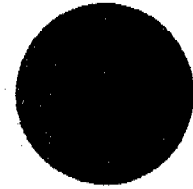


78/007

NORTHERN TERRITORY GEOLOGICAL SURVEY

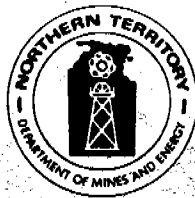
TECHNICAL REPORT



GS 78/7
DRILLING ASSISTANCE AT THE BYNOE HARBOUR
LEASES - 1976 to 1977

BY: G.C. LAU

OPEN FILE



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559.429
1978/07

Department of Mines and Energy

OPEN FILE

GS 78/7

DRILLING ASSISTANCE AT THE BYNOE HARBOUR LEASES, 1976-77

BY: G.C. LAU

NORTHERN TERRITORY
GEOLOGICAL SURVEY

GS 78 / 007

PURPOSE AND METHODS

In November 1975, an application for drilling assistance in the Bynoe Harbour area was made to the Director of Mines. The aim of drilling was to test a kaolin body on behalf of Mr. B. Brown, of Bynoe Industrial Minerals Pty. Ltd., who was proposing to market sand and clay in Darwin. Approval was granted in June 1976 and the Mines Branch drilled six holes (totalling 291m) between October 1976 and June 1977. The holes were drilled with the rig available at the time, a skid mounted Longyear 44 operated by W. Maurer. Longyear HQ3 wireline core barrels were used. After logging, sections of core were split and two samples were tested under the characterization of Australian Clays Scheme for the general evaluation of clay bodies (Spenser, 1977). An interpretation of the geology and stratigraphy of the Keswick area is presented in this report.

LOCATION AND ACCESS

The area under investigation is located between Keswick Control Point and Rankin Point on the Eastern Shore of Bynoe Harbour, 37km southwest of the Darwin Post Office. Access is via a poorly formed track which leaves the Mandorah road approximately 41km past Tumbling Waters. The location and access roads are shown on Plate 1. The road is subject to flooding and can be impassable during the wet season.

TITLE SITUATION

Eighteen mineral leases for sand and gravel were applied for in 1973 by Kamara Pty. Ltd. Ten leases totalling 104Ha were granted in 1974. The other eight leases totalling 41Ha are still pending awaiting a result of the Woodward Commission on Aboriginal Lands. In 1976, the leases and lease applications were transferred to Bynoe Industrial Minerals Pty. Ltd. with Mr. B. Brown as Managing Director. An application to include kaolin, lime, tin, tantalite, rutile, ilmenite, magnetite, zircon and monazite with sand and gravels as the minerals sought is still pending.

Kamara applied for Exploration Licence 1012 over unalienated Crown Land in February 1974. The application is still pending due to aboriginal land claims. Commonwealth Aluminium Corporation Limited (Comalco), who had a joint venture agreement with Kamara, applied for EL 1076 in November 1974. This was also to be deferred due to aboriginal land claims, but Comalco withdrew their application in November, 1975.

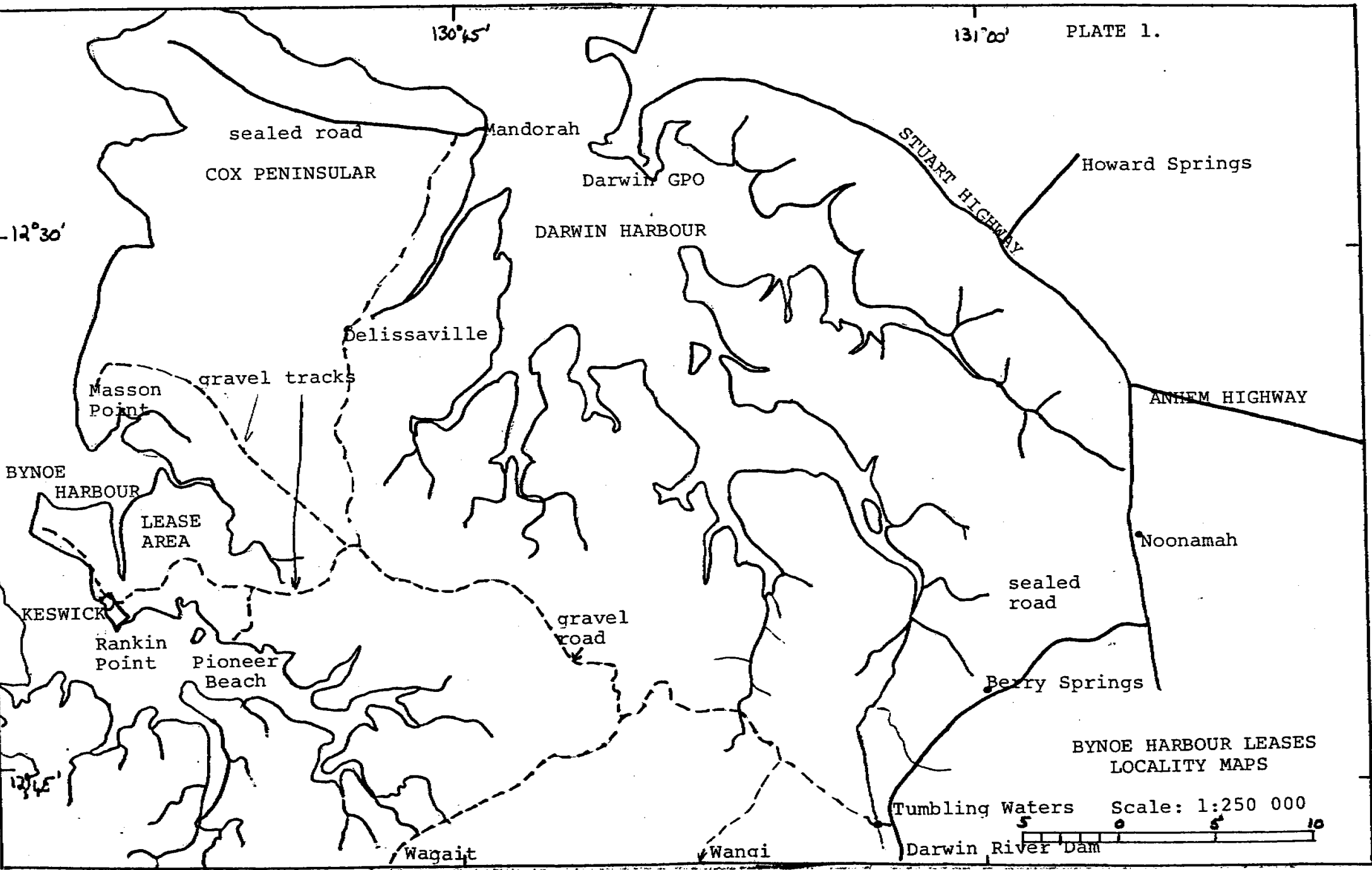
PREVIOUS WORK

In 1975, Comalco carried out exploration work in and around the leases and lease applications, under a joint venture agreement with Kamara, as reported by Chaku (1976). Comalco's main interest was the search for clay with a high aluminium, low silica and low iron content, i.e. a bauxitic kaolin. A wide ranging drilling programme was carried out and Comalco analysed the clay fraction of the drill samples after washing to remove the sand fraction. They halted the investigation because the clay was not suitable as a refractory material for lining furnaces. The clay body at Bynoe was found to be too sandy and chemically unsuitable for Comalco's requirements, they subsequently withdrew from the joint venture.

130°45'

131°00'

-12°30'



sealed road
COX PENINSULAR

Mandorah

Darwin GPO

DARWIN HARBOUR

STUART HIGHWAY

Howard Springs

Delissaville

Masson Point

gravel tracks

ANHEM HIGHWAY

BYNOE HARBOUR

LEASE AREA

Noonamah

sealed road

KESWICK

Rankin Point

Pioneer Beach

gravel road

Berry Springs

BYNOE HARBOUR LEASES
LOCALITY MAPS

Tumbling Waters

Scale: 1:250 000



Wagait

Wanci

Darwin River Dam

TOPOGRAPHY

The shores of Bynoe Harbour are low lying, dissected plateau remnants. High ground backing Keswick and Salmon Head (informally renamed, see Plate 2) is 10-25 m above mean sea level and supports open forest similar to the uplands around Darwin. It is bounded by cliffs along the coastline and slopes gently to the north, east and south to high tide level. The lower slopes also support forest with several thicker patches at points of seepage. The intertidal zone contains a well developed mangrove fringe with some bare salt flats. A patch of vine scrub just northeast of Rankin Point is developed on subcrop of granite and gneiss.

Raised and often curved sand dunes extend from Keswick and Salmon Head into and around the mangrove fringe. The dunes extend several metres above high tide level and support deciduous vine thicket with some larger trees, indicating that they have been stable for some time. The grain size appears too coarse to be wind blown, and the dunes are thought to be formed by wave action during severe storms or when the sea level was slightly higher than at present.

Outcrop in the area is restricted to Salmon Head and to the beaches and cliffs around Keswick, Salmon Head and Raft Point. The beach near Salmon Head also contains sheets of ferricrete, and that at Rankin point contains some broken sheets of beach rock.

RESULTS OF THE STUDY

The drill logs of the holes are presented in Appendix 1. The locations of the drill holes are shown on Plate 2.

Drilling intersected the Mullaman Beds of Cretaceous age, and "Basement Rocks" which have been differentiated into granitic basement and carbonate basement. These three units are described.

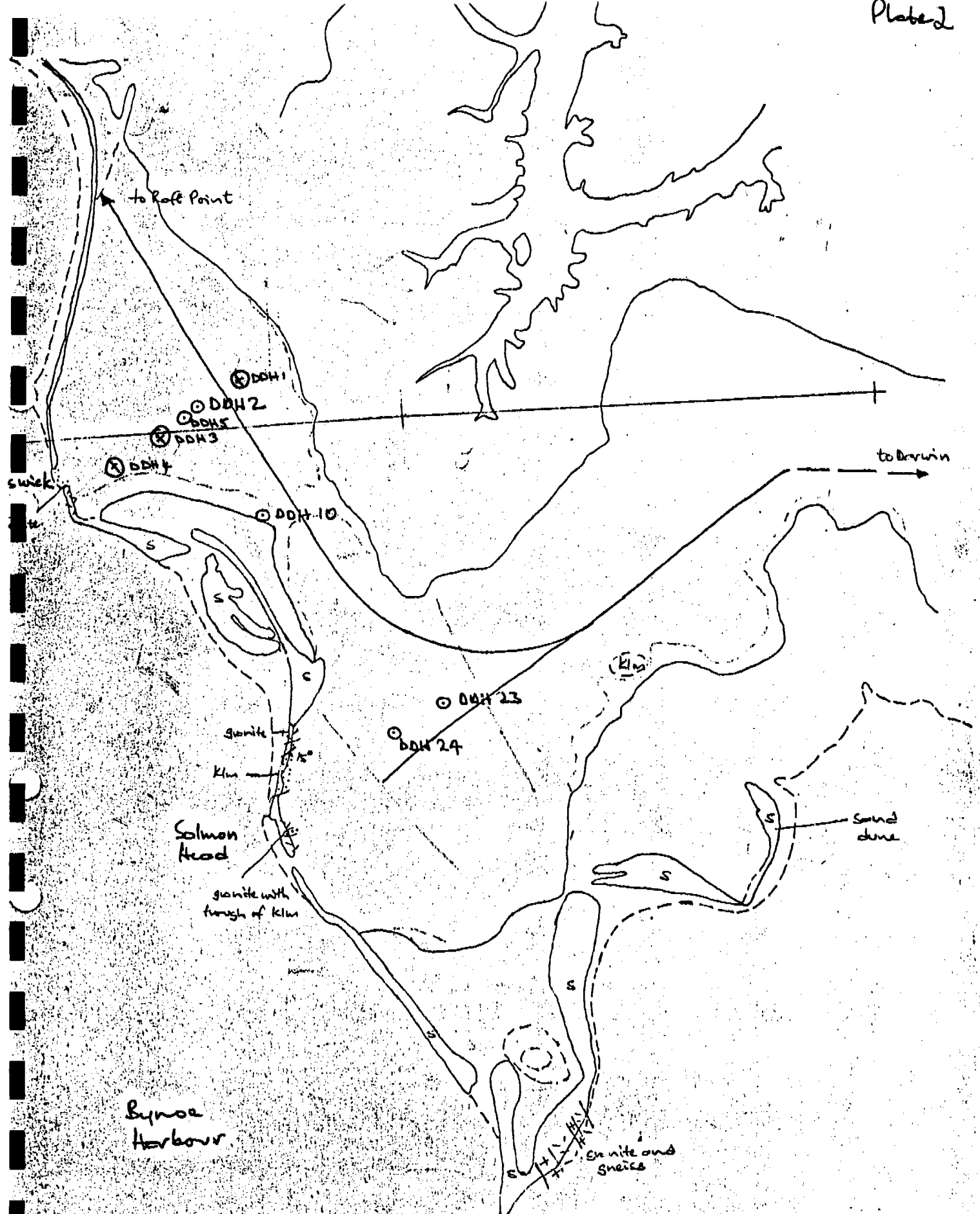
MULLAMAN BEDS

Rocks of the Mullaman Beds are well exposed in the cliffs at Keswick and at Salmon Head. The dominant lithology is quartz sandstone with minor siltstone and conglomerate. The sandstone is cross bedded in places, with dips of 10-15 degrees. Sections measured at Keswick and at Salmon Head are shown on Plates 4 and 5.

Brown, thinbedded, silicified, aphanitic mudstone cropping out on the beach just south of Keswick is folded in a trough shaped structure with dips of 30-50 degrees. Some white, clayey conglomeratic sandstone occurs at the base where it overlies in situ weathered granite. The mudstone and sandstone look very similar to rocks of the Mullaman Beds and may indicate post-Cretaceous deformation in the area.

The Comalco drillholes DDH 23 and 24 cored white-mauve-brown slightly sandy to sandy mudstone. The mudstone consists of 50-60% fine to coarse rounded quartz sand patchily distributed in a kaolinitic matrix. Core from Comalco DDH 32 is not preserved, but their log shows sandy clay passing into quartz sandstone at 13-14m depth.

From the log of this hole and from the knowledge of the sequence in the Mullaman Beds around Darwin, it



Geology and Drill holes at Bynoe Harbour. Approx. position only.

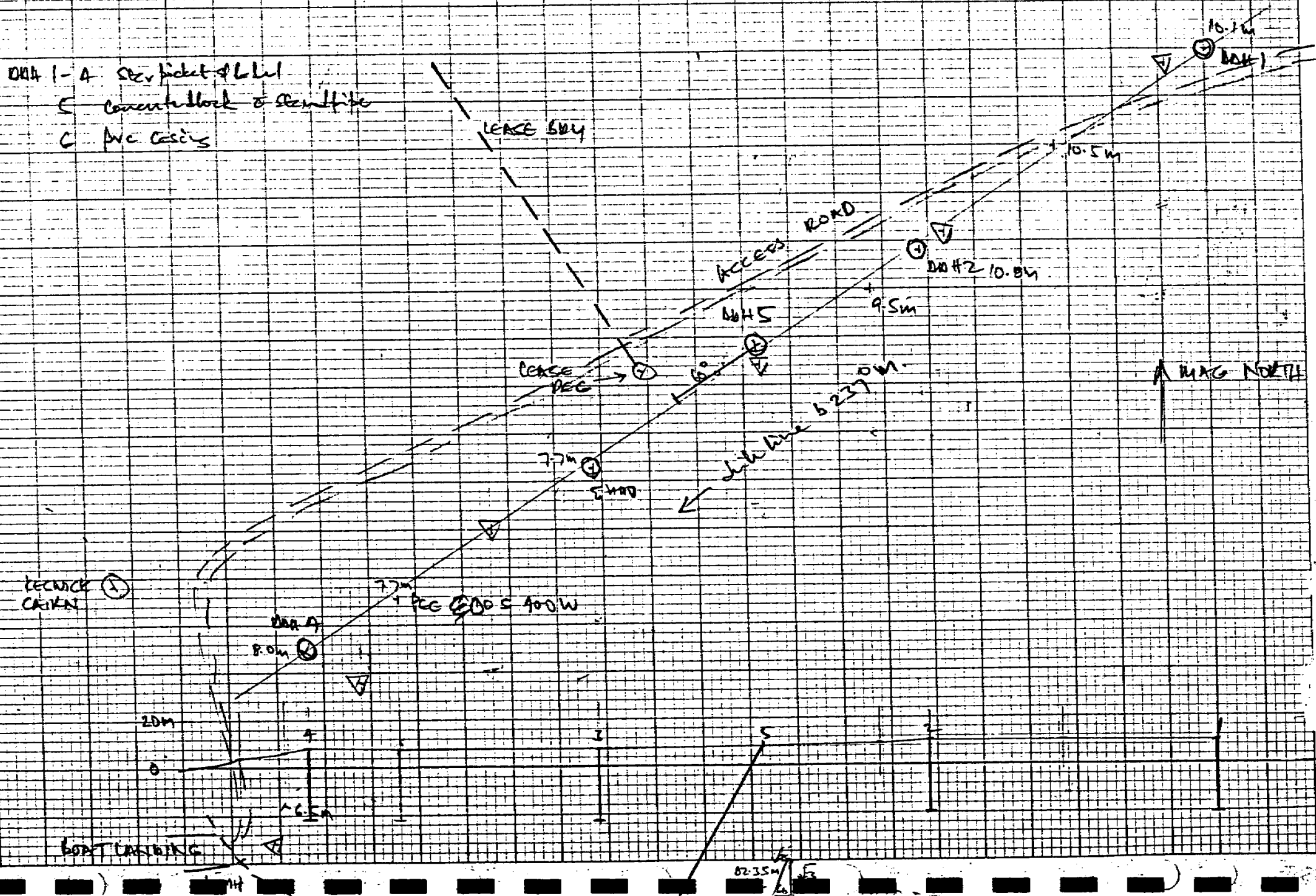
0 100 metres

Scale 1:16000 approx.

PLATE 2 (A)

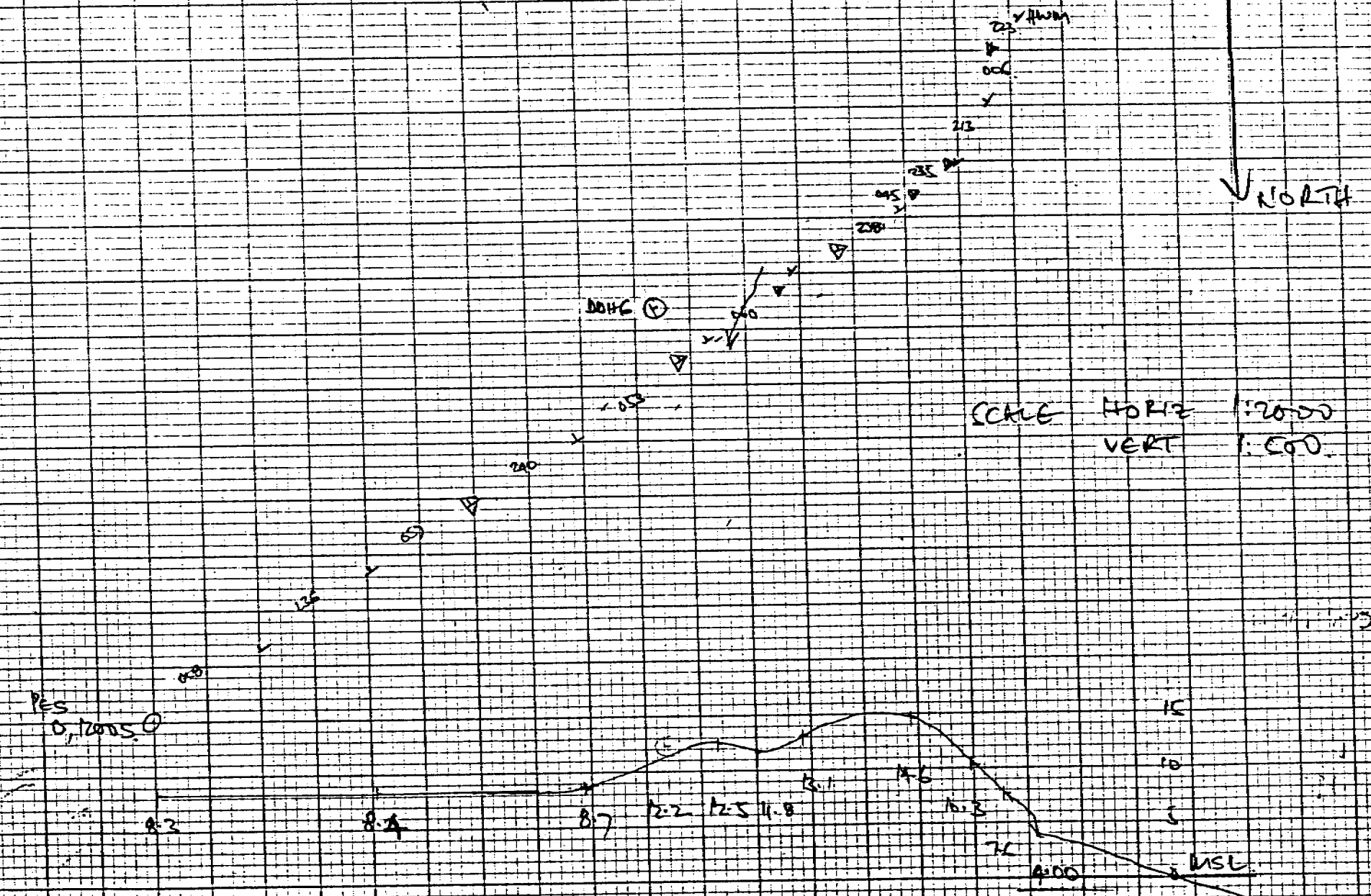
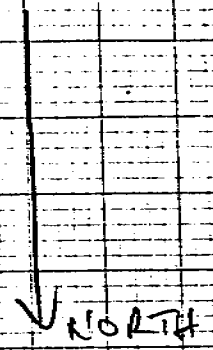
BANNOCK KESWICK LEVELLING

- DATA 1 - A. steel picket 46mm
- B. concrete block & steel pipe
- C. PVC casing



BYNOE SALMON HEAD LEVELING.

PLATE 2(B)

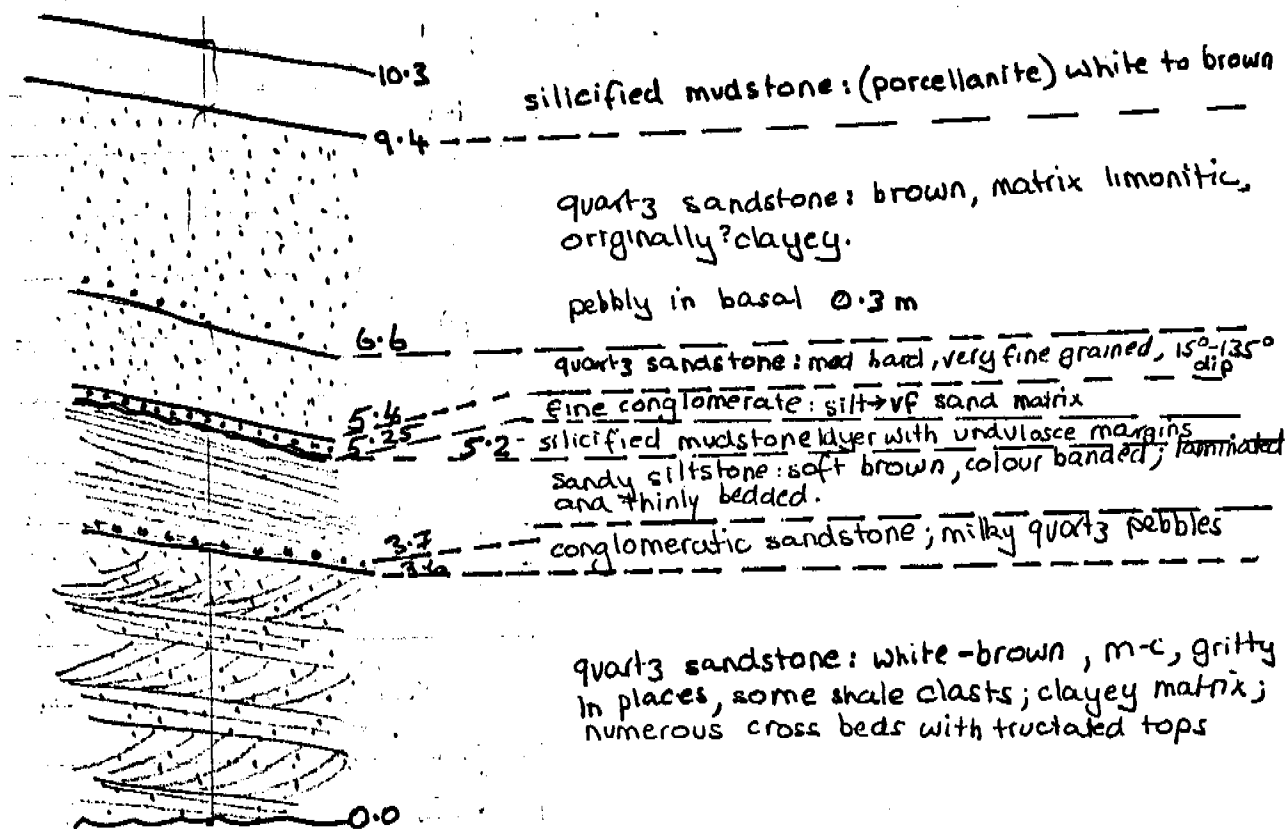


SCALE HORIZ 1:2000
VERT 1:500

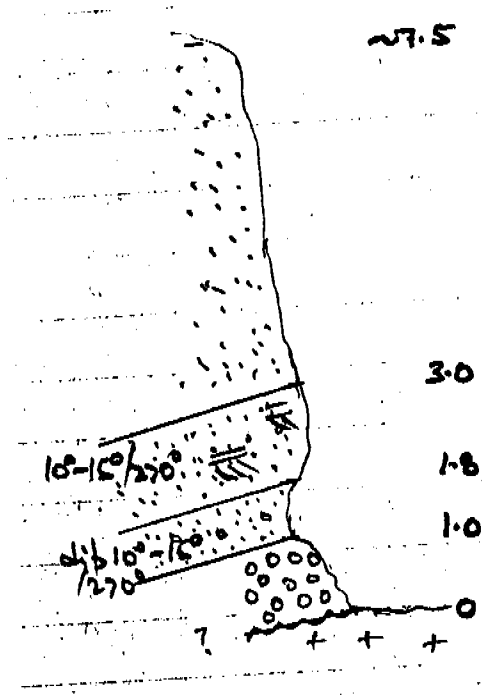
BENCH
0, 100.00

USE

Cliff Section below Salmon Head (PH10)



Cliff section below Keswick Camp



sandstone: brown, not examined; - on other side of headland, top layer is mudstone with brecciated patches.

3.0 sandstone: white-mauve-brown; thin granulo conglomerate beds; cross-bedded

1.8 conglomeritic sandstone: white-mauve-brown; 70-80 quartz sand + granules in kaolinitic mud matrix.

1.0 basal conglomerate: white mottled brown; 70% quartz pebbles + boulders in clayey matrix.

HW medium-coarse grained granite

is inferred that the sandstone exposed in the cliffs is a basal bed and is overlain higher in the sequence by sandy mudstone. The granitic rocks drilled in Comalco DDH 25 and Mines DDH 6 presumably represent sub-Cretaceous highs from which the thin cover of Mullaman Beds has been stripped.

No Mullaman beds were recognized in Mines holes DDH1-5.

BASEMENT ROCKS

(1) GRANITIC ROCKS

White or lightly ironstained sandy clay is exposed on some beaches and is the dominant material cored in drill holes. It consists of angular quartz grains generally 0.5-5 mm diameter with some to 20mm and more, set in a matrix of white kaolinitic clay. The content is commonly 10-30% quartz in 70-90% clay. Accessory minerals include biotite (partly altered to chlorite), muscovite, rutile and a pale blue unidentified mineral. Flecks of sulphide are almost ubiquitous in the granitic rocks.

(2) CARBONATE ROCKS

Fresh, strong carbonate rock was intersected from approximately 65.8m to total depth of 86.00m in DDH 6. The rock was light grey to greenish grey marble with carbonate crystals to 10mm. It was originally thought to be a dolomite, but a chemical assay indicated a ferroan dolomite or magnesite (see Table 1). A sample was sent to AMDEL where XRD analysis confirmed that the carbonate was magnesite (see Appendix 2).

Examination of hand specimens and one thin section show that the bulk of the rock consists of magnesite grains 2-10mm across, with a granular texture. The amount of chlorite in the rock varies from 5-30% and has a waxy, talc-like appearance. It consists of fine grained (0.01-0.04mm) flakey aggregates associated with quartz and sphene. The thin section contained 5% quartz as grains less than or equal to 0.1-2mm size, with planar boundaries against magnesite and irregular boundaries against chlorite. Graphite and pyrite form minor constituents and rare grains of rutile and sphene were noted in thin section.

Slickensided fractures in the marble have translucent talc-like coatings of graphite dust and chlorite; the identification of chlorite was confirmed by AMDEL (see Appendix 2).

Darker grey, non-crystalline rock between 77.45 and 77.90m was examined in thin section and determined as sericite-chlorite rock, as described in the drill logs. Small sections of broken core from approximately 59.60m are brown quartz with a rhombohedral boxwork preserved in places, and possibly represents a silicified capping on the marble. The driller reported a cavity at approximately 65.0m, so the marble may be cavernous in part and could have potential as a source of plant process water for a mining operation in the area.

TABLE ONE

CHEMICAL ASSAY OF CORE FROM DH 6, Bynoe Drilling Assistance.

DEPTH m.	SiO ₂ %	CaO %	MgO %	Fe ₂ O ₃ %	LOI %	BaO %	TiO ₂ %	P ₂ O ₅ %	Cu ppm	Pb ppm	Zn ppm
69.60	30.5	0.2	26.9	2.1	24.5	0.2	0.5	0.08	80	20	16
76.50	34.0	0.2	23.9	4.1	16.1	0.2	0.5	0.08	8	25	16
80.75	8.4	0.2	41.2	0.9	42.3	0.2	0.5	0.01	5	20	14
86.75	9.4	3.0	37.8	0.6	42.8	0.2	0.5	0.01	2	20	22

REFERENCES

Chaku, S.K. 1976 Keswick Clay Project, Northern Territory. Final Report on Exploration. COMALCO LIMITED COMPANY REPORT.(unpub)

Spenser, W.G. 1977 Characterization of Australian Clays, 1978. Progress Report M1. AMDEL REPORT. (unpub).

APPENDIX 1: Logs of Drill Holes, Bynoe Drilling Assistance.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT BUNOE DRILLING ASSISTANCE REMARKS _____
 HOLE N° DDH 2 CO-ORDINATES _____ R.L. GROUND _____
 LOCATION _____ ANGLE FROM HORIZONTAL Vertical DIRECTION _____

DESCRIPTION OF CORE	LOG	CORE RECOVERY %	INTERPRETED LITHOLOGY	SAMPLES
<p>metres</p> <p>4</p> <p>SANDY CLAY: contains minor flake sulphite, 10-40% quartz, 60-90% feldspar; banding indicates original schist.</p> <p>8</p> <p>12</p> <p>16</p> <p>Highly weathered GRANITE; in places completely weathered to SANDY CLAY; contains minor sulphite, 15-30% quartz, 70-85% feldspar; fine to medium grained, porphyritic in part.</p> <p>20</p> <p>SANDY CLAY similar to 0-16 above; banding indicates original schist.</p> <p>24</p> <p>28</p> <p>Total depth 30.50m.</p> <p>32</p>				
REFERENCES	LOGGED BY <u>G. Low</u>		SHEET <u>1</u> OF <u>1</u> DRAWING N° _____	

GEOLOGICAL LOG OF DRILL HOLE

PROJECT RYNOE DRILLING ASSISTANCE REMARKS _____
HOLE No DDH 3 CO-ORDINATES _____
LOCATION _____ ANGLE FROM HORIZONTAL Vertical R.L. GROUND _____
DIRECTION _____

DESCRIPTION OF CORE	LOG	CORE RECOVERY %	INTERPRETED LITHOLOGY	SAMPLES
<p>Metres</p> <p>0</p> <p>4</p> <p>8</p> <p>12</p> <p>SANDY and GRAVELLY CLAY: contains minor biotite/chlorite, 20-50% quartz, 70-80% feldspar; possibly weathered from medium to coarse grained granite.</p>			? + + + w-c + ? + w-c + ? + + w-c + ? +	
<p>16</p> <p>20</p> <p>24</p> <p>28</p> <p>GRAVELLY CLAY = highly weathered GRANITE: contains < 5% biotite/chlorite, 10-30% quartz, 70-90% feldspar; medium to coarse grained.</p> <p>Biotite-rich section →</p>			+ + w-c + + + + + w-c + + + w-c + + + + +	
<p>32</p> <p>Total depth 30.50 m.</p>				

REFERENCES

LOGGED BY G. Lew
SHEET 1 OF 1 DRAWING N° _____

GEOLOGICAL LOG OF DRILL HOLE

PROJECT BYNOE DRILLING ASSISTANCE REMARKS _____
 HOLE N° BDH 3 CO-ORDINATES _____ R.L. GROUND _____
 LOCATION _____ ANGLE FROM HORIZONTAL Vertical DIRECTION _____

DESCRIPTION OF CORE	LOG	CORE RECOVERY %	INTERPRETED LITHOLOGY
metres			
0 CLAYEY SAND and GRAVEL: surface soil.	[Pattern]	[Bar]	
SANDY CLAY: contains minor flake graphite, 30% angular and rounded quartz sand, 70% clay; possibly weathered granite or gneiss with rounded sand core or derived from surface.	[Pattern]	[Bar]	+ ? + ? +
8 SANDY CLAY: contains minor flake graphite, 5-30% angular quartz sand, 70-95% clay (sericitic in part) with rare white and pseudomorphic of pyrite; interpreted as schist and gneiss.	[Pattern]	[Bar]	[Diagram]
12	[Pattern]	[Bar]	[Diagram]
16	[Pattern]	[Bar]	[Diagram]
20	[Pattern]	[Bar]	[Diagram]
24	[Pattern]	[Bar]	[Diagram]
28	[Pattern]	[Bar]	[Diagram]
CLAY: contains 10-30% chlorite; interpreted as biotite (bluish) and biotite granite, gneiss and biotite impregnated granite.	[Pattern]	[Bar]	[Diagram] bedding at 80°-90° to
32 Total depth 30.65m.	[Pattern]	[Bar]	[Diagram]

REFERENCES _____

LOGGED BY G. Low

SHEET 1 OF 1 DRAWING N° _____

GEOLOGICAL LOG OF DRILL HOLE

PROJECT BYNOE DRILLING ASSISTANCE REMARKS _____
 HOLE N° DDH 5 CO-ORDINATES _____ R.L. GROUND _____
 LOCATION _____ ANGLE FROM HORIZONTAL 60° DIRECTION 297 MN

metre	DESCRIPTION OF CORE	LOG	CORE RECOVERY % 100	INTERPRETED LITHOLOGY SAMPLES
0	Not cored.			
4				
8	SANDY CLAY: 10-30% angular quartz sand, 70-90% clay, with minor graphite and rare rutile; interpreted as fine to medium grained gneiss.	[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
12	Micaceous SANDY CLAY: 0-10% muscovite, 0-10% quartz, 80-90% clay; some colour banding; interpreted as fine to medium grained gneiss.	[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
16	Alternating bands of SANDY CLAY and CLAY	[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
20	The SANDY CLAY contains 5-30% quartz, 70-95% clay (after feldspar), with < 5% graphite, < 20% biotite or muscovite, rare rutile; sections with isotropic texture are interpreted as granite; sections with colour and/or compositional banding as gneiss.	[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
24	The CLAY contains some graphite and < 30% biotite / chlorite; it is interpreted as schist or as quartz-free igneous rock, as gneiss.	[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
32		[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
36		[Pattern]	[Bar]	+ +
		[Pattern]	[Bar]	+ +
40				

banding at 80°-90° tch.

quartz stringers at 90° tch.

schistosity at 90° tch

schistosity at 80°-90° tch

schistosity at 60° tch.

REFERENCES

LOGGED BY G. Low

SHEET 1 OF 3

DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT BYNOE DRILLING ASSISTANCE REMARKS _____
 HOLE N° DDH 5 CO-ORDINATES _____ R.L. GROUND _____
 LOCATION _____ * ANGLE FROM HORIZONTAL _____ DIRECTION _____

DESCRIPTION OF CORE	LOG	CORE RECOVERY % 100	SAMPLES
<p>metres</p> <p>40</p> <p>Alternating bands of SANDY CLAY and CLAY as described above.</p> <p>44</p> <p>48</p> <p>52</p> <p>56</p> <p>60</p> <p>64</p> <p>68</p> <p>72</p> <p>76</p> <p>80</p>			<p>banding at 90° to H</p> <p>banding at 70° to H</p> <p>from SA-63, banding at 70° to H</p> <p>banding at 90° to H</p> <p>foliation at 30° to H at approx 77.90 m in section.</p> <p>quartz vein at 90° to H</p>
<p>QUARTZITE →</p>			
<p>GRANITE: light brown, coarse grained; contains about 15% quartz, 85% kaolinitized feldspar, and minor muscovite.</p>			

REFERENCES _____

LOGGED BY _____

SHEET 2 OF 3

DRAWING N° _____

GEOLOGICAL LOG OF DRILL HOLE

PROJECT BYNOE DRILLING ASSISTANCE REMARKS _____
 HOLE N° DH 5 CO-ORDINATES _____ R.L. GROUND _____
 LOCATION _____ ANGLE FROM HORIZONTAL _____ DIRECTION _____

DESCRIPTION OF CORE	LOG	CORE RECOVERY % No	INTERPRETED LITHOLOGY	SAMPLES
metres 80 GRANITE CS 77.20 - 80.00	+++	█	++ ++ ++	
Total depth 82.35 m. 84				

REFERENCES

LOGGED BY _____

SHEET 3 OF 3

DRAWING N° _____

GEOLOGICAL LOG OF DRILL HOLE

PROJECT RYNOE DRILLING ASSISTANCE REMARKS _____
 HOLE N° DH 6 CO-ORDINATES _____ R.L. GROUND _____
 LOCATION _____ ANGLE FROM HORIZONTAL Vertical DIRECTION _____

DESCRIPTION OF CORE	LOG	CORE RECOVERY %	INTERPRETED LITHOLOGY
metres			
0 200mm of core of SANDY CLAYSTONE: contains rounded quartz sand; interpreted as carbonaceous.			Whitsonian bed.
4 SANDY CLAY: 30-40% quartz in bands in 60-70% clay; interpreted as gneiss.			
8 CLAY: 10% quartz, 90% micaceous clay; interpreted as schist.			
12 SANDY CLAY: 20-40% quartz, 60-80% micaceous clay, with minor graphite, tourmaline and chlorite.			
16			foliation 55° ten
20			foliation 60° ten
			foliation 20°-30° ten
24 CLAY →			
24 SANDY CLAY: 10-30% quartz, 70-90% partly micaceous clay; interpreted as gneiss.			
28			
32			
36 SLIGHTLY SANDY CLAY: 5-10% quartz, 80-90% micaceous clay, with minor graphite; interpreted as schist or gneiss.			
40			

REFERENCES

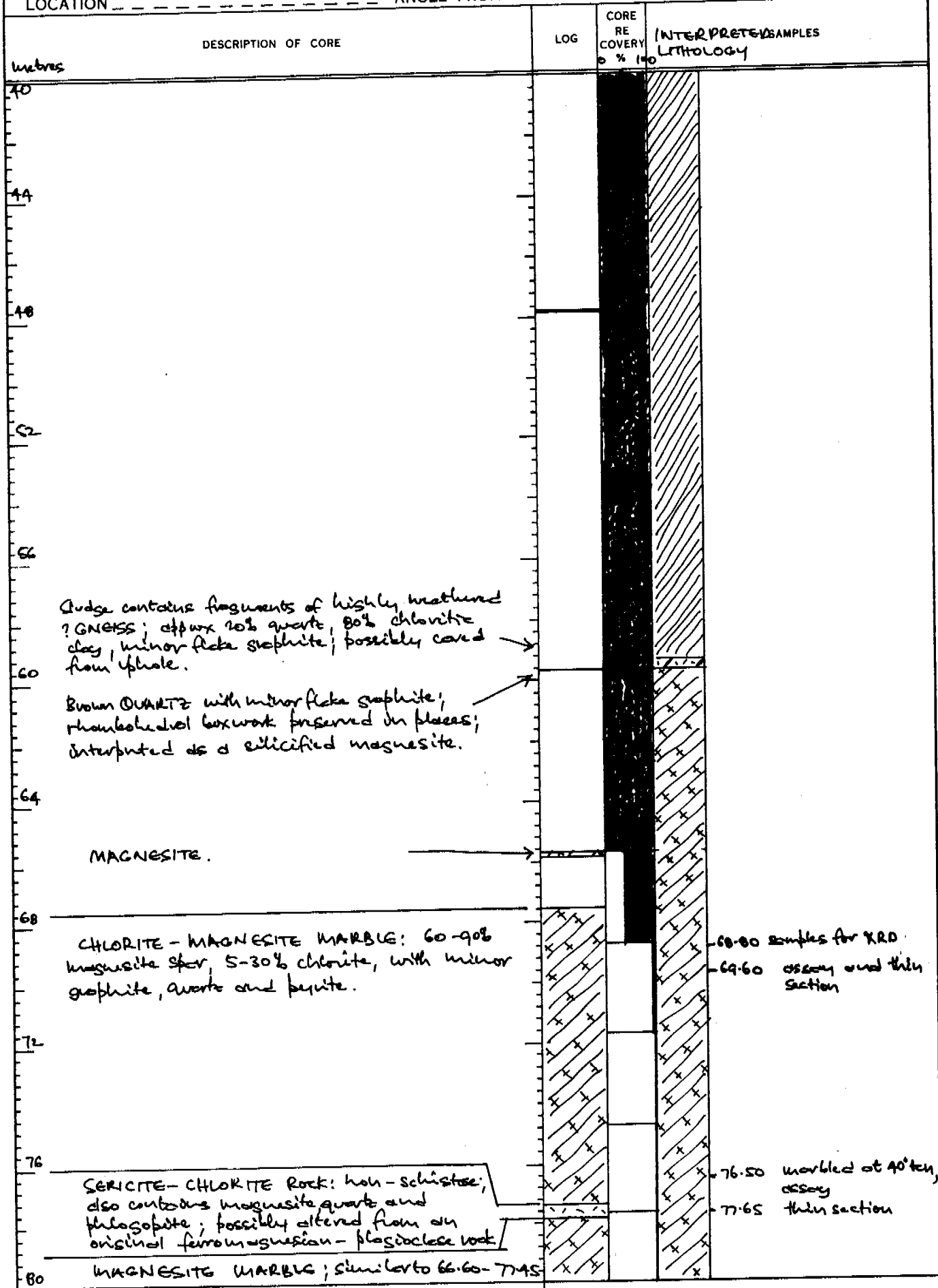
LOGGED BY G. Low

SHEET 1 OF 3

DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Byrd Drilling Assistance REMARKS _____
 HOLE No. DDFG CO-ORDINATES _____
 LOCATION _____ ANGLE FROM HORIZONTAL Vertical RL GROUND _____ DIRECTION _____



REFERENCES _____

LOGGED BY _____

SHEET 2 OF 3

DRAWING No _____

APPENDIX 2: Results of XRD analysis by AMDEL.



amdel

The Australian Mineral Development Laboratories

Flemington Street, Frewville, South Australia 5063
Phone Adelaide 79 1662, telex AA 82520



Winner of Award for Outstanding Export Achievement, 1975

Pilot Plant: Osmond Place, Thebarton, Sth. Aust.
Phone Adelaide 43 8053
Branch Offices: Perth and Sydney
Associated with: Professional Consultants Australia Pty. Ltd.
Please address all correspondence to Frewville.
In reply quote: **MP 2/5/0**

2nd May, 1977

The Chief Geologist,
Department of the Northern Territory,
PO Box 2900,
DARWIN, NT 5794.

Attention: Mr G.C. Lau

REPORT MP 3373/77

YOUR REFERENCE:

Letter MG/1/14, GCL:MD, dated
19/4/77

MATERIAL:

Two rock/mineral samples

IDENTIFICATION:

A, B.

DATE RECEIVED:

26/4/77

WORK REQUIRED:

Carbonate and chlorite
identification.

Investigation and Report by: Dr R.N. Brown

Officer-in-Charge, Mineralogy/Petrology Section: Dr K.J. Henley

K. J. Henley

for F.R. Hartley
Director

,jd

IDENTIFICATION OF THREE MINERALS

1. INTRODUCTION

Two samples were received from Mr G.C. Lau, Department of the Northern Territory, Darwin, for mineralogical examination.

The abundant colourless to pale greenish-grey carbonate in sample A, suspected of being dolomite, was to be identified, and in the same sample was a soft pale greenish phyllosilicate to be checked as a probable chlorite.

Sample B consisted of joint-filling material from the same rock, grey to greenish-grey in colour and massive in texture, also to be checked as a probable chlorite.

2. PROCEDURE

X-ray powder diffractometer traces were run of the bulk material of both A and B. A powder diffraction photograph was taken of the pale greenish phyllosilicate in A.

3. RESULTS

The carbonate in A is magnesite, and the phyllosilicate is confirmed as chlorite.

Sample B is essentially chlorite, with minor quartz, muscovite and magnesite also being recorded.