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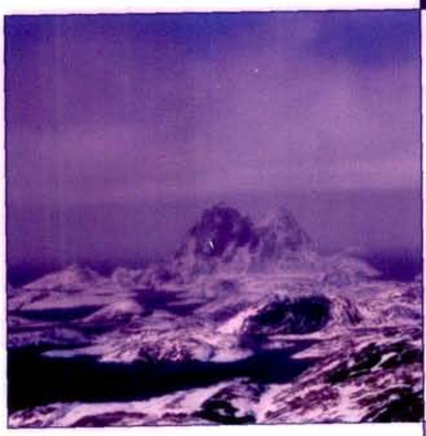

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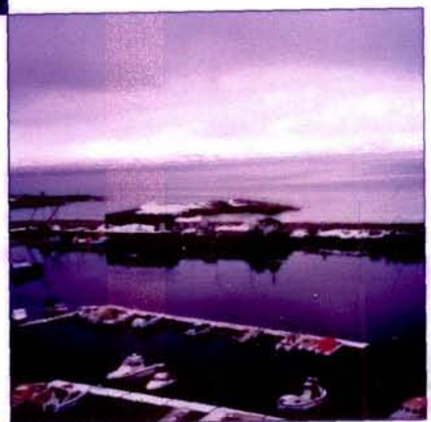
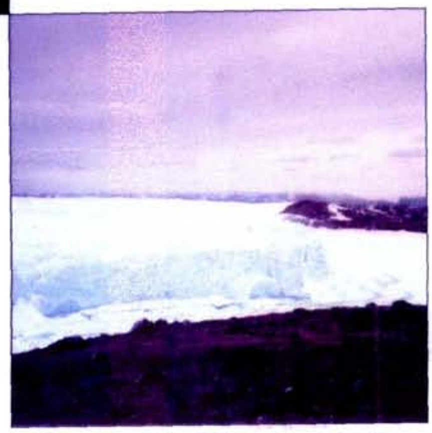
International Project, Construction & Design Management



GREENLAND NIOBIUM PROJECT

STAGE 1 FEASIBILITY REPORT (FOR COMMENT)

AUGUST 2000



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NEW MILLENNIUM RESOURCES N.L.

GREENLAND NIOBIUM PROJECT

FEASIBILITY STUDY – STAGE I REPORT

TABLE OF CONTENTS

Executive Summary

In April 2000 New Millennium Resources N. L. (NMR), on behalf of its shareholders, formally commenced Stage 1 of a feasibility study to determine the viability of a proposed Niobium Project, based on the exploration tenements at Sarfartoq and Qaqqaarsuk in South-West Greenland.

The high grade of the Sarfartoq deposit has promoted much excitement and speculation concerning the potential financial returns from a mining operation and processing facility based upon the Sarfartoq ore.

KEY ASSUMPTIONS – BASE CASE

MINE PRODUCTION	15,000 tonnes per annum @ Head Grade 11% (Nominal) Nb_2O_5	
OVERBURDEN TO ORE RATIO	Years 1 –3; Years 3+	1.50:1.00 5.50:1.00
PRODUCT	Ferro-Niobium (Standard Grade)	
PRICE	US$ 7.00 per lb 9 (Nb) US$15.43 per kg (Nb)	
CAPITAL COST	Base Case Electric Arc Furnace (EAF)	US$ xxxxx million
	Option 1 (Chemical Route) Option 2 (EAF Toll Refining)	US$ xxxxx million US$xxxxx million
OPERATING COST	US$ xxxxx per kg - Approx. (excluding depreciation)	
GEARING	Financial Model assumes 100% Equity. Gearing shown as a sensitivity	

FINANCIAL EVALUATION RESULTS

SECTION DELETED - COMMERCIAL-IN-CONFIDENCE

PROJECT OVERVIEW:

Project Brief.

- Evaluate the options and economics for a mining operation at Sarfartoq
- Maximise local content
- Minimise impacts to environment, archaeological sites and fauna & flora.
- Establish Base Case Economic Parameters.

With this brief, we have investigated all the options and arrived at the best, most economical solution. This Base Case is being presented as our recommended realisation path for this project.

Several variables exist within this Base Case. However the philosophy may not vary without impacting greatly on the economics.

Project Base Case.

The project Base Case incorporates the following :

1. **Mining and Transport are conventional (drill & blast – loader & truck)**

After investigating various options to transport ore from the mine site, and costing each option, the overall project is best served by a conventional road / truck method of transport.

Given the terrain and the range of possible weather conditions, the following options have been considered through the course of the preparation of the Stage I Report;

- Truck (articulated) – 2, 4 and 6 wheel drive
- Tundra, All-Terrain Vehicle – 6 wheel drive, low ground pressure tyres
- Snow Mobile (with and without trailer)
- Heavy Lift Helicopter
- Hovercraft
- C-130 Transport (Winter, Ice Landing Strip)
- Short Take-off and Landing Aircraft (Summer, Unsealed Landing Strip)
- Slurry Pipeline (Ore and Product transport).
- Ore Transport - Bulk (Truck)
- Ore Transport - half height 20' containers (Truck)
- Product Transport – Bulka Bags (1 tonne, 2 tonne), pallets, 20' container (Ship & Road)
- Product Transport – Drums (eg. 25 kg), pallets, 20' container (Ship & Road)
- Ship Transport (Ore) – Bulk

A comparison of transport costs for different options are presented below;

Transport Option	Tonnes/Cycle	Manning Requirements	Approx. Cost US$/tonne	Redundancy / Comments
Road/Truck	30 tonne	1.25 man / Truck	< $20.00	Excellent, 4 units
Helicopter Mi26	20 tonne	5 men / Helo	> $1,100	None / Large Fuel use
C-130 Hercules	50 tonne	4 men / Aircraft	> $500	None / Winter Operation
Slurry Pipeline	Continuous	2 men / shift	> $15	None / Maintainability of pump stations?
Caribou	25 tonne	4 men / Aircraft	> $320	None / Summer Landing Strip
Ice Road	30 tonne	2 men / Truck	> $30	Winter Operation
Snow Mobile	0.25 Tonne	1 man / Unit	Not Practical	Winter Operation. Not economic

Note: All pricing done using available rates, some detail supplied by NMR.

2. **Road built to haul ore to Augujartorfik**

After considering all options and visiting the site, we have proposed 4 road route selection options, namely A, B, C and D (refer to Figure 10.2). At this stage none has been physically surveyed. Portions of some routes have been walked on site. Route selection is based predominantly on Satellite images and photographs taken in May 2000.

It is planned to traverse these routes in late August to early September to verify the practical, environmental and archaeological significance or impact. All options traverse the plateau area between the fjord and the mine. None of the recommended options follow the river valley from the fjord.

Where possible, wildlife concentrations are avoided and overall road design grades are minimised. Naturally available materials of construction shall be used. By traversing the high ground we can, as much as possible, utilise the rock surfaces, and avoid using large amounts of fill and mechanical drainage systems.

α

3. Establishment of Plant at Augujartorfik

Given the economic constraints of rehandling any bulk materials, and the remoteness of this site, it was considered that all processing was best done as close to the mine as possible.

Manitsoq & Sisimiut were both considered as likely locations for a process facility. Both were impractical due to the added cost of multiple handling of the ore. Sea freight, road transfers and the cost of power at these sites have a substantial negative impact on project economics. Manitsoq has a 40 tonne bridge limit at the harbour road exit. In addition, the substantial cost of developing the land, wharf and other facilities, is prohibitive – assuming most of the costs would be borne directly by the project developer.

The economics and location of Qaqqaarsuk, may allow future planning to include the Manitsoq location.

Tailings storage and handling was another major consideration in both communities.

The form that tailings take has yet to be defined. This will not be fully known until all test work is complete.

Should Electric Arc Furnace tests prove successful, the tailings will be in the form of an impervious glass slag.

The project capital cost has been based upon a modular / pre-assembly design for construction and site erection (in order to minimise site construction man-hours). An added benefit of minimising site erection duration is to minimise construction site impacts on the environment. Site restoration after cessation of operations was also a prime consideration in considering modular / pre-assembly type construction, where possible.

4. Marine Facility

It is proposed that a small marine handling facility be constructed near the plant site, on the western shore of the Fjord.

This would consist of a lay down area with a road back to the plant.

Product can be shipped at the end of each operating season in containers, and fuel and other major consumables can be supplied during regular resupply from Kangerlussuaq.

Perishable resupply and parts etc., shall be operated on a regular daily commute by hovercraft from Kangerlussuaq. These craft would also serve as crew change and emergency transport, as they are relatively immune to weather conditions.

Two craft would be required for security of operations. The craft selected for the Stage I Feasibility Study is a 12 seater. Operations could also extend to winter, in a site caretaker role. A frozen Fjord would not limit their capability. With radar, GPS and radio systems, their role could be extended to the community of Kangerlussuaq .

5. **Local Involvement**

A staged training programme is envisaged as part of the commissioning and pre-start operations. Construction, commissioning and vendor support would require experienced personnel .

Kangerlussuaq, being the resupply base, would also require local hiring to maintain operations. Head office may also be in Kangerlussuaq, or at least an operations centre. Every effort will be made to maximise local content, local contractors and suppliers will be sourced at every opportunity.

The next phase of operations will be an extensive drilling programme at Sarfartoq and at Qaqqaarsuk. This will also employ local labour, and require local support.

Plant construction and road construction will also require personnel. However, with early design indicating a small facility, a large labour force is not envisaged. Approximately 30/40 people will be required at the peak of construction.

STAGE I FEASIBILITY STUDY CONCLUSIONS

- The Stage I Feasibility Study results indicate the project is robust to adverse changes in capital and operating costs, as well as sales revenue impacts.
- The Geological resources need further drilling to increase the tonnage of Proven and Measured Reserves.
- The Sarfartoq deposit requires drilling of 8-10 deep (150 metre) holes to confirm high grade deposit configuration to depth.
- Other high grade anomalies found from recent aerial survey work require drilling as soon as possible.
- Initiate environmental, archaeological and mine site access road surveys this summer (2000) period.

1

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INDICES 1–20
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Made in Norway

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Section 1 Introduction

In April 2000 New Millennium Resources N. L. (NMR), on behalf of its shareholders, formally engaged Van Der Meer Consulting (VDM) to commence Stage 1 of a Feasibility Study to determine the viability of a proposed Niobium Project, based on the exploration tenements at Sarfartoq and Qaqqaarsuk in South-West Greenland. General location information for Greenland and proposed project site locations are depicted in **Figures 1.1** and **1.2.**

The high grade of the deposit has promoted much excitement and speculation concerning the potential financial returns from a mining operation and processing facility based upon the Sarfartoq ore.

In addition to the high grade deposit at Sarfartoq, NMR. has the exploration rights to a very significant tonnage of indicated niobium bearing ore at Qaqqaarsuk – also in South-West Greenland.

The purpose of this process is to collate all currently available information, including information generated both during the course of the Study investigations and information accumulated over the past 3 years of exploration in Greenland. A sufficient level of information is now available to enable a logistical and financial evaluation of the project.

NMR has, over recent years, been delineating a Niobium Deposit on the west coast of Greenland. An overview of drilling and assay information is discussed in Section **3.0.**

Measured and Indicated resources suggest a commercially viable project is now possible.

This Stage 1 Feasibility Study delineates and investigates the following major issues in the course of demonstrating the commercial viability of the Sarfartoq and Qaqqaarsuk Niobium deposits: -

- Project review
- Plant Plot plan options
- Process plant design criteria
- Process plant configuration and description
- Infrastructure, services and logistics
- Long lead procurement plan
- Project implementation plan
- Capital cost estimate
- Operating cost estimate
- Financial modeling and analysis
- Project risks
- Test work

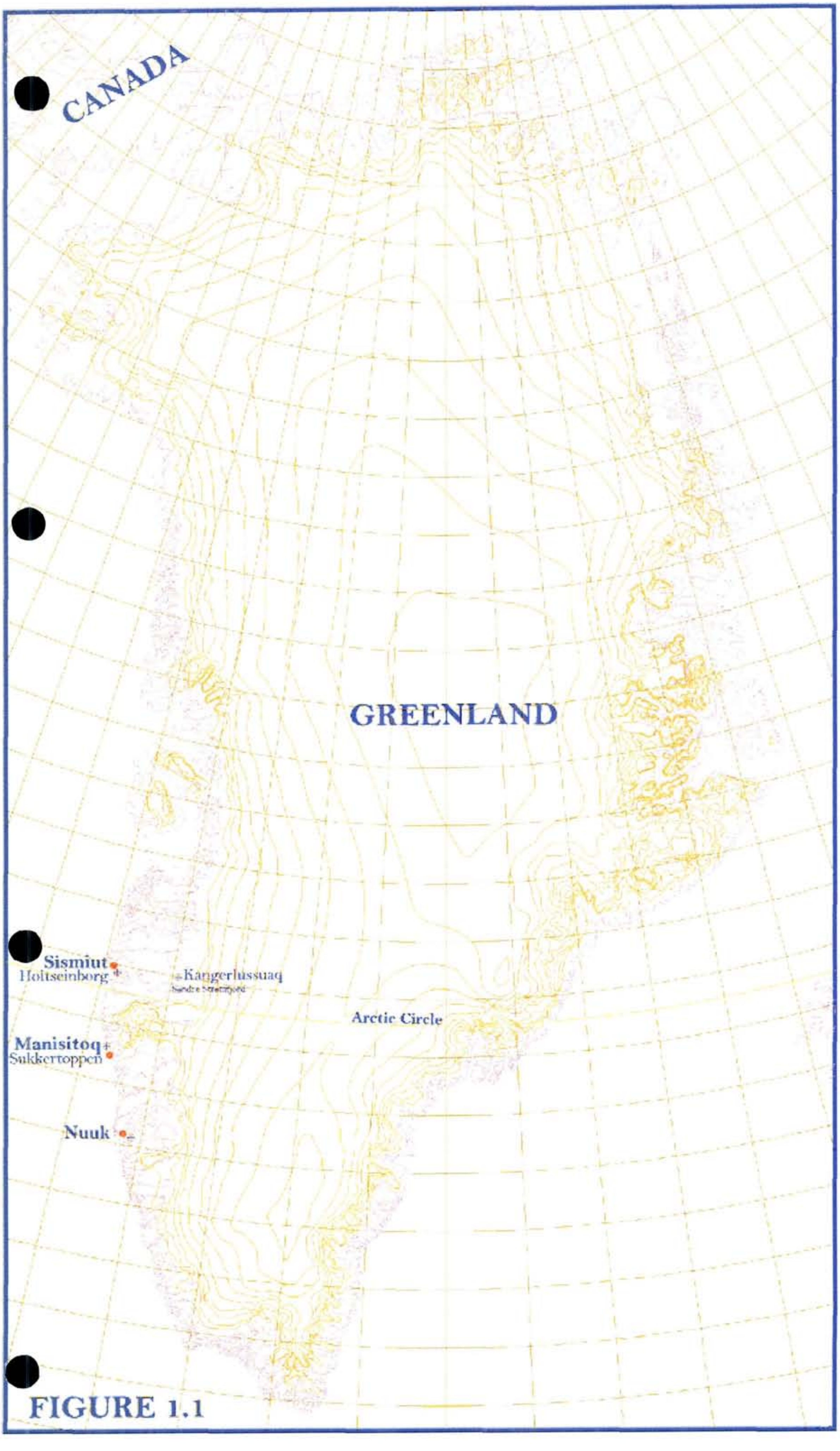

FIGURE 1.1

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NEW MILLENNIUM RESOURCES N.L.

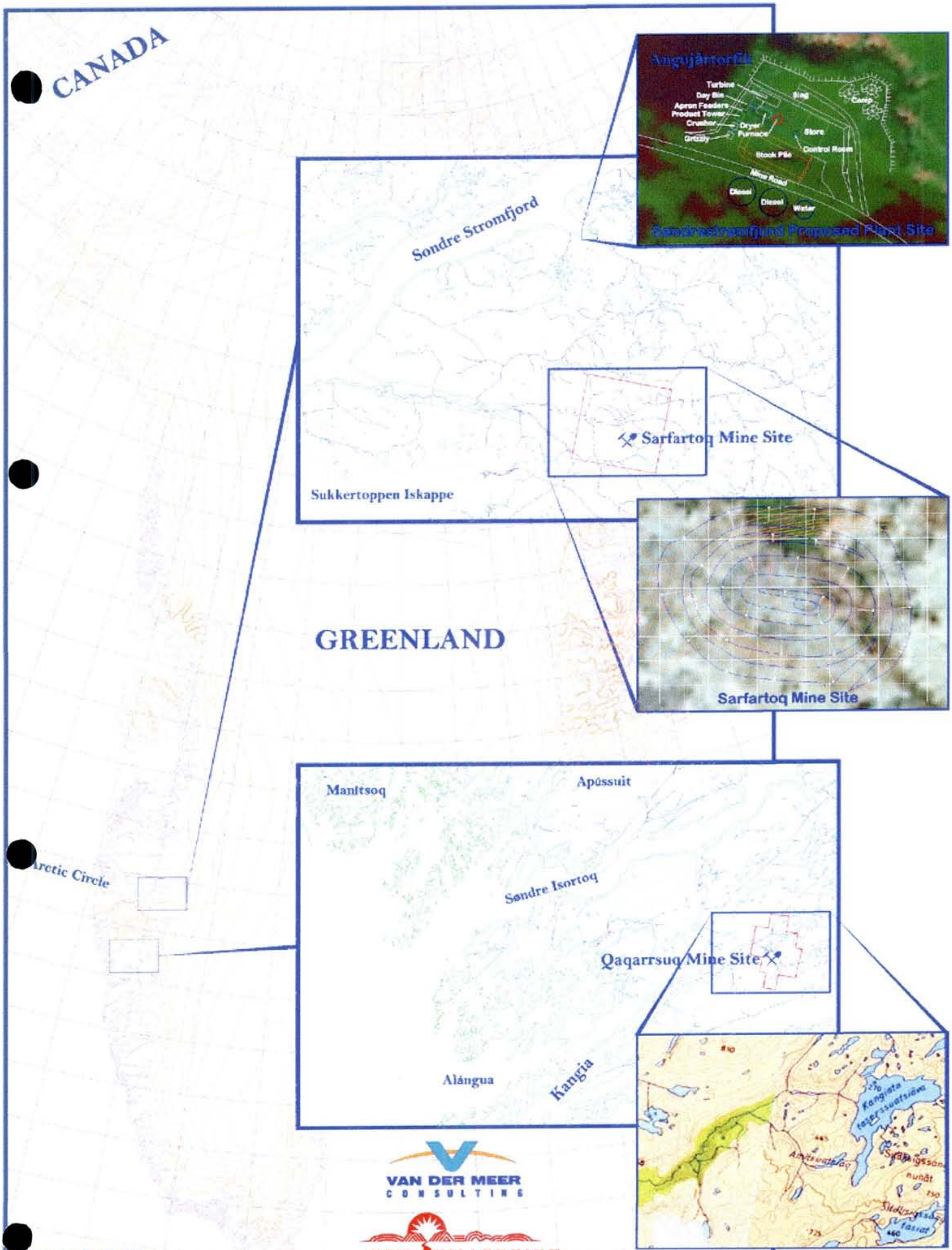


FIGURE 1.2

DWG:NMR-PR02 20th July 2000

2

SARFARTOQ ORE BODY

This ore body was first detected as a result of airborne radiometric investigation carried out by the Greenland Geological Survey Group in 1975-76. **Figure 2.1** depicts results of a full structural interpretation of satellite imagery. It also depicts spectral reflectance anomalies. Eleven (11) circular target zones and major lineaments are also shown. The Sarfartoq tenement boundary is also shown.

It was discovered that a 100 km² carbonitite complex existed in outcrops south west of Kangerlussuaq, (Sondre Stromfjord). A detailed survey was carried out to map and evaluate the area's economic potential.

At least 2 private evaluations (Hecla & NMR) have been carried out on this project. The results of these investigations, and the cores and data accumulated, show potential for a commercially viable Niobium Mine.

The challenge facing NMR is to extract, transport and process this ore body, whilst working in environmentally sensitive areas, in a potentially hostile climate with short operating seasons.

Current work in progress with airborne radiometrics, magnetics and digital ground mapping will further delineate the resource and future targets for explanation and drilling to extend the reserves in this area, and improve overall project economics.

It is envisaged that ore will be mined (initially) by open-cut methods and transported approximately 35 kms to "Augujartorfik" (Fjord) to be processed there, or shipped to the nearest available suitable port / infrastructure facility to be processed to a saleable product (ie. Ferro-Niobium).

QAQQAARSUK DEPOSIT

This deposit has limited available history. However, records of the previous exploration have just been made available to NMR and are currently being evaluated.

Once again this is a carbonitite complex of considerable size. Extensive drilling has been carried out in past years (excess of 200 holes). Further investigation, evaluation and documentation are in progress to add this ore body to the overall project reserves.

Qaqqaarsuk is approximately 150 kms south-west of the Sarfartoq deposit. **Figure 2.2** is a satellite image of this area, with the Qaqqaarsuk tenement boundary shown.

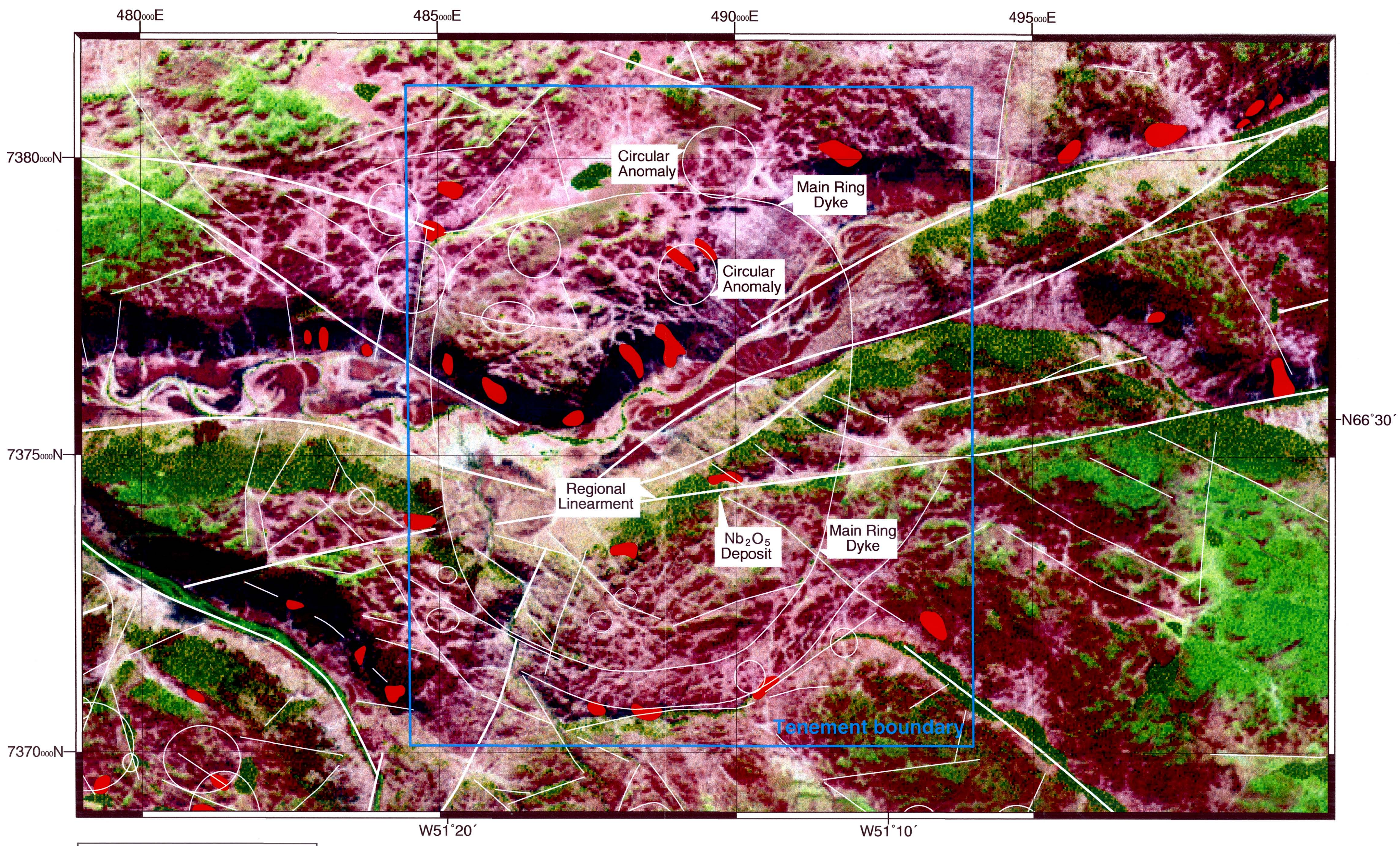
It is envisaged that Qaqqaarsuk will be developed from the cash flow of "Sarfartoq" and will be mined, transported and processed in much the same manner. However, being of a lesser grade, additional upgrading shall be required.

Test work will be programmed to give the earliest indication of an appropriate method of extraction.

The drilling programme for Summer of 2001 is currently being defined. The primary objective is a well organised programme, on identified targets, tied into existing holes to maximise the value of the drilling results in terms of measured reserves.

Development of both Niobium deposits will maximise the net present value of the overall project development.

Figure 2.3 and **2.4** illustrate the latest aerial survey data, collected in recent weeks. They also highlight the geological structure of Sarfartoq and Qaqqaarsuk respectively.



LEGEND

Circular Target Zones

Major Lineaments

Spectral Reflectance Anomalies

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SARFARTOQ NIOBIUM PROJECT - GREENLAND

LANDSAT 7 ETM+ DATA - RATIOED BANDS 5/7 4/7 4/2
STRUCTURAL INTERPRETATION AND SPECTRAL REFLECTANCE ANOMALIES

SCENE 008/013

Captured on 28th August 1999

0 5 10
Kilometers

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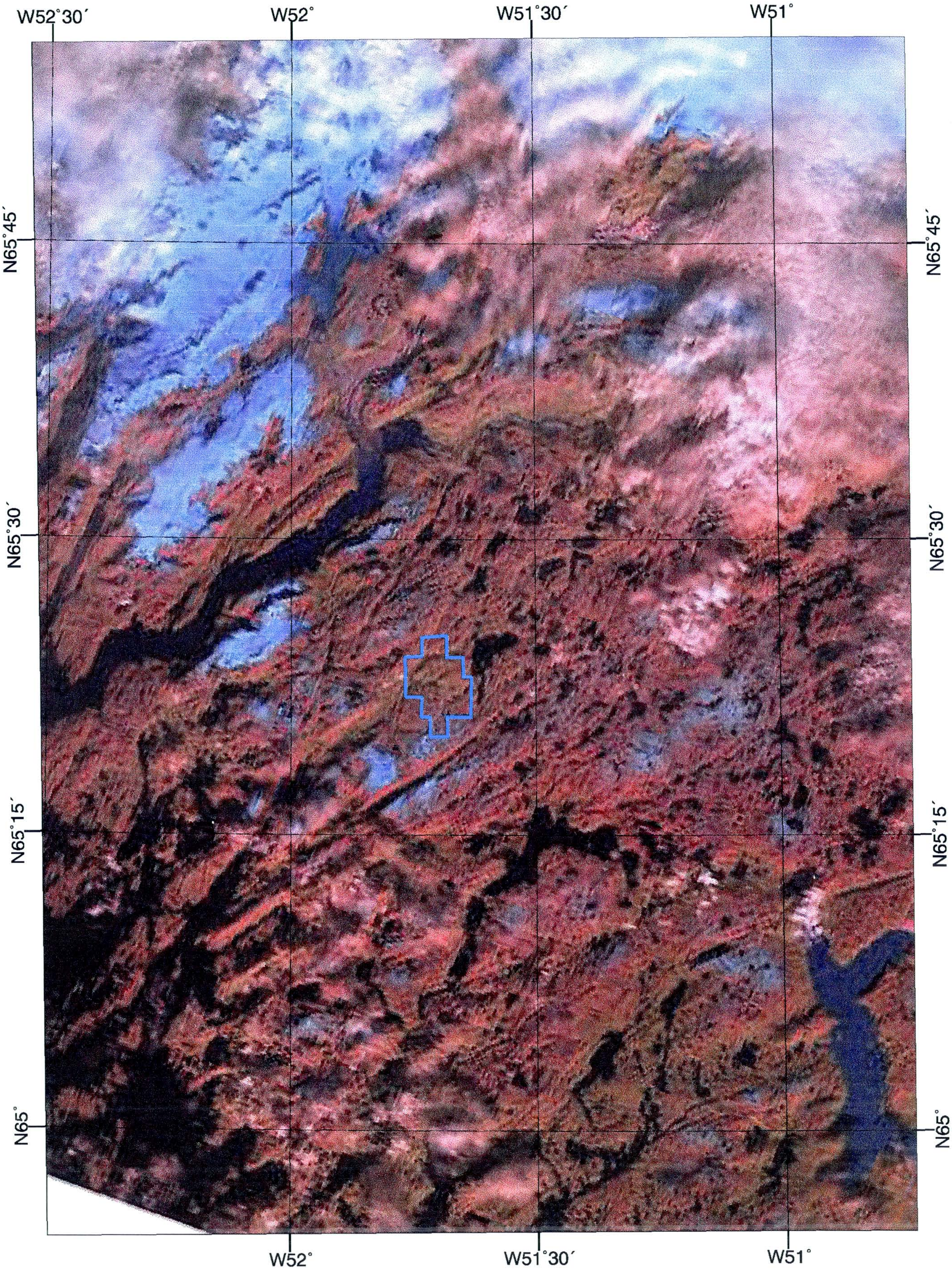
June 2000

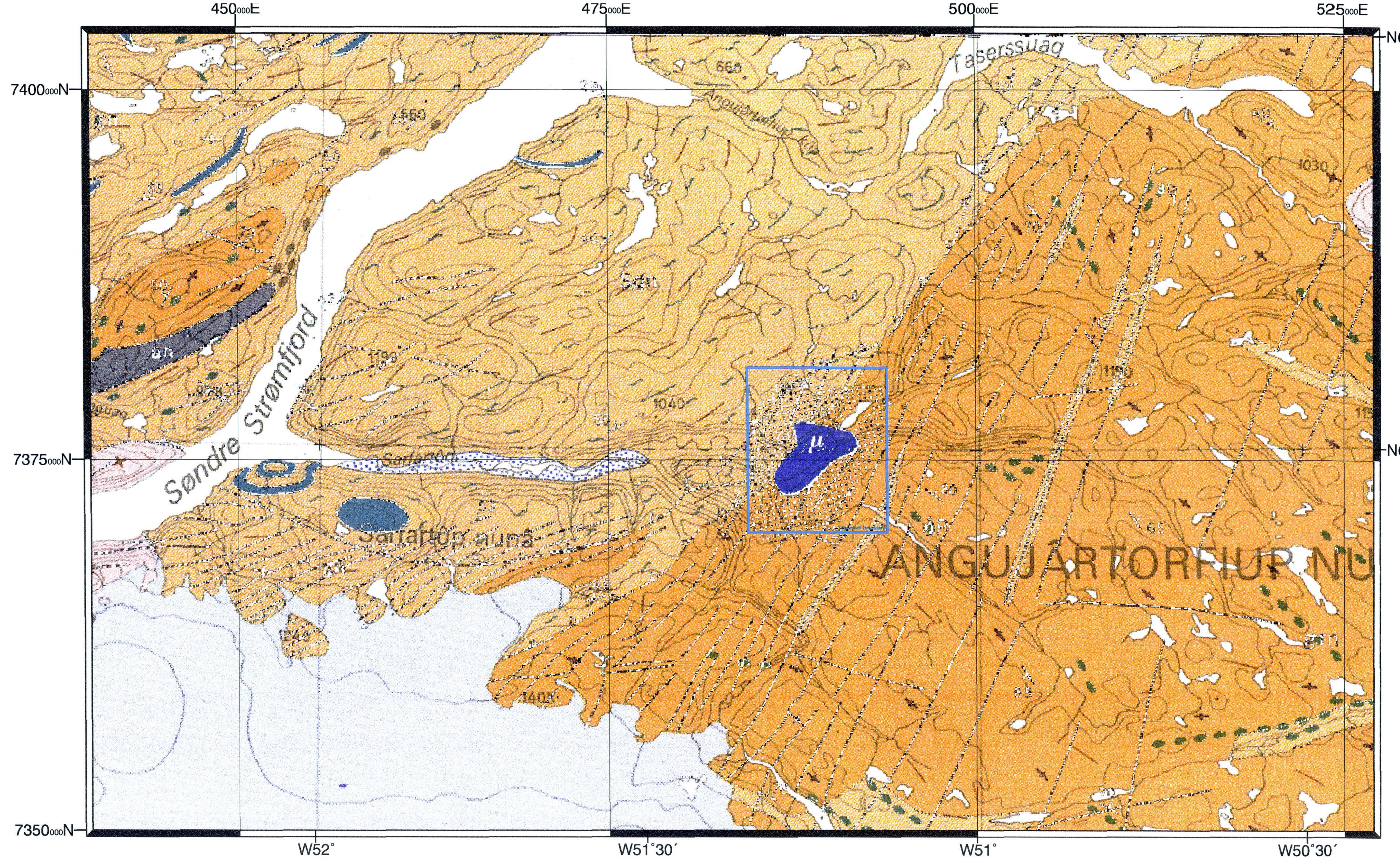
Figure 2.1



QAQARSSUK - WEST GREENLAND
LANDSAT 7 ETM+
SCENE 07/14 (September 1999)
Tenement Area

0 25 50
Kilometers

Figure 2.2



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SARFARTOQ NIOBIUM PROJECT - GREENLAND

REGIONAL GEOLOGY
taken from
FREDERIKSHABISBLINK GEOLOGICAL 1:500,000 MAP

0 5 10 15 20 25
Kilometers

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Email admin@earthscan.com.au
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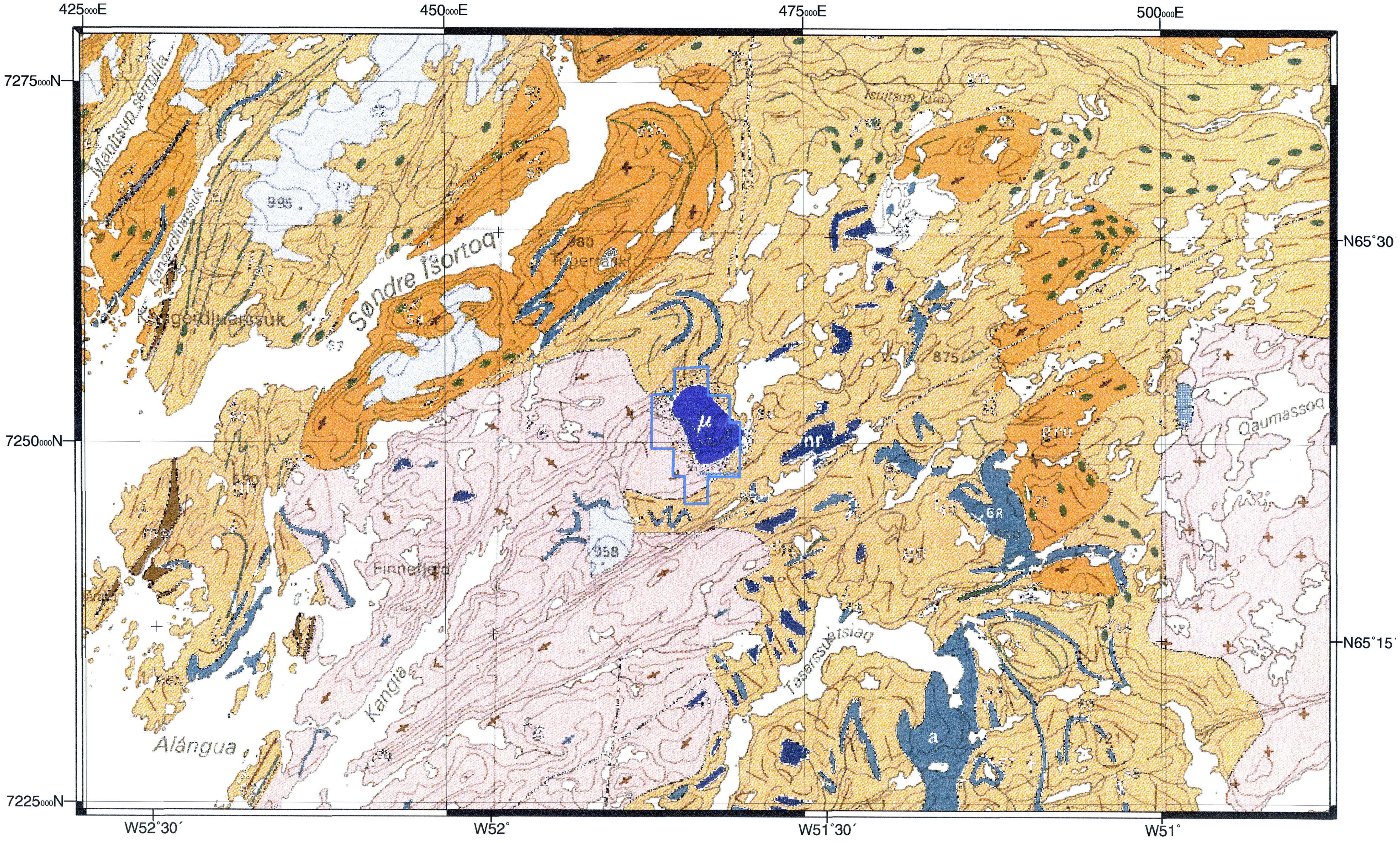
July 2000

Figure 2.3



NEW MILLENNIUM RESOURCES N.L.

QAQARSSUK PROJECT - WESTERN GREENLAND

REGIONAL GEOLOGY
taken from
FREDERIKSHABISBLINK GEOLOGICAL 1:500,000 MAP

0 5 10 15 20 25
Kilometers

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July 2000

Figure 2.4

3

Much of the following information is extracted directly from an independent report prepared by Mr. Al Maynard, Al Maynard & Associates [1].

3.1 Overview

The Exploration Licence ("EL") 25/69 covers 104 km² and is located at Sarfartoq in Western Greenland and centred at longitude 51° 14' west and latitude 66° 30' north. The area is serviced from the Kangerlussuaq air base 90 kilometres to the north-east.

The project area falls on the far north of the Frederikshab Isblink Sondre Stromfjord 1:500,000 scale geological series map – refer to **Figure 2.3** and **2.4**). The EL will be effective until December 31, 2000 and grants exclusive mineral rights to the holder (except hydrocarbons) by the Minister for the Environment and Energy under The Greenland Mineral Resources Act (as amended) Standard Terms.

This ground contains a high grade niobium resource hosted by the Phanerozoic Sarfartoq carbonatite complex. Rare earth elements ("REE") are present in highly anomalous concentrations. Potential also exists for diamond occurrence. Recent diamond drilling by NMR has enabled an upgrade of the previous resource estimate for the niobium deposit.

3.2 Sarfartoq Deposit

The Sarfartoq carbonatite complex intruded the Archaean amphibolite to granulite facies gneiss complex along the transition zone with the Proterozoic Nagssugtoqidian mobile belt to the north-west - refer to **Figure 2.3** and **2.4**

The Archaean gneisses that host the Sarfartoq complex are granitic to granodioritic in composition. The gneisses are cut by a swarm of undeformed diabase dykes (Kangamiut dykes) that have Rb/Sr ages in the range of 1900 to 2300 Ma. Many of these dykes are several kilometres in length and fairly closely spaced, representing at least 5% expansion of the basement complex.

These dykes may represent injection of rift related basaltic magmas during NW-SE extensional tectonics.

The NNE-trending dykes appear to be the dominant extension. The subordinate ENE shear zones are not laterally extensive because they probably represent only local compressional adjustment to the overall extensional regime. There is good field evidence for local synkinematic emplacement of diabase dykes within and adjacent to these shear zones – refer to **Figures 3.2** and **3.3.**

The niobium (pyrochlore) mineralisation is associated with fenitisation along portion of one of a series of ring dykes enclosing the central carbonatite intrusion. There are more than 100 kilometres of dyke structures within the EL that have yet to be systematically explored.

3.2.1 Resource Information

In the Measured Resource category (under the Australian Joint Ore Reserves Committee - JORC - Code for resource reporting as provided by the AIG and the AusIMM) the current estimate is 35,000 tonnes at a grade of 7.9% Nb (=10.6% Nb_2O_5) using a lower cut-off grade of 5% Nb.

This Measured Resource is contained within a larger Indicated Resource of 186,000 tonnes at 3.2% Nb (= 4.6% Nb_2O_5). The preliminary open-pit plan for the near surface part of this resource (49,000 tonnes) shows a waste to ore ratio of 4.5:1 using a lower cut-off grade of 1% Nb. The current Nb_2O_5 price is US$3.00 per pound which converts to approximately US$66 per 1% Nb_2O_5 per tonne.

It is considered that the potential for further discovery of niobium within the Exploration Licence is very high for deposits of similar (replacement) style, and also high for additional economic primary mineralisation (syn-tectonic style) to be outlined within the carbonatite core.

An overview of analytical report / assay information for bulk sample material from the Sarfartoq deposit is provided in **Appendix 1.**

3.2.2 Further Work

Remote sensing radiometric data acquisition and interpretation is currently underway during this summer period (2000). Preliminary information from this survey work is enclosed – refer to **Figure 3.4.**

It is recommended this be followed by diamond drilling of anomalous zones. It is further recommended a number of deep holes be drilled in the existing anomaly (eg. 150 metres) to check the extent of the deposit, to depth.

3.3 Qaqqarssuk Deposit

The following information is extracted from the GEUS (Geological Survey of Denmark and Greenland) document, "Trade and Industry in Greenland, GEODATA, Geological Information [2].

"The Qaqqaarsuk carbonatite complex...east of Maniitsoq/Sukkertoppen hosts pyrochlore mineralisation. A reserve of 1,200,000 tons grading 0.8% Nb2O5 has been indicated by drilling. In addition, carbonatite veins contain up to 4% lanthanides and apatite-rich parts of the complex are estimated to contain more than 4,000,000 tons averaging 4.4% P_2O_5. Further South-West a 800 kg bulk sample from a 2.5 km long kimberlite dyke has yielded 41 diamonds of which 16 are larger than 0.5 mm".

Remote sensing radiometric data acquisition and interpretation is currently underway during this summer period (2000). Preliminary information from this survey work is enclosed – refer to **Figure 3.5.**

The Qaqqaarsuk regional topographical map is included as **Figure 3.6.**


NEW MILLENNIUM RESOURCES NL
N-S Porphyritic Dolerite
As Above but Replaced by Ore
E-W Dolerite Dyke
As Above but Replaced by Ore
Shear Zone containing Carbonatite Breccia
Carbonatite Breccia
Gn Granite and Mafic Gneiss
Pyrochlore Main Ore Body
Drill hole
H 8 Hecla holes
NM 9 New Millennium holes
H1
H2,3
NM 7,8
H8,9
H7
H11
H10
H4,5
NM10-12
NM15
NM5,6
NM 14
H6
NM9,9A
H12
H13
NM1-4
Gn
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0
10
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Metres
Compiled: GBB, Jan. 1999
PYROCHLORE OREBODY :
GEOLOGY PLUS DRILL HOLES

Figure 3.2

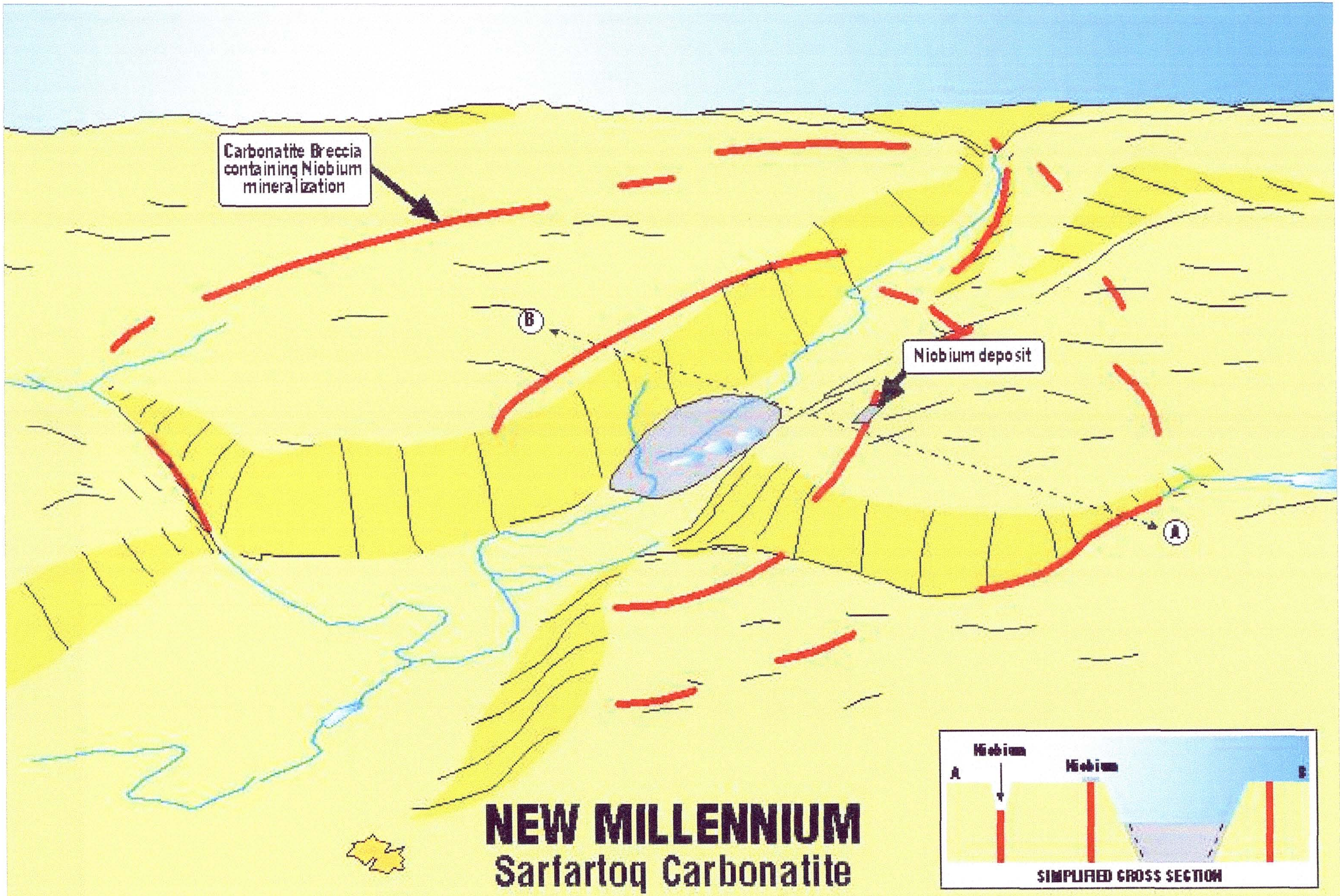
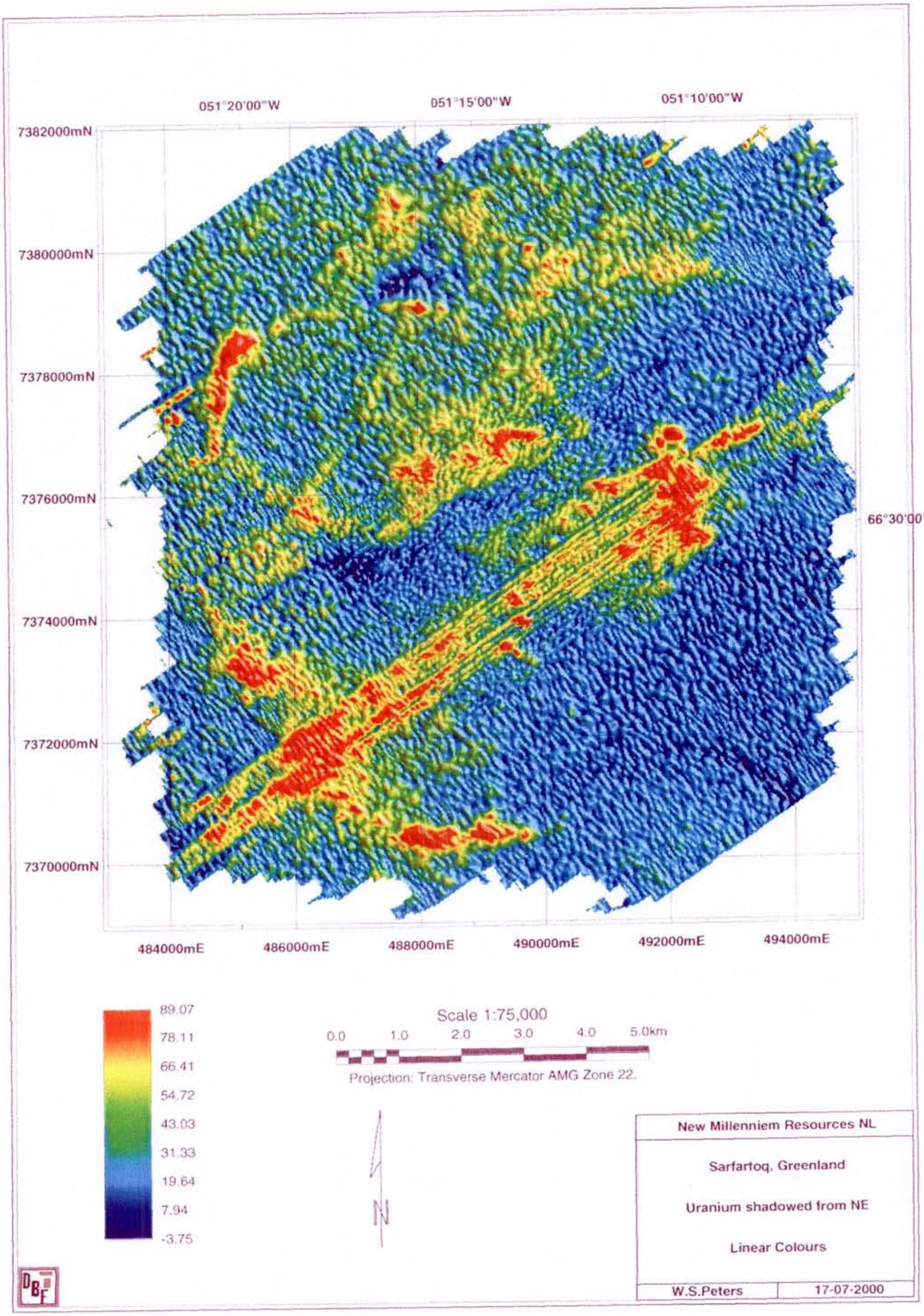

Carbonatite Breccia containing Niobium mineralization
B
Niobium deposit
A
NEW MILLENNIUM
Sarfartoq Carbonatite
Niobium
Niobium
A
B
SIMPLIFIED CROSS SECTION

Figure 3.3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66.41
54.72
43.03
31.33
19.64
7.94
-3.75
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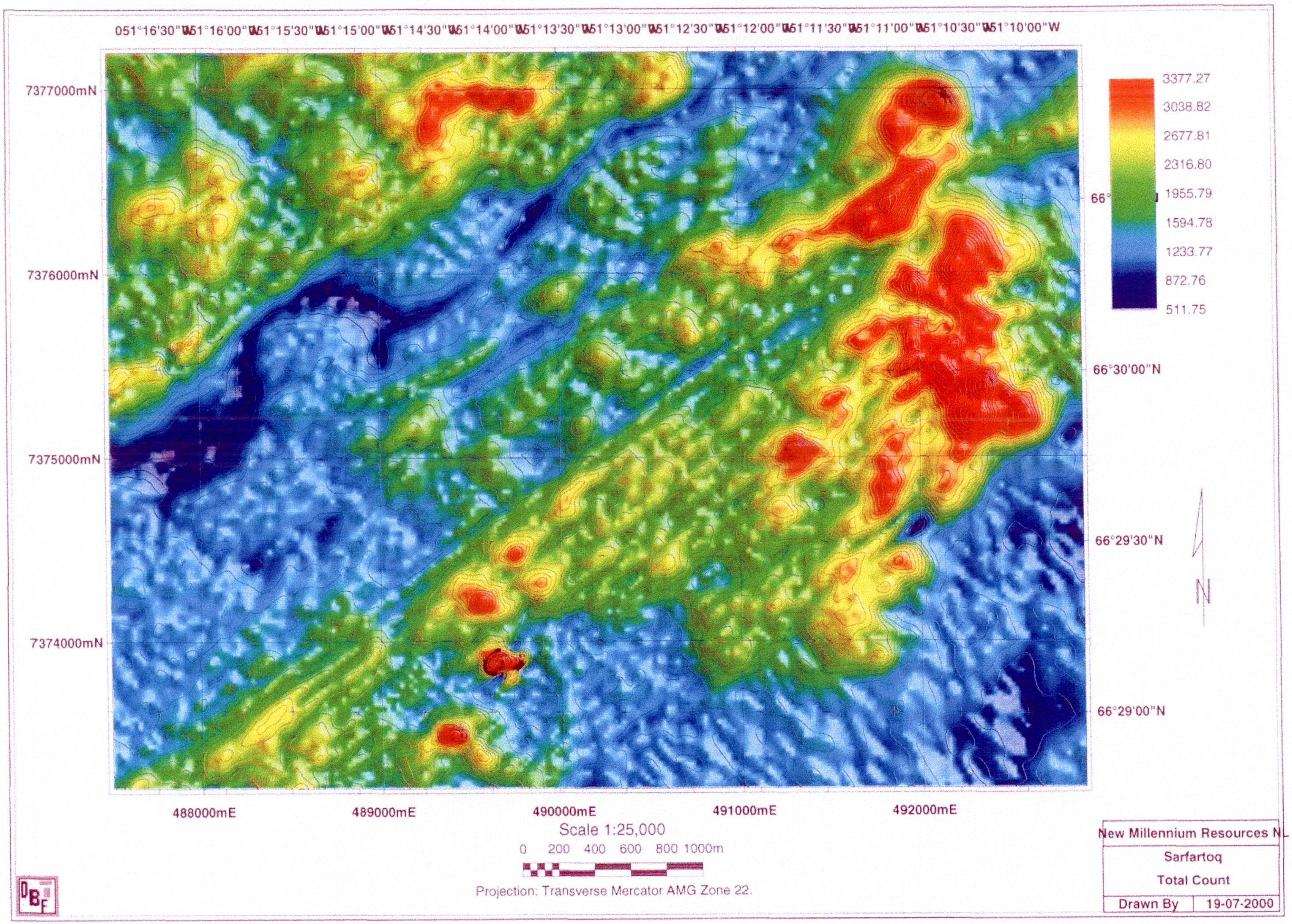
Projection: Transverse Mercator AMG Zone 22.
N
New Millenniem Resources NL
Sarfartoq, Greenland
Uranium shadowed from NE
Linear Colours
W.S.Peters
17-07-2000

Figure 3.4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511.75
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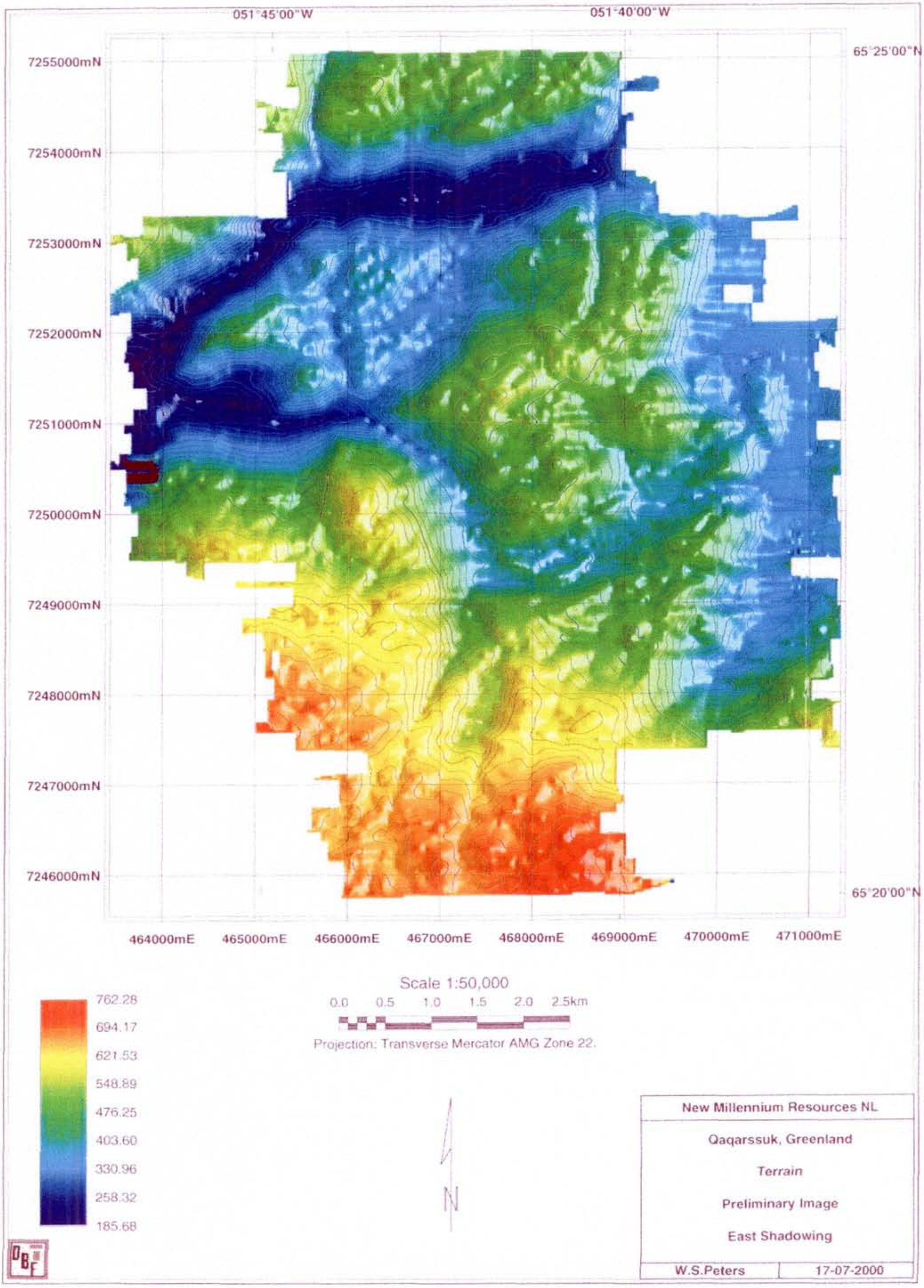
Sarfartoq
Total Count
Drawn By
19-07-2000

Figure 3.4



051°45'00"W
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65°20'00"N
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7254000mN
7253000mN
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7251000mN
7250000mN
7249000mN
7248000mN
7247000mN
7246000mN
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467000mE
468000mE
469000mE
470000mE
471000mE
Scale 1:50,000
0.0 0.5 1.0 1.5 2.0 2.5km
Projection: Transverse Mercator AMG Zone 22.
762.28
694.17
621.53
548.89
476.25
403.60
330.96
258.32
185.68
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New Millennium Resources NL
Qaqarssuk, Greenland
Terrain
Preliminary Image
East Shadowing
W.S.Peters
17-07-2000

Figure 3.2

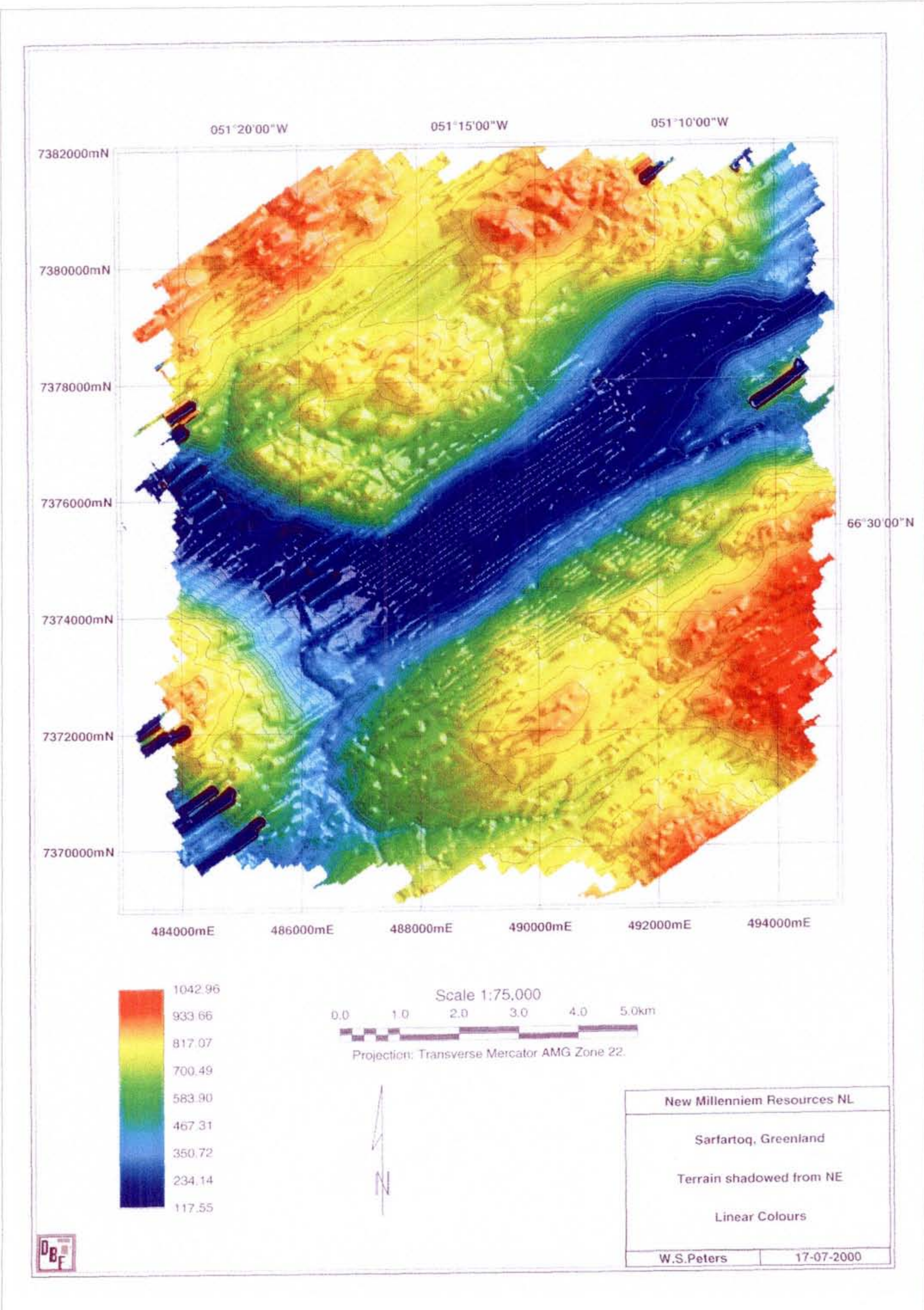
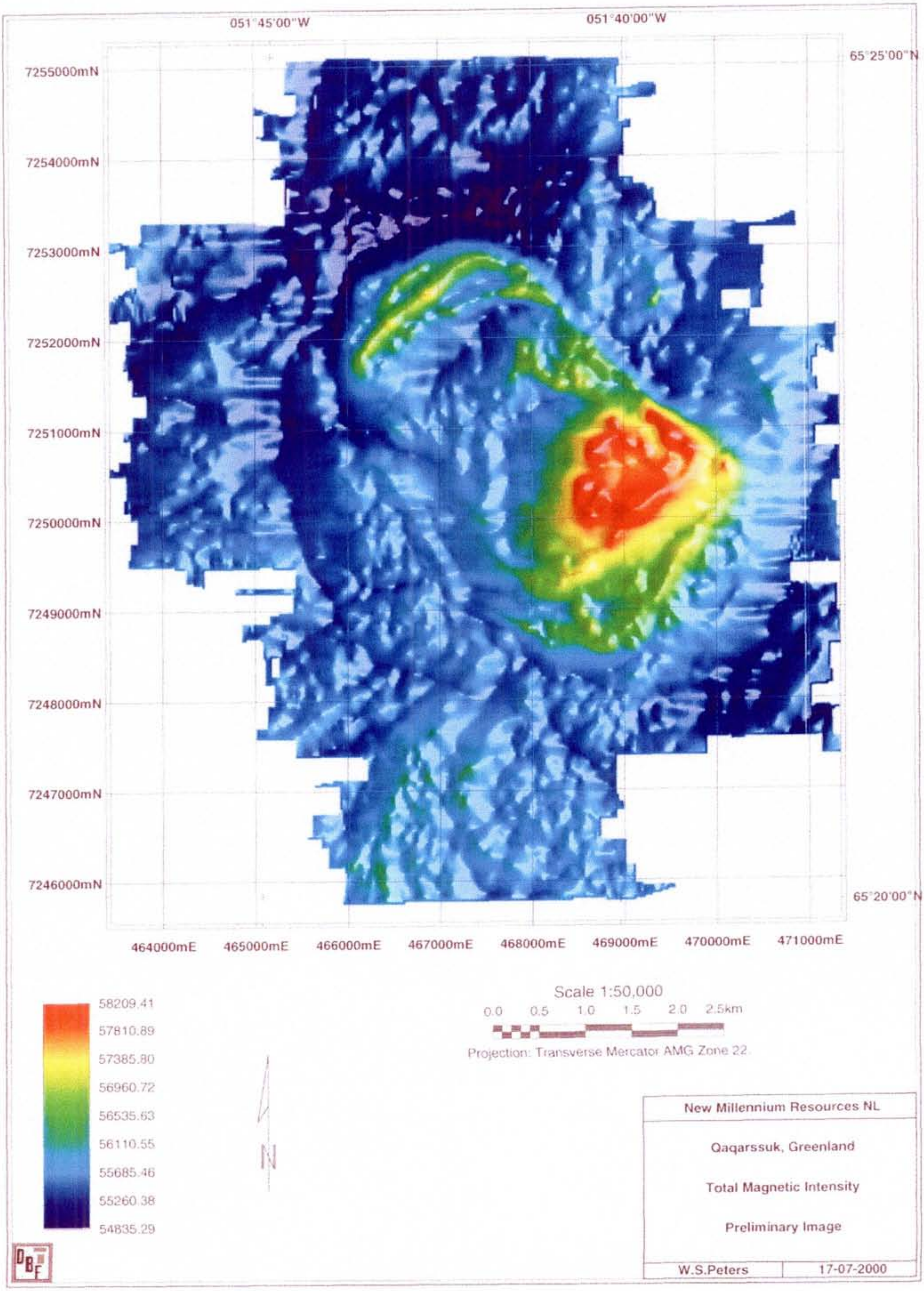

051°20'00"W
051°15'00"W
051°10'00"W
7382000mN
7380000mN
7378000mN
7376000mN
7374000mN
7372000mN
7370000mN
66°30'00"N
484000mE
486000mE
488000mE
490000mE
492000mE
494000mE
1042.96
933.66
817.07
700.49
583.90
467.31
350.72
234.14
117.55
Scale 1:75,000
0.0 1.0 2.0 3.0 4.0 5.0km
Projection: Transverse Mercator AMG Zone 22.
N
New Millenniem Resources NL
Sarfartoq, Greenland
Terrain shadowed from NE
Linear Colours
W.S.Peters
17-07-2000

Figure 3.4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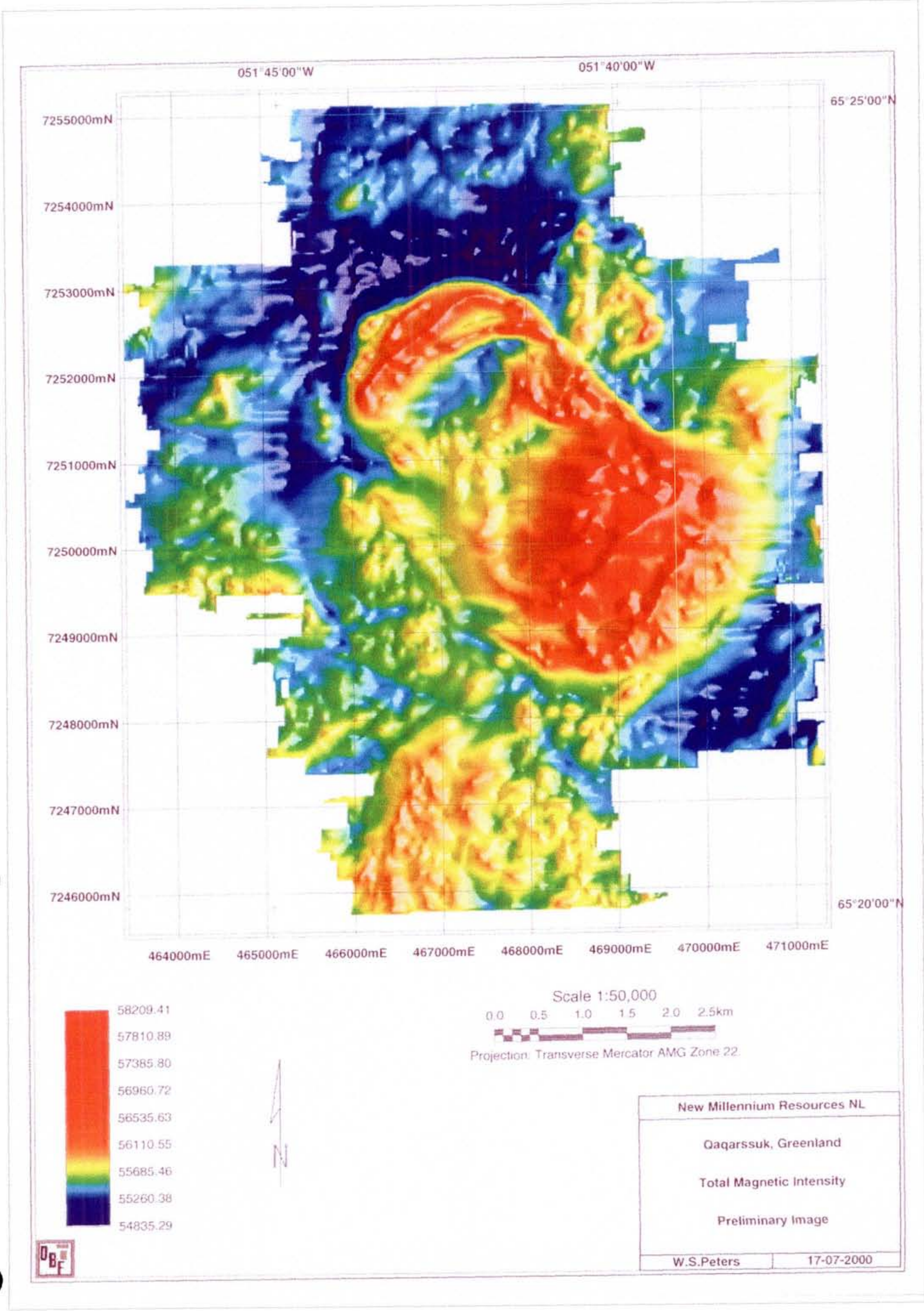
7251000mN
7250000mN
7249000mN
7248000mN
7247000mN
7246000mN
464000mE
465000mE
466000mE
467000mE
468000mE
469000mE
470000mE
471000mE
58209.41
57810.89
57385.80
56960.72
56535.63
56110.55
55685.46
55260.38
54835.29
Scale 1:50,000
0.0 0.5 1.0 1.5 2.0 2.5km
Projection: Transverse Mercator AMG Zone 22
N
New Millennium Resources NL
Qaqarssuk, Greenland
Total Magnetic Intensity
Preliminary Image
W.S.Peters
17-07-2000

Figure 3.5



051°45'00"W
051°40'00"W
65°25'00"N
65°20'00"N
7255000mN
7254000mN
7253000mN
7252000mN
7251000mN
7250000mN
7249000mN
7248000mN
7247000mN
7246000mN
464000mE
465000mE
466000mE
467000mE
468000mE
469000mE
470000mE
471000mE
Scale 1:50,000
0.0 0.5 1.0 1.5 2.0 2.5km
Projection: Transverse Mercator AMG Zone 22
58209.41
57810.89
57385.80
56960.72
56535.63
56110.55
55685.46
55260.38
54835.29
N
New Millennium Resources NL
Qaqarssuk, Greenland
Total Magnetic Intensity
Preliminary Image
W.S.Peters
17-07-2000

Figure 3.2

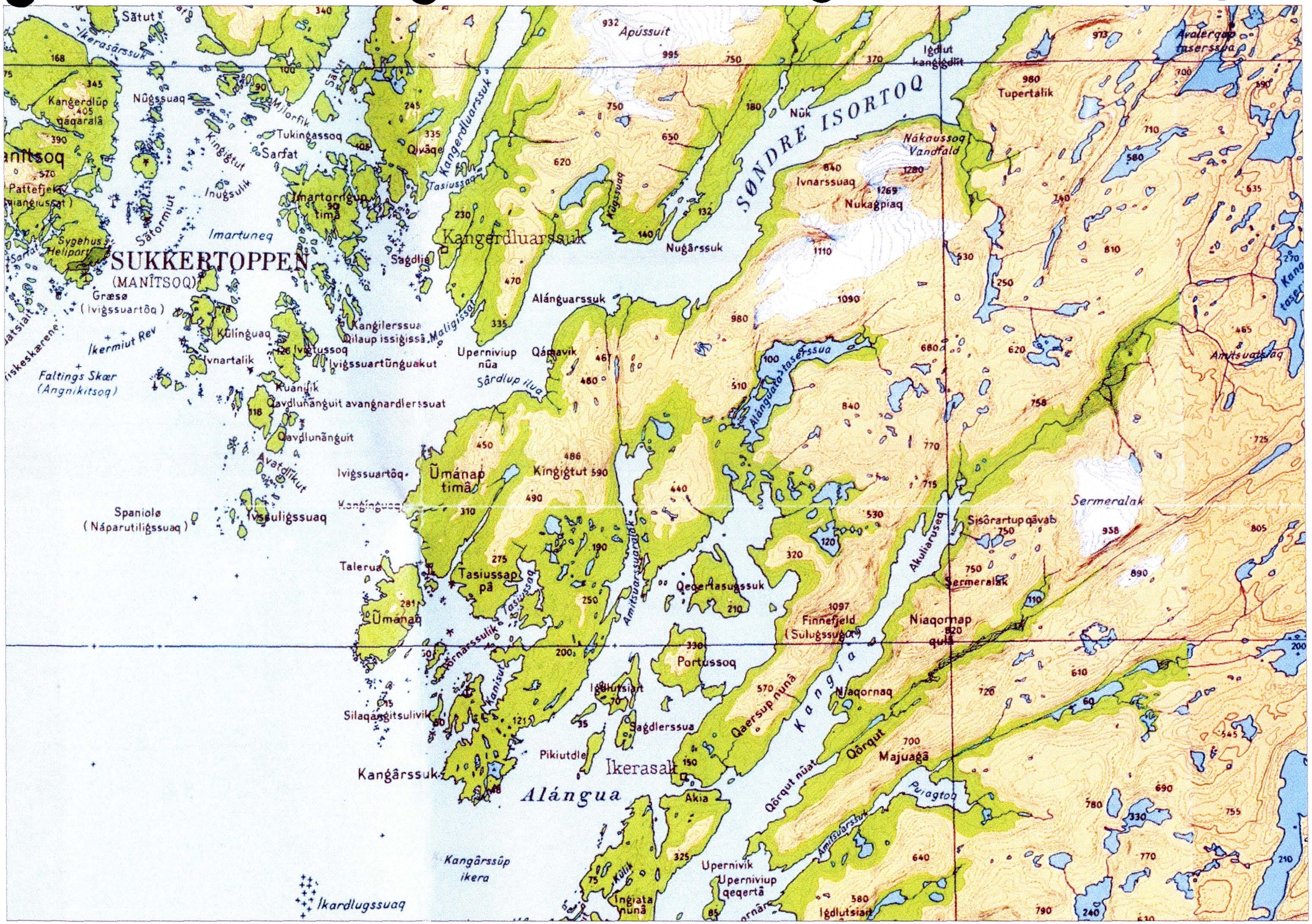

SUKKERTOPPEN
(MANÎTSOQ)
SØNDRE ISORTOQ
Kangerdluarssuk
Alángua
Ikerasak
Kangârssuk
Sâtut
Nûgssuaq
Tukingassoq
Sarfat
Imartuneq
Græsø
(Ivigssuartôq)
Kûlinguaq
Ivnartalik
Ikermiut Rev
Faltings Skær
(Angnikitsoq)
Kuanitik
Qavdlunãnguit
Iviĝssuartôq
Spaniolø
(Náparutiliĝssuaq)
Ivssuliĝssuaq
Talerua
Ûmanaq
Silaqangitsulivik
Kangârssûp ikera
Ikardlugssuaq
Ûmánap timâ
Kingigtut
Tasiussap pâ
Uperniviup nûa
Sârdlup ilua
Qámavik
Alánguarssuk
Nugârssuk
Apússuit
Nûk
Igdlut kangigdlît
Tupertalik
Ivnarssuaq
Nukagpiaq
Nákaussoq Vandfald
Alánguata taserssua
Qeqertasugssuk
Portussoq
Igdlutsiait
Sagdlerssua
Pikiutdleq
Akia
Finnefjeld
(Sulugssugut)
Niaqornaq
Niaqornap quia
Qârsup nunâ
Kangia
Akuliaruseq
Sermeralak
Sisôrartup qâvat
Qôrqut
Qôrqut nûat
Majuagâ
Puiagtoq
Amitsuarssuk
Upernivik
Uperniviup qeqertâ
Igdlutsiait
Ingiata nunâ
Amitsuatsiaq
Avalerqap taserssua

Figure 3.6

4.1 Overview

Sarfartoq valley has been the focus of several environmental studies since 1988, when exploration became active in the area. At that time the study involved investigation of a transport corridor to Sondre Stromfjord from the current area of interest.

This previous road route involved a distance of nearly 50 kms and 2 different routes were investigated **[Refer to reference document 3]** - see **Figure 4.1**. Three major technical groups were involved in this earlier work: -

- THE GREENLAND ENVIRONMENTAL RESEARCH INSTITUTE
- GREENLAND TECHNICAL ORGANISATION
- ARCHAEOLOGY - THE GREENLAND MUSEUM

The groups identified and mapped 252 single archaeological structures, dispensed on 65 locations. Five (5) of these were well known, while 60 were new finds. Of the new finds, 49 were regarded as preserved relics of the past, while 11 have traces of human activity that does not merit being left undisturbed – refer to **Figure 4.2**.

Musk ox and caribou were noted in the valley and comments also noted migrating trout in the stream on the valley floor.

Major conclusions were as follows:

"- Overall there is on the basis of the investigations carried out nothing prohibiting establishment of the proposed transportation corridors.

- Opening up the area gives the potential of more people visiting the area. This may mean a substantial risk of disturbance and potential destruction to valuable and vulnerable localities of biological and archaeological interest. With regulations on traffic and staying in the area, the problems are likely to be overcome.

- The proposals for corridors are feasible and the freedom in detail tracing of road / track generally is sufficient to consider areas of biological importance and special localities of archaeological interest.

- If demands to developed embarkation facilities are made a location in the bottom of Angujaartorfik technically is preferable. If the concept is unloading/loading of ship at anchor in the bay there is no immediate preference between the two proposals from a technical point of view".

A technical / economical comparison of the two proposals at this level of details is not likely to show a clear difference.

The Tatsip Ataa altemative biological is preferable as to the Angujaartorfik altemative will be placed in one of the biological important areas.

Archaeologically a corridor to Tatsip Ataa seems to imply much further conflicts than the altemative to Angujaartorfik.

In case of substantial coincides between the transportation corridor and archaeological localities the necessary archaeological investigations must be expected to be rather time consuming and costly."

"Prior to a final laying down of a transportation corridor in the terrain it will be necessary with further investigations of detailed areas including soundings at the embarkation locality. These investigations should be carried out in close co-operation between KNK, GM and GTO in order to consider environmental and archaeological interests in a technically sound solution."

4.2 Environmental Impact Statement (EIS)

A baseline (NMR) environmental study was done in 1998 [4]. A second study is programmed for August / September 2000.

Other studies carried-out during this period include; monitoring of particulate fall-out from drilling operations [5], and monitoring of radioactive levels in the ore [6].

Planning is needed to prepare a document for the approval of the BMP in Greenland. This document will identify proposed transport corridors and give a description of NMR proposed method of operation.

It is recommended that road selection routes / survey are carried out immediately and archaeological approval be sought at the same time.

4.2.1 Fauna

The area is populated by the following wildlife:-[14]

- CARIBOU
- MUSKOXEN
- PTARMIGANS
- ARCTIC FOX
- ARCTIC HARE
- ARCTIC CHAR (TROUT)
- VARIOUS BIRDS

It is not expected that the mining / transport of ore or processing facilities will have any great effect on the fauna of this area. Noise impacts due to blasting required for road construction possibly poses the major source of disturbance. Studies conducted in late 1987 reached the same conclusion [7].

4.2.2 Flora

A baseline study has been done [4] and a second one will be conducted in August / September 2000.

Dust and water leaching from stockpiles and tailings containment pose the major impact sources. Studies are required to delineate these possible risks.

There is some flexibility in road route selection to avoid any critical areas. However, road construction is also an impact consideration.

4.2.3 Archaeology

A major study was carried out in late 1987, by the Greenland Museum [3] and they identified all sites of significance (252 in total).

The current proposal recommends road route options which all traverse from the mine site location directly across the top of the hills adjoining Sarraftoq Valley to the fjord at Angujaartorfik. Other than crossing the valley floor, none of the proposed routes follow the valley floor route (as considered by others in previous studies).

However, only part of this route has been surveyed for sites of significance, hence in August / September 2000 when the environmental survey and route selection are done, it is recommended that all archaeological sites along the proposed route be surveyed – refer to **Figure 4.3**

4.2.4 Project Emissions

Good engineering practise shall be followed to minimise project impacts (eg. air emissions, noise and water, etc.) on the surrounding environment. Best-in-class technology shall be used wherever possible.

An ongoing monitoring programme for project emissions shall be a key component of the project Environment Management Plan (EMP). The EMP shall be developed during the Stage 2 Feasibility Study period.

In the early years of the project, ore extraction will be achieved by open cut mining. Depending upon the final configuration of the ore deposit, it is likely mining will convert to underground mining techniques. The underground approach itself may vary depending upon the structure of the deposit. Additional deep drilling is required to confirm this information.

Ore transport and logistics planning will also be mindful of these issues.

4.2.5 Weather

Weather data was collected at the Sarfartoq mine site during the period 30th August 1987 to 17th September 1989. Reference may be made to the report "Klimastation nr. 503, Sarfartoq 1987-1889" compiled by Gronlands Forundersogelser / Misissueqqaamerit. **[8].**

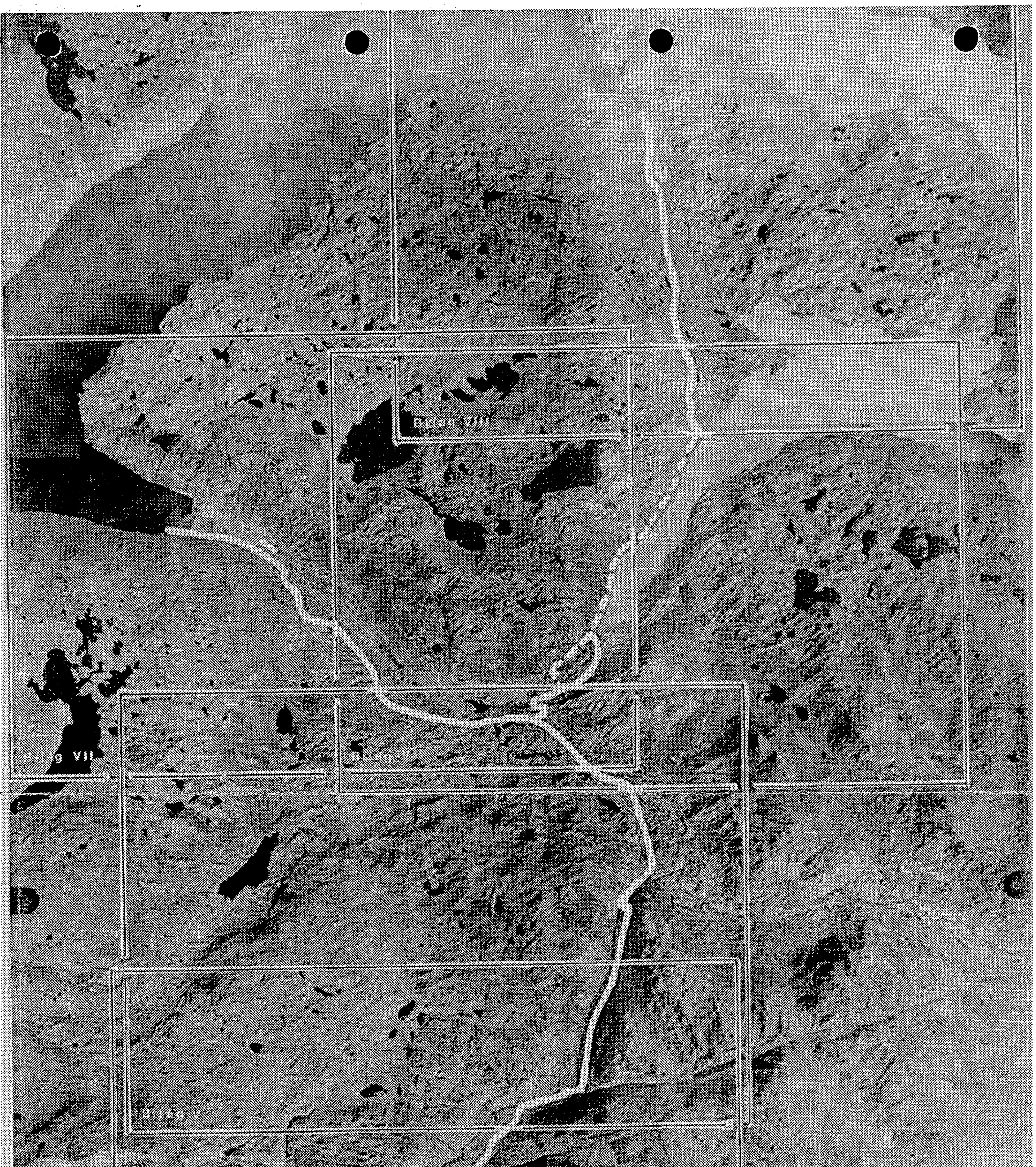
An extract of information from this report is enclosed in **Appendix 2.**

4.3 Base-line Programme - Summer 2000

The baseline environment and archaeology study scope for 2000 is currently being planned. This study will be carried-out in parallel with, and incorporating, a mine site access road survey.

Sample collection will include all areas of proposed activity covered by mining, ore transport and ore treatment, project processing and support facilities, infrastructure and product / waste storage. It is proposed that samples will be stored for future analysis, as needed. At this stage it is deemed unnecessary to add this analysis expense to NMR's commitments until final approvals are in place and work is about to commence on site - or at a nominated time thereafter.

Preliminary discussion **[4]** on these matters were held with Mr. Peter J Aastrup, National Environmental Research Institute Department of Arctic Environment, at Roskilde, Denmark. The common view was that it is more important to collect representative base line samples - analysis can be done later.



SARFARTOQ OMRÅDET

Transportkorridor, forslag
Transportation Corridor, Proposal
Assartuinermut aqqutissaq amitsoq, Siunnersuut

Figur nr.: II

1987

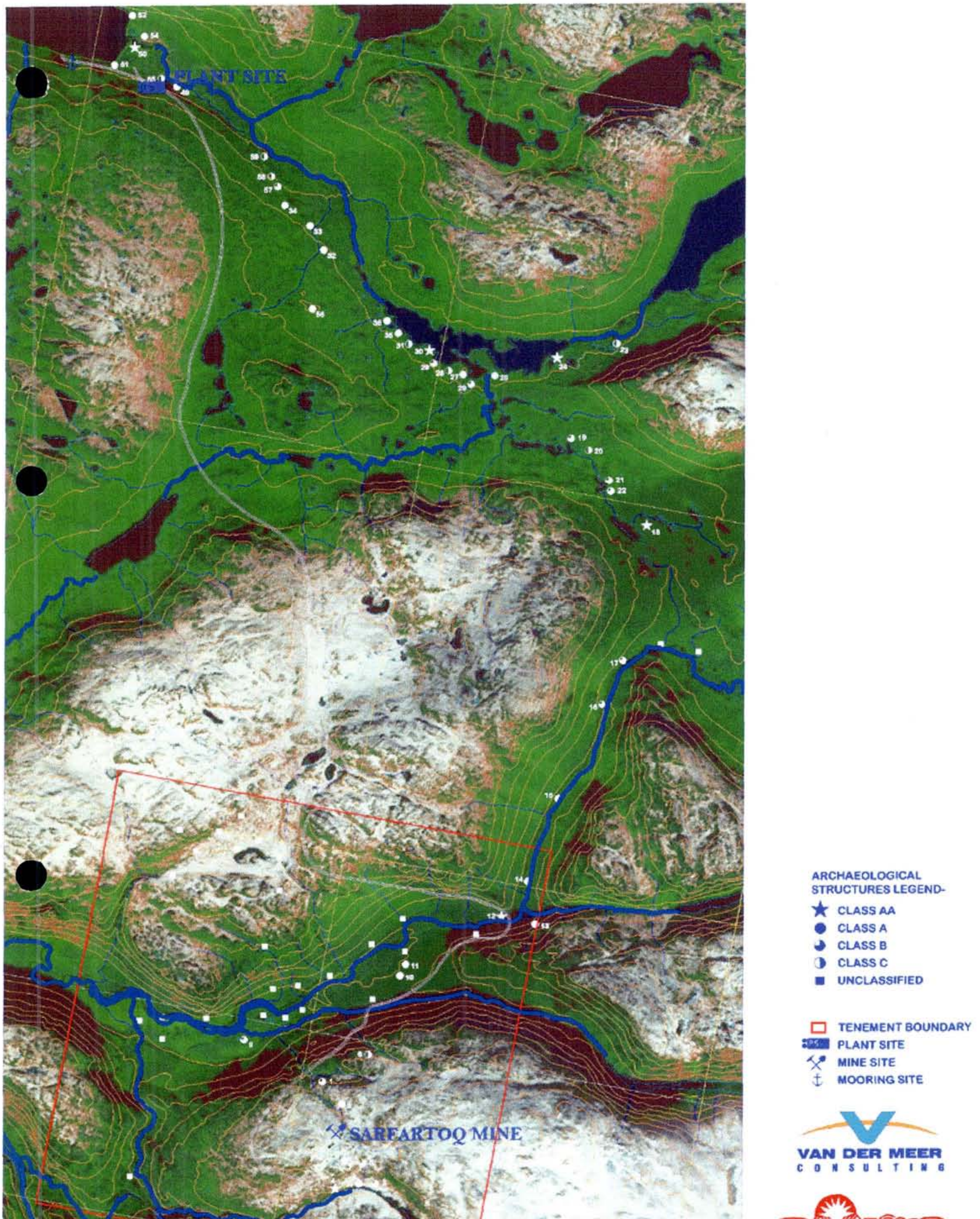


FIGURE 4.2 - ARCHAEOLOGICAL SITES

DWG:NMR-AR01 20th July 2000

5

5.1 Background

In 1801 an American chemist named Hatchett was testing a heavy black mineral from Connecticut and discovered that it contained a new element, which he named 'Columbium'. A year later Eckberg in Sweden discovered two minerals each containing an oxide of an unknown element. This proved very difficult to dissolve in acids and frustrating to work with, so he named it 'Tantalum' after the Greek god Tantalus.

In 1844 the chemist Rose showed that another element was present in the Swedish mineral, and he named it 'Niobium' after Niobe, the daughter of Tantalus. Only in 1866 did Marignac develop a method of separating the two elements chemically by taking advantage of the difference in solubility of the two potassium double fluorides (a procedure used until quite recently in the manufacture of the metals). The European 'Niobium' was soon shown to be identical to the American 'Columbium' and for nearly a century arguments raged over which name had priority.

Finally in 1950 the international chemical body, by a majority decision, settled for niobium but the old name columbium is still in common use in the Americas, complicated by the fact that one of the two most common minerals of niobium is universally known as 'Columbite'. Of the two elements, niobium is far more abundant in the earth's crust than tantalum; nevertheless they almost always occur together. This results from the great chemical similarity of their oxides (which gave those early chemists so much trouble), and from their very similar atomic radii, so that they freely replace each other in minerals. The columbite mentioned above is an iron or manganese niobate and there is an iron manganese tantalate known as tantalite. A full range of mixtures between the extremes exists, all naturally occurring.

When the two elements were finally separated, and the metals produced, it was obvious that the similarity did not extend to all their physical properties. Niobium metal is very similar in density to iron, but tantalum is nearly twice as heavy. As a result of all these factors, and the relative abundance (and cheapness) of niobium, they have very different applications, but in some uses, in particular of the high purity metal and its alloys, there is some overlap.

Applications of tantalum and niobium are based on their ability to form a non-conducting layer of oxide on the surface of the metal, a dense, stable and adhesive layer of pentoxide.

TANTALUM

By way of comparison, some current applications for tantalum are included:

1. As metal powder for the production of tantalum capacitors (dependent on the insulating property of the tantalum oxide films) and as metal wire for their connection to circuits.

   This biggest single use depends on the large surface area of the finely divided powder, and on the purity of the metal.

2. As fabricated metal for the construction of chemical process plants, and equipment such as heat exchangers, due to its resistance to corrosion.

3. As an ingredient of superalloys, principally for use in aircraft engines and spacecraft.

4. As the carbide, in hard metal cutting tools, also with tungsten carbide and cobalt binders.

The first item accounts for about 50% of current tantalum usage.

NIOBIUM

Some current applications:

1. In structural steels (especially high strength low alloy (HSLA) steels with up to 1% Nb).

2. In heat resisting steels and superalloys (iron, nickel or cobalt based).

3. As an alloy with titanium or tin for super conductive magnets.

4. As the oxide (Nb_2O_5) in high refractive index glass, as lead niobate in piezoelectric devices, and as single crystal lithium niobate in surface acoustic wave filters for television sets and similar equipment.

5. With copper in powder metallurgy composites for components requiring high strength with conductivity.

6. As an alloying addition to zirconium for nuclear reactor fuel tubes.

7. As the carbide, in cutting tools, with tungsten and tantalum carbides.

8. As the fabricated metal, for chemical plants, and, alloyed with zirconium or other metals, for high temperature applications in aerospace.

The first item accounts for about 90% of current niobium usage. General Niobium marketing information is provided in **Appendix 3.**

5.2 Summary of Niobium Properties

Niobium is a shiny-white, soft, metallic chemical element; its symbol is Nb. Niobium has an atomic number of 41 and an atomic weight of 92.9064.

It is a ductile metal, with the following properties;

- a melting point of 2,468 deg C (4,474.4 deg F)
- a boiling point of 4,742 deg C (8,567.6 deg F)
- a density of 8.51 g/cu cm at 20 deg C (68 deg F).

Niobium is a member of a small family of metals known as refractory metals. The colour you see is purely refracted light. The thickness of the oxide determines the colour. Niobium is totally hypo-allergenic. This refractory element (along with Titanium) is frequently used in artificial joints, plates, pacemakers and dental implants.

Niobium looks like steel or, when polished, like platinum. It resists corrosion, is a good shock absorber, and can withstand very high temperatures. Among its many industrial applications niobium (in small amounts) is used in alloys.

- The presence of niobium makes hot-pressing dyes and cutting tools resistant to shock and wear;
- Its conductivity makes it useful in electronic devices and super conductive magnets;
- If combined with nickel, it makes a high-temperature alloy;
- Added with iron to make stainless steel;
- It offers stability on welding or heating;
- Niobium is also used in high-strength structural steel;
- Nuclear reactor cores are constructed with niobium alloys because niobium does not react chemically with uranium and because it is resistant to corrosion.

More detail information on Niobium, Niobium products and their properties is provided in **Appendix 4.**

5.3 World Niobium Production

Niobium is found worldwide, and principal commercial sources are niobite (columbite), niobitetantalite, pyrochlore, tantalite, and euxenite. Major niobium producers are Brazil, Canada, Nigeria, and Zaire.

A small part of industry's needs for niobium is recovered during the treatment of tin slags and columbite / tantalite minerals (mined in West Africa, Brazil, South East Asia and Australia) which are the source of much of the world's tantalum.

More than 90% of all niobium is recovered as ferro-niobium for use in steel-making, from the smelting (by reduction with aluminium) of the mineral pyrochlore, a calcium fluoniobate (which, when the niobium is replaced by tantalum, is known as microlite, and mined for tantalum).

Two mines in Brazil (the CBMM mine at Araxá, and the Anglo-American mine at Catalão in Goiás) account for 80% of all niobium, and one in Canada (Niobec at St Honoré) for more than half the remainder.

Pure niobium and its oxide are prepared through a chemical route similar to that applied to tantalum.

World Niobium production is summarised in **Table 5.1**

TABLE 5.1: World Niobium Production and Reserves [9]

Producer	Country	Production (1998) ('000 tonnes, Nb)	Reserves ('000 tonnes)	Reserves / Prod. (Years)
CBMM	Brazil	16.00	32,000	2,000
Catalao	Brazil			
Niobec	Canada	2.30	140	61
	Australia	0.14	10	71
	Nigeria	0.02	60	2,609
Zaire	Congo	-	30	N. A.

Total Production (Nb Equivalent) 18.36
Total Production (FeNb Equivalent) 29.4
Total Production (Nb2O5 Equivalent) 26.3

(Note: To express the above production figures in tonnes of FeNb equivalent, multiply by approximately 1.6. To convert to tonnes of Nb2O5 equivalent, multiply by approximately 1.43.)

Niobium production by major product segment is summarised in **Table 5.2.** Ferro-Niobium, in particular standard grade for use in steel production, is by far the major product market (ie. 84% of total production.

TABLE 5.2: Niobium Production by Product Segment [9]

Ferro-Niobium	84%
Niobium Pentoxide	14%
Niobium Alloys	1%
Pure Niobium	1%
Total	100%

World Ferro-Niobium production, as well as current (1997) and projected (2003) capacity is summarised in **Table 5.3**

TABLE 5.3: World Ferro-Niobium Production and Capacity [9]

Producer	Production (1997) ('000 tonnes) (FeNb)	Capacity (1997) ('000 tonnes) (FeNb)	Capacity (2003) ('000 tonnes) (FeNb)
CBMM / Brazil	22.0	22.8	45.0
Catalao / Brazil	5.4	5.4	5.4
Niobec / Canada	3.4	3.4	4.1
Niocan / Canada	0.0	0.0	4.5
Various / China	0.1	0.3	0.3
Somima / Gabon	0.0	0.0	4.0
NMR / Green.	0.0	0.0	1.6
Total	30.9	31.9	64.9

5.4 Niobium Product Pricing

Year end average Niobium Concentrate and Ferro-Niobium (standard grade) prices are illustrated in **Figure 5.1** and 5.2.. The base data is also provided in tabular format in **Figure 5.3** and **5.4**. All prices are US Dollars (1992) per pound.

FIGURE 5.1:

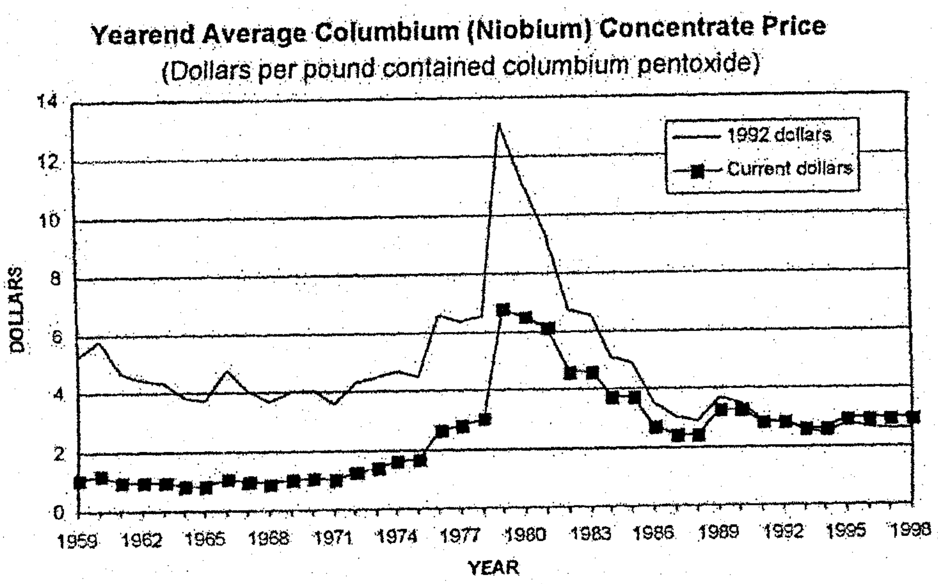


FIGURE 5.2:

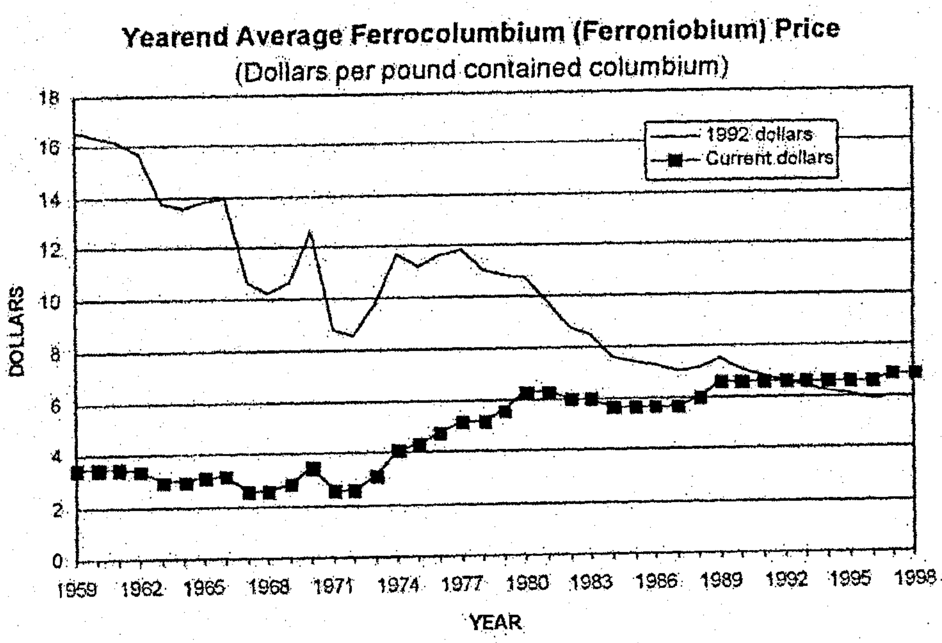


FIGURE 5.3:

Yearend Average Columbium (Niobium) Concentrate Price
(Dollars per pound contained columbium pentoxide[1])

Year	Price	Year	Price	Year	Price	Year	Price
1940	0.35	1955	3.40	1970	1.12	1985	3.75
1941	0.35	1956	3.40	1971	1.04	1986	2.75
1942	0.53	1957	3.40	1972	1.29	1987	2.43
1943	0.25	1958	3.40	1973	1.42	1988	2.43
1944	0.25	1959	1.08	1974	1.64	1989	3.25
1945	0.60	1960	1.22	1975	1.71	1990	3.25
1946	0.54	1961	1.00	1976	2.69	1991	2.83
1947	0.65	1962	0.95	1977	2.76	1992	2.83
1948	0.73	1963	0.95	1978	3.03	1993	2.60
1949	1.13	1964	0.85	1979	6.78	1994	2.60
1950	2.55	1965	0.85	1980	6.50	1995	3.00
1951	2.56	1966	1.11	1981	6.13	1996	3.00
1952	3.40	1967	0.97	1982	4.63	1997	3.00
1953	3.40	1968	0.92	1983	4.63	1998	3.00
1954	3.40	1969	1.05	1984	3.75		

[1] To convert to dollars per kilogram, multiply by 2.20462.

Sources: Metal Bulletin (1946-51), U.S. Government purchase (1952-58), E&MJ Metal and Mineral Markets (1959-66), Metals Week (1967-90), and Metal Bulletin (1991-98). Prices before 1946 were published by the U.S. Bureau of Mines; origins are unknown.

FIGURE 5.4:

Yearend Average Ferrocolumbium (Ferroniobium) Price[1]
(Dollars per pound contained columbium[2])

Year	Price	Year	Price	Year	Price	Year	Price
1940	2.30	1955	6.90	1970	3.49	1985	5.66
1941	2.30	1956	6.90	1971	2.55	1986	5.56
1942	2.28	1957	4.90	1972	2.55	1987	5.68
1943	2.28	1958	3.73	1973	3.10	1988	6.00
1944	2.28	1959	3.45	1974	4.12	1989	6.58
1945	2.28	1960	3.45	1975	4.30	1990	6.58
1946	2.28	1961	3.45	1976	4.73	1991	6.58
1947	2.55	1962	3.40	1977	5.12	1992	6.58
1948	2.90	1963	3.00	1978	5.12	1993	6.58
1949	2.90	1964	3.00	1979	5.58	1994	6.58
1950	4.90	1965	3.10	1980	6.29	1995	6.58
1951	4.90	1966	3.21	1981	6.29	1996	6.58
1952	4.90	1967	2.53	1982	6.00	1997	6.88
1953	6.40	1968	2.53	1983	6.00	1998	6.88
1954	12.00	1969	2.79	1984	5.66		

[1] Standard (steelmaking) grade, 65% contained columbium (1997-98).

[2] To convert to dollars per kilogram, multiply by 2.20462.

Sources: Mostly E&MJ Metal and Mineral Markets (1940-66), Metals Week (1967-92), Platt's Metals Week (1993-96), and American Metal Market (1997-98).

More recent pricing information is as follows (US Geological Survey, Mineral Commodity Summaries, February 2000) for November, 1999;

Niobium Ore US $ 2.80 – 3.20 / lb (contained Nb_2O_5)

α

Ferro-Niobium (Std Grade)	US $	6.75 –	7.00 / lb (contained Nb)
Ferro-Niobium (High Purity)	US $	17.50 –	18.00 / lb (contained Nb)

For comparison purposes;

Nickel-Niobium	US $	18.50 –	/ lb (contained Nb)
Niobium Metal Products	US $	24.00 –	100.00 / lb (contained Nb)
(Ingot form and special shapes).			

For the purpose of the Base Case financial analysis, a ferro-niobium price of US$7.00 per lb (as at July, 2000) has been used – ie. current dollars.

5.5 Ferro-Niobium

The ferro-niobium market, which makes up most (84%) of niobium consumption is used in the preparation of steels, in particular HSLA (high strength low alloy) type. Until recently the best-known use of the niobium-bearing steel has been in the manufacture of natural gas pipelines. The niobium gives the steel the strength to resist the great range of temperatures to which such pipes are subject. Niobium addition is now growing in other steels such as stainless, and this has been helped by the stability of its price compared with that of competing alloying elements.

Steel consumption of ferro-niobium is summarised in **Table 5.4.**

TABLE 5.2: Ferro-Niobium Consumption [9]

HSLA	84%	
- Gas Pipeline Production		35%
- Structural Applications		33%
- Automobiles		32%
Total		100%
Stainless Steel	13%	
Interstitial Free Steel	8%	
Others	7%	
Total	100%	

5.6 Niobium Pentoxide

5.6.1 Optics and Glass

Niobium also has several non-metallic applications. An important one is in optical glass. When the silica in glass is replaced by niobium oxide the refractive index is much greater, so thinner and lighter lenses can be used for the same focal length. This is already in use in many camera lenses and for eyeglasses.

Very recently, commercial exploitation of the optical and electronic properties of niobium has found two new uses. Improvement of the anti-glare properties of glass in architecture, and ensuring that carbon films adhere to razor blades may appear to be very different, but both are applications of thin film applications for niobium.

5.6.2 Molecular Sieve

The first niobium oxide molecular sieve – Meso-porous materials such as aluminosilicate MCM-41 are characterised by pore diameters of 20-100 Å - much larger than those of common molecular sieves or zeolites - and have considerable potential as catalysts. The first niobium oxide molecular sieve with hexagonal packing, a pore diameter of 27 Å, and a high surface area (400-600 m2/g), has recently been synthesised. The synthetic route involves a new approach in which the inorganic precursor and the tenside are first linked through a covalent Nb-N bond. Only then is the condensation reaction allowed to proceed. The tenside is removed under acidic conditions (EtOH/HINO, 40°C). The new material has a remarkably high thermal stability after removal of the template.

5.6.3 Piezoelectric Ceramics

Lead Metaniobate exhibits properties not usually present in other types of piezoelectric ceramics.

The noteworthy facts are its low mechanical QM, negligible aging, wide range of operating temperatures and small values for lateral and planar coupling compared to longitudinal coupling. The low QM enhances the use of PKI 100 material in the construction of wide bandwidth sensors for high frequency pulse echo measurements that require a short pulse and critical resolution. Its negligible aging helps simplify circuit design. Wide variations in temperature have limited effect on its dielectric and piezoelectric properties making it ideal for high temperature application. Its high longitudinal coupling compared to lateral and planar coupling allows it to generate a better response under hydrostatic pressures and makes it useful for underwater sonar equipment.

5.7 Other Niobium Products

Pure niobium, like tantalum, has considerable attraction as a material of construction for chemical plants, and in the formulation of superalloys. It also has an important use, when alloyed with titanium or tin as a superconductor.

Metallurgists feel that many applications employing tantalum could be more cost effectively dealt with by using niobium.

The largest user of niobium was and is the nuclear power industry, however the alloy has successfully been employed in a variety of other applications including jet engine components.

Further general information about niobium products is contained in **Appendix 4.**

5.7.1 Superconductors

Super conducting applications include magnetic resonance imaging for medical diagnostics and in particle accelerators for physics research. The Mag-Lev train may be a more conspicuous use of this material in the future. The high strength magnetic fields required can be generated in a small volume by superconducting coils — in medicine, the technique is much safer than that using X-rays.

Recently there has been a comparatively large quantity of niobium-titanium used for high energy physics research (eg. particle accelerator at CERN).

5.7.2 Superalloys

Niobium is used to good effect in superalloys for components in extreme conditions at high temperatures where reliability is paramount, such as aircraft engines and rocket components. It is commonly used as an alloying element in many of the high temperature superalloys.

6

Section 6 Testwork

The following issues (Items 6.1 – 6.4) are encapsulated within a report prepared by Downing Reynard & Associates (DRA) as part of the evaluation for the Stage I Feasibility Study **[10]**.

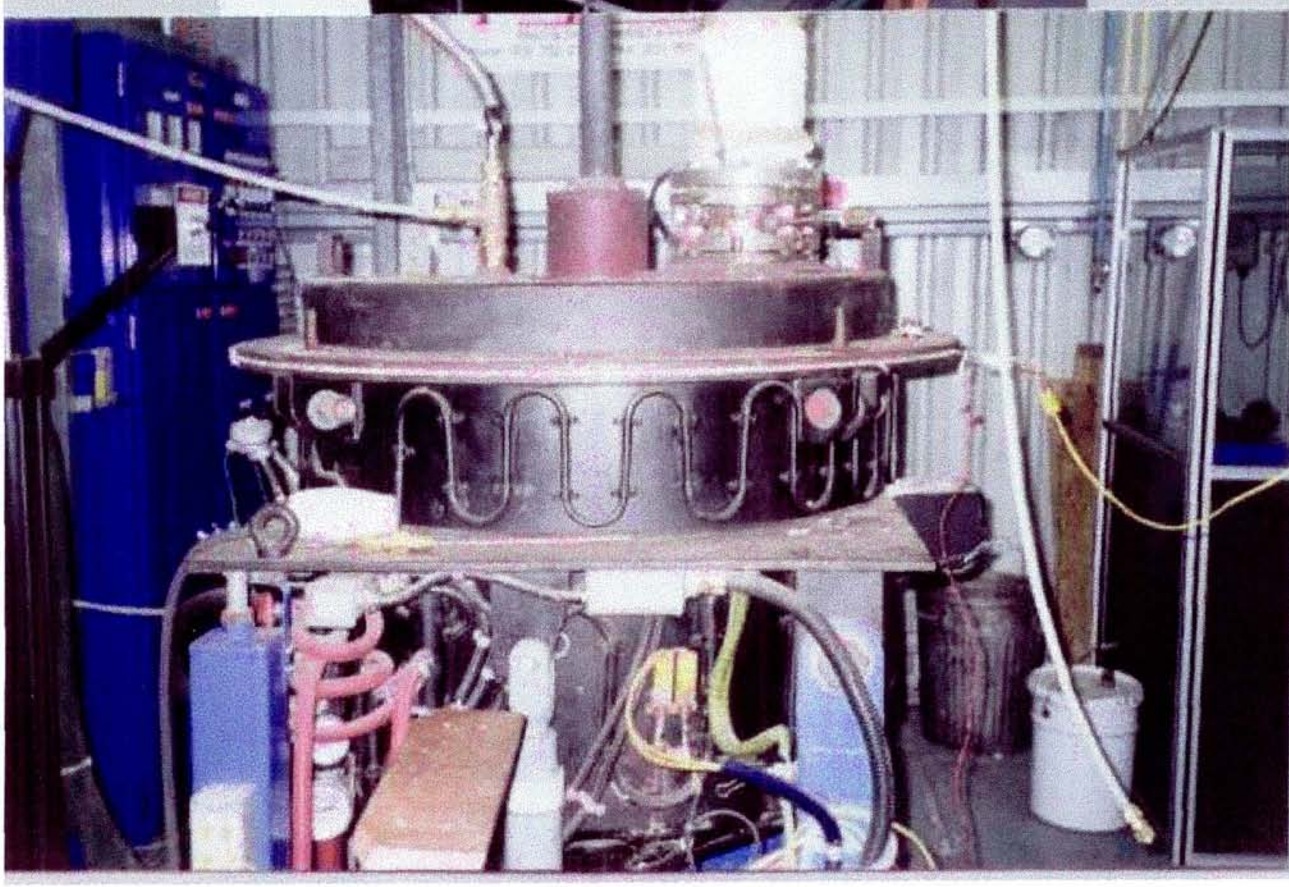
6.1 Overview of Testwork To Date

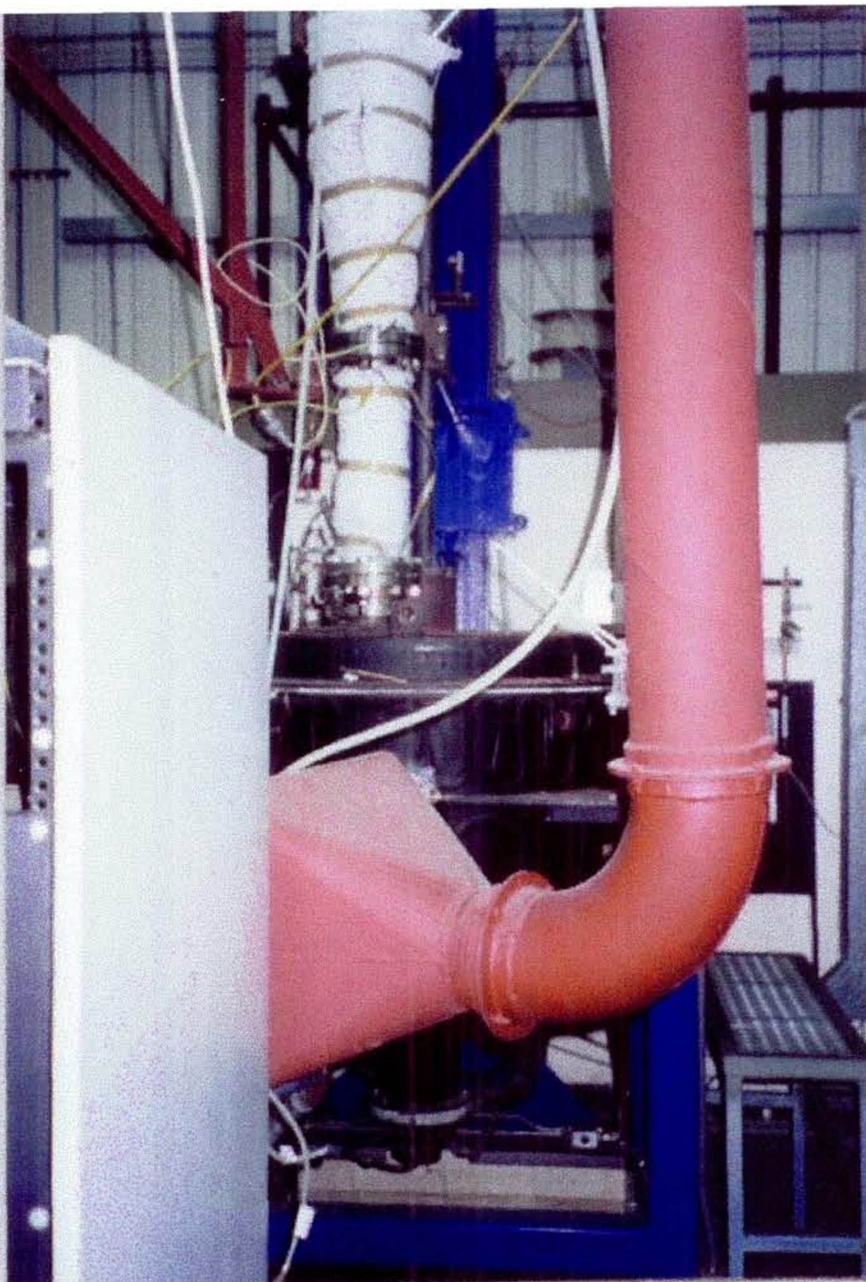
6.2 Review of Testwork Todate

6.3 Proposed Testwork Programme - Stage I

6.4 Proposed Testwork Programme - Stage II

6.5 Electric Arc Furnace Testwork (CSIRO)





7

7.1 Mining Methods

Based upon the current state of knowledge for the Sarfartoq ore deposit, the following mining methods are both open for further evaluation:

- Conventional drill and blast, surface open cut
- Underground:
  - vertical shaft (surface)
  - vertical shaft (bottom access to deposit)
  - incline shaft (less likely)

Further deep drilling is required to define the extent of the ore body, before a definitive life-of-mine plan can be established.

7.2 Open Pit Design

Given the exposure of high grade ore deposits at the surface, and the drill information currently in place, ore production during the early years of the project can easily be extracted via open pit mining techniques.

7.3 Mine Plan

Preliminary open pit mine plan designs have already been done **[1]**. The mine plan can be more fully developed with the aid of further drilling to delineate reserves at depth.

Refer to **Figure 7.1**, which shows both mine site survey details and preliminary mine plan pit details down to 45m.

7.4 Mine Equipment

A conventional drill and blast, open pit mining technique is proposed. It may be possible to paddock blast (wide spacing of drill holes). However, if the integrity of the country rock increases with depth, a close pattern blast will be more efficient.

Once blasting and grade control are complete, a front-end loader (FEL) will be used to load 30 tonne trucks for overburden removal and ore haulage.

To support this operation an excavator with a quick hitch attachment will be used as a stand-by loading tool.

This excavator will be fitted with multiple ground engaging tools, an hydraulic drill for blast hole preparation, a hydraulic rock hammer to break-up oversize boulders and a conventional bucket to load trucks, as and when needed.

Support equipment and fuel supply for mine site operations will be via 4WD's and a Three (3) tonne service vehicle (eg. repairs and fuel / lubrication).

A list of indicative mining equipment and mining / infrastructure support vehicles is provided in **Table 7.1.** Photographs of indicative mining equipment are provided in **Figure 7.2.**

TABLE 7.1: Mine Fleet Equipment & Support Vehicles

EQUIPMENT ITEM		QUANTITY
MINING:		
Caterpillar D6R	Dozer	1
Caterpillar 330 BL	Excavator	1
Terex TA30	Dump Trucks	4
Caterpillar 938G	Front End Loader	1
Blast Hole Drill	Excavator Mounted	1
Rock Hammer	Excavator Mounted	1
Service / Fuel Vehicle	Truck (3-5 Tonne)	1
MOBILE EQUIPMENT – OTHER:		
Vibrating Roller		1
Caterpillar 120H	Grader	1
Toyota 4X4	Light Vehicles	3
Hovercraft	12 Seat	2
Skid Steer Loader		1
Rough Terrain Crane40 Tonne		1
Caterpillar 938G	Front End Loader	1

7.5 Mine Personnel

A single shift (12 – 14 hour) will be needed to remove and transport high-grade surface ore. Stripping ratios are in the order of 1.5:1 for the first 35,000t of ore. This equates to approximately 22,500t of overburden to be removed and stored nearby, to achieve 15,000t of ore production.

It is estimated that a manning level of approximately 8 personnel will be needed to support an open pit mine plan of this scale, given the general transport and support logistics, ore transport turnaround times and overburden disposal requirements.

7.6 Owner Vs Contractor Options

In the Stage I Feasibility Study timeframe it has not been possible to evaluate the cost implications of contractor mining options, for the Base Case operating parameters.

Contractor mining options are unlikely to prove economic at a mining rate of 10,000 – 15,000 tonnes per annum, given the nature of the mine site location and the logistics involved (eg. mobilisation and demobilisation costs each season. Investigations to date suggest sea freight costs of approximately US$110 / t / m^3).

However, should the high grade nature of the deposit be proven to depth, it may well be economical to mobilise a mining contractor to extract a substantial portion of the ore, for example, enough to support 3 - 5 years processing. This would only need to be done every 3 – 5 years (or so). In terms of environmental impacts on the Sarfartoq Valley this may prove to be more acceptable.

As an owner operator NMR can take advantage of tax write-downs and, perhaps, be more secure with this independence. With the tax write-downs available and the relatively low mechanical depreciation of mechanical equipment, 100% depreciation will be achieved long before the end of the equipment service life. Operating timeframes each mining season are unlikely to exceed 1000 hours.

FIGURE 7.1 - SARFARTOQ MINE SITE PRELIMINARY PIT DEVELOPMENT (45m)

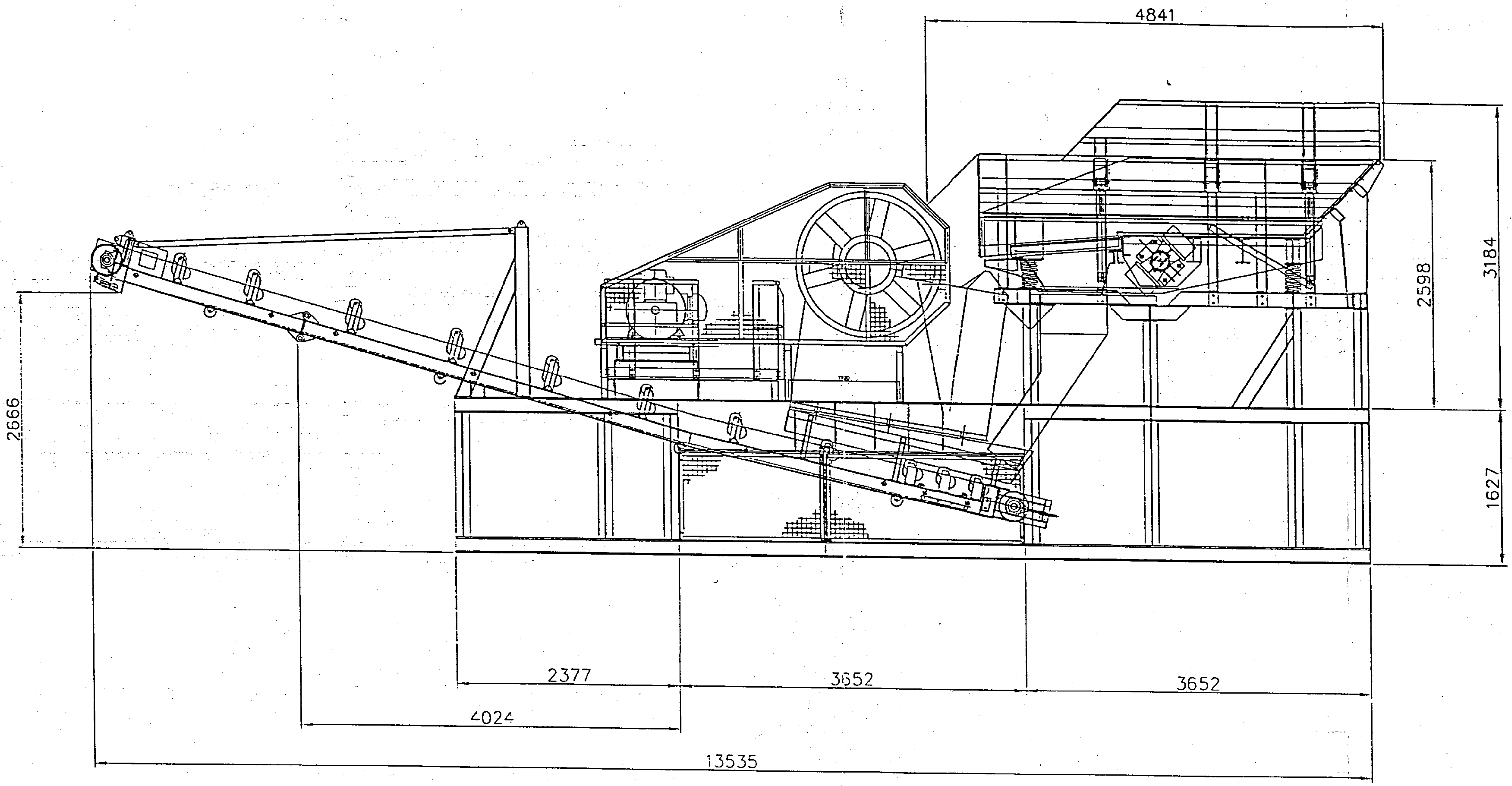
NEW MILLENNIUM RESOURCES N.L.

VAN DER MEER CONSULTING

20 July 2000

Figure 7.2

Figure 7.2



NOTES

JOB NUMBER

REV.	BY	DATE	REVISION
A	DB	12/7	ORIGINAL ISSUE

GEOMETRIC SYMBOLS, DIMENSIONING, MACHINING AND SUFRACE FINISH SYMBOLS TO A.S.1100, PART 201-1984.

THIRD ANGLE PROJECTION

QMS ENGINEERING PTY LTD.
41 DIVISION ST. WELSHPOOL 6106
Ph. (08) 9356 8111 FAX (08) 9356 8122

SCALE NTS | A3

DESIGNED

DESIGN APPROVED

DATE

DRAWN CP

DATE 12/7/00

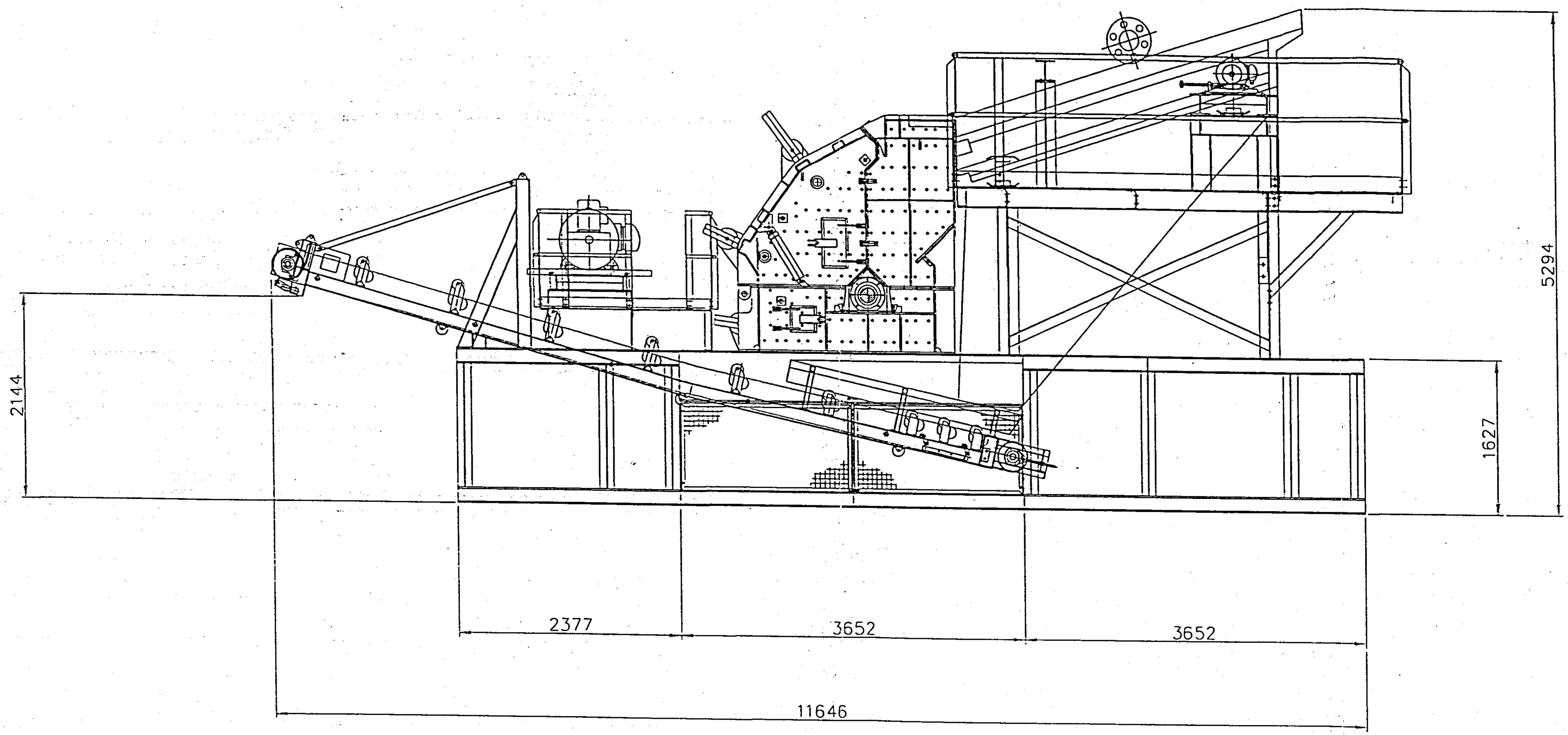
CHECKED

QMS ENGINEERING PTY LTD.

VAN DER MEER
PRIMARY CRUSHING STATION
GENERAL ARRANGEMENT

DRAWING No. Q601-G-101

REVISION A



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THIRD ANGLE PROJECTION

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DESIGNED
DESIGN APPROVED
DATE
DRAWN CP
DATE 12/7/00
CHECKED

OMS ENGINEERING PTY. LTD.

VAN DER MEER
IMPACTOR & SCREEN
GENERAL ARRANGEMENT

DRAWING No. Q601-G-103

REVISION A

8

8.1 Processing Overview

The relative locations of the project mine, mine access road, processing facilities and marine mooring is illustrated in **Figure 8.1**. Given the level of test work and process definition carried-out to date, this represents the best view of the structure of the project development.

A suitable high grade, head grade ore will be selectively mined for feed to the processing facilities. A flexible plant design is envisaged.

The design philosophy shall be to produce high quality products using a process design based upon new equipment and processes.

8.1.1 Mining

The proposed mining rate is approximately 15,000 tpa of high grade ore. The Base Case scenario is to mine this ore during the summer months of June – August. This is a mining period of approximately 12 – 13 weeks.

Mining equipment requirements are provided in **Section 7.0.**

The mining operations will feed the ore handling and treatment facilities, located approximately 40 kms away at the Fjord. The material will be carried over this haul by articulated, six wheel drive dump trucks. These trucks are nominated as Terex TA30's.

8.1.2 Ore Handling & Processing

The primary function of the ore handling and processing section of the plant is to crushing and screen the ore to a desired size range.

ROM feed material (-1000 mm +0 mm, nominally -650 mm) shall be screened and sorted, via grizzly into the following size ranges;

- -650 mm primary crusher feedstock (stockpile).
- \+ 650 mm recycle (stockpile).

It is currently envisaged the primary crusher will be a long jaw, Jaw Crusher. The primary product stream is -50mm (nominal) . The final ore handling and processing configuration is dependent upon which downstream processing option is finally adopted – for example, electric arc furnace (Base Case), or chemical processing (Option 1).

The optimal material size for the chemical processing option is (approximately) 80% minus 60 micron. In the case of the electric arc furnace, feed size is likely to be preferred ta 1 – 5 mm.

8.1.3 Acid Leaching

Tantalum and niobium are extracted from their ores, after concentration, by chemical means in this instance, rather than by smelting. The ore (pyrochlore) is attacked by H_2SO_4 which brings the tantalum and niobium (and other) compounds into solution, after a suitable residence / reaction time.

The balance of the ore (gangue) is not dissolved by the acid. This material is disposed of as tailings.

8.1.4 Solvent Extraction

The acid solution is mixed thoroughly with, for example, MIBK (methyl-iso-butyl ketone) which dissolves the tantalum and niobium compounds into the ketone while leaving impurities in the aqueous solution. The organic and inorganic solutions form separate layers and the organic (ketone) solution can be separated from the aqueous layer (liquid-liquid separation).

8.1.5 Product Refining & Dispatch

The niobium is stripped from solution and a niobium pentoxide (Nb2O5) intermediate product produced. Ferro-niobium is produced via aluminothermic reaction.

A small bagging and drumming facility shall be provided for packaging and palletising the final Ferro-Niobium product for dispatch. Product shall be packed into 20' containers for shipment.

8.2 Uranium & Thorium

AMMTEC have been engaged to conduct test work into the possible removal of Uranium from acid leach. This test work is currently ongoing. Refer to MRT technology information / documentation enclosed in **Appendix 6**.

8.3 Electric Arc Furnace

The production of standard grade Ferro-Niobium (FeNb) is achieved by melting a high grade pyrochlore feedstock (-5+1mm) in an electric arc furnace located within the Process Building.

The electric arc furnace system comprises a carbon electrode(s) which may be raised (or lowered) via a fine position, mechanical and instrumentation control system.

The furnace vessel is essentially a steel shell into which is placed the feed material. The steel shell may sit on a small "rail car" or trolley to facilitate handling.

Once the electrode(s) have been energised, an arc has been struck and a small pool of molten material has formed within the shell, the electrodes are raised slowly to control the fusion process as more feed is added.

Power input is carefully controlled. As the pool of molten material grows and the electrodes are progressively raised. A thick insulating layer of unfused material remains between the molten product phase in the centre of the furnace and the steel walls of the furnace shell.

On termination of the fusion cycle (incorporating melting and furnace vessel change over), the molten ingot is moved to a holding area to cool and another charge is prepared for the furnace.

Once sufficiently cool, (eg. below 400 - 600 C) the steel shell is removed. Unfused material around the ingot is removed and transferred to storage for recycling. The ingot shall then be allowed to cool further.

Following the second cooling period, the ingot is divided into sections using a specially designed hydraulic pick-type (rock) breaker. Semi-fused material is cleaned away from the surface of the ingot using a chipping machine. This semi-fused material is also recycled. The remaining fused ingot is broken up and fed to a small crushing and screening circuit for size reduction in accordance with the final product size requirements.

8.4 Mechanical Upgrading Issues

Preliminary test work carried out to date was not successful in this regard. However, as part of the review for the proposed Metallurgical test work programme (ie. "Metallurgical Stage I") it was recommended by the appointed technical consultants that mechanical upgrading be reviewed again. On the information currently available, it appears there is still scope for progress in this regard.

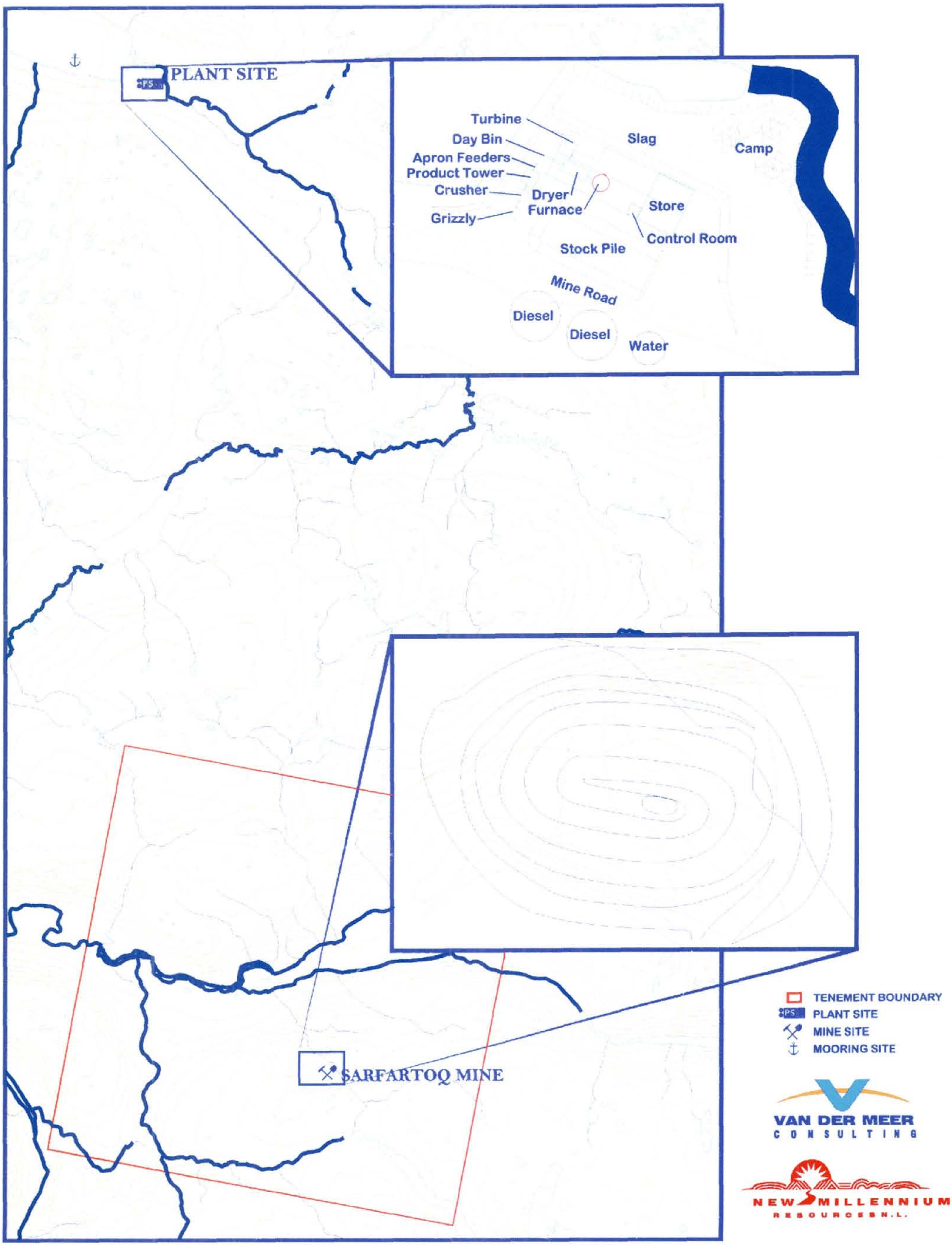


FIGURE 8.1 - SARFARTOQ MINE/PLANT PROPOSAL

DWG:NMR-GA01 20th July 2000

9

The following sections provide a breakdown of the operating input assumptions for the Base Case, which assumes production of standard grade Ferro-Niobium at approximately 1600 tonne per annum.

Operating costs for Stage I of the Feasibility Study are based on either percent of capital estimates or, where possible, direct cost estimates. The cost estimates reflect a Stage I Feasibility Study level of accuracy. In a number of cases (eg. electricity cost) checks have been carried out to confirm the veracity of the percentage method.

Sections 9.1 – 9.11 detail the main operating costs whilst a summary of the total operating costs is provided in **Section 9.12.**

9.1 Operating Cost Estimate

Base Case operating costs estimates are calculated upon a mining and processing campaign period of 100 days per season.

- Major Raw Material inputs, include;
  - Diesel — US$287 per tonne (c.i.f.)
  - Sulphuric Acid — US$70 per tonne (c.i.f.)
  - Fe_3O_4 — US$100 per tonne (c.i.f.)

Operating cost information is defined in the relevant project financial spreadsheet models– refer to **Figures 17.1 – 17.4.**

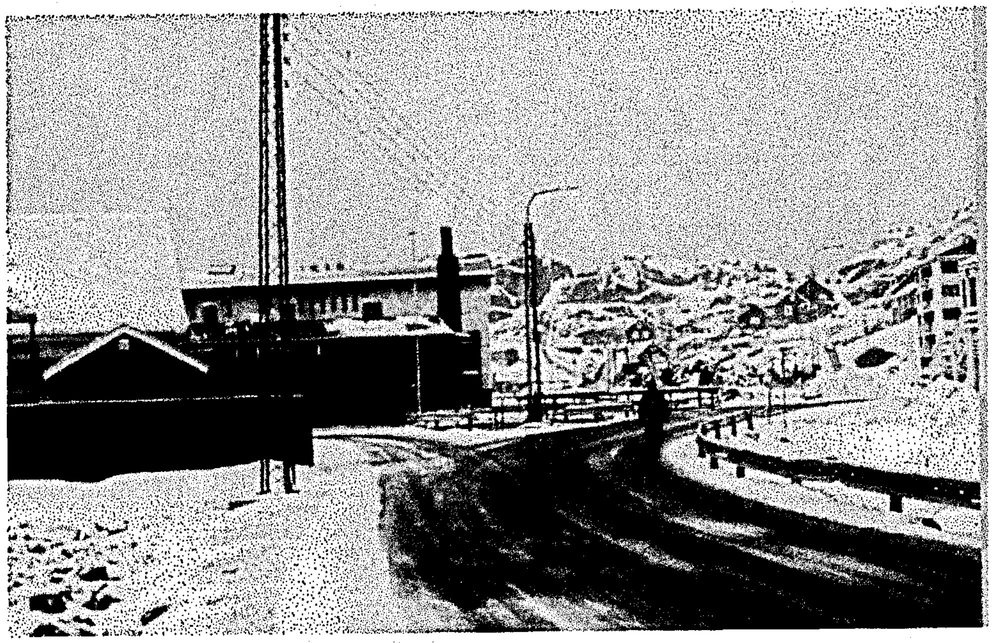
9.2 Electricity

Preliminary communications with Maniitsup Kommunea (Mr. Poul Therkelsen) indicate a local power cost of approximately US$0.27 per kWh.

The Base Case assumes power generation from project owned diesel powered engines (eg. Cummins, etc). It is estimated the project can produce power directly for approximately US$0.20 per kWh.

Electricity costs and power consumption per tonne of feed will be critically important for the fusion option. These are key parameters to be confirmed by CSIRO test work (refer to **Section 6.0**).

Figure 9.1 – Maniitsoq power station.



9.3 Fuel - Mobile Equipment

Fuel costs for the project mobile equipment fleet are based upon estimates from readily available sources (eg. Caterpillar Handbook [XX]), factored for experience.

9.4 Fuel – Electricity

The power supply component of the project fuel cost is based upon a nominal consumption of approximately 45,000 litres per 24 hour day.

9.5 Labour

Operating labour requirements are estimated at 10% of project capital. Project site overheads are calculated at 25% operating labour costs.

The labour strategy is to implement 'multi skilling' which maximises the value of the workforce skill base.

9.6 Maintenance

Annual maintenance costs for plant & equipment and machinery (excluding labour) are estimated as a percentage of capital cost, pro-rated for the campaign duration (eg. 100 days per year). Costs are summarised in **Table 9.1** for the Base Case:

TABLE 9.1: Project Maintenance Costs

Project Category	Capital Cost ($'000)	%	Maintenance Cost US$ (100 Days)
MINING FLEET & ORE TREATMENT PROCESSING	xxxxx	6.0	157,000
CHEMICAL PROCESS FACILITY (Option 1)	xxxxx	10.0	232,000
EAF & DISPATCH	xxxxx	6.0	158,000
INFRASTRUCTURE &	xxxxxx	3.0	94,000

9.7 Mining

9.7.1 Haulage Costs

Haulage cost estimates are based upon the mining equipment fleet specified in **Table 7.1.** A key element in determining the cost estimates is the mining philosophy assumed for the project - the mining (and overburden removal) philosophy is discussed in **Section 7.0.**

Second-hand equipment issues are discussed in **Section 17.0.**

For the Base Case mining conditions outlined in **Section 7.0,** the mining costs (for ROM extraction and overburden removal) are estimated at approximately $15.30 per tonne of material during years one (1) through three (3), at a strip ratio of 1.50:1.00 and approximately $9.08 per tonne of material thereafter.

9.7.2 Transport Options

Given the terrain and the range of possible weather conditions, the following options have been considered through the course of the preparation of this Stage I Report;

- Truck (articulated) – 2, 4 and 6 wheel drive
- Tundra, All-Terrain Vehicle – 6 wheel drive, low ground pressure tyres
- Snow Mobile (with and without trailer)
- Heavy Lift Helicopter
- Hovercraft
- C-130 Transport (Winter, Ice Landing Strip)
- Short Take-off and Landing Aircraft (Summer, Unsealed Landing Strip)
- Slurry Pipeline (Ore and Product transport).

- Ore Transport - Bulk (Truck)
- Ore Transport - half height 20' containers (Truck)
- Product Transport – Bulka Bags (1 tonne, 2 tonne), pallets, 20 ' container (Ship & Road)
- Product Transport – Drums (eg. 25 kg), pallets, 20' container (Ship & Road)
- Ship Transport (Ore) – Bulk

A comparison of transport costs for different options is presented below;

Transport Option	Tonnes/Cycle	Manning Requirements	Approx. Cost US$/tonne	Redundancy / Comments
Road/Truck	30 tonne	1.25 man / Truck	< $20.00	Excellent, 4 units
Helicopter Mi26	20 tonne	5 men / Helo	> $1,100	None / Large Fuel use
C-130 Hercules	50 tonne	4 men / Aircraft	> $500	None / Winter Operation
Slurry Pipeline	Continuous	2 men / shift	> $15	None / Maintainability of pump stations?
Caribou	25 tonne	4 men / Aircraft	> $320	None / Summer Landing Strip
Ice Road	30 tonne	2 men / Truck	> $30	Winter Operation
Snow Mobile	0.25 Tonne	1 man / Unit	Not Practical	Winter Operation. Not economic

Note: All pricing done using available rates, some detail supplied by NMR.

9.7.2.1 Road / Truck Option

(a) Disadvantages

- A road has to be surveyed & built to allow access.
- This road will pass physically through flora & fauna sites.
- Traffic will be regular for approx 3 months of each year.
- Reclamation at cessation of mining will be required.

(b) Advantages

- Road access to mine sites required for most options in some form.
- Mobilisation & Demobilisation costs significantly less than most options.
- Mobile equipment is relatively easy to maintain.
- Flexibility of operations at a remote site.
- Truck redundancy factor, means security of the operation.
- Trucks enable ore to be hauled from multiple mine sites.

- Trucks can haul ore to ROM crushing at Fjord (minimise site impacts)
- The mining fleet can be used to build the road.
- The same equipment can go to the next mine site.
- Opportunity to train local employees.
- Project independence for operations.
- Minimises any potential environmental damage (eg. ore spillage can be easily remedied).

9.7.2.2 Helicopter (Heavy Lift)

(a) Disadvantages

- Mobilisation / demobilisation cost is $815,000 per season.
- Noise pollution is extreme for craft of this type.
- Fuel burn rates for heavy lift helicopters is significant.
- High Maintenance costs - 2 hours maintenance / 1 hour flying
- Support facilities, spare parts etc expensive
- Productive flying time will be less than 50%.
- No redundancy, machine goes down all work stops
- Round trip to refuel 2 hours every 6/8 productive trips
- Best suited for non-repetitive operations
- Most likely need more than 1 machine

(b) Advantages

- None - cost prohibitive

9.7.2.3 C-130 – Hercules

(a) Disadvantages

- Significant mobilisation /demobilisation costs.
- Difficult to get reliable operating windows.
- Limited to winter operation – ice runway on southern lake
- Load restrictions limit mining equipment options, etc.
- Over 300 roundtrips required /annum to haul ore (cargo containers).
- High cost per tonne.
- Radioactive content of ore may be unacceptable for aircraft/crew safety.

(b) Advantages

- Use to ferry equipment to start mining before road constructed
- Low noise pollution, relative to heavy lift helicopter.
- Able to operate in winter

9.7.2.4 Slurry Pipeline

(a) Disadvantages

- Need to build a road to install & maintain (eg. refuel pump stations).
- Danger of fracture due to thermal cycling (summer or winter).
- Spill potential into valley is significant (eg. pipe fracture / Leak).
- Requires remote, intermediate pump stations.
- Environmentally hazardous even with check valves.
- Installation and maintenance costs are significant.
- Requires significant infrastructure at mine site.
- Requires ore crushing and support infrastructure at the mine site – eg. power / diesel / diesel storage / power distribution / water, etc.
- No redundancy.

(b) Advantages

- Low cost method of transport on a stand alone basis
- Low impact on Fauna
- Minimal manpower needed to operate
- Capital cost low for flow line materials

9.7.2.5 Caribou – Fixed Wing Aircraft

(a) Disadvantages

- Not unlike C130-Hercules in most aspects
- Airstrip has to be built.
- Material handling complex.
- No redundancy.
- high cost per tonne

(b) Advantages

- Summer operation
- May be used to transport lightweight early start-up equipment.
- Good for emergency supply

9.7.2.6 Ice Road

(a) Disadvantages

- Not intended to fully form a continuous road.
- Rock areas even with snow/ice difficult. More expensive road construction and maintenance equipment.
- Vehicle access down valley slopes ? (impossible?).

- Loading – unloading of material impossible , it will be frozen
- Inherently dangerous to men & equipment
- Hard on equipment, steel brittle under these conditions, diesel / oil characteristics.
- Use of chains inefficient, long haul times and fuel usage
- Requires expensive satellite navigation equipment to operate in adverse weather.

(b) **Advantages**

- Ability to modify production schedule – if delayed in summer
- Low environmental impact

9.7.2.7 Snow Mobile

- Not considered a serious option

Photos illustrative of these options are included at the end of **Section 9.0.**

9.7.3 Plant & Equipment Hire

Included as part of the allowance for plant overheads, estimated at 10% of operating labour cost.

9.7.4 Maintenance

Included within **Section 9.6.**

9.7.5 Royalties

Company tax is paid in lieu of royalty streams. **[10].**

9.7.6 Other Mining Costs

Other mining expenses typically include;

- Exploration Costs
- Explosives
- Rehabilitation Account

At the Stage I Report level of detail these are assumed included as part of the percentage estimated operating costs.

9.8 Electric Arc Fusion (EAF)

9.8.1 Electrodes

At the Stage I Report level of detail these are assumed included as part of the percentage estimated operating costs.

9.8.2 Fusion Vessel Replacement

At the Stage I Report level of detail these are assumed included as part of the percentage estimated operating costs.

9.9 Administration, Finance & Sales

Based upon in-house database information, an Administration and Finance cost allowance at 2% of total capital is included. This includes;

- Sales / Advertising
- Travel/Entertainment
- Administration and Finance

9.10 Corporate Administration

Based upon in-house database information, Corporate administration expenses for the project are assumed included in the 2% of total capital allowance in **Section 9.9**. Corporate administration includes the following;

- Legal contracts
- Audit Fees
- Other, minor legal fees

9.11 Other Costs

9.11.1 Bagging / Drumming Costs

Bagging Costs relate to the cost of bags, drums and pallets only. Labour and other costs associated with bagging are included as part of the production process.

At the Stage I Report level of detail these are assumed included as part of the percentage estimated operating costs for product dispatch.

9.11.2 Freight Costs

9.11.2.1 Royal Arctic Line

Freight costs of approximately US$1050 per container / trip have been used, based upon discussions with Royal Arctic Line (RAL) personnel in Nuuk, Greenland.

Figure 9.2 highlights the type of vessels operated by RAL and available to this project.

9.11.2.2 Project Site Re-supply

Figure 9.3 and **9.4** indicate the resupply route from Kangerlussuaq to the project site at Angujaartorfik Inlet, off Sondre Stromfjord.

Based on the Base Case site arrangements, this is estimated at approximately $60,000 per season.

9.11.3 Waste Disposal Costs

Special containment measures must be enacted to prevent fugitive waste emissions into the environment (eg. Sewage).

A project allowance of $200,000 per season is included.

9.11.4 Infrastructure Maintenance

An allowance for infrastructure maintenance is included at 3% percent of capital and includes;

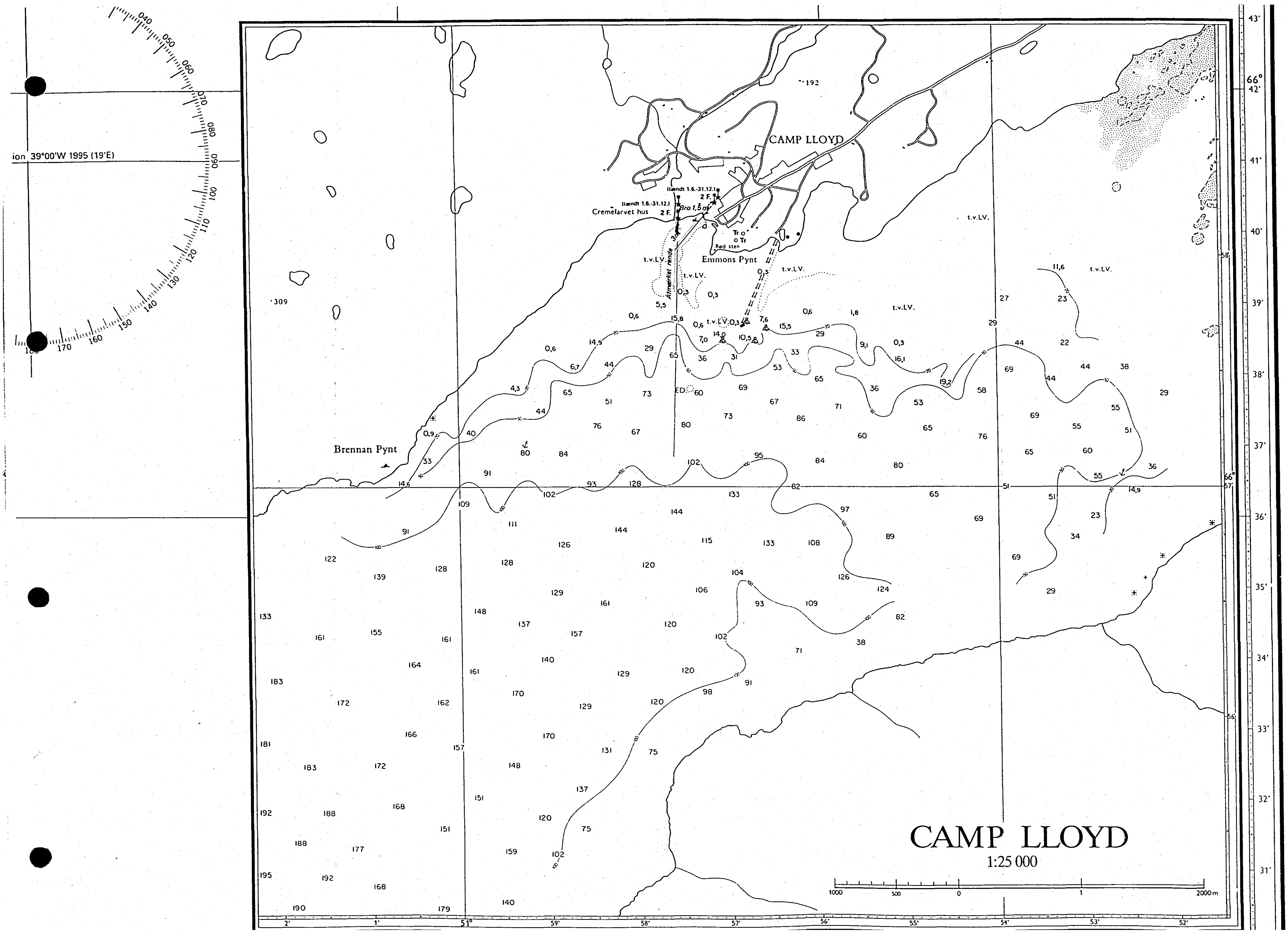
- Mine Site Access Road
- Water Supply
- General repairs
- Hardstands, etc

FIGURE 9.2 Royal Arctic Line Ships

GENERAL TRANSPORT OPTION PHOTOS

C-130 with Snow Skis

HOVERCRAFT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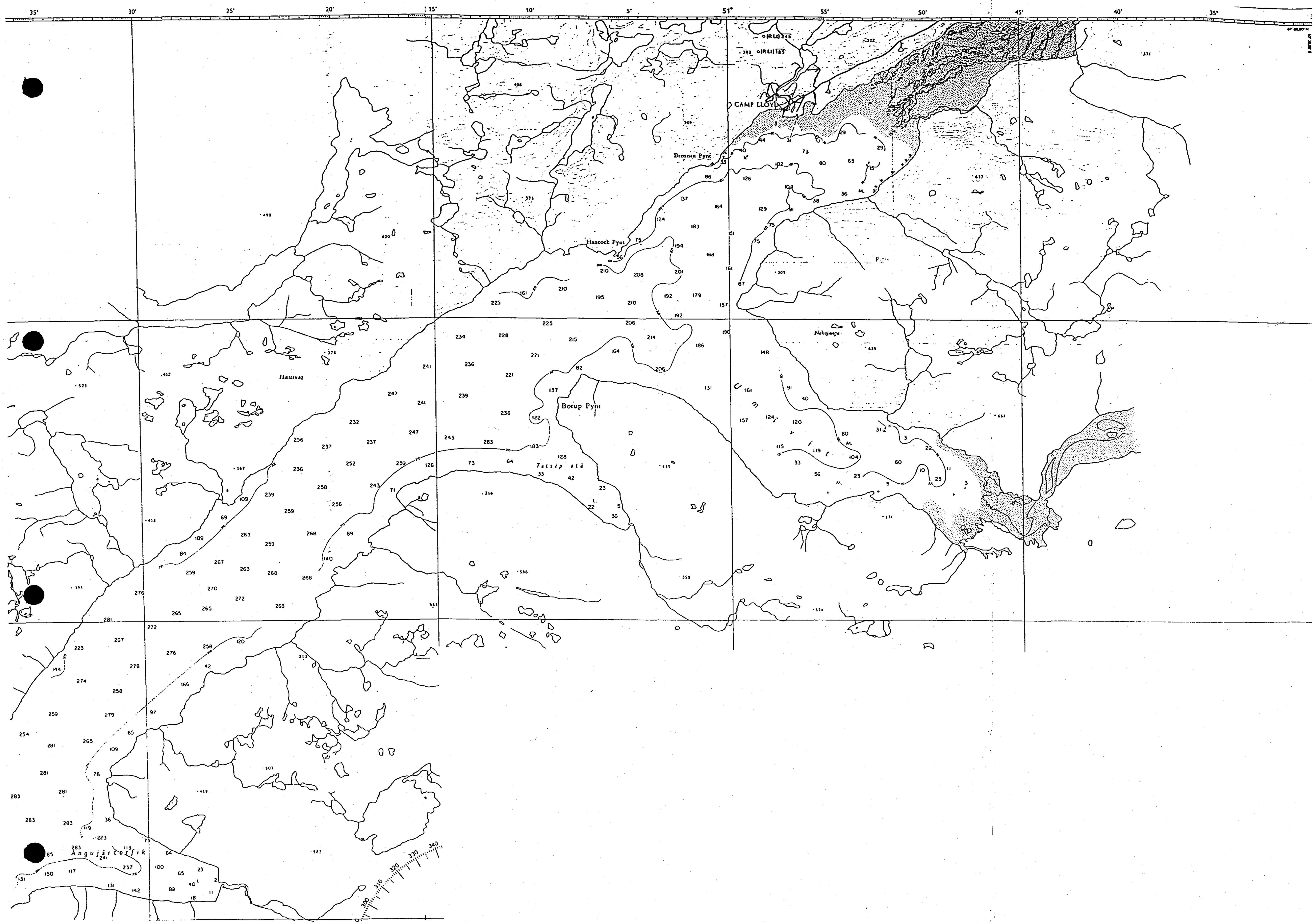

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CAMP LLOYD
Brennan Pynt
Hancock Pynt
Borup Pynt

10

10.1 Plant Location Options

The Base Case has been established, given the geographic constraints presented by the location of the mine and its surroundings, to minimise overall project capital and operating costs. Where possible this has entailed minimising duplication of services, minimising distances between serviced buildings and locations, and co-locating as many project facilities as practical

All site locations (for all options) require greenfields developments.

Figure 1.2 provides an overview of the general project locations in South West Greenland. **Figure 10.1** provides topographical and satellite information for the area from the mine site to Angujaartorfik Inlet, off Sondre Stromfjord.

Figure 10.2 gives an aerial perspective of the proposed road route from Angujaartorfi Inlet, the site of the project harbour, looking south, toward the mine site.

10.1.1 Logistics Issues

In line with the comments above, material logistics are a critical consideration for this project, especially given the remote locations involved. All avenues whereby material tonnages to be handled are minimised, double handling avoided, and transport distances are cut have been thoroughly investigated and evaluated.

The mine site access road is the preferred access / logistics option.

The road options considered are illustrated on collectively on **Figure 10.3.** Individual road options A, B, C & D are shown on **Figures 10.4 – 10.7** respectively. **Figures 10.8 – 10.13** show photographs of the proposed road route from Angujaartorfik Inlet through Arangarngup (kua) Valley to the mine site.

10.1.1.1 Environment & Archaeological Issues

The mine site overlooks the Arangarngup (kua) Valley. This valley is important from both environmental (eg. flora and fauna) and archaeological perspectives.

While a number of options for mine site access have been considered, it seems an inescapable conclusion that a mine site access road is fundamental to project feasibility.

The mine site access road from Angujaartorfik Inlet must cross this valley

10.2 Capital Expenditure

Capital Cost information is presented for the following cases;

- Base Case - Electric Arc Furnace (EAF), Site
- Option 1.0 - Chemical Processing
- Option 2.0 - EAF Toll Refining, Off-site

Financial sensitivity considerations are addressed in **Section 17.0.** Capital cost disbursements is discussed in **Section 15.0, Use of Funds.**

10.2.1 Base Case – Electric Arc Fumace (EAF)

Table 10.1 summarises the capital cost for this case - approximately US$ xxxxx million.

A more detail breakdown of the cost estimate is provided in **Appendix 7.**

10.2.2 Option 1.0 – Chemical Processing

Table 10.2 summarises the capital cost for this case - approximately US$ xxxxx million.

A more detail breakdown of the cost estimate is provided in **Appendix 7.**

10.2.3 Option 2.0 – EAF Toll Refining

Table 10.3 summarises the capital cost for this case - approximately US$ xxxxx million.

A more detail breakdown of the cost estimate is provided in **Appendix 7.**

10.2.4 Qualifications & Clarifications

It must be stressed that, at this point in time, no engineering design has been done on this project. Site visits have been carried-out. Discussions have taken place with contracting organisations, equipment suppliers and vendors in Greenland, Denmark and Australia. However, the capital and operating costs are based upon best available information, for the project work scopes as currently defined.

The major qualifications pertinent to the capital costs estimate are as follows;

- Chemical Processing Facilities

  At this time only limited chemical processing, leaching, solvent extraction and product recovery / refining has been carried-out.

  A programme of metallurgical test work has been recommended, incorporating;

- Comminution & Sample Preparation
  (including a repeat of Abrasion, Rod and Ball mill index).
- Bench Scale Testwork
  (including comprehensive head assay, leach tests, assays on liquors and residues, optimise operational conditions).
- Extraction and stripping Isotherms
- Loading and stripping kinetics
- Leach liquor stability tests
- Mixer – Settler tests
- Precipitation tests
- Continuous piloting
- Final product precipitation and marketing samples

• Mine Planning (post open cut)

Further drilling of the deposit to depth (ie. beyond the current 70 – 80 metres) is required to confirm deposit configuration and consolidation. A number of drill holes to 150 metres is considered essential to adequately prepare a longer term mining plan.

• Electric Arc Furnace (EAF) Test Work

A programme of metallurgical test work is ongoing with CSIRO Minerals, GK Williams Cooperative Research Centre for Extractive Metallurgy, (Clayton, Victoria) to carry out this work.

Expectations are high that this test work will be successful.

• Infrastructure & Services

Definitive quantities and maximum demands for key services are to be confirmed by further test work and engineering design (eg. electricity, water, chemical process facility inputs – such as acid).

• Uranium / Tailings Disposal

The project Base Case assumes simple, cost-effective disposal (ie. as a land fill in a solid, encased format).

TABLE 10.1 – Capital Cost Summary Format

DIRECT COSTS
Purchased Equipment Cost (PEC) – Delivered to site

1.0	Mine
2.0	Ore Handling & Processing
3.0	Chemical Process Facilities
4.0	Electric Arc Furnace Process Facilities
5.0	Product Bagging / Drumming & Dispatch
6.0	Infrastructure & Services

DIRECT COSTS – FACTORED

2. Purchased Equipment Installation (PEI)
3. Insulation
4. Instrumentation and Controls
5. Piping
6. Electrical Equipment & Facilities
7. Buildings Including Services
8. Site Improvements
9. Service Facilities
10. Land

DIRECT COST TOTAL

INDIRECT COSTS – FACTORED
Engineering & Supervision

1. Construction Expense
2. Project Management Fee
3. Contingency

INDIRECT COST TOTAL

TURN-KEY COST
TOTAL COST: DIRECT & INDIRECT

OWNER'S COST
CAPITAL INVESTMENT (NON FACTORED ITEMS)
Commissioning – Spare Parts
Commissioning

Mine Site Access Road
Power Station
Harbour Facilities
Site Resupply & Transport (Hovercraft)
Mining Fleet Mobile Equipment

TOTAL PROJECT CAPITAL INVESTMENT — US $29.5 million

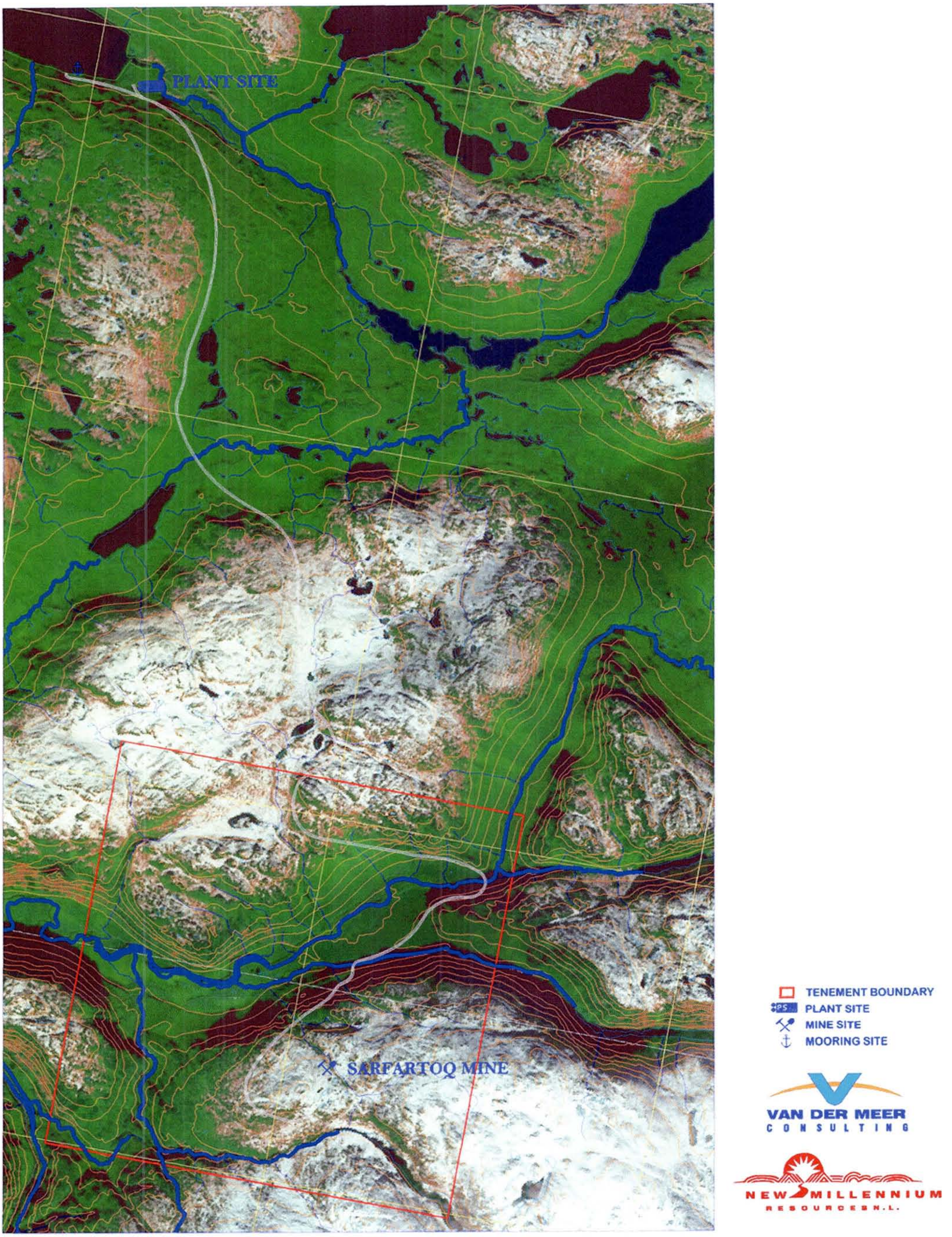

FIGURE 10.1 - SARFARTOQ MINE PROPOSAL

DWG:NMR-RD00 20th July 2000

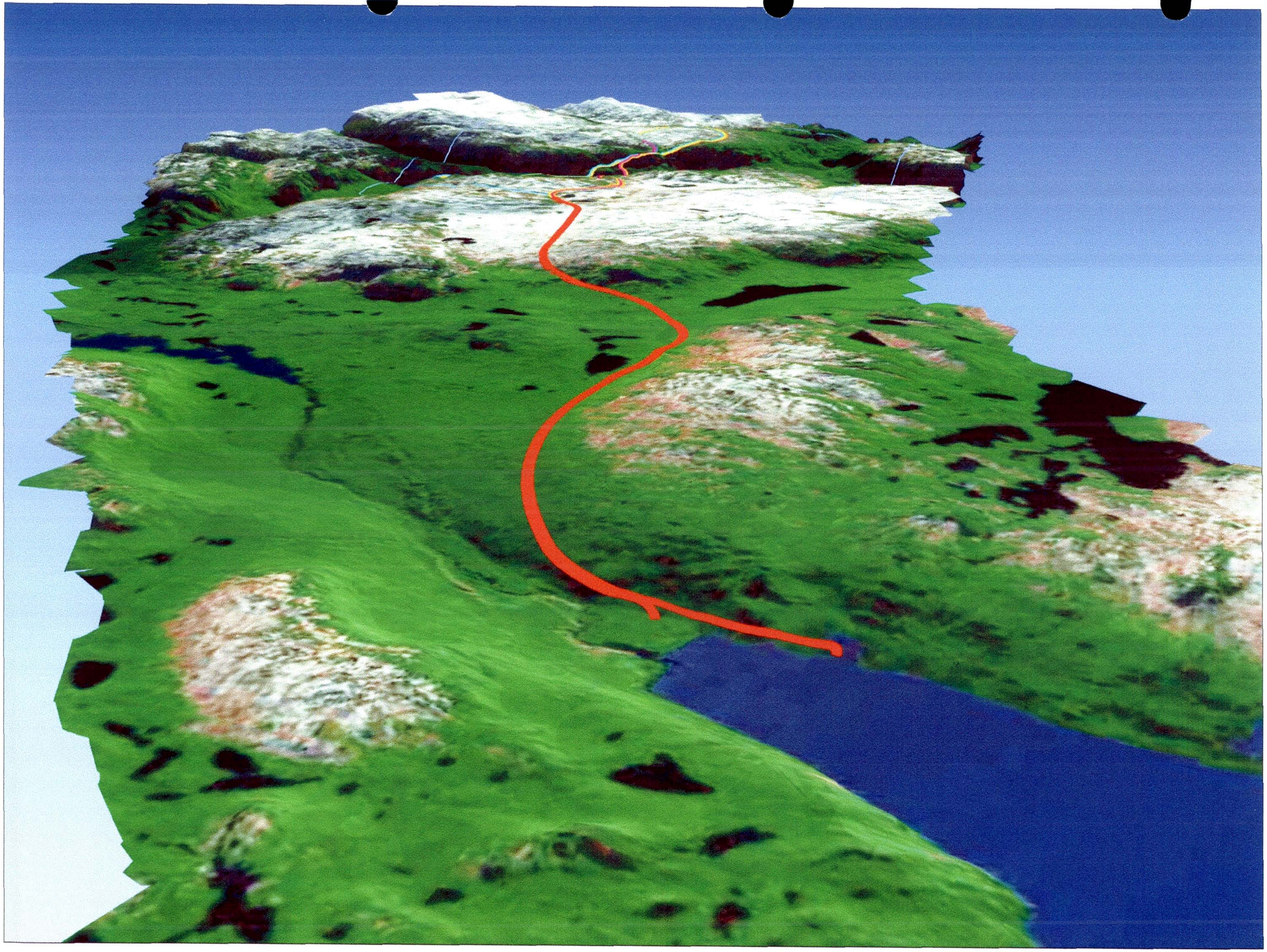

Figure 10.2

Aerial Perspective

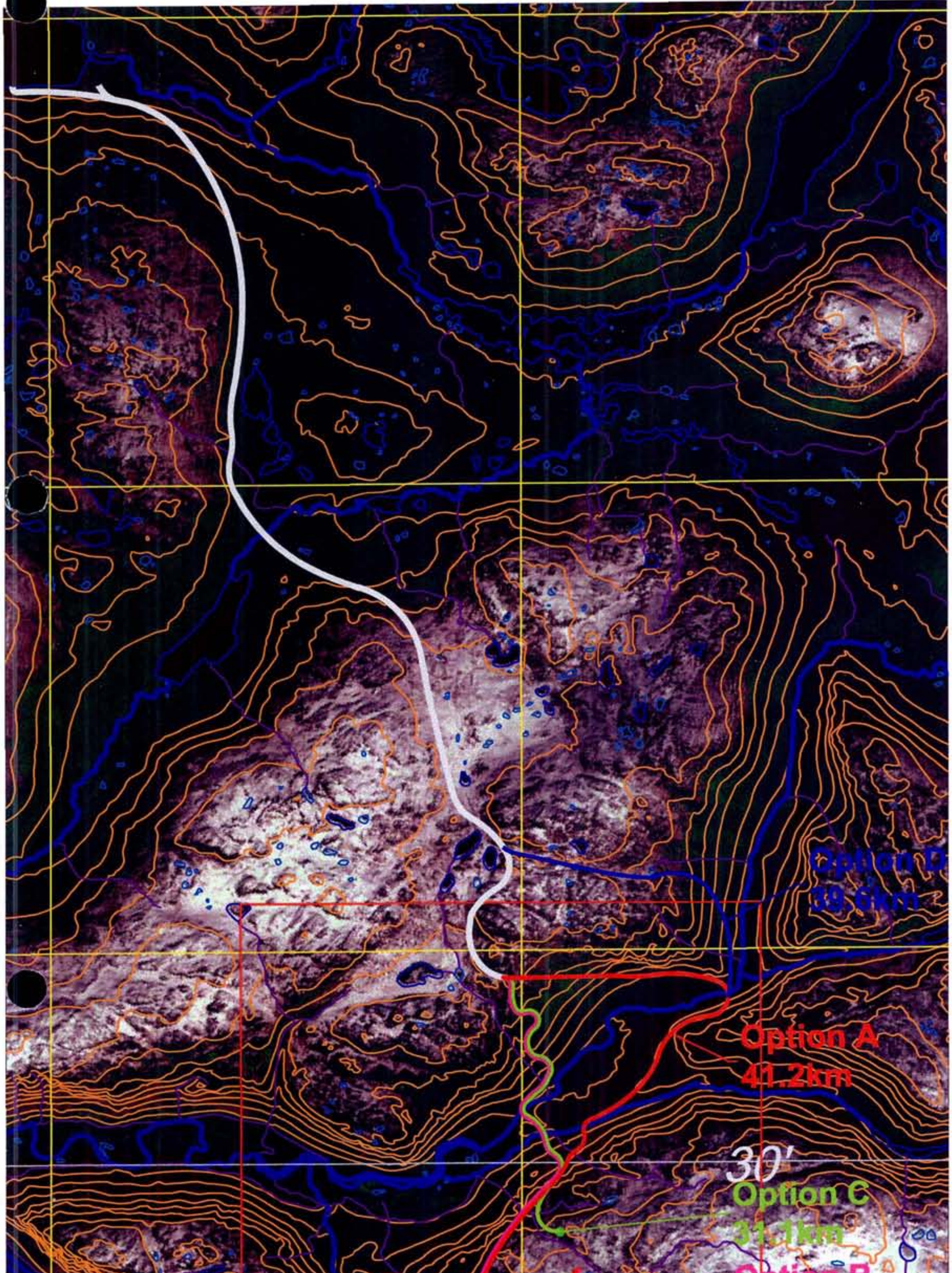

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FIGURE 10.3 - SARFARTOQ MINE/PLANT PROPOSAL

DWG:NMR-GA01 20th July 2000

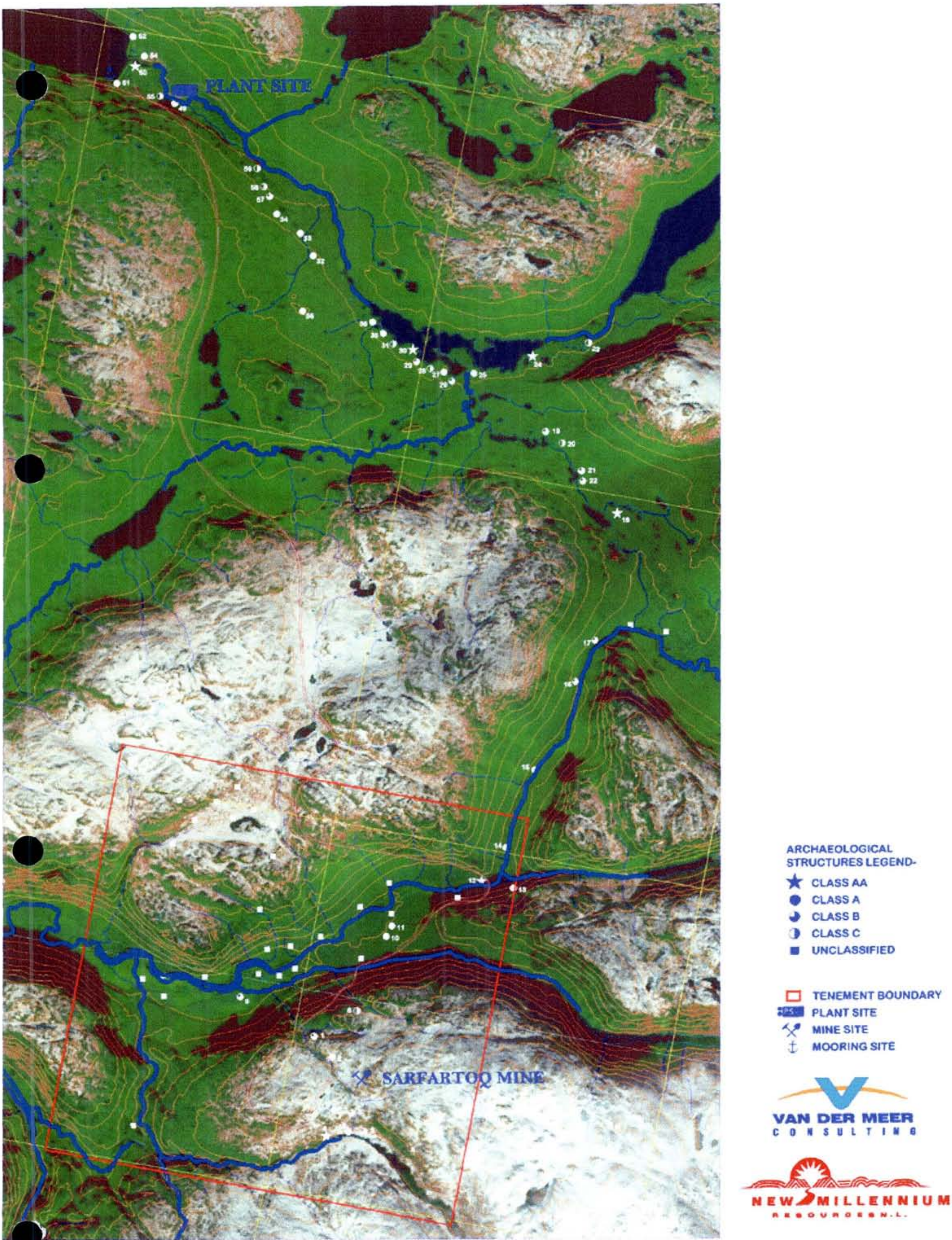
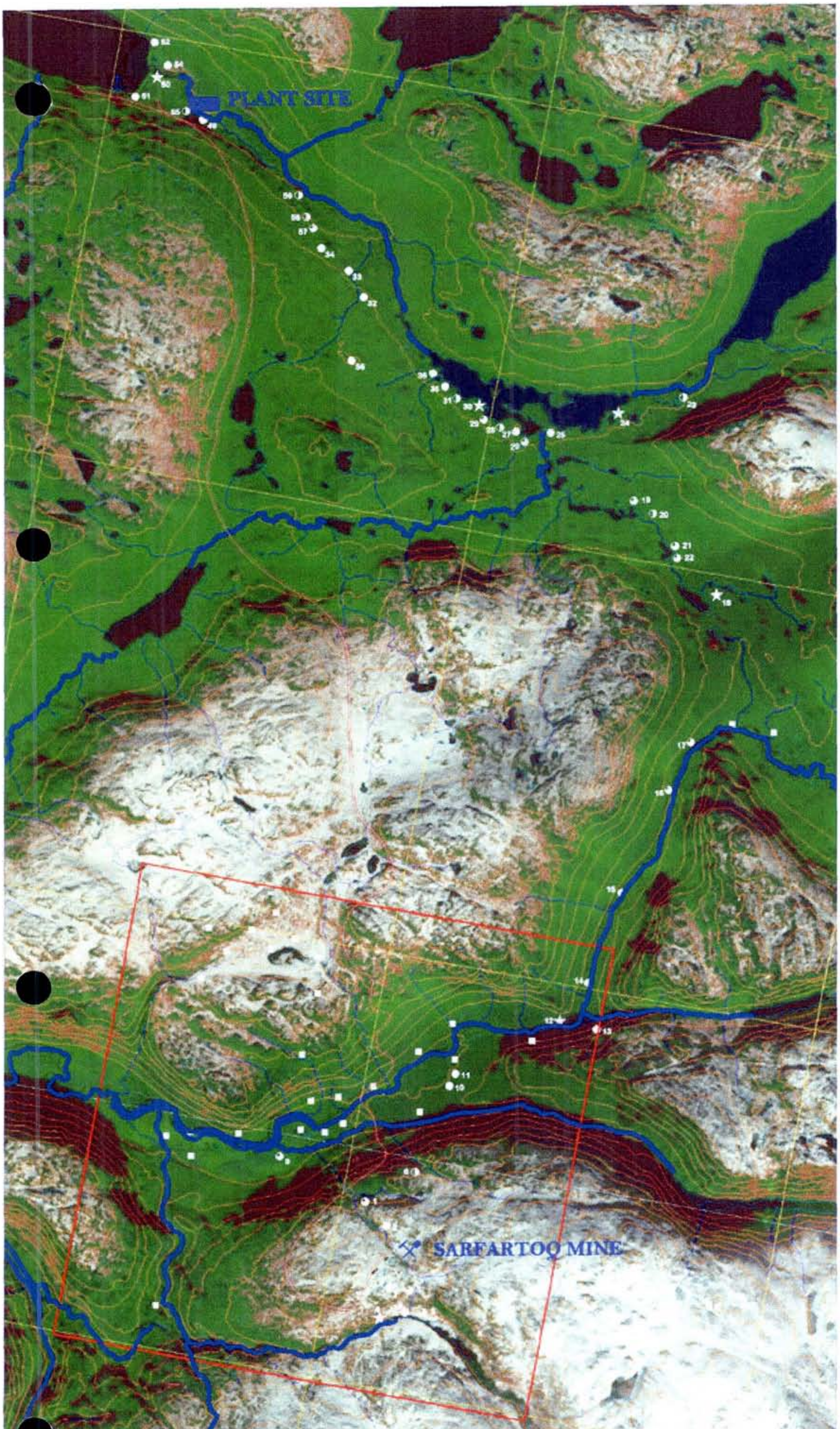


FIGURE 10.4 - SARFARTOQ MINE ROAD OPTION A

DWG:NMR-RD02 20th July 2000



ARCHAEOLOGICAL STRUCTURES LEGEND-

- CLASS AA
- CLASS A
- CLASS B
- CLASS C
- UNCLASSIFIED

- TENEMENT BOUNDARY
- PLANT SITE
- MINE SITE
- MOORING SITE

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FIGURE 10.5 - SARFARTOQ MINE ROAD OPTION B

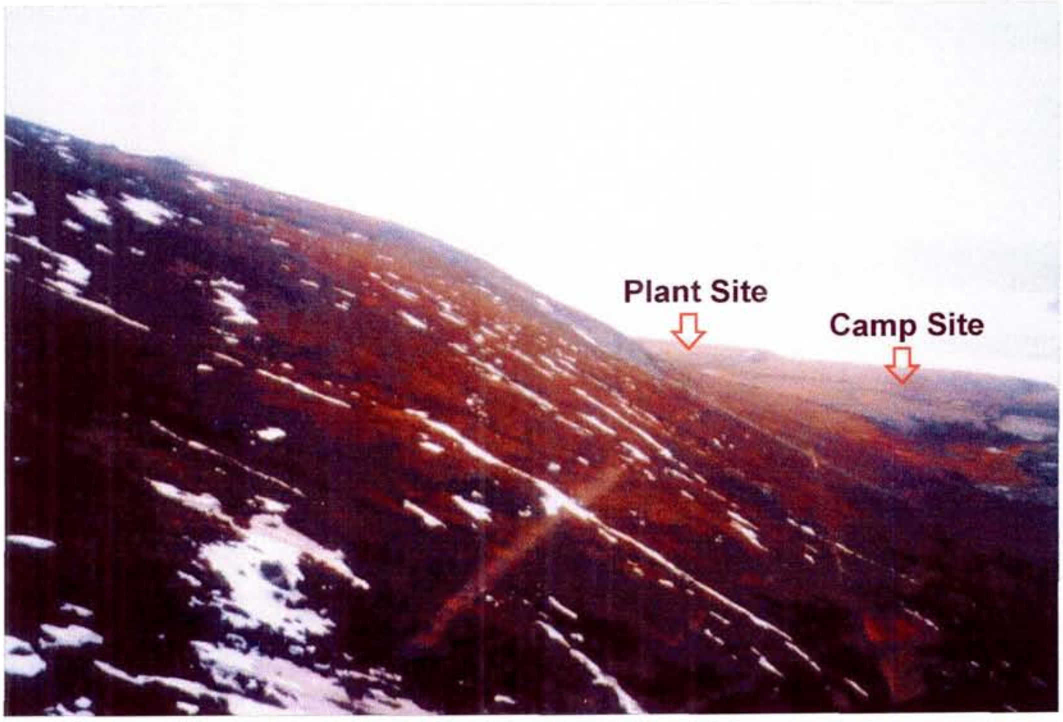
DWG:NMR-RD03 20th July 2000

FIGURE 10.6 - SARFARTOQ MINE ROAD OPTION C

DWG:NMR-RD04 20th July 2000

FIGURE 10.7 - SARFARTOQ MINE ROAD OPTION D

DWG:NMR-RD05 20th July 2000



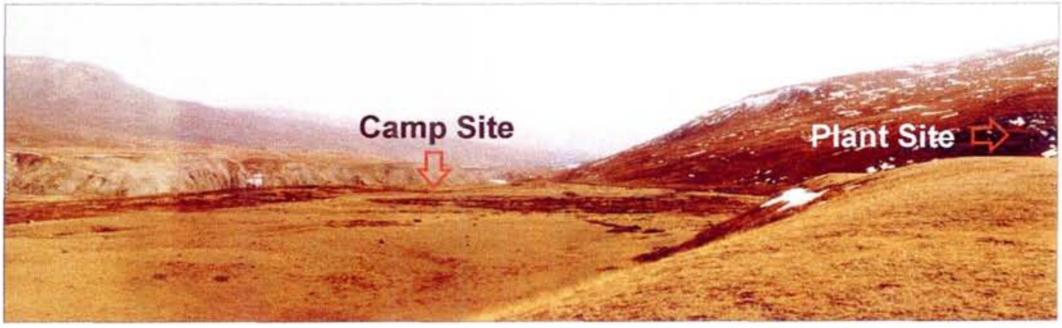
Camp and Plant Site

Mooring & Access Road

Figure 10.8

Plant Site

Plant Site

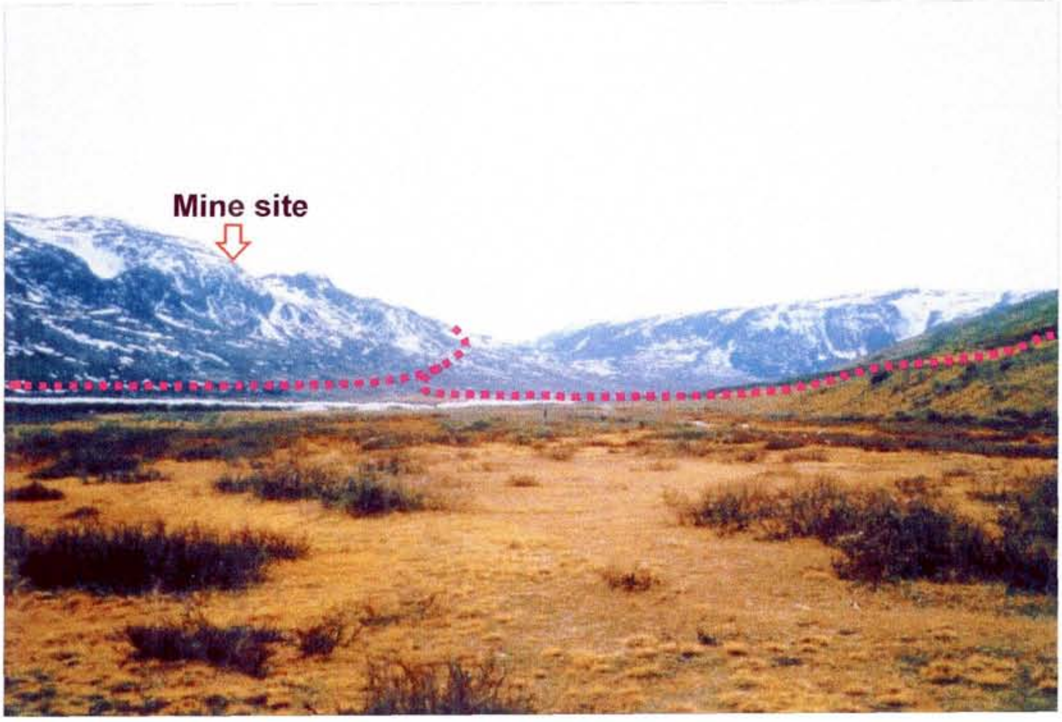


Camp and Plant Site

Plant site

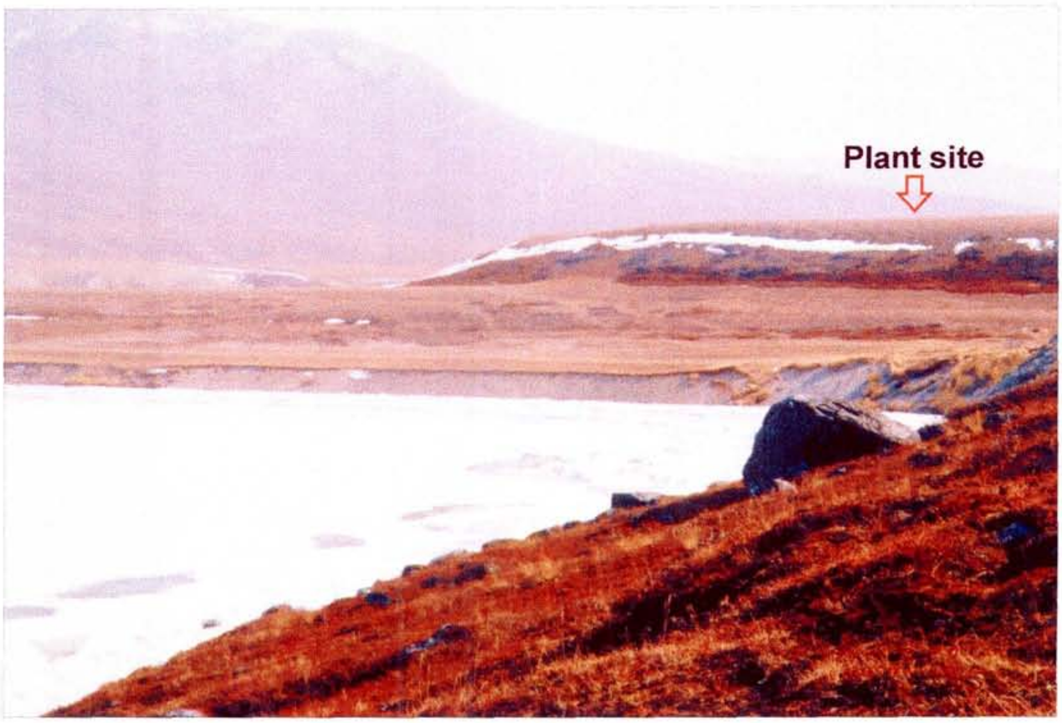
Valley floor

Figure 10.10



Road access options

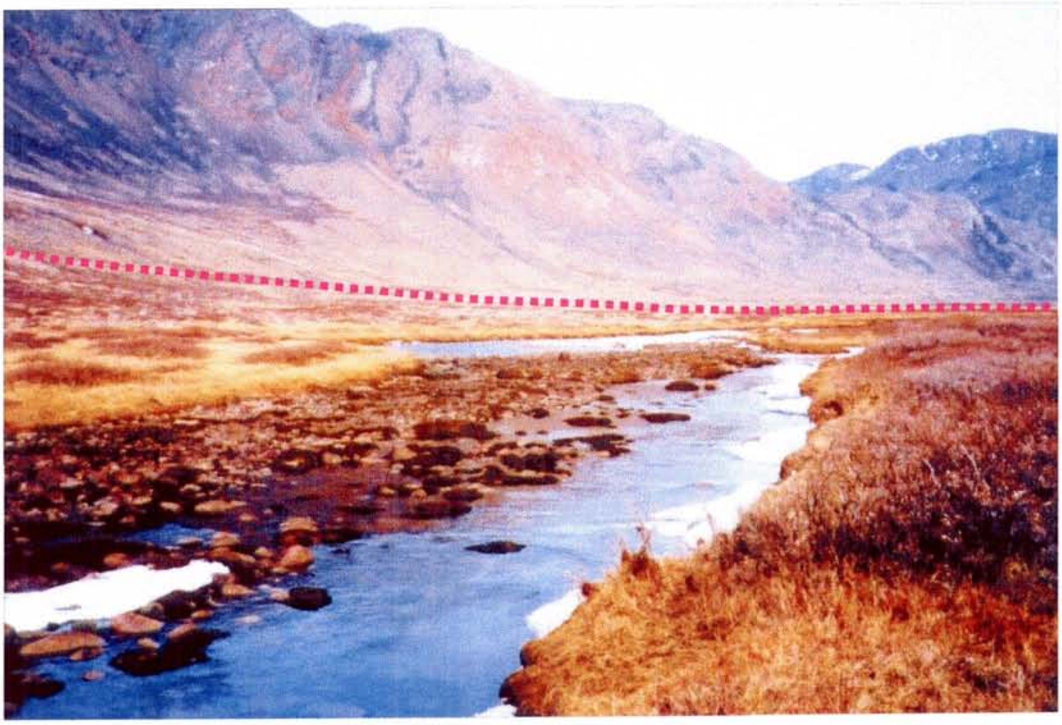
Mooring road access



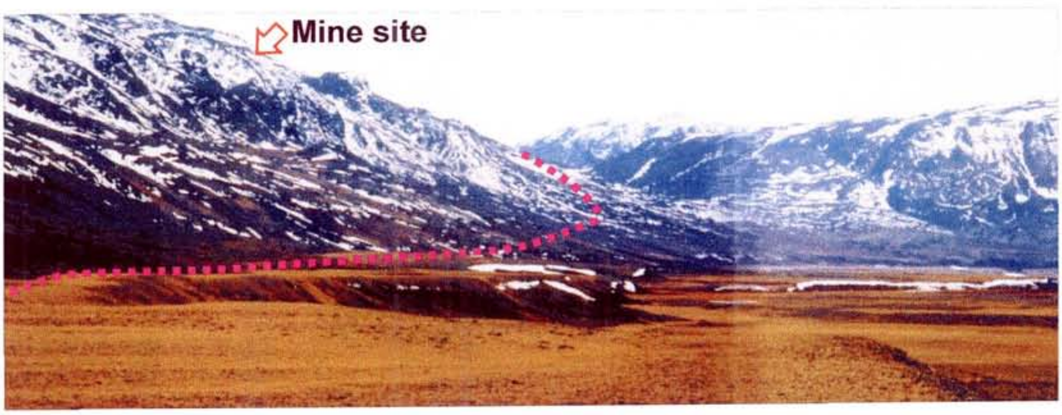
Plant Site

Figure 10.11

Road Alignment



Road Alignment



Road Alignment

Mine site and ore body

Arnangarnup Valley

Figure 10.13

11

The following government, and local authorities have been consulted during the Stage I feasibility study process;

- Bureau of Minerals and Petroleum, Government of Greenland
- Maniitsup Kommunea
- Kangerlussuaq Borgerrad
- National Environmental Research Institute, Department of Arctic Environment, Frederiksborgvej, Roskilde, Denmark

The following companies and organisations have also been contacted;

- Mittarfeqarfiit, Greenland Airport Authority
- Greenland Resources A/S
- Asiaq, Misisueqqaarerit
- Royal Arctic Line A/S
- Skanska
- Permagreen
- Greenland Service Partners

11.1 Environmental Impact Statement (EIS)

Preliminary base line environmental and archaeological work was undertaken in 1987 [3]. Further work is currently being planned for the summer period of 2000.

This work will provide an important benchmark upon which to compare future development activities and any project impacts.

Base line studies and the collection of samples for future reference are a critical element in the process to granting formal project approval. These studies, together with a road survey and archaeological survey along the road corridor will need to be completed by September 2000. A base line survey of "Angujartorfik" proposed infrastructure site will have to be incorporated in this study.

11.2 Determining Authority for Development

The determining authority for the Development Application and Approval process is the Bureau of Minerals and Petroleum (BMP).

As part of the "one-door" development process in Greenland, the BMP are the prime interface between NMR ("the project developer") and the Greenland Government and its agencies.

11.3 Local Government Considerations

Discussions have taken place with the following Local Government groups during the Stage I feasibility study process;

- Maniitsup Kommunea
- Kangerlussuaq Borgerrad

Permits and licences will have to be obtained from these parties as the project progresses.

11.4 Export Licence

An export licence is required for the project products envisaged (ie. Ferro-Niobium, Niobium Pentoxide, etc.) Applications are made to the Greenland Executive for Fisheries and Industry, cf. Section 2 of Act No. 5 of 22 November 1984. An Export Licence Application will be strongly supported by the BMP.

11.5 Water Resources

To our knowledge at this stage, access to water resources in the vicinity of the project sites proposed is unrestricted. However formal approval will, nonetheless, be sought as part of the development approval process.

12

12.1 Corporate Structure

The structure of NMR as a Greenland domiciled limited company is yet to be decided.

For the purposes of the Stage I Feasibility Study NMR Corporate Administration, Marketing and Sales functions have been estimated as a percentage of project capital costs (ie. 2%). A cost allowance for these functions of approximately $600,000 has been made.

As a business entity the "NMR Niobium Company" is likely to require key operations management personnel for the following roles: -

- Managing Director / General Manager
- Marketing / Sales Manager
- Operations Manager
- Site / Process Facility Supervisor
- Mining Foreman
- Exploration / Grade Control Geologist

12.2 Operations Management

The General Manager will be responsible for all facets of operations including:

- Managing all aspects of mining, processing, fusion and services operations.
- Ensuring that all corporate statutes and laws are followed.
- Financial planning and preparation of annual budgets.
- The development and implementation of;
  - Plant maintenance and operations procedures; and
  - Quality assurance / quality control procedures.
- Maintenance of effective industrial relations.
- Occupational health, safety and welfare of all employees.
- Recruitment and training.
- Business and Market Development.

During the initial start-up and operations of the project it is envisaged both the General Manager and Operations Manager will have a more hands-on operational role. They will work closely with the NMR Client Representative and Project Manager. As plant availability / operational on-stream factors improve and become more routine, the focus of the role will shift towards overall business performance, marketing and business development of opportunities.

12.3 Organisation Personnel

Operational personnel for the Base Case number approximately 20 in total.

Depending upon the course the project takes in future, for example, increased Ferro-Niobium production capacity - employment numbers could increase.

12.4 Employee Relations Management Plan

The Base Case assumes mining operations of one shift per day (nominally 12 hours). The process facilities will operate two shifts per day (nominally 2 X 12 hours per day). It is further assumed operations will only occur for 100 days per year, through the summer / autumn period.

Enterprise bargaining / agreements and multi-skilling opportunities for the workforce will form the platform for the Employee Relations Management environment

Quality management principles are planned for introduction to the new workforce.

13

13.1 Exploration & Mining Licence

Under existing law, an exploitation licence is granted when the applicant qualifies under the following guidelines.

Mineral Resources Act, No. 335 (of June 6, 1991) as amended by;

- Act No. 1074 of December 22, 1993
- Act No. 303 of April 24, 1996
- Act No. 317 of June 3, 1998

Chapter 3, Exploration and Exploitation, Section 7;

" Licences may be granted separately for exploration and exploitation, respectively"

Subsection 3;

"An exploitation licence regarding mineral resources will as a main rule only be granted to limited companies domiciled in Greenland, exclusively carrying out activities under licences granted pursuant to this Act and not being taxed together with other companies. The licence shall furthermore have the necessary expert knowledge and adequate financial background with respect to the exploitation activities in question."

Section 10;

"Prior to commencement of exploitation and development activities, a plan for the activities, including organisation of the production and the production installations (production measures, etc.), shall have been approved by the Greenland Home Rule Government subject to agreement under Section 3."

NMR holds a current exploration licence, which will be upgraded with an application to the BMP, once a project plan is completed.

NMR has a registered limited Greenland company (New Millennium Resources Greenland). This company will be activated to support the application for an Exploitation Licence. This process will be instigated in the next 2 months.

13.2 Land Access

Following discussions with the BMP it is understood that land access is a reasonably straightforward formality, once all environmental and licence obligations are fullfilled.

Land is applied for and granted on submission of a land use document. Relevant timeframe information must be allowed in the overall project development schedule. However, it is not expected this will be a critical path activity.

13.3 Marketing - Product Off-take

It is proposed off-take contracts / market support agreements will be sought in the Stage II Feasibility Study phase.

13.4 Letters of Undertaking

Part of Stage II Feasibility Study Phase.

13.5 Heads of Agreement(s)

Part of Stage II Feasibility Study Phase.

13.6 Joint Venture Agreement(s)

Part of Stage II Feasibility Study Phase.

13.7 Power

The Base Case makes provision for a stand-alone owner / operator power supply.

The Stage I Feasibility Study financial analysis is based upon an assessed electricity price of US 20.0 cents / kWh (at site). The estimated capital cost for this project infrastructure component, with the current level of detail, is US$ xxxxx million.

Preliminary discussions with the local government in Maniitsoq conceming a possible project site, indicated a power supply cost from the local grid of approximately US 27.0 cents / kWh.

14

14.1 Project Development Schedule

Figure 14.1 is a simplified project development schedule, highlighting the major activities, timing and milestone dates.

At this point in time the overall period from NMR Board commitment (assumed in the schedule to be 01/12/2000) to project start-up is estimated to be approximately 10 - 11 months.

14.2 Project & Construction Management

In order to achieve maximum flexibility and the most competitive fabrication, construction and installation bids, it is proposed NMR implement a horizontal contracting strategy for the project.

The horizontal contracting strategy will be managed by the Client Representative, Project, Construction and Design management team.

One of the major benefits of this contracting approach will be a saving on contractor margins (for example, compared to a design and construct, or turnkey approach). This will result in significant capital cost savings for the project and NMR.

Critical supply elements, for example the electric arc furnace, will be issued as design and construct packages.

Figure 14.2 outlines the envisaged Client Representative, project, construction & design management organisation structure. This structure will oversee the process detail design, equipment procurement, construction, commissioning and acceptance hand-over to operations personnel. Commissioning and start-up will involve NMR operations personnel.

14.3 Project Pre-Commitment Issues

A number of key activities are either currently in progress or will need to be initiated as soon as project commitment is formally achieved.

14.3.1 Environmental Impact Statement (EIS)

This document shall be prepared during Stage II of the Feasibility Study. It shall collate all relevant project proposal data and environment, archaeology, emission and other information.

No insurmountable hurdles have been raised at this stage.

The final EIS document will be issued to the Determining Authority (ie. Bureau of Minerals and Petroleum) as part of the project Development Application process (see **Figure 14.1**), as well as to other relevant Government Authorities.

14.3.2 Development Application

As indicated in **Figure 14.1** the Development Application will be made to the BMP, (the Deputy Minister being the consent authority). A formal application must be accompanied by a project EIS.

If there are no objections of any substance lodged against the project, it is our current understanding that a Development Approval should be achieved within three months from the date of lodgement of the application.

No site construction activities can commence until granting of the Development Application.

14.3.3 Project Site Items

14.3.3.1 Water Supply

Preliminary site visits and checks of the surrounding areas suggest good quality water supplies are plentiful. Water quality tests will be required to confirm potable water standards.

The establishment of potable and process water supplies is likely to be a critical path activity. Nonetheless, this is not expected to present any difficulties. This matter will be addressed during Stage II of the Feasibility Study.

14.3.3.2 Geotechnical Investigations

Preliminary site visits and checks of the surrounding terrain suggest there should be no geotechnical problems.

Ground / Soil Bearing Pressure tests shall, nonetheless, be carried-out during Stage II of the Feasibility Study for critical project site locations.

Preliminary engineering design is yet to be carried-out and no assumptions have been made in this regard at this time.

14.3.4 Long Lead Items

The major long lead items for the Base Case are likely to include the following;

14.3.4.1 High Voltage Transformer & Switchgear

Site voltage supply is yet to be specified. This matter will be addressed during Stage II of the Feasibility Study.

14.3.4.2 Power Supply Equipment

This is likely to be supplied skid mounted. This matter will be addressed during Stage II of the Feasibility Study.

14.3.4.3 Hovercraft

If adopted as the preferred re-supply delivery system for the project site (as proposed). This matter will be addressed during Stage II of the Feasibility Study.

14.3.5 Construction Implementation

As discussed, the Client Representative, Project, Construction & Design Management team shall adopt a horizontal contract package philosophy. This team will also fill the role of project "Superintendent".

This team will also conduct regular procedural audits to ensure performance requirements are being met.

Consideration will be given to appointing the Construction Site Manager on the basis this person may continue with the project into the operations phase to ensure that construction knowledge and supplier contacts made during the construction phase are not lost to the project.

This team will produce detailed monthly progress reports to the NMR. These reports will review performance to date with respect to physical progress and budgets, and help to ensure project milestones are being achieved.

14.4 Commissioning

Commissioning and project start-up will be managed by the IMT, with suitable support and performance guarantee activities by nominated contractors, equipment vendors and suppliers.

The acceptance procedure by NMR Operations will require a hand-over evaluation (mechanical, electrical, instrumentation etc.) of the relevant plant section by operations personnel. Punch-list items (on a nominated priority basis) will require rectification before hand-over of the services, equipment or plant section to operations.

Project services will be commissioned first, followed by appropriate process sections and facilities.

14.5 Personnel Issues

Under Greenland Law an act has been adopted for the control of manpower from abroad, cf. Act no. 27 of 30 October 1992 of the Greenland Assembly. Under this Act employment of manpower from abroad in positions, which are covered by cf. Section 2 , can only take place if prior permission has been obtained from the Municipal Labour Market Committee, cf. Section 5.

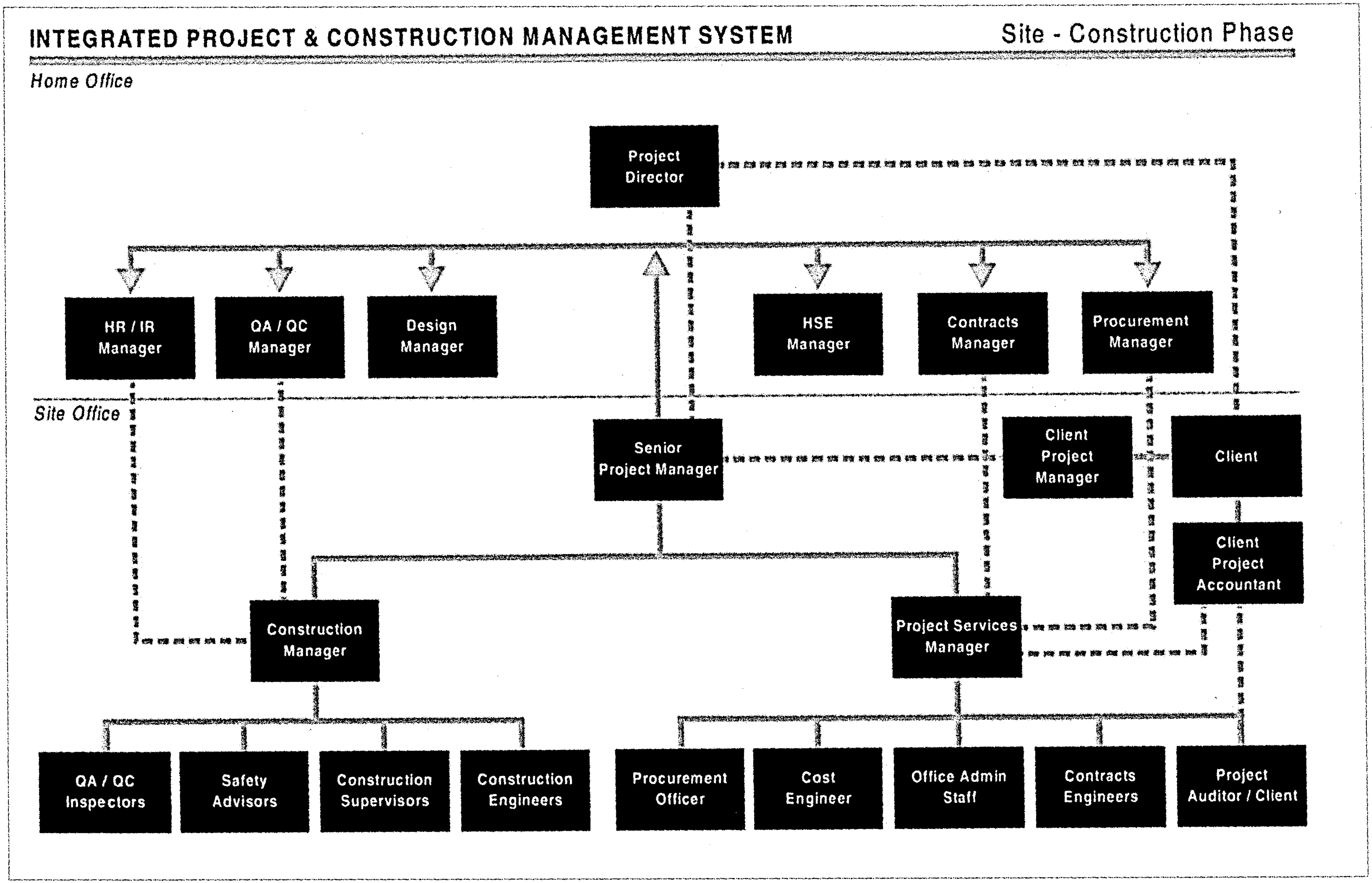
14.5.1.1 Personnel Recruitment Schedule

This matter will be addressed during Stage II of the Feasibility Study.

14.5.2 Operator Training

The only plant area where specific training may be warranted at a facility outside Greenland is the Electric Arc Furnace technology.

Experienced expatriate supervision shall be needed for personnel training on key project facilities and operations (eg. power generation, electrical switching, process facilities, ore handling & processing and product bagging, etc.).



INTEGRATED PROJECT & CONSTRUCTION MANAGEMENT SYSTEM
Site - Construction Phase
Home Office
Project Director
HR / IR Manager
QA / QC Manager
Design Manager
HSE Manager
Contracts Manager
Procurement Manager
Site Office
Senior Project Manager
Client Project Manager
Client
Client Project Accountant
Construction Manager
Project Services Manager
QA / QC Inspectors
Safety Advisors
Construction Supervisors
Construction Engineers
Procurement Officer
Cost Engineer
Office Admin Staff
Contracts Engineers
Project Auditor / Client

Figure 14.2

15

15.1 Construction Phase

The construction phase is assumed to commence from the time the decision to proceed is made (ie. the Base Case assumes a commitment date of 01 December 2000) and to cease at the start of commissioning. **Section 10.2** discusses the capital costs associated with the purchase of equipment and the fabrication / construction / installation of plant necessary for the project during the construction and commissioning phase. This section is only concerned with those costs incurred during the construction phase.

15.1.1 Plant Assets & Equipment / Facilities

Plant and equipment to be purchased are discussed in **Section 10.2**. An overview of the project capital expenditure for the Base Case and Option 1 is as follows;

SECTION DELETED - COMMERCIAL-IN-CONFIDENCE

The mining equipment is priced as new equipment.

Where possible equipment will be skid mounted and pre-assembled for delivery to site.

The capital cost for the Base Case, totalling $29.5 million, is assumed to be expended during the design, procurement, construction and commissioning periods.

15.1.2 Infrastructure & Services

Infrastructure and services totalling approximately $11-12 million (inclusive of contingency component) are estimated for all cases considered.

15.1.3 Professional Fees

Professional fees are inclusive of the following;

SECTION DELETED - COMMERCIAL-IN-CONFIDENCE

15.1.4 Owner's Costs

Owner's costs are those costs incurred directly by NMR during the construction phase. These costs are included in the capital cost. Total Owner's Costs are estimated at approximately $260,000. A breakdown of typical Owner's cost items is summarised below;

15.1.4.1 Management Costs

During the Construction Phase it is assumed NMR will appoint a Client Representative, Project, Construction & Design Manager to directly represent their interests. The costs for this are shown as the Project Management Fee in the Capital Estimate Summary.

In addition, however, there is an allowance within the Owners Cost for travel and accommodation for NMR personnel to attend meetings during the construction phase.

This component cost allowance is approximately $100,000.

15.1.4.2 Insurances

The following levels of insurance have been budgeted and will become the responsibility of the NMR Client Representative in the lead up to the project construction phase, for example;

(a) Contract Works and Public Liability
Sum insured: eg. Material damaged $20,000,000
Public Liability $10,000,000

(b) Marine Transit
Sum insured: eg. $4,000,000 for any conveyance or location

Estimated cost: 0.5% of Capital Cost, approximately $50,000

15.1.4.3 Legal

An allowance has been made for legal costs incurred during the construction phase, for example, the preparation and / or vetting of construction contracts. At this stage this is incorporated in the Project Management Fee estimate.

15.1.4.4 Recruitment & Salaries

As discussed in **Section 14.5.1** it is intended to recruit NMR personnel at various stages, prior to commissioning.

Labour costs incurred prior to (hot) commissioning have been capitalised. Costs incurred during or after (hot) commissioning are treated as an operating cost.

In addition an allowance has been made for the recruitment of new staff, which is treated as a capital cost item.

This component cost allowance is approximately $100,000.

15.1.4.5 Pre-start Training

Pre-start technical training will be an important requirement, particularly for process plant operators.

This component cost allowance is approximately $60,000.

15.1.5 Construction Spares

The capital cost estimate discussed in **Section 10.2** included an allowance for operating spares equal to 1% of the cost of Purchased Equipment Costs (ie. for Plant and Equipment and Services).

This component cost allowance is approximately $40,000.

15.1.6 Ground Breaking Ceremony

At this stage no allowance has been made for a 'Ground-Breaking' Ceremony.

Previous projects on which we have been associated have clearly demonstrated the need and merits of such a ceremony in terms of:

(i) Publicity and promotion of the project
(ii) Gaining support from the local population, unions and government

15.2 Commissioning

The Capital Cost discussed in **Section 10.2** includes a commissioning cost allowance equal to 2% of the Direct Costs – approximately $260,000.
This cost does not include an allowance for a Plant Open Day.

At this stage no allowance has been made for a Plant Open Day at the completion of the commissioning. On the basis of the previous experience such an event has the following benefits:

(i) Publicity for the project
(ii) The opportunity to invite potential customers

An allowance of $150,000 may be required. The requirement for this event needs to be established during Stage II of the Feasibility Study.

15.3 Operating Phase

Once the plant is operational, further capital injection will be required for working capital (eg. current assets less current liabilities) and for the establishment of inventories.

The Stage I Feasibility Study model (discussed in **Section 17.0**) allows for working capital, for the Base Case conditions and assumptions, of 10% of invested capital- approximately $3 million. This makes allowance for the following;

15.3.1 Additional Spares
15.3.2 Consumables & Cash

For example;

- Cash
- Consumables
- Electrodes
- Bulka Bags
- Pallets
- Lubes/Oils

15.3.3 Inventory

It is necessary to maintain stockpiles of inventory including Plant Feed, Process Facility Feed and Finished Product. It is often adequate to assume that maintenance of inventories for finished goods is equivalent to four weeks of sales. In addition, all other inventories are often assumed to be maintained at levels equivalent to two weeks of production. Given the project location, these issues will need to be evaluated in detail during the Stage II of the Feasibility Study.

15.3.4 Debtors & Creditors

The financial model established for the Stage I Feasibility Study is comparatively simple, assuming year end cash flows and transactions. Timing issues associated with delays on the receipt of cash from sales, etc.- have not been modelled at this time.

15.3.5 Total Funds Required

The total capital funds, including funds for working capital during the start-up phase of the project (Base Case) are approximately US$xxxxx million.

The peak cash injection for the project is estimated to be incurred approximately August 2001. Clearly this will change if any of the Base Case assumptions herein are modified.

16

This section aims to identify major areas of project risk in terms of:

a) Pre-commissioning Risk - will the project be completed according to schedule, price and specification?

b) Commissioning Risk.

c) Post-commissioning Risk - will the project generate adequate revenues?

Within each category commercial, political and economic risk and force majeure events are considered.

16.1 Pre-Commissioning Risks

16.1.1 Construction Schedule

It is essential the project is completed in a timely manner according to the development plan (refer to **Section 14.0**) to ensure that potential market opportunities are achieved, and not lost to competitors. Factors that will affect the completion date include the time taken to:

(i) make the 'go/no go' decision for project initiation.
(ii) obtain all necessary project approvals - refer to **Section 16.1.9.**
(iii) complete the necessary metallurgical test work and subsequent detail engineering for the project.

The development plan assumes the project 'go/no go' decision will be reached prior to 01 December 2000. Any delays in reaching this decision will directly delay the construction completion date, given the project Base Case presented herein.

A critical area associated with the detail design and construction timetable is the time required to construct and commission the processing facility. A final decision on the type of process facility will require appropriate test work to be completed on typical feed material. The outcome of the test work is likely to impact the amount of detailed engineering required before a construction contract for the process can be issued.

The sensitivity of the project to variations in the capital cost and construction delays is discussed in **Section 17.1.3.**

A critical area associated with the timetable, particularly for the Electric Arc Furnace (EAF) Base Case option, is the installation of the high voltage power supply and associated long lead procurement items.

Whilst the construction timetable is demanding, it is considered to be achievable assuming a 01 December 2000 project commitment

16.1.2 Construction Contract

Given the project locations involved, the costs associated with site mobilisation and demobilisation, as well as the limited construction windows due to weather and logistics - the construction package is likely to be a vertical package.

Contractors will be selected according to a competitive tender process subject to them having the necessary technical and financial resources. Design & Construct or Turnkey contracts quoting a lump sum project price (terms, conditions and warranties subject to negotiation) may be preferred.

In addition, contractors shall be required to submit a detailed schedule of rates so that contract variations can be negotiated independently. It will be imperative the contractors ensure that the contract is completed according to schedule and that each item of plant is installed and operates according to specification.

Factors relevant to contractor selection include; price, industrial relations record, relevant experience & local knowledge, experienced personnel, proposed project methodology, demonstrated project planning & scheduling, and financial capacity and stability.

In the current economic environment competitive bidding is expected to result in a minimum capital cost project.

16.1.3 Construction Contractor Performance

A number of control mechanisms, including up front security payments, penalties and incentives, etc. are open to negotiation to ensure the selected contractor meets the project schedule.

16.1.4 Insurances

Insurances required during the construction phase will include; Contracts Works and Public Liability, and Marine Transit Overseas Insurance as discussed in **Section 15.1.6.2**. An optimal insurance strategy will be developed once the decision to proceed with the project has been made.

16.1.5 Technology / Process

As discussed in **Section 8.0**, in order to minimise technology risk it is proposed to use existing and proven technologies wherever possible.

16.1.5.1 Mining

The mining philosophy is discussed in **Section 7.0**. Mining operations and methodology are perceived to be of low risk based upon the current knowledge of the deposit and actual mining experience.

16.1.5.2 Crushing, Screening & Grinding

This is considered to be of low risk as current and proven technology will be used.

16.1.5.3 Process

The chemical processing option requires the completion of metallurgical test work to confirm the optimum processing parameters and conditions. While the technical approach is, in general, well proven (ie. acid leaching and solvent extraction, etc.) aspects of the technology require metallurgical test work to confirm the application to the pyrochlore ore deposit in question.

16.1.5.4 Electric Arc Fusion (EAF)

The Base Case development option proposed herein uses commercially proven Electric Arc Furnace (EAF) Technology. While metallurgical test work is still required to confirm the application of this technology to the ore deposit in question – the technology itself is proven.

All other aspects of the project development involve commercially proven technology and equipment.

16.1.6 Management During Construction

As discussed in **Section 16.1.1** it is important that careful control of the project is maintained to ensure the construction is completed on schedule. Consequently it is proposed the project construction be undertaken by a major construction company. Procedures for the pre-qualification and selection of the contractor and control mechanisms to ensure the contractor achieves the schedule are discussed **in Section 16.1.2.**

NMR shall appoint an experienced "Client Representative & Project, Construction & Design Manager" to act on their behalf. This group shall be responsible for management of the overall project timing, budget control and installed quality of the facility.

The NMR Process Operations Manager should be appointed early in the project development process. This is to guarantee the Process Operations Manager is involved during the construction and commissioning phase - to ensure a full understanding of the operations prior to commissioning.

16.1.7 Marketing Risk

It is considered likely the key target market for Ferro-Niobium, in the early years of the project, is likely to be the European Union markets.

Development of a detail strategic marketing strategy and off-take agreement negotiations will take place in the near future. These activities will address any concerns and issues related to project marketing risk. Specific issues to be addressed include;

(i) Confirm target markets and specific off-take targets;

(ii) Test marketing of sample product material;

(iii) identify and contact with strategic marketing partners

A primary objective is to minimise the marketing risk by confirming that target markets are in fact attainable. In addition, adopt a strategy to pursue long term supply relationships, on the basis of producing a competitive, quality product.

16.1.8 Mining Reserves

As discussed in **Section 3.0** there are sufficient measured and indicated reserves available within the existing deposit for a long-term project development. In addition, additional reserves available at Qaqqaarsuk and recent favourable aeromagnetic survey work at Sarfartoq indicate additional high grade reserves are likely to be proven up.

The Base Case assumes these additional high-grade reserves are in fact achieved. Based upon the current level of knowledge and the prospectivity of the deposits, the reserves risk for the project is assumed to be low.

16.1.9 Government Support

Home Rule Government and Local Government support and co-operation has been excellent. It is envisaged government support will continue. The development of minerals-based projects and secondary processing industry is a primary objective of both the Greenland Home Rule Government, Local Governments and the Denmark Government.

16.1.10 Approvals

Development approval is required prior to construction taking place, consequently any delays with obtaining relevant approvals will have a direct impact on the completion date. Environmental approval is on the critical path for obtaining this approval. Any delays with obtaining environmental approval, as a result of objections for example, will delay the completion date. Other approvals such as project specific building approvals, etc. are not critical at this time.

Every effort needs to be made to ensure that environmental approval will be obtained in a timely manner. No major problems are currently perceived with obtaining environmental approval, and the subsequent development approval.

16.2 Project Commissioning

Project commissioning will take place in two stages:

a) 'Cold' commissioning / Pre-commissioning: to ensure that each item of plant is aligned correctly and operates satisfactorily, this is treated as part of the construction phase.

b) 'Hot' commissioning: to ensure that all equipment items operate to design specification, both as single units and as integrated plant under normal operating conditions.

The contractor is required to complete the contract according to schedule and will be responsible for the 'cold' commissioning of the plant, as outlined above. Contractor responsibility in this regard shall not cease until the end of a 12 month warranty / liability period.

NMR personnel shall have responsibility for undertaking 'hot' commissioning of the total facility. This will be carried-out with assistance (specified by contract) from specialist consultants and contractors as required.

16.3 Post Commissioning Risks

16.3.1 Personnel

Section 12.0 outlines the personnel requirements for the project development. Training of local personnel in all facets of the project operations will be an important aspect for a successful project.

Specialist contractor technical assistance will be required during commissioning and the initial operating phase.

16.3.2 Production Efficiency

It has been assumed that in the Base Case modelling herein the project achieves nameplate capacity in year one. Specific plant and processing efficiencies and the economic impacts of these parameters are discussed in **Section 17.0.**

Given the commercial maturity of the Base Case technology, these plant efficiencies and availabilities are considered to be quite achievable. As a result there should be little risk of adverse impact upon forecast product sales.

16.3.3 Quality Control

Quality control and quality assurance in general will be the responsibility of the General Manager. Preliminary feedback from potential customers indicates that quality is one of the key decision factors when selecting between suppliers

Product specifications will require a high level of quality assurance at all levels of the operation including the:

(1) Consistency of feed material supplied - it is recognised that the ore resource is of very high purity;

(2) Process Facility, to ensure that the chemical and physical properties of the product are within specification - extensive test work (refer to **Section 6.0**) is proposed to ensure the most applicable process design is adopted.

(3) Packaging requirements;

The Base Case assumes the product is packaged in 1 tonne bulka bags to achieve the best market penetration.

(4) Distribution arrangements to ensure reliable supply to target markets.

16.3.4 Operations Inputs

The main operating inputs are discussed below

16.3.4.1 Labour / Personnel

Process plant operators and general company personnel shall sourced from the local and surrounding areas. Availability of suitable staff is not considered to be a problem. Suitable technical training and skills upgrading will be an integral part of project establishment.

16.3.4.2 Feedstock Ore Grade

The ore feedstock is sourced from a resource of high purity. The available high-grade ore reserves will ultimately determine the overall life of the project. As discussed in **Section 6.0**, the Base Case assumes sufficient reserves exist.

However, an important recommendation of the Stage I Feasibility Study is that additional reserves need to be proved to acceptable JORC standards.

Other supplies include bags, general consumables and maintenance items which are to be purchased in quantities in excess of demand and no supply risk is anticipated in this area.

16.3.4.3 Electric Arc Furnace Electrodes

Electrodes are used in the EAF process for the production of Ferro-Niobium. Consumption rates and electrode costs used in this study have been based on publicly available information.

16.3.4.4 Electricity Supply

The Base Case assumes power will be generated on site using diesel-fuelled engines or turbines. The risk associated with this approach is minimal. It is a common approach at many remote sites and in offshore oil and gas installations.

16.3.5 Insurances

The following insurances need to be considered for the project, either as project specific insurances, or part of NMR corporate insurances;

(1) Project / Industrial Special Risks
(2) Machinery Breakdown Insurance
(3) Data Processing (Computer Equipment)
(4) General Products and Public Liability, also includes an Umbrella Policy
(5) Motor Vehicle Insurance, includes third party damage
(6) Marine Transit

Workers Compensation needs to be in line with local Workers Compensation and Assistance requirements (or equivalent).

Prior to commencement of the construction and operations phases, operations management shall formulate a definitive insurance policy in conjunction with NMR insurance advisers.

16.3.6 Market Issues

16.3.6.1 Market Penetration

The marketing strategy, discussed in **Section 5.0**, relies on product sales into the Ferro-Niobium (Standard Grade) target market. This is by far the major niobium market, in terms of tonnage sales.

The Base Case market penetration assumptions are considered to be conservative.

The sensitivity of the project to variations in the market growth assumed is discussed in **Section 17.1**.

16.3.6.2 Foreign Exchange

The Base Case Model is developed in US Dollars. More detailed financial modelling is proposed as part of the Stage II Feasibility Study scope.

16.3.6.3 Escalation Factors

The financial analysis discussed in **Section 17.0** is based upon a 'real' model, with no escalation of any for inflation incorporated parameters (other than depreciation deflation).

Many high cost items such as energy and labour will escalate at reasonably well-defined rates which historically are lower than CPI. The variation of product selling prices in the future is much more difficult to estimate. Consequently the approach adopted herein has been to carry out a detailed sensitivity analysis (see **Section 17.2**), to evaluate the effect on the project of various future pricing scenarios.

17

This section references and ties together much of the information presented in other sections of the report in describing the financial evaluation of the proposed Greenland Niobium Project.

The economics of the project are based on a financial model, which represents, as closely a possible, the proposed development – given the level of detail available from the Stage I Feasibility Study process.

17.1 Base Case Assumptions

The Base Case assumes:

Run-of-mine ore production at 15,000 tpa.

- Trucking of the ore from the mine to production facilities at Angujaartorfik Inlet.
- Minimal infrastructure at the mine site.
- Ore handling and processing at Angujaartorfik Inlet.
- Accommodation and camp support facilities at Angujaartorfik Inlet.
- Ferro-Niobium production on site at Angujaartorfik Inlet (off Sondre Stromfjord).
- Ferro-Niobium production by Electric Arc Furnace (EAF) technology.
- Ferro-Niobium product load-out packed (Bulka bags/drums) into 20' containers.
- Trans-shipment to Nuuk via Royal Arctic Lines for export to destination.
- Power generation on site, via diesel powered engines (5 MW).
- Slag containment and disposal in a sealed depression adjacent to the production facilities.
- Ferro-Niobium (standard grade) sales of approximately 1600 tonnes per annum.
- A sales price equivalent (f.o.b. Angujaartorfik Inlet) of US$15.43 per kg (ie. US$7.00 per lbw). Freight costs for delivery C.I. "Major European Port" are included in the financial model.
- Resupply of the project site from Kangerlussuaq by hovercraft.
- Project production and revenue generation by year end 2001.

17.2 Capital Expenditure (CAPEX) Schedule

Capital cost estimates for the project Base Case (and Options 1.0 and 2.0) are presented in **Section 10.0.**

The use of second-hand equipment or processing plant & equipment has not been explicitly evaluated to date as part of the Stage I Feasibility Report. Opportunities in this regard can be inferred from the capital cost sensitivity analysis.

17.3 Operating Expenditure (OPEX) Schedule

Operating costs developed for the project are outlined in **Section 9.0.** These form the basis of the financial model operating costs structure.

17.4 Market Segments & Penetration

The proposed production tonnage of approximately 1600 tonne per year (Ferro-Niobium) is relatively small. Given the monopoly nature of the industry and the geographic position of Greenland relative to Europe, it is anticipated market penetration into Europe will be achieved in a satisfactory timeframe.

Marketing details and strategy are discussed in **Section 5.0.**

17.5 Project Life

For the purposes of this Stage I Feasibility Study, a project life of 20 years has been evaluated. Sensitivity analysis has also looked at shorter project life spans (eg. 10 years).

17.6 Accounting Issues

Financial model Issues related to Working Capital, Inventory, Spares, depreciation and Tax, etc. are nominated on the attached spreadsheet summaries – **Figures 17.1 – 17.4**

18

[1] **Independent Appraisal of the Sarfartoq Niobium Project, EL25/96 Western Greenland for New Millennium Resources NL.** July 1999.

Al Maynard & Associates, Consulting Geologists, 9/280 Hay Street, Subiaco Western Australia, 6008. Tel: (+618) 089 388 1000 Fax: (+618) 089 388 1768 Email: amayard@wantree.com.au

[2] **Trade and Industry in Greenland, 2: GEODATA Geological information (Edition 5), GEUS, The Geological Survey of Denmark and Greenland.** November 1988.

Greenland Resources A/S, P.O. Box 821, DK-3900 Nuuk. Tel: (+299) 32 79 13 Fax: (+299) 32 79 14 Email: green.sourses@greennet.gl

[3] **Sarfartoq Transportkorridor, Forslag og konsekvenser.** February 1988.

Grønlands Landsmuseum, Grønlands Miljøurdersøgelser, Grønlands Tekniske Organisation.

[4] **Meeting with Peter Anstrup.** May 2000

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[5] **Monitoring of Particulate Fall-out During Exploratory Activities in Sarfartoq, Summer 1989.** April 1990.

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[6] **Miljøundersøgelser ved Sarfartoq 1987-88, Prøveindsamling, radonmaling og analyser for polonium-210 og bly-210.** February 1989.

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[7] **Study Programme 1987-1989 Relating to Exploration and Possible Exploitation of Niobium-containing Minerals in the Sarfartoq-area in West-Greenland (Unofficial Translation).** January 1987.

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[8] **Klimaudersøgelser 1987-1989, Klimastation nr. 503, Sarfartoq, Syd for Kangerlussuaq / Sdr. Strømfjord, VestGrønland.** (Weather Reports) March 1990.

Grønlands Forundersøgelser Misissueqqaarnerit Regulering af Rastofvirksomhed.

[9] **US Geological Survey – Web Page.** Access July 2000.

[10] **Summary of Metallurgical Testwork Programme.** May 2000.

Dowding Reynard Associates, Pacific Pty Ltd, Gracechurch House, Ground Floor, 25 Richardson Street, West Perth Western Australia, 6005. Tel: (+618) 089 486 8884 Fax: (+618) 089 486 8885.

[11] **Trade and Industry in Greenland, 5: Taxation of Individuals and Companies in Greenland (Edition 5).** November 1998.

Deloitte & Touche, H.C. Andersens Boulevard 2 DK-1780 Copenhagen V Denmark. Tel: (+45) 33 76 33 33 Fax: (+45) 33 76 39 92 www.deloitte.dk.
Greenland Resources A/S, P.O. Box 821, DK-3900 Nuuk. Tel: (+299) 32 79 13 Fax: (+299) 32 79 14 Email: green.sourses@greennet.gl

[12] **Annual Report on Mineral and Petroleum Activities in Greenland 1998.** April 1999.

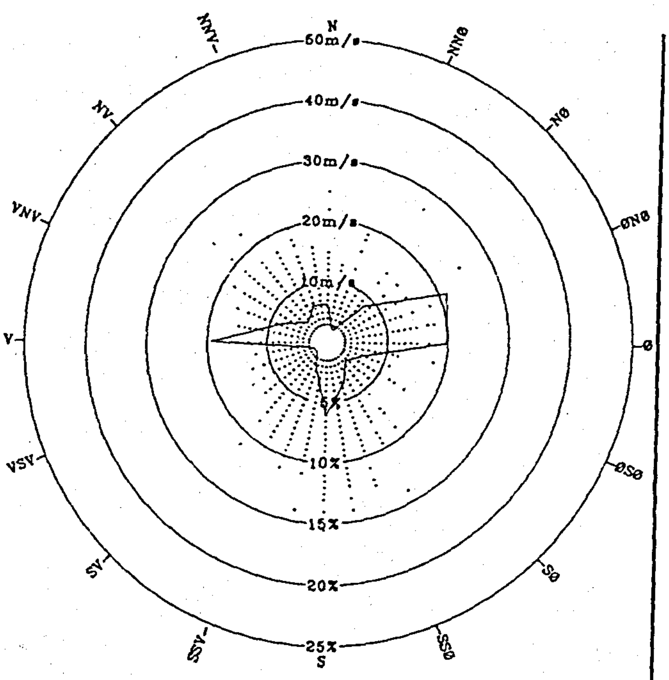
Bureau of Mineral and Petroleum, Joint Committee in Mineral Resources in Greenland, P.O. Box 930 DK-3900, Nuuk, Greenland. Tel: (+299) 346 800 Fax: (+299) 324 302 Email: bmp@gh.gl Website: www.bmp.gl

[13] **Bureau of Minerals and Petroleum Internet Website** www.bmp.gl/ENGL english/ENGL.../ENGL-B100 00-20ba-minres xlat.htm June 2000.

[14] **Miljøundersøgelser ved Sarfartoq 1986-87**
Vildt og vegetation

Appendix 2	Sarfartoq Mine Site – Selection of Weather Data
Appendix 3	General Niobium Marketing Information
Appendix 4	General Niobium Technical Information
Appendix 6	Technology Brochures

VINDROSE / COMPASS CARD



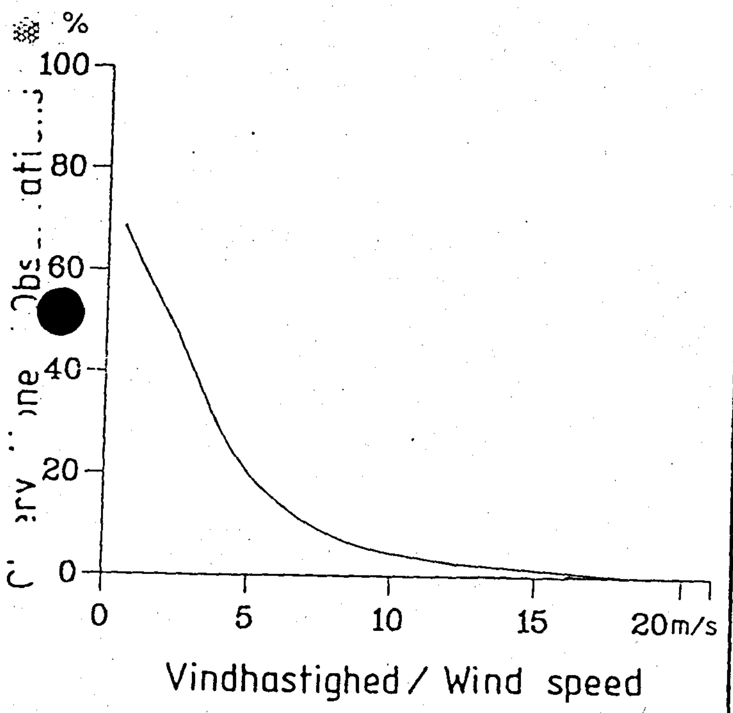
Totalt antal observationer / No. of observations = 40117 ~ 100.0%
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 12963 ~ 32.3%

Observationer < 2,5 m/s er ikke markeret / Observations < 2,5 m/s are not shown

Absolut antal observationer / No. of observations

	N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	NNV
No.	1258	403	1690	4275	3972	1201	869	1479	2447	927	486	456	3895	1577	911	1310
%	3.1	1.0	4.2	10.7	9.9	3.0	2.2	3.7	6.1	2.3	1.2	1.1	9.7	3.9	2.3	3.3

Relativt antal observationer / Observations %



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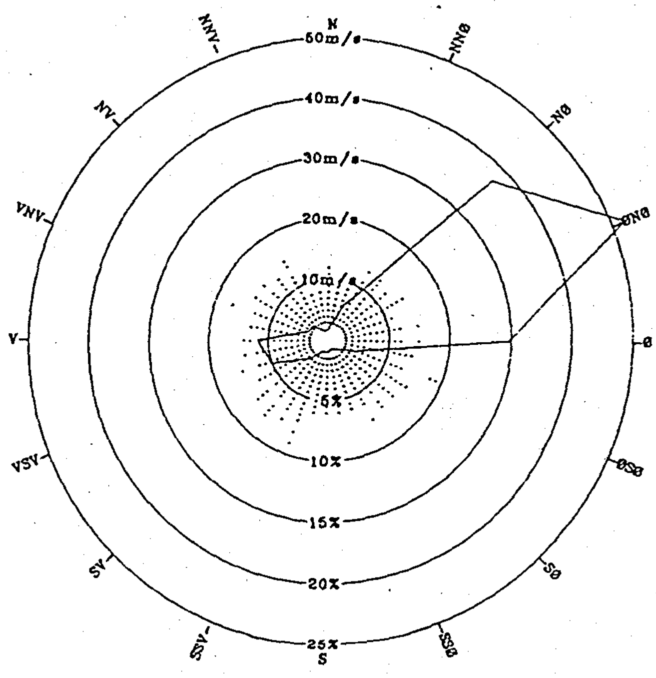
(Holsteinsborg)
1/1 1964 - 31/12 1981

VINDROSE / COMPASS CARD



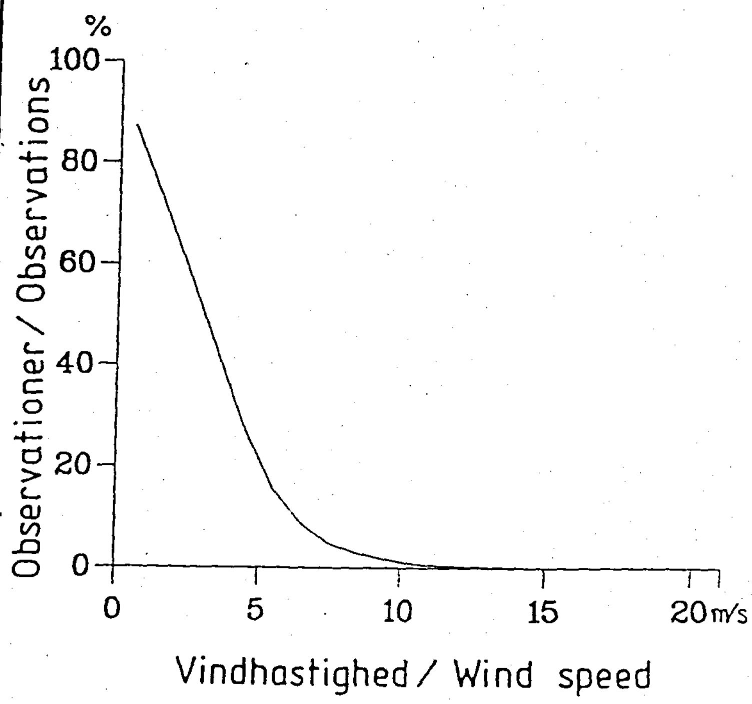
Totalt antal observationer / No. of observations = 25931 ~ 100.0%
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 3365 ~ 13.0%

Observationer < 2,5 m/s er ikke markeret / Observations < 2,5 m/s are not shown

Absolut antal observationer / No. of observations

	N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	NNV
No.	219	788	4848	6774	3644	596	261	204	264	271	563	1306	1523	484	434	211
%	0.8	3.0	18.7	26.1	14.8	2.3	1.0	0.8	1.0	1.0	2.2	5.0	5.9	1.8	1.7	0.8

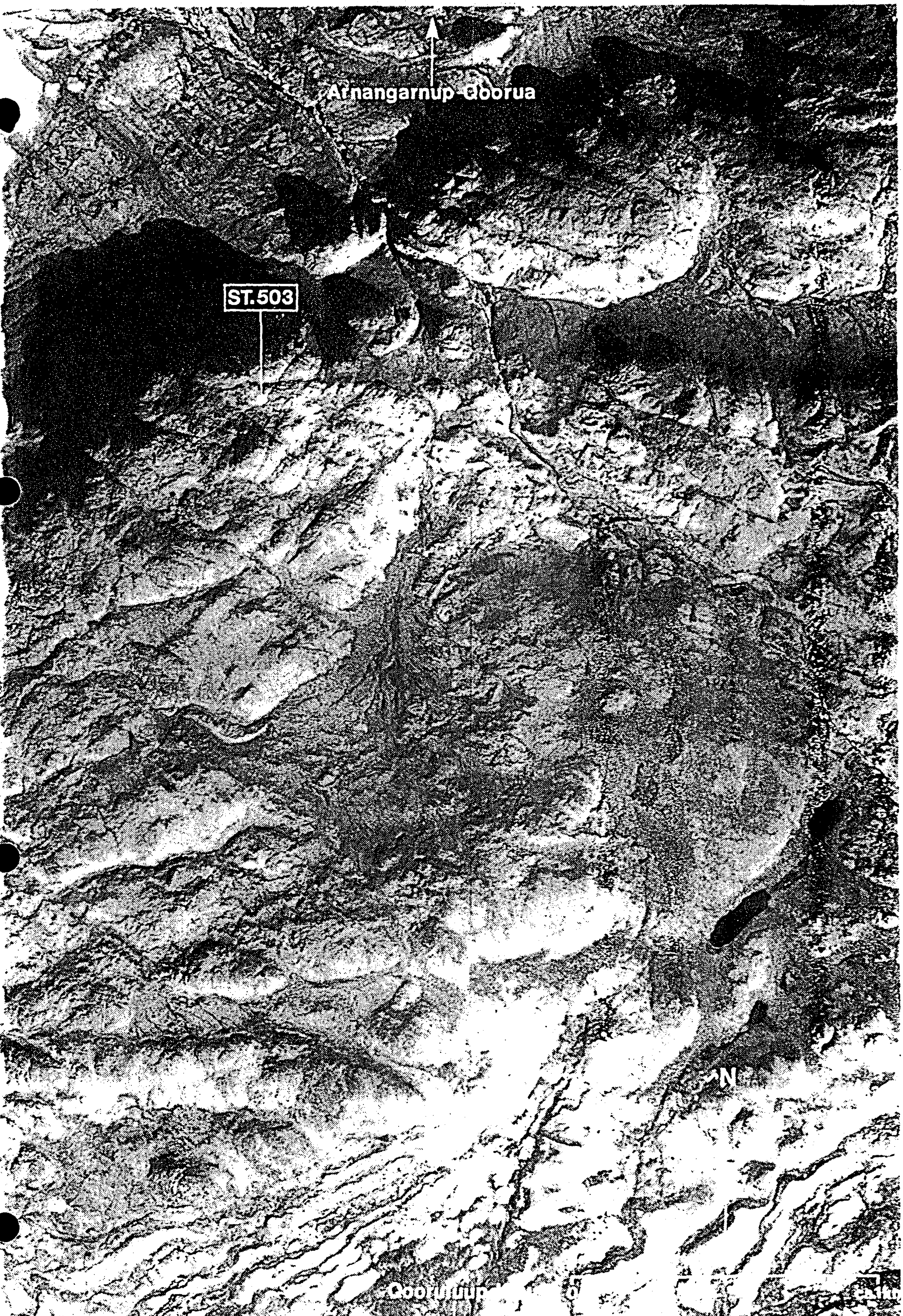
Relativt antal observationer / Observations %

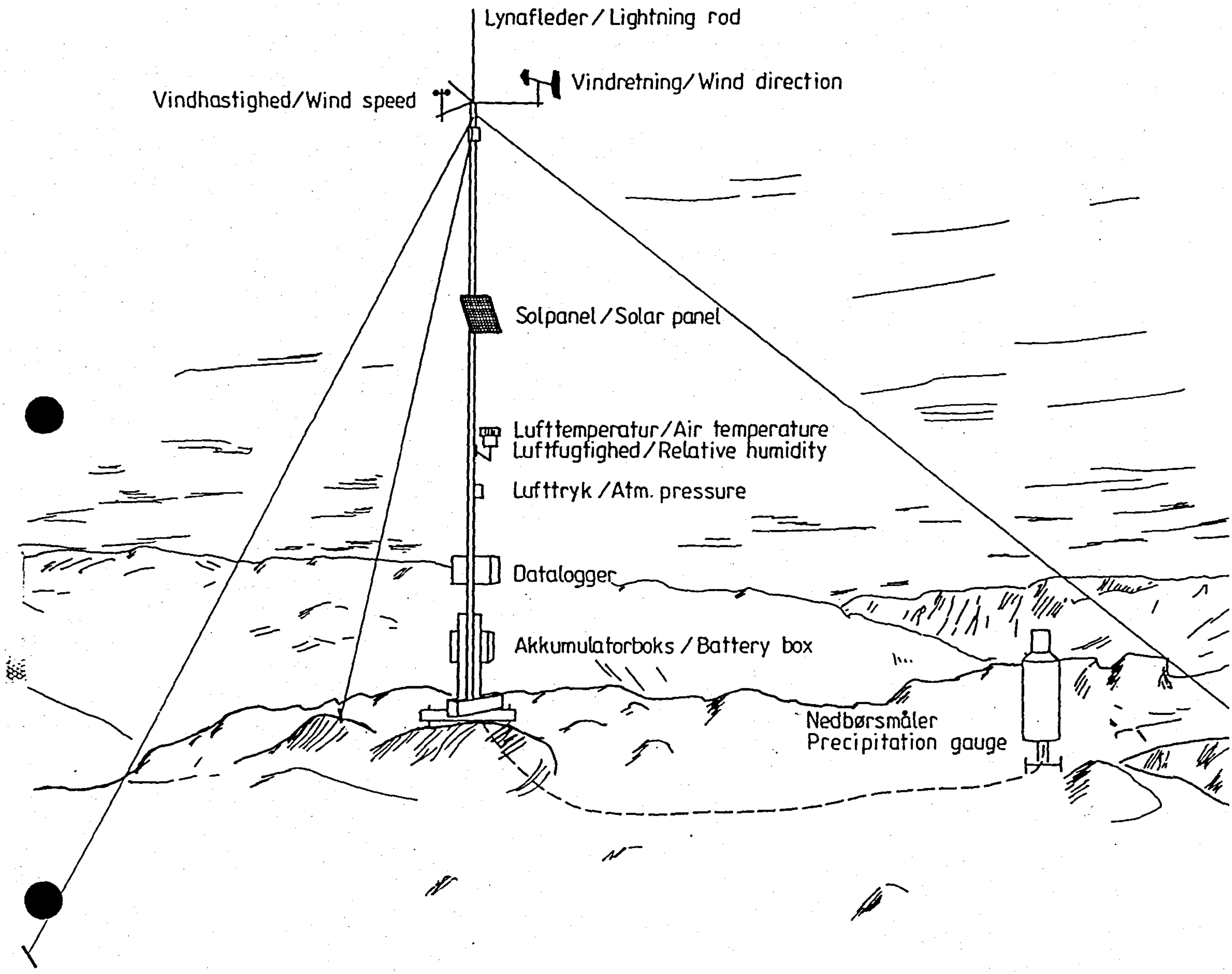


STATION: KANGERLUSSUAQ
(Søndre Strømfjord)
1/1 1975 - 1/7 1984

10 min. middel vindhastighed og -retning

10 min. mean Wind speed and direction


Arnangarnup Qoorua
ST.503
N



Position / Position:	66°29'08"N / 51°14'19"W
Kote / Altitude:	~640 m.o.h. / m.a.s.l.
Vindhastighed / Wind speed:	6 m.o.t. / m.a.g.l.
Vindretning / Wind direction:	6 m.o.t. / m.a.g.l
Lufttemperatur/Air temperature:	2 m.o.t / m.a.g.l.
Luftfugtighed/Relative humidity:	2 m.o.t. / m.a.g.l.
Lufttryk/Atmospheric pressure:	~640 m.o.h. / m.a.s.l.
Nedbør/ Precipitation:	1,2 m.o.t / m.a.g.l.

Klimastation nr. 503 - Sarfartoq - Weatherstation No. 503

Figur/Figure 4

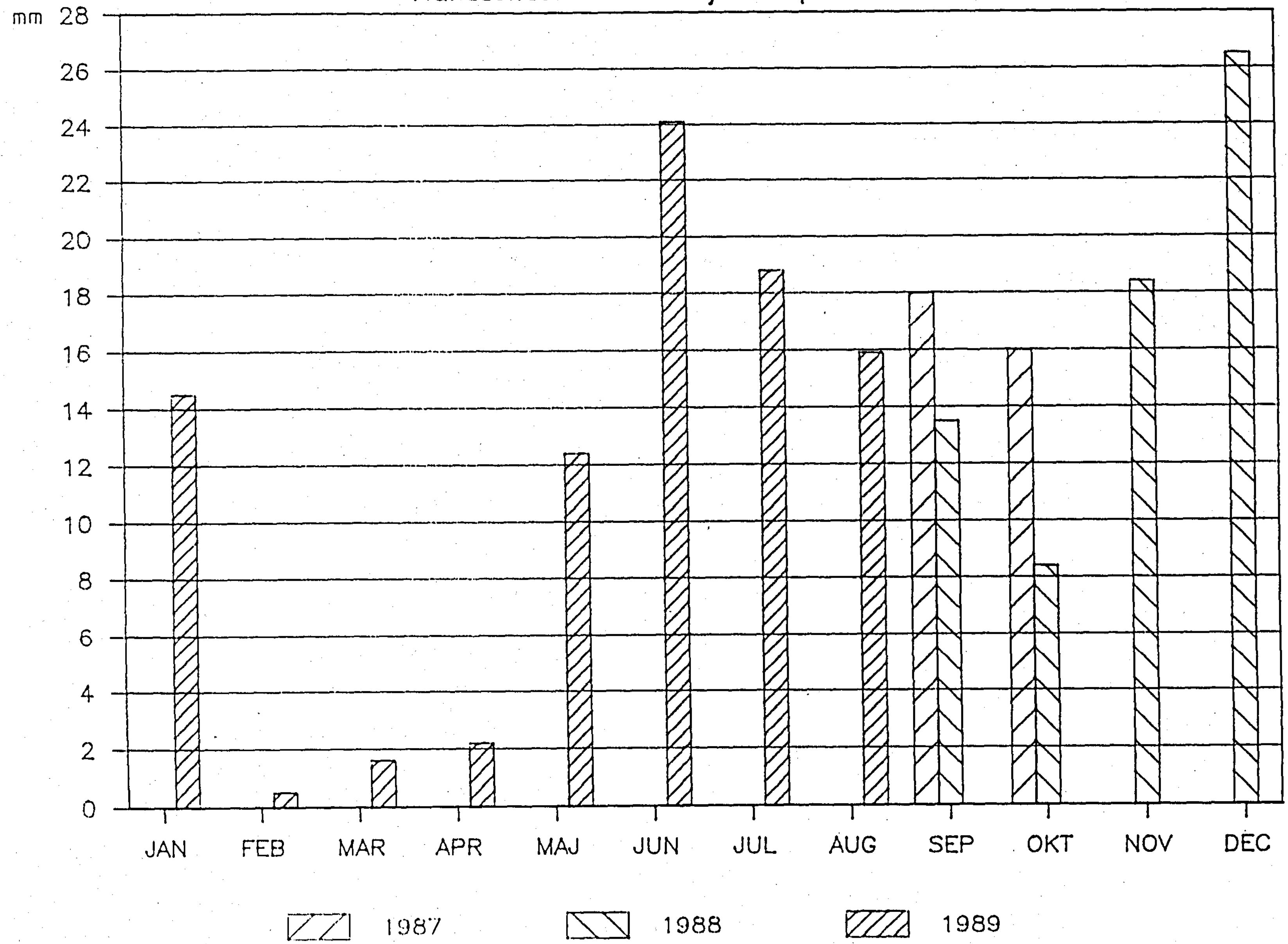
Klimastation Nr. 503 pr. september 1989

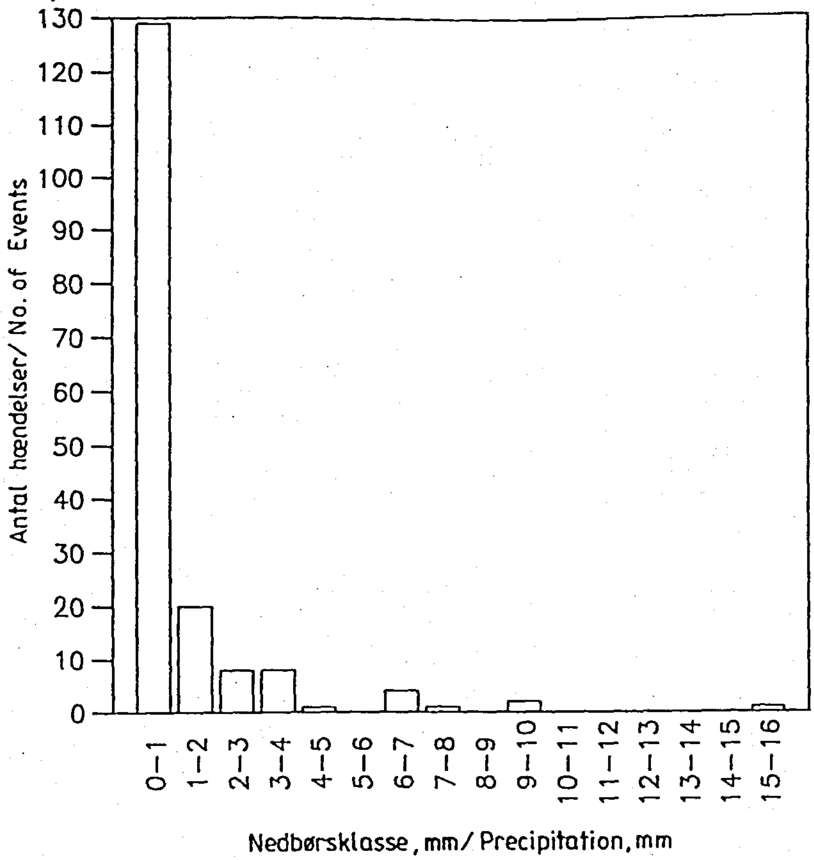
PARAMETER	FABRIKAT	RANGE	SYSTEM NØJAGTIGHED	OPLØSNING	SCANRATE/INTERVAL	DATA	DATATIDSPUNKT N=0,1,2,3,4,5,6,7
VINDHASTIGHED	HANDAR 430A	0-70 m/s	±5%	0,1 m/sec.	3 t / 1 s	MIDDEL AF 10 MIN.	GMT = 3 ×N
VINDRETNING	HANDAR 431 A	0-360°	±5°	1°	3 t / 1 s	MIDDEL AF 10 MIN.	GMT = 3 ×N
MAX. VINDHASTIGHED	HANDAR 430 A	0-70 m/s	±5%	0,1 m/s	3 t / 10 s	MAX. VÆRDI OVER 3T	GMT = 3 ×N
(MAX.) VINDRETNING	HANDAR 431 A	0-360°	±5°	1°	3 t / 10 s	RELATERET TIL MAX. VINDHAST.	GMT = 3 ×N
LUFTTEMPERATUR	HANDAR 432 A	-50°C+50°C	±0,4°C	0,1°C	3 t	ØJEBLIKSVÆRDI	GMT = 3×N
MIDDEL LUFTTEMPERATUR	HANDAR 432 A	-50°C+50°C	±0,4°C	0,1°C	12 t / 10 min.	MID. VÆRDI OVER 12T	GMT=9, GMT=21
MAX. LUFTTEMPERATUR	HANDAR 432 A	-50°C+50°C	±0,4°C	0,1°C	12 t / 10 min	MAX. VÆRDI OVER 12T	GMT=9, GMT=21
MIN. LUFTTEMPERATUR	HANDAR 432 A	-50°C+50°C	±0,4°C	0,1°C	12 t / 10 min	MIN. VÆRDI OVER 12T	GMT=9, GMT=21
LUFTFUGTIGHED	HANDAR 435 A	0-100%	±5%	1%	3 t	ØJEBLIKSVÆRDI	GMT = 3 ×N
LUFTTRYK	YSI	830-999 mb	±0,3%	0,1 mb	3 t	ØJEBLIKSVÆRDI	GMT = 3 ×N
NEDBØR	BELFORT	0-300 mm	±1%	0,1 mm	3 t	ØJEBLIKSVÆRDI	GMT = 3 ×N
BATTERISPÆNDING	POWERSONIC AKK. HANDAR SOLPANEL	12 V / 106 Ah 15 W		0,1 V	3 t	ØJEBLIKSVÆRDI	GMT = 3 ×N
DATALOGGER	HANDAR 540 S-1						

Figur 5

Station 503

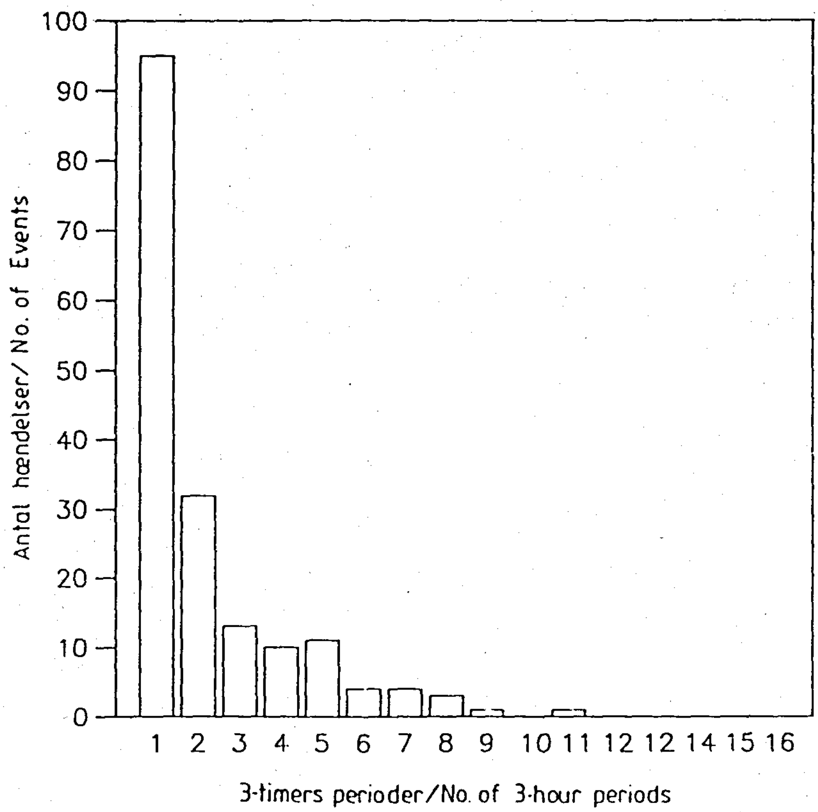
Månedsnedbør / Monthly Precipitation





Nedbørshændelser efter størrelse

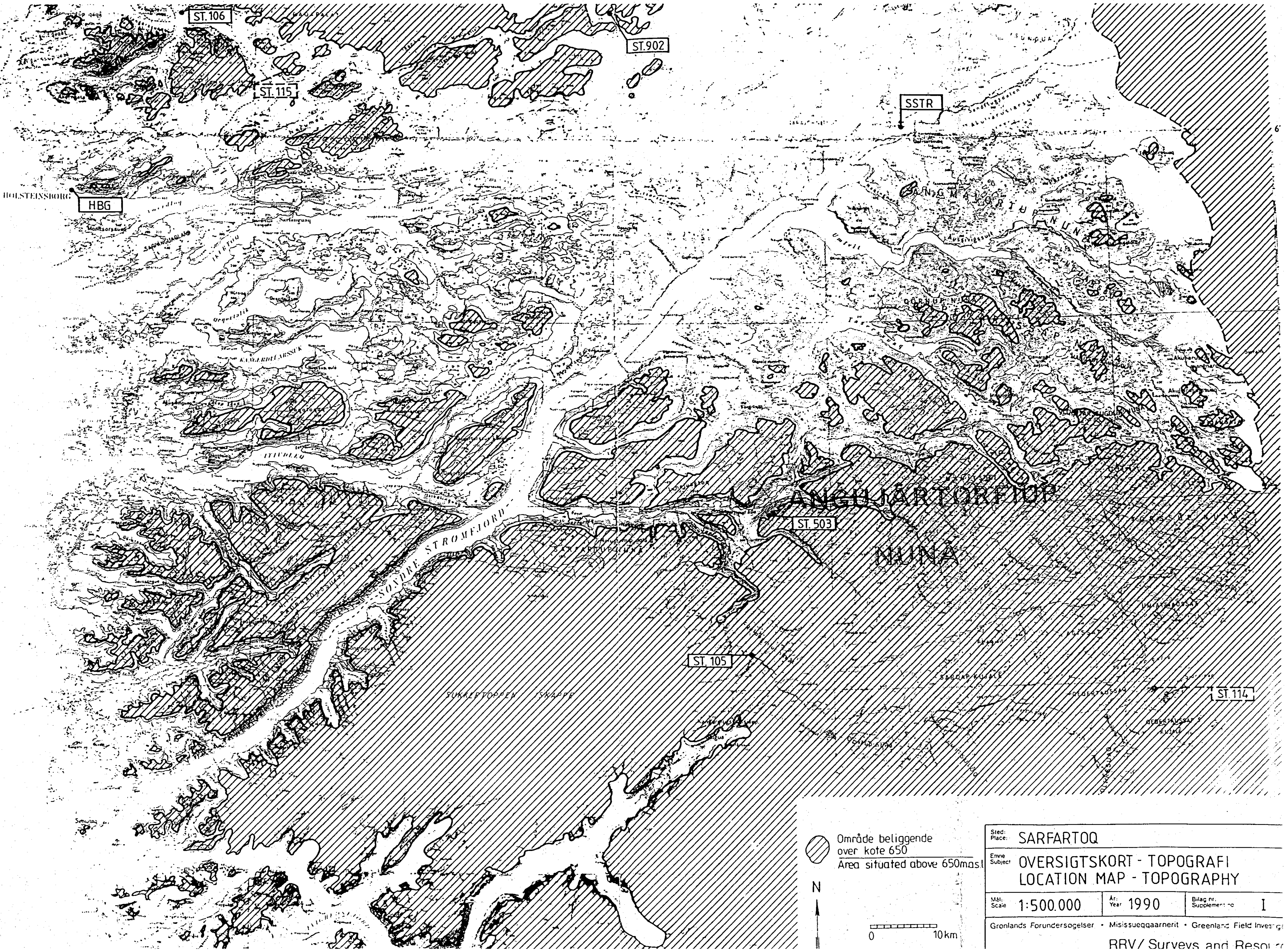
Precipitation events ranked by mm

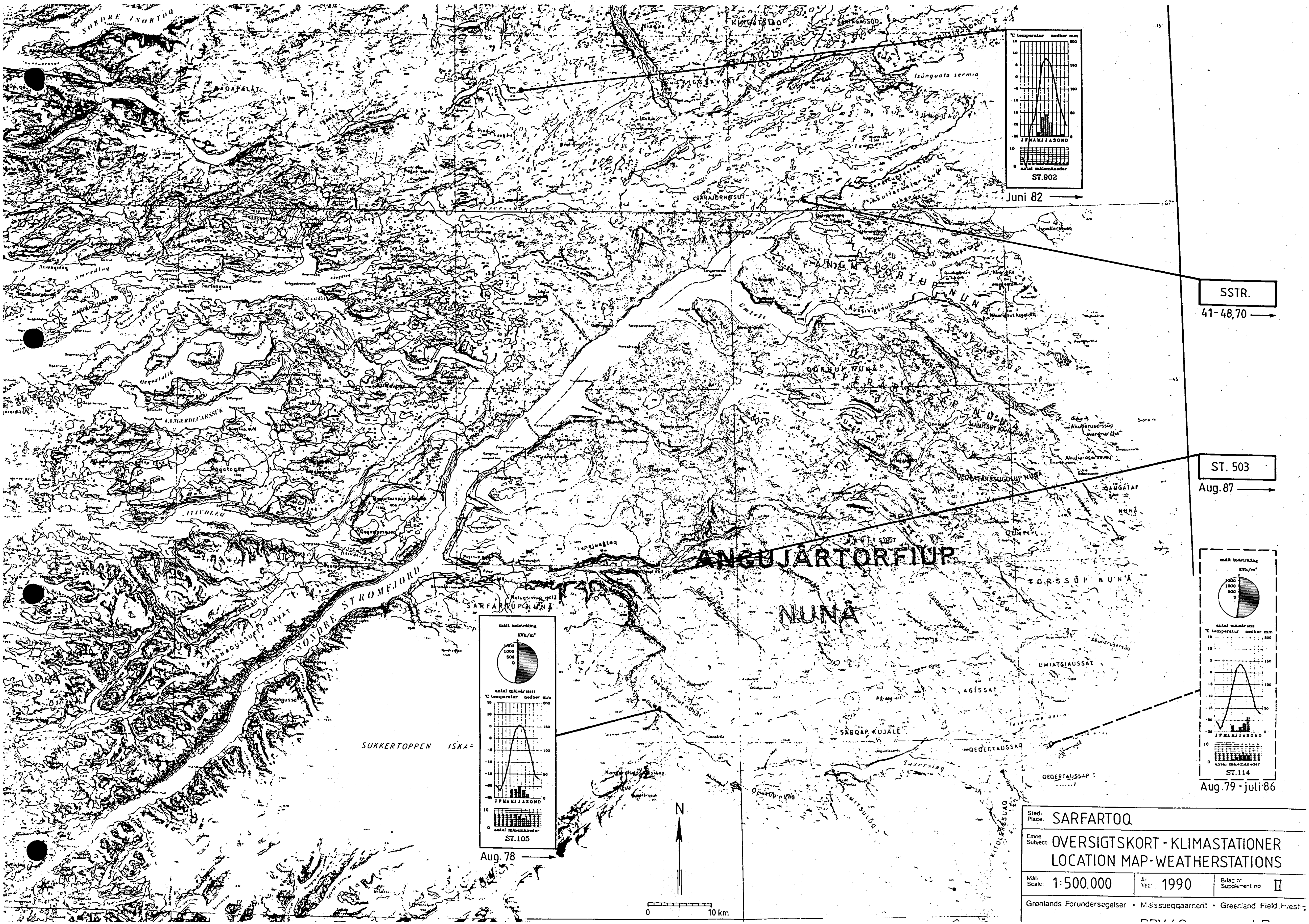


Nedbørshændelser efter varighed

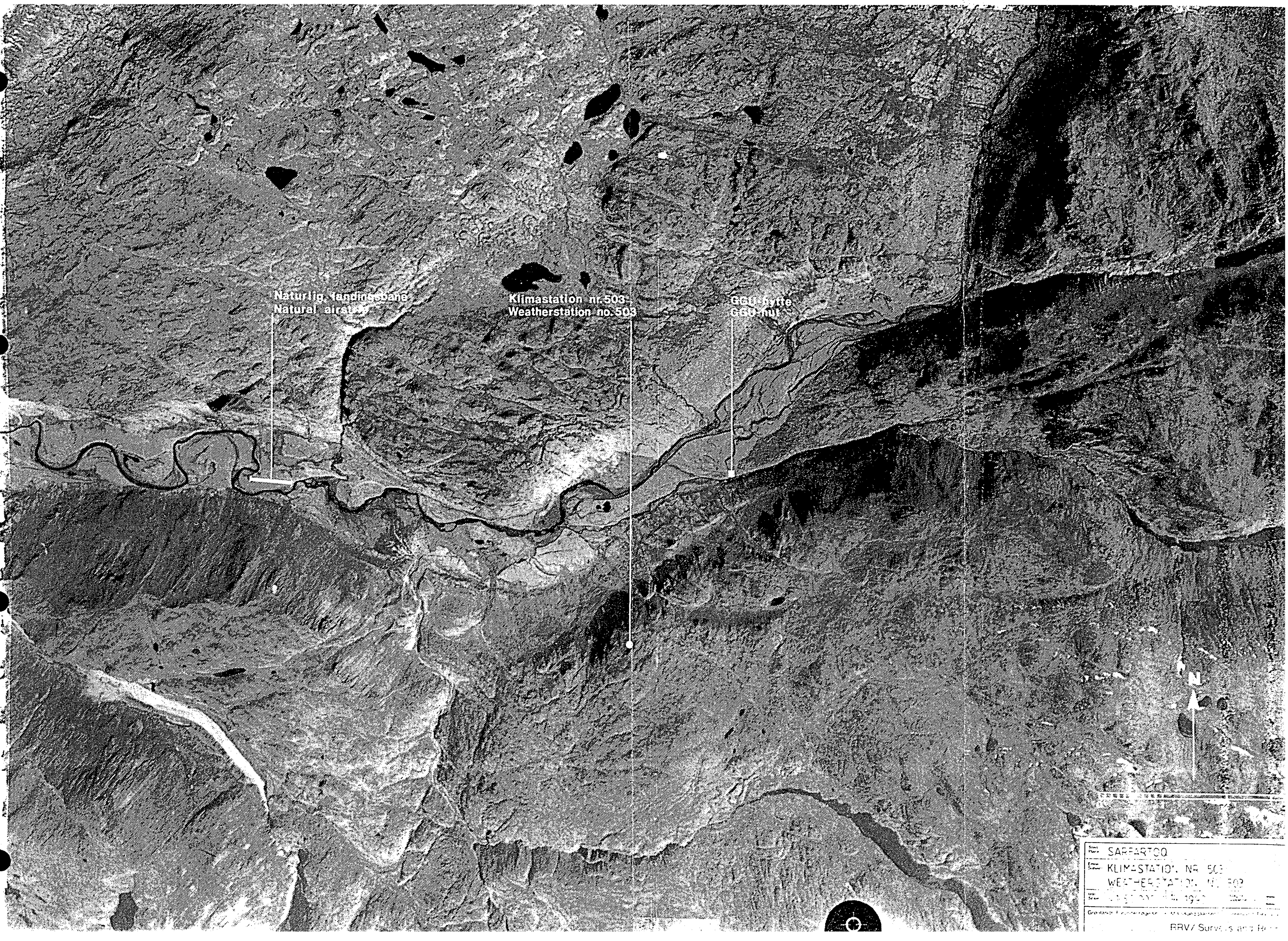
Precipitation events ranked by duration

Figur / Figure 7

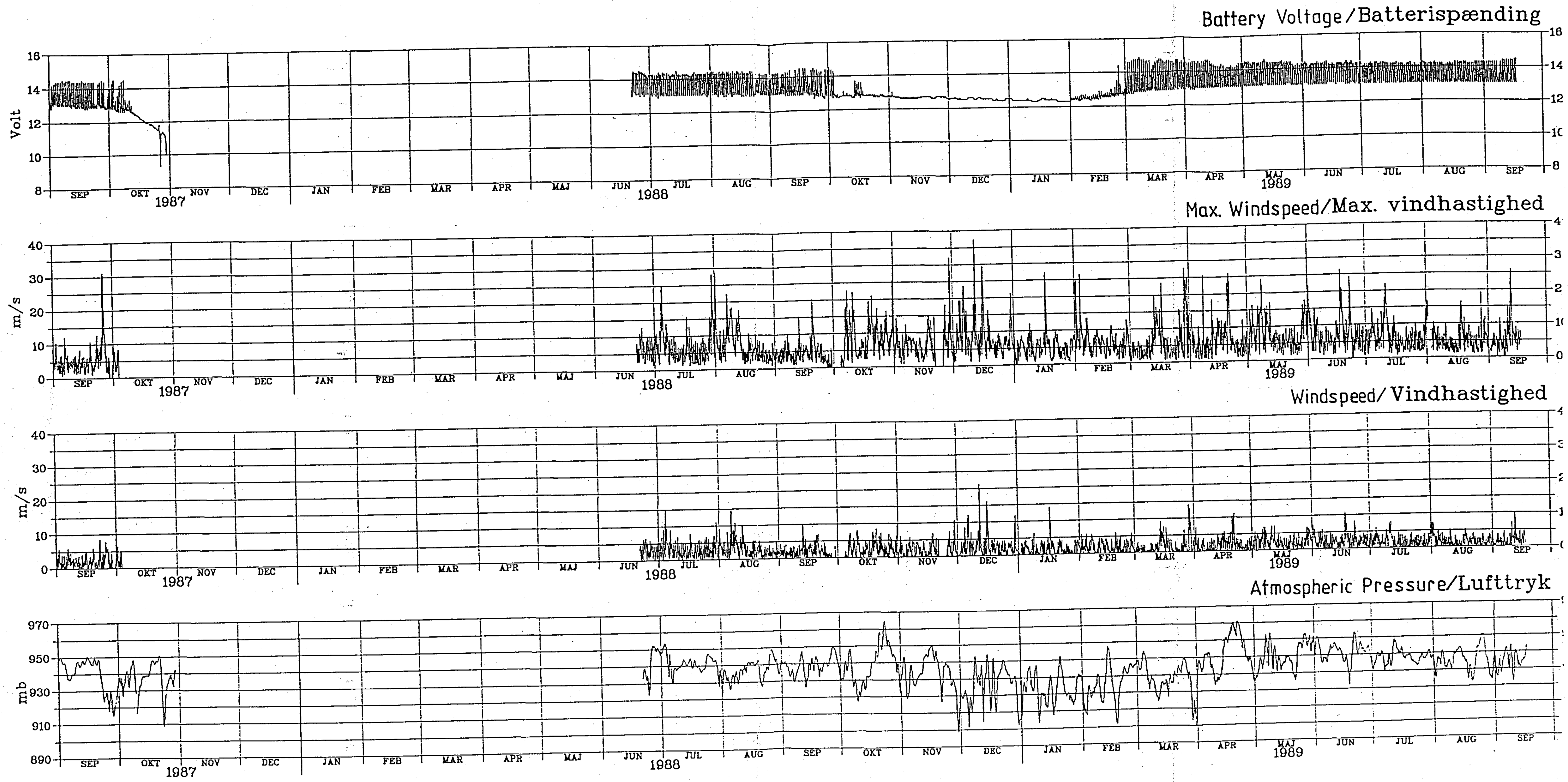

ST. 106
ST. 902
ST. 115
SSTR
HOLSTEINSBORG
HBG
ANGUJÅRTORFIUP
NUNÅ
ST. 503
SØNDRE STRØMFJORD
ST. 105
SUKKERTOPPEN ISKAPPE
ST. 114
Område beliggende over kote 650
Area situated above 650masl
N
0 10km
Sted: Place: SARFARTOQ
Emne Subject: OVERSIGTSKORT - TOPOGRAFI
LOCATION MAP - TOPOGRAPHY
Mål: Scale 1:500.000
År: Year 1990
Bilag nr. Supplement no. I
Grønlands Forundersøgelser • Misissueqqaarnerit • Greenland Field Investig
BRV/ Surveys and Resou



ST.902
Juni 82
SSTR.
41-48,70
ST. 503
Aug. 87
ANGUJÂRTORFIUP
NUNÂ
SØNDRE STRØMFJORD
SUKKERTOPPEN ISKAP
ST.105
Aug. 78
ST.114
Aug.79 - juli 86
målt indstråling
antal målemåneder
N
0
10 km
Sted: Place: SARFARTOQ
Emne Subject: OVERSIGTSKORT - KLIMASTATIONER
LOCATION MAP - WEATHERSTATIONS
Mål Scale: 1:500.000
År Year: 1990
Bilag nr. Supplement no II
Grønlands Forundersøgelser • Misissueqqaarnerit • Greenland Field Investig


Naturlig landingsbane
Natural airstrip
Klimastation nr. 503
Weatherstation no. 503
GGU hytte
GGU hut
N
SARFARTOQ
KLIMASTATION NR. 503
WEATHERSTATION NO. 503
RRV/ Surveys and

Sarfartoq

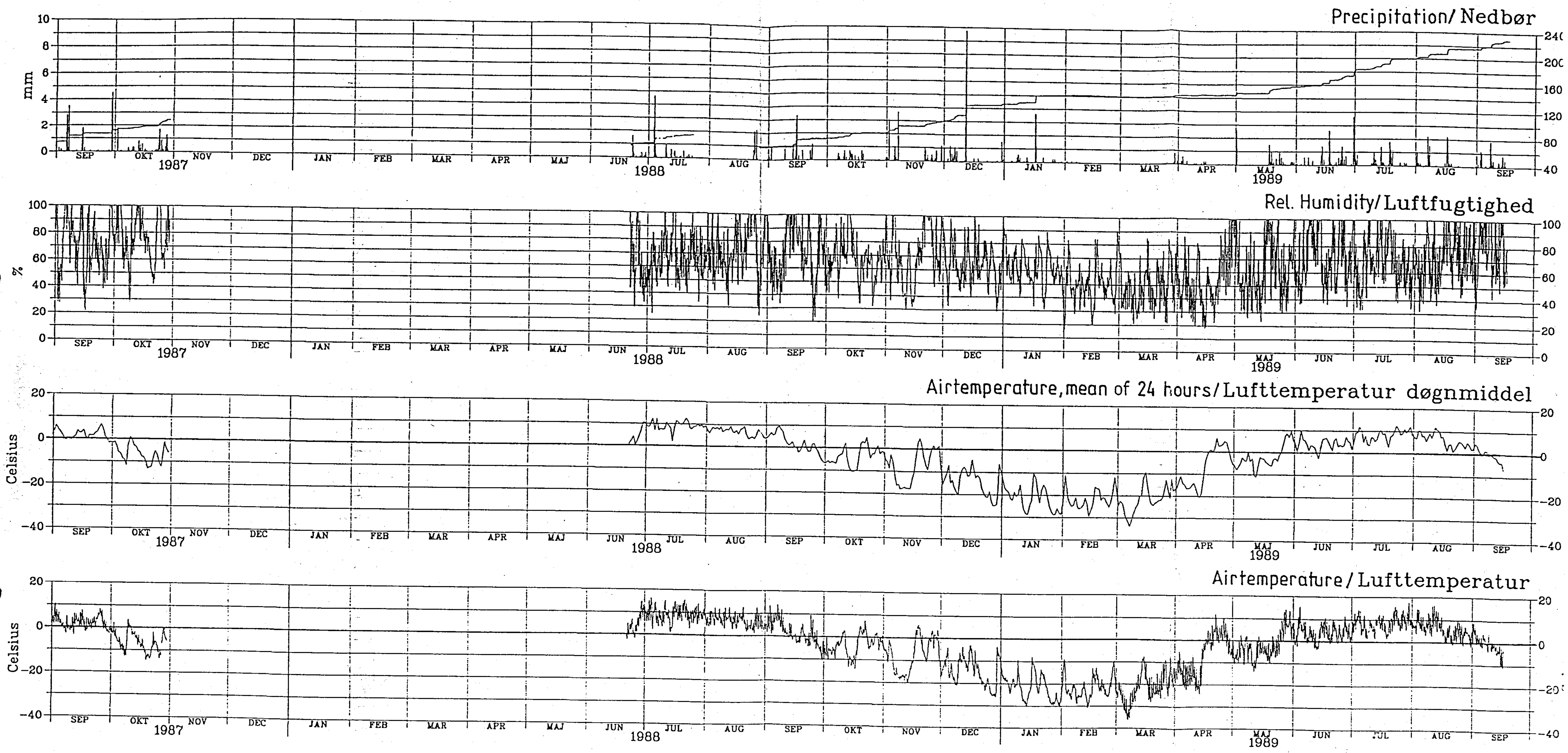


Sted: Place:	SARFARTOQ - ST. 503
Emne Subject:	TIDSSERIER DATASERIES 1987-1989
Mål: Scale: —	År: Year: 1990 · Bilag nr: Supplement no: V

Grønlands Forundersøgelser • Misissueqqaarnerit • Greenland Field Invest

RRV/ Surveys and Resou

Sarfartoq



Sted: Place: SARFARTOQ - ST. 503

Emne Subject: TIDSSERIER DATASERIES 1987-1989

Mål: Scale: –

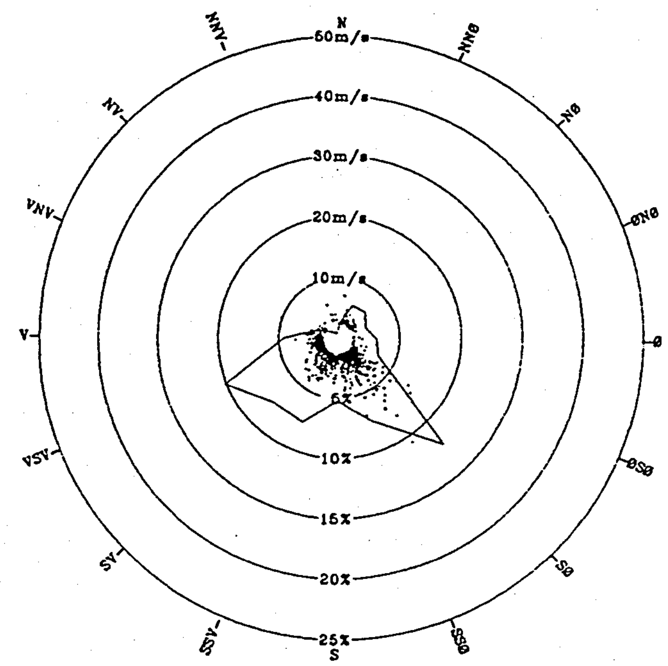
År: Year: 1990

Bilag nr: Supplement no. VI

Gronlands Forundersogelser • Misissueqqaarnerit • Greenland Field Investigations

RRV/ Surveys and Resources

VINDROSE / COMPASS CARD



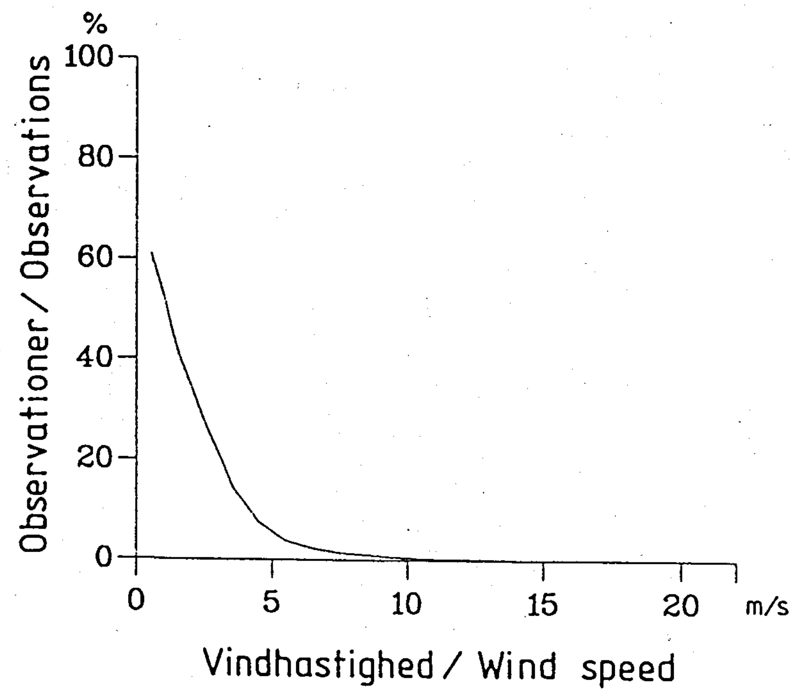
Totalt antal observationer / No. of observations = 3346 ~ 100.0%
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 866 ~ 25.9%

Observationer < 2,5 m/s er ikke markeret / Observations < 2,5m/s are not shown

Absolut antal observationer / No. of observations

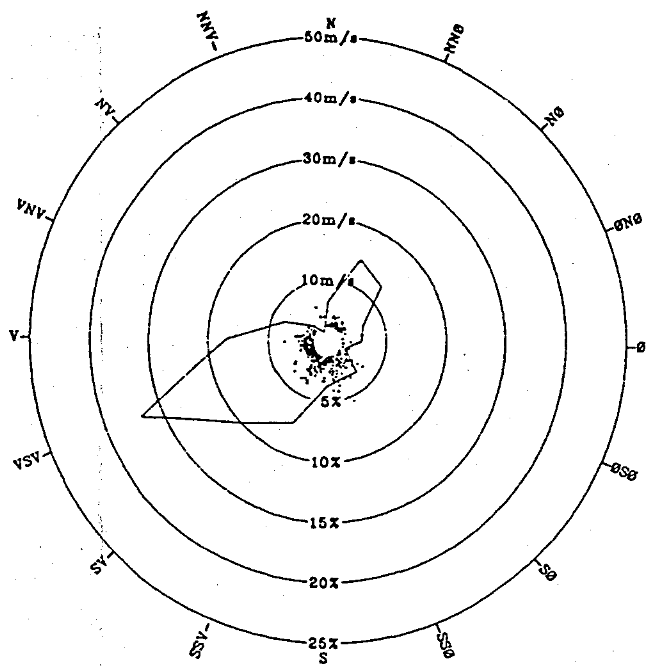
43	99	102	80	104	118	412	248	176	253	253	337	153	62	26	15
N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	NNV
1.3	3.0	3.0	2.4	3.1	3.5	12.3	7.4	5.2	7.6	7.6	10.1	4.6	1.9	0.8	0.4

Relativt antal observationer / Observations %



30 Aug. 1987 - 17 Sept. 1989
Total periode / Total Period

VINDROSE / COMPASS CARD



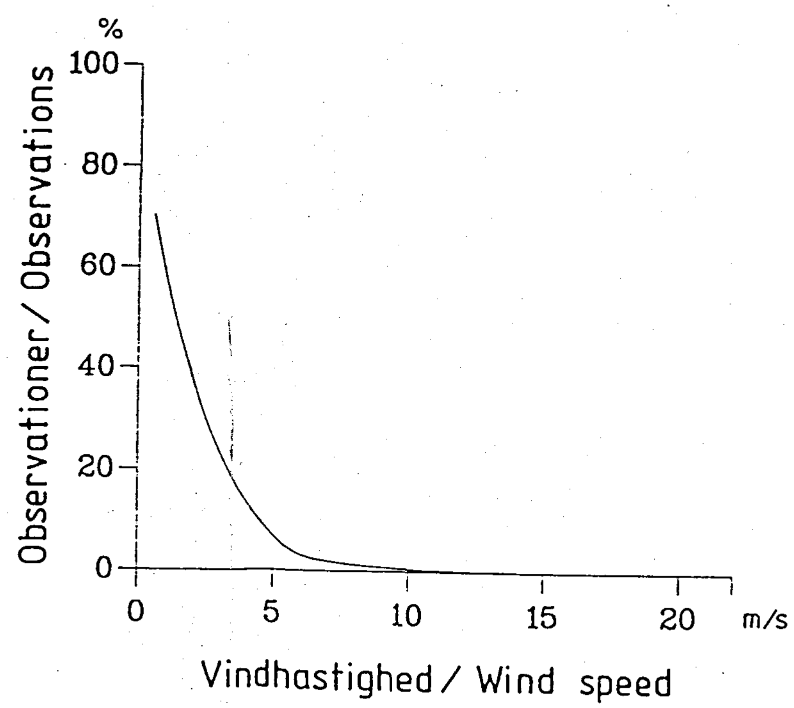
Totalt antal observationer / No. of observations = 1147 ~ 100.0%
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 182 ~ 15.9%

Observationer < 2,5 m/s er ikke markeret / Observations < 2,5m/s are not shown

Absolut antal observationer / No. of observations

37	83	73	37	33	18	41	38	43	85	113	193	97	45	20	9
N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	NNV
3.2	7.2	6.4	3.2	2.9	1.6	3.6	3.3	3.7	7.4	9.9	16.8	8.5	3.9	1.7	0.8

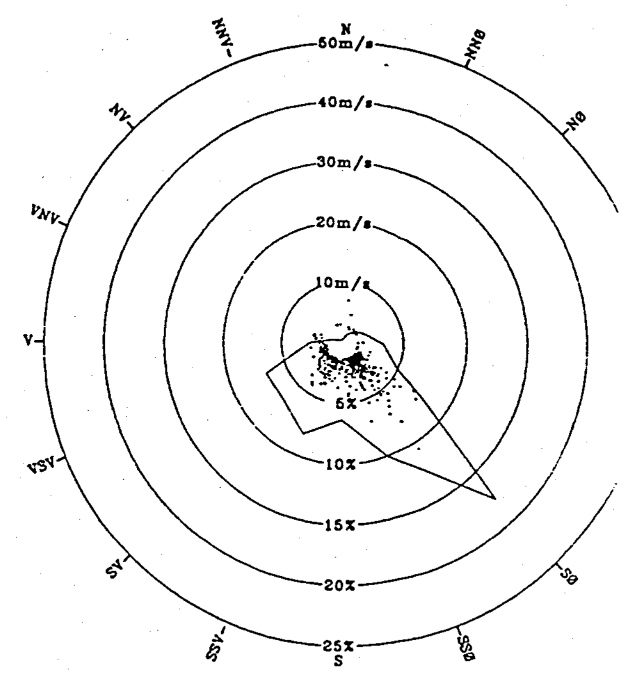
Relativt antal observationer / Observations %



01-15 Sept. 1987
21 June - 15 Sept. 1988
15 May - 15 Sept. 1989

Sommer/Summer Period

VINDROSE / COMPASS CARD



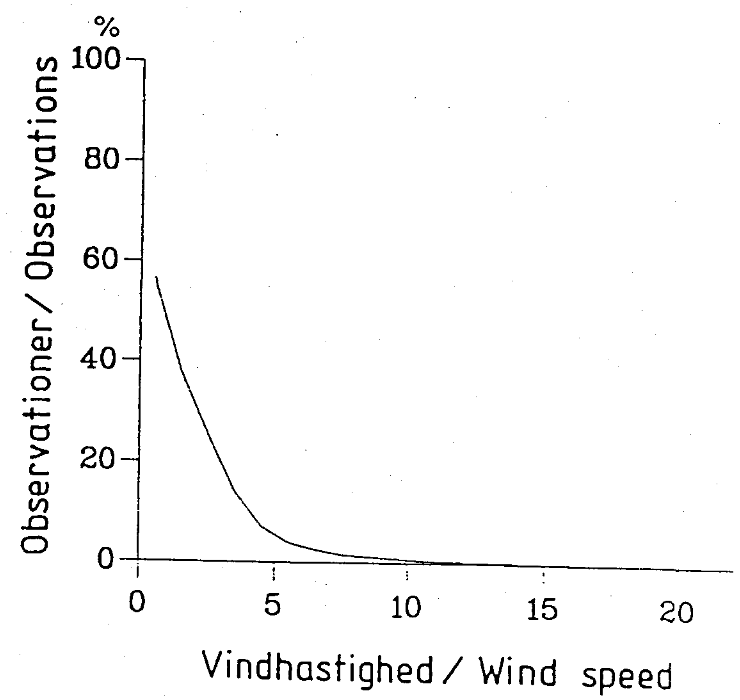
Totalt antal observationer / No. of observations = 2054 ~ 100.
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 559 ~ 27

Observationer < 2,5 m/s er ikke markeret / Observations < 2,5m/s are not sh

Absolut antal observationer / No. of observations

6	16	29	42	70	99	365	206	131	168	139	139	56	17	6	
N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	N
0.3	0.8	1.4	2.0	3.4	4.8	17.8	10.0	6.4	8.2	6.8	6.8	2.7	0.8	0.3	(

Relativt antal observationer / Observations %



16 Sept. - 15 Oct. 1987
16 Sept. 1988 - 14 May 1989

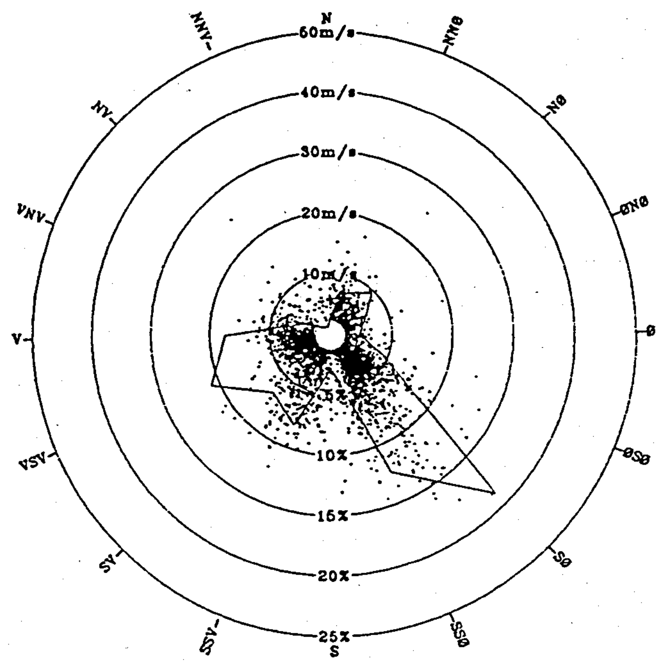
Vinter / Winter Period

Sted: Place:	SARFARTOQ - ST. 503
Emne Subject:	VINDHASTIGHED OG -RETNING, 10 MIN MIDC WIND SPEED AND DIRECTION, 10 MIN. MEAI
Mål: Scale: –	År: Year: 1990 — Bilag nr: Supplement no: VII

Grønlands Forundersøgelser • Misissueqqaarnerit • Greenland Field Investigat

RBV / Surveys and Resourc

VINDROSE / COMPASS CARD



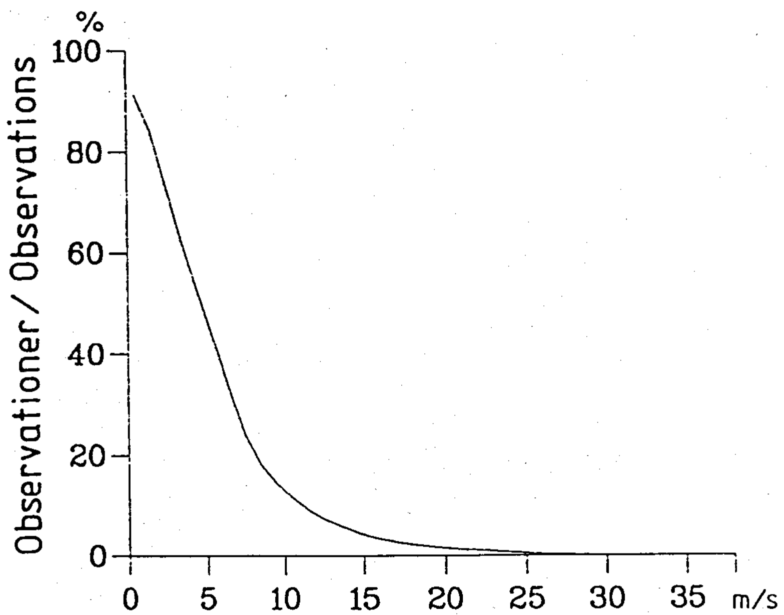
Totalt antal observationer / No. of observations = 4087 ~ 100.0%
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 325 ~ 8.0%

Observationer < 2,5 m/s er ikke markeret / Observations < 2,5 m/s are not shown

Absolut antal observationer / No. of observations

69	163	198	122	95	189	769	507	116	331	273	437	356	97	34	28
N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	NNV
1.4	3.7	4.8	3.0	2.3	4.6	18.8	12.4	2.8	8.1	6.7	10.7	8.7	2.4	0.8	0.7

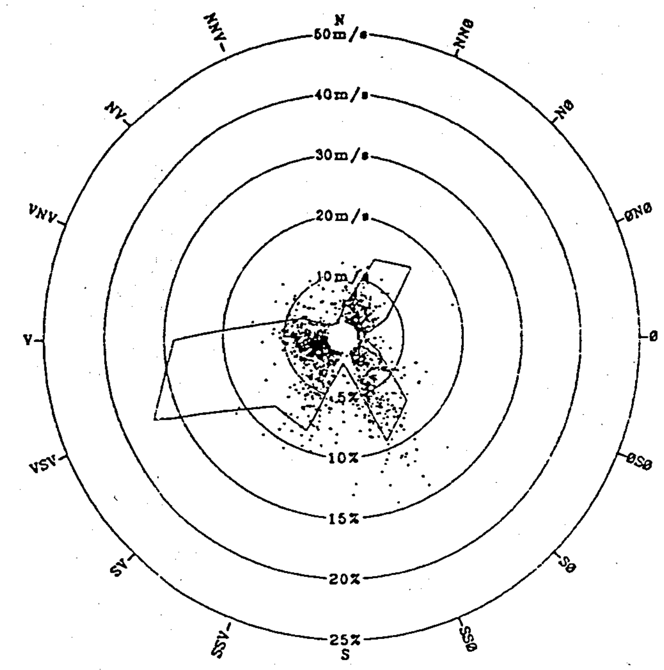
Relativt antal observationer / Observations %



Vindhastighed / Wind speed

30 Aug. 1987 - 17 Sept. 1989

Total periode / Total Period



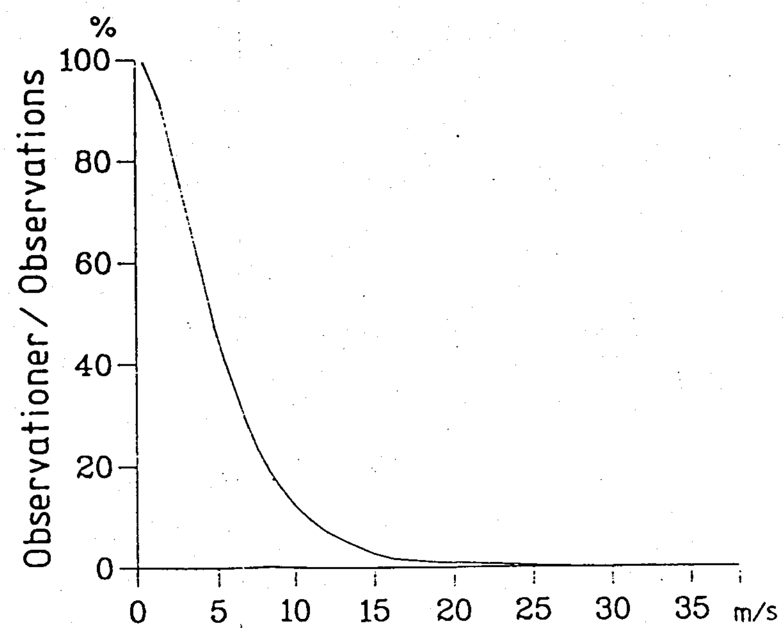
Totalt antal observationer / No. of observations = 1798 ~ 100.0%
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 9 ~ 0.5%

Observationer < 2,5 m/s er ikke markeret / Observations < 2,5 m/s are not shown

Absolut antal observationer / No. of observations

40	124	146	70	30	58	134	168	39	162	146	311	256	70	24	22
N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	NNV
2.2	6.9	8.1	3.9	1.7	3.2	7.5	9.3	2.2	8.5	8.1	17.3	14.2	3.9	1.3	1.2

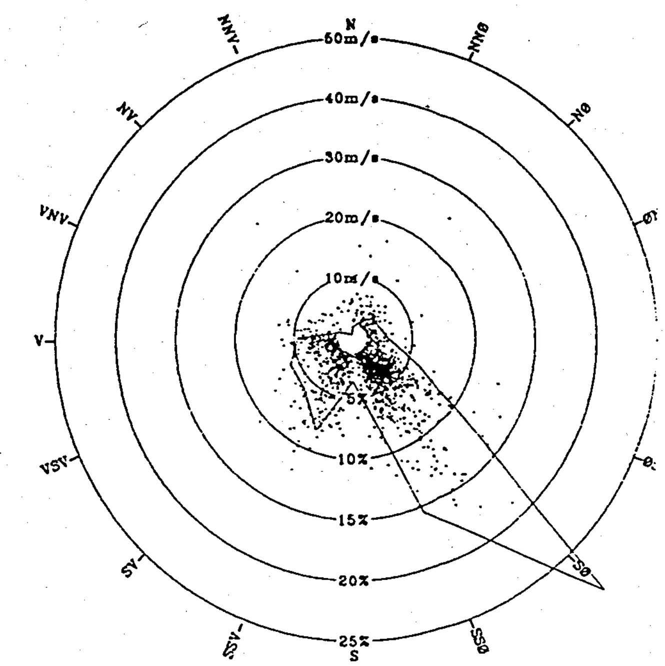
Relativt antal observationer / Observations %



Vindhastighed / Wind speed

01-15 Sept. 1987
21 June - 15 Sept. 1988
15 May - 15 Sept. 1989

Sommer/Summer Period



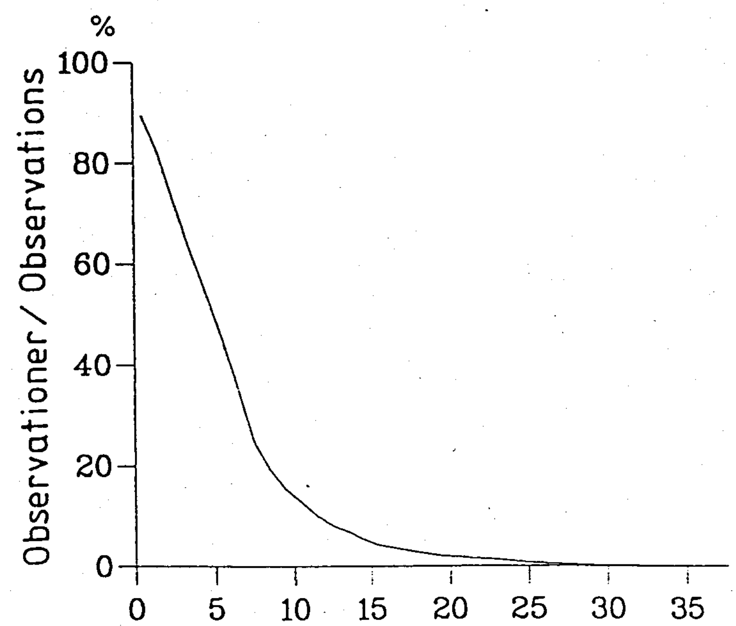
Totalt antal observationer / No. of observations = 2154 ~ 100.0%
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 202 ~ 9.4%

Observationer < 2,5 m/s er ikke markeret / Observations < 2,5 m/s are not shown

Absolut antal observationer / No. of observations

19	29	50	61	64	131	628	333	77	178	126	123	100	27	10	[illegible]
N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	NN[illegible]
0.9	1.3	2.3	2.4	3.0	6.1	29.2	15.5	3.6	8.3	5.8	5.7	4.6	1.3	0.5	0[illegible]

Relativt antal observationer / Observations %



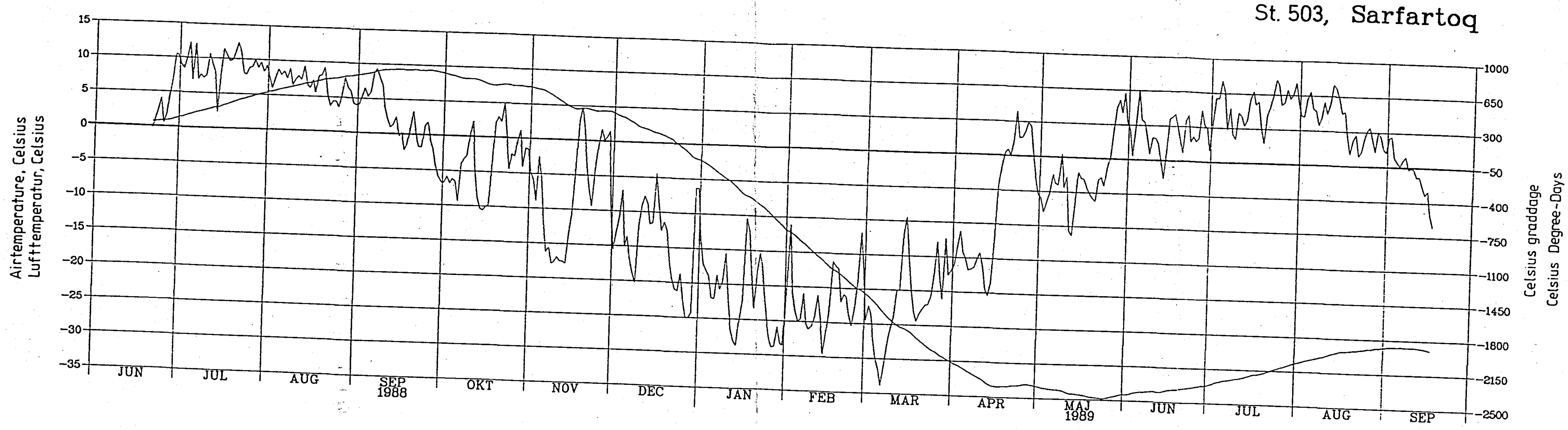
Vindhastighed / Wind speed

16 Sept. - 15 Oct. 1987
16 Sept. 1988 - 14 May 1989

Vinter / Winter Period

Sted: Place: SARFARTOQ - ST. 503		
Emne Subject: MAX. VINDHASTIGHED OG -RETNING MAX. WIND SPEED AND DIRECTION		
Mål: Scale: –	År: Year: 1990	Bilag nr. Supplement no: VIII
Gronlands Forundersogelser • Misissueqqaarnerit • Greenland Field Investiga… RRV/ Surveys and Resourc…		

St. 503, Sarfartoq



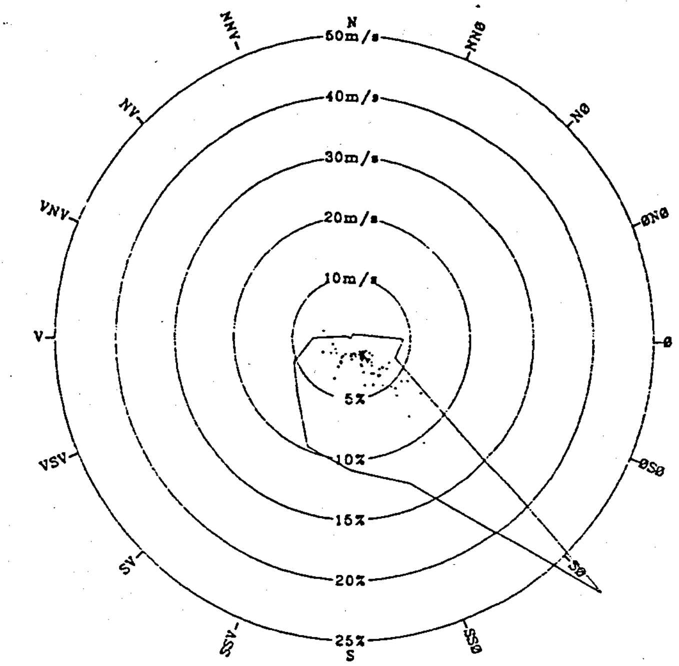
Sted: Place:	SARFARTOQ - ST. 503
Emne Subject:	LUFTTEMPERATUR - GRADDAGE AIRTEMPERATURE - DEGREE DAYS 1988/1989
Mål: Scale: —	År: Year: 1990 / Bilag nr.: Supplement no: IX

Grønlands Forundersøgelser • Misissueqqaarnerit • Greenland Field Investigations

December 1988 . St 503 Sarfartoq

VINDROSE / COMPASS CARD

1/12 - 31/12 1988



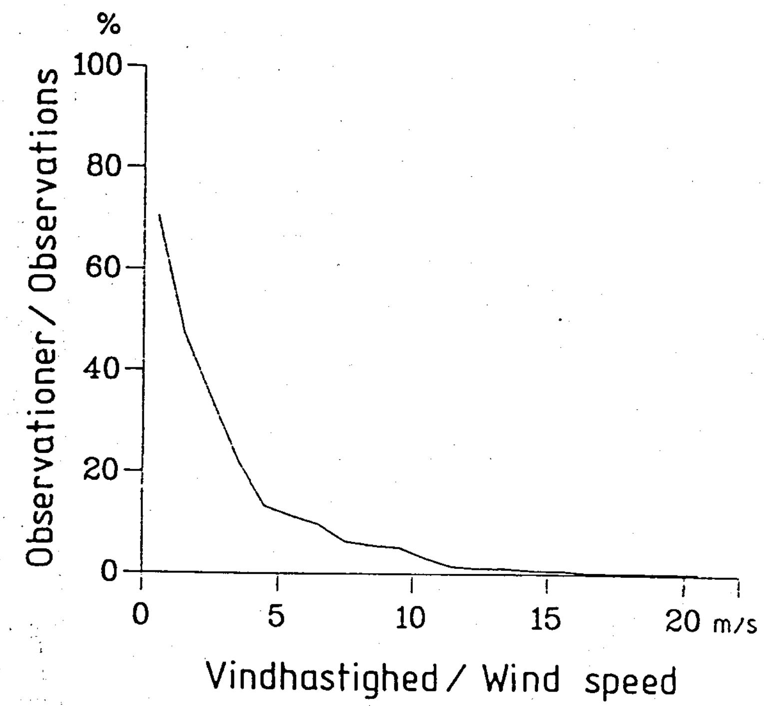
Totalt antal observationer / No. of observations = 248 ~ 100.0%
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 29 ~ 11.7%

Observationer < 2,5 m/s er ikke markeret / Observations < 2,5 m/s are not shown

Absolut antal observationer / No. of observations

0	1	1	2	11	10	73	32	27	24	16	13	8	1	0	0
N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	NNV
0.0	0.4	0.4	0.8	4.4	4.0	29.4	12.9	10.9	9.7	6.5	5.2	3.2	0.4	0.0	0.0

Relativt antal observationer / Observations %

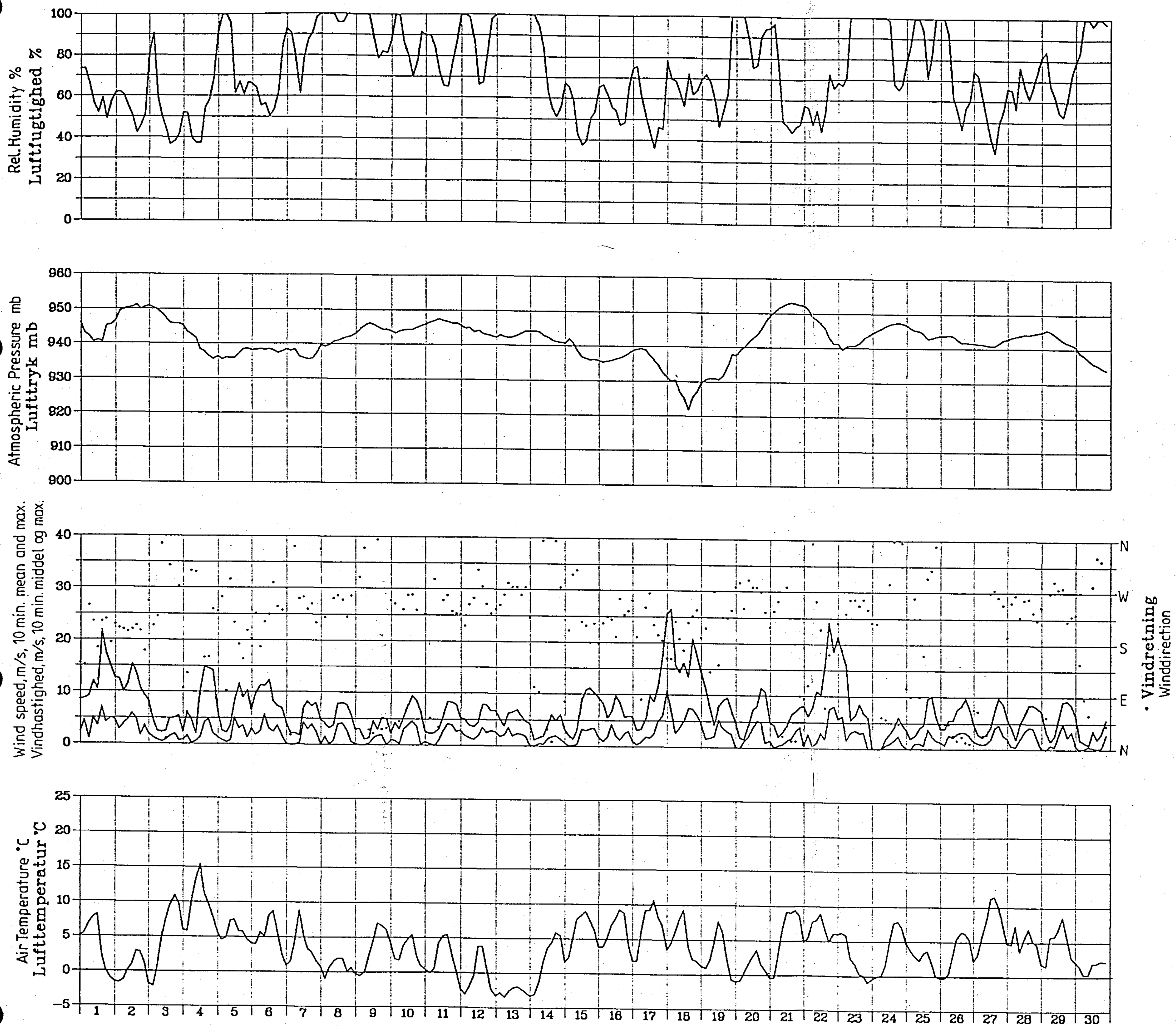


Sted: Place: SARFARTOQ - ST. 503	
Emne Subject: DECEMBER 1988	
Mål: Scale: –	År: Year: 1990 — Bilag nr: Supplement no: X

Grønlands Forundersøgelser • Misissueqqaarnerit • Greenland Field Investigations

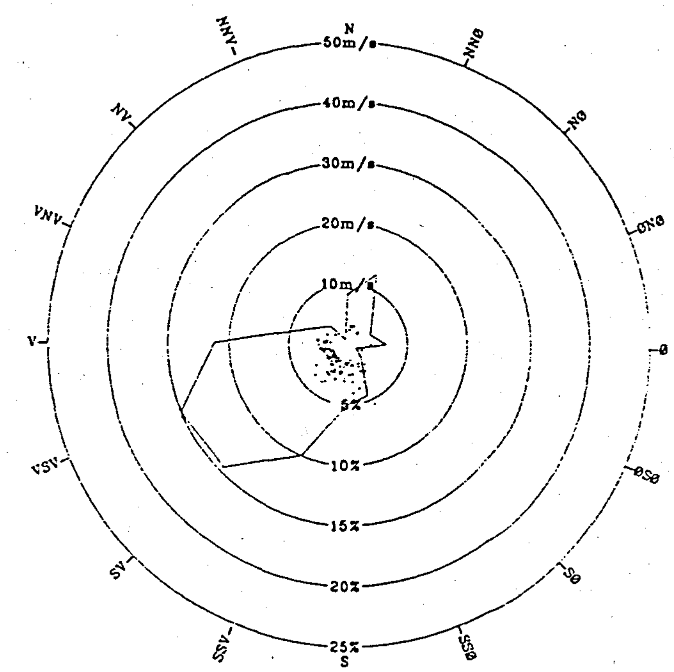
RRV / Surveys and Resources

Juni 1989. St. 503. Sarfartoq
June 1989



VINDROSE / COMPASS CARD

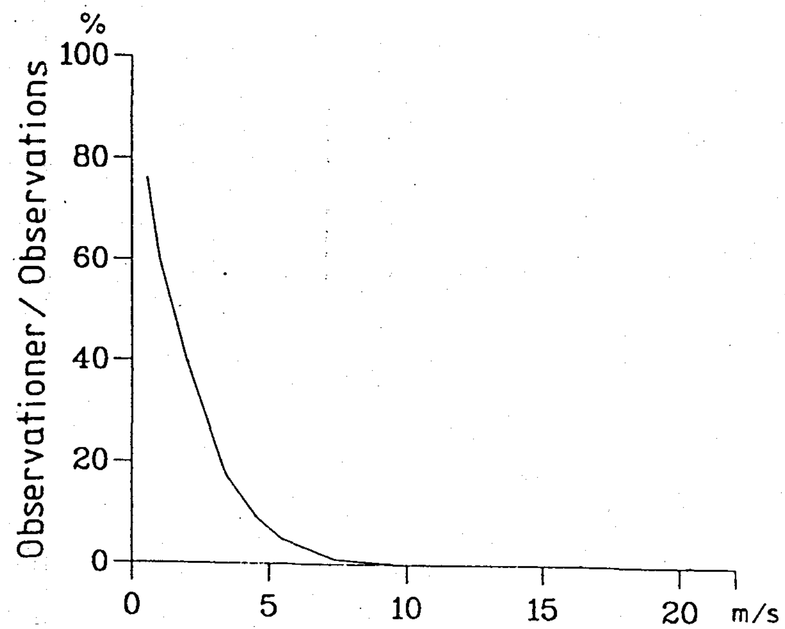
1/6 - 30/6 1989



Totalt antal observationer / No. of observations = 240 ~ 100.0%
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 30 ~ 12.5%

Observationer < 2,5 m/s er ikke markeret / Observations < 2,5 m/s are not shown

	N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	NNV
Absolut antal observationer / No. of observations	10	15	7	5	8	2	4	11	12	24	35	36	27	8	5	1
Relativt antal observationer / Observations %	4.2	6.3	2.9	2.1	3.3	0.8	1.7	4.6	5.0	10.0	14.6	15.0	11.3	3.3	2.1	0.4



Sted: Place: SARFARTOQ - ST. 503

Emne Subject: JUNI / JUNE 1989

Mål: Scale: –

År: Year: 1990

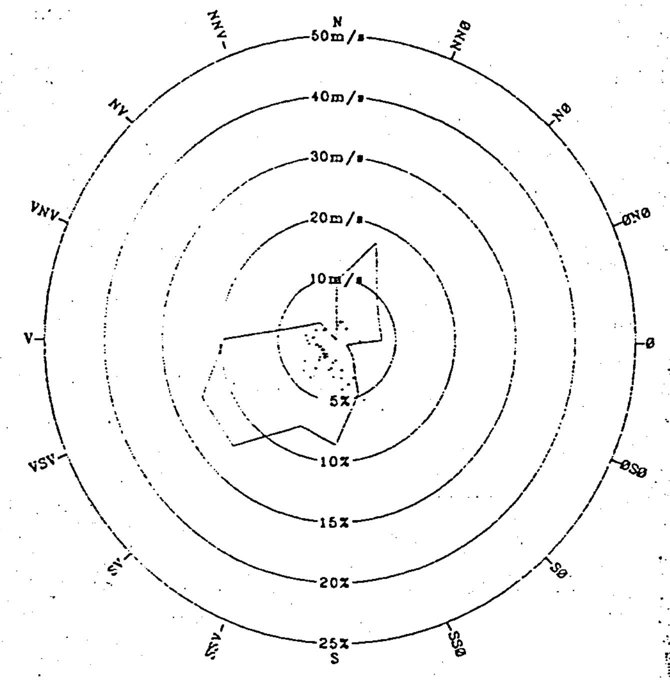
Bilag nr: Supplement no.: XI

Grønlands Forundersøgelser • Misissueqqaarnerit • Greenland Field Investigations

RBV / Surveys and Resources

10 MIN. MEAN WIND SPEED AND DIRECTION

VINDROSE / COMPASS CARD



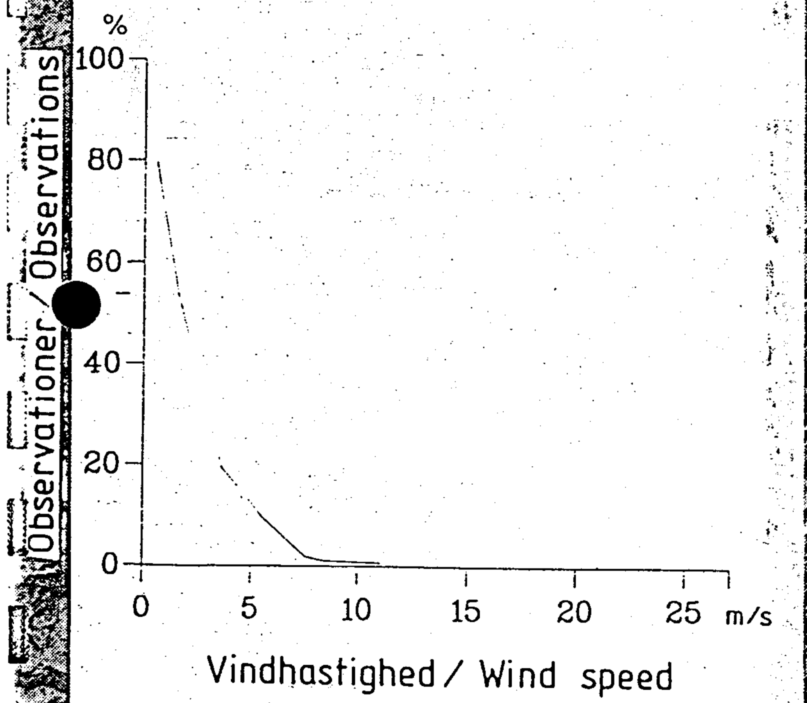
Totalt antal observationer / No. of observations = 104 ~ 100.0%
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 11 ~ 10.6%

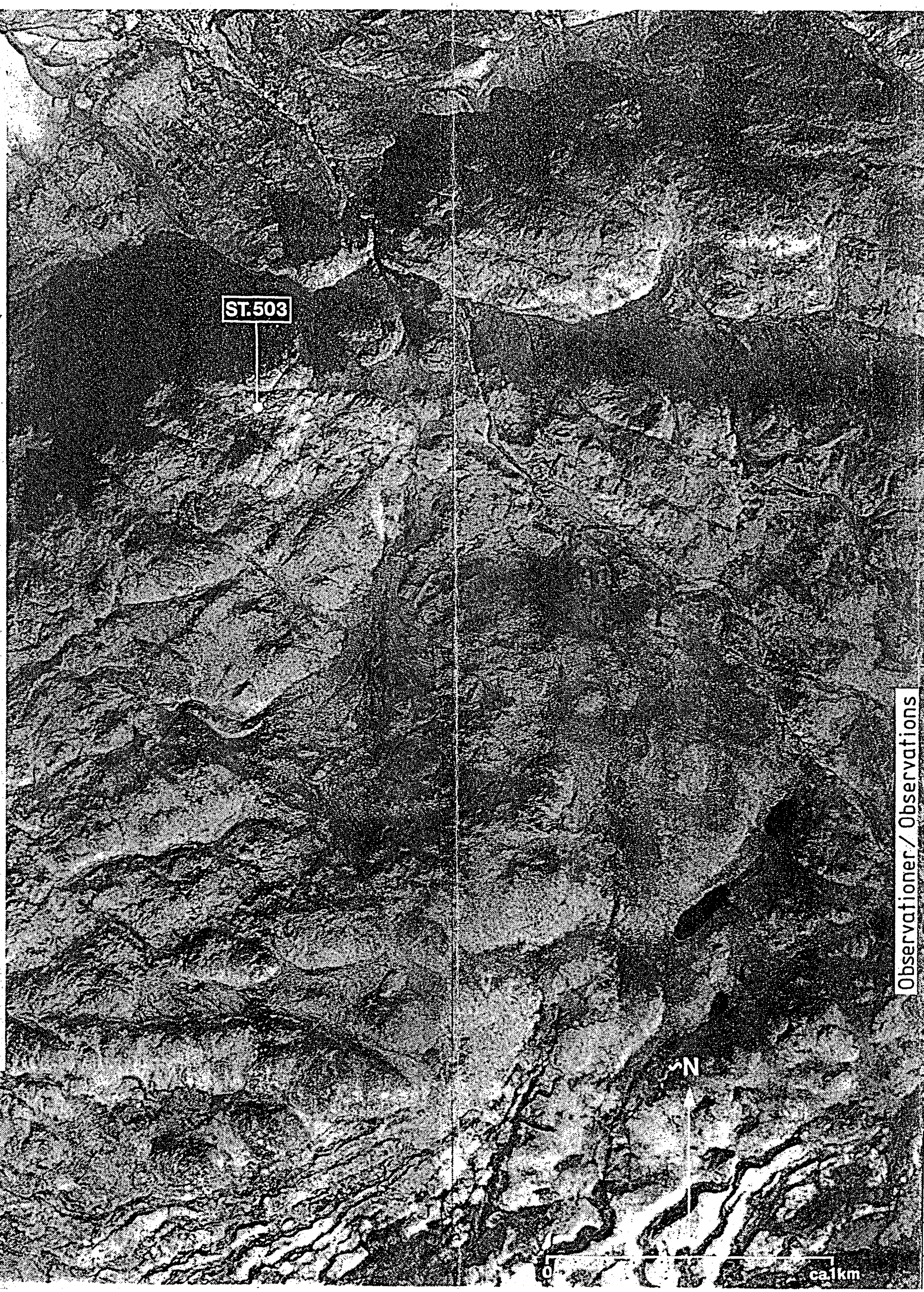
• Observationer < 2,5 m/s er ikke markeret / Observations < 2,5m/s are not shown

Absolut antal observationer / No. of observations

	N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	NNV
No.	5	7	5	4	4	1	2	5	7	8	13	13	10	3	2	0
%	4.8	6.7	4.8	3.8	3.8	1.0	1.9	4.8	6.7	7.7	12.5	12.5	9.6	2.9	1.9	0.0

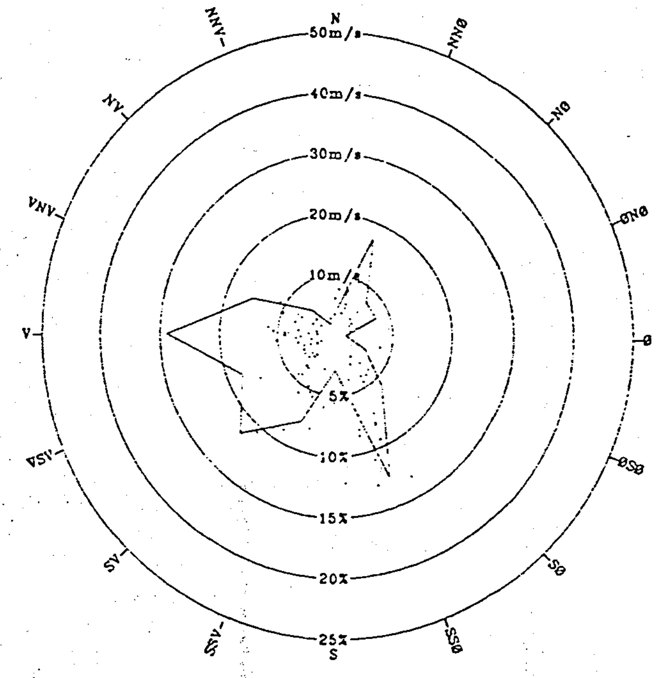
Relativt antal observationer / Observations %





MAX. WIND SPEED AND DIRECTION

VINDROSE / COMPASS CARD



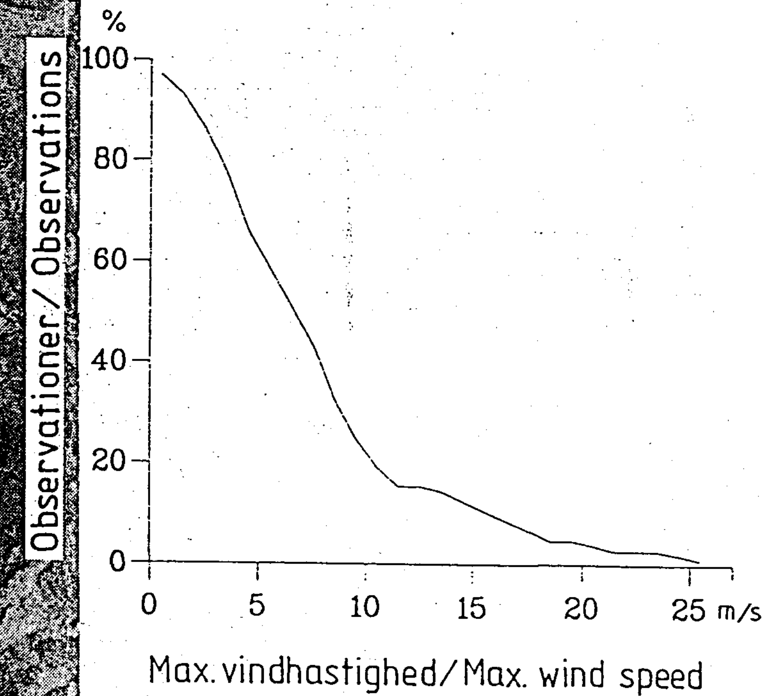
Totalt antal observationer / No. of observations = 104 ~ 100.0%
Antal observationer med vindstille (≤ 0,2 m/s) / Calm = 3 ~ 2.9%

Observationer < 2,5 m/s er ikke markeret / Observations < 2,5m/s are not shown

Absolut antal observationer / No. of observations

	N	NNØ	NØ	ØNØ	Ø	ØSØ	SØ	SSØ	S	SSV	SV	VSV	V	VNV	NV	NNV
No.	2	7	4	4	1	3	6	13	3	8	12	9	15	8	3	1
%	1.9	6.7	3.8	3.8	1.0	2.9	5.8	12.5	2.9	7.7	11.5	8.7	14.4	7.7	2.9	1.0

Relativt antal observationer / Observations %



Sted: Place:	SARFARTOQ - ST. 503
Emne Subject:	VINDFORHOLD 15-27 JUNI 1989 WINDCONDITIONS 15-27 JUNE 1989
Mål: Scale:	~ 1:15.000
År: Year:	1990
Bilag nr: Supplement no:	XII

Grønlands Forundersøgelser • Misissueqqaarnerit • Greenland Field Investigations

CSIRO

Facsimile

CSIRO Minerals

Site Address: Bayview Avenue, Clayton, Vic., Australia
Postal Address: Box 312 Clayton South, Vic 3169

Telephone: +61 3 9545 8500
Fax: +61 3 9562 8919

To:	Mr Mal Thornton	**From:**	Karen Rogers
Company:	Van Der Meer Consulting	**Date:**	11 July, 2000
Fax no:	08 9227 5853	**CSIRO File no:**	SB1/111/455 Quotation # BP98AL
CC:	Frank Jorgensen, Sharif Jahanshahi	**Number of pages** Including this one:	5

Dear Mal,

Experimental Testwork - CSIRO Quotation # BP98AL

We are pleased to submit our attached quotation for this work.

If you have any technical queries with regard to the proposed work please contact Frank Jorgensen on (03) 9545 8531. I would be happy to discuss any other queries you may have and can be contacted on (03) 9545 8693.

CSIRO Minerals can commence work on the project after receipt of the signed quotation, therefore should you wish work to proceed, please fax the completed form to me on (03) 9562 8919.

Where Van Der Meer Consulting provides samples or other materials to CSIRO Minerals for or during the course of the provision of services, Van Der Meer Consulting must advise CSIRO Minerals of any hazardous or otherwise dangerous components or properties of those samples or other materials. A copy of such advice must be returned along with the signed Quotation Form and another copy must also accompany those samples or other materials. You should note that we cannot start the work prior to receipt of the above.

If your Accounts Department requires a Purchase Order to be raised for this work, please write the Purchase Order Number in the space provided at the bottom of the attached Quotation form. Results/reports cannot be delivered until a Purchase Order Number (if required) is received.

Payment via credit card is preferred. Should Van Der Meer Consulting also prefer this method of payment, please complete the credit card details section at the bottom of the attached form.

Yours sincerely,

Karen Rogers
Contracts Administrator

CSIRO Minerals

CSIRO's Australian Business Number: 41 687 119 230

QUOTATION # BP98AL

Quotation Date: 11 July, 2000

Client: Van Der Meer Consulting

Attention: Mr Mal Thornton

Address / ABN: 41 Stuart St Northbridge, WA 6003

Fax: 08 9227 5853

This quotation is only valid for 60 days from the quotation date shown above.

Work Program:

As detailed in the attached Work Program.

Staff Involved in Work Program: Marshall Lanyon, Garry Jensen and Terry Hall

CSIRO Contact Person(s): Frank Jorgensen **Contact Ph:** 03 9545 8531

Start Date: Within a fortnight of receiving signed contract and the ore samples

Completion Date: Six weeks to the draft report stage, final report 3 weeks later

Total Fee: A$36,300 , of which $3,300 constitutes the GST component, payable within thirty days of date of invoice. Should you choose to make payment via credit card, this document will double as a tax invoice for GST when payment is made via your credit card authorisation on completion of the above work. An amount totalling 50% of the Total Fee will be invoiced upon commencement of the work, with the balance invoiced upon completion.

Should you wish to proceed with the work as detailed, please sign and fax this form to the CSIRO Minerals, Contracts Administrator on 03 9562 8919. This quotation is subject to the approval of the Chief of CSIRO Minerals and CSIRO cannot be bound until such approval is obtained.

To CSIRO Minerals, I the undersigned have authority to accept this quotation on behalf of the Client and in accepting this quotation the Client agrees to the terms and conditions shown above and attached hereto.

Signed for and behalf of the Client: ____________________

Please Print Your Name: ____________________

Date: ____________________

Will a Purchase Order be raised for this work? ☐ NO ☐ YES → P.O. Number ____________

If payment is to be made by **credit card** please provide the following details:

Cardholder's Name: ____________________ Credit Card Type: ____________

Card Number: ____________________ Card Expiry Date: __ __/__ __ __ __

For CSIRO Purposes Only: Account Code to charge to: ____________ *Chief:* ____________ *Date:* ___/___/___

Work Program

Four samples (the compositions of which will be specified by Van Der Meer) will be the subject of the testwork.

In preparing this work program it has been assumed that the desired alloy composition would be between 60-70% Nb and that the melting point would be about 1600°C

The conduct of the experiments would be as follows:-

1. Calculate the charge compositions to give the required grade of alloy. Check the melting points of the slag compositions and if necessary add fluxing agents to give fluid slags.
2. To limit the amount of work the thermal analysis would be limited to one sample the best sample for this would be the lowest grade sample as it would contain more of the gangue minerals.
3. Consider the results of the thermal analysis test and if necessary calcine the samples to remove moisture.
4. Grind, mix and sample -submit samples for chemical analysis
5. In order to minimise dusting during smelting the charge would be pelletized. 2 Kg of each of the samples would be formed into pellets 5-10 mm in diameter incorporating the necessary amounts of aluminium and fluxing agents (if necessary).
6. Form a protective layer of the ore within the crucible of the 15 KVA Electric Arc Furnace.
7. Melt a small initial charge under a protective atmosphere of Ar, then feed fresh pellets into the melt pool.
8. At the end of the experiment separate the slag from the alloy, sample both.
9. Submit the samples for chemical analysis by ICP and XRF. The elements of interest would be Nb,Fe, Al, Si, Ca, Ti, U and Ta.
10. Report the results.

The above work program would require about 5 kg of each ore composition.

TERMS AND CONDITIONS

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION a body corporate established by the Commonwealth Science and Industry Act 1949 and having its principal office at Limestone Avenue, Campbell, ACT, through and limited to its Division of Minerals ("CSIRO") and the customer or purchaser named in this Agreement ("the Client") HEREBY AGREE that the provision of services as described in the attached Work Program ("the Service") shall be upon the following terms and conditions.

1. These terms and conditions and the attached Quotation and Work Program (collectively referred to as "this Agreement") contain the whole of the agreement between CSIRO and the Client. No other terms and conditions shall apply whether or not they are contained in any purchase order or other document dated before or after the date of this Agreement unless such conditions are agreed to in writing by CSIRO and expressly vary this Agreement. The Client acknowledges that no person whether servant or agent of CSIRO or otherwise has made or given any guarantee, representation, statement or warranty whether verbally or otherwise in relation to this Agreement.

2. Without prejudice to such other rights as CSIRO may have, CSIRO reserves the right to request from the Client such securities or guarantees it may from time to time think desirable to secure the payment to CSIRO of all sums of money due to CSIRO and may refuse to supply further services to the Client until such securities or guarantees are given.

3. In consideration of CSIRO agreeing to provide the Service, the Client will pay the fee within 30 days of the date of invoice or other period as stated in the Quotation. Such moneys shall be forwarded to:

   CSIRO Minerals
   Box 312
   CLAYTON SOUTH VIC 3169

   The fee does not include GST. CSIRO reserves the right to vary the amounts quoted in this Agreement to take into account the effect of GST on its supply of goods or services. In calculating any such variation CSIRO will take into account not only the GST but also any cost savings made by it due to the removal of indirect taxes.

   If GST is payable CSIRO will provide the Client with a tax invoice in accordance with the GST law.

4. Unless otherwise stated the fee does not include sales tax, which remains the responsibility of the Client.

5. Until such time as the Client pays CSIRO the full fee for the Service, the property in any report provided pursuant to the Service shall not pass to the Client and the relationship between the parties shall be a fiduciary one and during that time the Client shall hold the report as bailee for CSIRO.

6. In the event of the Client not paying the full fee for the Service within the specified time , in addition to any other remedies available to CSIRO, the Client must, on demand in writing, return any report provided pursuant to the Service to CSIRO without delay.

7. If the Client defaults in payment of an invoice or any part thereof, CSIRO may:

   (i) claim interest on any unpaid sum at the aggregate rate of the Westpac Indicator Rate published from time to time by Westpac Banking Corporation plus 2% per annum, such interest to accrue from 30 days after the date of invoice and to continue until full payment is received.
   (ii) recover all costs and expenses reasonably incurred in the recovery of any money owing by the Client to it including all legal fees, process server's charges and collection agent's expenses as well as the time reasonably spent and incurred by CSIRO in such recovery.

8. If any dispute arises between the parties about any matter the subject of or related to this Agreement the parties agree to negotiate in good faith to resolve the dispute and, if necessary or desirable to obtain a resolution, involve the Chief of the Division of Minerals and an Executive Officer of the Client directly in those negotiations. If a dispute has not been resolved by negotiations within thirty (30) days the dispute must be referred to the Australian Commercial Disputes Centre Ltd (ACDC) for mediation in accordance with the Mediation Rules of ACDC in force at the date of this Agreement. If the dispute is not resolved by mediation, the dispute must be referred to the Australian Commercial Disputes Centre Ltd (ACDC) for arbitration in accordance with the Arbitration Rules of ACDC in force at the date of this Agreement. Any arbitration shall be final and binding on the parties, including any award as to costs, provided that nothing in this clause shall prevent any party from seeking urgent interlocutory relief.

9. The Client acknowledges that:-

   (i) the Client uses the Results of the Service and any advice, opinions, reports or information supplied by CSIRO, its servants or agents at its own risk; and
   (ii) it is the responsibility of the Client to make its own assessment of the suitability of the Service and any advice or information generated from the Service.

10. The parties acknowledge and agree that:-

   (i) CSIRO to the extent it is legally possible to do so disclaims all warranties and conditions with respect to the Service including without limitation all implied warranties and conditions whether of merchantability or fitness or description and whether implied by statute or otherwise.

   (ii) In so far as CSIRO's liability can be limited, it is limited to the re-performance of the Service or the payment of the cost of having the Service performed again.

(iii) Notwithstanding the above the Client agrees that any claim whatsoever against CSIRO by any other person, including the Client, for compensation or damages shall not include a claim for any loss of profits or consequential damages.

(iv) Any description of the Service in the Agreement is given by way of identification only and the use of such description shall not constitute a contract of sale by description.

(v) If a term or provision of these conditions excludes restricts or modifies any statutory rights or remedies granted to the Client which may not as a matter of law be so excluded restricted or modified by agreement such term or provision shall not apply to the extent to which such right or remedy is granted to the Client.

11. Where the Client provides samples or other materials to CSIRO for or during the course of the provision of the Services, the Client must advise CSIRO of any hazardous or otherwise dangerous components or properties of those samples or other materials. A copy of such advice must be returned with the signed Quotation Form and another copy must also accompany those samples or other materials. CSIRO will not start the Service prior to receipt of the above.

12. Any dispute arising between the parties shall be heard in and be governed by the laws of the State of Victoria.

13. Any intellectual property rights including copyright, patents, inventions, improvements, trademarks, designs, trade secrets and know-how owned by a party at the date of this Agreement, or independently created by a party at any time, shall remain the property of that party.

14. The intellectual property rights subsisting in all inventions, discoveries, improvements and innovations created by CSIRO during the course of carrying out the Service ("Results of the Service") including copyright in the reports shall be owned by CSIRO.

15. CSIRO hereby grants to the Client a non-exclusive non-transferable, royalty-free right to use the Results of the Service, such right shall not include the right to grant sub-licences.

16. CSIRO retains ownership of all CSIRO's scientific skills, methodology, know-how and experience (and any enhancements of them) which are used or developed by CSIRO in performing the Service.

17. (i) The Client acknowledges that by signing and returning this Agreement it shall be entering into a binding contract on these terms and conditions and be authorising CSIRO to immediately commence work on the Service on the Start Date specified.

(ii) Once the Client has signed and returned this Agreement to CSIRO, the Client will afford full cooperation to CSIRO as requested by CSIRO in the provision of samples for testing and any other matters to enable CSIRO to proceed with the Service.

18. CSIRO shall not be liable in any circumstances whatsoever for any failure to perform any obligations pursuant to this Agreement where such failure is due to any cause beyond the reasonable control of CSIRO including but not limited to instrument breakdown and failure.

19. Any time period within which results are to be supplied which is specified in this Agreement is subject to clause 18 and subject to the timely delivery of samples by the Client.

20. (i) Each party shall not disclose any information which has been provided to that party by the other party which is by its nature confidential without the prior written consent of the other party.

(ii) The Client has no right to publish any report provided by CSIRO pursuant to the Service or CSIRO's name without CSIRO's prior written consent.

21. The Client hereby releases and indemnifies and shall continue to release and indemnify CSIRO, its officers, employees and agents from and against all actions, claims, proceedings or demands (including those brought by third parties) which may be brought against it or them, whether on their own or jointly with the Client and whether at common law, in equity or pursuant to statute or otherwise, in respect of any loss, death, injury, illness or damage (whether personal or property, and whether direct or consequential, including consequential financial loss) and any infringement of copyright, patents, trade marks, designs or other intellectual property rights, howsoever arising out of the Client's exercise of its rights under this Agreement and/or any use or interpretation made of the Results of the Service and from and against all damages costs and expenses incurred in defending or settling any such claim, proceeding or demand.

22. The Client acknowledges that this Agreement will only apply to that part of CSIRO's operations in the Division of Minerals and does not affect or commit in any way the operations or resources of any other Division of CSIRO the activities of which are completely independent of this Agreement.

Mal Thornton

From:	Frank Jorgensen [Frank.Jorgensen@minerals.csiro.au]
Sent:	Sunday, 16 July 2000 18:20
To:	MALT@vandermeer.com.au
Subject:	Re your E mail of 14th July

Mal,

The analyses of the multihead sample total to about 97%. This is much closer to 100% than the totals for p151 and p162. The reduction in the unnacounted for material would reduce the amount of water assumed to be in the sample. This would have some consequences for the calculated power consumption resulting in a small reduction.

Re your queries

1. We could do a literature search on the production of the High (vaccuum) Grade material for you.
2. For the slag stability we could
a) carry out TCLP tests (or some other leaching tests if preferred) on the four slag samples produced in the electric arc smelting testwork. These results would serve as datums for the virgin slags.

   b) the slag samples would then be thoroughly wet and subjected to 10 cycles of freezing to minus 50C (using liquid nitrogen) and thawing to room temperature.
   c) the four slags would then be again subjected to TCLP testing and the results compared with those obtained for the virgin materials.
   d) polished sections would be prepared and examined microscopically to determine the effect of treatment on the structure.

3.Estimates could be prepared of the effect of head grade on

   a) recovery of Nb
   b) power costs
   c) reagent consumption eg Al, Fe fluxing agents

4. A report would be produced embodying the results of the lit. search leaching work and estimates..

A very rough estimate of the cost of the additional work is about $25K.

Re your last query.
If the alloy from the electric smelting tests is produced in the form of a saucer shaped button and it is required in a more massive form it may be necessary to remelt the samples.to produce the samples in this form. Let's see the shape of the buttons we produce first before we worry about this.

I hope that the above enables you to proceed with your preparations.

Regards

Frank Jorgensen

SGS Australia Pty Ltd
A.C.N. 000 964 278
80 Railway Parade,
Queens Park,W.A.
P.O. BOX 91,
Cannington,6107,
Tel :(08) 458 9666
Fax :(08) 9458 9361

ANALYTICAL REPORT ON SAMPLES SUBMITTED BY / ON BEHALF OF

Ammtec

6 MacAdam Place

BALCATTA WA 6021

Attention Doug

REC

Our Ref	G61680
Your Ref	30293
Date Received	19 OCT., 1999
Date Completed	20 OCT., 1999
Number of Samples	17
Pages in Report	2

Issued at Perth on .. 21 OCT., 1999

1. Analytical results in the following report pertain to samples as received at this laboratory
This report supersedes all previous interim or provisional Faxes , Reports or Electronic Mail and Final Reports.

SGS Australia Pty Ltd
A.C.N. 000 964 278

Our Ref G61680

Order 30293

ANALYTICAL REPORT

SAMPLE REFERENCE	Ta2O5	Sn	Nb2O5	Fe2O3	MnO	TiO2	CaO	SiO2	Al2O3	S
1 P100	0.02	0.04	3.51	26.2	0.03	1.24	1.22	50.4	3.43	0.04
2 P101	0.06	0.03	3.49	26.1	0.01	1.08	1.07	51.5	2.98	< 0.01
3 P102	0.03	0.02	5.66	22.8	0.02	1.29	1.50	50.1	5.12	0.03
4 P103	0.10	0.04	13.2	8.80	0.01	0.92	2.89	49.2	9.66	0.06
5 P104	0.18	0.04	16.7	17.4	0.01	1.38	3.34	43.1	4.68	0.08
6 P105	0.26	0.04	30.5	15.8	0.02	2.04	5.67	30.4	2.24	0.22
7 P106	0.10	0.03	15.2	16.9	0.01	1.28	3.07	44.8	4.81	0.06
8 P107	0.07	0.03	5.92	9.05	0.01	0.60	1.59	56.2	12.0	0.03
9 P108	0.15	0.07	16.5	10.4	0.01	1.17	3.32	45.8	8.61	0.09
10 P109	0.12	0.06	12.8	11.3	< 0.01	0.99	2.71	49.2	8.31	0.05
11 P110	0.16	0.03	19.6	16.3	0.01	1.49	3.85	40.4	3.94	0.08
12 P111	0.20	0.03	27.0	16.0	0.02	1.85	5.04	33.7	2.72	0.16
13 P112	0.08	0.03	10.7	16.2	0.03	1.02	2.52	52.2	6.67	0.03
14 P113	0.08	0.03	6.04	19.2	0.01	0.96	1.63	51.5	7.63	0.02
15 P114	0.09	0.02	9.99	2.10	< 0.01	0.56	2.23	55.4	14.7	0.05
16 P115	0.11	0.04	15.6	17.7	0.01	1.35	3.30	43.8	5.46	0.07
17 P116	0.33	0.04	38.6	1.41	< 0.01	1.78	7.07	29.1	7.97	0.18
RESULTS EXPRESSED AS	%	%	%	%	%	%	%	%	%	
LOWER DETECTION LIMIT	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.
ANALYSIS CODE	M-14	M-14	M-14	M-14	M-14	M-14	M-14	M-14	M-14	M-14
METHOD OF PREPARATION	SP 7	SP 7	SP 7	SP 7	SP 7	SP 7	SP 7	SP 7	SP 7	SP

2/77

Attention : DOUG MOYSES

Complete and final results
Our reference : G61868
Your reference : Order # 30577
Sample prep code : SP 7
Number of samples : 17

Authorised by P. Bannister

ELEMENTS	Ta2O5	Sn	Nb2O5	Fe2O3	MnO	TiO2	CaO
UNITS	%	%	%	%	%	%	%
LLD	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CODE	M-14	M-14	M-14	M-14	M-14	M-14	M-14
P135	0.02	0.02	0.66	22.8	0.16	3.10	2.81
P136	0.01	0.03	0.36	25.8	0.06	1.22	1.61
P137	0.01	0.02	0.39	24.9	0.04	0.93	1.63
P138	0.06	0.02	0.47	26.3	0.07	1.16	1.73
P144	0.01	0.02	1.13	5.80	0.01	0.30	2.27
P145	0.33	0.03	21.6	19.1	0.02	1.63	4.35
P146	0.22	0.03	7.93	26.4	0.01	1.36	1.80
P147	0.20	0.02	11.7	24.3	0.01	1.43	2.43
P148	0.17	0.03	14.1	24.2	0.04	1.54	2.96
P149	0.51	0.02	40.2	5.95	< 0.01	1.94	7.74
P150	0.57	0.04	43.1	5.76	< 0.01	2.06	8.30
P151	0.56	0.01	42.6	6.60	< 0.01	2.08	8.28
P152	0.35	0.01	28.0	10.1	< 0.01	1.57	5.80
P153	0.07	< 0.01	8.06	8.31	0.02	0.76	3.87
P154	0.03	0.01	5.59	7.78	0.02	0.60	3.30
P155	0.03	0.01	3.45	6.83	0.01	0.46	2.95
P156	0.05	0.01	1.77	7.19	0.02	0.39	2.72

ELEMENTS	SiO2	Al2O3	S
UNITS	%	%	%
LLD	0.01	0.01	0.01
CODE	M-14	M-14	M-14
P135	50.7	6.99	0.05
P136	52.5	4.45	0.01
P137	52.4	4.48	0.01
P138	50.3	4.77	0.03
P144	61.2	14.6	0.02
P145	36.6	2.35	0.10
P146	46.6	2.68	0.03
P147	44.2	1.96	0.04
P148	40.5	1.87	0.06
P149	25.6	5.82	0.15
P150	22.2	4.12	0.15
P151	22.9	3.68	0.16
P152	33.9	4.82	0.10
P153	52.5	11.3	0.31

SGS Australia Pty Ltd
A.C.N. 000 964 278

Our Ref G61737

Order 30380

ANALYTICAL REPORT

SAMPLE REFERENCE	Ta2O5	Sn	Nb2O5	Fe2O3	MnO	TiO2	CaO	SiO2	Al2O3	S
1 A7030 P117	0.14	0.03	5.49	23.9	0.04	1.35	1.65	49.4	4.01	0.03
2 A7030 P118	0.05	0.01	4.07	25.5	0.01	1.08	1.20	50.9	2.98	0.01
3 A7030 P119	0.05	0.03	5.26	24.3	0.01	1.06	1.40	50.7	3.30	0.01
4 A7030 P120	0.06	0.02	3.98	26.8	0.03	1.07	1.17	50.0	2.75	0.01
5 A7030 P121	0.28	0.02	32.7	6.86	< 0.01	1.72	6.13	32.9	5.86	0.13
6 A7030 P122	0.23	0.01	27.1	7.11	< 0.01	1.48	5.16	37.8	7.26	0.11
7 A7030 P123	0.19	0.01	16.4	7.42	< 0.01	1.00	3.34	47.8	10.0	0.06
8 A7030 P124	0.12	0.01	11.2	9.06	0.01	0.82	2.54	51.3	10.5	0.03
9 A7030 P125	0.05	0.01	4.10	28.1	0.02	1.68	1.28	48.9	1.81	0.03
10 A7030 P126	0.13	0.02	7.57	25.0	0.01	1.23	1.82	48.1	2.31	0.04
11 A7030 P127	0.13	0.02	5.86	26.2	0.01	1.16	1.50	49.0	2.11	0.02
12 A7030 P128	0.08	0.03	6.06	26.6	0.01	1.21	1.54	48.7	1.99	0.02
13 A7030 P129	0.26	0.02	29.3	6.52	0.01	1.56	5.60	35.8	6.97	0.12
14 A7030 P130	0.13	0.03	13.3	15.2	< 0.01	1.12	2.84	47.1	6.36	0.05
15 A7030 P131	0.08	0.02	9.84	16.3	0.01	1.01	2.51	48.4	6.64	0.04
16 A7030 P132	0.15	0.02	15.2	11.1	0.01	1.07	3.15	47.7	8.48	0.06
17 A7030 P133	0.20	0.02	14.7	12.4	0.01	1.09	3.09	47.2	7.78	0.07
18 A7030 P134	0.12	0.02	7.49	10.5	< 0.01	0.72	1.92	53.9	10.5	0.03
RESULTS EXPRESSED AS	%	%	%	%	%	%	%	%	%	%
LOWER DETECTION LIMIT	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
ANALYSIS CODE	M-14	M-14	M-14	M-14	M-14	M-14	M-14	M-14	M-14	M-14
METHOD OF PREPARATION	SP 7	SP 7	SP 7	SP 7	SP 7	SP 7	SP 7	SP 7	SP 7	SP 7