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REPORT

on

STAGE 2 - GEOLOGICAL INVESTIGATION

OF EL 43/70

for

KAISER ALUMINUM

PXT250

April 1981

LONGWORTH & MCKENZIE PTY. LIMITED



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Rec. 25/5/81

LONGWORTH & MCKENZIE PTY. LIMITED

A Member of the Association of Consulting Engineers Australia



REF: PXT250/RJC:pf
30th April 1981

The General Manager
Finance and Planning
Kaiser Aluminum Australia
7th Floor, AMP Centre
50 Bridge Street
SYDNEY N.S.W. 2000

Attention: Mr. C.W. Blandy

Dear Sir,

RE: REPORT ON STAGE 2 - GEOLOGICAL INVESTIGATION OF EL 43/70

Please find attached our report on the above.

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

Yours faithfully,
LONGWORTH & MCKENZIE PTY. LIMITED

L. de AMBROSIS

TCR 81-1553

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Plans

Drawing Nos.

*2 transparencies
each of plans
2 and 3.*

Photo Mosaic- Agreement Area EL 43/70	- 1	PRINT
Recorded Field Data	- 2	} TRANSPARENTS
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" " "	- 5	
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" " "		

DRAWING NOS 1, 4, 5 & 6
IN VOLUME 2

1.0 SUMMARY

Kaiser Aluminum and Chemical Corp. (Aust.) Pty. Limited has an agreement with Mineral Holdings Australia Pty. Limited (MHAS) to explore for high grade quartzite within the northern half of Exploration Licence 43/70 held by MHA in north western Tasmania.

Longworth & McKenzie Pty. Limited was engaged by Kaiser Aluminum to carry out a three stage exploration programme to locate a large (Approx. 2Mt) high graded deposit of quartzite on the above area.

Stage 1 has previously been reported. This report contains the findings of Stage 2 (Geological Reconnaissance Mapping, costeaning, percussion drilling, sampling and analysis) which was limited to surface or shallow sub-surface work (less than 15 metres below ground surface).

The 'quartzite' beds within the northern portion of EL 43/70 were found to be variably cemented sandstone. These units varied laterally and vertically (to the depth of exploration) in the degree of silicification and hence physical characteristics.

Chemically the sandy beds appear to be of high quality, but some evidence exists that this may partially be a result of near surface enrichment by leaching.

Most prospects within the northern half of EL 43/70 were found to be unsuitable due to physical character, access or available quantity. Two prospects, Quartzite Peak and Dip Range No. 1 North, are considered worthy of further exploration (preliminary diamond coring) however, these prospects may have environmental (Quartzite Peak) and quantity/physical quality problems (Dip Range No.1 North).

2.0 INTRODUCTION

This report provides details of the second stage investigation of silica deposits within the northern half of Exploration Licence 43/70 near Wynyard in northern Tasmania.

The area covered by the investigation (known as the Agreement Area) is shown on Drawing Nos.1 and 2 and is the subject of an agreement between Mineral Holding Australia (MHA) the holder of EL 43/70 and Kaiser Aluminum (KA) who have undertaken the investigation of silica deposits within the Agreement Area. Longworth & McKenzie 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 has 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 sub-surface 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 (LM) and K. Pinner (MHA) in January 1981, identified the Dip Range No.1 area as the prime prospect for the second stage investigation. During this stage of the investigation the Agreement Area would also be investigated by a reconnaissance survey to identify other promising prospects in addition to those already identified by MHA.

During the field work (11th March to 5th April) the Dip Range No.1 Prospect was investigated by costeaning and percussion drilling, surface samples from other sites were obtained by blister blasting and numerous quarry and other sites were inspected.

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The terrain of the Agreement Area is moderately mountainous with elevations from about 100m to 554m ASL at Detention Peak. Some of the gullies and gorges are steep and rugged with well developed quartzite cliffs. Much of the terrain, however, consists of rounded, though steep sided hills.

The physiography placed some limitations on vehicle access, but the main factor limiting access both on foot and by vehicle was the vegetation. During the reconnaissance work, the areas covered were limited to those served by existing and overgrown vehicle tracks and areas of open button grass and thin scrub cover. Areas of heavy timber and thick scrub could not be investigated due to the extremely slow progress attainable when travelling on foot and the lack of visibility within these areas.

3.0 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 by 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 containing the quartzite and sandstone 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. However, the present programme indicated that quartzite within both the Jacob Quartzite and Detention Sub-group may be much more limited than previously indicated and that in fact much of these units may be very poorly cemented sandstones which have been subject to irregular silicification.

Within the Agreement Area the quartzite and sandstone of the Detention Sub-group covers by far the larger area and forms the more prominent out-crops. Gee (1971, p10) 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 during the recent field inspection it appears that his general description would apply to the agreement area.

From the present work (Drawing No. 2) it has not been possible to elucidate the details of the geological structure. The general strike of the beds 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.

4.0 FIELD ACTIVITIES

4.1 General

The site work was carried out by geologists C.L. Adamson and R.J. Carr between the 11th March and 5th April 1981. The exploration programme consisted broadly of two parts; firstly a general EL reconnaissance and secondly, a more detailed site exploration and sampling programme. The later activity being based initially on the results of the preliminary investigation and later on the concurrently run general reconnaissance.

The sampling programme involved the winning of near surface and subsurface samples by:

1. Costeaming of selected sites by a D7 dozer with supplementary blasting in hard rip areas to expose strata and collect bulk samples.
2. Percussion drilling with an Atlas Copco ROC601 air track drilling to indicate subsurface quality and collect chip samples. The original planned use of the percussion rig was to drill blast holes to win samples at a depth below the dozers ripping capability. However, with the discovery of considerable depths of soft sandstone its use developed into that of preliminary exploration drill to test the depth to harder rock. The depth of exploration was limited to 15 metres due to drill rod availability.
3. Blister blasting of samples from areas where, for environmental reasons, the provision of access tracks or the excavation of costeams was not considered prudent.

Percussion holes, costeaning and blasting activities were restricted to crown land while general reconnaissance was carried out across the EL's crown and private land.

The general reconnaissance mapping was viewed as a directly related programme to the detailed investigations. In order to facilitate interpretations of subsurface and surface geology periodic personnel changes were made between the field mapping and subsurface explorations/sampling supervision.

Representative sections within the costeans and the percussion holes were logged with the results presented in Appendix A. Representative hand samples were collected for analysis and where applicable measurements of outcrops made.

4.2 General Reconnaissance

General reconnaissance of the Agreement Area was carried out by four wheel drive vehicle and on foot. Access along boundaries of the Agreement is generally good, however, due to increasing vegetation cover and increasing topographic relief accessibility decreases rapidly towards the central portions of the area. The limit of access due to the above may be seen on Drawing Nos. 1 and 2. The major exposures across strike through the Agreement Area were provided by railway and road cuttings.

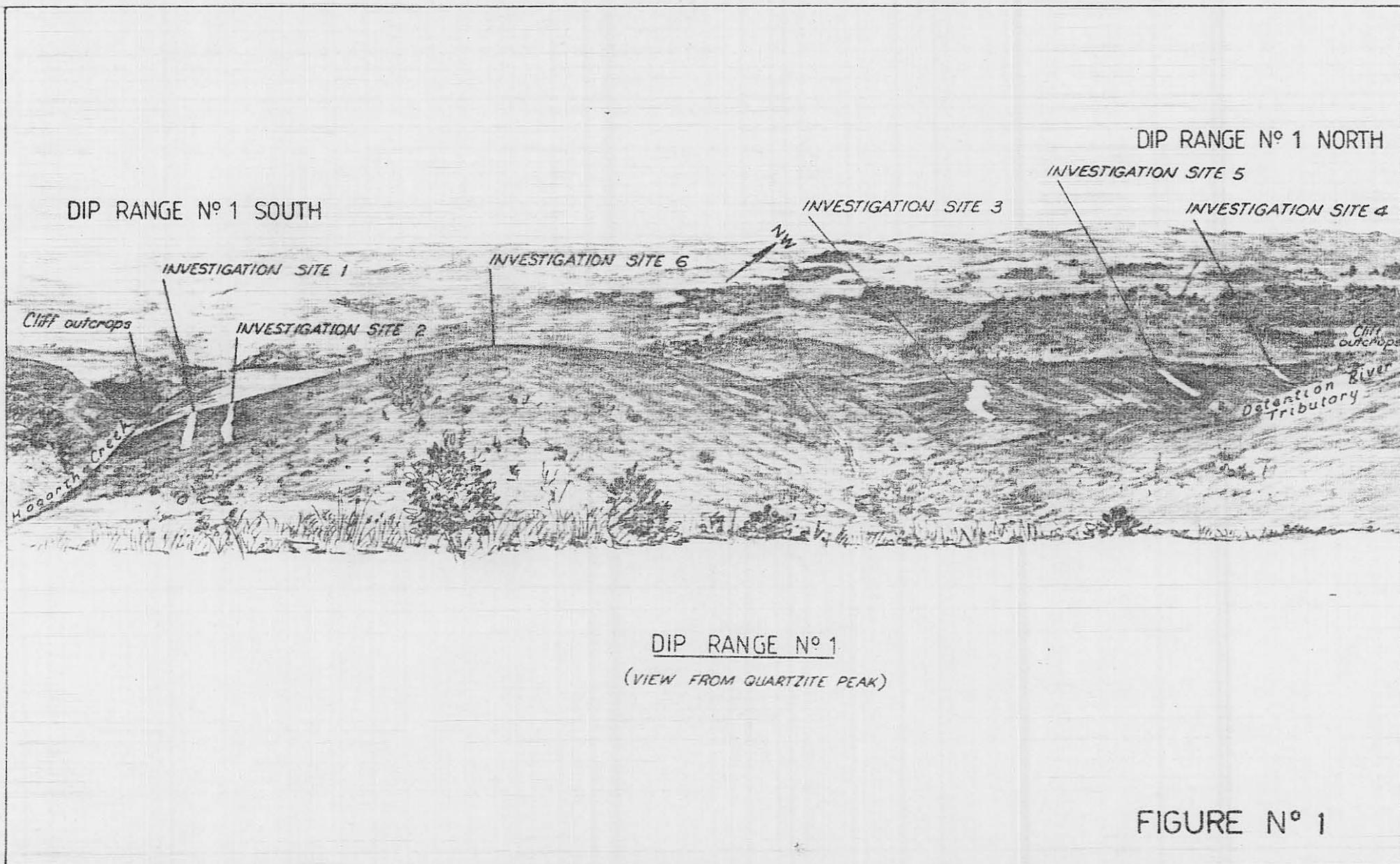
Where possible, in addition to rock type, the strike and dip of outcrops were recorded on air photographs in the field.

4.3 Sampling Programme

Based on work previously carried out on EL43/70. (Ref. Preliminary Assessment.) Dip Range No.1 was identified as the first priority prospect area.

The sampling programme was commenced at Dip Range 1 South, with an access track being constructed from Newhaven Road. The provisions of the access track involved the pushing of low scrub in the foot hills and limited side cuts in the upper areas. Side cuts were, however, restricted to slopes with natural screens from surrounding areas. Two costeans were cut at Dip Range 1 South, with three others being excavated along the ridge to Dip Range 1 North (see Drawing Nos. 4 - 6 and Figure No.1). Drilling and blasting was carried out in costeans at Investigation Sites 4 and 5 to allow them to be excavated to a greater depth. Samples were taken at all investigation sites with bulk samples being taken at Investigation Sites 4 and 5. Percussion holes were drilled at each investigation site to assess the competency of the strata and to a limited extent for collection of deeper samples. Plan locations and sections along these percussion holes are shown on Drawing Nos. 4, 5 and 6.

Hand samples from costean 4 (the deepest excavation) were air freighted to Sydney for chemical analysis prior to the completion of field work. This provided necessary on site information to plan the bulk samples programme. Costean 4, was subsequently sampled over the range of apparent physical and chemical variations intersected to allow estimates of the probable percentage of acceptable product to be assessed. The location of bulk samples are shown on the logs (Appendix A). Samples were blister blasted from three



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FIGURE N° 1

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locations on Quartzite Peak, one location on Dip Range 1 North at the bottom of costean 5 (Drawing 4) and one from Mount Sunshine. Samples taken in the field were packed into plastic bags and loaded into three 44 gallon drums for transportation to Sydney.

5.0 SUMMARY OF FIELD RESULTS

5.1 Reconnaissance Survey

The factual information recorded from vehicle or foot traverses is recorded on Drawing No. 2. Drawing No. 3 supplies an interpretation based on data from the present survey together with data from Geological Survey mapping.

The basalt country which masks much of the rocks of interest has been mostly cleared for grazing and agriculture. The areas not cleared are generally very heavily forested and not easily accessible. Most of the basalt occurs in the eastern half of the Agreement Area and has been mapped by the Geological Survey. Basalt boundaries shown in the western half of the Agreement Area are a combination of those derived from the Geological Survey (Burnie 1:250,000 Geological Sheet) and the reconnaissance mapping.

In the northern part of the Area no promising quartzite beds are exposed along either the Bass Highway or the railway line in the Sisters Hill region. It would appear that from both environmental and geological respects no favourable locations exist north of grid line 5464000.

In the south eastern corner of the Area the rocks are the phyllites and schists of the Keith Metamorphics.

The Pokes Road prospect appears to be a south westerly extension of the Jacob Quartzite as exposed in the Maynes Creek prospect. In the vicinity of Pokes Road the dips of the strata suggest a synclinal structure, but owing to lack of outcrops it is not possible to relate these outcrops structurally to others to the north west.

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The Detention Sub-group crops out in parts of the eastern half of the Agreement Area, but most of this area is rugged and very heavily timbered or scrub covered. The Milabeena Sites are the only prospects listed in this area and any area west of the Detention River has the problem of a most difficult access.

The main mass of the Detention Sub-group rocks containing sandy beds are located in a zone extending from Mt. Dipwood and Dipwood Plain in a north north easterly direction to the region of the Dip Range No. 1 prospect.

From the results of investigations at Dip Range No. 1 it appears that if no quartzite crops out in very visible masses, there is little chance of finding solid quartzite in the sub surface. If this hypothesis regarding visible quartzite outcrops and subsurface occurrence is valid no promising sandstone beds in the Detention Sub-group were identified in the southern part of the area.

The most visible southern massive outcrop of quartzite occurs on the north western flank of Detention Peak. An attempt to reach this outcrop failed due to very thick scrub. To the north the next prominent outcrops are at the Dip Range No.2 Prospect. Here quartzite outcrops are confined to the crest of the range. Most other outcrops on the north western flank of this range are of schist or schistose quartzite and restricted in outcrop distribution. Scattered small outcrops of massive quartzite in this area showed no indication of continuity.

Further north again the most prominent quartzite outcrops are located on the Dip Range No.1 ridge and on the ridge of Quartzite Peak (local name Shakespeare).

Along the valley in which the Newhaven Track is located the rocks exposed in gravel pits, road cuts and quarries are phyllites, siltstones and schists. Similar rocks have been recorded on the hills to the east of the track.

In conclusion, the most prospective areas are the most prominent hills showing distinct quartzite outcrops. Many smoothly contoured hills with a cover of button grass exist in the Area but they contain little surface evidence of quartzite. Individual localities identified as possible prospects are discussed in the following sections.

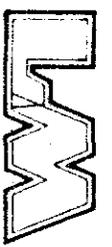
5.2 Individual Localities

5.2.1 Dip Range No. 1

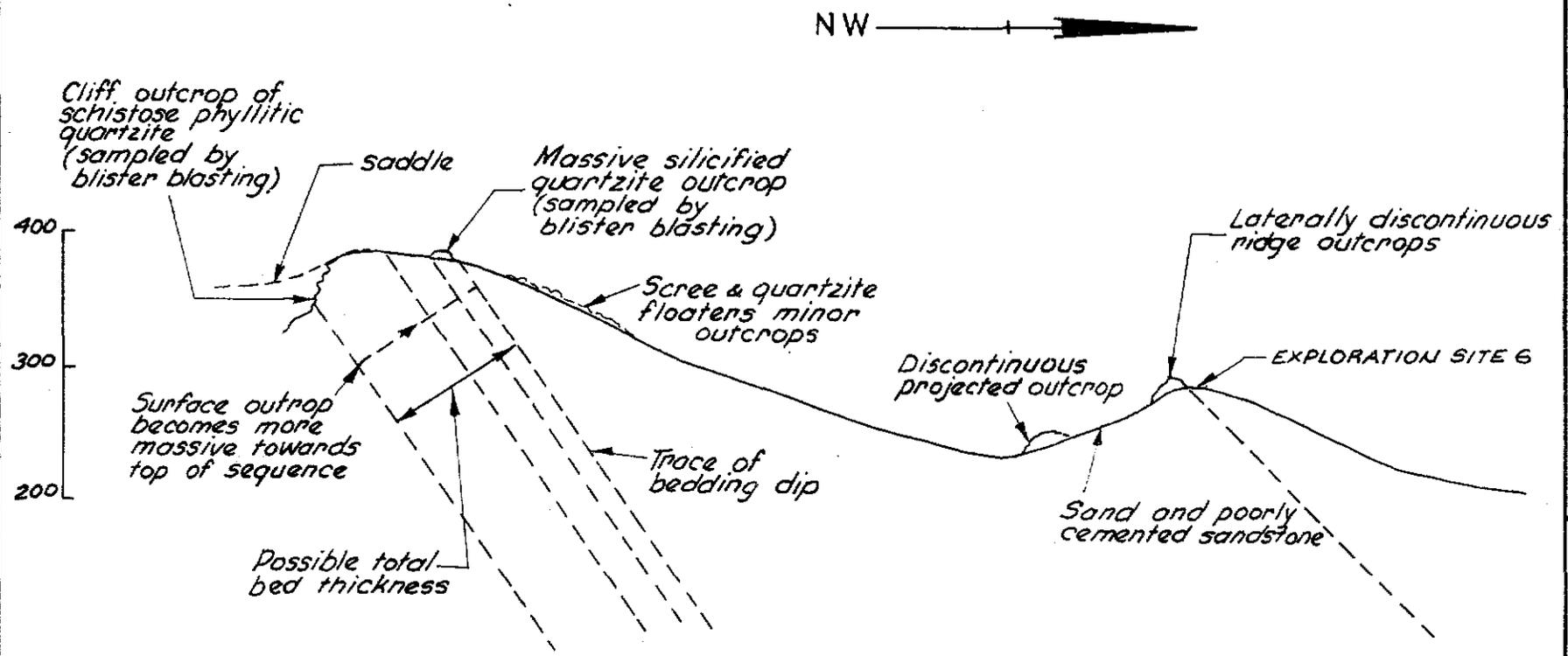
This prospect is a partially dissected strike controlled ridge some 1.5 km long. The prospect is truncated by Hogarth Creek at its south western extremity and a tributary of the Detention River on the north eastern end. The south western end of the prospect has been named Dip Range No. 1 South with the north western end named Dip Range No. 1 North. Outcrops of hard white silicified quartzite dipping to the north west occur in the dissected valleys at either end of the prospect and intermittently along the ridge.

Subsurface exploration on this prospect included the excavation of 5 costeans and the percussion drilling of 27 bore holes. The locations of these exploration sites are shown on drawings 4, 5 and 6 with the relevant logs contained in Appendix A.

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DIAGRAMMATIC SECTION THROUGH
QUARTZITE PEAK ON
DIP RANGE 1

5 cm

FIGURE No 2

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Exploration activity was commenced at Dip Range No.1 South due to the presence of massive exposed bluffs of quartzite in Hogarth Creek. A costean was excavated at Investigation Site No. 1 (Drawing No. 4) to expose the subsurface extension of the Hogarth Creek outcrops. This costean, however, showed only sand, talus and poorly cemented, extremely weak sandstone. (IS 1/1 and 2, Appendix A.)

Due to the unexpected nature of subsurface conditions, the percussion drill was used as an exploration tool to test the thickness of the material exposed within the costean.

BH 1 to 3 were drilled in costean 1 across the ridge line some 70 metres north east of the Hogarth Creek Cliff and intersected only weak sandstones.

Excavation site 2 gave results similar to 1 with minor quartzite bands being intersected.

Moving further north along the Dip Range 1 ridge to its highest point (Investigation Site 6, Drawing No. 6), three percussion holes, drilled in a line across the strike, showed a decreasing quality of material from quartzite on the south western side of the ridge to sand or soft sandstone on the north western side.

Investigation Site 3, to the north of 6, showed apparent interbedded units of strong and extremely weak sandstone. Further north again, at Investigation Site 5, a costean excavated perpendicular to the strike between two hard silicified sandstone outcrops, showed only weak sandstone in the costean and in associated percussion holes.

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Investigation Site 4, at Dip Range No. 1 North (Drawing No. 5), showed the most consistent subsurface rock profile. It may be seen, however, from the section BH24 - BH21 that the depth to hard rock increased to the south west and north west.

A large costean was excavated in rock at Investigation Site 4 by blasting and ripping to allow inspection and bulk sampling of the subsurface profile. The sandstone/quartzite exposed was logged (IS 4/W1 and E1 Appendix A) in detail. In summary, however, the material consisted of sandstone ranging in strength from extremely weak to very strong depending on the degree of silicification. Generally the correlation of strata between the two sides of the costean was poor, however, the more highly silicified units appear to correlate between outcrop, the eastern wall of the costean and BH 23.

Visually, the quality of the harder quartzite was good at IS 4, however, a brownish unit was intersected in percussion drilling. Chips of this material were sampled for testing. Due to the limited depth of the costean and the percussion drill holes the thickness and spacial occurrence of this brownish quartzite was not determined. However, from the bore hole information at hand it appears to be erratic constituting up to approximately 30% of the strata in some holes.

5.2.2 Quartzite Peak

Quartzite Peak (Shakespeare) forms one of the most prominent skyline features within the Agreement Area. The peak is a high point on a ridge which runs

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parallel with, but to the south west of, Dip Range No.1 (See Drawing No. 4). Quartzite Peak rises some 100 metres above the highest point on Dip Range No. 1 and is visible from the main Bass Highway for many kilometers.

The south eastern face of the peak is composed essentially of a cliff face which runs from a saddle at the top of the peak, north east to a tributary of Detention River and south west to Hogarth Creek.

The length of this outcrop is approximately 1.0 km and is the largest most continuous outcrop located on the Agreement Area.

Figure 2, a diagrammatic typical cross-section through Quartzite Peak and Dip Range No.1, shows the bedding dipping steeply to the north west and a large possible total bedding thickness of outcrop on Quartzite Peak.

Two distinct beds are discernable running across the top of Quartzite Peak. The first, which forms the cliff face is composed of a thinly bedded schistose interbedded phyllite, schist and quartzite sequence. The second bed crops out some 50 - 70 metres from the cliff face at the top of Quartzite Peak and consists of a massive hard silicified quartzite unit. The relative thickness of these beds is unclear as outcrop is not continuous between the two units. The estimated expected thickness from outcrop, however, are 50 - 70m and 20 - 30m respectively.

Due to the exposed nature of Quartzite Peak no costeaning was carried out and hence the true relative thickness of the two units are presently unknown.

5.2.3 Dip Range No. 2 Prospect

This prospect is located on the crest of the Dip Range, about 2.5 km east of the Newhaven Track the closest point of vehicle access. It is about 200 m above the Newhaven Track.

The outcrops at this prospect are distributed along the crest of the ridge for about 500 - 600 m. There is no continuity between outcrops, some are offset so that it appears that there may be faulting or irregular distribution of the quartzite in the sandy beds.

Irregular silicification is evident in outcrop with highly silicified rock, with no sedimentary structures, grading into sandstone with clearly defined bedding features. Loose sandstone fragments are present among the rock debris on the crest of the ridge. Between the main quartzite outcrops there are occasional quartzite fragments and very few small outcrops.

The prospect is very similar in character to the quartzite outcrops along the ridge at Dip Range No. 1 where depths of at least 15 m of soft sandstone exist in locations adjacent to solid quartzite outcrops.

A measurement across the bedding, which dips south easterly at 70° - 80° , showed a width of about 20 metres at the most southern outcrop on the ridge. Other outcrops would be narrower or of the same order of width. It was also noted that many outcrops showed a preferred orientation across the line of strike.

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The prospect does not show surface evidence of continuity along the strike for lengths greater than about 30 m, even though the several outcrops are spaced over about 600 m.

In the vicinity of this prospect other weathered quartzite outcrops have been identified but none are as prominent as the Dip Range No. 2 Prospect. Numerous locations of schistose quartzite, phyllite schist and generally silty beds have been recorded in the valley and flanks of Newhaven Creek.

Owing to the time involved in achieving access to this site and its generally unfavourable potential, no attempt was made to collect subsurface samples.

5.2.4 Maynes Creek

This prospect extends for approximately 4.8 km in a north easterly direction from a prominent bluff on Maynes Creek (Drawing No. 1). Over most of its length it has a width of 300 - 400 m with a near vertical easterly dip.

The prospect which is completely surrounded by basalt is part of the Jacob Quartzite. Physically, the quartzite varies from a silicified fine grained, massive quartz sandstone, at the Maynes Creek bluff, to a poorly cemented fine to medium grained sandstone with interbedded siltstone in the central portion of the prospect.

Vehicular access to this deposit is good with most of the deposit being on private land.

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Previous exploration on this prospect by others (BHP) included percussion drilling and surface blasting of material at the Maynes Creek end of the prospect. Verbal reports on the drilling via one of the property owners indicate a softening of the deposit with depth, while reports from the BHP testing of surface samples via Kaiser Aluminum show the material to be sub-specification with respect to abrasion resistance.

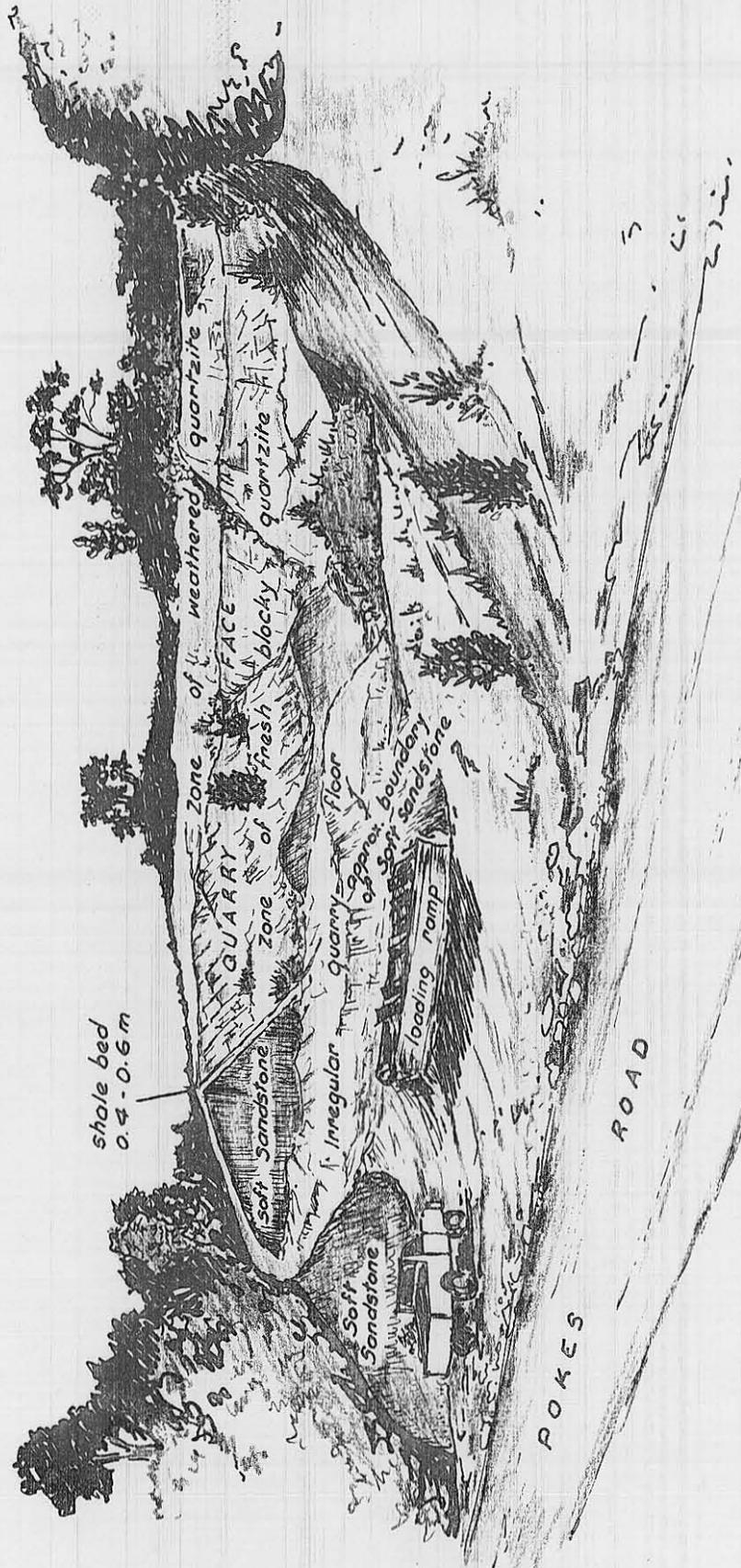
Based on the reconnaissance mapping results, and the results of the above, previous exploration work on this project, it was decided not to undertake further work on this prospect during this stage of the investigation.

5.2.5 Pokes Road Prospect

This prospect is located on the southern boundary of the Agreement Area. From the published mapping by the Geological Survey (Burnie 1:63,360) this deposit would seem to be located within the Jacob Quartzite.

At this location two road material quarries have been developed, one of which is on the crest of the ridge off a side road. The quarry exposes about 20m of quartzite dipping at 50° to the north west. Taking into account the bedding dip the true bed thickness would be in the order of 15 metres. The quartzite is generally fairly well silicified and most thinly bedded (10 - 50 mm) with a colour range from white to very common pink shades. Phyllite overlies the quartzite. The second quarry is on Pokes Road and located to the east of that just described. It is at a lower level and exposes the same quartzite bed in a face which is about 7 - 8 m high. The quartzite overlies a soft uncemented sandstone, which is

FIGURE NO 3



POKES ROAD QUARRY
 SHOWING QUARTZITE OVERLYING SOFT SANDSTONE



separated from the quartzite by a shale bed 0.4 - 0.6 m thick. At the ground surface, the quartzite has deteriorated to a soft friable sandstone while the lower parts of the quartzite face is fresh hard with block jointing at high angles to the bedding planes.

Fig. No.3 shows relative positions of sandstone shale quartzite and weathered quartzite. The quartzite is distinctly brown in colour with dark brown staining along the numerous joints. Strikes of the sandstone and quartzite are 45° and dips of 30° to 55° to the north west were measured. These agree with those measured in the quarry on the ridge crest.

From evidence obtained in the roads and other quarries of the surrounding area along the strike, both to the north east and south west of the Pokes Road Quarries, there are considerable amounts of sandy sediments which form the lines of hills. However, most of the exposures are of soft sandstone and only in a few restricted places are these rocks cemented by silica.

5.2.6 Milabeena Sites

This prospect consists of two separate sites, Mt. Sunshine and Misery Mountain. The quartzites at these sites are located within the mapped area of the Detention Sub-Group.

5.2.6.1 Mt. Sunshine

Physically the Mt. Sunshine prospect consists of the mountain and a lower adjoining strike controlled ridge line to the north east.

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The quartzite of Mt. Sunshine is bounded in the east by basalt overlying schist in Sisters Creek, in the north by basalt and to the south west by schistose quartzite, schist and soft sandstone.

In outcrop the quartzite at Mt. Sunshine consists of a hard massive silicified sandstone with minor less silicified bands. These beds dip steeply to the east. The largest outcrop, which occurs on the lower strike controlled ridge line, is some 30 metres across strike and crops out for some 20 meters along strike.

Access to the prospect is by 4-wheel drive and walking track with minor dozer work being required to allow 4-wheel access to site. The site is, however, visible, from surrounding areas and may therefore be subject to extractive environmental problems.

Although a surface sample was blister blasted from this locality no costeaning was attempted due to the exposed nature of the deposit. Consequently, in the absence of further subsurface definitive work, assessments of the quartzite quantity or quality could only be regarded as speculative.

5.2.6.2 Misery Mountain

The Misery Mountain prospect lies to the west of Detention Falls. The Detention Falls area is a reserve and a prominent tourist

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attraction. The mountain and lower bluff, associated with the Detention River and Falls are formed by a large silicified outcrop of sandstone.

This prospect is bounded on the east by schistose quartzite and to the south east by schist. Difficulty of access prevented exploration to the immediate west of Mt. Misery, however exposures to the north east and south west indicate that the area would be primarily schistose in nature containing poor quality schistose quartzite.

The provision of vehicular access to Mt. Misery would be difficult due to the presence of the Detention River and associated rugged topography, and dense vegetation.

Due to the access difficulty, the close proximity to a reserve, and the generally visible nature of the deposits, no costeaning of subsurface work was carried out on this prospect.

5.2.7 Nye Silica Deposit

This deposit is located within EL 43/70, but is outside the northern half of the EL known as the Agreement Area. Following instructions from the Kaiser representatives, an inspection of this site was made. The following information was gathered from a brief inspection of the quarry and surrounding area. A tape and compass traverse along the road and within the quarry was used to prepare the sketch plan

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(Drawing No. 6). As the location of this prospect is not included within the 1:25,000 plan, it can be identified as follows:

Arthur River 1:100,000 Sheet 7915, Grid Ref. 694 465.

The deposit which has been quarried for forestry road material, is located on a small hill on the western side of Pruana Road. The quarry about 6 m deep and 60 m long exposes a variety of siliceous material ranging from silica flour, with angular siliceous quartzite fragments to quartzite. Parts of this mass are uncemented while others are hard silcrete with variations between these two extremes. Some of the material has the appearance of breccia with angular fragments in a matrix of less cemented or uncemented siliceous flour. The origin of the deposit is the subject of some speculation, but it has the appearance of a Tertiary fluvial or lacustrine sedimentary deposit where very fine silica has been deposited. Silicification of the original silica flour has produced the range of material described above.

Parts of the quarry exposed coloured clayey material in the walls about half way from the top of the face extending down to the floor. The floor was covered with quartzite fragments which showed frequent iron staining. The colour in these lower sections contrast

with the white bleached appearance of the upper sections of the face. Very little topsoil was exposed in the face profile.

From the evidence in the quarry, along the road and from other exposures, the deposit is surficial with an irregular floor. The underlying material is weathered claystone/siltstone, or metamorphic equivalents.

6.0 SUMMARY OF TEST PROCEDURES AND RESULTS

6.1 Laboratory Testing

Samples collected and returned to Sydney were subjected to the following analysis and tests:

- Chemical analysis at A.C.I. Technical Centre Pty. Limited by X.R.F. (x-ray fluorescences). Spectrometer for Fe_2O_3 ; Al_2O_3 ; TiO_2 ; Cr_2O_3 ; CaO ; MgO ; Na_2O ; K_2O . Gravimetric analysis of LOI at 1000°C . SiO_2 calculated as balance.
- Friability testing based on J.I.S. M8712 as used by T.E.M.Co (Tasmanian Electro Metalurgical Co. Pty. Ltd.).
- Decrepitation of Quartzite at 1000°C (T.E.M.Co. Specification).
- Thermal stability of Quartzite at 1300°C (T.E.M.Co. Specification).

XRF is a well known analytical technique commonly used in the analysis of silica sources for a variety of end uses and thus requires no elaboration.

The physical tests are based on specification used by the Tasmanian Electro Metalurgical Co. Pty. Limited (Appendix C). T.E.M.Co., the only local producer of Ferro silicon and silicon carbide, have developed these specifications from overseas specifications.

While these specifications may not be a universal standard for the range of plant available they do represent the criteria upon which quartzite feed is judged for the current local market.

The abrasion test is a Los Angeles abrasion type test carried out in a larger (914mm diameter) tumbler. This test was carried out using BHP'S central laboratory tumbler at Newcastle with the sieve analysis being carried out at Longworth & McKenzie's laboratory.

The decrepitation and thermal stability tests as described in Appendix C are similar, with the only variant between the two being the temperature. The decrepitation test was done completely in Longworth & McKenzie's laboratory but due to the high temperature requirement A.C.I. Technical Centre did the heating for the thermal stability test. The samples were then processed in Longworth & McKenzie's laboratory.

6.2 Summary of Results

Details of sample analysis are contained within Appendix B. Table 1 and Table 2 present a summary of the chemical analysis and physical testing respectively.

6.2.1 Dip Range No. 1 North

i) Chemical Analysis

Chemical analysis on surface and near surface hand and bulk samples show the sandstone/quartzite to be of high quality, however, analysis of deeper chip samples of brownish quartzite from hole 22 (9 - 12m) showed a high aluminium content. Generally within the surface or near surface samples the less competent, more permeable members (i.e. sample Nos. 17116, 17119 and 17118) showed a marginally higher silica purity. This increase in purity of the more permeable units may be an effect of surface leaching as may the general surface quality when compared to the higher aluminium content found at depth in hole 22.

(ii) Physical Testing

The bulk samples taken from the costean at Investigation Site 4 showed extreme physical variation. A number of samples were not abrasion tested due to break up during transportation to Sydney (Sample Nos. 17119, 17164). A size analysis of Sample No. 17119 (Appendix B) showed some 30% of the sandstone had broken down to less than 25mm during transportation.

Of the three samples sent for abrasion testing two passed and one failed. The sample which failed (17118) also failed the decrepitation test.

Figure 4 shows the east wall of the costean at Investigation Site 4 with the acceptable units (based on T.E.M.Co. specification) shaded. This assessment is based on the test results and the tactile assessment within the profile logs (Appendix C).

A particle size analysis was carried out on the sand from the extremely weak, poorly cemented sandstone excavated at Investigation Site 5. This material was shown to be a clean poorly graded (well sorted), medium grained sand.

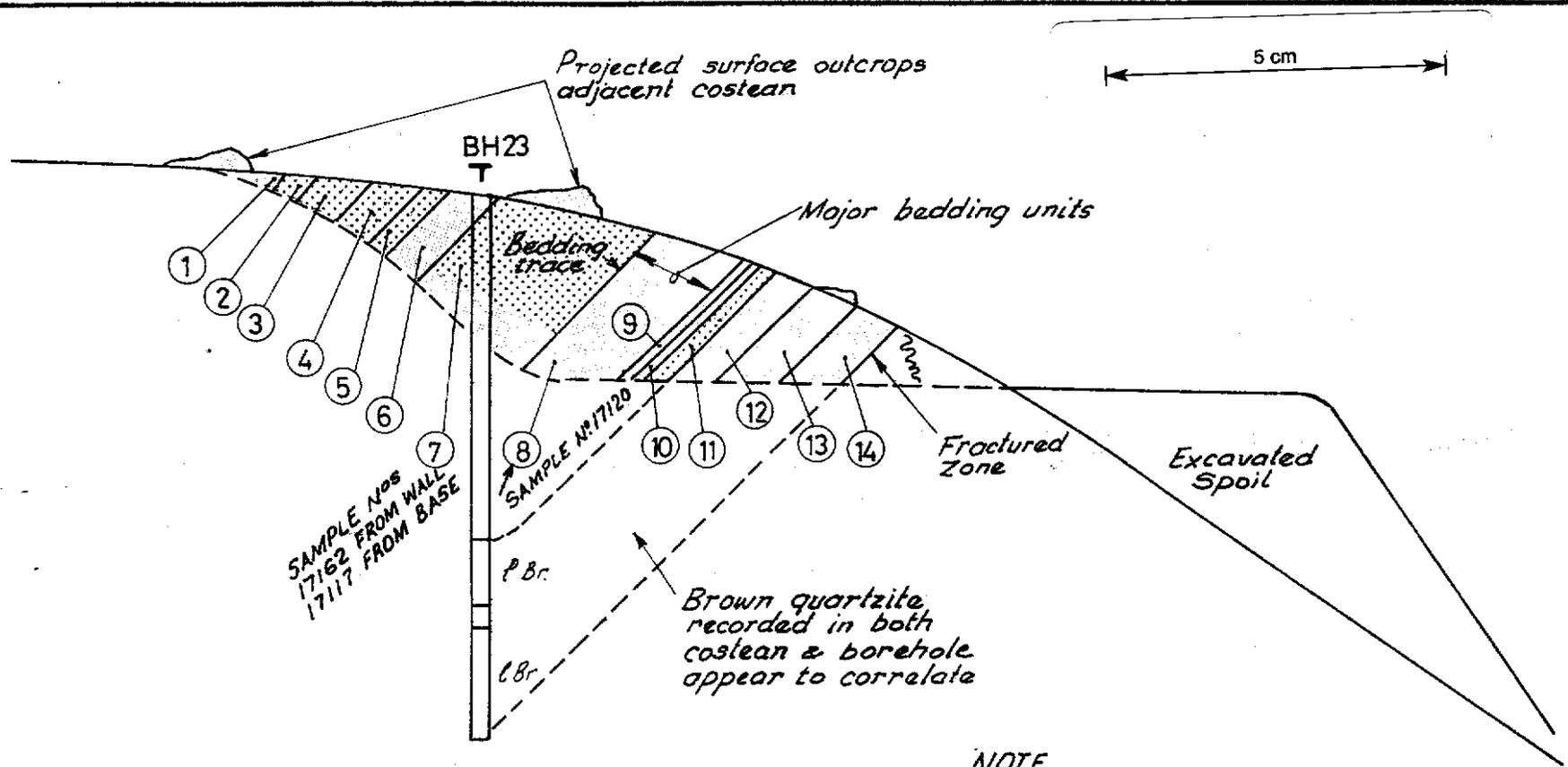
6.2.2 Quartzite Peak(i) Chemical Analysis

Samples from the cliff line (Nos. 17123 and 17122) showed poor quality material as expected. The sample (No. 17120) taken from the more massive quartzite bed (Figure No.1) showed good quality silica.

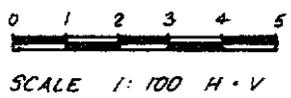
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EASTERN WALL COSTEAN 4



NOTE

- ① ROCK DESCRIPTIONS GIVEN IN LOG IS. 4/E1 (APPENDIX A)
- PHYSICALLY ACCEPTABLE
- PHYSICALLY SUB TEMCO STANDARD

DIAGRAMMATIC REPRESENTATION OF QUARTZITE / SANDSTONE PHYSICAL CHARACTER AT DIP RANGE 1 NORTH

FIGURE No 4

(ii) Physical Testing

Due to the platy schistose nature of the cliff material only the more massive quartzite bed sample (B) was tested. The abrasion test and the decrepitation test results were acceptable, however, the thermal stability was sub T.E.M.Co. standard. Due to the similarity of the decrepitation test and thermal test this disagreement would generally not be expected. This result may in fact be due to the small sample sizes used in these tests not being representative of the bulk samples. This effect no doubt has led T.E.M.Co. to review the test as stated in Appendix C.

6.2.3 Mount Sunshine(i) Chemical Testing

The surface blister blasted sample showed a relatively high aluminium and potassium content. The quartzite shows a silica purity lower than either Quartzite Peak or Dip Range No. 1 North.

(ii) No physical testing was carried out on the sample, however, based on its silicification level, it could be expected to meet T.E.M.Co. specifications.

6.2.4 Nye Deposit

A fine size grading ($< .075\text{mm}$) was carried out on the white flour from the Nye deposit. It may be seen that this material is essentially a silt with less than 3% clay.

TABLE 1 - SUMMARY OF CHEMICAL ANALYSES

Sample Location	Fe ₂ O ₃	Al ₂ O ₃	TiO ₂	Cr ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	L.O.	IS ₁ O ₂ (bal)
<u>Dip Range 1 North (Costean 4)</u>										
(Hand Samples)										
No. 1	.023	.08	.082	<.001	.01	<.01	.01	.02	.11	99.6
2	.18	1.0	.043	.001	.01	.03	.01	.30	.20	98.2
3	.085	.86	.048	<.001	.01	.03	.01	.25	.15	98.5
4	.037	.30	.026	.003	.01	.01	.01	.09	.13	99.3
5	.058	.47	.054	<.001	.01	.02	.01	.15	.16	99.0
(Bulk Samples)										
No. 17117	.068	.68	.060	<.001	<.01	.02	.01	.20	.12	98.8*
17118	.017	.05	.087	<.001	<.01	<.01	<.01	.01	.05	99.7*
17119	.019	.05	.068	<.001	<.01	<.01	<.01	.01	.05	99.8†
17121	.034	.15	.034	<.001	.03	.02	<.01	.04	.12	99.5
(Percussion Hole 22)										
(9 - 12 metres)	.11	2.3	.09	<.001	.01	.07	.01	.59	.88	96.0
<u>Dip Range 1 North (Costean 5)</u>										
Poorly Cemented Sand										
No. 17116	.013	.04	.12	<.001	<.01	<.01	<.01	.01	.12	99.6†
<u>Quartzite Peak</u>										
Blister Blasted Samples										
(Ref. Drawing No. 4)										
(A) No. 17123	.21	4.2	.11	.002	.01	.48	.02	1.0	.68	93.2
(B) No. 17120	.018	.16	.029	<.001	<.01	.01	<.01	.04	.07	99.6*
(C) No. 17122	.41	4.1	.16	<.001	.01	.50	.01	1.3	.78	92.7
<u>Mount Sunshine</u>										
Blister Blasted Sample										
No. 17128	.035	.83	.047	.001	.02	.02	.01	.23	.15	98.6

*Sample subjected to Abrasion, Decrepitation and Thermal Testing

†As received seive analysis carried out.

TABLE 2 - SUMMARY OF PHYSICAL TESTING

	Friability Test		Decrepitation of Quartzite 1000°C		Thermal Stability 1300°C	
	Tumble Index	Abrasion Index	+19 after Heating %	+5 after Heating & Tumbling %	+19mm after Heating %	+ 5mm after Heating & Tumbling %
<u>Dip Range 1 North</u>						
Costean 4						
17117	90	8	92	98		
17118	47+	47+	99	75+	86.9	93.0
17121	80	1	100	98.9	100	96.6
17119		Sample break down during transport			93.1	51.1 +
17164†		Partial break down during transport				
<u>Nye Deposit</u>						
17165†						
<u>Quartzite Peak</u>						
Site B (Ref. Drawing No.4)						
17120	73	19	99.5	95.5	67.2 +	83.0 +

+ Sub T.E.M.Co. Standard

† As recieved sieve analysis carried out

Refer Appendix C for test details.

7.0 CONCLUSIONS

1. The term quartzite as used in the nomenclature of the Rocky Cap Group is a misnomer. Both the Detention Sub-group quartzite and the Jacob Quartzite are better described as variably and, at this stage of the exploration, somewhat erratically silicified quartzose sandstones.
2. The degree of silicification within the sandstones is not necessarily consistent within bedding units either along strike or down dip. Further, there appears to be no correlation between the stratigraphic location of beds and the degree of silicification.
3. While it can only be proven by deeper cored drilling, the apparent lack of silicification of some beds is not generally considered to be due to surface weathering. However, there is surface silicification of some units and softening of others at discrete localities that may be attributable to weathering effects.

The reasons for the variation in silicification across the quartzite is thus thought to be polygenetic in character.

4. Chemical composition of the sandstones is generally good except towards the boundaries with other rock types (i.e. Quartzite Peak cliff line). Physical quality is, however, widely variable.

With respect to the general high chemical quality, there is limited evidence which indicates that surface leaching has enhanced the near surface quartzite purity by reducing the Al_2O_3 and Fe_2O_3 content.

- 30 -

5. Of the individual prospects identified and discussed in Section 5.2, Dip Range No.1, Quartzite Peak and to a lesser extent Mt. Sunshine are considered worthy for further exploration.

Dip Range 2 Prospect has access difficulties and is small in quantity with an almost vertical dip.

Maynes Creek Prospect has been shown to be physically inferior (BHP) and this was confirmed visually during field reconnaissance.

Pokes Road Prospect is generally physically inferior with only minor silicified beds.

Misery Mountain suffers from access difficulty (i.e. Detention River and rugged terrain) and it lies adjacent to a reserve and popular tourist attraction.

The Nye Silica Deposit which lies outside the Agreement Area is apparently restricted in size and subject to chemical variations.

During the investigation, no other prospects were identified as having suitable potential quartzite reserves.

6. Potentially, Quartzite Peak has in excess of the 2 million tonnes required. Chemical and physical quality of the blister blasted samples from the more massive unit to the north west of the cliff face were acceptable. The above tonnage, however, would be subject to this unit maintaining acceptable characteristics with depth and along strike.

While Quartzite Peak is the most promising prospect in terms of quantity its development may suffer environmental problems due to its visibility from surrounding areas.

7. Dip Range No.1 North has apparently consistent rock strata although restricted in size. Chemically, the surface and near surface samples were good, however, high Al_2O_3 (2 - 3%) material was encountered at depth (9 - 12m).

Physically, the near subsurface rock is variable, based on logs of costean 4 and physical test results it is estimated that between 30 to 50% of this material may be unsuitable on physical grounds. Thus this prospect's suitability would appear to depend on the rock quality increasing with depth.

8. Chemical tests on blister blasted samples from Mt. Sunshine as well as the physical appearance of the quartzite and outcrop thickness were encouraging. However, the units continuity along strike and down dip is not known.
9. The stratigraphic variation in chemical or physical properties of the sandstone/quartzite is not understood. Quartzite quality (physical and chemical), may vary favourably or unfavourably with depth. Sub surface coring would be required to resolve the prospect of depth variations.

8.0 RECOMMENDATIONS

The nature of the quartzite at depths below ground surface is generally unknown. Further it was not considered prudent to costean Quartzite Peak due to possible environment problems, therefore, no subsurface data is available on the prime prospects. Assuming that a more attractive potential source of silica has not been located elsewhere, it is proposed that a limited number of cored holes (3) be drilled. Two at Quartzite Peak and one at Dip Range North. The findings of this limited programme would provide the basis for a decision on the programmes continuation or otherwise. The drilling of Quartzite Peak would:

- Delineate the change from the more massive beds to the schistose cliff units.
- Provide chemical and physical variations if present with depth.

While collectively the drilling at Dip Range No.1 North and Quartzite Peak would provide data to make a more quantitative estimate on reserves for preliminary submissions to the Mines Department to gain approval in principle for development prior to commitment on a full scale reserve proving drilling programme.

APPENDIX A

BORE HOLE LOGS AND COSTEAN PROFILE LOGS

CONTENTS

	<u>PAGE NO.</u>
Logs of Percussion Holes 1 - 27	35 - 61
Logs of Investigation Sites Profiles	
IS1/1	62
IS1/2	63
IS1/3	64
IS3/1	65
IS4/E1	66
IS4/W1	70
IS5/1	74

NOTES:

- (1) The profile log numbering is based on:

IS1 - Investigation Site No. 1

IS1/1 - Profile No. 1 at Investigation Site 1

IS4/W4 - Profile No. 1 on West Side of the Costean at IS4

(see Drawing Nos. 4 - 6 for Log Locations).

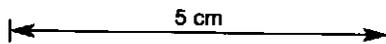
- (2) Due to the combination of air pressures, hammer and rotation rate variations, the penetration rate is a qualitative guide only to strata hardness.

The following field criteria were used:

0 - 1 minute/rod (3m)	Very rapid penetration
1 - 2 minutes/rod	Rapid penetration
2 - 4 minutes/rod	Moderate penetration
> 4 minutes/rod	Slow penetration.

BOREHOLE LOG SHEET

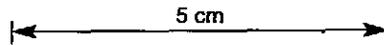
Client: KAISER ALUMINUM		HOLE NO 1		
Project: SILICA PROSPECT E.L. 43/70				
Location: WYNYARD				
Position: REFER FIGURE		Surface Elevation: GL - 1		
Date Started: 20-3-81		Date Completed:		
		Logged By: R.J.C.		
Rig Type (Mounting): AIRTRACK (Percussion) 75mm		Contractor: ATLAS COPCO		
Progress	Sample of Test	Depth (RL) metres	Strata	DESCRIPTION: - (cuttings colour, penetration rate, cutting type, moisture)
5		6.0		<u>White, rapid penetration, sand no chips, dry.</u>
	composite sample	6.6		<u>White, medium penetration, sand no chips, dry.</u>
10				<u>White, generally rapid penetration, minor harder bands, dry.</u>
		12.0		Hole terminated, rods jamming due to sand/bit screwed off to retrieve rods.
15				



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BOREHOLE LOG SHEET

Client: KAISER ALUMINUM		HOLE NO 2	
Project: SILICA PROSPECT E.L. 43/70		SHEET 1 OF 1	
Location: WYNYARD		Position: REFER FIGURE	
Date Started: 20-3-81		Date Completed: _____	
Rig Type (Mounting): AIRTRACK (Percussion) 75mm		Contractor: ATLAS COPCO	
Date Started: 20-3-81		Logged By: R.J.C.	
Progress	Sample of Test	Depth (RL) metres	DESCRIPTION: - (cuttings colour, penetration rate, cutting type, moisture)
5			White, moderate penetration, sand no chips, dry.
		9.0	
10			White, rapid, sand, dry.
		15.0	
15			White, moderate penetration, some chips over the last 1.5m, dry.
			Hole terminated.



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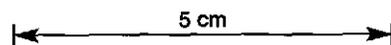
Job No
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BOREHOLE LOG SHEET

Client: KAISER ALUMINUM	HOLE NO 3
Project: SILICA PROSPECT E.L. 43/70	SHEET 1 OF 1
Location: WYNYARD	Position: REFER FIGURE
Date Started: 20-3-81	Date Completed: _____
Surface Elevation: GL - 1	
Logged By: R.J.C.	
Rig Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO	

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cuttings colour, penetration rate, cutting type, moisture)
		3.0		White, moderate penetration, surface chips becoming softer, dry.
5				White, very rapid to rapid penetration, sand, dry (drill winding down under no percussion or minimum percussion.)
10		9.0		Hole terminated due to possibility of jamming rods.
15				



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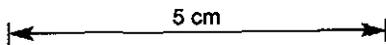


Job No
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BOREHOLE LOG SHEET

Client: KAISER ALUMINUM		HOLE NO 4	
Project: SILICA PROSPECT E.L. 43/70		SHEET 1 OF 1	
Location: WYNYARD		Position: REFER FIGURE	
Date Started: 20-3-81		Date Completed: _____	
Rig Type (Mounting): AIRTRACK (Percussion) 75mm		Contractor: ATLAS COPCO	
Logged By: R.J.C.		Surface Elevation: GL - 2	

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cuttings colour, penetration rate, cutting type, moisture)
5		6.0		<u>White, rapid to very rapid drilling</u> , little to no percussion, sand cuttings.
		9.0		As above, <u>rapid penetration</u>
10		10.0		As above, <u>moderate penetration.</u>
		15.0		As above, <u>rapid penetration.</u>
15				Hole terminated.

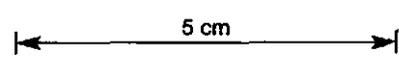




BOREHOLE LOG SHEET

Client: KAISER ALUMINUM	HOLE NO 5
Project: SILICA PROSPECT E.L. 43/70	
Location: WYNYARD	SHEET 1 OF 1
Position: REFER FIGURE	Surface Elevation: GL
Date Started: 21-3-81	Date Completed: _____
	Logged By: CLA
Rig Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO	

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cuttings colour, penetration rate, cutting type, moisture)
5		6.0		<u>White, rapid</u> , sand, dry.
		9.0		<u>White, moderate</u> , sand, dry. <u>White, rapid</u> , sand, dry.
10		12.0		<u>White, slow</u> , sand and some sandstone, dry.
	sample	15.0		<u>White, slow</u> , sand and some sandstone, dry.
15				



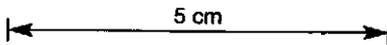
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BOREHOLE LOG SHEET

Client: KAISER ALUMINUM		HOLE NO 6	
Project: SILICA PROSPECT E.L. 43/70		SHEET 1 OF 1	
Location: WYNARD			
Position: REFER FIGURE		Surface Elevation: GL	
Date Started: 21-3-81		Date Completed: _____	
		Logged By: CLA	
Rig Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO			
Progress	Sample or Test	Depth (RL) metres	DESCRIPTION: - (cuttings colour, penetration rate, cutting type, moisture)
5		7.0	White, <u>very rapid</u> , sand, dry.
10			Hole abandoned at about 7m due to very soft drilling.



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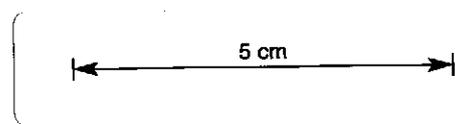
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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 7	SHEET 1 OF 1
Project:	SILICA PROSPECT E.L. 43/70		
Location:	WYNYARD		
Position:	REFER FIGURE	Surface Elevation:	GL
Date Started:	21-3-81	Date Completed:	Logged By: CLA
Rig Type (Mounting):		AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO	

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION:- (cuttings colour, penetration rate, cutting type, moisture)
		3.0		<u>White, very rapid</u> , sand, dry.
5		5.5		<u>White, moderate</u> , sand, dry.
		9.0		<u>White, rapid</u> , sand, dry.
10		15.0		<u>White, rapid</u> , drilled without hammer, sand, dry.
15				



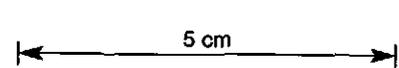
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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 8
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	21-3-81	Date Completed: Logged By: CLA
Rig Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO		

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION:- (cuttings colour, penetration rate, cutting type, moisture)
5		6.0		White, <u>very rapid</u> , sand, dry.
10	composite sample			White, <u>rapid</u> , bottom 1.5m drilled without hammer, sand, dry.
15		15.0		



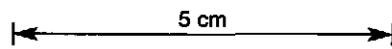


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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 9
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	21-3-81	Date Completed: _____
		Logged By: CLA
Rig Type (Mounting):	AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO	

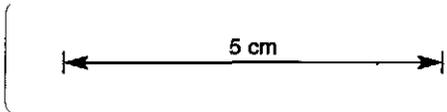
Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cuttings colour, penetration rate, cutting type, moisture)
		3.0		<u>White, very rapid, sand, dry.</u>
5	composite sample			
10				<u>White, rapid, drilled without hammer in bottom 2m, sand, dry.</u>
15		15.0		



BOREHOLE LOG SHEET

Client: KAISER ALUMINUM	HOLE NO 10
Project: SILICA PROSPECT E.L. 43/70	SHEET 1 OF 1
Location: WYNYARD	
Position: REFER FIGURE	Surface Elevation: GL
Date Started: 21-3-81	Date Completed: _____
	Logged By: CLA
Rig Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO	

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cuttings colour, penetration rate, cutting type, moisture)
5		6.0		<u>White, rapid, sand, dry.</u>
		6.3		<u>White, very rapid, sand, dry.</u>
		8.4		<u>White, moderate to slow, sand and quartzite chips, dry.</u>
10				<u>White, very rapid, bottom 3m drilled without hammer, sand, dry.</u>
15		15.0		



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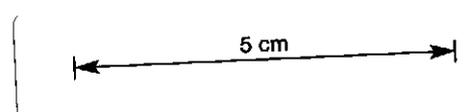
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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 11
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	21-3-81	Date Completed: Logged By: CLA
Rig Type (Mounting):	AIRTRACK (Percussion) 75mm	Contractor: ATLAS COPCO

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cuttings colour, penetration rate, cutting type, moisture)
5				<p><u>Yellow, cream, brown, rapid, some brown siltstone chips, dry.</u></p>
10				
15		15.0		

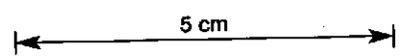


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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 12	
Project:	SILICA PROSPECT E.L. 43/70		
Location:	WYNYARD		
Position:	REFER FIGURE	Surface Elevation: GL	
Date Started:	23-3-81	Date Completed:	Logged By: R.J.C.
Rig Type (Mounting): AIRTRACK (Percussion) 75mm		Contractor: ATLAS COPCO	

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cuttings colour, penetration rate, cutting type, moisture)
5	sample	5.0		<u>White, moderate to slow</u> , chips and dust, dry.
		7.0		<u>Light brown, rapid penetration</u> no percussion, sand, dry.
		9.0		<u>White, moderate to slow</u> , chips and sand, dry.
10	sample	11.5		<u>Light brown, moderate</u> , silty sand, dry.
		15.0		<u>White, slow to moderate</u> , chips, dry with alternating bands of light brown softer material.
15	sample	15.0		Hole terminated.



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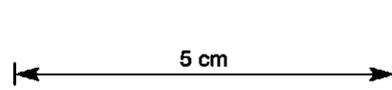


Job No
PXT 250

BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 13
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	23-3-81	Date Completed: Logged By: CLA
Rig Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO		

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cuttings colour, penetration rate, cutting type, moisture)
		3.0		<u>White, very rapid</u> , sand, dry, rotation only in bottom 1.5m.
5		6.0		<u>Light brown, very rapid</u> , sand, dry, rotation only.
10		12.0		<u>White, rapid</u> , sand, wet at bottom.
15				Hole abandoned due to wet moisture.



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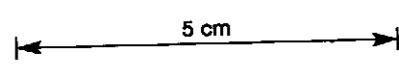


Job No
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BOREHOLE LOG SHEET

Client: KAISER ALUMINUM		HOLE NO 14	
Project: SILICA PROSPECT E. L. 43/70		SHEET 1 OF 1	
Location: WYNYARD			
Position: REFER FIGURE		Surface Elevation: GL	
Date Started: 23-3-81		Date Completed:	
		Logged By: CLA	
Rig Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO			
Progress	Sample or Test	Depth (RL) metres	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
		2.5	<u>White, slow</u> , quartzite chips, dry. <u>Note</u> : Drilling started on quartzite outcrop.
		4.5	<u>Light brown to brown at bottom, moderate</u> , some quartzite chips, dry.
5		6.75	<u>White to light brown, slow</u> , quartzite chips, dry.
		7.5	<u>Brown, moderate</u> , some chips, dry.
	composite sample	9.0	<u>Dark red brown, moderate</u> , some chips, dry.
10			
			<u>Brown, light with frequent dark brown, moderate</u> , some chips, dry.
15		15.0	
			<u>Note</u> : The collar of this hole is located on a solid quartzite outcrop.



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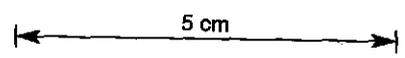
Job No
PXT 250

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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO	15
Project:	SILICA PROSPECT E.L. 43/70		
Location:	WYNYARD	SHEET	1 OF 1
Position:	REFER FIGURE	Surface Elevation:	GL
Date Started:	24-3-81	Date Completed:	
		Logged By:	RJC
Rig Type (Mounting):		AIRTRACK (Percussion) 75mm	Contractor: ATLAS COPCO

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
				<u>White, slow penetration, chips, dry.</u>
5		5.0		
		6.0		<u>White, rapid to moderate penetration, sand, dry.</u>
		7.0		<u>Yellow to white, as above.</u>
		7.8		<u>As above, moderate penetration.</u>
10				<u>White, rapid penetration, little to no percussion, sand, dry.</u>
15		15.0		<u>Hole terminated.</u>
				<u>Note: Collar located on outcrop.</u>



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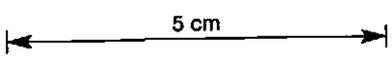


Job No
PXT 250

BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 16
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	24-3-81	Date Completed: Logged By: RJC
Rig Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO		

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
5				<u>White, rapid penetration</u> , little percussion, sand, dry.
		7.0		
		8.0		<u>White, moderate penetration</u> , as above.
10				<u>White, rapid penetration</u> , little to no percussion, sand, dry.
		14.0		
15		15.0		<u>Red-brown, moderate penetration</u> , sand, dry. Hole terminated.



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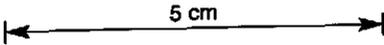
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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 17
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	24-3-81	Date Completed:
		Logged By: RJC
Rig Type (Mounting):	AIRTRACK (Percussion) 75mm	Contractor: ATLAS COPCO

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
		3.0		White, moderate penetration, chips and sand.
5				As above, slow penetration, chips, dry.
	composite sample			
10				
		15.0		Hole terminated.
15				Note: Collar located on outcrop.

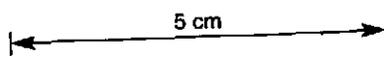




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BOREHOLE LOG SHEET

Client: KAISER ALUMINUM		HOLE NO 18		
Project: SILICA PROSPECT E.L. 43/70				
Location: WYNYARD		SHEET 1 OF 1		
Position: REFER FIGURE		Surface Elevation: GL - 0.5		
Date Started: 24-3-81		Date Completed:		
		Logged By: RJC		
Rig Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO				
Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
		2.5		<u>White, moderate</u> , chips, dry.
5		5.2		<u>White, rapid</u> , sand, dry.
		6.1		<u>White, moderate</u> , sand, dry.
		7.5		<u>White, rapid</u> , sand, dry.
10				<u>light brown to brown, moderate</u> , chips and dust, dry.
		12.0		Hole terminated, buttons fractured off bit.
15				



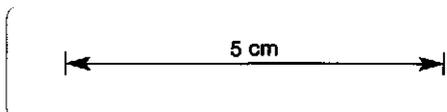
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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 19
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	24-3-81	Date Completed: Logged By: CLA
Rig Type (Mounting):	AIRTRACK (Percussion) 75mm	Contractor: ATLAS COPCO

Progress	Sample or Test	Depth (RL) metres	Strata	DISCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
		2.25		<u>White</u> , <u>very rapid</u> , sand, dry.
5		6.2		<u>White</u> , <u>moderate</u> , sand and chips of friable sandstone, dry.
		6.5		<u>Brown</u> , <u>moderate</u> , some chips, dry.
10		12.0		<u>White</u> , <u>slow</u> , quartzite chips and sand, dry.
		12.5		<u>Brown</u> , <u>slow</u> , quartzite chips, dry.
		13.5		<u>White</u> , <u>slow</u> , quartzite chips, dry.
15		15.0		<u>Brown</u> , dark in bottom 100mm, <u>slow</u> , sand and chips, dry.



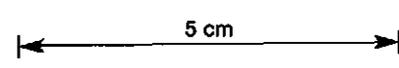
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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 20
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	24-3-81	Date Completed: Logged By: CLA
Rig Type (Mounting):	AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO	

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
		1.5		<u>White</u> , <u>rapid</u> , sand, dry.
		7.5		<u>White</u> , <u>slow</u> , hard sandstone and quartzite chips, dry.
		9.0		<u>Brown</u> , <u>slow</u> , hard sandstone and quartzite chips, dry.
		10.5		<u>White</u> , <u>slow</u> , hard sandstone chips, dry.
		10.65		<u>Brown</u> , <u>slow</u> , sandstone chips, dry.
		12.5		<u>White</u> , <u>slow</u> , hard sandstone chips, dry.
		14.0		<u>Brown</u> , <u>slow</u> , some sandstone chips, dry.
		15.0		<u>White</u> , <u>slow</u> , sandstone chips and sand, dry.

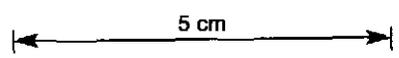


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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 22
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	24-3-81	Date Completed: Logged By: CLA
Rig Type (Mounting): AIRTRACK (Percussion) 75mm		Contractor: ATLAS COPCO

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
		1.5		<u>White, rapid</u> , sand, dry.
		5.8		<u>White, slow</u> , some chips, dry.
5		6.0		<u>Brown, moderate</u> , sand, dry.
		7.0		<u>White, slow</u> , some chips, dry.
		8.5		<u>Brown, moderate</u> , sand, dry.
		9.8		<u>White, slow</u> , some chips, dry.
10	sample	12.0		<u>Brown, moderate</u> , numerous dark brown to black fragments in chips, dry.
		15.0		<u>Brown, moderate</u> , sand, damp when drilled, water in hole next day.
15				



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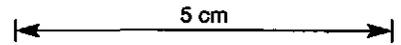
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PXT 250

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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	<h2>HOLE NO 23</h2>
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	
		SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	25-3-81	Date Completed: Logged By: CLA
Rig Type (Mounting): AIRTRACK (Percussion) 75mm		Contractor: ATLAS COPCO

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
5		7.5		White, <u>slow</u> , sandstone chips, dry.
		8.9		<u>Light brown</u> , <u>slow</u> , sandstone chips, dry.
		9.5		White, <u>slow</u> , sandstone chips, dry.
10		12.0		<u>Brown</u> , mostly light but with some dark brown, <u>slow</u> , sandstone chips, dry.
15				



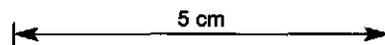
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BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 24
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	26-3-81	Date Completed: Logged By: CLA
Rig Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO		

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
		2.7		<u>White, rapid, sand, dry.</u>
5		5.95		<u>White, moderate, sandstone in cuttings, dry.</u>
		6.0		<u>Brown, moderate.</u>
		8.0		<u>White, slow, hard sandstone in chips, dry.</u>
		9.0		<u>Brown, moderate, sand, dry.</u>
10		10.5		<u>White to light brown, moderate, sand, dry.</u>
		15.0		<u>Brown, light to dark red-brown, moderate, sand, dry.</u>
15				



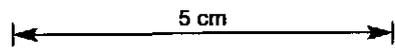
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BOREHOLE LOG SHEET

Client:	KATSER ALUMINUM	HOLE NO 25
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	
		SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Date Started:	26-3-81	Date Completed: _____
		Logged By: RJC
Rig Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO		

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
		2.1		Sand & Top soil
5				<u>light brown, rapid penetration, limited percussion, big chips, dry.</u>
		9.0		No chips, rods in cavity. Rods jammed in cavity (joint, shear or fault zone) Hole terminated (one rod and bit lost)
10				
15				



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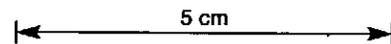


Job No
PXT 250

BOREHOLE LOG SHEET

Client:	KAISER ALUMINUM	HOLE NO 26
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: 2.7m below GL
Date Started:	26-3-81	Date Completed: _____
		Logged By: RJC
Rig Type (Mounting):	AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO	

Progress	Sample or Test	Depth (RL) metres	Strata	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
5				White, rapid to very rapid penetration, sand, dry.
10		10.7		As above, moderate penetration, sand, dry.
		12.0		Hole terminated.
15				



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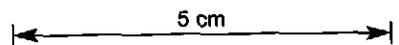


Job No
PXT 250

L.S. 815-000-1901

BOREHOLE LOG SHEET

Client: KAISER ALUMINUM		HOLE NO 27	
Project: SILICO PROSPECT E.L. 43/70			
Location: WYNYARD		SHEET 1 OF 1	
Position: REFER FIGURE		Surface Elevation: GL	
Date Started: 27-3-81		Date Completed:	
		Logged By: RJC	
Rlg Type (Mounting): AIRTRACK (Percussion) 75mm Contractor: ATLAS COPCO			
Progress	Sample or Test	Depth (RL) metres	DESCRIPTION: - (cutting colour, penetration rate, cutting type, moisture)
5			<p><u>White, rapid penetration, sand, dry.</u></p>
		6.0	<p>Lost bit breaking in sand.</p>
10			



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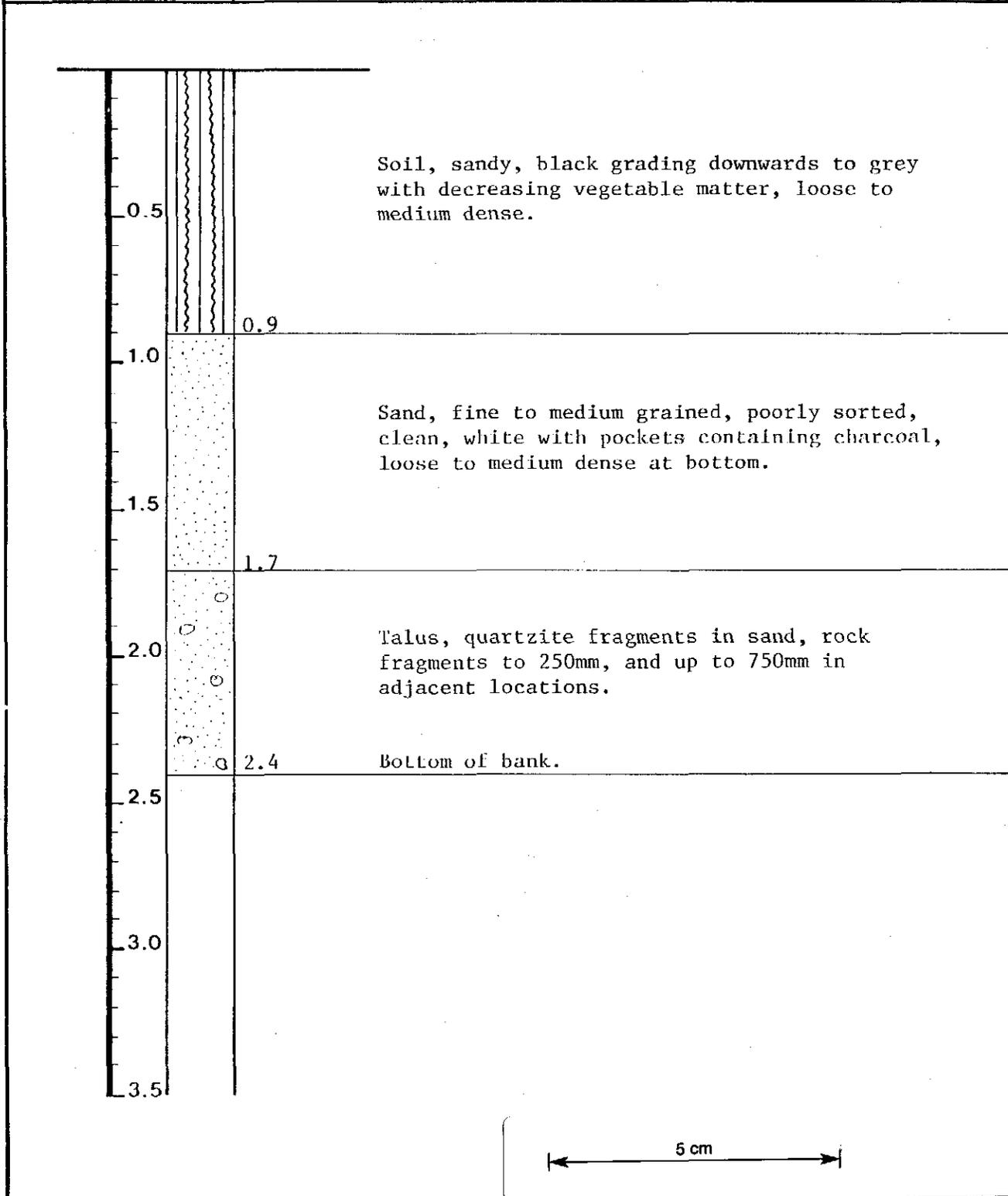


Job No
PXT 250

PROFILE SHEET

Client: KAISER ALUMINUM	HOLE NO IS1/1
Project: SILICA PROSPECT E.L. 43/70	
Location: WYNYARD	SHEET 1 OF 1
Position: REFER FIGURE	Surface Elevation: GL
Method of Exploration: D7	Hole Size: 5x110 x 1.5 (Av. depth)
Date: 12-3-81	Logged by: CA

Sample or Test	Depth metres	Strata	DESCRIPTION (moisture, colour, consistency, structure, SOIL TYPE, origin)
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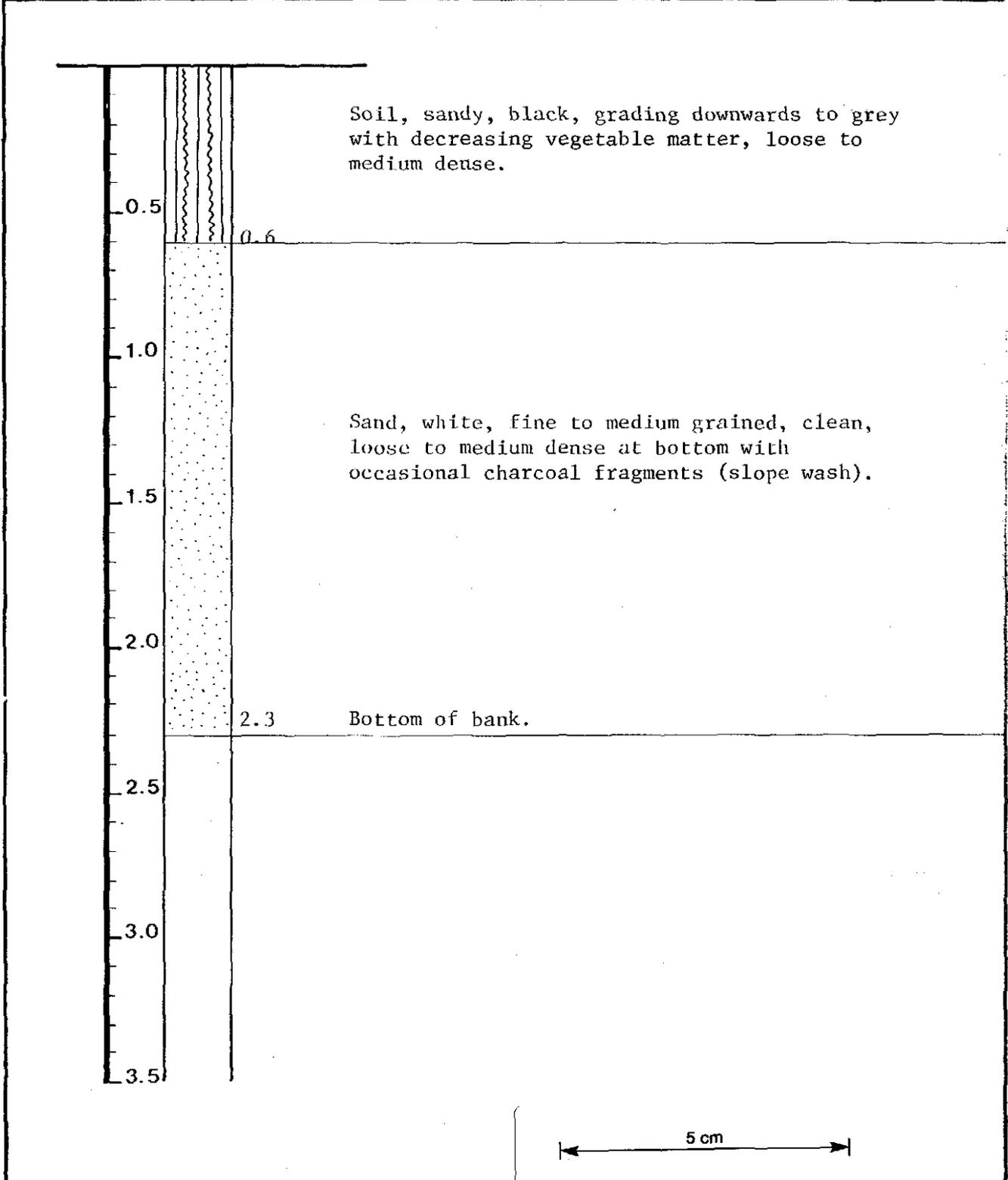
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PROFILE SHEET

Client:	KAISER ALUMINUM	HOLE NO IS1/2
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 1
Position:	REFER FIGURE	Surface Elevation: GL
Method of Exploration:	D7	Hole Size: 5x110x1.5 (Av. depth)
Date:	12-3-81	Logged by: CA

Sample or Test	Depth metres	Strata	DESCRIPTION (moisture, colour, consistency, structure, SOIL TYPE, origin)
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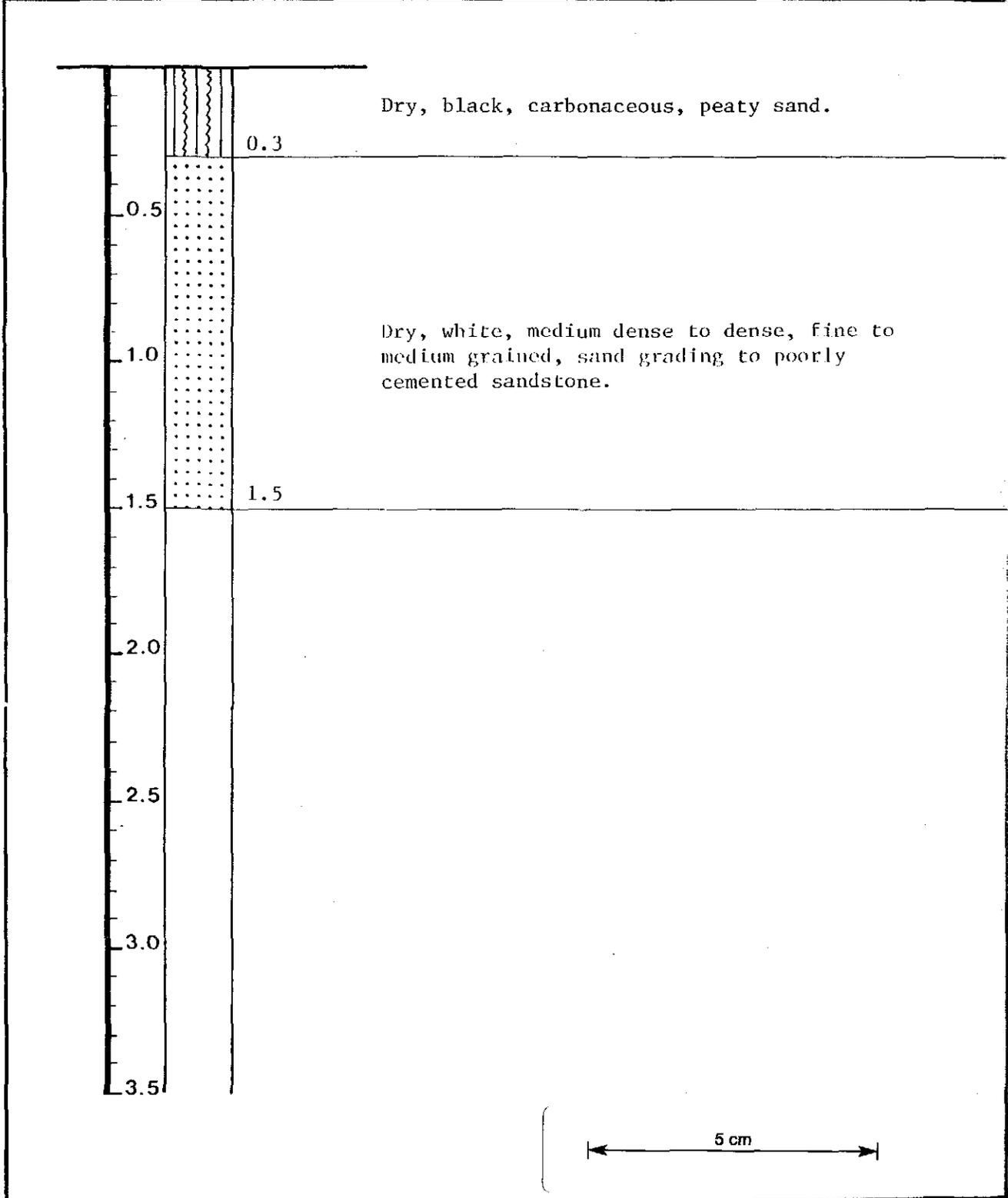


Job No
PXT 250

PROFILE SHEET

Client:	KAISER ALUMINUM	HOLE NO IS3/1
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	
Position:	REFER FIGURE	Surface Elevation: GL
Method of Exploration:	D7	Hole Size: Approx. 6x60x15m
Date:	19-3-81	Logged by: RJC

Sample or Test	Depth metres	Strata	DESCRIPTION (moisture, colour, consistency, structure, SOIL TYPE, origin)
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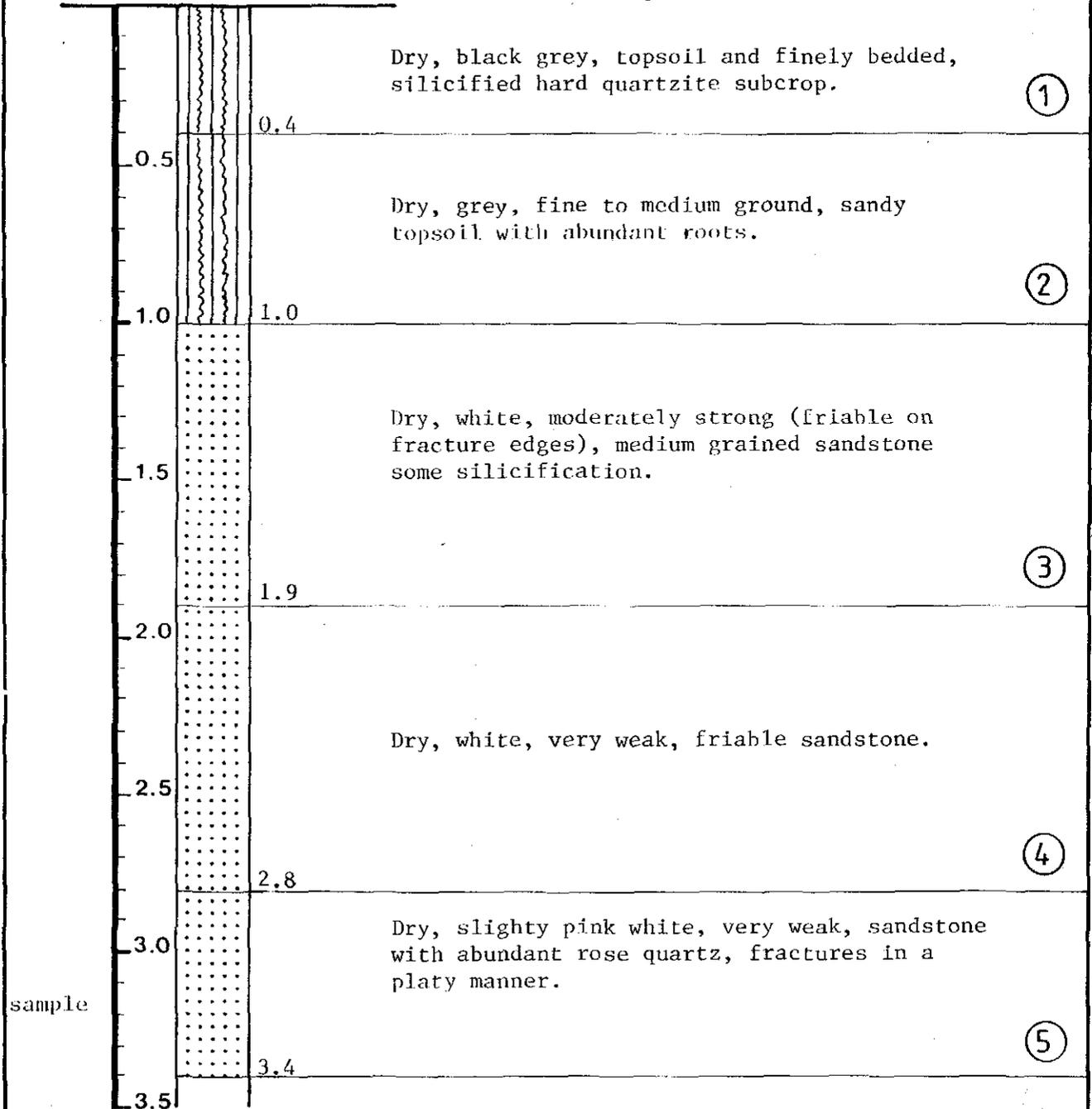
PROFILE SHEET

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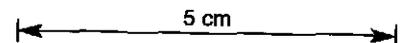
Client:	KAISER ALUMINUM	HOLE NO IS4/E1
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 4
Position:	REFER FIGURE	Surface Elevation: G.L.
Method of Exploration:	BLAST AND RIP (D7)	Hole Size: REFER FIGURE
Date:	3-4-81	Logged by: RJC

Sample or Test	Depth metres	Strata	DESCRIPTION (moisture, colour, consistency, structure, SOIL TYPE, origin)
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Note: Log line at 25° to the horizontal from 0 - 9.6m, horizontal from 9.6m (refer figure).



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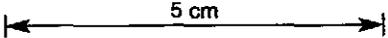


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PROFILE SHEET

Client: KAISER ALUMINUM		HOLE NO IS4/E1	
Project: SILICA PROSPECT E.L. 43/70			
Location: WYNYARD			
Position: REFER FIGURE		Surface Elevation: GL	
Method of Exploration: BLAST AND RIP (D7)		Hole Size: REFER FIGURE	
Date: 3-4-81		Logged by: RJC	
Sample or Test	Depth metres	Strata	DESCRIPTION (moisture, colour, consistency, structure, SOIL TYPE, origin)
	4.0	4.2	Dry, white, moderately strong, thinly to medium bedding, clayey joint faces, silicified sandstone. (6)
Bulk sample No. 17118	5.0		Dry, white, moderately strong to strong fine grained, quartzite, with some clayey bedding, thin to medium bedding.
sample	6.0	6.2	6.2 abundant rose quartz bedding planes. (7)
Bulk sample No. 17162	6.5		(silicification increases with depth from white moderately silicified quartzite in the costean walls to a very strong grey glassy highly silicified quartzite in the costean floor) Bulk Sample No. 17117
	7.0		



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Consulting Geotechnical Engineers

3 Eden Street, Crows Nest 2065

Telephone: 929 0122

LONGWORTH & MCKENZIE PTY. LIMITED



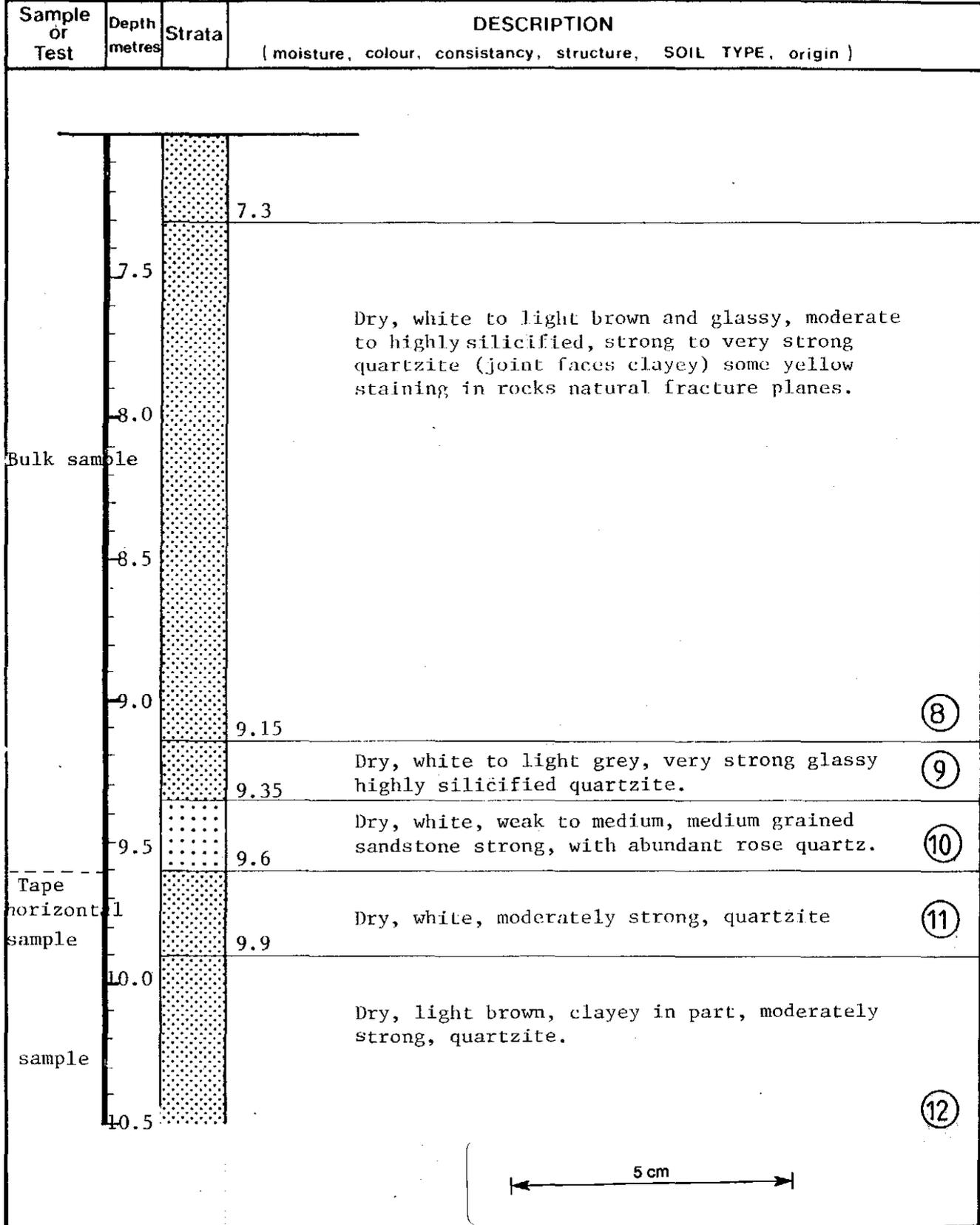
Job No

PXT 250

PROFILE SHEET

972077

Client:	KAISER ALUMINUM	HOLE NO IS4/E1
Project:	SILICA PROSPECT E.L. 43/70	SHEET 3 OF 4
Location:	WYNYARD	
Position:	REFER FIGURE	Surface Elevation: GL
Method of Exploration:	BLAST AND RIP (D7)	Hole Size: REFER FIGURE
Date:	3-4-81	Logged by: RJC



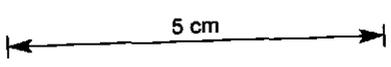
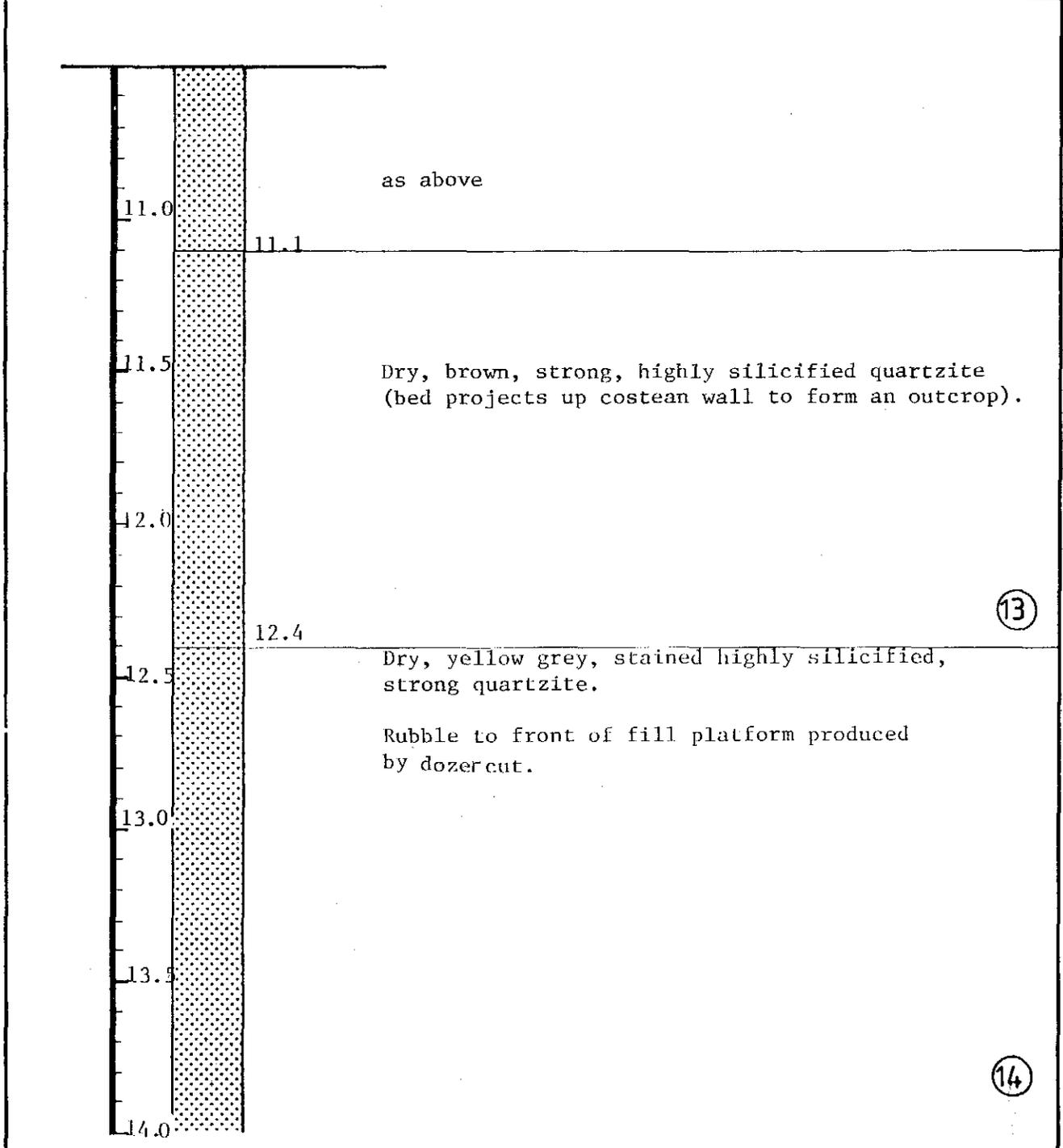
L & M · P · S · Jan. 1981

PROFILE SHEET

Client:	KAISER ALUMINUM	HOLE NO IS4/E1
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	
Position:	REFER FIGURE	Surface Elevation: GL
Method of Exploration:	BLAST AND RIP (D7)	Hole Size: REFER FIGURE
Date:	3-4-81	Logged by: RJC

SHEET 4 OF 4

Sample or Test	Depth metres	Strata	DESCRIPTION (moisture, colour, consistency, structure, SOIL TYPE, origin)
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Note: For locations of beds (1) - (14) refer figure.

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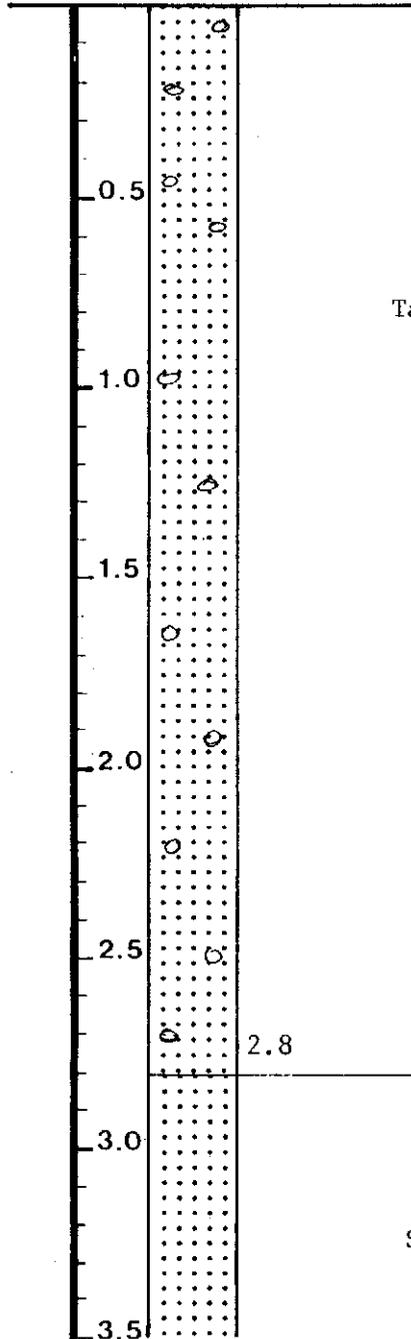
Consulting Geotechnical Engineers 3 Eden Street, Crows Nest 2065 Telephone: 929 0122 LONGWORTH & MCKENZIE PTY. LIMITED		Job No PXT 250
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PROFILE SHEET

Client:	KAISER ALUMINUM	HOLE NO IS4/W4
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 1 OF 4
Position:	REFER FIGURE	Surface Elevation: GL
Method of Exploration:	BLAST AND RIP	Hole Size: REFER FIGURE
Date:	3-4-81	Logged by: RJC

Sample or Test	Depth metres	Strata	DESCRIPTION (moisture, colour, consistency, structure, SOIL TYPE, origin)
----------------	--------------	--------	--

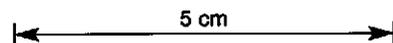
Note: Log line at 25° to the horizontal from 0-9.6 horizontal from 9.6m (refer figure)



Talus, sandstone and medium grained sand.

①

See following page.



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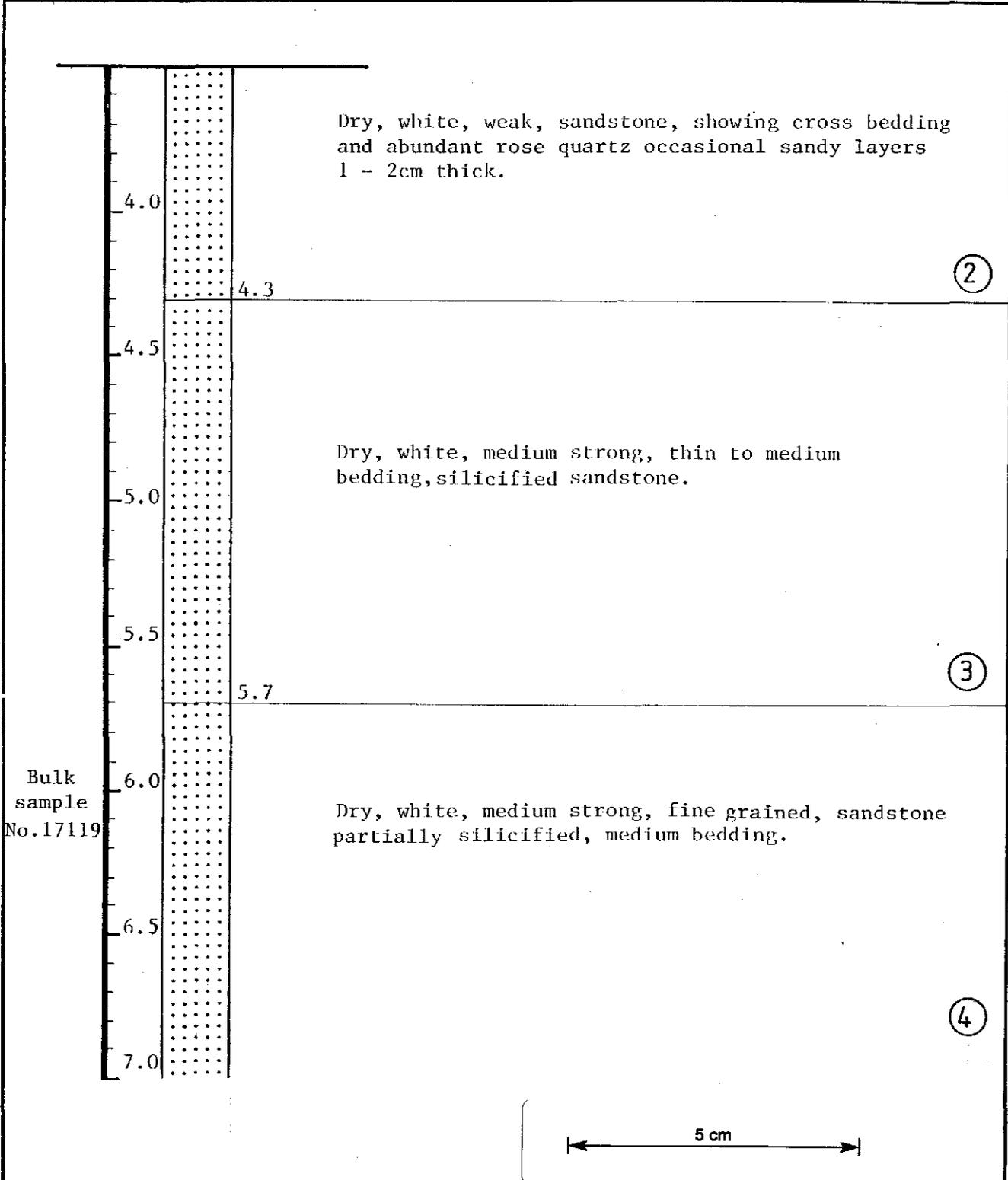


PROFILE SHEET

Client:	KAISER ALUMINUM	HOLE NO IS4/W4
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	
Position:	REFER FIGURE	Surface Elevation: GL
Method of Exploration:	BLAST AND RIP	Hole Size: REFER FIGURE
Date:	3-4-81	Logged by: RJC

SHEET 2 OF 4

Sample or Test	Depth metres	Strata	DESCRIPTION (moisture, colour, consistency, structure, SOIL TYPE, origin)
----------------	--------------	--------	--

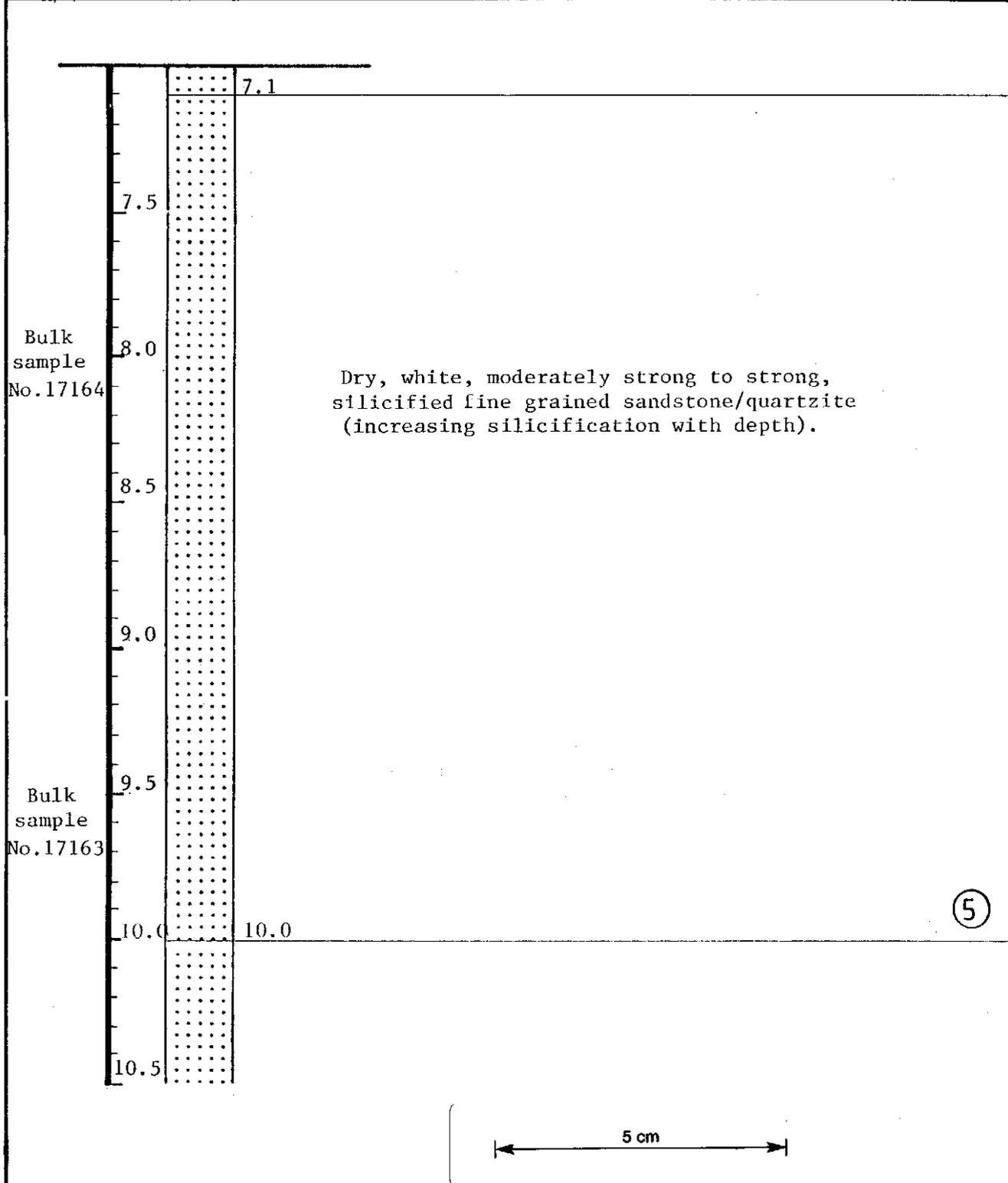


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PROFILE SHEET

Client:	KAISER ALUMINUM	HOLE NO IS4/W4
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 3 OF 4
Position:	REFER FIGURE	Surface Elevation: GL
Method of Exploration:	BLAST AND RIP	Hole Size: REFER FIGURE
Date:	3-4-81	Logged by: RJC

Sample or Test	Depth metres	Strata	DESCRIPTION (moisture, colour, consistency, structure, SOIL TYPE, origin)
----------------	--------------	--------	--



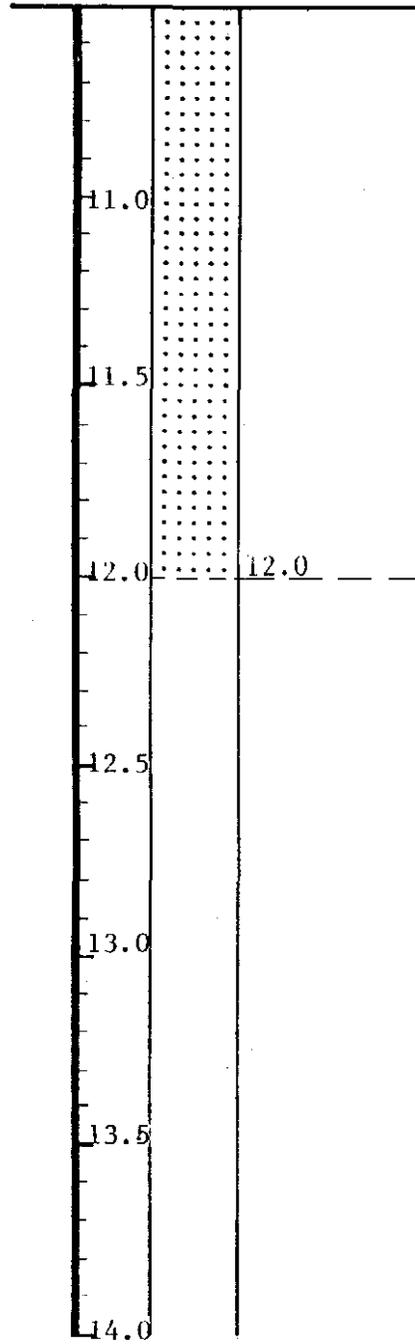
L & M - P S : Jan. 1981

PROFILE SHEET

972082

Client:	KAISER ALUMINUM	HOLE NO 1S4/W4
Project:	SILICA PROSPECT E.L. 43/70	
Location:	WYNYARD	SHEET 4 OF 4
Position:	REFER FIGURE	Surface Elevation: GL
Method of Exploration:	BLAST AND RIP	Hole Size: REFER FIGURE
Date:	3-4-81	Logged by: RJC

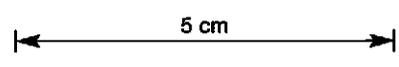
Sample or Test	Depth metres	Strata	DESCRIPTION (moisture, colour, consistency, structure, SOIL TYPE, origin)
----------------	--------------	--------	--



Dry, white, weak, medium grained sandstone, some silicification, abundant rose quartz and thin to moderately bedded, frequent fracture and mica sand beds to 12m where fill platform commences.

⑥

Note: For location of beds ① - ⑥ refer figure.



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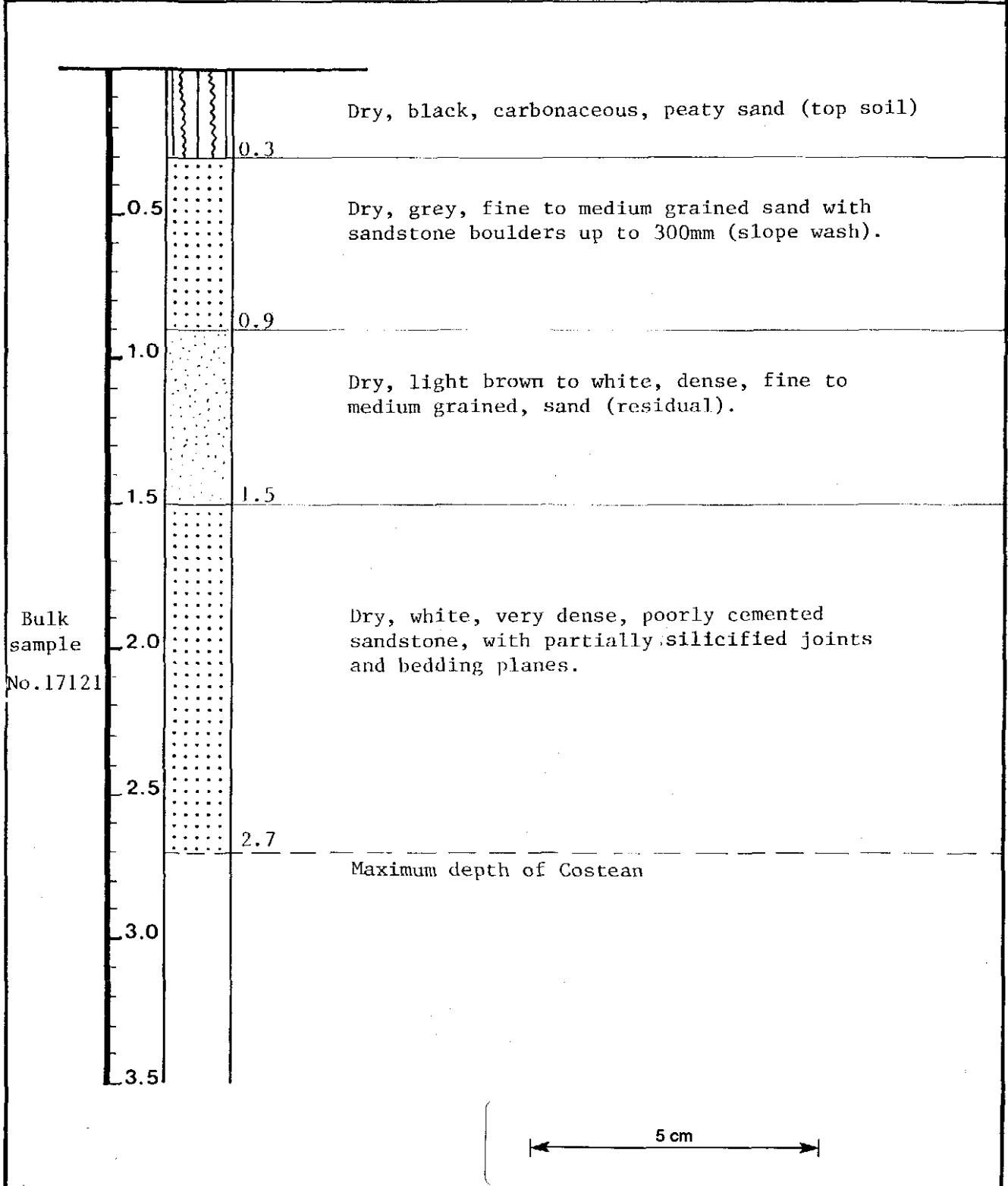
PROFILE SHEET

972083

Client: KAISER ALUMINUM	HOLE NO IS5/1
Project: SILICA PROSPECT E.I. 43/70	
Location: WYNYARD	
Position: REFER FIGURE	Surface Elevation: GL
Method of Exploration: D7	Hole Size: Approx. 6 x 80 x 2.7m
Date: 25-3-81	Logged by: R.J.C.

SHEET 1 OF 1

Sample or Test	Depth metres	Strata	DESCRIPTION (moisture, colour, consistency, structure, SOIL TYPE, origin)
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L & M - P S : Jan. 1981

Consulting Geotechnical Engineers 3 Eden Street, Crows Nest 2065 Telephone: 929 0122 LONGWORTH & MCKENZIE PTY. LIMITED		Job No PXT 250
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APPENDIX B

SAMPLE TESTING AND ANALYSES

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Fine grading on Silica Flour (Nye Deposit)	95

SAMPLE PROGRAMME

Sample	Location	Material	Testing
17116	I.S.5	Sand	Chem. and particle size grading.
17117	IS4/E1 6.2m in floor	Highly Silicified Sandstone/Quartzite	Chem. & T.E.M.Co. Physical analysis
17118	IS4/E1 4.7M	Sandstone	as above
17119	IS4/W1 6.0m	Sandstone	Chem.& as received bulk sieve analysis.
17120	Quartzite Peak (B)	Silicified sandstone	Chem. & T.E.M.Co. physical analysis.
17121	IS4/E1 8.3m	Sandstone	as above
17122	Quartzite Peak (C)	Schist-sandstone	chem.
17123	Quartzite Peak (A)	Schistose quartzite	chem.
17128	Mt. Sunshine	Quartzite	Chem. & T.E.M.Co. physical analysis.
-	Percussion Hole 22	Brown quartzite	chem.
-	IS4	Assorted hand samples 1 - 5	chem.
17165	Nye Deposit	Silica floor	fine partical size analysis



813 Dowling Street, Waterloo, N.S.W. 2017
Postal Address: Box 1, P.O. Waterloo, 2017
Telephone: 698 6611 x 260

TEST REPORT

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

No.: 002553

Date: 9th April, 1981

ATTENTION: MR. R. J. CARR

Client O/No.:

Analysis of Six Quartzite Samples

	Rod 4 Hole 22	Cost 4 No. 1	Cost 4 No. 2	Cost 4 No. 3	Cost 4 No. 4	Cost 4 No. 5
Fe ₂ O ₃	0.11	0.023	0.18	0.085	0.037	0.058
Al ₂ O ₃	2.3	0.08	1.0	0.86	0.30	0.47
TiO ₂	0.090	0.082	0.043	0.048	0.026	0.054
Cr ₂ O ₃	<0.001	<0.001	0.001	<0.001	0.003	<0.001
CaO	0.01	0.01	0.01	0.01	0.01	0.01
MgO	0.07	<0.01	0.03	0.03	0.01	0.02
Na ₂ O	0.01	0.01	0.01	0.01	0.01	0.01
K ₂ O	0.59	0.02	0.30	0.25	0.09	0.15
L.O.I.	0.88	0.11	0.20	0.15	0.13	0.16
SiO ₂ (bal.)	96.0	99.6	98.2	98.5	99.3	99.0

Spectrographic Scan (Qualitative) of Three Quartzite Samples

	Hole 22	No. 1	No. 2	
ZrO ₂	0.02	0.01	-	} in addition to the
CuO	0.01	0.01	0.01	
PbO	0.003	0.003	-	
NiO	trace	trace	0.01	} above named
MnO	-	-	trace	
ZnO	-	-	-	} elements
SnO	-	-	-	

All figures are in percentage state

form no. T 56A

293/30

Approved by D. MacKENZIE
Manager
Analytical & Testing

RECEIVED
13 APR 1981



ACI Technical Centre Pty. Ltd.

813 Dowling Street, Waterloo, N.S.W. 2017
Postal Address: Box 1, P.O. Waterloo, 2017
Telephone: 698 6611 x.260.....

TEST REPORT

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

No.: 002563

Date: 28th April, 1981

Attention: Mr. R. Carr

Client O/No.:

XRF Analysis of 9 Quartzite Samples

Preliminaries

Samples were screened, washed, re-screened, jaw crushed, magnetically treated and finally ground to minus 300 mesh in a Siebtechnik gyratory mill, as detailed in letter of quotation, dated 10th November, 1980.

Results

	<u>17116</u>	<u>17117</u>	<u>17118</u>	<u>17119</u>
Fe ₂ O ₃	0.013	0.068	0.017	0.019
Al ₂ O ₃	0.04	0.68	0.05	0.05
TiO ₂	0.12	0.060	0.087	0.068
Cr ₂ O ₃	<0.001	<0.001	<0.001	<0.001
CaO	<0.01	<0.01	<0.01	<0.01
MgO	<0.01	0.02	<0.01	<0.01
Na ₂ O	<0.01	<0.01	<0.01	<0.01
K ₂ O	0.01	0.20	0.01	0.01
LOI	0.12	0.12	0.05	0.05
SiO ₂ (balance)	99.6	98.8	99.7	99.8

form no. T 56A

293/45

Approved by D. McKENZIE
Manager
Analytical & Testing

	<u>17120</u>	<u>17121</u>	<u>17122</u>	<u>17123</u>	<u>17128</u>
Fe ₂ O ₃	0.018	0.034	0.41	0.21	0.035
Al ₂ O ₃	0.16	0.15	4.1	4.2	0.83
TiO ₂	0.029	0.034	0.16	0.11	0.047
Cr ₂ O ₃	<0.001	<0.001	<0.001	0.002	0.001
CaO	<0.01	0.03	0.01	0.01	0.02
MgO	0.01	0.02	0.50	0.48	0.02
Na ₂ O	<0.01	<0.01	0.01	0.02	0.01
K ₂ O	0.04	0.04	1.3	1.0	0.23
LOI	0.07	0.12	0.78	0.68	0.15
SiO ₂ (balance)	99.6	99.5	92.7	93.2	98.6

All figures are in percent state.

Thermal Stability Tests

Four samples (17118, 17119, 17120, 17121) in the size range - 1.0 inches to +3/4 inches were subjected to 1300°C for 1 hour, then allowed to air cool.

Samples re-packaged and returned to Longworth and MacKenzie.

JM

TASMANIAN ELECTRO METALLURGICAL CO. PTY. LTD.

BELL BAY - TASMANIA

FRIABILITY TEST FOR QUARTZITE

SAMPLE 17117

23kg of clean washed and dried quartzite should be used for this test.

Carry out a sieve test recording the weights and calculating the percentage of material at: TOTAL MASS = 23,440

MESH SIZE	MASS	TALLY	%ACCUM
+ 75mm	23,290	23,290	99.4
+ 53mm			
+ 37mm	150	23,440	100
+ 25mm			
+ 13.7mm			
- 13.7mm			

Take 23kg of the quartzite larger than 25mm and tumble it for 200 revolutions in the J.I.S. Friability drum. Ensure that the drum is thoroughly clean prior to placing the sample in the drum to avoid contamination for chemical analysis.

Collect the tumbled quartzite and sieve it, recording the mass at:

MESH SIZE	MASS	(B+C)
+ 25mm	21,050	
+ 6.7mm	630	
- 6.7mm	1,760	
TOTAL	23,440	

Calculate the Friability indexes S & F.

$$S = \frac{B}{A} \times 100 = \frac{21,050}{23,440} \times 100 = 90 > 50 \text{ OK}$$

$$F = \frac{A - (B+C)}{A} \times 100 = \frac{23,440 - (21,050 + 1,760)}{23,440} \times 100 = 8 < 20 \text{ OK}$$

- A = Total mass + 25mm before tumbling.
- B = Mass + 25mm after tumbling.
- C = Mass + 6.7mm after tumbling.
- S = Tumble index.
- F = Abrasion index.

Recombine all the tumbled and untumbled quartzite including fines. Then crush and prepare the sample for chemical analysis.

TASMANIAN ELECTRO METALLURGICAL CO. PTY. LTD.

BELL BAY - TASMANIA

FRIABILITY TEST FOR QUARTZITE

SAMPLE 17118

23kg of clean washed and dried quartzite should be used for this test.

Carry out a sieve test recording the weights and calculating the percentage of material at: **TOTAL MASS 23130**

MESH SIZE	MASS	TALLY	%ACCUM
+ 75mm	23000		
+ 53mm			
+ 37mm	100		
+ 25mm	30	-----	
+ 13.7mm			
- 13.7mm			

Take 23kg of the quartzite larger than 25mm and tumble it for 200 revolutions in the J.L.S. Friability drum. Ensure that the drum is thoroughly clean prior to placing the sample in the drum to avoid contamination for chemical analysis.

Collect the tumbled quartzite and sieve it, recording the mass at:

MESH SIZE	MASS	(B+C)
+ 25mm	10830	
+ 6.7mm	1530	-----
- 6.7mm	10770	
TOTAL	-----	

Calculate the friability indexes S & F.

$$S = \frac{B}{A} \times 100 = \frac{47}{50} \times 100 = 94 \quad \text{No good}$$

$$F = \frac{A - (B+C)}{A} \times 100 = \frac{47}{20} \times 100 = 235 \quad \text{No good}$$

- A = Total mass + 25mm before tumbling.
- B = Mass + 25mm after tumbling.
- C = Mass + 6.7mm after tumbling.
- S = Tumble index.
- F = Abrasion index.

Recombine all the tumbled and untumbled quartzite including fines. Then crush and prepare the sample for chemical analysis.

TASMANIAN ELECTRO METALLURGICAL CO. PTY. LTD.

BELL BAY - TASMANIA

FRIABILITY TEST FOR QUARTZITE

SAMPLE 17120

23kg of clean washed and dried quartzite should be used for this test.

Carry out a sieve test recording the weights and calculating the percentage of material at: TOTAL MASS 23,300

MESH SIZE	MASS	TALLY	ZACCUM
+ 75mm	23150		
+ 53mm	150		
+ 37mm			
+ 25mm		-----	
+ 13.7mm			
- 13.7mm			

Take 23kg of the quartzite larger than 25mm and tumble it for 200 revolutions in the J.I.S. Friability drum. Ensure that the drum is thoroughly clean prior to placing the sample in the drum to avoid contamination for chemical analysis.

Collect the tumbled quartzite and sieve it, recording the mass at:

MESH SIZE	MASS	(B+C)
+ 25mm	17100	
+ 6.7mm	1770	-----
- 6.7mm	4430	
TOTAL	-----	

Calculate the Friability indexes S & F.

$$S = \frac{B}{A} \times 100 = \frac{73}{17100} \times 100 = 0.43 \rightarrow 50 \text{ OK}$$

$$F = \frac{A - (B+C)}{A} \times 100 = \frac{17100 - (1770 + 4430)}{17100} \times 100 = 73.1 \rightarrow 20 \text{ OK just}$$

- A = Total mass + 25mm before tumbling.
- B = Mass + 25mm after tumbling.
- C = Mass + 6.7mm after tumbling.
- S = Tumble index.
- F = Abrasion index.

Recombine all the tumbled and untumbled quartzite including fines. Then crush and prepare the sample for chemical analysis.

TASMANIAN ELECTRO METALLURGICAL CO., PTY., LTD.

BELL BAY - TASMANIA

FRIABILITY TEST FOR QUARTZITE

SAMPLE 17121

23kg of clean washed and dried quartzite should be used for this test.

Carry out a sieve test recording the weights and calculating the percentage of material at: TOTAL MASS = 23400

MESH SIZE	MASS	TALLY	%ACCUM
+ 75mm	23190		
+ 53mm	210		
+ 37mm			
+ 25mm		-----	
+ 13.7mm			
- 13.7mm			

Take 23kg of the quartzite larger than 25mm and tumble it for 200 revolutions in the J.I.S. Friability drum. Ensure that the drum is thoroughly clean prior to placing the sample in the drum to avoid contamination for chemical analysis.

Collect the tumbled quartzite and sieve it, recording the mass at:

MESH SIZE	MASS	(B+C)
+ 25mm	18,610	
+ 6.7mm	1,460	-----
- 6.7mm	3,330	
TOTAL	-----	

Calculate the Friability indexes S & F.

$$S = \frac{B}{A} \times 100 = \frac{80}{100} > 50$$

$$F = \frac{A - (B+C)}{A} \times 100 = \frac{1}{100} < 20$$

- A = Total mass + 25mm before tumbling.
- B = Mass + 25mm after tumbling.
- C = Mass + 6.7mm after tumbling.
- S = Tumble index.
- F = Abrasion index.

Recombine all the tumbled and untumbled quartzite including fines. Then crush and prepare the sample for chemical analysis.

SAMPLE NO. 17117

DECREPITATION TEST

	Sieve sizes for Stack (after preheating)	Fractions Cumulative (after tumbling)
mm	%	%
19.0	92.1	85.4
13.0	100.0	98.0
9.5	"	98.4
6.7	"	98.4
4.75	"	98.7
3.35	"	98.8
2.36	"	100.0

Thermal stability + 19mm after heating - 92 > 85 OK
Mechanical Strength + 5mm after
heating and tumbling - 98 > 90 OK

SAMPLE NO. 17118

DECREPITATION TEST

mm	Sieve sizes for Stack (after preheating) %	Fractions Cumulative (after tumbling) %
19.0	99.07	57.44
13.0	99.07	69.61
9.5	99.07	73.72
6.7	99.07	74.54
4.75	99.07	75.17
3.35	99.19	75.87
2.36	100.00	100.00

Thermal Stability + 19mm after heating - 99 > 85 OK
Mechanical Strength + 5mm after heating and tumbling - 75.17 ✗ 9 OK

SAMPLE NO. 17120

DECREPITATION TEST

Sieve sizes for Stack (after preheating)		Fractions Cumulative (after tumbling)
mm	%	%
19.0	99.5	73.1
13.0	99.5	94.6
9.5	"	94.6
6.7	"	94.6
4.75	"	95.5
3.35	"	95.6
2.36	"	100.0

Thermal Stability + 19mm after heating - 99.5 > 85 OK
Mechanical Strength + 5mm after heating and tumbling - 99.5 > 90 OK

SAMPLE NO. 17121

DECREPITATION TEST

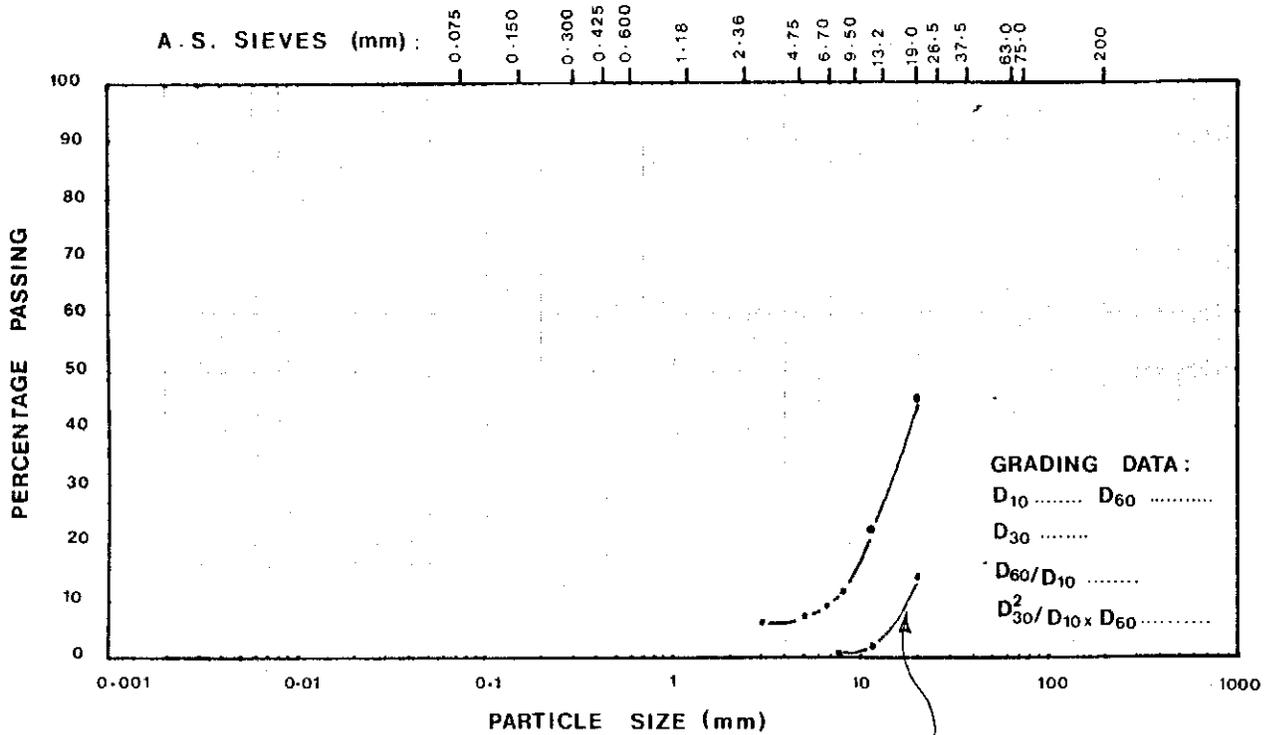
mm	Sieve sizes for Stack (after preheating) %	Fractions Cumulative (after tumbling) %
19.0	100	61.5
13.0	"	97.1
9.5	"	98.6
6.7	"	98.9
4.75	"	98.9
3.35	"	99.1
2.36	"	100.00

Thermal Stability + 19mm after heating - 100 > 85 OK

Mechanical Strength = 5mm after heating
and tumbling - 98.9 > 90 OK

SOIL CLASSIFICATION

TRIAL HOLE
 DEPTH
 SAMPLE No. ... 17118



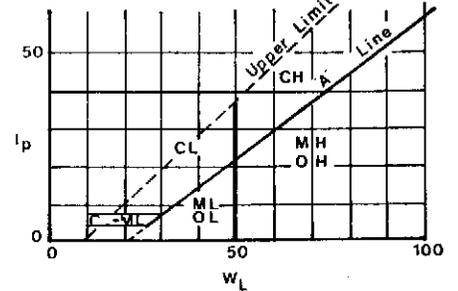
NOTE: SIEVE BEFORE REVOLUTIONS IN L & M TUMBLER.

CLAY	SILT			SAND			GRAVEL			COBBLE	BOULDER
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse		

WET SIEVE PRETREATMENT MASS LOSS SPECIFIC GRAVITY
 DRY SIEVE DISPERSION AGENT MEASURED ASSUMED

INDEX PROPERTIES :

Liquid Limit	%	Plasticity Index	%
Plastic Limit	%		
Linear Shrinkage	%		

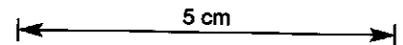


SAMPLE HISTORY PREPARATION METHOD

Natural Wet
 Air Dried Dry
 Oven Dried

LIQUID LIMIT TEST:
 Standard One Point

UNIFIED SOILS CLASSIFICATION :



BRIEF SAMPLE DESCRIPTION * MATERIAL PREHEATED TO 1300°C

* Described in terms of : moisture, colour, soil type

TESTED: D.B.
 DATE 25.4.81
 CHECKED:

MATERIALS LABORATORY
 3 EDEN STREET., CROWS NEST, 2065 TELEPHONE: 929 0122
 LONGWORTH & MCKENZIE PTY. LIMITED



CERTIFIED BY:



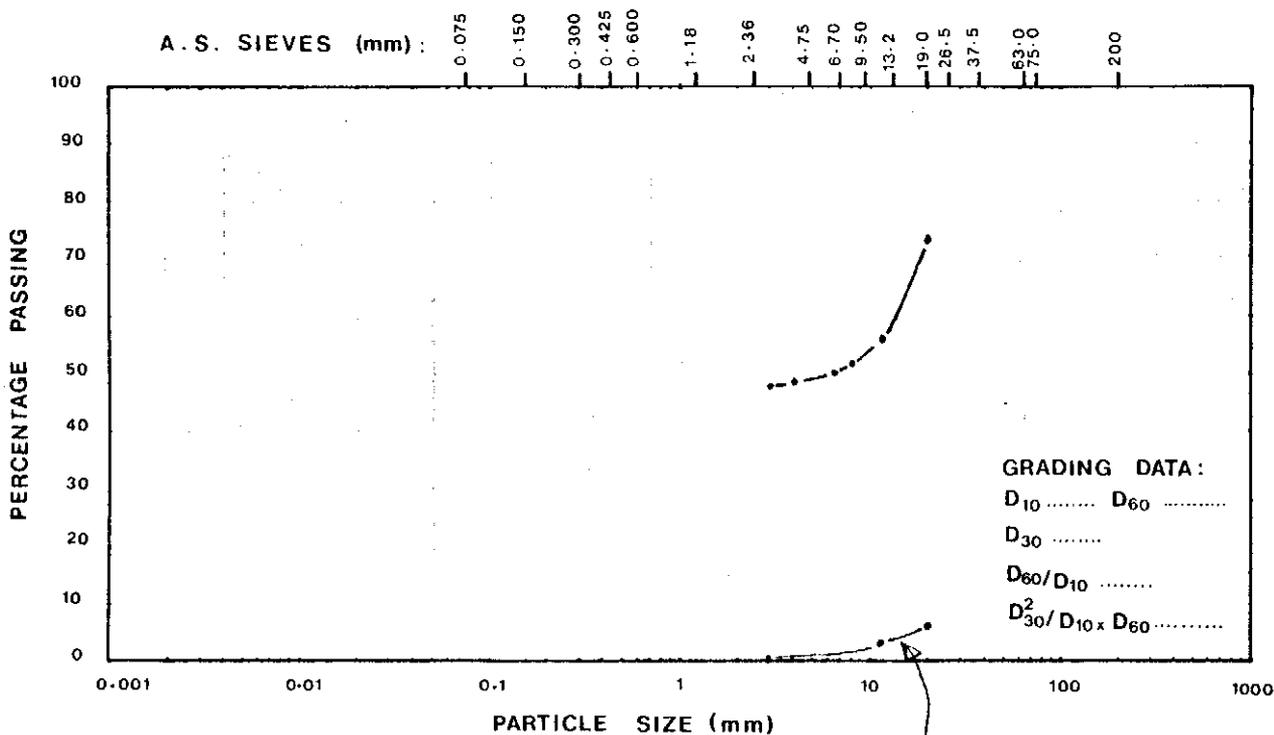
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JOB No. DWG No.
 PXT-250

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SOIL CLASSIFICATION

TRIAL HOLE
 DEPTH
 SAMPLE No. ...17112.....



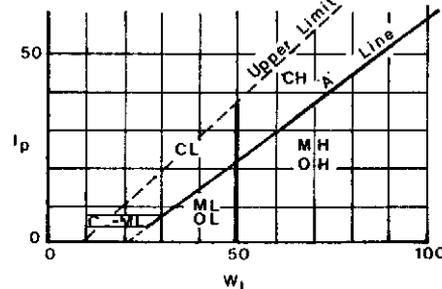
NOTE: SIEVE BEFORE REVOLUTIONS IN 4M TUMBLER.

CLAY	SILT			SAND			GRAVEL			COBBLE	BOULDER
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse		

WET SIEVE PRETREATMENT MASS LOSS SPECIFIC GRAVITY
 DRY SIEVE DISPERSION AGENT MEASURED ASSUMED

INDEX PROPERTIES :

Liquid Limit %	Plasticity Index %
Plastic Limit %	
Linear Shrinkage %	



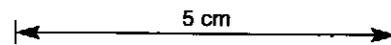
SAMPLE HISTORY PREPARATION METHOD

Natural Wet LIQUID LIMIT TEST:

Air Dried Dry Standard One Point

Oven Dried

UNIFIED SOILS CLASSIFICATION :



BRIEF SAMPLE DESCRIPTION * MATERIAL PREHEATED TO 130.0°C

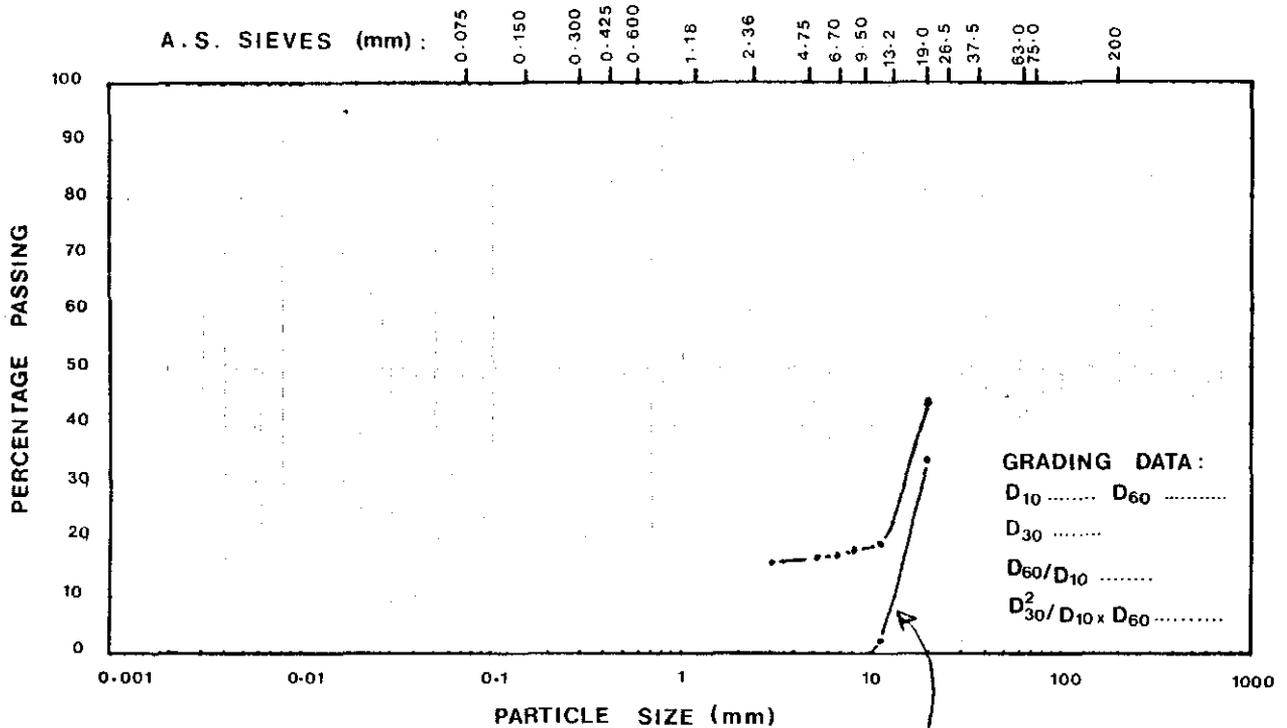
* Described in terms of : moisture, colour, soil type

TESTED: DB	MATERIALS LABORATORY		
DATE 25.4.81	3 EDEN STREET., CROWS NEST, 2065 TELEPHONE: 929 0122		
CHECKED:	LONGWORTH & MCKENZIE PTY. LIMITED		
CERTIFIED BY:		THIS LABORATORY IS REGISTERED BY THE NATIONAL ASSOCIATION OF TESTING AUTHORITIES AUSTRALIA. THE TESTS REPORTED HEREIN HAVE BEEN PERFORMED IN ACCORDANCE WITH ITS TERMS OF REGISTRATION.	JOB No.
			DWG No.
			PXT-250

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SOIL CLASSIFICATION

TRIAL HOLE
 DEPTH
 SAMPLE No. ... 17120



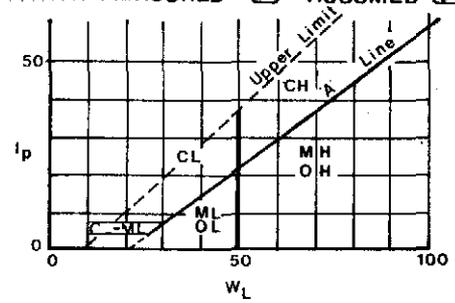
NOTE: SIEVE BEFORE REVOLUTIONS IN 1M TUMBLER.

CLAY	SILT			SAND			GRAVEL			COBBLE	BOULDER
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse		

WET SIEVE PRETREATMENT MASS LOSS SPECIFIC GRAVITY 2.65
 DRY SIEVE DISPERSION AGENT MEASURED ASSUMED

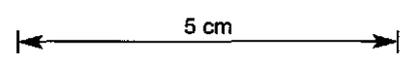
INDEX PROPERTIES :

Liquid Limit	%	Plasticity Index	%
Plastic Limit	%		
Linear Shrinkage	%		



SAMPLE HISTORY **PREPARATION METHOD**
 Natural Wet **LIQUID LIMIT TEST:**
 Air Dried Dry Standard One Point
 Oven Dried

UNIFIED SOILS CLASSIFICATION :



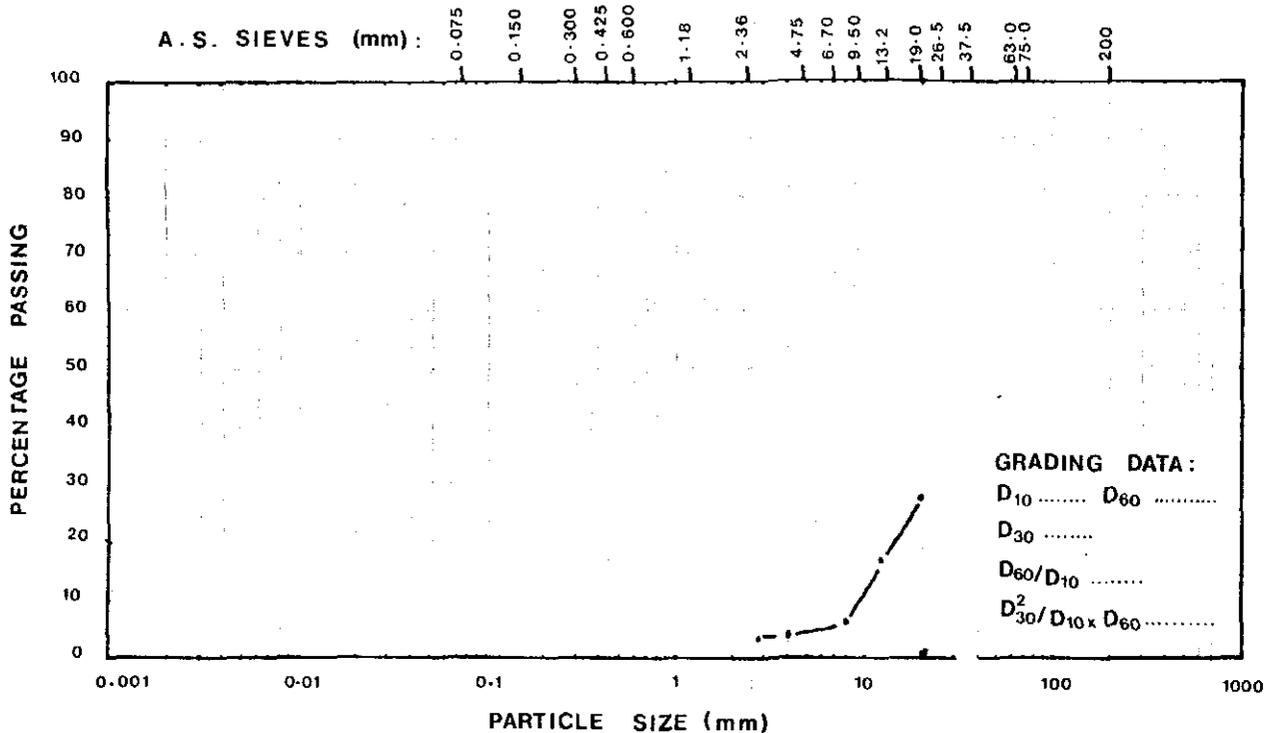
BRIEF SAMPLE DESCRIPTION * MATERIAL PREHEATED TO 1300°C

* Described in terms of : moisture, colour, soil type

TESTED: D.B	MATERIALS LABORATORY 3 EDEN STREET., CROWS NEST, 2065 TELEPHONE: 929 0122 LONGWORTH & MCKENZIE PTY. LIMITED	
DATE 25.4.81		
CHECKED:		
CERTIFIED BY:	 THIS LABORATORY IS REGISTERED BY THE NATIONAL ASSOCIATION OF TESTING AUTHORITIES AUSTRALIA. THE TESTS REPORTED HEREIN HAVE BEEN PERFORMED IN ACCORDANCE WITH ITS TERMS OF REGISTRATION.	JOB No. DWG No. PXT-250

SOIL CLASSIFICATION

TRIAL HOLE
 DEPTH
 SAMPLE No. 17/A1

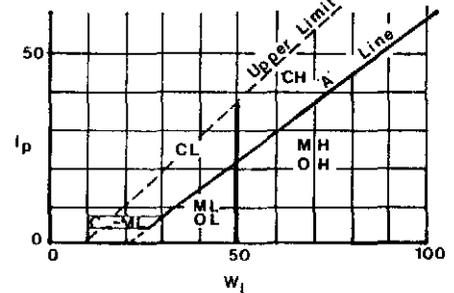


CLAY	SILT			SAND			GRAVEL			COBBLE	BOULDER
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse		

WET SIEVE PRETREATMENT MASS LOSS SPECIFIC GRAVITY 2.65
 DRY SIEVE DISPERSION AGENT MEASURED ASSUMED

INDEX PROPERTIES :

Liquid Limit	%	Plasticity Index	%
Plastic Limit	%		
Linear Shrinkage	%		

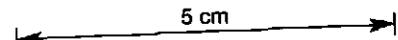


SAMPLE HISTORY PREPARATION METHOD

Natural Wet
 Air Dried Dry
 Oven Dried

LIQUID LIMIT TEST:
 Standard One Point

UNIFIED SOILS CLASSIFICATION :



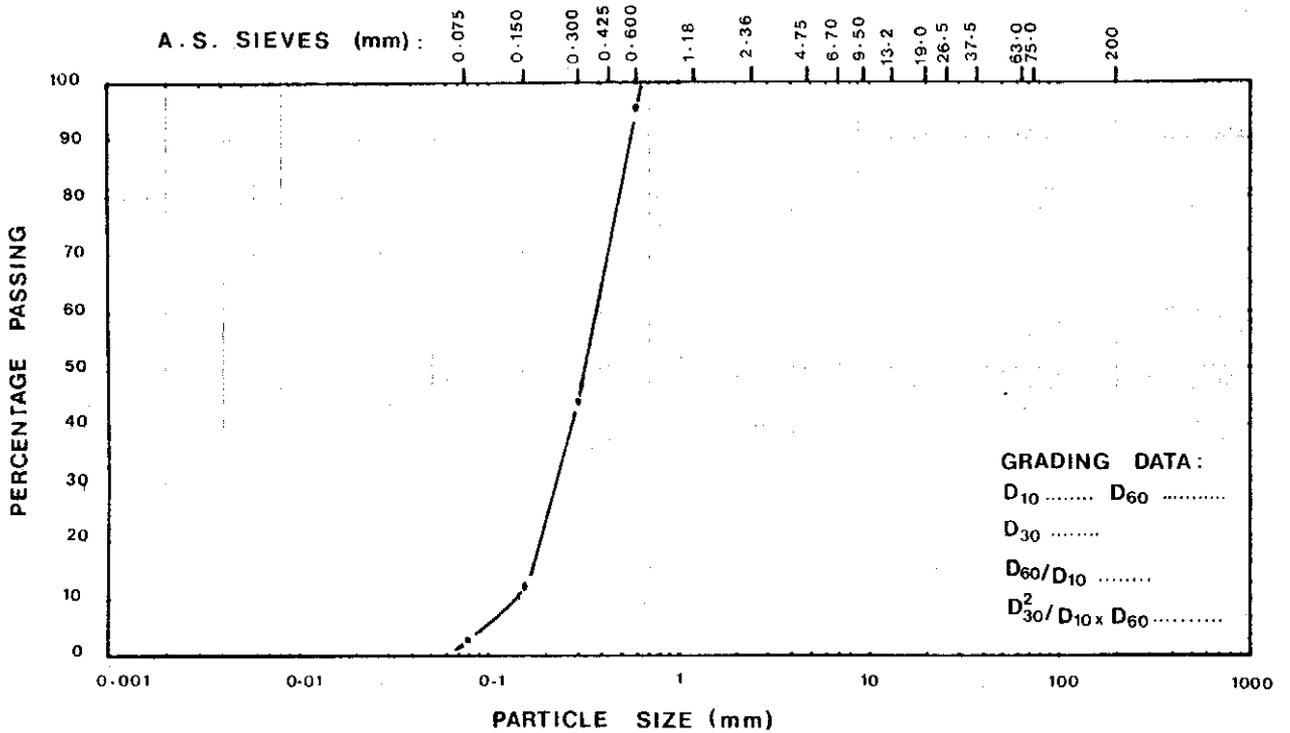
BRIEF SAMPLE DESCRIPTION * NOTE: Sample preheated to 1300°C
sample did not break down after heating.
 * Described in terms of : moisture, colour, soil type

TESTED: <u>D-B</u>	MATERIALS LABORATORY		
DATE <u>25.4.81</u>	3 EDEN STREET., CROWS NEST, 2065 TELEPHONE: 929 0122		
CHECKED:	LONGWORTH & MCKENZIE PTY. LIMITED		
CERTIFIED BY:		THIS LABORATORY IS REGISTERED BY THE NATIONAL ASSOCIATION OF TESTING AUTHORITIES AUSTRALIA THE TESTS REPORTED HEREIN HAVE BEEN PERFORMED IN ACCORDANCE WITH ITS TERMS OF REGISTRATION	JOB No.
			DWG No.
			<u>PXT-250</u>

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SOIL CLASSIFICATION

TRIAL HOLE
 DEPTH
 SAMPLE No. 17116

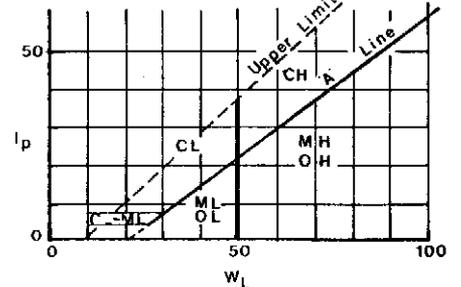


CLAY	SILT			SAND			GRAVEL			COBBLE	BOULDER
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse		

WET SIEVE PRETREATMENT MASS LOSS SPECIFIC GRAVITY 2.65
 DRY SIEVE DISPERSION AGENT MEASURED ASSUMED

INDEX PROPERTIES:

Liquid Limit	%	Plasticity Index	%
Plastic Limit	%		
Linear Shrinkage	%		



SAMPLE HISTORY **PREPARATION METHOD**
 Natural Wet
 Air Dried Dry
 Oven Dried

LIQUID LIMIT TEST:
 Standard One Point

UNIFIED SOILS CLASSIFICATION :

BRIEF SAMPLE DESCRIPTION * SAND (medium grained)

* Described in terms of : moisture, colour, soil type

TESTED: D. B
 DATE 24.4.81
 CHECKED:
 CERTIFIED BY:

MATERIALS LABORATORY
 3 EDEN STREET., CROWS NEST, 2065 TELEPHONE: 929 0122
 LONGWORTH & MCKENZIE PTY. LIMITED

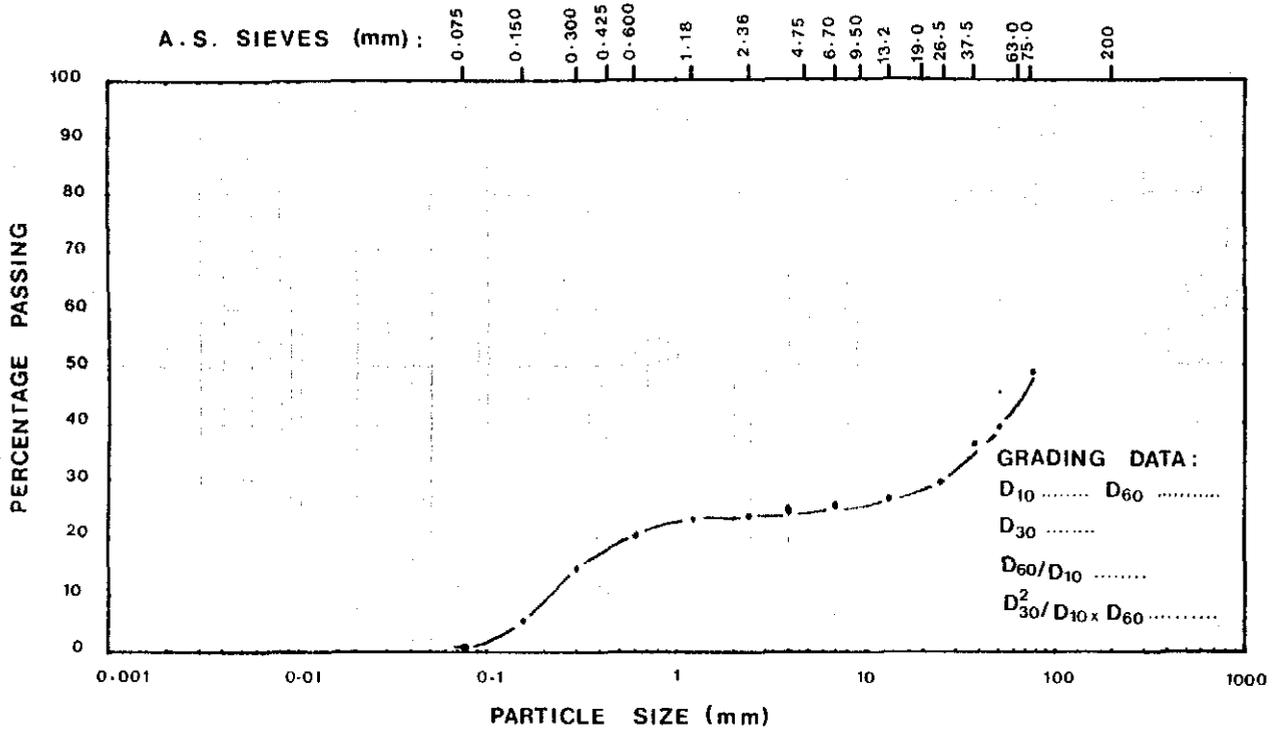


THIS LABORATORY IS REGISTERED BY THE NATIONAL ASSOCIATION OF TESTING AUTHORITIES AUSTRALIA. THE TESTS REPORTED HEREIN HAVE BEEN PERFORMED IN ACCORDANCE WITH ITS TERMS OF REGISTRATION.

JOB No. DWG No.
PXT.250

SOIL CLASSIFICATION

TRIAL HOLE
 DEPTH
 SAMPLE No. 17119

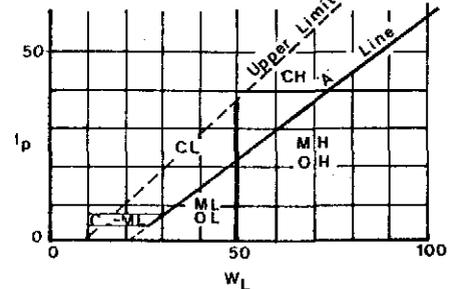


CLAY	SILT			SAND			GRAVEL			COBBLE	BOULDER
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse		

WET SIEVE PRETREATMENT MASS LOSS SPECIFIC GRAVITY 2.65
 DRY SIEVE DISPERSION AGENT MEASURED ASSUMED

INDEX PROPERTIES :

Liquid Limit	%	Plasticity Index	%
Plastic Limit	%		
Linear Shrinkage	%		

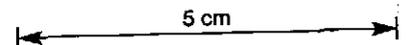


SAMPLE HISTORY
 Natural
 Air Dried
 Oven Dried

PREPARATION METHOD
 Wet
 Dry

LIQUID LIMIT TEST:
 Standard One Point

UNIFIED SOILS CLASSIFICATION :



BRIEF SAMPLE DESCRIPTION *

* Described in terms of : moisture, colour, soil type

TESTED: D. B
 DATE 24.4.81
 CHECKED:
 CERTIFIED BY:

MATERIALS LABORATORY
 3 EDEN STREET., CROWS NEST, 2065 TELEPHONE: 929 0122
 LONGWORTH & MCKENZIE PTY. LIMITED

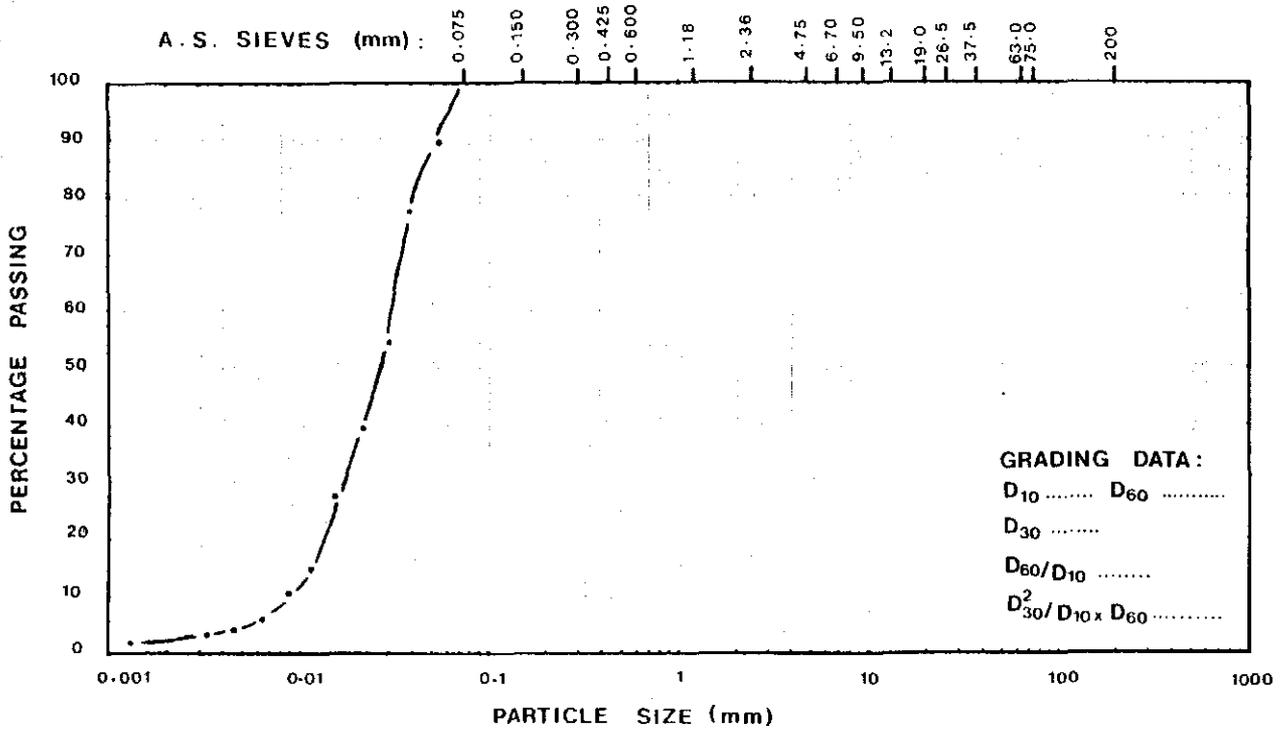


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 AUSTRALIA
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 IN ACCORDANCE WITH ITS TERMS OF REGISTRATION

JOB No. DWG No.
PXT-250

SOIL CLASSIFICATION

TRIAL HOLE
 DEPTH
 SAMPLE No. 17165

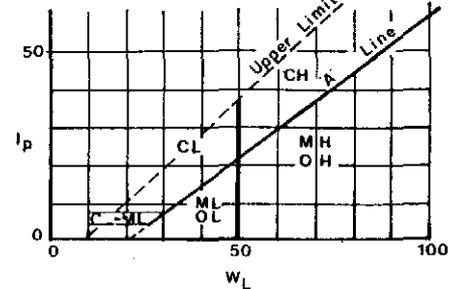


CLAY	SILT			SAND			GRAVEL			COBBLE	BOULDER
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse		

WET SIEVE PRETREATMENT MASS LOSS SPECIFIC GRAVITY 2.65
 DRY SIEVE DISPERSION AGENT YES MEASURED ASSUMED

INDEX PROPERTIES :

Liquid Limit	%	Plasticity Index	%
Plastic Limit	%		
Linear Shrinkage	%		



SAMPLE HISTORY **PREPARATION METHOD**
 Natural Wet
 Air Dried Dry
 Oven Dried

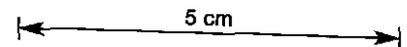
LIQUID LIMIT TEST:
 Standard One Point

NOTE: Sample all passing the .075 microns sieve.

UNIFIED SOILS CLASSIFICATION :

BRIEF SAMPLE DESCRIPTION *

* Described in terms of : moisture, colour, soil type



TESTED: <u>34</u>	MATERIALS LABORATORY 3 EDEN STREET., CROWS NEST, 2065 TELEPHONE: 929 0122 LONGWORTH & MCKENZIE PTY. LIMITED	 THIS LABORATORY IS REGISTERED BY THE NATIONAL ASSOCIATION OF TESTING AUTHORITIES AUSTRALIA. THE TESTS REPORTED HEREIN HAVE BEEN PERFORMED IN ACCORDANCE WITH ITS TERMS OF REGISTRATION.		JOB No.	DWG No.
DATE <u>16.4.81</u>				PXT-250	
CHECKED:					
CERTIFIED BY:					

APPENDIX C

T.E.M.Co. (PHYSICAL TEST SPECIFICATION)

TEMCO

TASMANIAN ELECTRO METALLURGICAL CO. PTY. LTD.
(Incorporated in the State of Victoria)



P.O. Box 164, George Town, Tasmania 7253

Your Ref. :

Our Ref. : JH/LP

8th April, 1981

The Manager,
Longworth & McKenzie,
3 Eden Street,
CROWS NEST, N.S.W.

ATTENTION: Mr. Robert Carr

Dear Sir,

G18/6-7 SILICA

Further to your telephone conversation with Mr. J. Hatty, please find enclosed information relating to friability and thermal stability tests used at T.E.M.Co to assess Quartz/Quartzite suitability for ferro silicon production.

The friability test is based on J.I.S. M8712 (Tumble test for Iron Ores and Sinters), sketches of the test drum are included. The two indices generated by this test offer a useful basis for assessing the tendency of quartzite to degrade by handling in loading and unloading (Tumble index "S"), and by transport by shipping and trucking (Abrasion index "F"). For this reason samples for analysis should ideally be taken from a quarry face or outcrop or after a mine crushing plant, and be handled gently to the analysis site to avoid bias. The aperture size of 25mm was chosen, as the minimum size quartzite fed to furnace is 25mm.

Acceptable Quartz/Quartzite to T.E.M.Co would have a Tumble index "S" of 50.0 (Minimum value) and an abrasion index "F" of 20.0 (Maximum value).

Thermal Testing;

Numerous tests carried out at T.E.M.Co indicate that the values of

85.0% (min)	+	3/4" After heat treatment
90.0 (min)	+	3/16" After tumbling,

would be an indication of suitable material. Further more we believe the test leaves something to be desired with respect, to the size of material tested being unrepresentative of that used, as the mass taken is too small. This procedure is under our review at present.

...2/

Office and Works : Bell Bay. Telephone : (003) 82 1411. Telex : AA 58873

Head Office : B.H.P. House, 140 William Street, Melbourne 3000

- 2 -

The drums internal diameter is 200mm the depth is 100mm. The drum must have a lid with a tight seal and four 6 x 17mm ribs welded to its inner side.

Further thermal testing has been carried out by our laboratories at Newcastle Iron and Steel Works and at Australian Industrial Refractories to determine softening and fusion points for various quartz ores and quartzite. We believe that a suitable fusion point is 1700^oC. The method used is the "Pyrometric Core Equivalent" AS 1774.10 - 1976.

Yours faithfully,

MANAGER.

DECREPITATION OF QUARTZITE - *TIEMCO*

Sieve a $-1'' + 3/4''$ fraction of quartzite chips weighing between 200-300 g. Place this sample into a hollowed pre-heated fire brick and heat in a muffle furnace for 1 hour at 1000°C . Note:- Preheating takes about 20 minutes. When the sample has been removed from the muffle and cooled, it is gently screened through a stack of sieves, so as not to break up loosely bonded fragments.

<u>Sieve Sizes for Stack</u>	<u>Fractions</u>
$3/4''$ 19 mm	+ $3/4''$
$1/2''$ 13.2 mm	+ $1/2''$
$5/16''$ 8 mm	+ $5/16''$
$1/4''$ 6.4 mm	+ $1/4''$
$3/16''$ 4.8 mm 4.8 mm	+ $3/16''$
$1/8''$ 3.2 mm	+ $1/8''$
6	+ 6
	- 6

Each of the above fractions is weighed and reported as a percentage of the total weight.

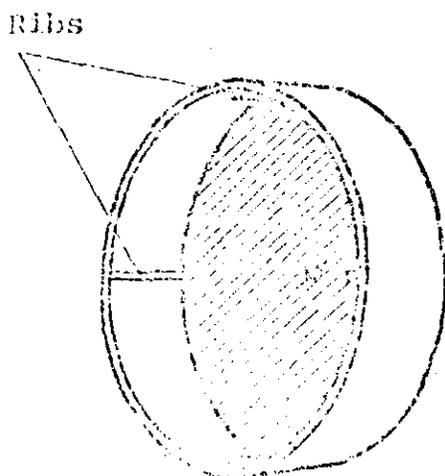
Recombine fractions in a tumbling mill and tumble for 100 revolutions then resize the sample through the above sieves. Each fraction is again weighed and the weight reported as an accumulative percent of the total. i.e. (a % tally).

THERMAL STABILITY OF QUARTZ.

The $-1.06 + 3/4"$ U.S. sieve fraction is prepared. A graphite crucible containing about 200 g quartz is placed into a Tammann furnace at 1300°C and held at this temperature for one hour. The crucible is then withdrawn and cooled to room temperature. Sieve analysis is carried out. The whole sample is placed in the drum shown in the sketch and rotated for 100 revolutions (2½ minutes).

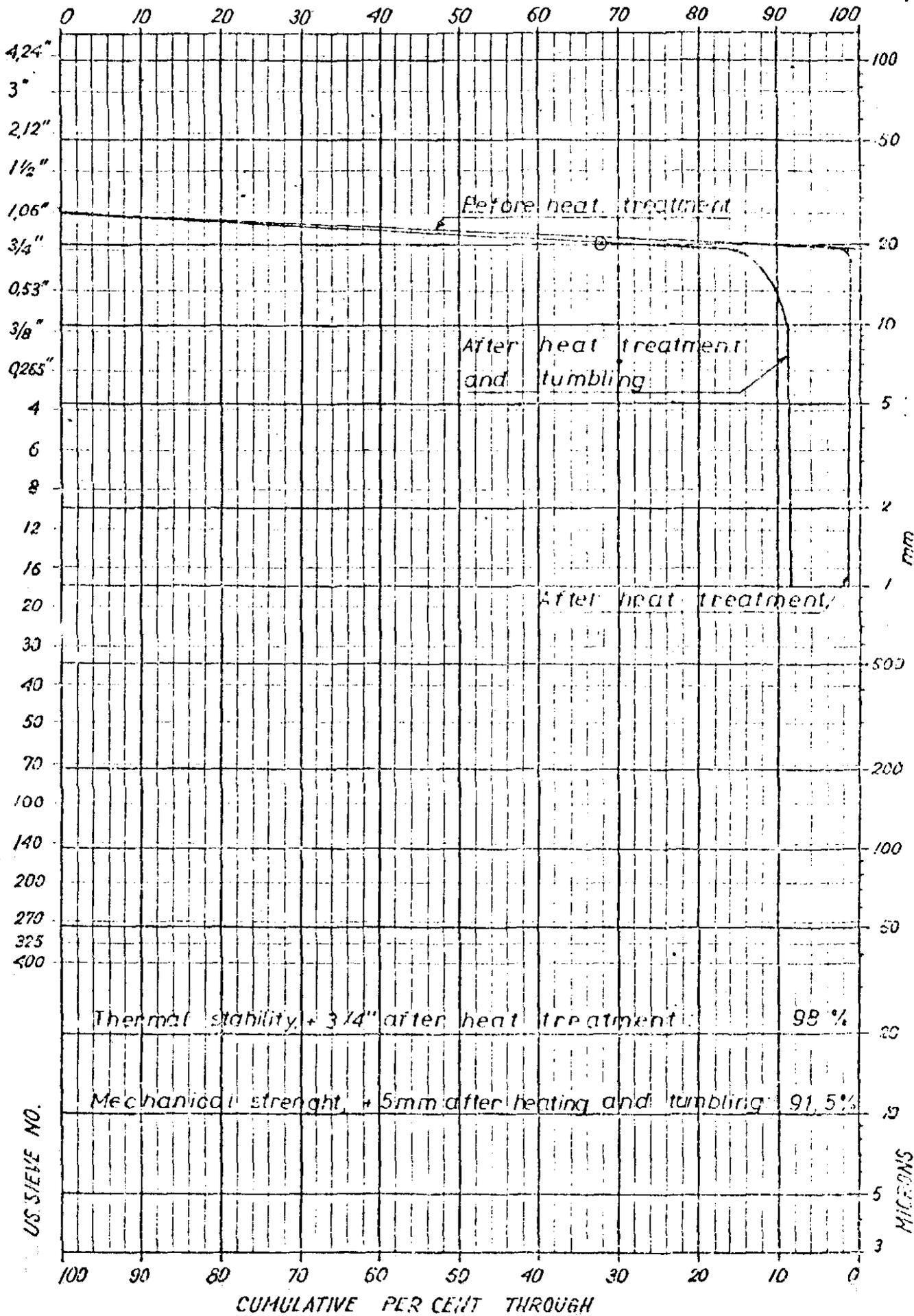
Finally, sieve analysis is again carried out.

The result is given as sieve curves. The amount of $+ 3/4"$ fraction after heat treatment and of ± 5 mm after 100 revolutions are especially noted.



U.S. GOVERNMENT PRINTING OFFICE: 1947

Thermal stability of quartz.



Thermal stability, + 3/4" after heat treatment 98 %

Mechanical strenght, + 5mm after heating and tumbling 91,5%

US SIEVE NO.

MICRONS

TASMANIAN ELECTRO METALLURGICAL CO. PTY. LTD.BELL BAY - TASMANIAFRIABILITY TEST FOR QUARTZITE

23kg of clean washed and dried quartzite should be used for this test.

Carry out a sieve test recording the weights and calculating the percentage of material at:

MESH SIZE	MASS	TALLY	%ACCUM
+ 75mm			
+ 53mm			
+ 37mm			
+ 25mm		-----	
+ 13.7mm			
- 13.7mm			

Take 23kg of the quartzite larger than 25mm and tumble it for 200 revolutions in the J.I.S. Friability drum. Ensure that the drum is thoroughly clean prior to placing the sample in the drum to avoid contamination for chemical analysis.

Collect the tumbled quartzite and sieve it, recording the mass at:

MESH SIZE	MASS	(B+C)
+ 25mm		
+ 6.7mm		-----
- 6.7mm	-----	
TOTAL	-----	

Calculate the Friability indexes S & F.

$$S = \frac{B}{A} \times 100 =$$

$$F = \frac{A - (B+C)}{A} \times 100 =$$

A = Total mass + 25mm before tumbling.

B = Mass + 25mm after tumbling.

C = Mass + 6.7mm after tumbling.

S = Tumble index.

F = Abrasion index.

Recombine all the tumbled and untumbled quartzite including fines. Then crush and prepare the sample for chemical analysis.

REPORT

on

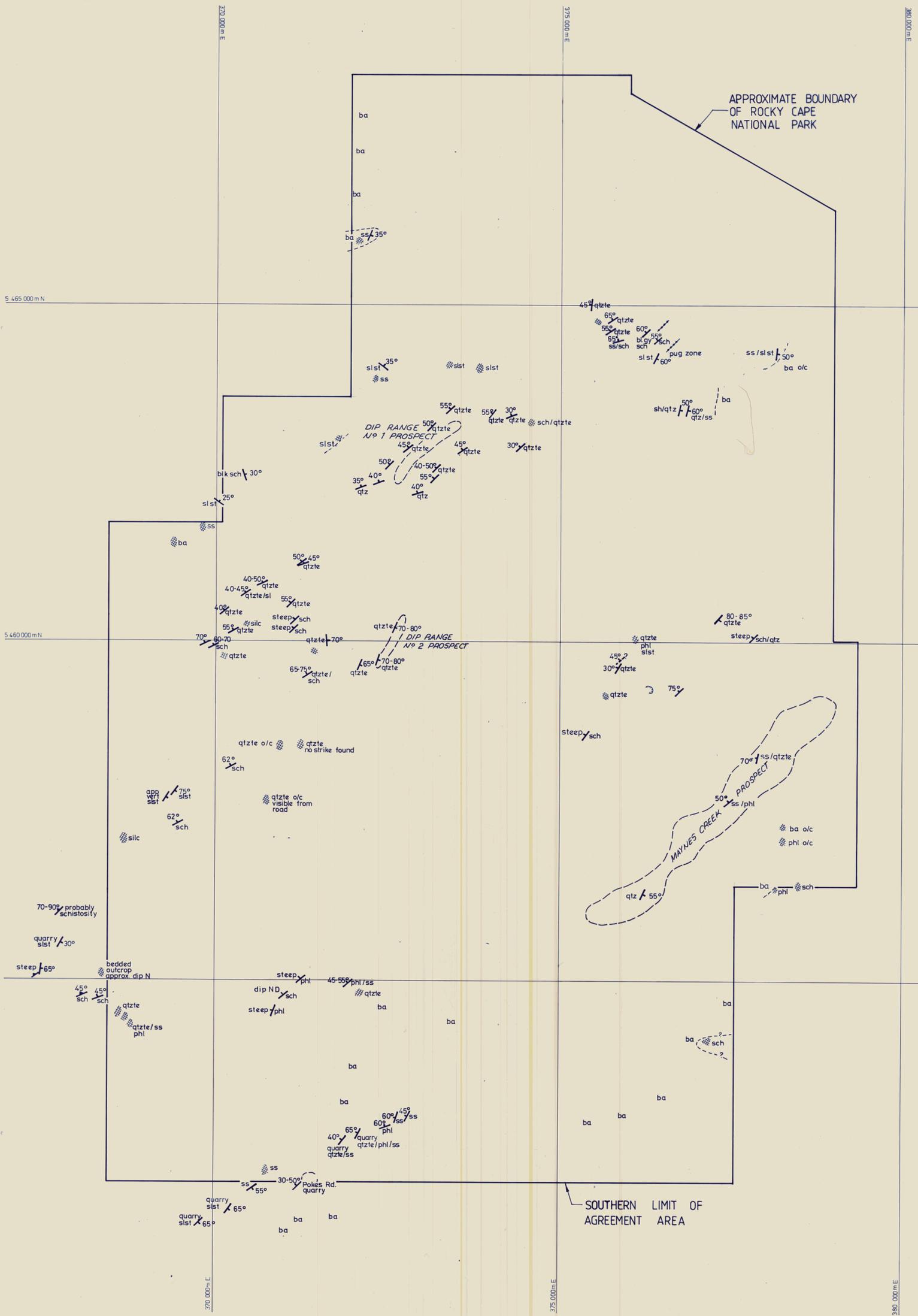
STAGE 2 – GEOLOGICAL INVESTIGATION

OF EL 43 / 70

for

KAISER ALUMINUM

VOLUME 2 / 2



LEGEND

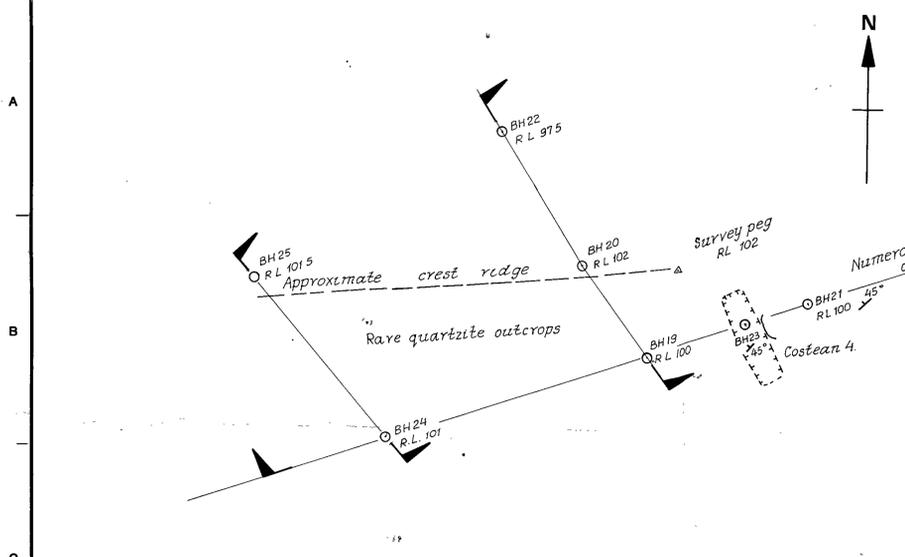
- | | | | |
|-------|---------------------------------|-----|---------|
| qtz | QUARTZ | phl | PHYLITE |
| qtzte | QUARTZITE | sch | SCHIST |
| sist | SILTSTONE | sh | SHALE |
| silc | SILCRETE | shy | SHALY |
| ss | SANDSTONE | | |
| ba | BASALT | | |
| sl | SLATE | | |
| bl | BLUE | | |
| blk | BLACK | | |
| gy | GREY | | |
| N D | DIP NOT DETERMINABLE | | |
| ↘ 65° | MEASURED STRIKE AND DIP OF BEDS | | |
| ↘ | FOLIATION STRIKE AND DIP | | |
| ⊞ | OUTCROP - NO STRIKE OR DIP | | |
| ⊞ | QUARRY | | |



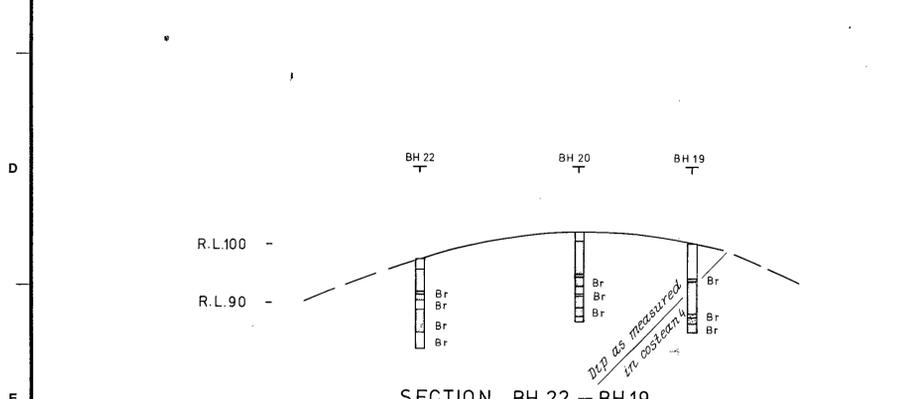
NOTE
THIS DRAWING TO BE READ IN
CONJUNCTION WITH DRGS. PXT 250/1 & 3

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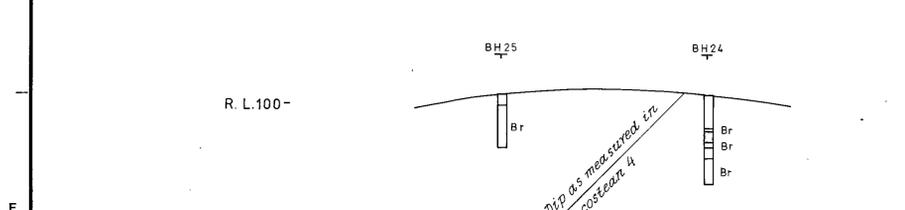
Drawn: MW	Designed: C.A./RJC	RECORDED FIELD DATA
Checked: RJC	Approved for Construction:	
Date: 30-4-81	Scale: 1:25,000 (approx)	STAGE 2 - GEOLOGICAL INVESTIGATION SILICA DEPOSIT E.L. 43/70
Kaiser Aluminium		LONGWORTH & MCKENZIE PTY. LIMITED
Job No: PXT 250	Drawing No: 2	Consulting Geotechnical Engineers: 3 Field St, Cross Street 2065 Tel: 928 0122 Members of the Institution of Engineers, Australia



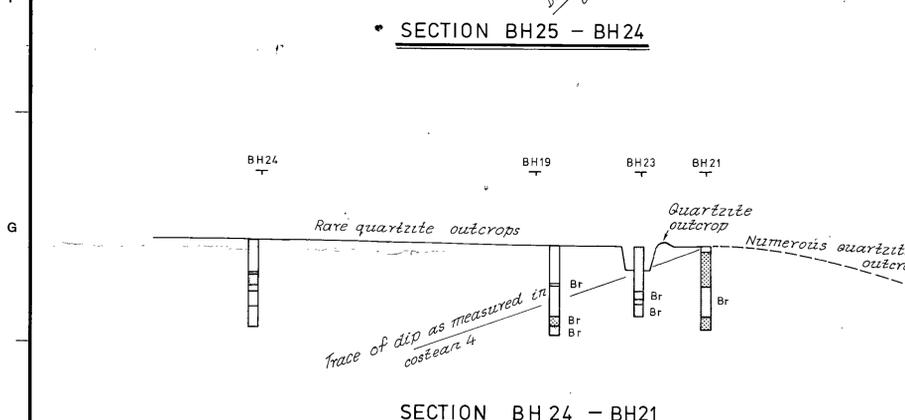
PLAN



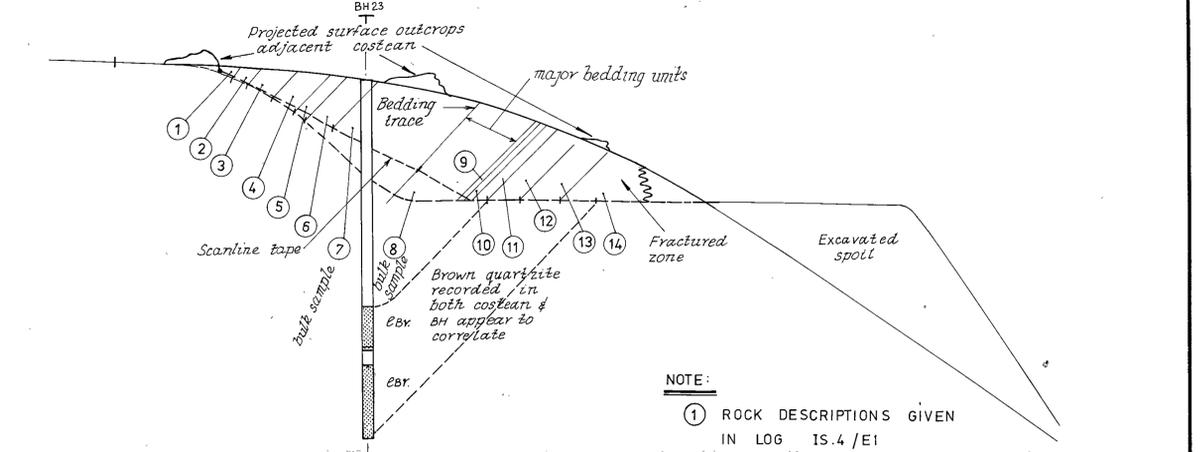
SECTION BH 22 - BH 19



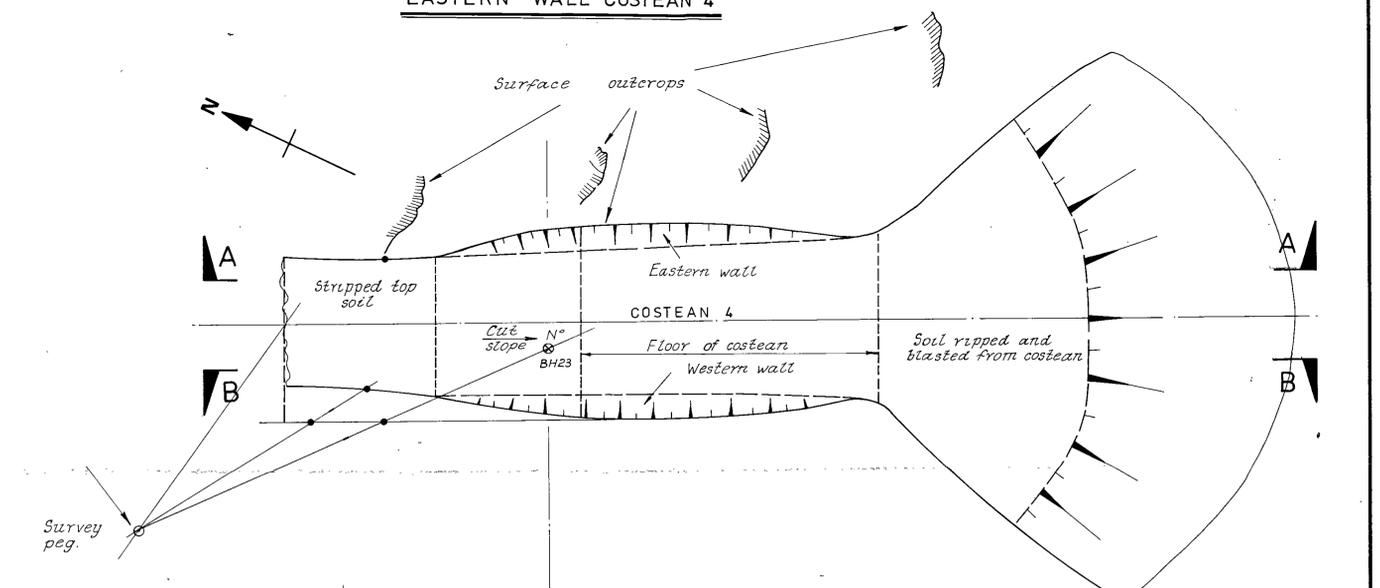
SECTION BH 25 - BH 24



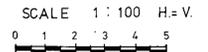
SECTION BH 24 - BH 21
INVESTIGATION SITE NO 4



SECTION A - A
EASTERN WALL COSTEAN 4

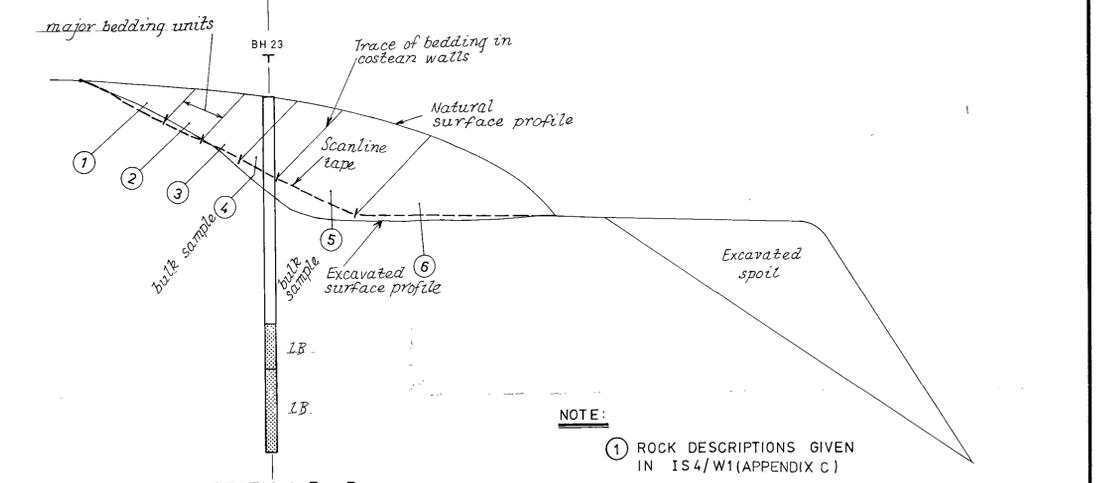


SECTION B - B
WESTERN WALL COSTEAN 4



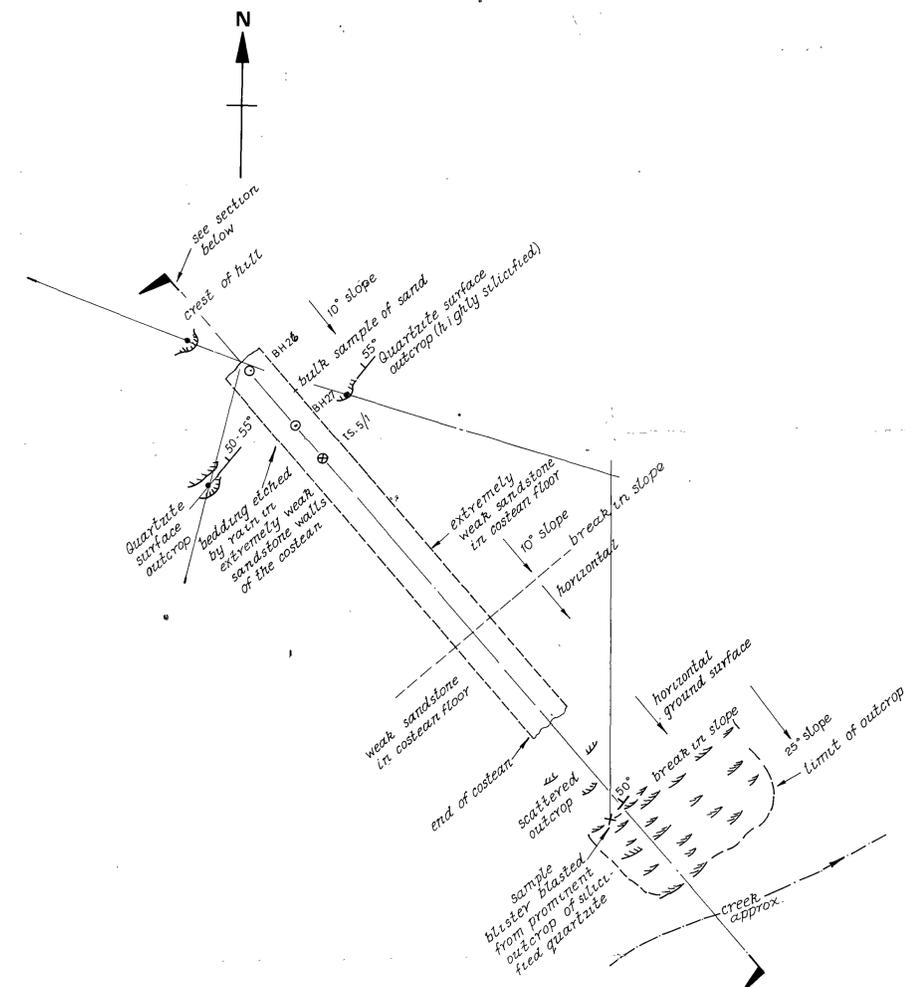
- LEGEND:**
- PERCUSSION BORE HOLE LOCATION IN PLAN.
 - ⊗ PROFILE LOG LOCATION IN PLAN.
 - ⊕ PERCUSSION & PROFILE LOG LOCATION ON SECTION.
 - APPROXIMATE R. L.
 - SAND, SANDSTONE (VERY WEAK TO WEAK)
 - ▨ STRONG SANDSTONE.
 - ▩ QUARTZITE / SILICIFIED SANDSTONE.
 - Br. BROWN CUTTINGS AND / OR DUST.

- 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 EL43/70



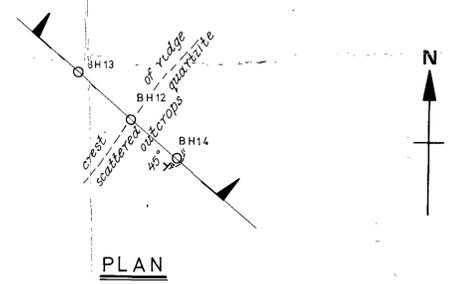
- NOTE:**
1. ROCK DESCRIPTIONS GIVEN IN IS 4/W1 (APPENDIX C)

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Drawn: R.D. - Checked: R.J.C. - Scale: AS SHOWN Date: 30-4-81						Designed: C.A./R.J.C. Approved for Construction:		STAGE 2 - GEOLOGICAL INVESTIGATION SILICA DEPOSIT E.L.43/70 KAISER ALUMINUM	
Amendment Date Description						Job No: PXT250		Drawing No: 5	



SECTION ALONG CENTRELINE OF COSTEAN
INVESTIGATION SITE 5

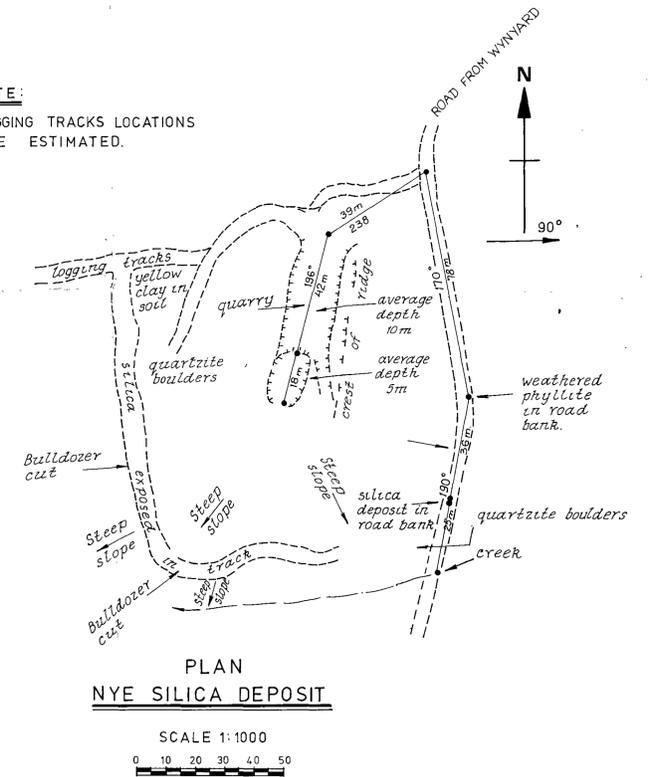
SCALE HORIZONTAL 1:500
VERTICAL 1:500



SECTION BH13-BH14
INVESTIGATION SITE 6

SCALE HORIZONTAL 1:500
VERTICAL 1:500

NOTE:
LOGGING TRACKS LOCATIONS ARE ESTIMATED.



LEGEND:

- PERCUSSION BORE HOLE LOCATION IN PLAN.
- ⊗ PROFILE LOG LOCATION IN PLAN.
- 154/1 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"

Amendment	Date	Description									

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Drawn: R.D.
Checked: RJC
Scale: AS SHOWN
Date: 30.4.81

Designed: CA/RJC
Approved for Construction:

DETAILED PLANS AND SECTIONS

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

KAISER ALUMINUM

Consulting Engineers: 3 Eden Street, Crows Nest, 2060 Telephone 929 0122
MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS, AUSTRALIA

LONGWORTH & MCKENZIE PTY. LIMITED

Job No: PXT 250
Drawing No: 6
Issue: