonnage of quartzite of the chemical and physical quality required.

8.0 RECOMMENDATIONS

Based on the results from the Stage 3 drilling and subsequent sample analyses no further exploration effort is recommended on the Agreement Area for silica of the specific physical and chemical quality nominated by Kaiser Aluminum

561050

APPENDIX A

SEISMIC DATA

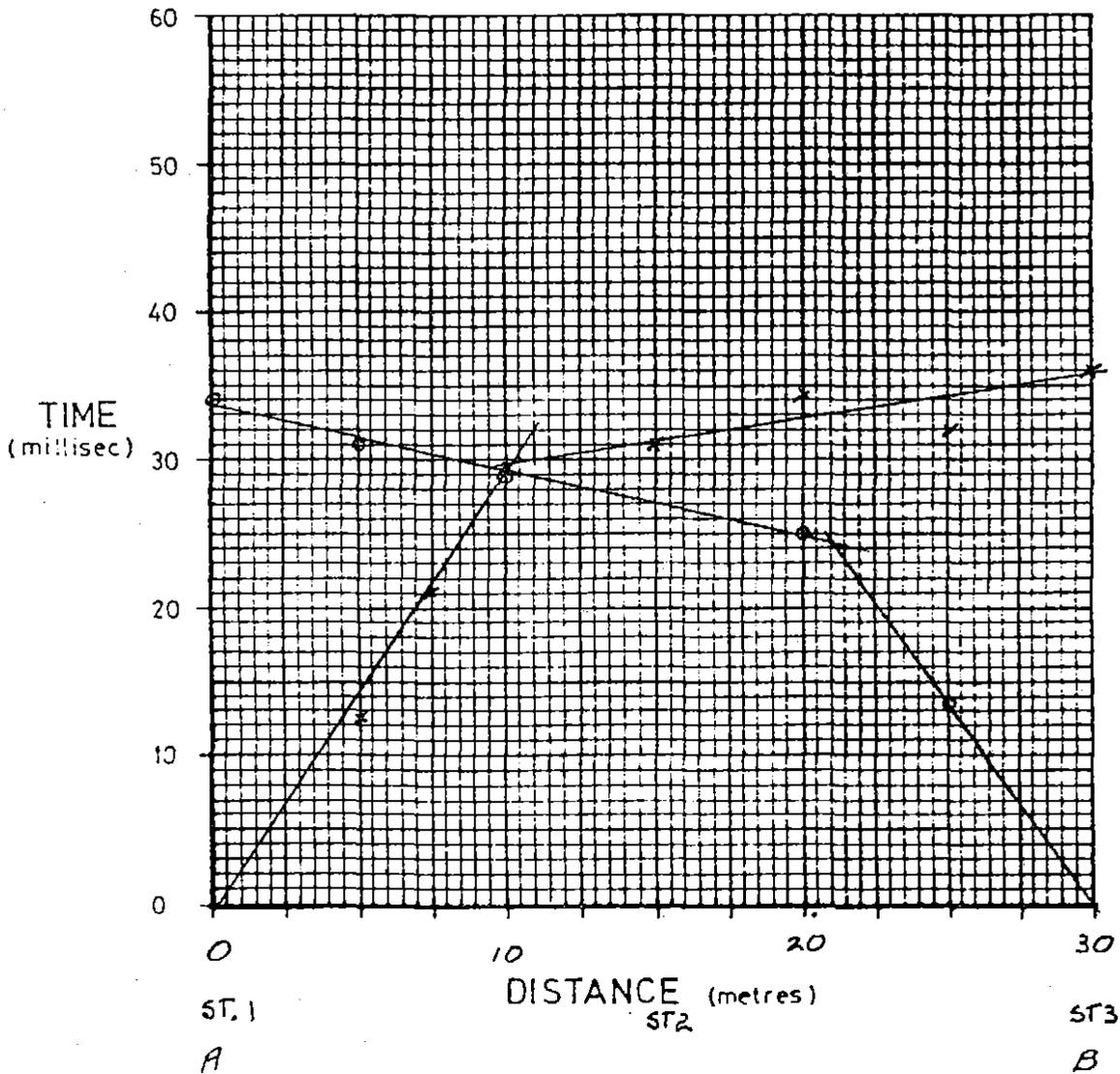
TRAVERSE N° 1

FROM *A* TO *B*

561051

REF. FIG. 3

DISTANCE	0	5	7.5	10	15	20	25	30									
FORWARD		12.5	21.2	29.8	31.0	34.4	32.0	36.0									
REVERSE	34.2	31.1		29.0		25.0	13.5										



OPERATOR *R.J.C*
 MACHINE *NIMBUS*
 DATE

REFRACTION SEISMIC TRAVERSE

JOB N° *PXT 250*

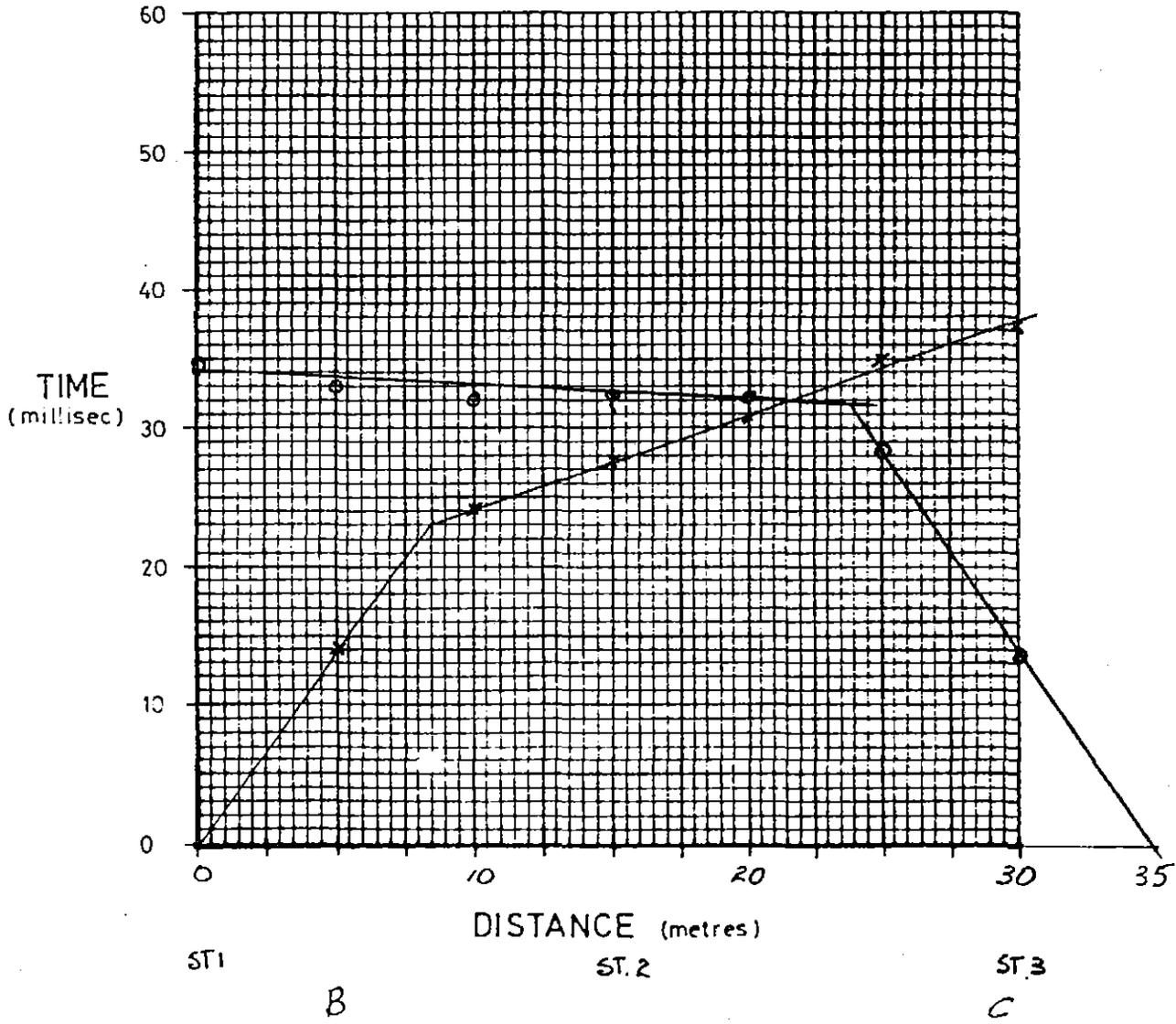
561053

TRAVERSE N° 2

FROM B TO C

REF FIG 2

DISTANCE	0	5	10	15	20	25	30	35									
FORWARD		14.1	24.2	27.7	30.9	35	37.3	-									
REVERSE	34.7	33	32	32.4	32.4	28.3	13.9										



OPERATOR: R.J.C
 MACHINE: NIMBUS
 DATE:

REFRACTION SEISMIC TRAVERSE

JOB N° PXT 250

FIGURE NO

TRAVERSE NO 2

LAYER	VELOCITY (m/sec)	FORWARD VEL. (APPARENT)	REVERSE VEL. (APPARENT)
1	354.99	357.00	353.00
2	2395.09	1428.50	7407.00

FIRST LAYER

STATION	NORMAL THICKNESS(m)
1	2.42
2	4.09
3	6.10

YOUR INPUT DATA IS AS FOLLOWS

NO OF LAYERS= 2
 NO OF STATIONS ANALYSED= 3
 THE APPARENT FORWARD VELOCITIES ARE:

357 1428.5

THE APPARENT REVERSE VELOCITIES ARE:

353 7407

THE RECIPROCAL TIMES FOR EACH REFRACTOR ARE:

37.5

ARRIVAL TIMES, EACH STATION, FIRST FORWARD RUN ARE:

17 27.7 41

REVERSE TIMES, FIRST REFRACTOR, LEFT TO RIGHT, ARE:

34 32.6 30.5

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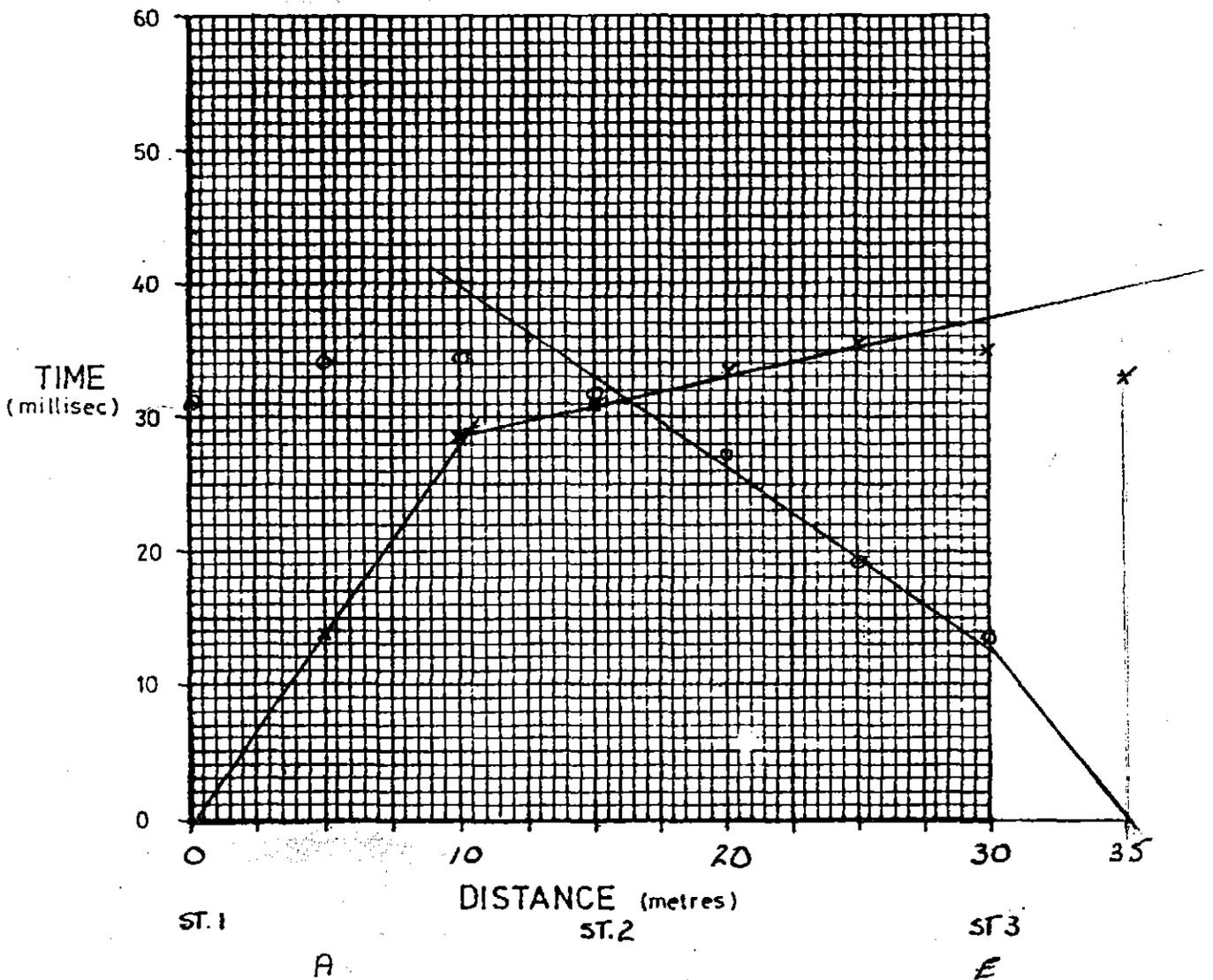
TRAVERSE N° 3

FROM A TO E

REF. FIG. 3

DISTANCE	0	5	10	15	20	25	30	35									
FORWARD	-	13.8	28.4	31	33.5	35.8	35	33									
REVERSE	31.0	34.2	34.6	31.8	27.3	19.2	13.4	-									

561055



OPERATOR: R.J.C	REFRACTION SEISMIC TRAVERSE	JOB N° PXT 250
MACHINE: NIMBUS		LM
DATE:		

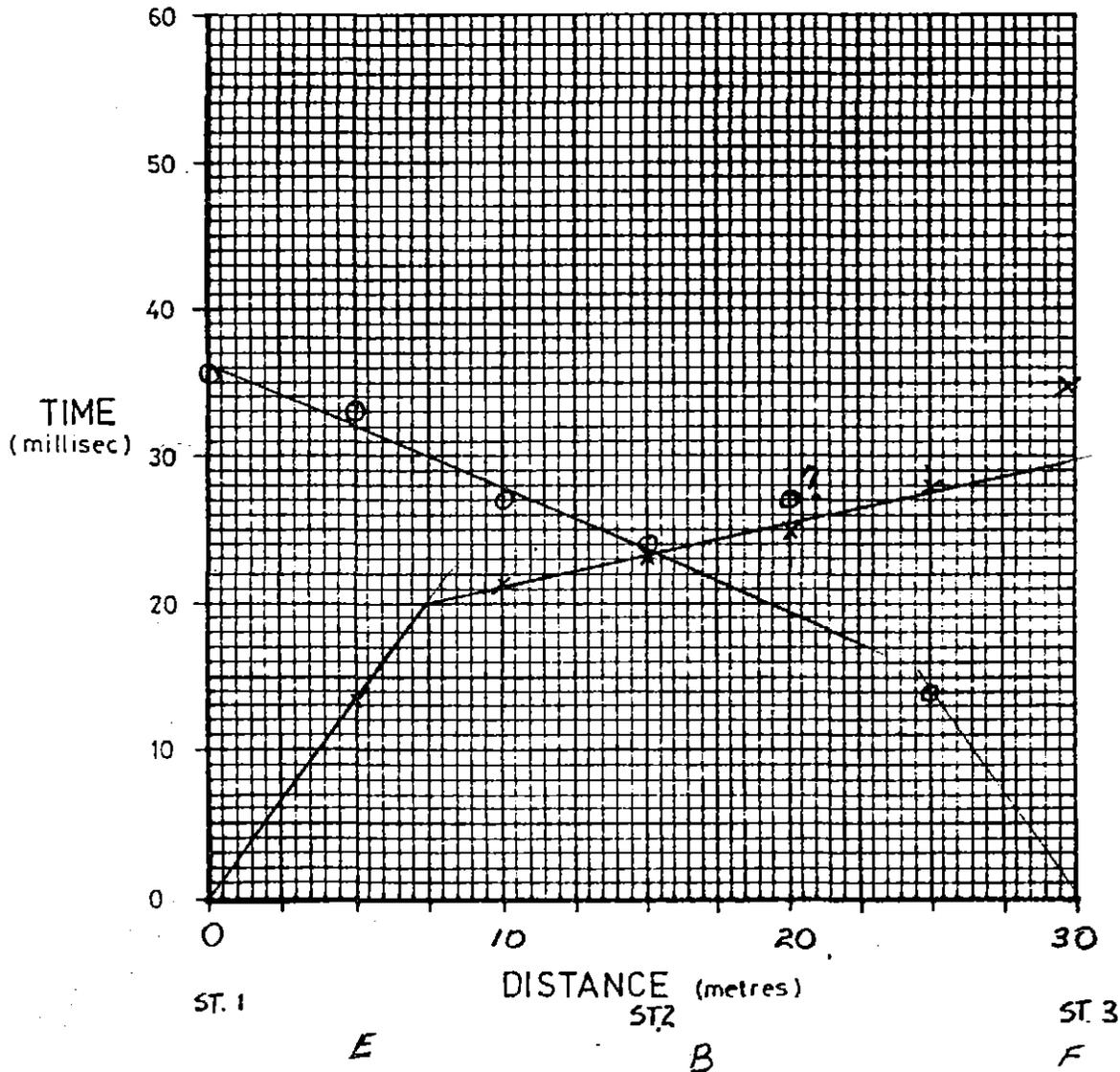
TRAVERSE N° 4

FROM E TO F

REF. FIG 3

DISTANCE	0	5	10	15	20	25	30										
FORWARD	-	13.4	21.4	23.2	25.0	28	35.9										
REVERSE	35.5	33	27	24.0	27	14	-										

561056



OPERATOR: R.J.C.
 MACHINE: NIMBUS
 DATE:

REFRACTION SEISMIC TRAVERSE

JOB N°
 PXT 250

FIGURE NO

561058

x

TRAVERSE NO 5

LAYER	VELOCITY (m/sec)	FORWARD VEL. (APPARENT)	REVERSE VEL. (APPARENT)
1	352.95	357.00	349.00
2	1232.00	1400.00	1100.00

FIRST LAYER

STATION	NORMAL THICKNESS(m)
1	3.96
2	3.32
3	2.58

YOUR INPUT DATA IS AS FOLLOWS

NO OF LAYERS= 2

NO OF STATIONS ANALYSED= 3

THE APPARENT FORWARD VELOCITIES ARE:

357 1400

THE APPARENT REVERSE VELOCITIES ARE:

349 1100

THE RECIPROCAL TIMES FOR EACH REFRACTOR ARE:

42

ARRIVAL TIMES, EACH STATION, FIRST FORWARD RUN ARE:

20.5 31 31

REVERSE TIMES, FIRST REFRACTOR, LEFT TO RIGHT, ARE:

43 29 15

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Job. No
 PXT 250

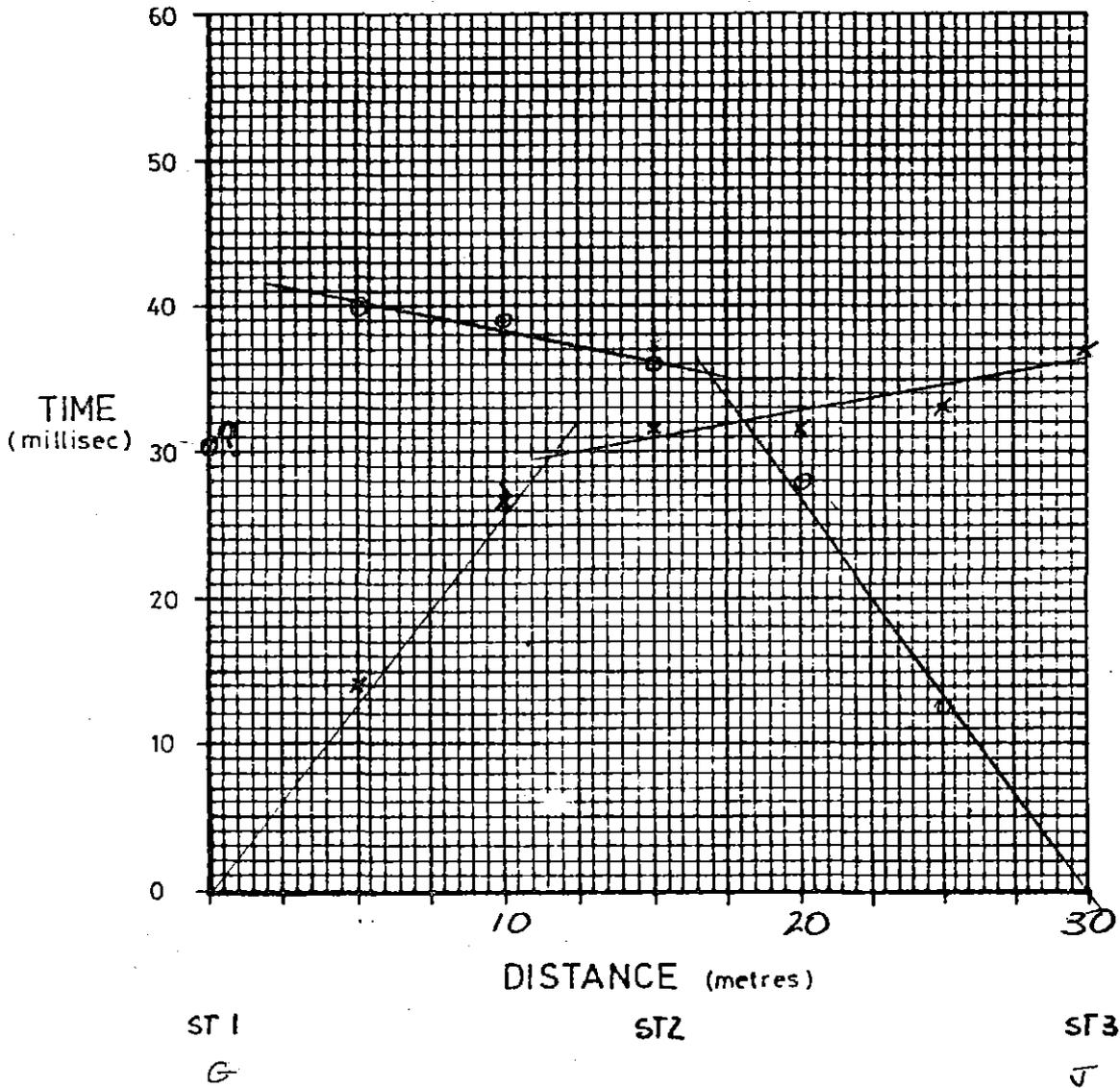
TRAVERSE N° 6

FROM G TO J

REF FIG 3

DISTANCE	0	5	10	15	20	25	30								
FORWARD	-	14	26.5	32.3	32.8	33	37								
REVERSE	-	40	39	36	28	13.5	0								

561059



OPERATOR: R.J.C
 MACHINE: NIMBUS
 DATE:

REFRACTION SEISMIC TRAVERSE

JOB N° PXT 250

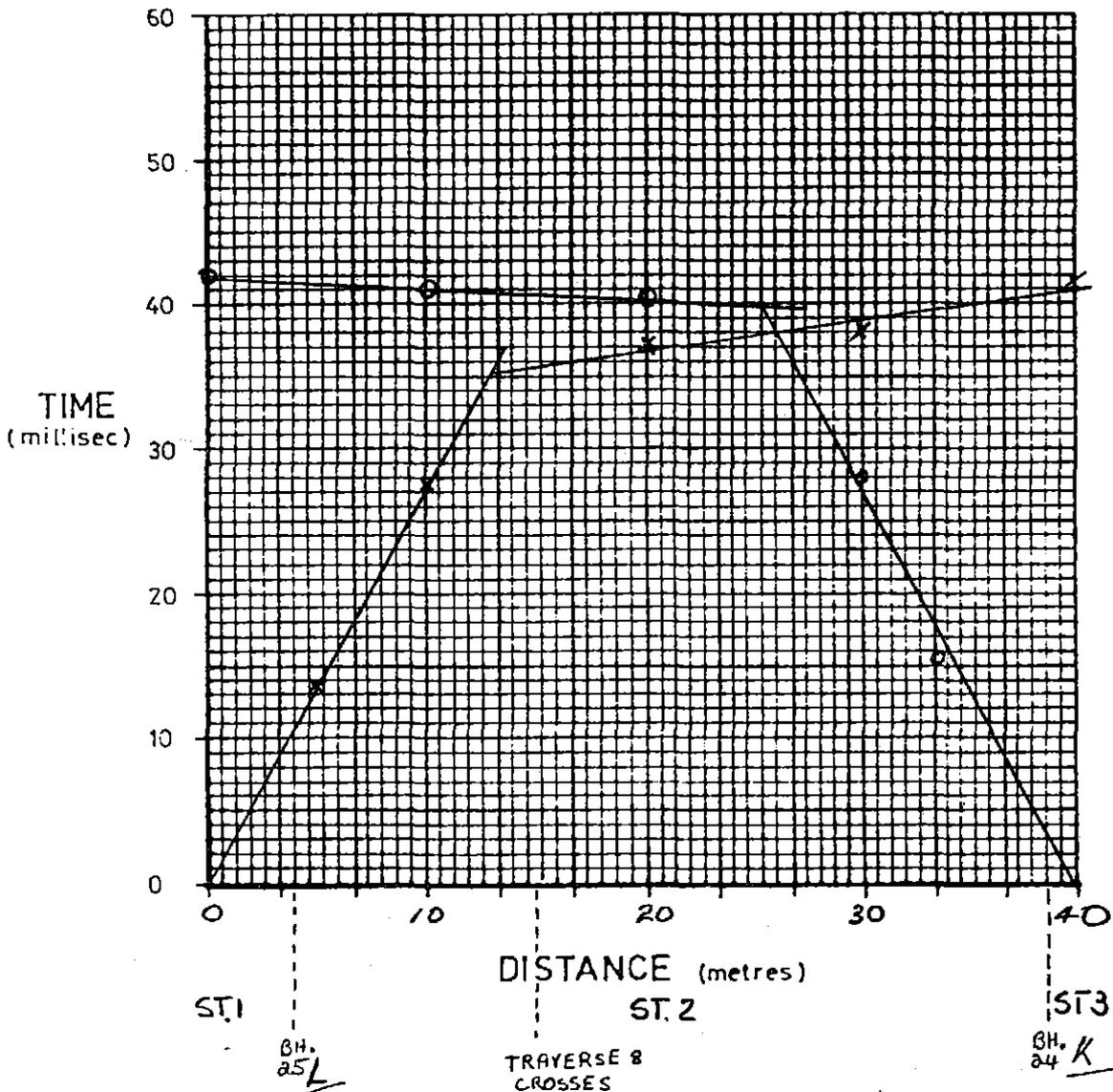
TRAVERSE N° 7

FROM L TO K

REF FIG 3

DISTANCE	0	5	10	20	30	35	40										
FORWARD	-	13.8	27.4	37.1	38	-	41.3										
REVERSE	42	-	41	40.2	28	15.3	-										

561060



OPERATOR: R.J.C	REFRACTION SEISMIC TRAVERSE	JOB N°
MACHINE: NIMBUS		PXTR50
DATE:		LM

561061

TRAVERSE NO 7

LAYER	VELOCITY (m/sec)	FORWARD VEL. (APPARENT)	REVERSE VEL. (APPARENT)
1	368.49	367.00	370.00
2	6153.42	4444.00	10000.00

FIRST LAYER

STATION	NORMAL THICKNESS(m)
1	6.13
2	6.55
3	7.11

YOUR INPUT DATA IS AS FOLLOWS

NO OF LAYERS= 2
 NO OF STATIONS ANALYSED= 3
 THE APPARENT FORWARD VELOCITIES ARE:

367 4444

THE APPARENT REVERSE VELOCITIES ARE:

370 10000

THE RECIPROCAL TIMES FOR EACH REFRACTOR ARE:

41

ARRIVAL TIMES, EACH STATION, FIRST FORWARD RUN ARE:

32.2 36.5 41

REVERSE TIMES, FIRST REFRACTOR, LEFT TO RIGHT, ARE:

42 40 38.5



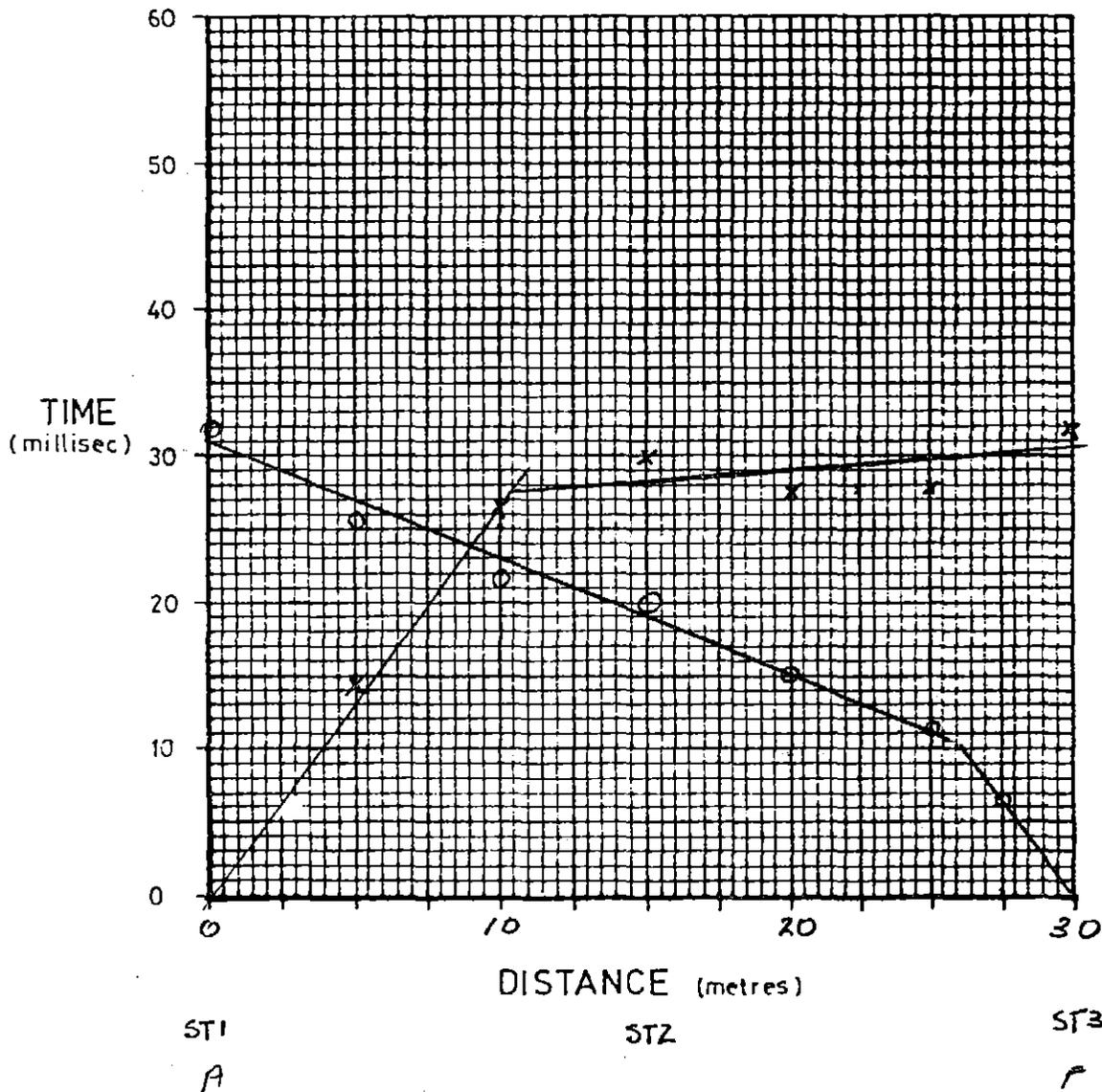
TRAVERSE N° 9

FROM A TO F

REF FIG 3

DISTANCE	0	5	10	15	20	25	27.5	30									
FORWARD		14.7	26.3	30	27.3	27.9		32									
REVERSE	32	25.8	21.5	20	15	11.3	6.6	—									

561064



OPERATOR: A.J.C.
 MACHINE: NIMBUS
 DATE:

REFRACTION SEISMIC TRAVERSE

JOB N° PXR250

561065

TRAVERSE NO 9

LAYER	VELOCITY (m/sec)	FORWARD VEL. (APPARENT)	REVERSE VEL. (APPARENT)
1	379.50	380.00	379.00
2	2105.28	6667.00	1250.00

FIRST LAYER

STATION	NORMAL THICKNESS(m)
1	4.73
2	2.93
3	0.97

YOUR INPUT DATA IS AS FOLLOWS

NO OF LAYERS= 2
 NO OF STATIONS ANALYSED= 3
 THE APPARENT FORWARD VELOCITIES ARE:

380 6667

THE APPARENT REVERSE VELOCITIES ARE:

379 1250

THE RECIPROCAL TIMES FOR EACH REFRACTOR ARE:

32

ARRIVAL TIMES, EACH STATION, FIRST FORWARD RUN ARE:

25.5 28.2 30.05

REVERSE TIMES, FIRST REFRACTOR, LEFT TO RIGHT, ARE:

31 19 7



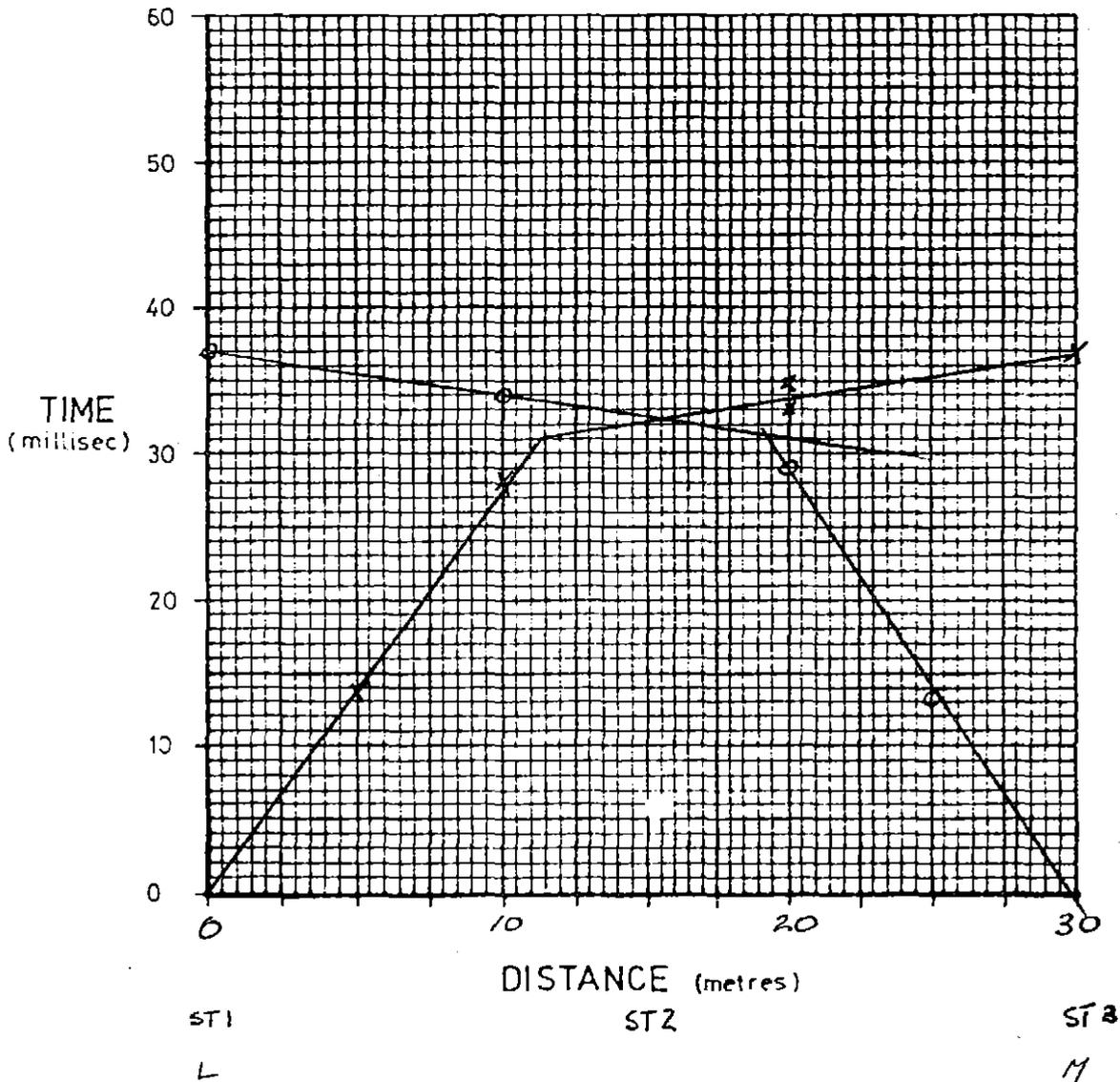
TRAVERSE N° 10

FROM L TO M

REF FIG 3

DISTANCE	0	5	10	15	20	25	30									
FORWARD	-	138	28	-	33	-	37									
REVERSE	37	-	34	-	29	142	-									

561066



OPERATOR R.T.C

MACHINE NIMBUS

DATE

REFRACTION SEISMIC TRAVERSE

JOB N° PXR50



TRAVERSE NO 10

LAYER	VELOCITY (m/sec)	FORWARD VEL. (APPARENT)	REVERSE VEL. (APPARENT)
1	355.66	367.00	345.00
2	3203.13	3083.00	3333.00

FIRST LAYER

STATION	NORMAL THICKNESS(m)
1	4.92
2	4.97
3	5.01

YOUR INPUT DATA IS AS FOLLOWS

NO OF LAYERS= 2
 NO OF STATIONS ANALYSED= 3
 THE APPARENT FORWARD VELOCITIES ARE:

367 3083

THE APPARENT REVERSE VELOCITIES ARE:

345 3333

THE RECIPROCAL TIMES FOR EACH REFRACTOR ARE:

37

ARRIVAL TIMES, EACH STATION, FIRST FORWARD RUN ARE:

27.5 32.25 37

REVERSE TIMES, FIRST REFRACTOR, LEFT TO RIGHT, ARE:

37 32.5 28



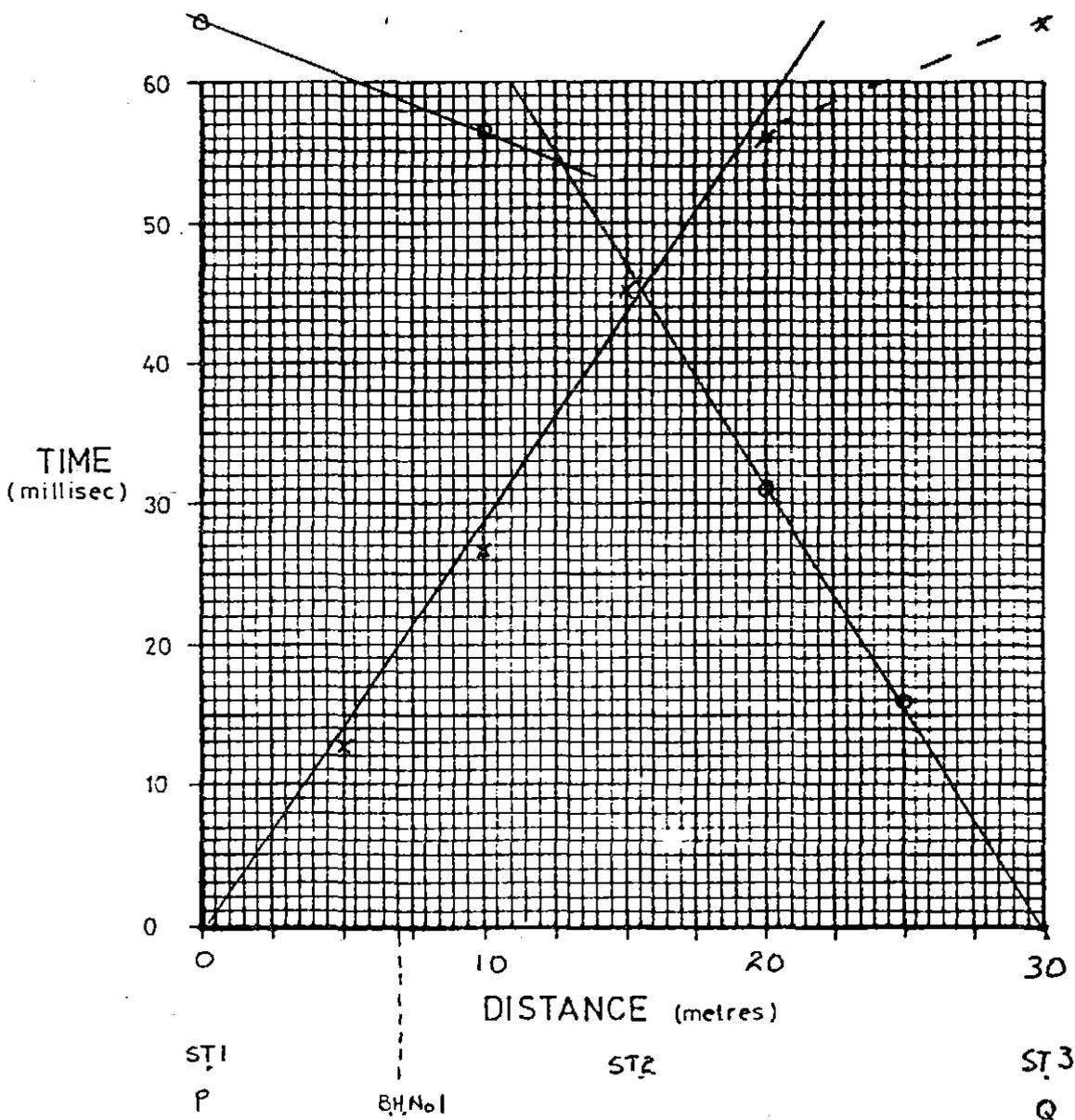
TRAVERSE N° 12

FROM P TO Q

REF FIG No 2

DISTANCE	0	5	10	15	20	25	30									
FORWARD	-	12.8	26.8	45.1	56	-	64									
REVERSE	64.4	-	56.6	-	31	16	-									

561070



OPERATOR R.J.C

MACHINE NIMBUS

DATE

REFRACTION SEISMIC TRAVERSE

JOB N°
PXR250



561071

TRAVERSE NO 12

LAYER	VELOCITY (m/sec)	FORWARD VEL. (APPARENT)	REVERSE VEL. (APPARENT)
1	333.64	345.00	323.00
2	1250.00	1250.00	1250.00 ← DUMMY LAYER

FIRST LAYER

STATION	NORMAL THICKNESS(m)
1	7.01
2	6.23
3	7.01

YOUR INPUT DATA IS AS FOLLOWS

NO OF LAYERS= 2
 NO OF STATIONS ANALYSED= 3
 THE APPARENT FORWARD VELOCITIES ARE:

345 1250

THE APPARENT REVERSE VELOCITIES ARE:

323 1250

THE RECIPROCAL TIMES FOR EACH REFRACTOR ARE:

69

ARRIVAL TIMES, EACH STATION, FIRST FORWARD RUN ARE:

40.5 52.5 69

REVERSE TIMES, FIRST REFRACTOR, LEFT TO RIGHT, ARE:

69 52.5 40.5



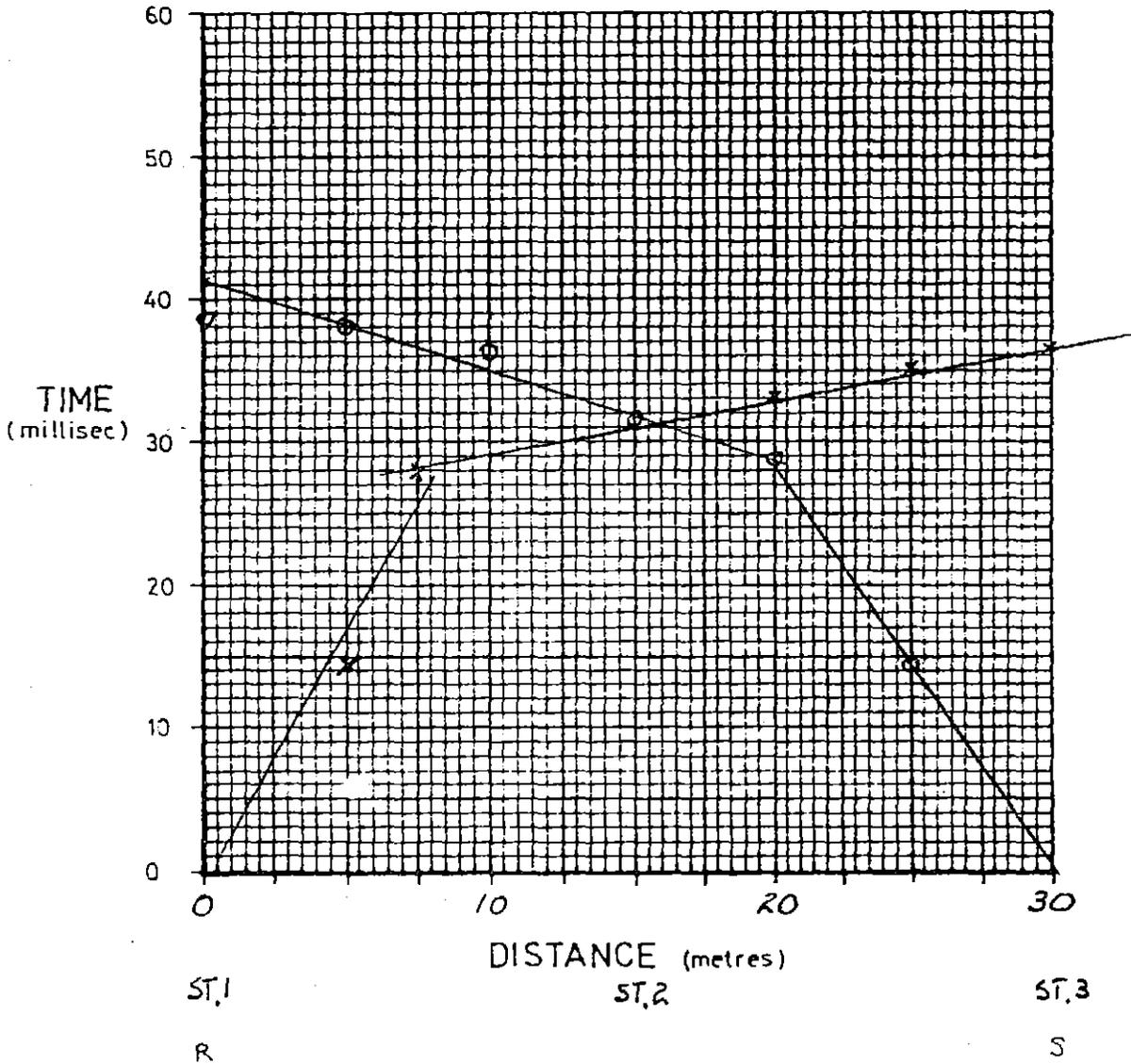
TRAVERSE N° 13

FROM R TO S

REF FIG 2

DISTANCE	0	5	10	15	20	25	30										
FORWARD	-	14.5	28	-	33.2	35.1	36.7										
REVERSE	38.3	38.0	36.3	31.6	28.9	14.5	-										

561072



OPERATOR R.J.C	REFRACTION SEISMIC TRAVERSE	108 N°
MACHINE NIMBUS		PXT 250
DATE		

561073

TRAVERSE NO 13

LAYER	VELOCITY (m/sec)	FORWARD VEL. (APPARENT)	REVERSE VEL. (APPARENT)
1	320.93	300.00	345.00
2	1899.82	2210.00	1666.00

FIRST LAYER

STATION	NORMAL THICKNESS(m)
1	4.40
2	3.91
3	3.26

YOUR INPUT DATA IS AS FOLLOWS

NO OF LAYERS= 2
 NO OF STATIONS ANALYSED= 3
 THE APPARENT FORWARD VELOCITIES ARE:

300 2210

THE APPARENT REVERSE VELOCITIES ARE:

345 1666

THE RECIPROCAL TIMES FOR EACH REFRACTOR ARE:

39

ARRIVAL TIMES, EACH STATION, FIRST FORWARD RUN ARE:

25 31 36.5

REVERSE TIMES, FIRST REFRACTOR, LEFT TO RIGHT, ARE:

41 32 22.5



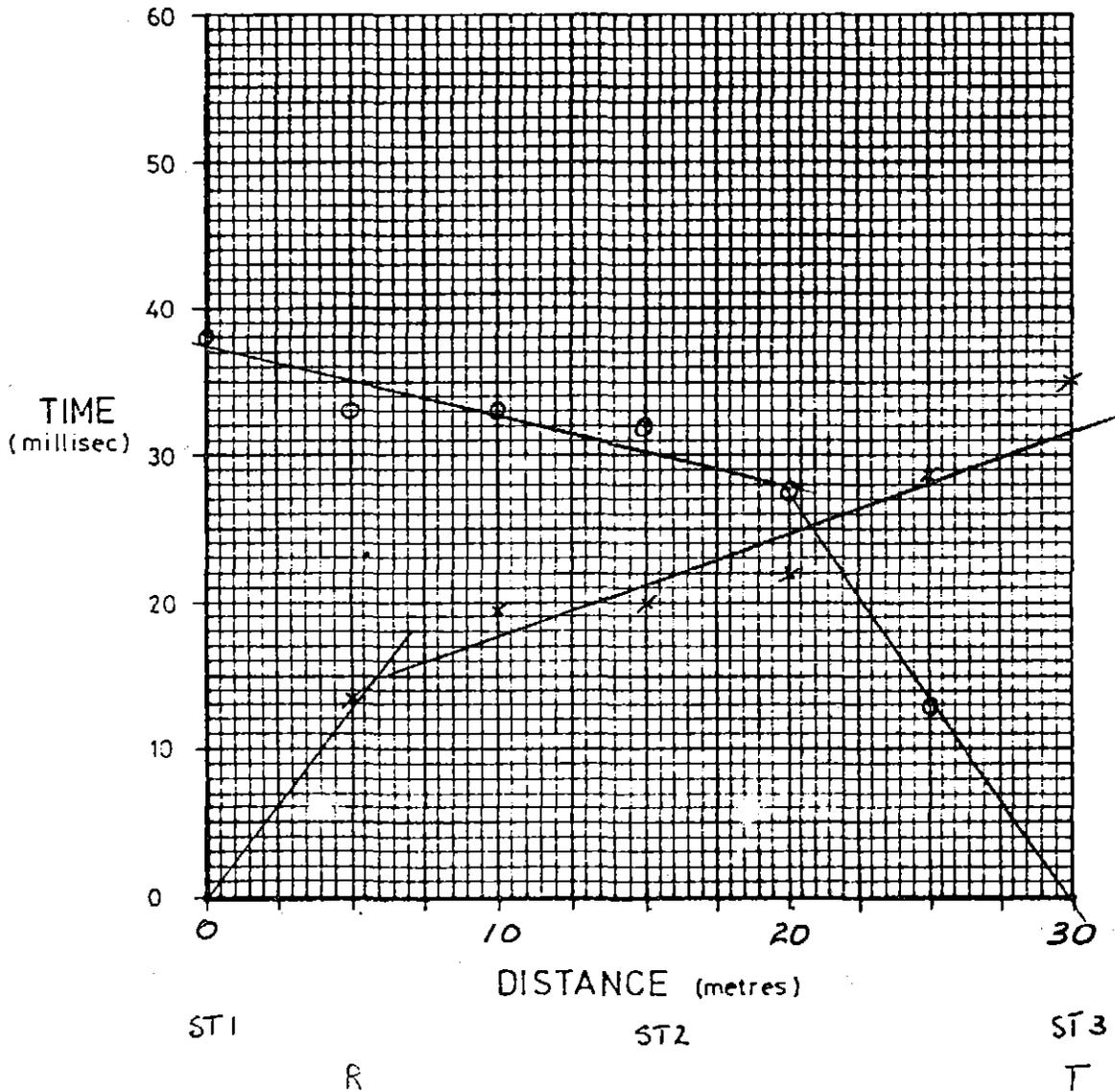
TRAVERSE N°14

FROM R TO T

REF FIG. 2

DISTANCE	0	5	10	15	20	25	30										
FORWARD	-	13.5	19.5	20	22	28.8	35.1										
REVERSE	38	33	33	32	27.3	12.8	-										

561074



OPERATOR R.J.C.
 MACHINE NIMBUS
 DATE

REFRACTION SEISMIC TRAVERSE

JOB N° PXT 250

561075

TRAVERSE NO 14

LAYER	VELOCITY (m/sec)	FORWARD VEL. (APPARENT)	REVERSE VEL. (APPARENT)
1	371.62	400.00	347.00
2	1666.67	1428.57	2000.00

FIRST LAYER

STATION	NORMAL THICKNESS(m)
1	2.48
2	3.05
3	3.72

YOUR INPUT DATA IS AS FOLLOWS

NO OF LAYERS= 2
 NO OF STATIONS ANALYSED= 3
 THE APPARENT FORWARD VELOCITIES ARE:

400 1428.57

THE APPARENT REVERSE VELOCITIES ARE:

347 2000

THE RECIPROCAL TIMES FOR EACH REFRACTOR ARE:

35

ARRIVAL TIMES, EACH STATION, FIRST FORWARD RUN ARE:

10.5 21 31.5

REVERSE TIMES, FIRST REFRACTOR, LEFT TO RIGHT ARE:

37.5 30 23



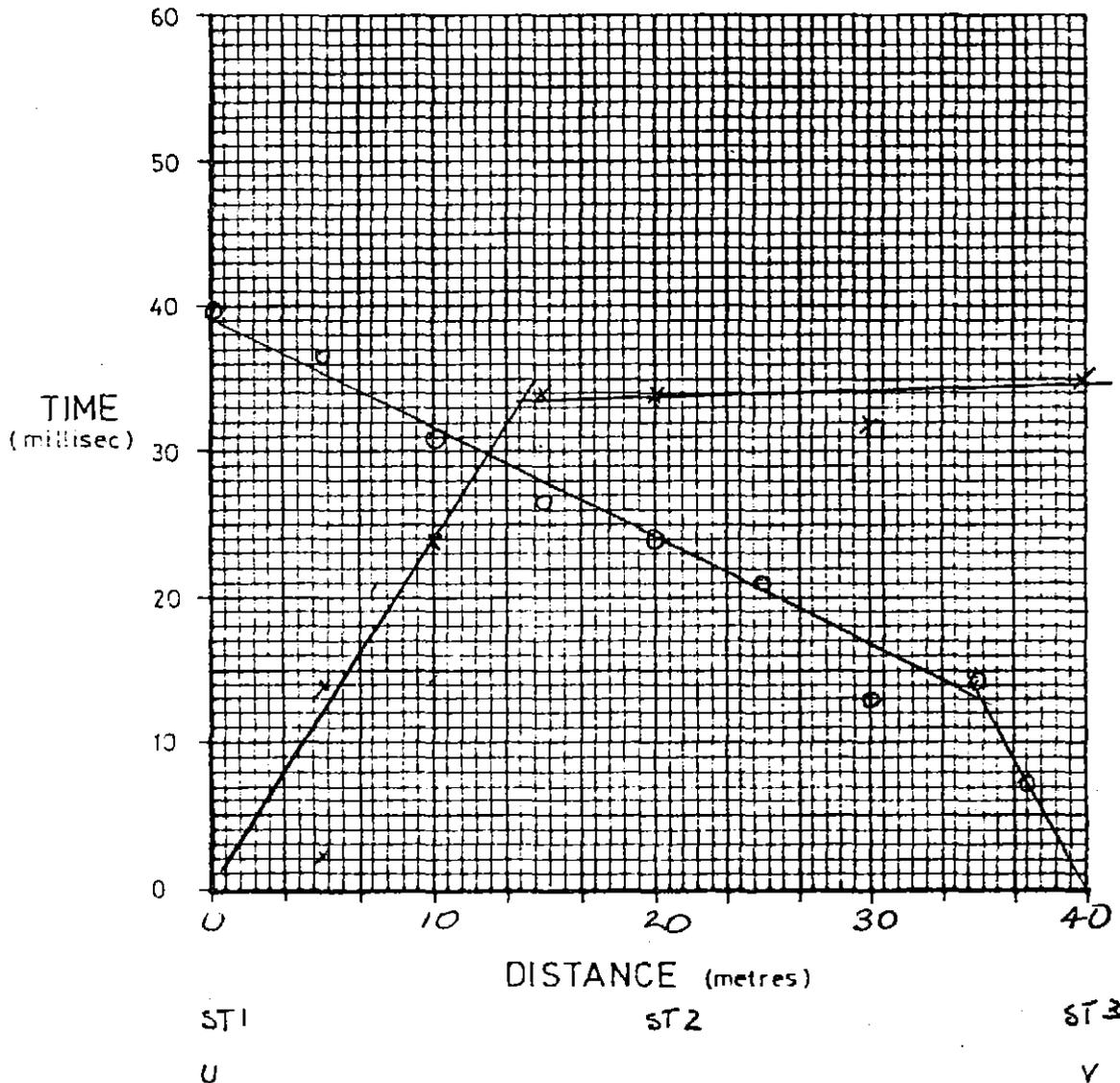
TRAVERSE N° 15

FROM U TO V

REF FIG 2

DISTANCE	0	5	10	15	20	25	30	35	37.5	40						
FORWARD	-	14.3	24	34	34		32			35						
REVERSE	39.7	36.9	31.0	26.5	24	21	13.2	14.2	7.1							

561076



OPERATOR <i>R.T.C</i>	REFRACTION SEISMIC TRAVERSE	JOB N° <i>PXTR50</i>
MACHINE <i>NIMBUS</i>		LM
DATE		

561077

TRAVERSE NO 15

LAYER	VELOCITY (m/sec)	FORWARD VEL. (APPARENT)	REVERSE VEL. (APPARENT)
1	391.65	416.00	370.00
2	2556.33	21000.00	1361.00

FIRST LAYER

STATION	NORMAL THICKNESS(m)
1	6.64
2	4.16
3	1.49

YOUR INPUT DATA IS AS FOLLOWS

NO OF LAYERS= 2
 NO OF STATIONS ANALYSED= 3
 THE APPARENT FORWARD VELOCITIES ARE:

416 21000

THE APPARENT REVERSE VELOCITIES ARE:

370 1361

THE RECIPROCAL TIMES FOR EACH REFRACTOR ARE:

37

ARRIVAL TIMES, EACH STATION, FIRST FORWARD RUN ARE:

32.5 34 35

REVERSE TIMES, FIRST REFRACTOR, LEFT TO RIGHT, ARE:

38 24 9.5



561078

APPENDIX B

BORE HOLE LOGS

LM

BOREHOLE LOG SHEET

561079

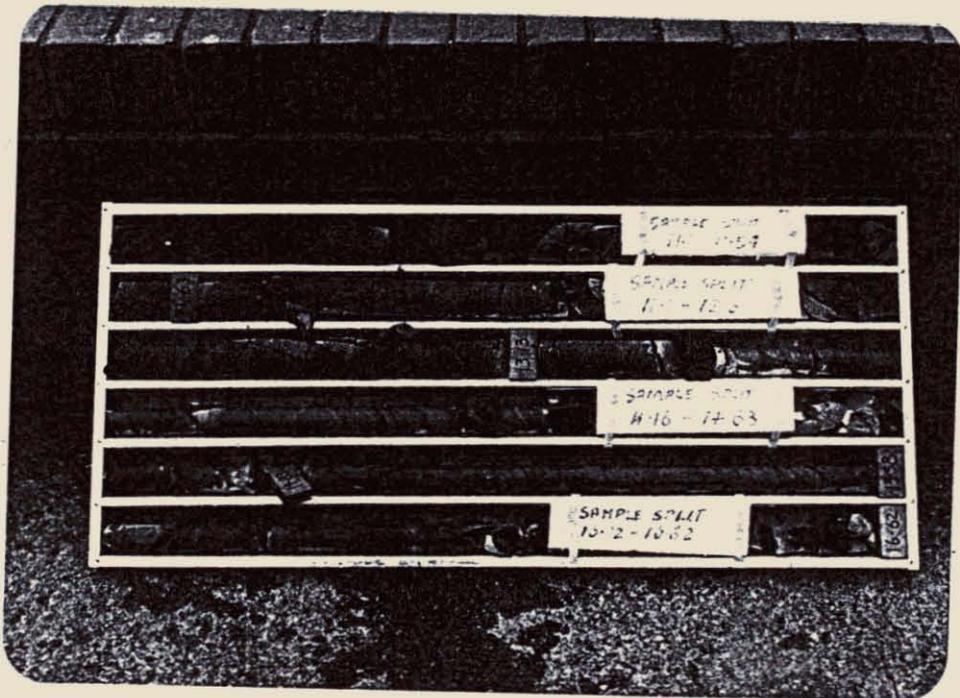
Client: KAISER ALUMINUM			HOLE NO. DDH 1	
Project: SILICA PROSPECT E.L. 43/70				
Location: WYNYARD TASMANIA			SHEET 1 OF 1	
Position: DIP RANGE NORTH REF. FIGURE 2		Surface Elevation: G.L.		
Date Started: 14/5/81		Date Completed:		Logged By: R.J.C.
Rig Type (Mounting): TRAILOR (GEMCO)		Contractor: H. STACPOOL		
Progress	Sample or Test	Depth (RL) metres	Strata	Description <small>(moisture, colour, consistency, structure, SOIL TYPE, origin)</small>
		0.3	UUU UU UUU	Moist, black, loose, sandy top soil.
				SEE ROCK CORE LOG
▽ 11.7				~
		36.12		END OF HOLE

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Job No
PXT 250

561080

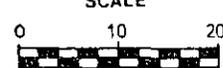


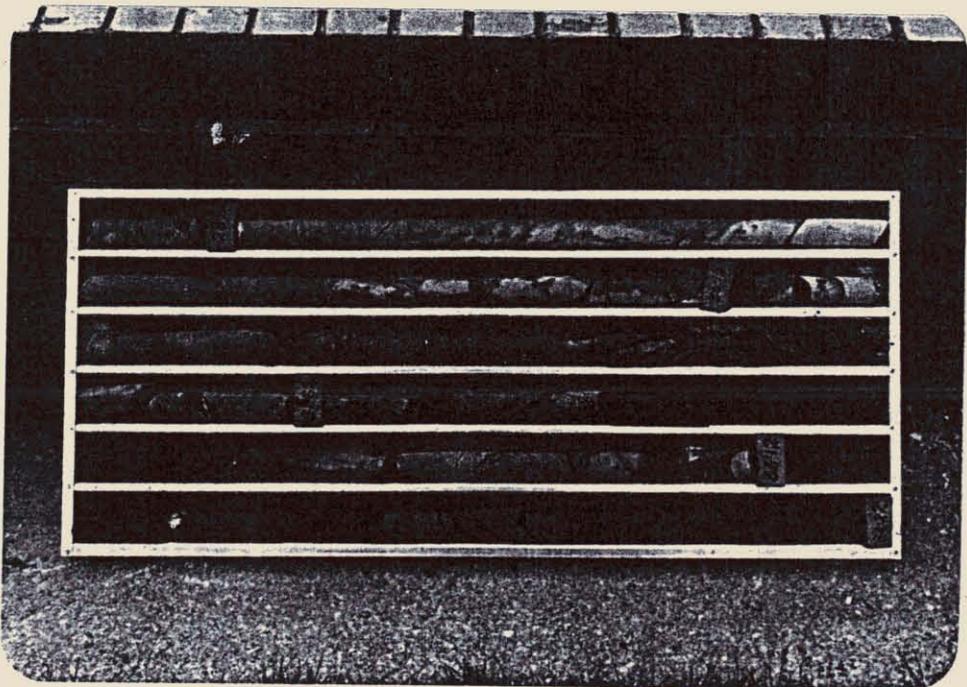
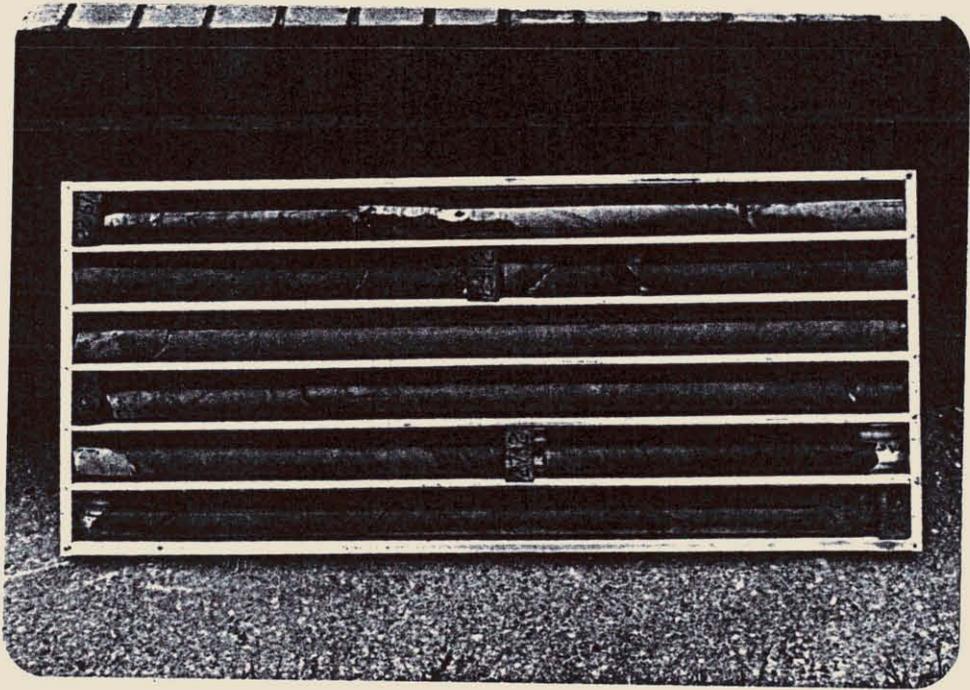
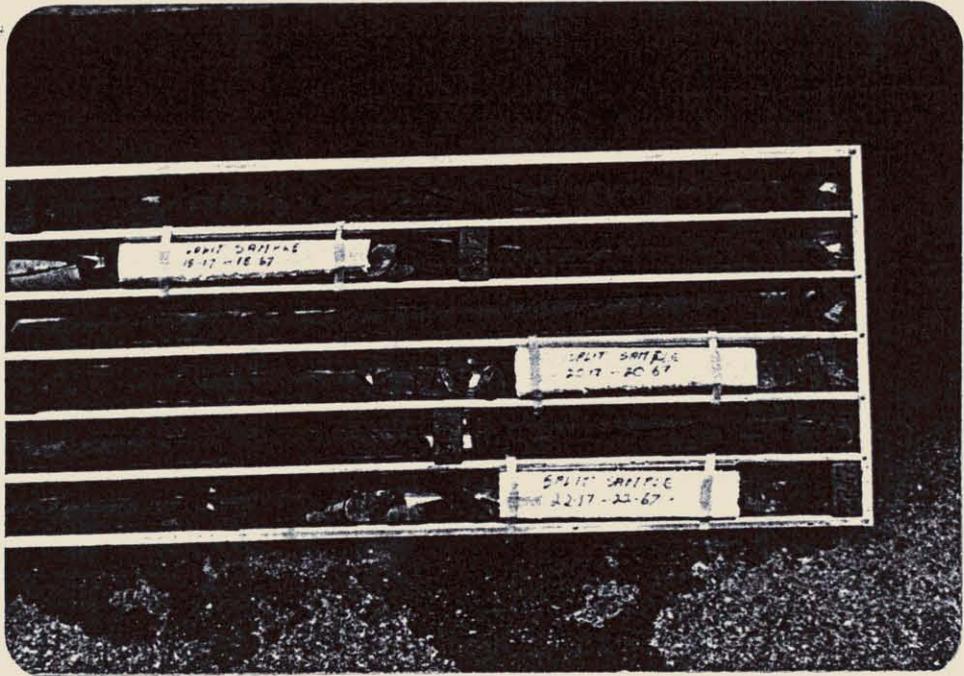
CORE LOG SHEET

003004

Client: KAISER ALUMINUM		HOLE NO: DDH NO 1	
Project: SILICA PROSPECT E.L. 43/70		SHEET 1 OF 3	
Location: WYNYARD TASMANIA		Position: DIP RANGE NO. 1 NORTH REF. FIGURE 2	
Surface Elevation: G.L.		Angle from Horizontal: 90°	
Rig Type: GEMCO	Mounting: TRAYLOR	Contractor: H. STACPOOL	Driller: R.G. IETHBORG
Casing Diameter: N	Barrel (length): 2.445	Bit: NO/T46	Bit Condition Before: GOOD After: CHANGED
Date Started: 12-5-81	Date Completed:	Logged by: R. J. CARR	Date Logged: 14/5/81

Progress	DRILLING/ CASING	WATER	DRILL DEPTH (Core loss run %)	SAMPLES/ FIELD TESTS	DEPTH (RL) (m)	STRATA	DESCRIPTION (Rock type, Colour, Grain size, Structure (texture, mineral composition, hardness, alteration cementation, etc. as applicable))	Weathering		Strength (50)MPa		NATURAL FRACTURES				ADDITIONAL DATA (joints, veins, seams, faults) Description, dip, smoothness, coating, other.	
								EW	HW	EW	HW	EW	HW	EW	HW		ES
			0.3		0.3		SEE BOREHOLE LOG SHEET										
					0.5		SANDSTONE, white, fine grained, quartzose, poorly cemented and friable.										
1			76		1.15		CORE LOSS										
2			100		1.95		CORE LOSS										
3					2.11		SANDSTONE, white, fine grained, quartzose, poorly cemented and friable.										Bedding dipping approximately at 45°
4			89		3.395		CORE LOSS										
5					4.8		SANDSTONE, white and light brown, fine to medium grained, quartzose, minor harder bands generally poorly cemented and porous.										Thinly bedded with solution cavities and clay minerals along bedding planes. Joints at 15° to core
6			53	4.9 5.4	5.5		CORE LOSS										
7			6.3		8.40		SANDSTONE, white, fine to medium grained, quartzose, some rose quartz, partially silicified.										Silicification along joint planes
8			0		8.71		As above crossbedded.										
9			23		8.9		CORE LOSS										
10			8.71		13		SANDSTONE, white to light brown, fine grained, silicified.										
11			10.31		9.4		CORE LOSS (sand)										
12			0		10.56		As above										Joints and fractures infilled with black iron oxides etc.
13			11.63		11.1		SANDSTONE, black brown, iron/ alumina, oxide stained, medium grained with micaceous matrix material.										
14			0		12.1		QUARTZITE, light brown, minor micaceous material, fine to medium grained, silicified sandstone.										
15			13.13		12.6		QUARTZITE, light brown and grey, glassy, fine grained, possible secondary silicification, grains structure obscured by silica cement. Bedding structure still apparent as thin micaceous bands.										At 13.33 NQ bit refused. Changed to thin walled AQ barrel and impregnated bit.
16			13.30		14.16		QUARTZITE, light brown and grey, glassy, fine grained, possible secondary silicification, grains structure obscured by silica cement. Bedding structure still apparent as thin micaceous bands.										Joints and fractures infilled with brown black oxides. Joint spacing varies from 150 to 600mm. Two joint sets observed 30° apart both at 10-15° to core
			14.63		14.63												

<p>SCALE</p>  <p>Metres</p>	<p>Consulting Geotechnical Engineers</p> <p>3 Eden Street, Crows Nest 2065 Telephone: 929 0122</p> <p>LONGWORTH & MCKENZIE PTY. LIMITED</p>	 <p>Job No PXT 250</p>
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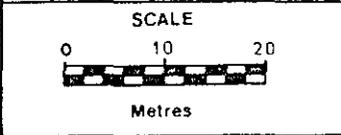
561082

CORE LOG SHEET

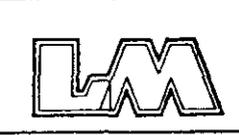
301003

Client: KAISER ALUMINUM		HOLE NO. 001H N°1	
Project: SILICA PROSPECT E.L. 43/70		SHEET 2 OF 3	
Location: WYNYARD TASMANIA			
Position: DIP RANGE NO.1 NORTH REF. FIGURE 2	Surface Elevation: G.L.	Angle from Horizontal: 90°	
Rig Type: GEMCO	Mounting: TRAILOR	Contractor: H. STACPOOL	Driller: R.G. LETHBORG
Casing Diameter: N	Barrel (length): 2.445	Bit: NQ/T46	Bit Condition Before: GOOD After: CHANGED
Date Started: 12-5-81	Date Completed:	Logged by: R.J. CARR	Date Logged: 14-5-81

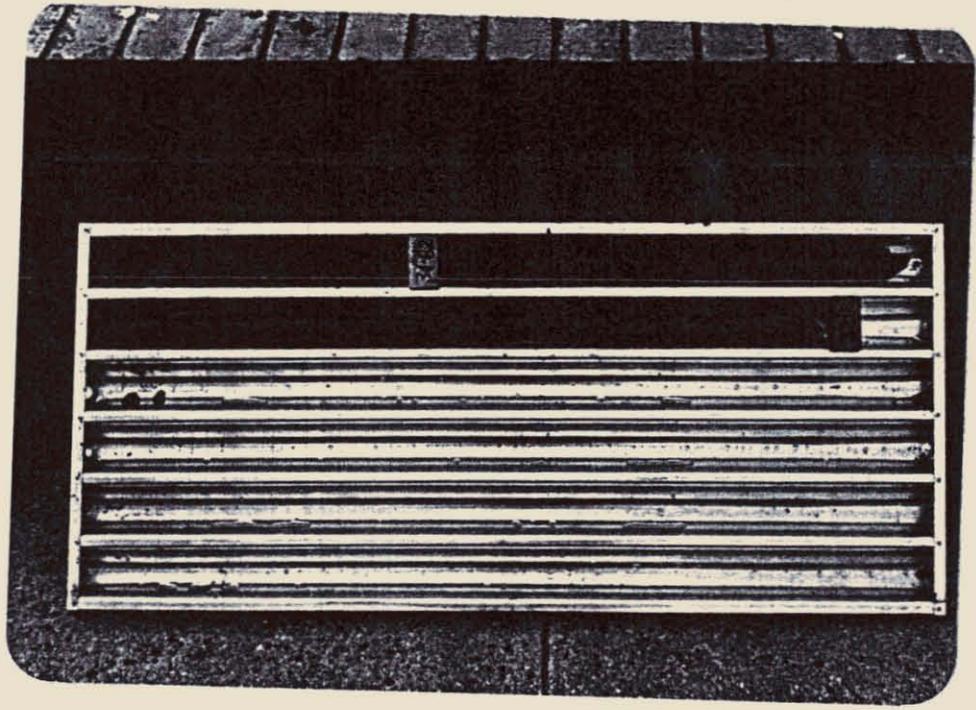
Progress	DRILLING/ CASING	WATER	DRILL DEPTH (Core loss in %)	SAMPLES / FIELD TESTS	DEPTH (RL) m	STRATA	DESCRIPTION (ROCK TYPE, Colour, Grain size, Structure (texture, mineral composition, hardness, alteration cementation, etc. as applicable))	Weathering		Strength Is (50) MPa		NATURAL FRACTURES					
								SW	VS	SW	VS	SW	VS	SW	VS	SW	VS
17			15.62		17.0		As above with finely interbedded micaceous bands. QUARTZITE grading to earth brown colour as micas increase.										Joints brown oxide filled at 10-15° to core.
18			18.17		18.17		QUARTZITE with abundant micaceous minerals, white to light brown, in part schistose.										Joints and fractures infilled with oxides and micaceous material.
19			18.67														
20			19.67		20.0		QUARTZITE in part, micaceous, blue grey, fine grained, glassy.										
21			20.61														
22			21.17				As above minor micaceous beds.										
23			22.17														
24			22.67														Joints tight and clean, minor infill.
25			24.12		24.6												Joint 10-15° to core.
26			25.62				QUARTZITE, grey, fine grained with frequent interbedded fine yellow micaceous beds.										Joint, 10-15° to core.
27			27.12														Joint, 10-15° to core.
28			28.47														Joints, 10-15° to core.
29			28.67				As above.										Joint
30			30.12		30.2												Bit replaced with new impregnated unit.
31							SANDSTONE, dark brown to black, fine grained and silty, silicified.										Joint and fracturing.
32			31.62														Black oxide in joints, bedding and fracture surfaces.



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Job No
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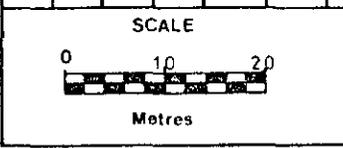
561084

CORE LOG SHEET

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Client:	VAISER ALUMINIUM		HOLE NO. D.D.H. N°1
Project:	SILICA PROSPECT E.L. 47/70		SHEET 3 OF 3
Location:	WYNYARD TASMANIA		
Position:	DIP RANGE NO. 1 NORTH REF. FIGURE 2	Surface Elevation: G.L.	Angle from Horizontal: 90°
Rig Type:	GEMCO	Mounting: TRAILOR	Contractor: H. STACPOOL Driller: R.G. LETHBORG
Casing Diameter:	N	Barrel (length): 2.445	Bit: NQ/T46 Bit Condition Before: GOOD After: CHANGED
Date Started:	12-5-81	Date Completed:	Logged by: R.J. CARR Date Logged: 14-5-81

Progress	DRILLING/ CASING	WATER	[Core loss] DRILL DEPTH (m)	SAMPLES/ FIELD TESTS	DEPTH (RL) m	STRATA	DESCRIPTION <small>ROCK TYPE, Colour, Grain size, Structure (texture, mineral composition, hardness, alteration cementation, etc. as applicable)</small>	Weathering		Strength ts (50) MPa		NATURAL FRACTURES					
								EW	HW	EW	HW	Spacing (mm)			VISUAL	ADDITIONAL DATA <small>(joints, veins, seams, faults) Description, dip, smoothness, coating, other.</small>	
33			0 33.12				As above SANDSTONE, brown black, fine silty (carbonaceous) black oxide stained.										Black oxides in fracture, joint and bedding planes.
34			0 34.22														
35			0 34.62														
36			0 36.12														
37							D.D.H No. 1 TERMINATED										



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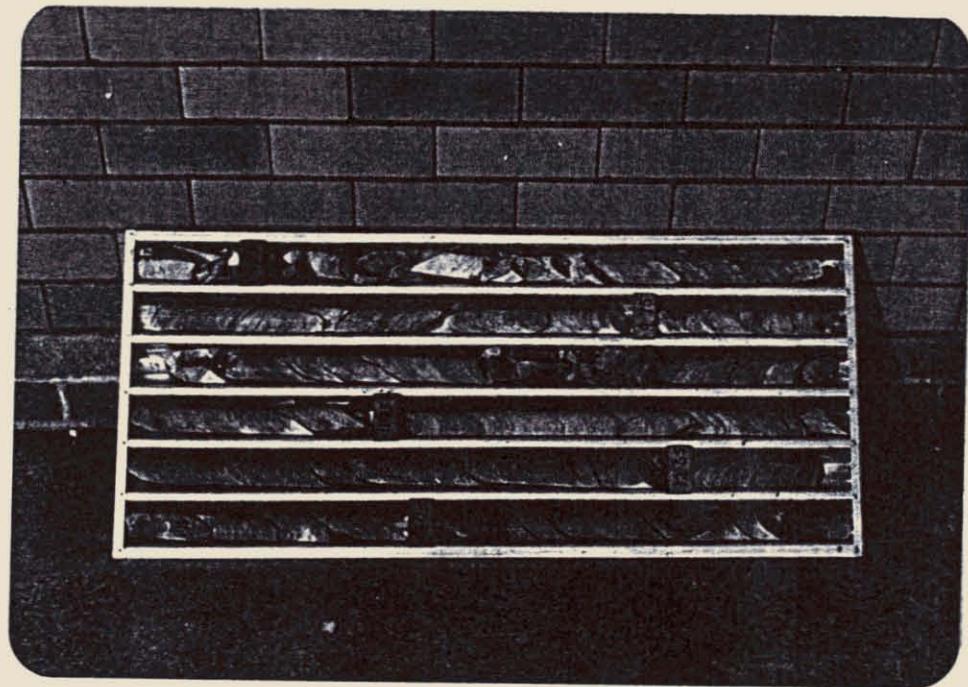
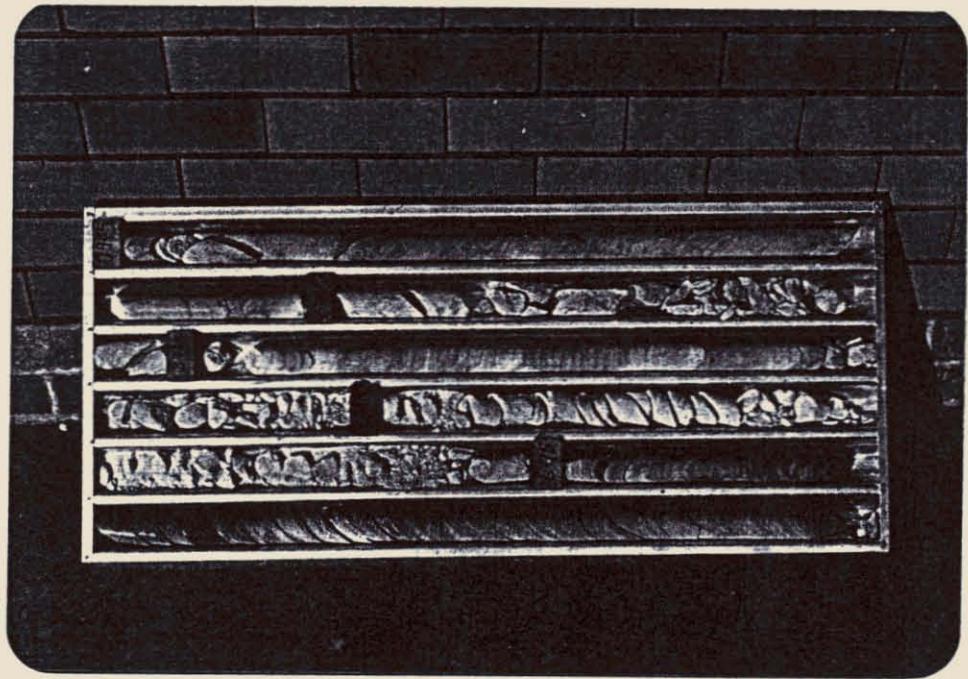


Job No
PTX 250

BOREHOLE LOG SHEET

561086

Client: KAISER ALUMINUM				HOLE NO. DD.H 2
Project: SILICA PROSPECT EL 43/70				
Location: WYNYARD TASMANIA				
Position: QUARTZITE PEAK REF. FIGURE 2		Surface Elevation: APPROX 380m		
Date Started: 24/5/81		Date Completed: 26/5/81		Logged By: R.J. CARR
Rig Type (Mounting): GEMCO (TRAILOR)		Contractor: H.J. STACPOOL -		
Progress	Sample or Test	Depth (RL) metres	Strata	Description (moisture, colour, consistency, structure, SOIL TYPE, origin)
		0.3	UUU UUU UUU	Moist, black, loose, sandy TOPSOIL.
		0.945	White, moist, very weak SANDSTONE.
				SEE ROCK CORE LOG
				~
				~
		17.7		END OF HOLE

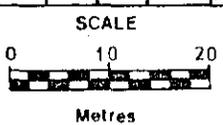


CORE LOG SHEET

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Client:	KAISER ALUMINUM		HOLE NO. DD.H N°2
Project:	SILICA PROSPECT EL 43/70		SHEET 1 OF 2
Location:	WYNYARD TASMANIA		
Position:	QUARTZITE PEAK REF. FIGURE 2	Surface Elevation: G.L.	Angle from Horizontal: 90°
Rig Type:	GEMCO	Mounting: TRAILER	Contractor: H.J. STACPOOL Driller: R.C. LETHBORG
Casing Diameter:	NQ	Barrel (length): 1.955	Bit: IMPREGNATED Bit Condition Before: WORN After: CHANGED
Date Started:	24/5/81	Date Completed: 26/5/81	Logged by: R.J. CARR Date Logged: 28/4/81

Progress	DRILLING/ CASING	WATER	DRILL DEPTH (Core loss / run %)	SAMPLES / FIELD TESTS	DEPTH (RL) 'E	STRATA	DESCRIPTION (texture, mineral composition, hardness, alteration cementation, etc. as applicable)	Weathering	Strength Is (50) MPa	NATURAL FRACTURES							
										EW 0.03	VW 0.1	VW 0.5	NZ 1	VZ 3	VZ 10	ES	Specing (mm)
	CASING		0.945		0.945		SEE BORE HOLE LOG										
1			0				SANDSTONE, white, fine to medium grained, silicified, colour grades to glassy grey.										
2			2.245														
3			0				SANDSTONE, white, medium grained and friable.										Claystone band 3mm wide Core fractured, near vertical joint
4			3.745														Bedding at 45° to ̸
5			0				SANDSTONE, white, medium to fine grained, friable, sandy sandstone										Core partially sand
6			5.25														
7			0														
8			6.75				Shaley SANDSTONE, light brown grey, interbedded medium grained sandstone with silty and claystone beds, thinly bedded sequence, banded colours vary from brown, green to black.										Parting, along bedding planes
9			8.25														
10			0														Near vertical joint
11			9.75														
12			0														Joints at 15° to ̸
13			11.25														
14			0														Joint at 15° to ̸
15			12.65														
16			13.20														Joint at 30° to ̸
17			0				As above light grey, green										

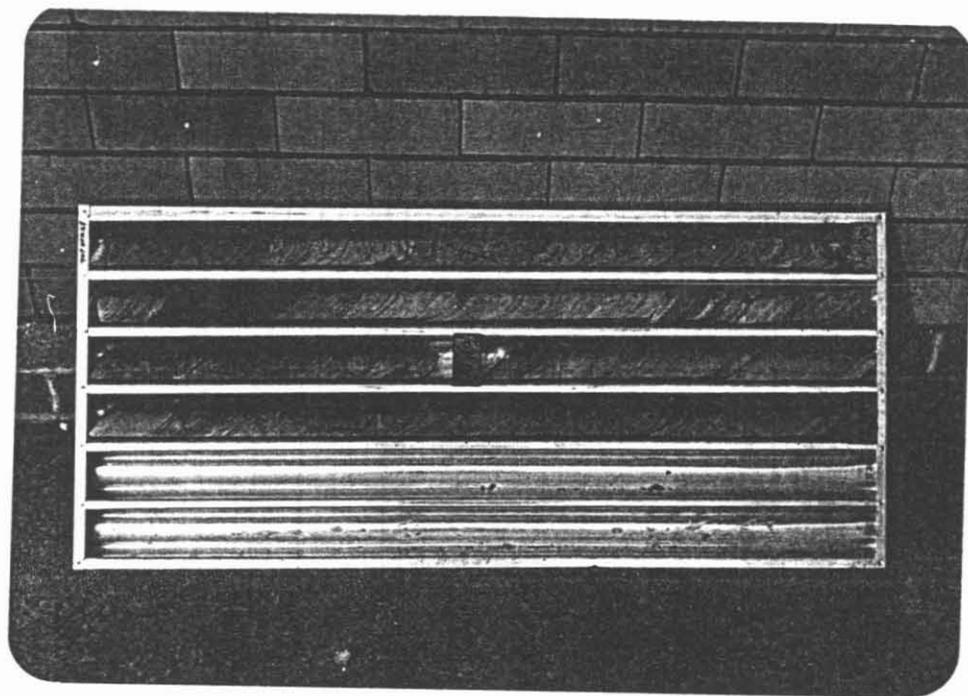


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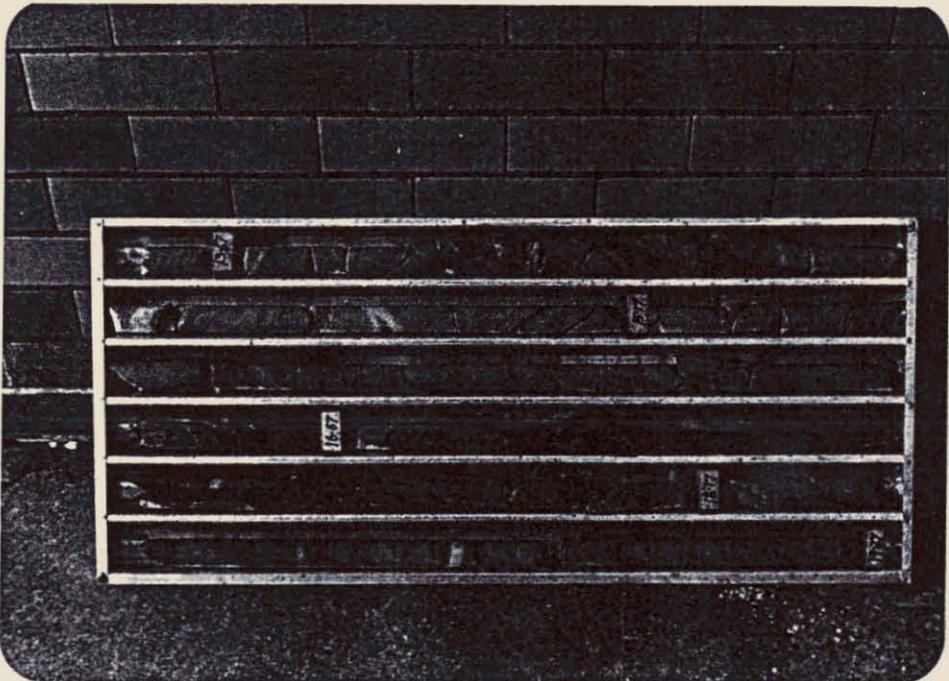
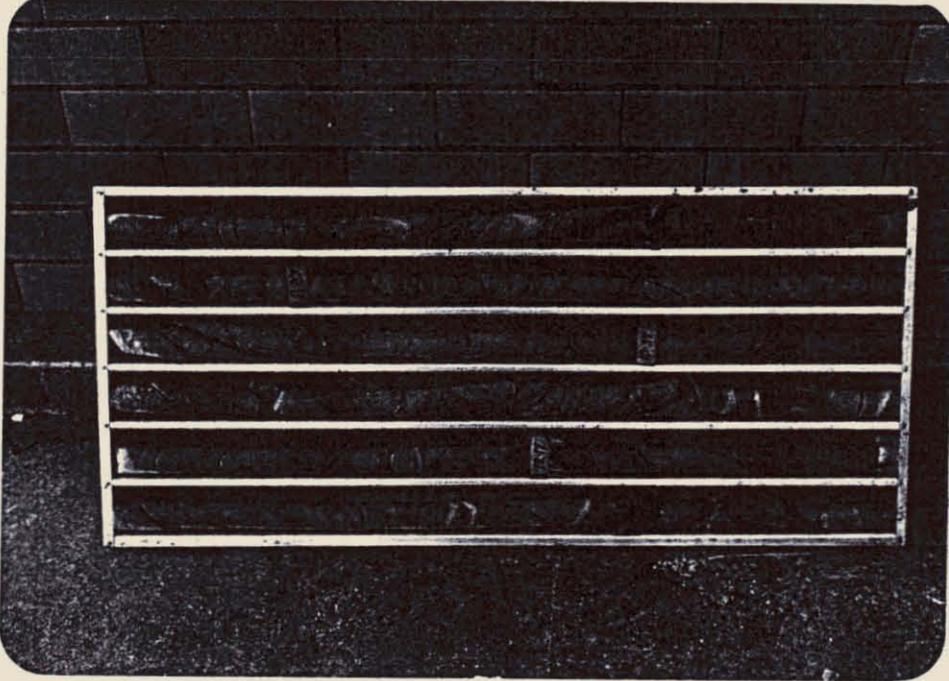
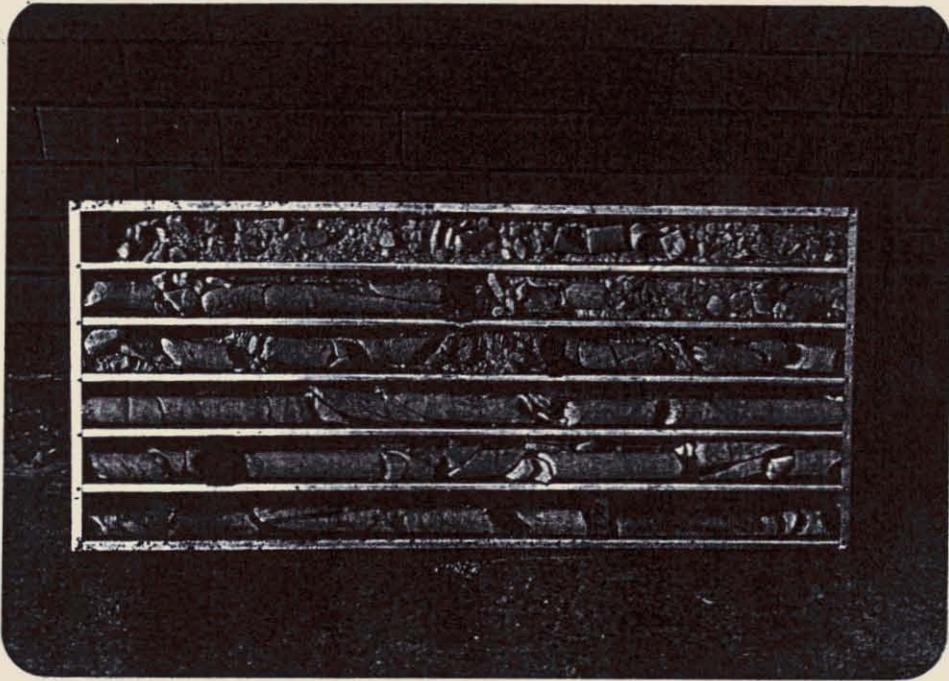


Job No
NXT 250

561089



561091



BOREHOLE LOG SHEET

561092

Client: KAISER ALUMINUM	HOLE NO. D.D.H 3
Project: SILICA PROSPECT EL 43/70	SHEET 1 OF 1
Location: WYNYARD TASMANIA	
Position: N.N.W. OF SHAKESPEARE (REF. DMC)	Surface Elevation: G.L.
Date Started: 27/5/81	Date Completed: 1/6/81
	Logged By: R.J. CARR
Rig Type (Mounting): GEMCO (TRAILOR)	Contractor: H.J. STACPOOL

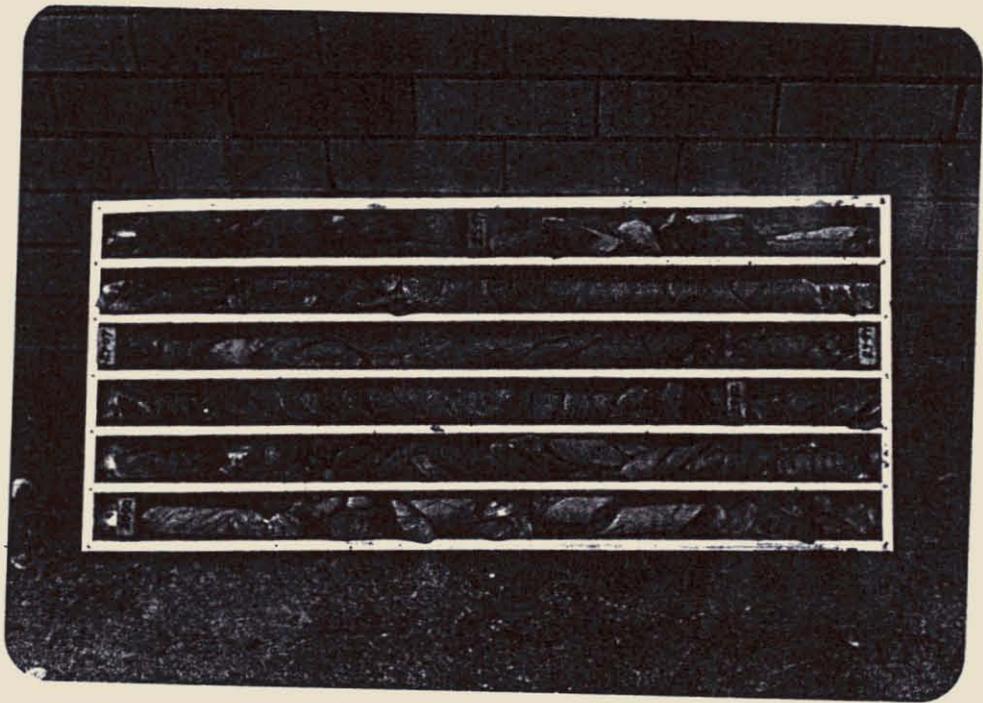
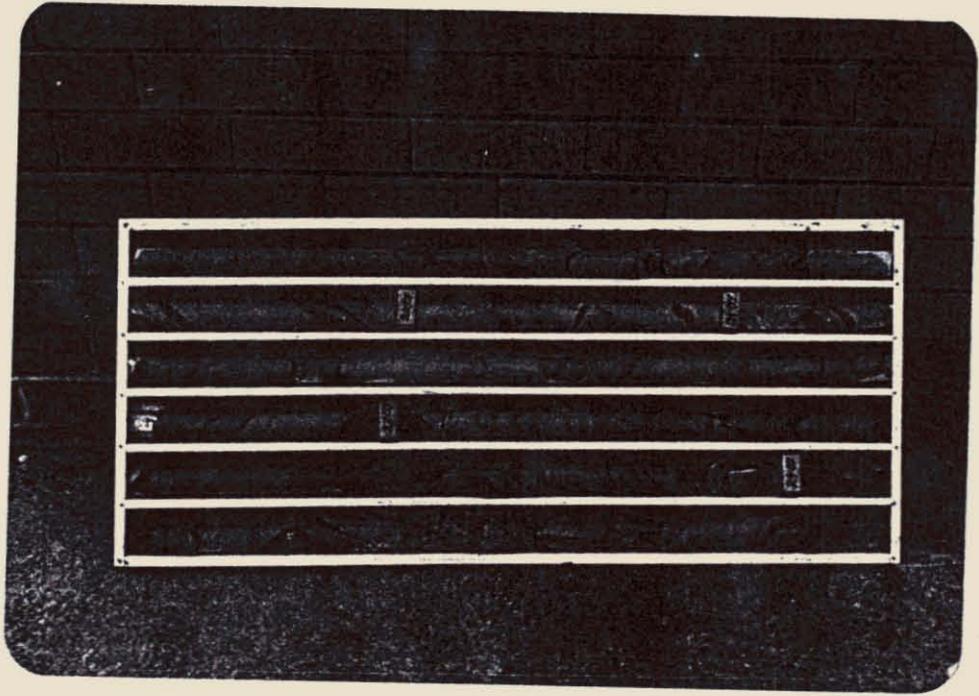
Progress	Sample or Test	Depth (RL) metres	Strata	Description (moisture, colour, consistency, structure, SOIL TYPE, origin)
		0.3	UUU UUU UUU	Wet, black, organic, sandy TOPSOIL.
		1.0	Moist, light grey to white, medium dense SAND.
		1.5	SANDSTONE, white, weak, highly weathered.
				SEE ROCK CORE LOG
				~
				~
		36.19		HOLE TERMINATED

Consulting Geotechnical Engineers
 3 Eden Street, Crows Nest 2065 Telephone: 929 0122
LONGWORTH & MCKENZIE PTY. LIMITED



Job No
PXT 250

561093



CORE LOG SHEET

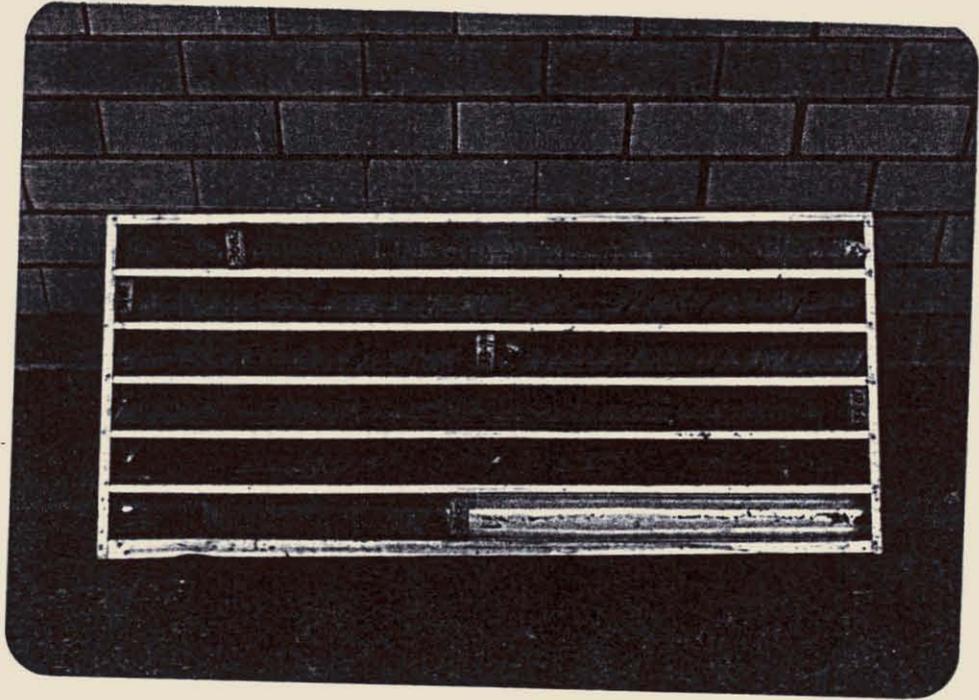
561094

Client:	KAISER ALUMINUM		HOLE NO DDH N^o 3
Project:	SILICA PROSPECT EL 43/70		
Location:	WYNYARD TASMANIA		SHEET 1 OF 3
Position:	N.N.W. OF SHAKESPEARE REF. FIGURE 2	Surface Elevation:	G.L. Angle from Horizontal: 90°
Rig Type:	GEMCO	Mounting:	TRAILOR Contractor: H.J. STACPOOL Driller: R. LETHBORG
Casing Diameter:	NO	Barrel (length):	1.995m Bit: IMPREGNATED Bit Condition Before: 5 USED After:
Date Started:	27/5/81	Date Completed:	1/6/81 Logged by: R.J. CARR Date Logged: 2/6/81

Progress	DRILLING/ CASING	WATER	Casing loss (m %)	SAMPLES/ FIELD TESTS	DEPTH (RL) m	STRATA	DESCRIPTION (Rock type, colour, grain size, structure, texture, mineral composition, hardness, alteration cementation, etc. as applicable)	Weathering										Strength Is (50) MPa				NATURAL FRACTURES				ADDITIONAL DATA (joints, veins, seams, faults) Description, dip, smoothness, coating, other.	
								U	W	K	M	S	E	EW	0.03	VW	0.1	W	0.3	M	0.5	S	1	V	5		10
1	CASING		0		1.57		SEE SOILS BORE LOG																				
2			0				SANDSTONE, white, medium to fine grained, silica leached.																				Sand in barrel
3			0		3.07																						Near vertical joint
4			0		4.37																						Sand in barrel
5			0		5.87																						Joint
6			0		6.53		Depth of primary leaching																				Joint dipping 20° to NE oxide infilled
7			0		7.37		QUARTZITE, light grey, medium grained, glassy, silicified and crystalline with some black staining along fine bedding planes.																				Oxide infilled joint
8			0		8.87																						Bedding plane fracture
9			0		10.25																						Tight joints
10			0		10.37																						Joint and fracture clay coated
11			0		12.0																						Bedding plane fractures clay filled
12			0		12.17		As above with frequent bedding planes and joint clay and oxides.																				Clay filled joints near vertical and at 20° to core
13			0		15.0																						Clay filled bedding plane
14			0		13.67																						Bedding plane with shistose infilling material and joints
15			0		15.17																						Bedding plane fracture
16			0				As above rockmass generally crystalline with bedding and joint plane impurities																				As above
			0																								Bedding plane fractures
			0																								Some quartz veining finely bedded

<p>SCALE</p> <p>Metres</p>	<p>Consulting Geotechnical Engineers</p> <p>3 Eden Street, Crows Nest 2065 Telephone: 929 0122</p> <p>LONGWORTH & MCKENZIE PTY. LIMITED</p>	<p>Job No</p> <p>NXT 250</p>
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561095



CORE LOG SHEET

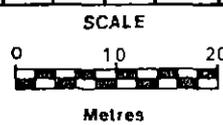
561096

Client: KAISER ALUMINUM
 Project: SILICA PROSPECT EL 43/70
 Location: WYNARD TASMANIA
 Position: N.N.W. OF SHAKESPEARE REF. FIGURE 2 Surface Elevation: G.L. Angle from Horizontal: 90°
 Rig Type: GEMCO Mounting: TRAILOR Contractor: H.J. STACPOOL Driller: R. LETHBORG
 Casing Diameter: NQ. Barrel (length): 1.995m Bit: IMPREGNATED Bit Condition Before: 5 USED After:
 Date Started: 27/5/81 Date Completed: 1/6/81 Logged by: R.J. CARR Date Logged: 2/6/81

HOLE NO. DDH N°3

SHEET 2 OF 3

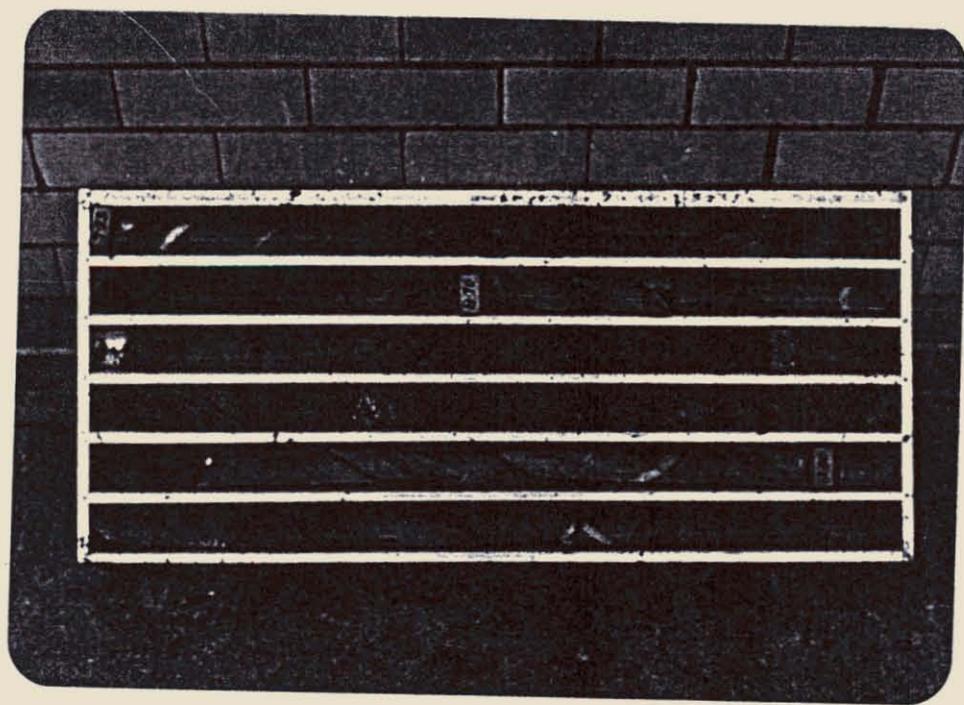
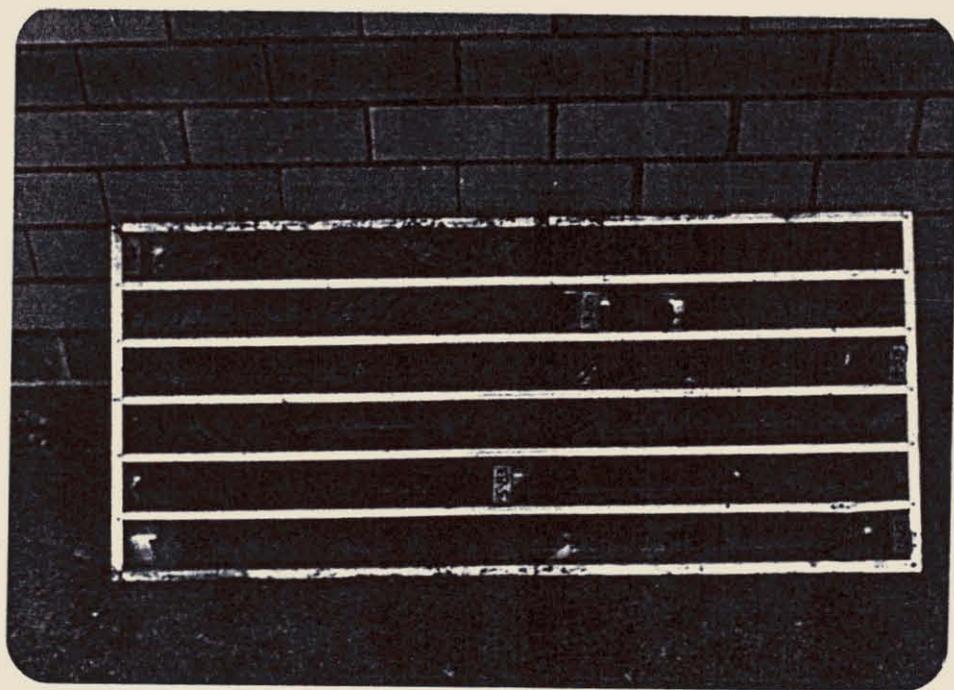
Progress	DRILLING/ CASING	WATER	DRILL DEPTH	SAMPLES/ FIELD TESTS	DEPTH (RL) m	STRATA	DESCRIPTION ROCK TYPE, Colour, Grain size, Structure (texture, mineral composition, hardness, alteration cementation, etc. as applicable)	Weathering		Strength Is (50)MPa					Spacing (mm)			VISUAL	ADDITIONAL DATA (joints, veins, seams, faults) Description, dip, smoothness, coating, other					
								EW	KW	HW	SW	P	EW	VW	UV	UV	UV			UV	UV	UV	UV	UV
			0				MICA SHISTS, black (100mm thick)																	
17			16.67				As above QUARTZITE, glassy grey, fine to medium grained with impurities in joint, bedding and frequent micro fracture planes.														Near vertical joints with mica and oxide surface deposits.			
			0		17.12																			
18			18.17																				Bedding plane fracture	
			0																					
19			19.27		19.2																			Bedding plane fracture
20			0																					
			20.67																					
21			21.07																					Bedding plane fracture
			0																					Bedding plane fracture
22			22.57																					Bedding plane fracture
			0																				Bedding 40° to Q	
23			23.9																				Near vertical joint at right angles to bedding plane	
24			24.07		23.9																		Bedding plane fracture	
			0																				Mica lined vertical joints with frequent bedding plane fractures	
25			25.57				As above																	
26			27.0																					
27			27.07		27.0																			
			0			27.6																		
28			28.5				Interbedded QUARTZITE and SILICEOUS QUARTZITE MICA SCHIST, light grey, finely bedded.																Numerous bedding plane fractures along micaceous bedding planes	
			28.82																				Bedding plane 30° to Q	
29			29.7																					
			0			29.7																		
30			30.00		30.9		QUARTZITE, SILICEOUS MICA SCHIST, light grey and green, fine to medium grained with interbedded green maceous bands.																	
			0																					
31			31.16																					
			0																					
32			31.86																					



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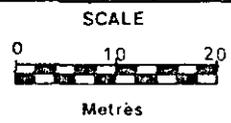


CORE LOG SHEET

361100

Client: KAISER ALUMINUM		HOLE NO. DDH N°4	
Project: SILICA PROSPECT EL 43/70		SHEET 1 OF 3	
Location: WYNARD TASMANIA		Position: REF. FIGURE 2	
Surface Elevation: G.L.		Angle from Horizontal:	
Rig Type: GEMCO	Mounting: TRAILOR	Contractor: H.J. STACPOOL	Driller: R. LETHBORG
Casing Diameter: NO ROD	Barrel (length): 1.955	Bit: IMPREGNATED	Bit Condition Before: 3 USED After:
Date Started: 1/6/81	Date Completed: 6/6/81	Logged by: R.J. GARR	Date Logged: 7/6/81

Progress	DRILLING / CASING		WATER	DRILL DEPTH (Core loss / run %)	SAMPLES / FIELD TESTS	DEPTH (RL) m	STRATA	DESCRIPTION (texture, mineral composition, hardness, alteration cementation, etc. as applicable)	Weathering		Strength (50) MPa		NATURAL FRACTURES			ADDITIONAL DATA (joints, veins, seams, faults) Description, dip, smoothness, coating, other.	
	DRILLING	CASING							EW	HW	EW	HW	VS 03	VS 01	VS 02		VS 03
1				0				SEE BOILS BORE LOG SHEETS									
2				1.4		1.4		SCHIST, black and white, fine grained, very finely bedded.									Frequent bedding plane parting Bedding at 45° to
3				3.0				QUARTZITE, brown grey with occasional bands of interbedded schist (moderately silicified), finely bedded, medium to fine grained.									Micaceous minerals abundant in bedding planes and matrix
4				4.33													
5				5.83				As above light brown, micaceous QUARTZITE, fine grained, highly silicious.									Frequent closed micro fractures and infilled bedding planes.
6				7.23													
7				8.7													Black Oxide coated fractures and near vertical joint
8				9.5													
9				10.1				SCHIST, black and white, fine grained, very finely bedded.									Frequent bedding plane partings
10				11.2													
11				12.3				QUARTZITE, light grey, fine grained, highly silicified, micaceous matrix, finely bedded with some quartz veining.									Shistoze material occasionally forms 1mm beds in quartzite bedding planes Bedding plane fracture
12				13.8													
13				15.2				As above, some brown staining from joint infill material.									Near vertical joints
14																	
15																	
16																	

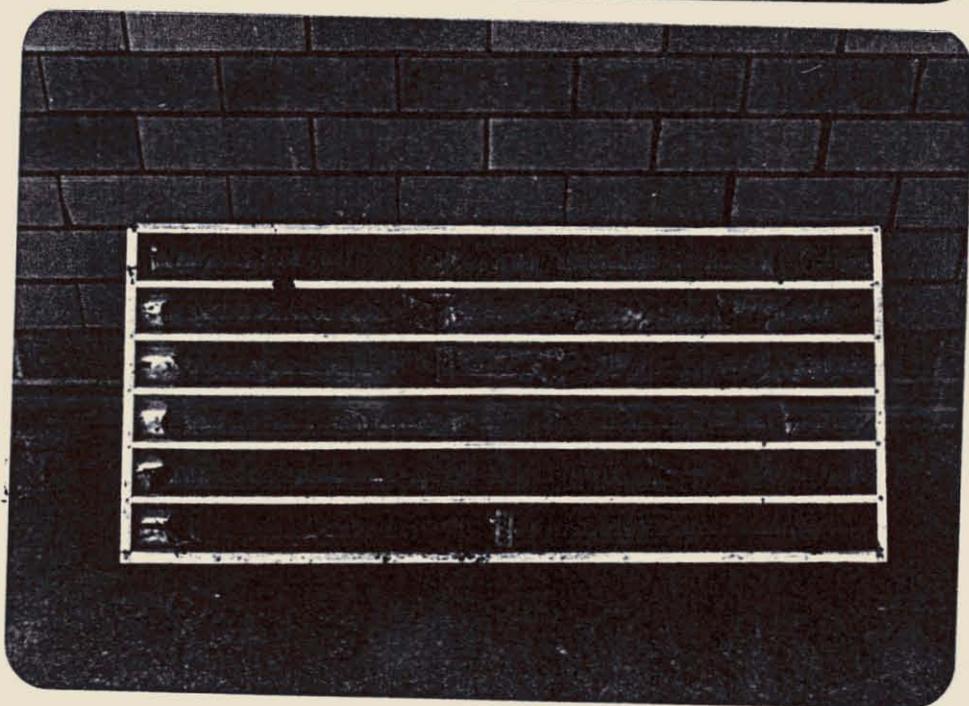
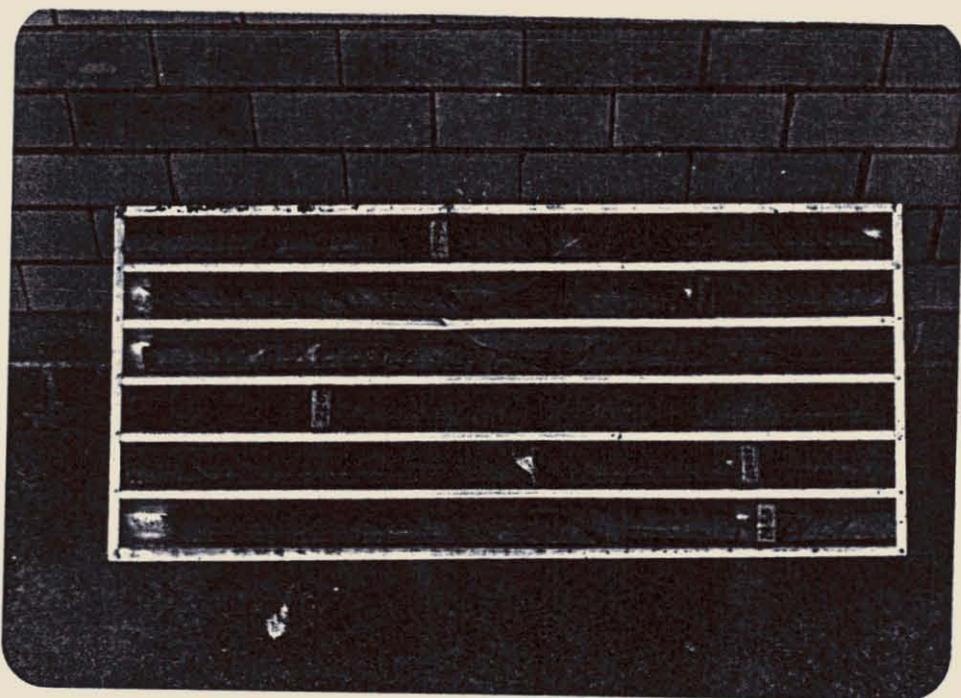
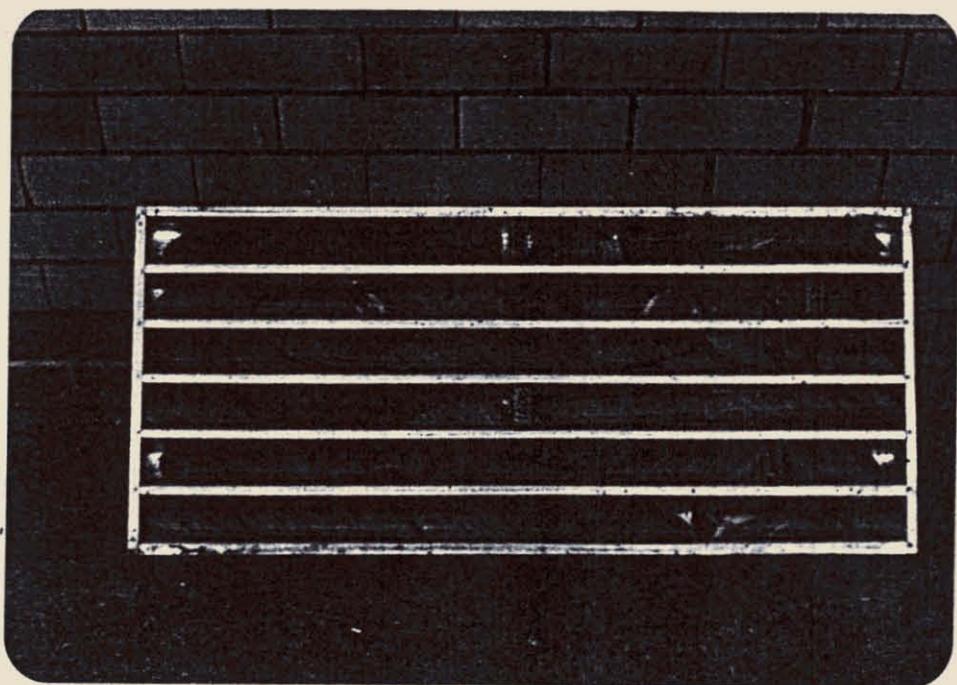


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Job No
NXT 250

561101



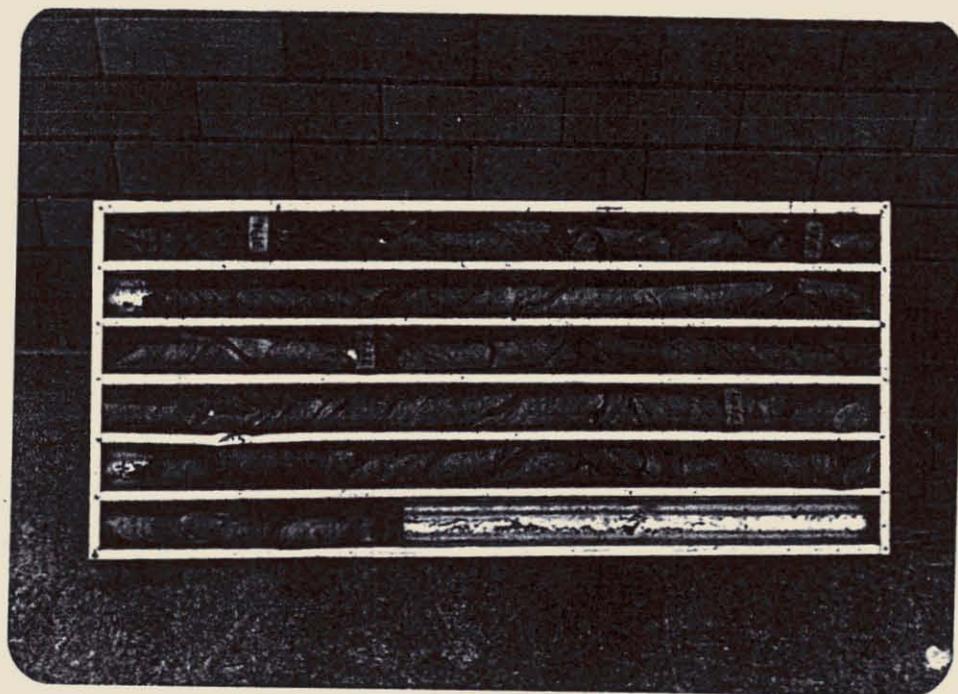
CORE LOG SHEET

Client: KAISER ALUMINUM		HOLE NODDHN^o4	
Project: SILICA PROSPECT EL 43/70		SHEET 2 OF 3	
Location: WYNARD TASMANIA		Surface Elevation: G.L. Angle from Horizontal: 90°	
Position: REF. FIGURE 2		Contractor: H.J. STACPOOL Driller: R. LETHBORG	
Rig Type: GEMCO Mounting: TRAILOR		Bit: IMPREGNATED Bit Condition Before: 3 USED After:	
Casing Diameter: NQ ROD Barrel (length): 1.955		Date Started: 1/6/81 Date Completed: 6/6/81 Logged by: R.J. CARR Date Logged: 7/6/81	

Progress	DRILLING/ CASING	WATER	Core loss (% run %)	SAMPLES/ FIELD TESTS	DEPTH (RL) m	STRATA	DESCRIPTION (texture, mineral composition, hardness, alteration cementation, etc. as applicable)	Weathering		Strength Is (50) MPa		NATURAL FRACTURES				
								EW	HW	EW	HW	MS	V5	ES	ADDITIONAL DATA (joints, veins, seams, faults) Description, dip, smoothness, coating, other.	
			0				As above QUARTZITE with occasional schist bands and variable micaceous impurities in matrix								Joint, near vertical, black oxide coated	
			16.7													Joint, near vertical, black oxide coated
17			0													
			18.05													
18			0													
			19.42													
19			0													
			20.67													Joint and bedding planes coated with micaceous minerals
20			0													
			22.09													Bedding plane fractures
21			0													
			23.59													
22			0		24.0											
			24.53				QUARTZITE, fine grained, highly silicified, minimal clay in rock matrix, abundant micaceous minerals in the thinly bedded bedding planes, some thin black or yellow schist beds.									
23			0													
			25.83													
24			0													Near vertical joint showing silica leaching around sand grains
			27.29													As above
25			0													
			28.72													Bedding plane fractures
26			0													As above
			30.22													
27			0													
			30.82													
28			0													
			31.65													
29			0													
30																
31																
32																

<p>SCALE</p>  <p>Metres</p>	<p>Consulting Geotechnical Engineers</p> <p>3 Eden Street, Crows Nest 2065 Telephone: 929 0122</p> <p>LONGWORTH & MCKENZIE PTY. LIMITED</p>	 <p>Job No NXT 250</p>
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561103



CORE LOG SHEET

561104

Client: KAISER ALUMINUM		HOLE NO. 00HN ^o 4	
Project: SILICA PROSPECT EL. 43/70		SHEET 3 OF 3	
Location: WYNARD TASMANIA		Position: REF. FIGURE 2	
Surface Elevation: G.L.		Angle from Horizontal: 90°	
Rig Type: GEMCO	Mounting: TRAILOR	Contractor: H.J. STACPOOL	Driller: R. LETHBORG
Casing Diameter: NQ ROD	Barrel (length): 1.955	Bit: IMPREGNATED	Bit Condition Before: 3 USED After:
Date Started: 1/6/81	Date Completed: 6/6/81	Logged by: R.J. CARR	Date Logged: 7/6/81

Progress DRILLING/ CASING	WATER	Core logs (run &) DRILL DEPTH	SAMPLES/ FIELD TESTS	DEPTH (RL) E	STRATA	DESCRIPTION ROCK TYPE, Colour, Grain size, Structure (texture, mineral composition, hardness, alteration cementation, etc. as applicable)	Weathering		Strength I _a (50) MPa		NATURAL FRACTURES				ADDITIONAL DATA (joints, veins, seams, faults) Description, dip, smoothness, coating, other.
							EW	HW	VW	UV	SW	UW	EW	VW	
		33.11				As above									
		34.61		34.35		QUARTZITE, brown, fine to medium grained, silicified, micaceous matrix, clay and oxide filled bedding and joint planes.									Near vertical joint infilled with black oxide
		36.01				HOLE TERMINATED									Near vertical joint

<p>SCALE</p>  <p>0 10 20 Metres</p>	<p>Consulting Geotechnical Engineers</p> <p>3 Eden Street, Crows Nest 2085 Telephone: 929 0122</p> <p>LONGWORTH & MCKENZIE PTY. LIMITED</p>	 <p>Job No NXT 250</p>
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561105

APPENDIX C

SAMPLE ANALYSES

LM



561106

813 Dowling Street, Waterloo, N.S.W. 2017
Postal Address: Box 1, P.O. Waterloo, 2017

Telephone: 698 6611 x...379.....

TEST REPORT

Client: Longworth and MacKenzie Pty. Ltd.,
3 Eden Street,
CROWS NEST, N.S.W. 2065

No.: 102587

Date: 5th June, 1981

Attention: Mr. R. Carr

Client O/No.:

Sample : 9 drilled cores ex DDH No. 1

Date : 25th May 1981

Work required : Full X-ray fluorescence analysis and Thin section preparation.

XRF results in percentage:

<u>Drilled Core</u>	<u>4.9-5.4</u>	<u>8.9-9.5</u>	<u>11.10-11.50</u>	<u>12.1-12.6</u>	<u>14.16-14.63</u>
Fe ₂ O ₃	0.028	0.044	0.60	0.077	0.047
Al ₂ O ₃	0.14	0.64	1.2	1.4	0.63
TiO ₂	0.23	0.073	0.061	0.074	0.041
Cr ₂ O ₃	<0.001	<0.001	<0.001	<0.001	<0.001
CaO	0.10	0.01	<0.01	0.01	0.03
MgO	0.01	0.02	0.04	0.05	0.02
Na ₂ O	<0.01	<0.01	<0.01	0.01	<0.01
K ₂ O	0.02	0.19	0.31	0.40	0.18
L.O.I.	0.12	0.17	2.26	0.26	0.45
SiO ₂ (Bal.)	99.3	98.8	95.5	97.7	98.6

Approved by BART CHEN
Section Leader
Spectrographics

<u>Drilled Core</u>	<u>16.12-16.62</u>	<u>18.17-18.67</u>	<u>20.17-20.61</u>	<u>22.17-22.67</u>
Fe ₂ O ₃	0.062	0.072	0.12	0.12
Al ₂ O ₃	1.1	1.2	1.0	2.0
TiO ₂	0.052	0.051	0.061	0.11
Cr ₂ O ₃	<0.001	<0.001	<0.001	<0.001
CaO	0.01	0.01	0.01	0.01
MgO	0.03	0.04	0.04	0.07
Na ₂ O	0.01	0.01	0.01	0.01
K ₂ O	0.30	0.33	0.30	0.54
L.O.I.	0.38	0.35	0.20	0.34
SiO ₂ (Bal.)	98.0	97.9	98.2	96.7

Please Note:

The powder bricquetting technique XRF analysis of Quartz or Sand for Al₂O₃ above 1.0% is not as accurate as the fusion technique. Thin section slides have been sent to you separately.

Barth

561108



813 Dowling Street, Waterloo, N.S.W. 2017
Postal Address: Box 1, P.O. Waterloo, 2017

Telephone: 698 6611 x... 379....

TEST REPORT

Client: Longworth & McKenzie,
3 Eden Street,
CROWS NEST, N.S.W. 2065

No.: 102591

Date: 3rd June, 1981

Attention: Mr. R. Carr

Client O/No.:

Sample : 9 Rocks

Date : 1st June, 1981

Work required : Full X-ray fluorescence analysis

XRF results in percentage:

<u>DDDH3</u>	<u>10.25-10.37</u>	<u>12.0-12.17</u>	<u>15-15.17</u>	<u>17.12-17.24</u>	<u>19.2-19.28</u>
Fe ₂ O ₃	0.095	0.065	0.26	0.063	0.065
Al ₂ O ₃	2.4	0.67	2.2	0.97	1.2
TiO ₂	0.063	0.025	0.086	0.034	0.050
Cr ₂ O ₃	<0.001	<0.001	0.001	<0.001	<0.001
CaO	0.01	0.01	0.01	0.01	0.01
MgO	0.11	0.03	0.10	0.04	0.22
Na ₂ O	0.01	0.01	0.01	0.01	0.01
K ₂ O	0.57	0.17	0.46	0.25	0.24
L.O.I.	0.34	0.14	0.29	0.21	0.24
SiO ₂ (Bal.)	96.4	98.8	96.5	98.4	97.9

Approved by BART CHEN
Section Leader
Spectrographics

<u>DDH3</u>	<u>23.9-24.0</u>	<u>27.0-27.07</u>	<u>28.5</u>	<u>30.9-31.0</u>
Fe ₂ O ₃	0.28	0.064	0.41	0.26
Al ₂ O ₃	2.8	1.5	7.4	4.9
TiO ₂	0.089	0.040	0.31	0.20
Cr ₂ O ₃	0.001	<0.001	0.002	0.001
CaO	0.05	0.01	0.06	0.06
MgO	0.13	0.10	1.5	2.3
Na ₂ O	0.02	0.01	0.04	0.04
K ₂ O	0.64	0.30	1.7	1.0
L.O.I.	0.40	0.21	1.37	1.34
SiO ₂ (Bal.)	95.5	97.7	87.2	89.8

Please Note:

The powder bricquetting technique XRF analysis of Quartzite samples for Al₂O₃ above 1% is not as accurate as the fusion technique.



ACI**ACI Technical Centre Pty. Ltd.**

813 Dowling Street, Waterloo, N.S.W. 2017
 Postal Address: Box 1, P.O. Waterloo, 2017
 Telephone: 699 0055
 Cables & Telegrams: "Carboy" Sydney

332/16

11th June, 1981

Longworth and MacKenzie,
 3 Eden Street,
 CROWS NEST, N.S.W. 2065

Attention: Mr. R. Carr

Dear Sir,

This is to confirm our verbal report that sample of quartzite labelled 28.5 metres was examined by X-ray diffraction and petrological microscope. The following minerals were noted:

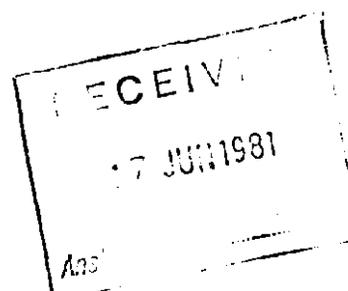
Biotite	-	moderate
Muscovite	-	Low
Feldspar	-	V. Low
Kaolinite	-	Low to V. Low

The presence of biotite would correlate with the presence of Al_2O_3 , K_2O , Fe_2O_3 , MgO and TiO_2 (also L.O.I.) as noted in the analytical report.

Yours faithfully,



D. MacKENZIE



Longworth & Mc Kenzie Plans & SectionsDip Range EL 43/70 30.4.81Sheet
No

1	Legend		
2	Investigation sites 1 to 6	Location map	
3	" " 1 & 2	plan	
4	" " "	sections	
5	" " 3	plan & section	
6	" " 4	plan costean 4	
7	" " "	Section west wall " "	
8	" " "	" east wall " "	
9	" " "	plan	
10	" " "	Sections BUS 22-19	} 25-24 19-21
11	" " 5	plan	
12	" " "	Section	
13	" " 6	plan & section	

DETAILED PLANS AND SECTIONS

Consulting Engineers: 3 Eden Street, Crows Nest, 2060
MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS, AUSTRAL

LONGWORTH & MCKENZIE PTY. LIMITE

STAGE 2 - GEOLOGICAL INVESTIGATION
SILICA DEPOSIT E.L. 43/70

Job No:

PXT250

KAISER ALUMINUM

LEGEND:

○ PERCUSSION BORE HOLE LOCATION IN PLAN.

⊗ PROFILE LOG LOCATION IN PLAN.

$\frac{IS4/1}{+}$ $\frac{BH1}{+}$ PERCUSSION & PROFILE LOG LOCATION ON SECTION.

• APPROXIMATE R.L.

 SAND, SANDSTONE (VERY WEAK TO WEAK)

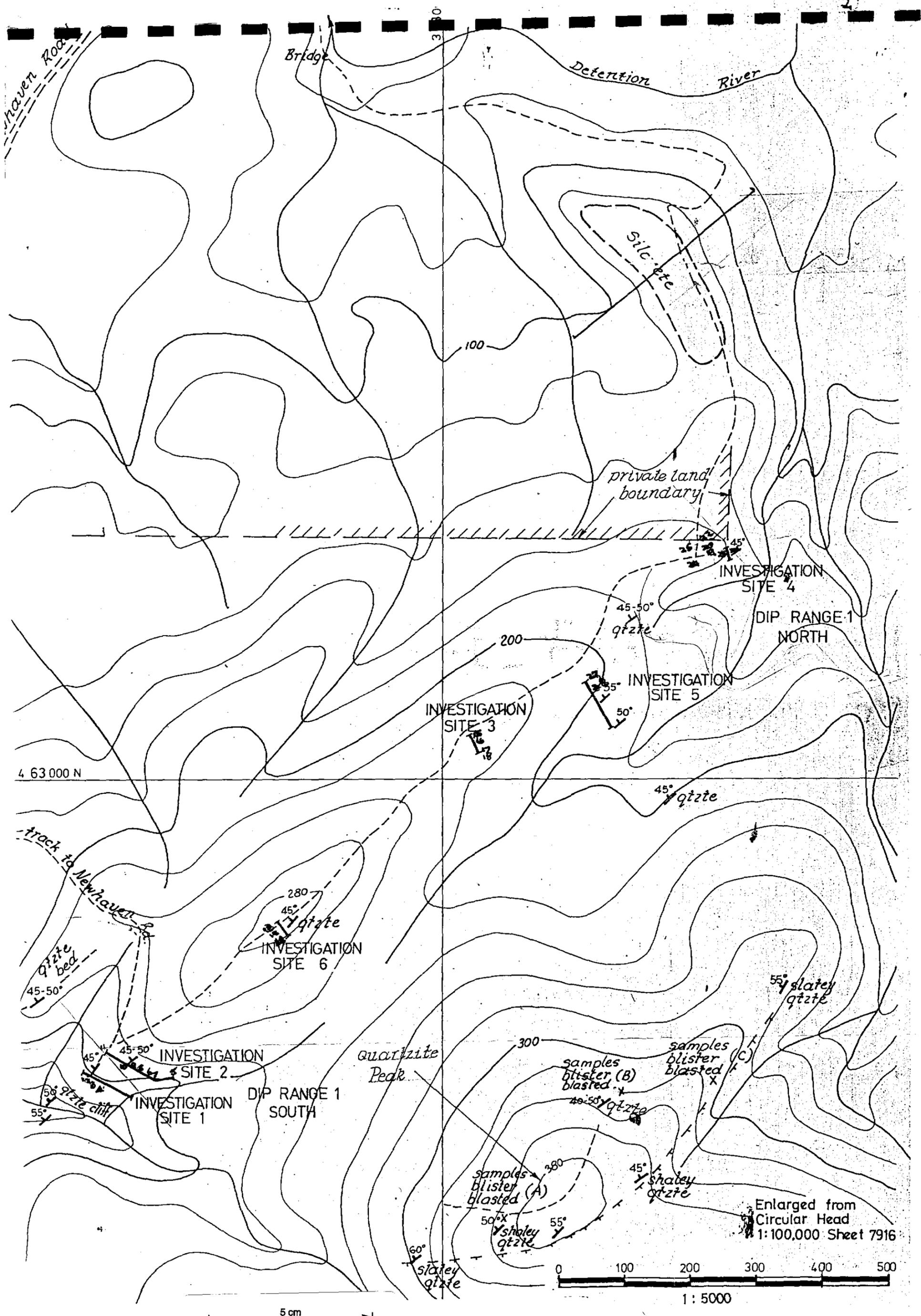
 STRONG SANDSTONE.

 QUARTZITE/ SILICIFIED SANDSTONE.

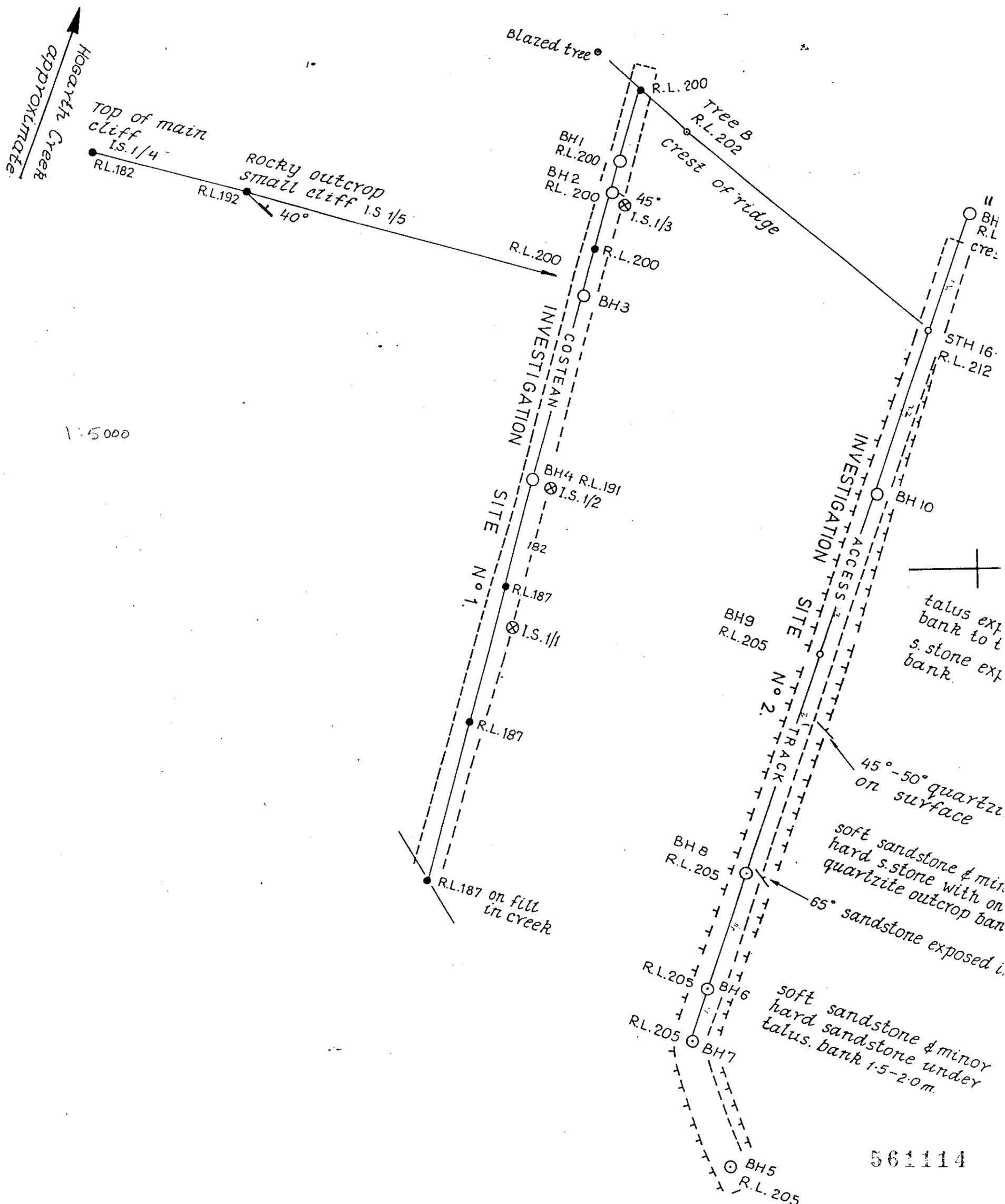
Br. BROWN CUTTINGS AND/ OR DUST.

NOTE:

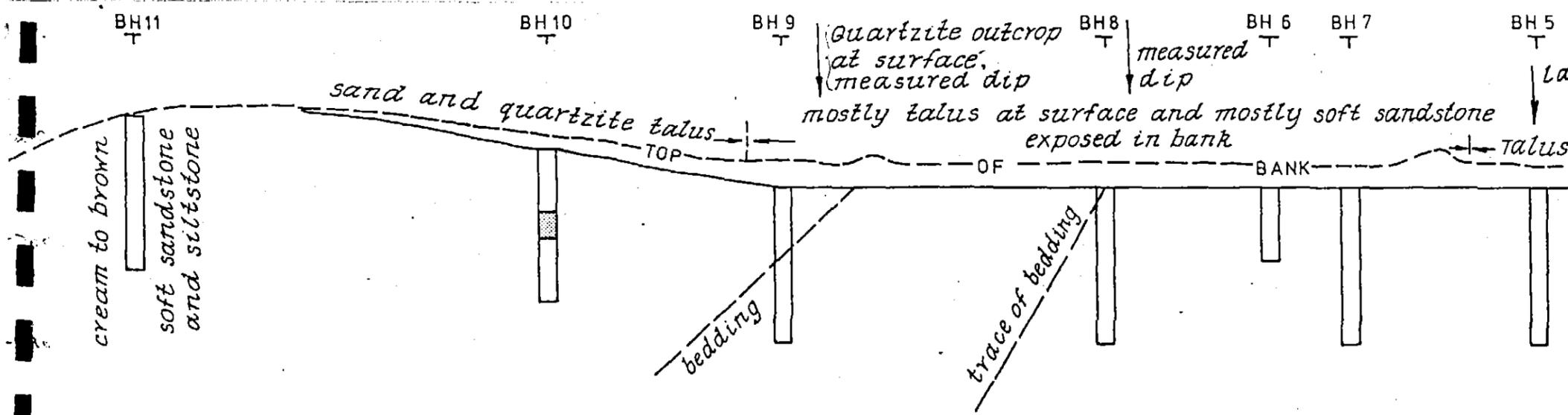
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH PHOTO MOSAIC DRAWING N° 1.
2. THE RELATIVE POSITION OF BOREHOLES AND COSTEANS WAS FIXED BY TAPE, COMPASS AND INCLINOMETER
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH REPORT " STAGE 2 GEOLOGICAL INVESTIGATION OF EL 43/70"



601113

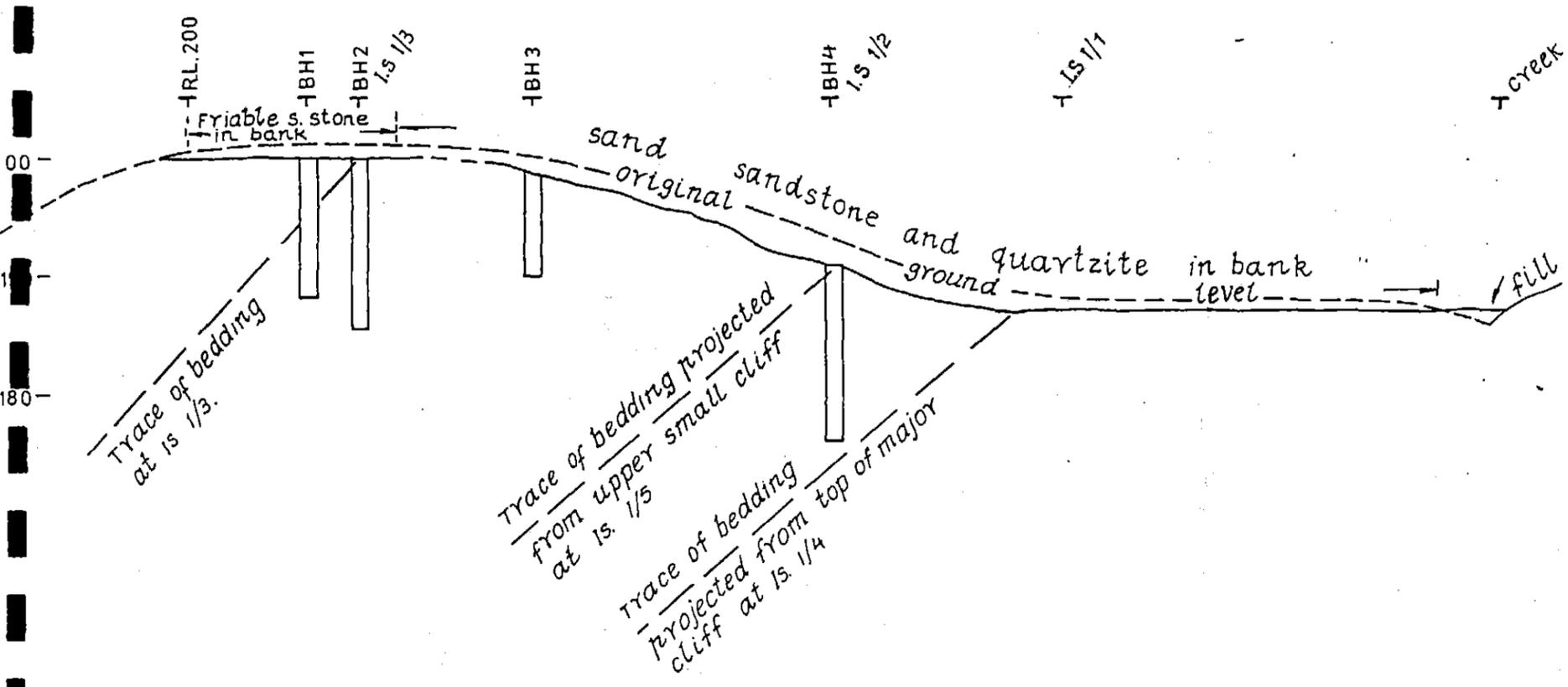


1:5000



SECTION AT INVESTIGATION SITE 2

NOTE: OWING TO THE SIDE SLOPE AT THIS SITE ALL BORES ARE LOCATED APPROXIMATELY AT GROUND LEVEL

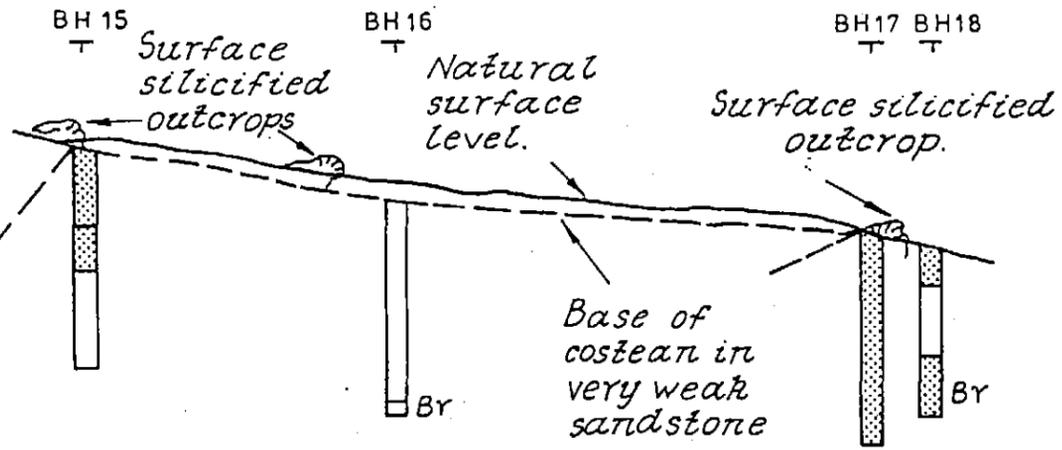


SECTION AT INVESTIGATION SITE I
INVESTIGATION SITES I AND 2

NOTE: ALL BORES AT THIS SITE ARE LOCATED BELOW GROUND LEVEL

5 cm

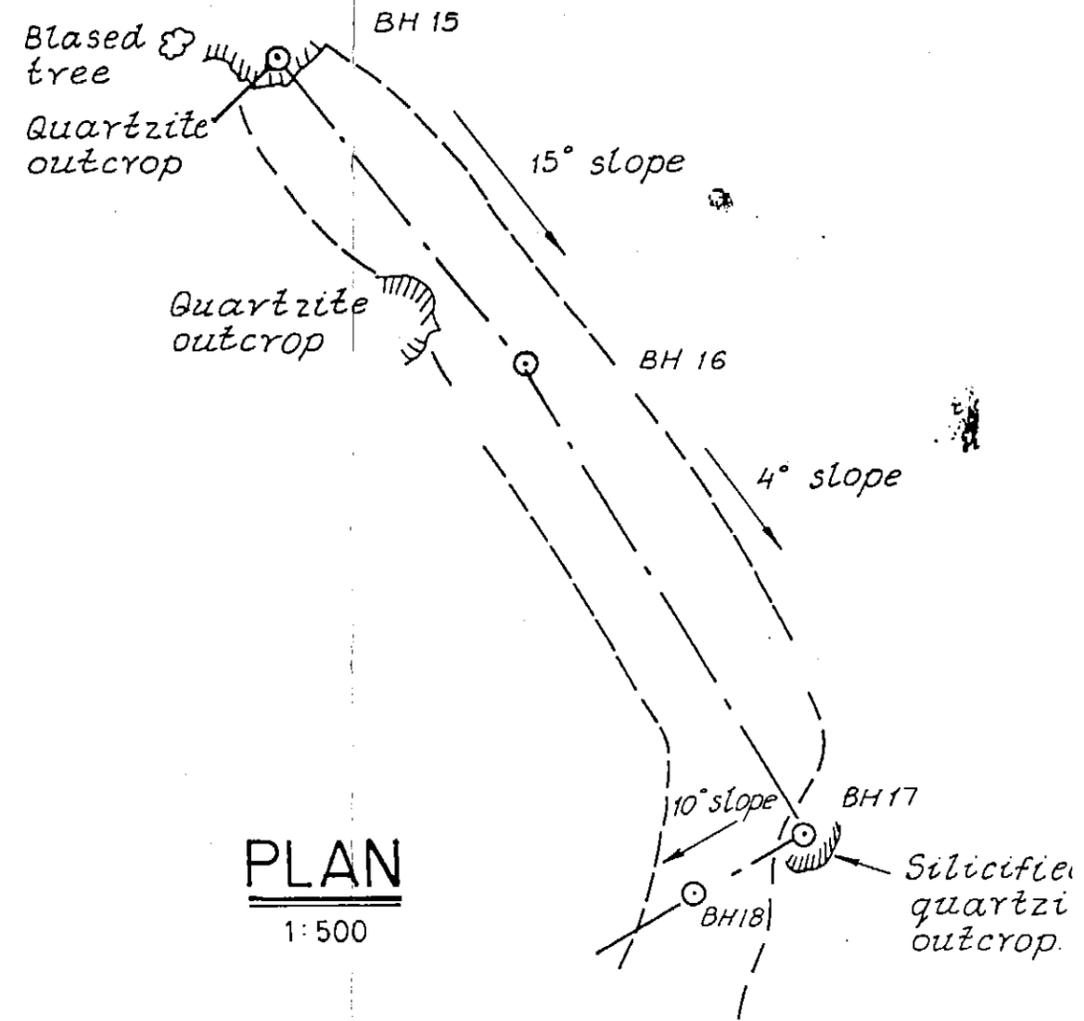
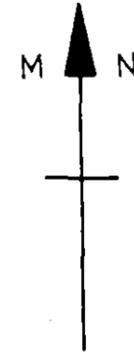
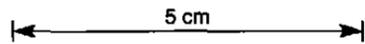
SCALE 1:500 H = V



SECTION AT INVESTIGATION SITE 3

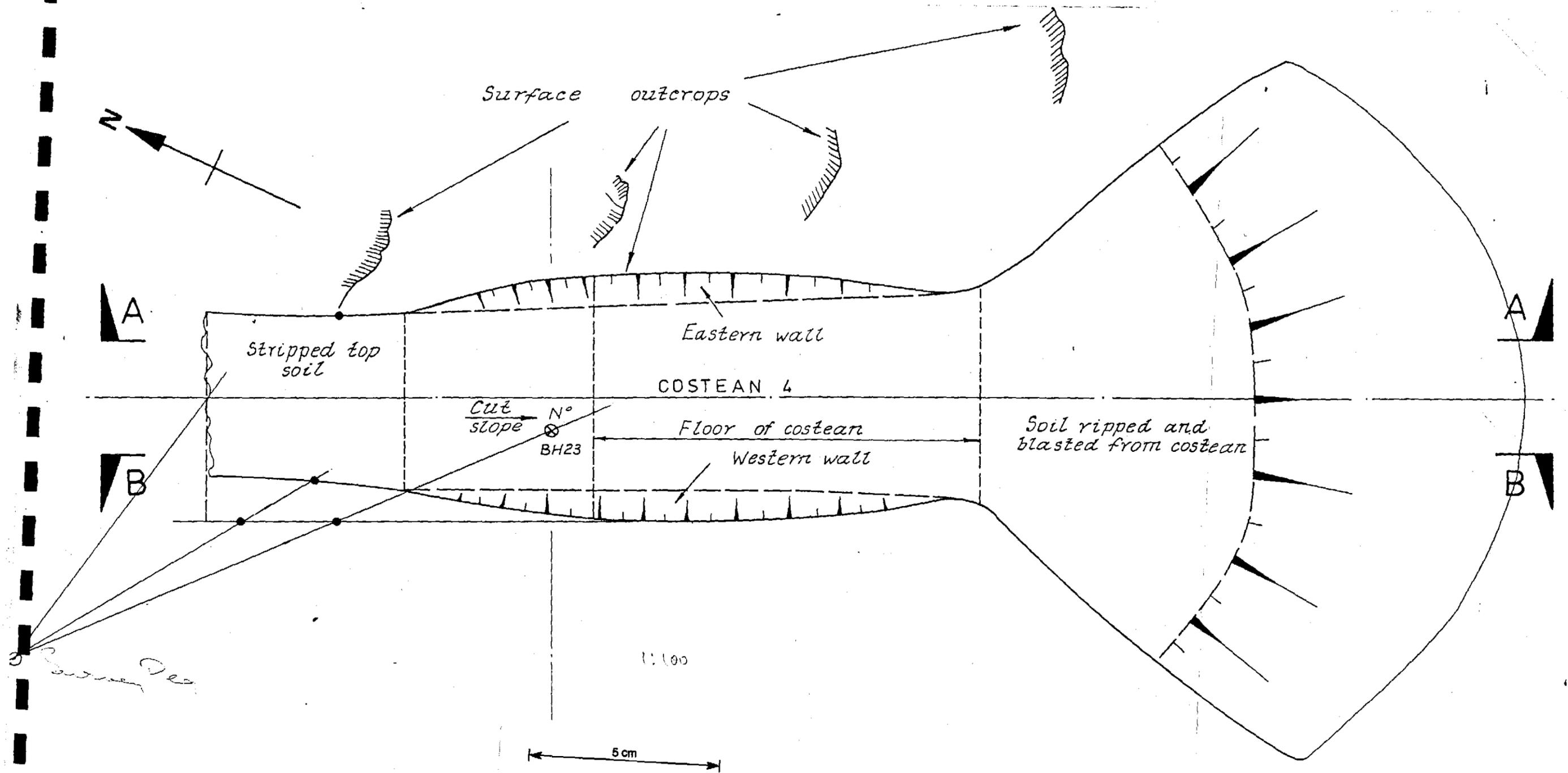
INVESTIGATION SITE 3

1:500

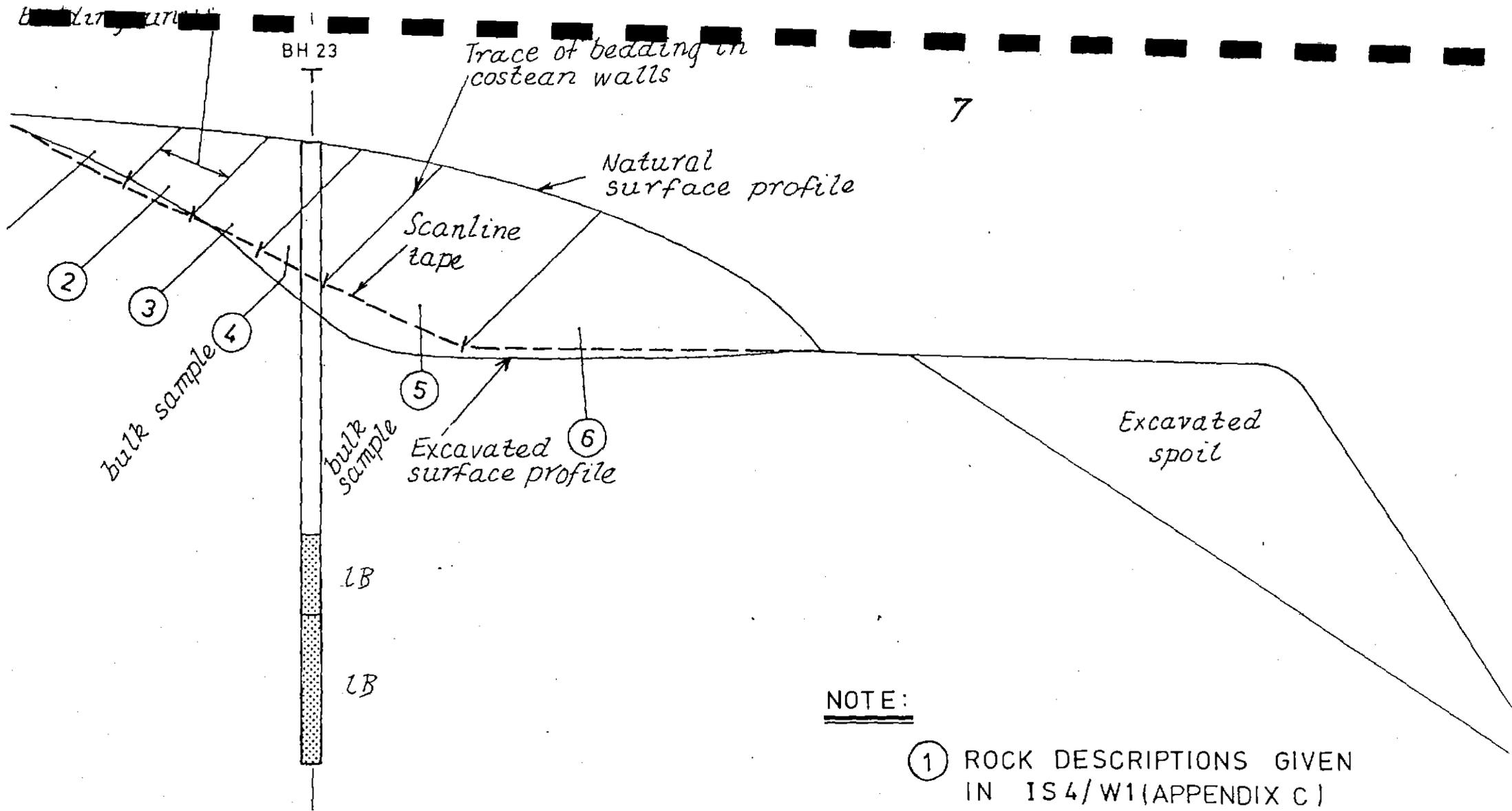


PLAN

1:500

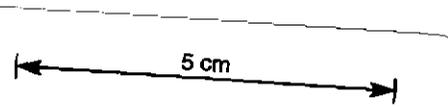
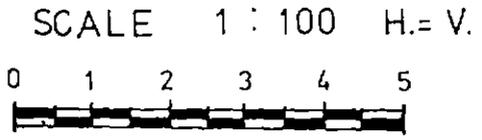


Carven Dec

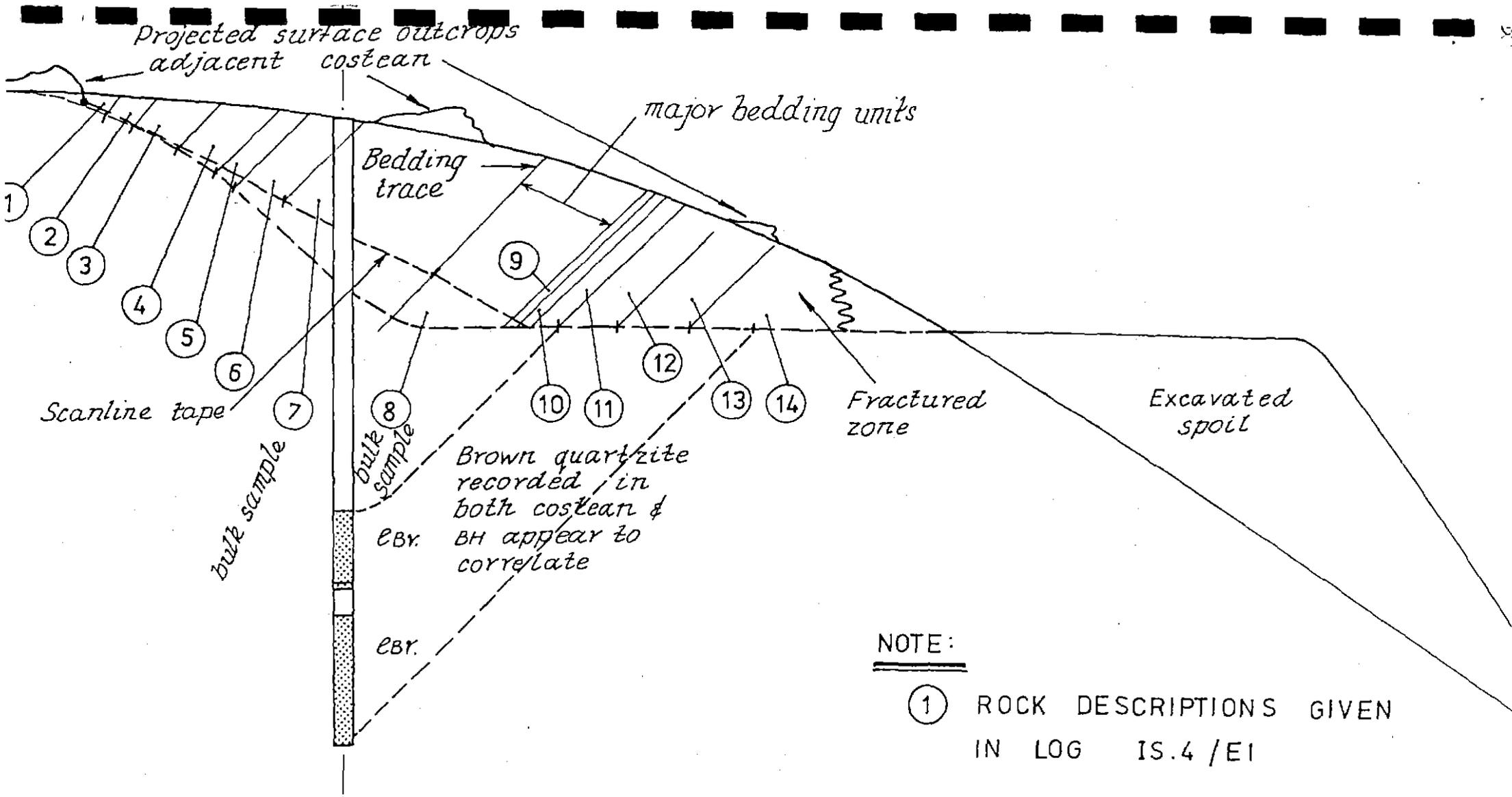


7

SECTION B - B
WESTERN WALL COSTEAN 4



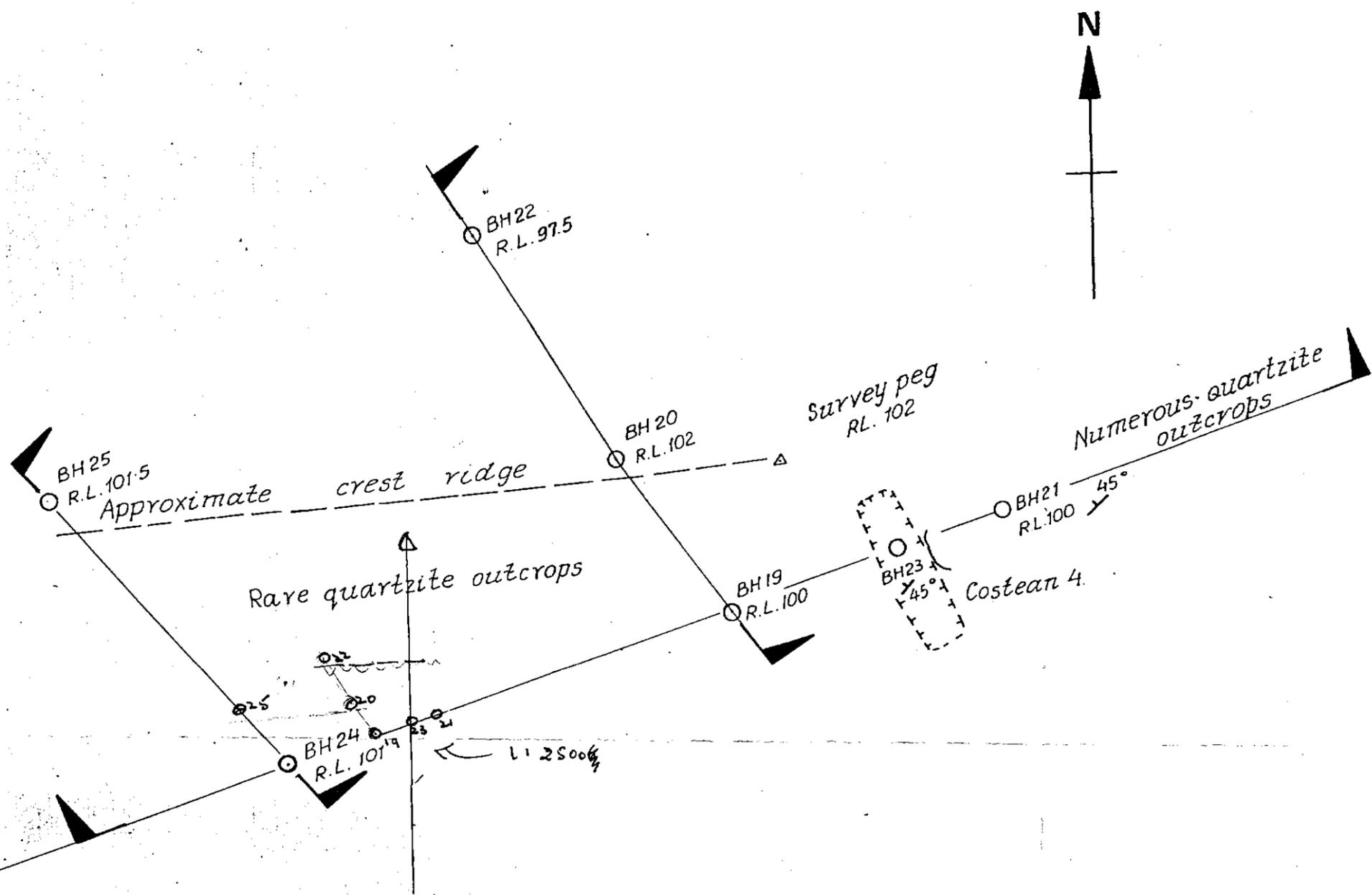
561118



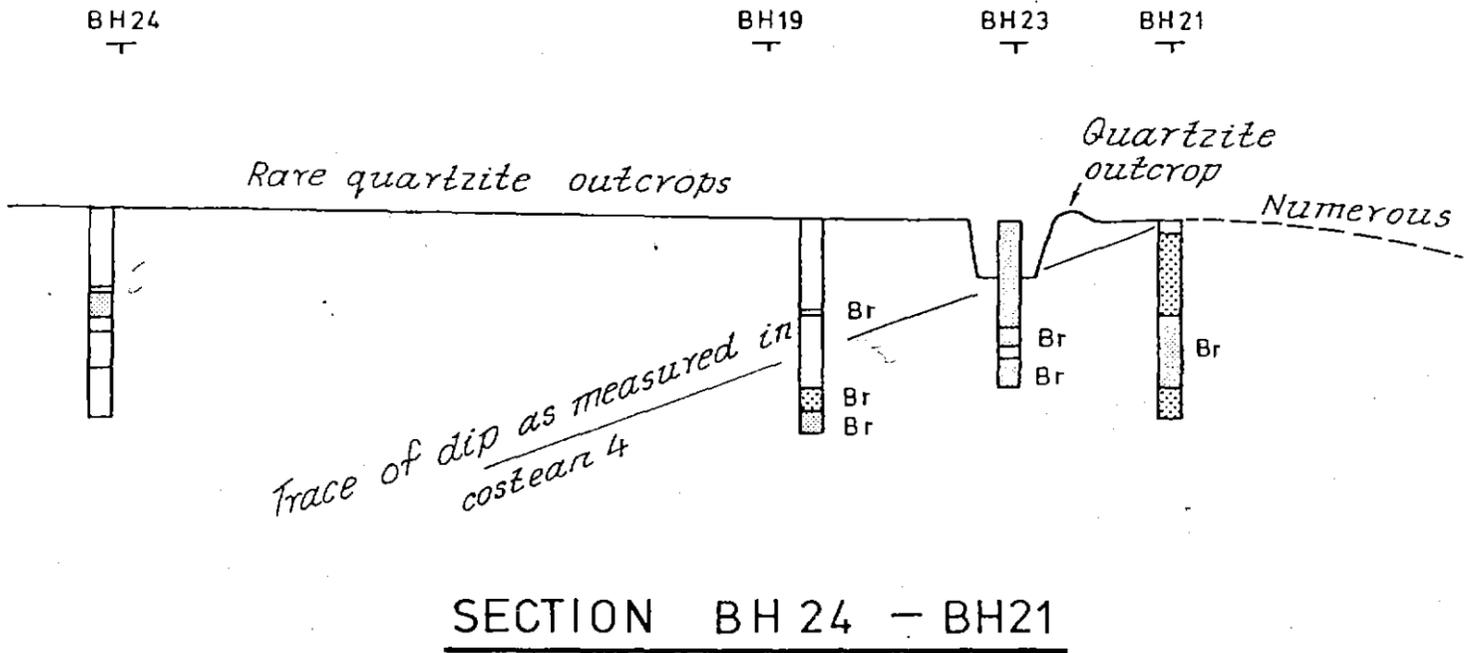
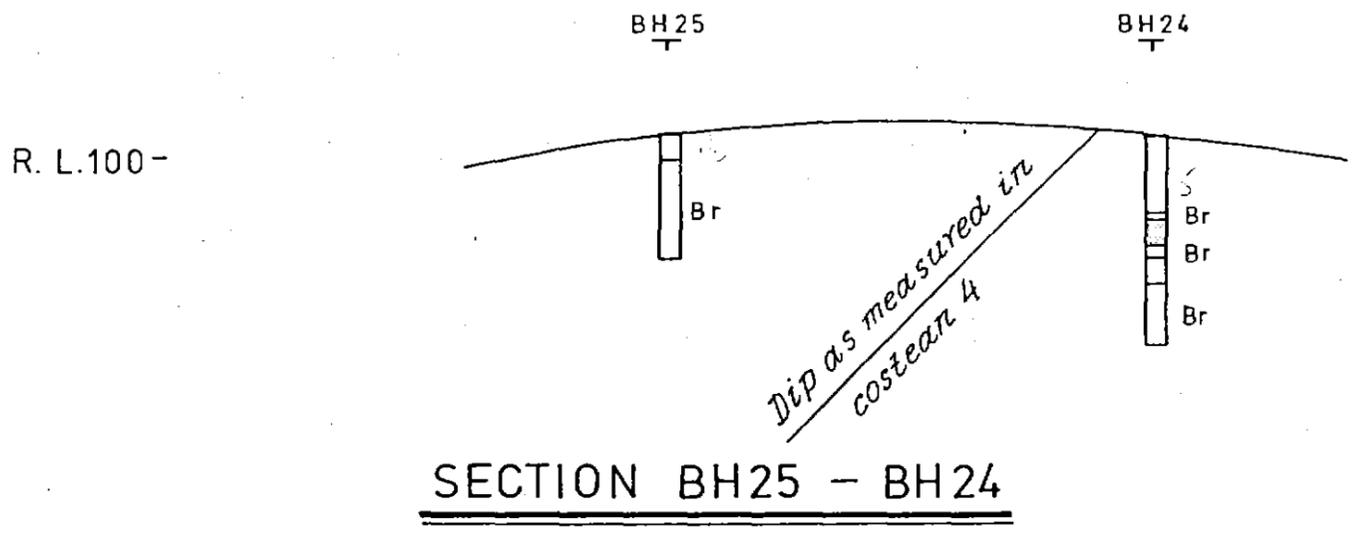
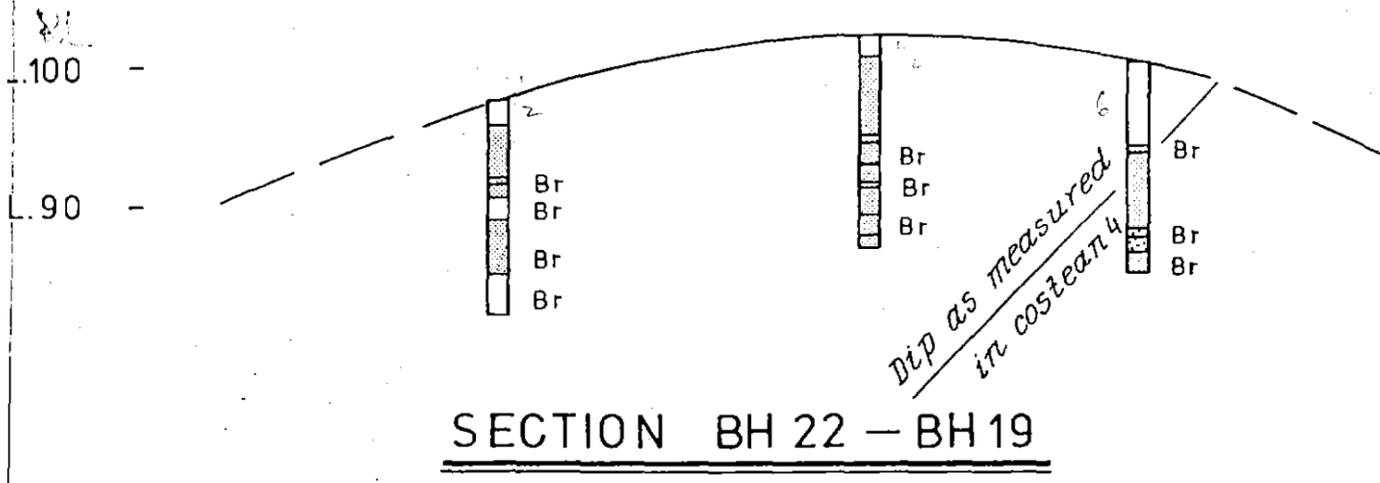
SECTION A-A
EASTERN WALL COSTEAN 4

NOTE:
 (1) ROCK DESCRIPTIONS GIVEN
 IN LOG IS.4/E1

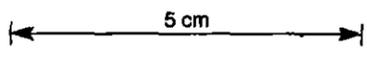
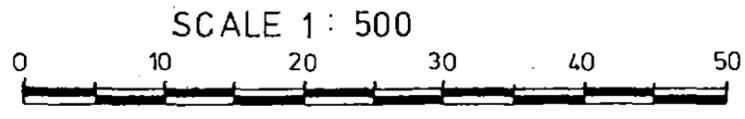
561119

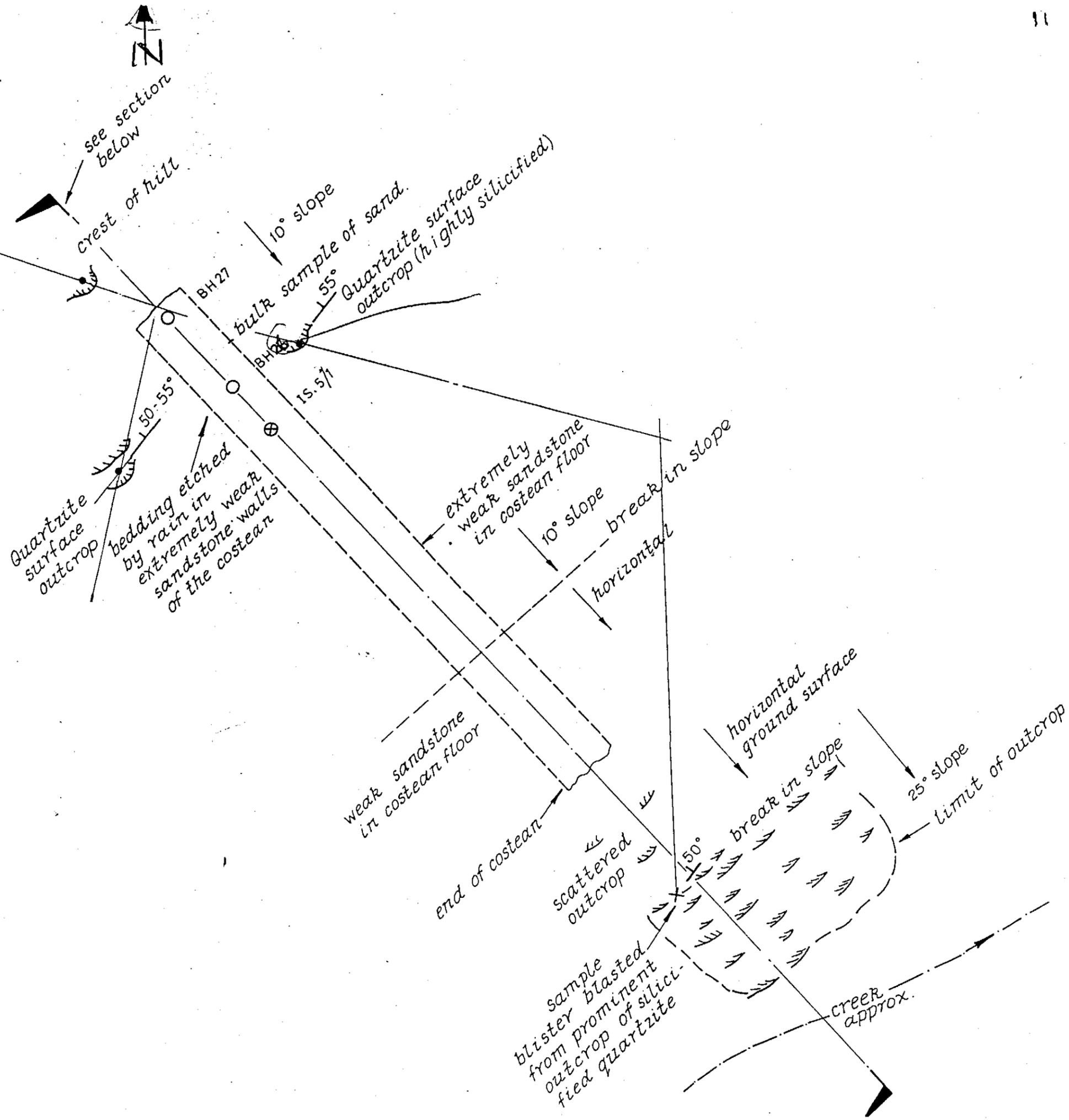


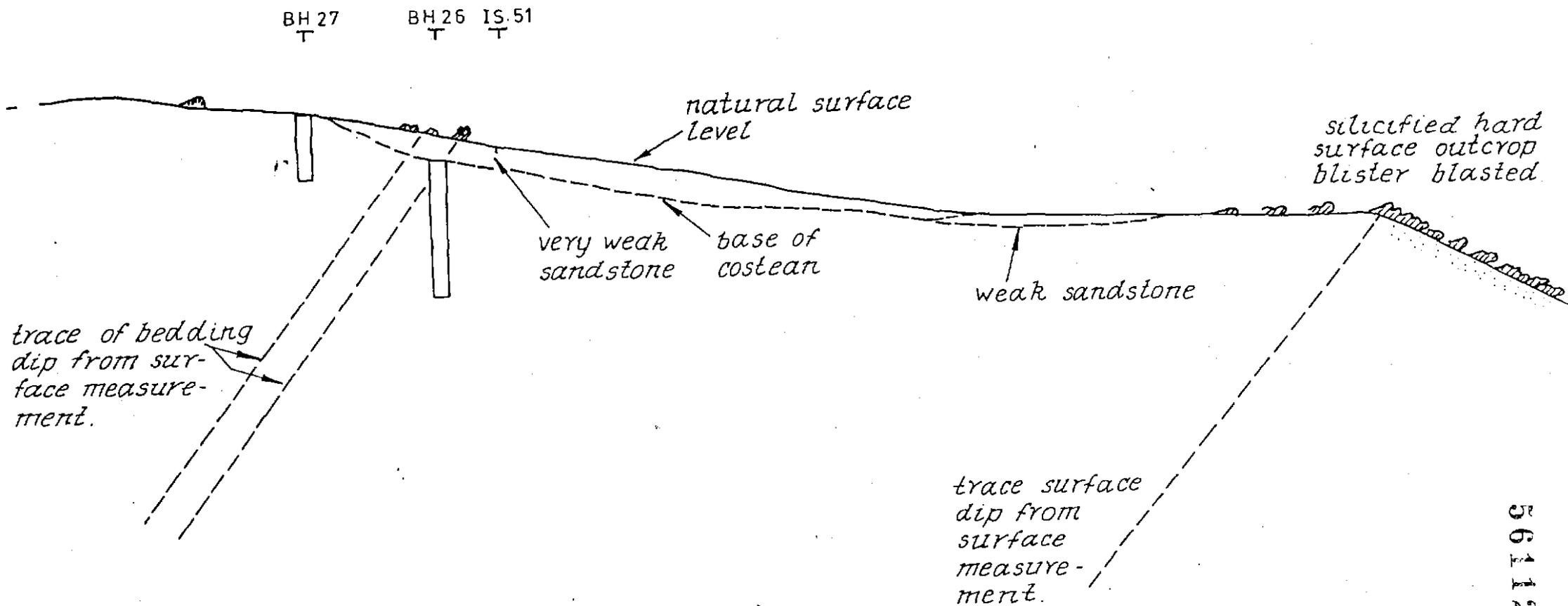
PLAN



INVESTIGATION SITE N° 4

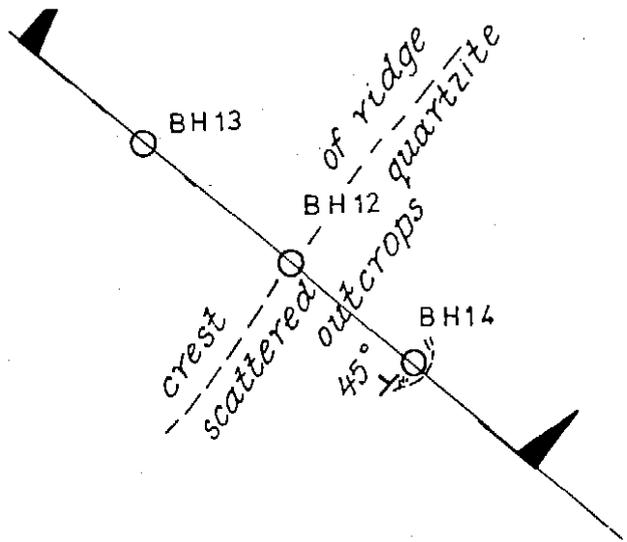






SECTION ALONG CENTRELINE OF COSTEAN

561123

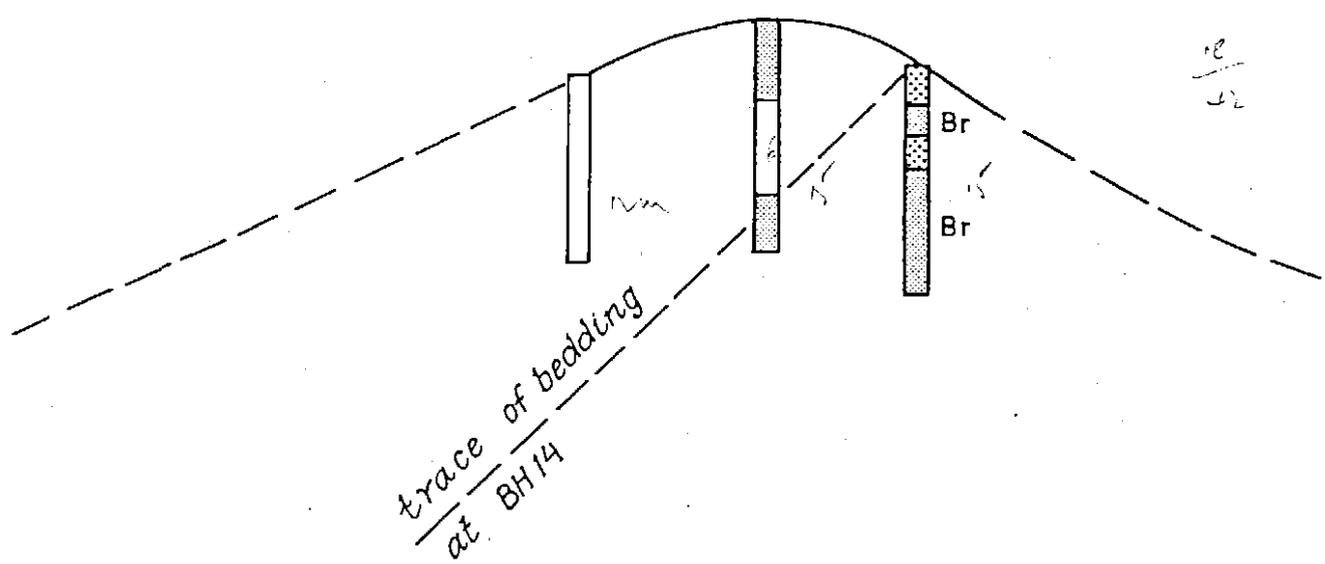


PLAN

BH13
T

BH12
T

BH14
T



SECTION BH13-BH14

INVESTIGATION SITE 6

SCALE HORIZONTAL 1:500
VERTICAL 1:500

