REPORT ON EXPLORATION LICENCE 35/79

FOR THE 6 MONTHS ENDED 14th DECEMBER 1981



1. GENERAL

Exploration licence No. 35/79 was taken out by the Tasmanian Electro Metallurgical Company Pty. Ltd., to explore for high purity quartzite for use in the manufacture of ferrosilicon and silico-manganese at Bell Bay Tasmania.

2. WORK DONE

2.1 ENVIRONMENTAL IMPACT STUDIES

Two reports from contractors in archeology and botany have been received, their respective titles being:

(i) "ARCHEOLOGICAL RESOURCES OF THE EAST COAST OF HUNTER ISLAND" - Sandra Bowdler 1981.

(ii) "A BOTANICAL SURVEY OF HUNTER ISLAND" - J. B. Davies 1981.

Copies of these reports are included for your retention.

2.2 GEOLOGICAL FIELD WORK

Geological reconnaissance and surface sampling continued particularly in the Ainslie Beach to Cave Bay area on the East Coast.

Analyses of samples collected and their locations and comments are as follows:

..2/

AINSLIE BEACH TO CAVE BAY AREA

| TRAVERSE ONE | | | | TRAVERSE TWO | | | |
|---|---|---|---|---|---|---|---|
| SAMPLE No. | ANALYSIS % | | | SAMPLE No. | ANALYSIS % | | |
| | $SiO_2$ | $Al_2O_3$ | L.O.I. | | $SiO_2$ | $Al_2O_3$ | L.O.I. |
| H.1.2. | 97.3 | 1.76 | 0.38 | H.1.15 | 97.9 | 0.87 | 0.22 |
| " 3 | 98.6 | 0.27 | 0.12 | " 16 | 98.6 | 0.43 | 0.09 |
| " 4 | 98.8 | 0.31 | 0.06 | " 17 | 99.0 | 0.28 | 0.26 |
| " 5 | 98.3 | 0.25 | 0.27 | " 18 | 98.0 | 0.66 | 0.01 |
| " 6 | 98.5 | 0.25 | 0.01 | " 19 | 98.9 | 0.43 | 0.12 |
| " 7 | 95.6 | 3.04 | 0.59 | " 20 | 99.0 | 0.15 | 0.15 |
| " 8 | 97.5 | 1.35 | 0.37 | " 21 | 98.5 | 0.43 | 0.14 |
| " 9 | 98.1 | 0.70 | 0.18 | " 22 | 99.2 | 0.14 | 0.06 |
| " 10 | 97.9 | 0.46 | 0.08 | " 23 | 99.3 | 0.08 | 0.01 |
| " 11 | 97.2 | 1.19 | 0.18 | " 24 | 98.8 | 0.28 | 0.03 |
| " 12 | 96.3 | 0.61 | 0.43 | " 25 | 99.0 | 0.10 | 0.07 |
| " 13 | 97.9 | 1.15 | 0.06 | " 26 | 98.2 | 0.52 | 0.03 |
| " 14 | 98.0 | 0.58 | 0.02 | " 27 | 98.4 | 0.50 | 0.01 |
| | | | | " 28 | 98.6 | 0.63 | 0.12 |
| | | | | Composite 15 to 20 | 98.6 | 0.47 | 0.14 |
| Composite | 97.7 | 1.00 | 0.21 | Composite 21 to 28 | 98.7 | 0.34 | 0.06 |

EXPLANATION

TRAVERSE ONE

Samples are chip samples taken every four metres across strike and representing a fairly pure orthoquartzite sequence from it's coast side outcrop, SAMPLE (2) approximately 50m from high water mark, to a more foliated zone of schists adjacent to it's inland side.

Strike of the rocks is N. 10°E. and dip is near vertical to 80° to the East.

TRAVERSE TWO

Samples are chip samples taken every ten metres across strike and representing a thin bedded orthoquartzite sequence generally appearing hard and siliceous in outcrop.

Sample No. 27 corresponds with the highest point above sea level of 79m marked on the plan while a 50m wide schist (?) band exists between samples 20 and 21 where lack of outcrop prevented sampling.

CHEMICAL QUALITY

Composite analyses as listed on page two of this report may be taken to be indictive of the underlying rock only, as inconsistent outcrop prevented channel sampling, and the rock exposed is in the oxidised zone so that an increase in $Al_2O_3$ values may be expected with depth in the case of the softer surface outcrop.

In the case of traverse two, the outcropping rock was predominantly very hard and of vitreous appearance indicating intense silicification and low intial mica content before weathering. Unfortunately the traverses sampled do not represent the full width of quartzite sequence in the area due to sporadic outcrop in some areas and a lack of time available to carry out more sampling of this type.

NOTE

Bad weather conditions and difficult access to the area limited the actual time available for sampling. Use of survey gear was impossible due to constant westerly wind.

It appears that the area is made up of a fairly typical pre-Cambrian quartzite rich sequence - as found at both the Weld River and Dip Range areas.

However, as stated previously, much of the quartzite present is of a hard, vitreous nature in outcrop whereas this rock type makes up only a minor part of the sequences at the other two areas.

The maximum width of strata of good chemical quality sampled is 70 to 80m as represented by the inland end of traverse two and it seems likely that a mineable zone of high grade quartzite could be proven up in subsequent exploration activity.

The attached plan shows the rough positions of chemically good and chemically bad sections of the sequence as known at this time and assuming continuity along strike.

Much more surface sampling is required in this area, before the best positions for bore holes is decided.

The area described above between Ainslie Beach and Cave Bay is considered to have the best potential for future exploration work and development of a mining operation.

Much of the remainder of the island was covered on land during the visit and other spot samples collected where outcrops were considered worthy of note.

The sample localities and their analyses are listed below:

| SAMPLE No. | ANALYSIS % | | | LOCATION AND COMMENTS |
|---|---|---|---|---|
| | $SiO_2$ | $Al_2O_3$ | L.O.I. | |
| H.1. 29 | 97.8 | 0.66 | 0.21 | Orthoquartzite from cliff-face near small cave at north end of Ainslie Beach. (Eastern limit of hard quartzite.) |
| " 30 | 97.6 | 0.91 | 0.27 | |
| " 31 | 97.5 | 0.73 | 0.12 | |
| 32 | 81.5 | 2.71 | 2.39 | Schist from dune area between above cliff and beach. |
| 33 | 98.4 | 0.36 | 0.18 | Quartzite from interbedded 3m wide bed in schists closer to beach. |
| 34 | 81.2 | 2.71 | 2.30 | Slates and schist from outcrops on the beach to the East of the quartzite cliffs represented by samples 29,30 & 31. - indicative of potential quarry wall rock. |
| 35 | 80.7 | 3.31 | 3.08 | |
| 36 | 93.6 | 3.31 | 0.34 | |
| 37 | 98.6 | 0.36 | 0.16 | Orthoquartzite from approximately 30m wide bed outcropping prominently at Cuvier Point. |
| 38 | 98.7 | 0.25 | 0.03 | |
| 1 | 98.9 | 0.24 | 0.17 | Quartzite from 0.5Km North of Perigo Point (20m wide bed in foliated schists) |

COSTS

| | | |
|---|---|---|
| Hire of plane - | 2 trips Smithton to Hunter Island<br>2 trips Hunter Island to Smithton | $ 200.00 |
| Hire of trail bikes - | 2 bikes for 4 days | $ 240.00 |
| Cash expenditure - | includes camping gear hire, food etc. | $ 277.00 |
| Wages | | $ 1,120.00 |
| Cost of sample analysis @ estimated $10 per sample | | $ 400.00 |
| Cost of archeological report | | $ 420.00 |
| Cost of botanical report | | $ 900.00 |
| | TOTAL | $ 3,557.00 |

D. J. HASSELL

GEOLOGIST.

N

5 cm

3/10

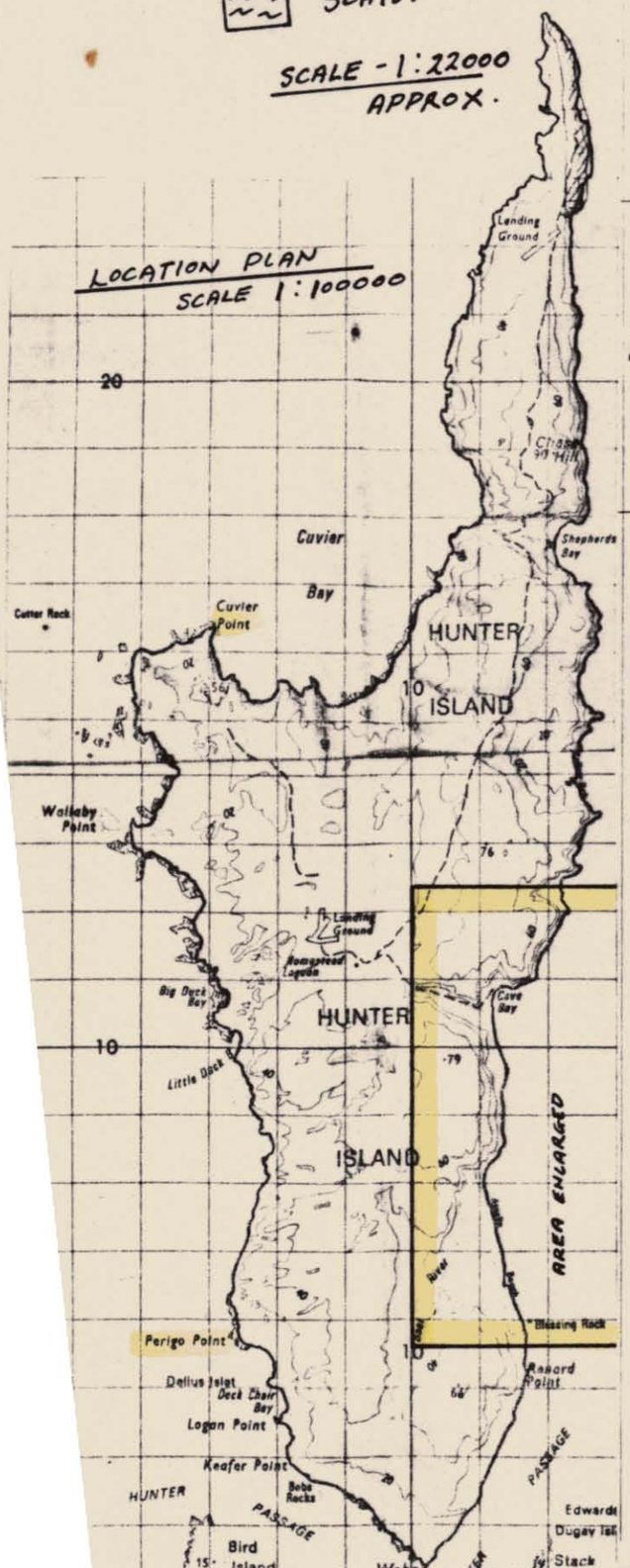
## LEGEND

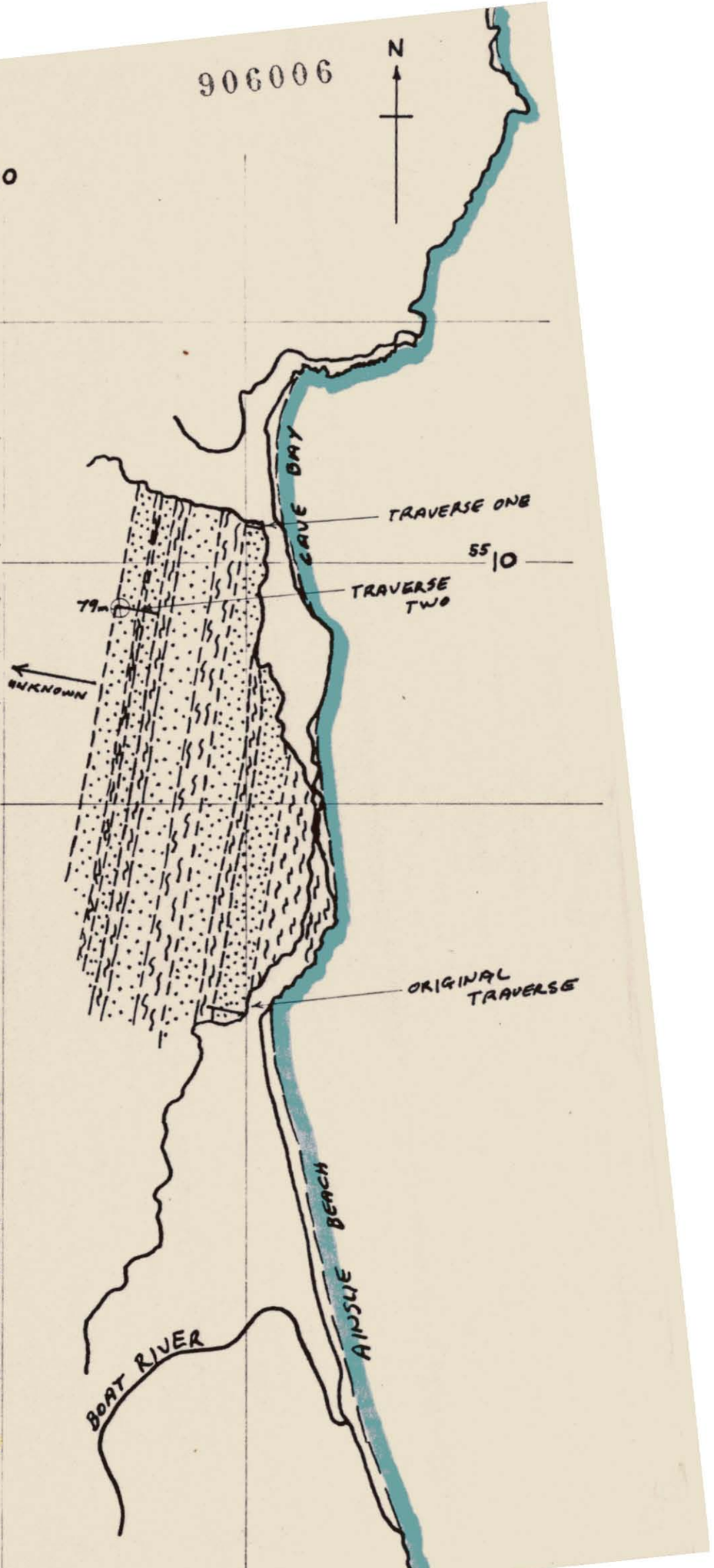
PREDOMINANTLY QUARTZITE

PREDOMINANTLY SCHIST

SCALE - 1:22000 APPROX.

## LOCATION PLAN
SCALE 1:100000



## DISCUSSION AND CONCLUSIONS.

### 1. POSSIBILITY OF HIGH GRADE QUARTZITE BODY.

Results of work carried out are inconclusive and do not rule out the possibility of finding a body of high grade quartzite on Hunter Island of sufficient size to allow for open cut mining.

However, previous investigation of similar sequences of pre-Cambrian quartzites and quartz sericite schists on mainland Tasmania, notably in the areas of Sisters Creek, Weld River and the Dip Ranges, indicate that surface outcrop is rarely a good indication of the underlying rock.

Drilling in the Sisters Creek area has often shown that a bed of very hard orthoquartzite outcropping at the surface deteriorates to a poorly cemented sandstone only a few metres below the surface.

We now believe that hard orthoquartzite in such sequences only persists at depth in beds which, before surface silicification, were free of sericite, and other minerals unstable under oxidising conditions.

The silicification evident in outcrop is considered to post date lithification and to be the result of weathering processes in the great majority of such occurrences although a secondary or intermediate mobilisation of silica post dating deep weathering is known to have occurred in some areas resulting in complete silicification deeper into the sequence.

Surface activated precipitation of silica results in a cap of hard quartzite only a few metres thick where beds were sericitic quartzite or schist with the underlying softer sandstone being the remnant framework of quartz sand after removal of sericite by oxidation in the near surface zone.

Given that the above hypothesis is basically true, it then becomes rare to find a mineable, high grade, hard quartzite deposit in such sequences which typically have individual bed widths of less than a few metres.

### 2. MINING, TREATMENT AND TRANSPORT.

Originally, it was envisaged that, should an economic ore body be discovered, it would be mined and the ore treated (crushed and screened), on the island on a seasonal basis by a subcontractor using mobile crushing and screening equipment.

Transport of the resulting product was to have been by tug and barges direct from Hunter Island to Bell Bay.

It was envisaged that drop front barges would be loaded with conventional trucks and front end loaders from the beach while unloading at Bell Bay would be by grab into trucks for transport to the Temco plant.

The whole operation as outlined above would minimise capital expenditure as special ship loading facilities would not be required.

The economics of the above system were investigated briefly by our Resource Planning division, and a rough cost of $60.00 per tonne delivered was calculated. This was assuming that all problems involved in setting up a tug and barge transport system would be overcome to actually allow the system to exist.

The indicated cost of supply above is enough to prevent development for short to medium term supply.

Future fuel price escalation may still make such deposits attractive in the longer term due to the comparitive low cost of sea freight when compared with road and rail fuel efficiency.

## 3. ENVIRONMENTAL SENSITIVITY.

Hunter Island is, or could be, of interest to persons or organisations who hold an entirely anti mining viewpoint.

It must not be forgotten therefore that even if an ore body were proven up which was economically viable, the project may still be abandoned because of pressure brought to bear through the media by such organisations.

Concern has already been expressed by the National Parks and Wildlife Department regarding possible threats to birdlife on the east coast as well as coastal heath assemblages.

In the case of protection of plant species such as the coastal heath, we have complied with special conditions written into our exploration licence aimed at preventing the spread of Phytophthora cinnamomi to the island.

It was noted at the time that such conditions appeared to apply only to ourselves, while others who regularly travel to and from the island were not subject to the same conditions. While we do not object to such provisions, we feel that they should apply to all parties capable of causing the same environmental damage.

Similarly inconsistent were provisions written into our licence conditions aimed at protection of fauna while 1080 poison trails could be readily observed on the island.

We feel this is a good indication of the type of inconsistent attention such an operation would attract which, when publicised through media reports, could well bring an end to the project.

The island also has a history of aboriginal occupation and has ancient sites presently under study which we would undertake to protect to the satisfaction of interested parties.

However, the possibility of a future confrontation with pressure groups concerned with aboriginal pre-history cannot be overlooked.

4. PROTECTION OF THE ENVIRONMENT.

During the course of exploration activity no tracks were constructed and no excavation carried out.

Transport was by foot or trail bike and sampling was surface chip sampling only.

As far as we are aware no damage was caused to the environment and no rehabilitation work is required.

In conclusion, and in view of points 1, 2 & 3 above (and possibly others), we feel that expenditure on diamond drilling - the next logical phase of exploration, at an estimated cost of $85,000, is unwarranted.

# EXPLORATION LICENCE NO. 35 of 1979 HUNTER ISLAND.

## (1) GENERAL:

An exploration licence covering Hunter Island was applied for in November 1979 and finally granted in July 1980.

The licence was taken out to explore for high purity quartzite for use in the manufacture of ferrosilicon and silicomanganese at Temco, Bell Bay.

## (2) WORK DONE:

Two trips to the island have been undertaken for preliminary geological reconnaissance and surface sampling.

An area of apparently high grade quartzite has been defined between Cave Bay and Ainslie Beach on the eastern side of the island and is considered the main area of interest for a drilling programme to test the quartzite at depth, (see attached plan).

The attached lists of analyses indicate the quality of quartzite from the numbered localities on the plan, (bulk samples of approximately 20 Kg. each) and chip samples across the strike at Ainslie Beach and Shepherds Bay.

Some decrepitation testing has also been carried out with favourable results.

## (3) EXPENDITURE:

Expenditure debited to E.L. 35/79 to December 1980 is as follows:-

| | |
|---|---|
| Wages and salaries | $2584. 00 |
| Tenement fees, licences etc. | $1051. 00 |
| Transport, accomodation etc. | $1025. 00 |
| Analysis and testing work | $ 540. 00 |
| TOTAL | $5200. 00 |

## (4) PROGRAMME CONTINUATION:

Following completion of environmental impact studies - (estimated to be completed by 14th June 1981), it is proposed to carry out a drilling programme in the area between Cave Bay and Ainslie Beach.

It is envisaged that five diamond drill holes spaced along approximately 1 Km. of strike length will be drilled to a depth of approximately 100 metres for initial sub surface evaluation.

Efforts are currently being made to obtain a drilling contractor for this work.

This report is submitted to the Mines Department as required by Schedule 'A' of Exploration Licence No. 35 of 1979.

CHIP SAMPLE TRAVERSES - ANALYSES.

| AINSLIE BEACH | $SiO_2$ | $Al_2O_3$ | L.O.I |
|---|---|---|---|
| AB1 | 98.2 | 0.67 | 0.44 |
| AB2 | 97.9 | 1.08 | 0.35 |
| AB3 | 98.6 | 0.38 | 0.30 |
| AB4 | 98.8 | 0.40 | 0.26 |
| AB5 | 99.0 | 0.36 | 0.30 |
| AB6 | 98.2 | 0.64 | 0.44 |
| AB7 | 98.0 | 0.62 | 0.19 |
| AB8 | 98.2 | 0.64 | 0.28 |
| AB9 | 98.2 | 0.47 | 0.22 |
| AB10 | 97.5 | 0.30 | 0.17 |
| AB11 | 98.3 | 0.68 | 0.24 |
| AB12 | 98.1 | 0.85 | 0.31 |
| AB13 | 98.3 | 0.56 | 0.15 |
| AB14 | 98.7 | 0.45 | 0.20 |
| AB15 | 98.8 | 0.34 | 0.19 |
| AB16 | 98.8 | 0.34 | 0.15 |
| AB17 | 99.3 | 0.10 | 0.02 |
| AB18 | 98.7 | 0.30 | 0.04 |
| AB19 | 98.3 | 0.74 | 0.18 |
| AB20 | 97.3 | 1.45 | 0.26 |
| | | | |
| SHEPHERDS BAY | | | |
| SB1 | 96.9 | 2.00 | 0.50 |
| SB2 | 98.9 | 0.54 | 0.09 |
| SB3 | 98.2 | 1.42 | 0.20 |
| SB4 | 98.5 | 0.69 | 0.31 |
| SB5 | 98.1 | 1.30 | 0.25 |
| SB6 | 96.8 | 1.59 | 0.31 |
| SB7 | 96.0 | 1.36 | 0.27 |
| SB8 | 98.3 | 0.76 | 0.28 |
| SB9 | 97.5 | 1.09 | 0.41 |
| SB10 | 98.7 | 0.57 | 0.13 |

011

906012

TASMANIAN ELECTRO METALLURGICAL CO. PTY. LTD.

BELL BAY - TASMANIA

LABORATORY REPORT: BULK SAMPLES - NUMBERED LOCALITIES DATE: 24·10·79

MATERIAL: HUNTER ISLAND QUARTZITE

| SAMPLE DESCRIPTION | $Al_2O_3$ | L.O.I. | $SiO_2$ |
|---|---|---|---|
| 1 IN SITU | 0·90 | 0·26 | 97·9 |
| 1 SHINGLE | 0·48 | 0·21 | 98·7 |
| 2 IN SITU | 0·84 | 0·69 | 97·5 |
| 2 SHINGLE | 0·88 | 0·13 | 97·5 |
| 3 OLD SHINGLE | 1·19 | 0·50 | 97·3 |
| 4 IN SITU | 0·40 | 0·11 | 98·6 |
| 4 SHINGLE | 0·43 | 0·03 | 98·1 |
| 5 CAVE BAY IN SITU | >10·0 | 2·53 | 83·9 |

CHEMIST.

012

# DECREPITATION TESTS :

906013

| SCREENS | 1 INSITU | | | | 2 INSITU | | | | 3 INSITU | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BEFORE | | AFTER | | BEFORE | | AFTER | | BEFORE | | AFTER | |
| +- 1" | ·678 | 1·267 | ·674 | 1·249 | ·7565 | — | ·714 | ·832 | — | — | ·844 | ·862 |
| | 90% | 96·4% | 90·3% | 95% | 90·5% | | 85·4% | 98·2% | | | 95·8% | 98·3% |
| + 3/16" | ·064 | 0425 | ·063 | ·055 | ·0785 | — | ·115 | ·010 | — | — | ·0265 | ·006 |
| | 8·6% | 3·2% | 8·4% | 4·2% | 9·4% | | 13·7% | 1·2% | | | 3% | 0·7% |
| - 3/16" | ·0035 | ·0045 | ·009 | ·010 | ·001 | — | ·007 | ·005 | — | — | ·010 | ·009 |
| | 0·5% | 0·3% | 1·2% | 0·8% | 0·1% | | 0·8% | 0·6% | | | 1·1% | 1·0% |
| TOTAL | 7455 | 1·314·0 | ·746 | 1·314 | ·836 | ·847 | ·836 | ·847 | ·8805 | ·877 | ·8805 | ·877 |
| | 100% | 99·9% | 99·9% | 100% | 100% | | 99·9% | 100% | | | 99·9% | 100% |

013

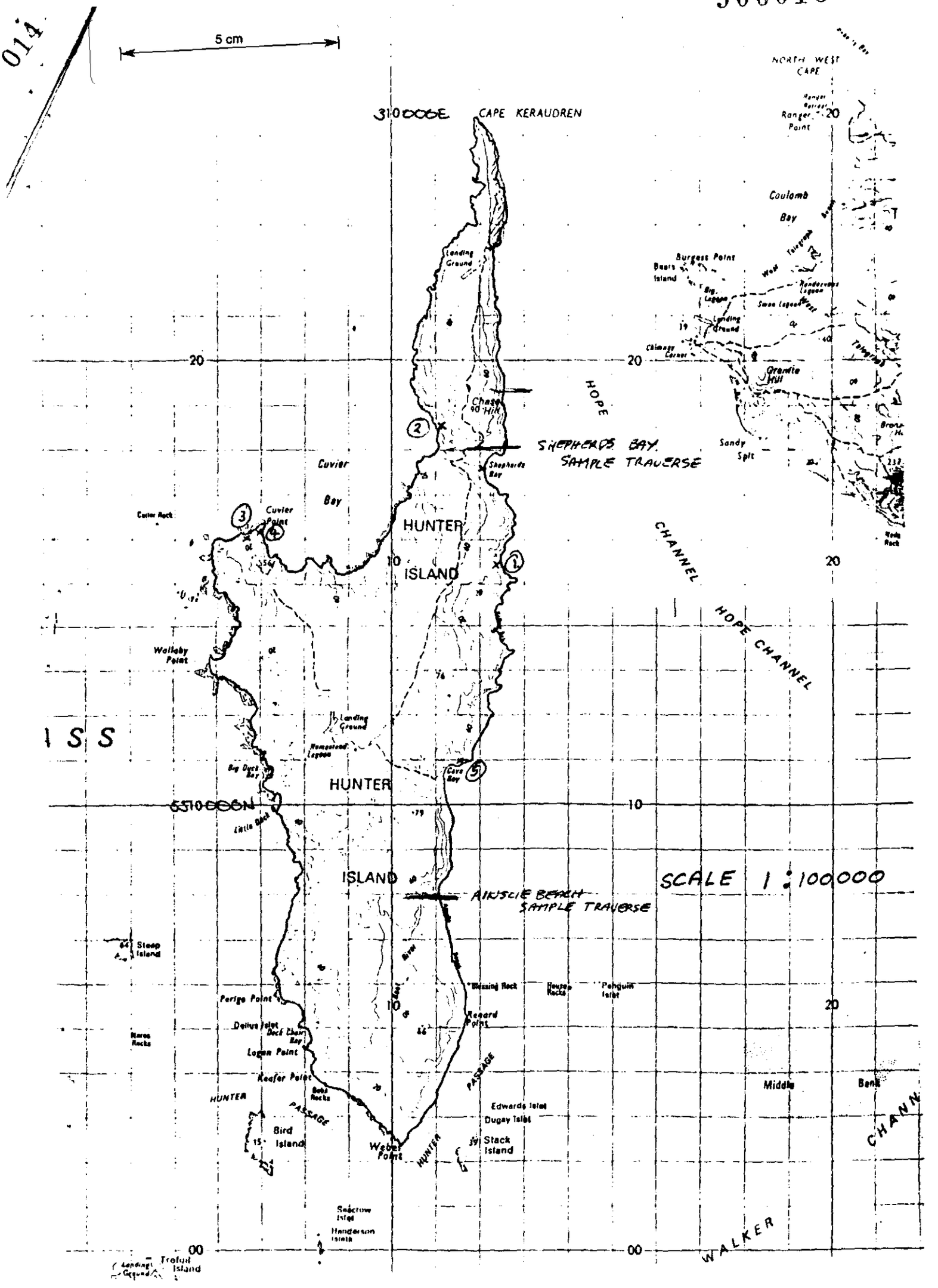
906014

| SCREENS | 5 IN SITU | | | | 1 COBBLE | | | | 2 COBBLE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BEFORE | | AFTER | | BEFORE | | AFTER | | BEFORE | | AFTER | |
| + 1" | 589.5 | 1.088 | 574.5 | 0.951 | — | — | 820 | 542 | — | 840.5 | — | 837 |
| | 92% | 99.5% | 89.6% | 87% | | | 98.4% | 99.8% | | 99.9% | | 99.5% |
| - 3/16" | 049 | 004 | 059 | 127.5 | — | — | 0085 | — | — | 0005 | — | 001.5 |
| | 7.6% | 0.4% | 9.2% | 11.6% | | | 1% | | | 0.1% | | 0.2% |
| - 3/16" | 0025 | 001 | 0075 | 014 | — | — | 005 | 001 | — | — | — | 002.5 |
| | 0.4% | 0.1% | 1.2% | 1.3% | | | 0.6% | 0.2% | | | | 0.3% |
| TOTAL | 641.0 | 1.093 | 641.0 | 1.092.5 | 833.5 | 543 | 833.5 | 543 | 676 | 841 | 676 | 841.0 |
| | 100% | 100% | 100% | 99.9% | | | 100% | 100% | | | | 100% |

906015

014

5 cm



# A BOTANICAL SURVEY OF HUNTER ISLAND - NORTH WEST TASMANIA

J.B. DAVIES
BOTANY DEPARTMENT
UNIVERSITY OF TASMANIA

# CONTENTS

# A BOTANICAL SURVEY OF HUNTER ISLAND

# - NORTH WEST TASMANIA

## 1. INTRODUCTION

### 1.1 The Brief

The author accepted a brief from Temco (Tasmanian Electro Metallurgical Co. Pty. Ltd.) to:-

"Complete a report which describes as comprehensively as possible, given the time available, the present vegetation and flora of Hunter Island. The report shall describe areas where maximum impact will occur if mining was carried out, as well as areas where mining is more desirable in terms of least impact to particular plant species or plant communities."

The report was required to be completed in fourteen days before March 31st, 1981.

### 1.2 Characteristics of The Area

Hunter Island consists of sandy beaches, undulating dune systems, rocky headlands, cleared grazing country and coastal plains. Its maximum altitude is only of the order of 80m. Numerous freshwater lagoons and swamps are found on the island but many dry up completely over summer. A few small creeks drain down to the beaches.

The annual rainfall is about 900 mm. The mean maximum winter temperature is about 13°C and the mean maximum summer temperature is 20°C. "The mean minumum ranges from 7° to 12°C. The oceanic climate and strong westerly winds provide an equable cool environment" (Hope 1978).

Soils in the study area are commonly shallow, acidic and highly infertile. Extensive but shallow accumulations of peat occur across the plateau and on marine terrace systems, particularly in areas of restricted drainage. The frequent occurrence of fire has reduced peat depths exposing areas of bedrock particularly along the quartzite plateaus.

### 1.3 The Vegetation of Hunter Island

The vegetation of Hunter Island has not been intensively surveyed to date. However, Kirkpatrick (1977) recorded five different heath communities on the Island.

Hope (1978) made an east-west traverse of the island in May 1976 and listed the plant communities as shown in Table 1.

Table 1. Communities noted on Hunter Island

| Structural form | Alliance Name | Percentage of Island Area |
|---|---|---|
| Low closed-forest | Melaleuca ericifolia-M. squarrosa | 5 |
| Low woodland | Eucalyptus nitida-E. ovata | 35 |
| Closed-scrub | M. ericifolia-M. squarrosa | 10 |
| Open-scrub | Myoporum insulare-Acacia sophorae | +* |
| Tall shrubland | Leptospermum laevigatum - Banksia marginata | 5 |
| Open-heath | Banksia marginata - Casuarina monilifera | 10 |
| | Cyathodes juniperina - Correa alba | + |
| | Sprengelia incarnata - Epacris lanuginosa | 5 |
| | Banksia marginata - Bossiaea cordigera - Melaleuca ericifolia | 5 |
| Herblands | Lepidosperma gladiatum | + |
| | Salicornia quinqueflora - Cotula coronopifolia | + |
| | Disphyma australe | + |
| | Poa poiformis - Spinifex hirsutus - Scirpus nodosus | 5 |
| | Exotic pasture | 30 |

*+, widespread but not extensive

(from Hope 1978)

A species list for the island was constructed by Kirkpatrick in 1976 and kindly made available for this report.

## 2. THE SURVEY

### 2.1 Location and Boundaries of Study Area (See Map 1 & 2)

Hunter Island is located 5 km off the North Western tip of Tasmania. It is about 24 km in length and up to 7 km wide. The boundaries of this plant survey included an area within Temco's exploration licence on the Eastern side of the island between the Northern end of Ainslie Beach to just North of Shepherds Bay (see Map 2). However, much of the survey concentrated primarily on the headland South of Cave Bay shown as "primary drill target zone" in Map 2. This particular region is of initial interest to Temco for quartzite extraction.

### 2.2 The Survey Method

The survey was conducted during one five day field trip to the island between 18-22 March, 1981. An additional week was spent in a literature survey, plant identification and preparation of the report.

The survey entailed listing all plant species from a total of 25 quadrat sites - each $100m^2$ in area. Quadrats were located so as to include all visibly different communities and environments within the study area. Map 3 shows the locations of the 25 quadrat sites studied in detail. Qualitative notes were also made of structure, dominance, slope and drainage conditions. Species found in the study area, but not included in quadrats were recorded. Lichens, algae and mosses were excluded from the study.

Plant names follow Curtis (1965, 1967, 1975) and Willis (1970).

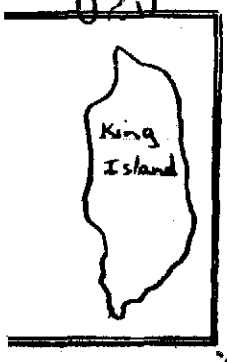
Acknowledgment must be made to Dr J. B. Kirkpatrick for helpful assistance and comments.

### 2.3 Survey Results

The plant species recorded in quadrat sites 1-25 are listed in Appendix I with respective cover estimates.

An alphabetic species list for Hunter Island is shown in Appendix II. This includes a breakdown of those species recorded in the primary drill target zone, (see Map 2) as well as those recorded elsewhere on the island by the author or by J. B. Kirkpatrick in 1976.

The quadrat data from sites 1-25 was classified subjectively into the heath communities described in a study of the conservation of coastal heath communities of North and East Tasmania and the Furneaux Group by Kirkpatrick (1977).




BASS STRAIT

# MAP 1

## THE STUDY AREA (HUNTER ISLAND)

Three Hummock Island

Hunter Island

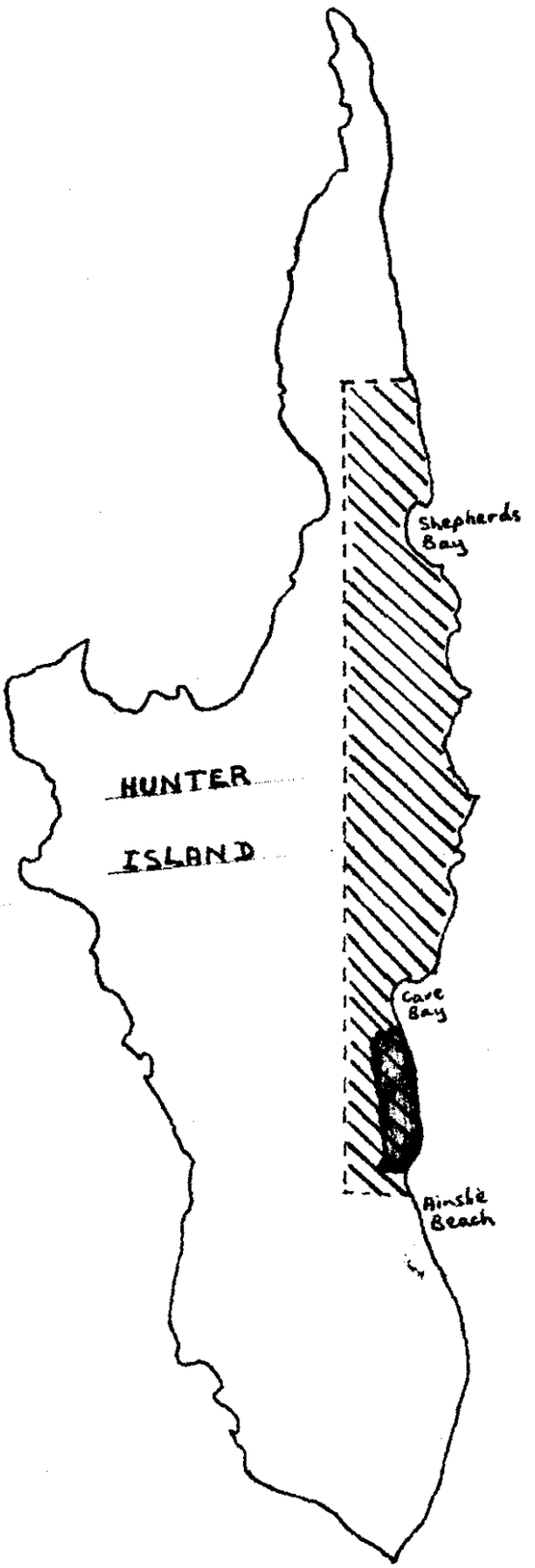
Robbins Island

Scale 1 : 1,800,000

5 cm

# MAP 2






AREA OF INITIAL INTEREST

PRIMARY DRILL TARGET ZONE

Scale 1:100,000

5 cm

J22

906023

# MAP 3

20

QUADRAT SAMPLING SITES 1-25

310000E

Chase Hill

Shepherds Bay

Cuvier Bay

Cuvier Point

Cutter Rock

HUNTER ISLAND

10

Yellow Bch

Wallaby Point

Landing Ground

Homestead Lagoon

Big Duck Bay

Cave Bay

HUNTER ISLAND

5510000N

10

Little Duck B

Ainslie River

Scale 1:50,000

5 cm

Steep Island

Of the 37 coastal heath communities of Tasmania described by Kirkpatrick only 6 were found in the area sampled in this survey. These were Kirkpatrick's community No's 1, 2, 5, 12, 13, and 37.

Most of these community types were difficult to discriminate between as a continuum of these community types was evident. The recent firing of the area no doubt caused extra difficulties in classification of the vegetation.

Two other community types were recognised in the area apart from the heath communities defined by Kirkpatrick. These were called "Halophytic Headland" and "Coastal Bench" communities for the sake of classification. The "Halophytic Headland community" was only found in quadrat 8. It is characterised by halophytic plant species growing on areas of the quartizite escarpment exposed to the stresses of saltspray and wind in areas close to the seashore.

The "Coastal Bench communities" were all located between the foot of the escarpment and the coastline.

Table II shows a breakdown of the 25 quadrat sites into their respective community types. Quadrat sites were listed under more than one heath communtiy type when ambiguity existed in classification and the site was potentially classifiable into a number of community types. (eg sites 2, 5, 6 etc.).

TABLE II:

HEATH TYPES (KIRKPATRICK 1977)

| TYPE 1 | 2 | 5 | 12 | 13 | 37 | HALOPHYTIC HEADLAND COMMUNITY | COASTAL BENCH COMMUNITY |
|---|---|---|---|---|---|---|---|
| 2,5,6,7,11 | 5,6,7 20,24 25 | 22 | 2,6,21 23,25 | 23 | 1,3,4,5 9,10,12 13,15,19 20,24,25 | 8 | 14,16,17 18 |

2.4 Discussion

From the above table it can be seen that the vegetation surveyed included 6 heath communities as defined by Kirkpatrick (1977) (one outside the primary drill target zone, a Halophytic Headland community and Coastal Bench communities.

The coastal heath communities occur along the top and on the scarp of the quartzite plateau. The Halophytic Headland community occurs on the Northern extremity of the escarpment above Cave Bay (Site 8 Map 3).

The Coastal Bench communities all occur along the foreshore flats.

Detailed descriptions of the communities are listed below with respective comments on their present conservation status in the State.

(A) The Heath Communities

Although 6 different heath communities were sampled on the island, overall they were found to be highly heterogeneous. Heath community (5) was only recorded once, north of Cave Bay and was not found in the primary drill target zone (See Map 3).

Heath Community (1)

Leucopogon australis - Melaleuca squamea

Kirkpatrick (1977) made the following comments on this community:

"This community is confined to Three Hummock and Hunter Islands where it occurs on shallow, acid, peaty and seasonally ill-drained soils formed on quartzite plateaus. The taller shrubs which dominate the later development stages of the community after fire are Banksia marginata, Leptospermum scoparium, Melaleuca squamea, M. squarrosa, Leucopogon australis and Dillwynia glaberrima. The epacrids Sprengelia incarnata and Epacris lanuginosa are the only two consistently present (constant) smaller shrubs, although Aotus ericoides, normally a component of better-drained heaths, occurs in more than fifty percent of the quadrats as does Epacris impressa. Selaginella uliginosa and Drosera pygmaea are constant members of the largely herbaceous groundlayer. Tall tussocks of cutting-grass (Gahnia) occur sporadically within the heaths in this community. Species diversity is relatively low, averaging only 20 per quadrat.

Heaths referable to or similar to this community probably occur widely outside the study area on the west and south coasts of Tasmania. The community is reserved on Three Hummock Island." (Kirkpatrick 1977)

Heath Community (2)

Shoenus tenuissimus - Epacris lanuginosa - Empodisma minus

"This community on seasonally ill-drained, acid soils is found from Blackmans Bay in the south east to Rocky Cape in the north west. The only consistently present taller shrubs are Leptospermum scoparium and Dillwynia glaberrima. The constant smaller shrubs are Sprengelia incarnata, Epacris lanuginosa, E. impressa and ferns, the most constant of which are Schoenus tenuissimus, Lepidosperma filiforme, Calorophus lateriflorus, Leptocarpus tenax, Selaginella uliginosa and Lindsaya linearis. The species diversity is variable, but averages 27 per quadrat.

The community is found in Rocky Cape National Park, Mt. William National Park, Schouten Island State Reserve and Tasman Arch S.R." (Kirkpatrick 1977).

Heath Community (12)

Leptospermum glaucescens - Hibbertia procumbens

This community - "Is found on acid, shallow or deep sandy soils which are generally well-drained although their peaty surface horizon may often be soaked to a sufficient extent to impede root aeration. The constantly present larger shrub species are Leptospermum glaucescens, Casuarina monilifera and Banksia marginata. The constant small shrubs are Hibbertia procumbens, Epacris impressa, Leucopogon collinus, Aotus ericoides, Gompholobium huegelii, Amperea xiphoclada and Dillwynia glaberrima. Selaginella uliginosa and Patersonia fragilis are the only herbaceous species that occur in most quadrats. The mean species diversity is twenty-eight. Labillardiere State Reserve contains this community." (Kirkpatrick 1977)

Heath Community (13)

Leptospermum glaucescens - Lepidosperma concavum

"The centre of distribution of this community is the Furneaux Group, although it is also found in the far north west, on Bruny Island, on the Freycinet Peninsula and Schouten Island. It occurs on acid, siliceous, well-drained soils formed on deep sand deposits and granitic or quartzitic colluvium. As in the previous community Leptospermum glaucescens, Casuarina monilifera and Banksia marginata are the constant large shrubs. However, of the constant herbs and smaller shrubs found in the previous community only Epacris impressa, Leucopogon collinus and Dillwynia glaberrima maintain high frequencies. Lepidosperma concavum, a species without a high degree of constancy in the previous community, occurs in almost all quadrats referable to this community. The mean species diversity is twenty-seven. The community occurs in four national parks". (Kirkpatrick 1977)

Heath Community (37)

Banksia marginata - Leptospermum scoparium

"This community is highly heterogeneous. It is found in the Furneaux Group, in the far north west and at Brown Mountain on the Tasman Peninsula, and consists largely of quadrats located in vegetation that given even a relatively short period without fire would develop into closed-scrub. Banksia marginata and Leptospermum scoparium are the only highly constant species. Epacris impressa, Casuarina monilifera, Leptospermum glaucescens and Danthonia are less constant but occur in more than fifty percent of the quadrats. Species diversity is low, averaging only twenty. The community is found in the Rocky Cape National Park, the Strzelecki National Park and in the Brown Mt - Remarkable Cave State Reserve". (Kirkpatrick 1977)

Heath Community (5)

Sprengelia incarnata - Gymnoschoenus sphaerocephalus - Xyris

This community was not found in the primary drill target zone south of Cave Bay (See Map 3). It was restricted to quadrat (22) 4 km north of Cave Bay.

It "occurs on the margin of the Gymnoschoenus hummock sedgeland so characteristic of almost constantly ill-drained, extremely acid and peaty Tasmanian soils and is doubtless even more common in the humid west of Tasmania. The taller shrubs, which dominate in variable mixture, are Leptospermum scoparium, Melaleuca squarrosa and M. gibbosa. The only constant smaller shrubs are Sprengelia incarnata and the dwarf Boronia parviflora. The community is mainly characterized by its constant non-woody component; the species being Gymnoschoenus, Xyris, Calorophus lateriflorus, Leptocarpus tenax and Utricularia dichotoma and U. lateriflora, the carnivorous bladderworts. Species diversity is relatively low, averaging only twenty-three. The community occurs in three national parks." (Kirkpatrick 1977)

(B) Halophytic Headland Community

This community was found only at quadrat site (8), on the rocky escarpment at the northern extremity of the primary drill target zone (map 3). It is characterized by the presence of a number of halophytic plant species including Crassula sieberiana, Carpobrotus rossii, Correa alba and Pelargonium australe. The strong complement of coastal plant species in site (8) suggests more exposure to wind and spray action from the sea than any other region of the escarpment. All of the species recorded in this community are ubiquitous in their distribution around the coastal areas of Tasmania and are well reserved in coastal parks.

(C) Coastal Bench Communities

These communities are all located along the coastal plain at the base of the Precambrian escarpment in areas exposed to spray and strong winds (e.g. sites 14, 16, 17, 18 on Map 3). These factors and a history of frequent firing have restricted the development of forest forms on the marine bench landform. Only small isolated pockets of stunted mallee-like Eucalyptus nitida occur at the base and along the top of the escarpment. Most of the marine bench is covered in heath and scrub with sedgelands and grasslands developing on poorly drained shallow soils. Halophytic tussocklands of Poa and Stipa species commonly occur directly behind rocky and sandy foreshores. However diffuse "strand communities" develop in the more exposed situations where salt tolerant succulent species predominate such as Atriplex cinerea, Chenopodium glaucum, Apium prostratum, Sonchus megalocarpus, Selliera radicans and Carpobrotus rossii. These strand communities are better developed on the more exposed western coast of the island. All these species are common around the coastline of Tasmania and well reserved in coastal reserves elsewhere in the State.

## 3. CONCLUSIONS AND RECOMMENDATIONS

3.1 The vegetation of the area south of Cave Bay which is of initial interest to Temco for quartzite mining was sampled at 20 quadrat sites. These sites were located (as shown in Map 3) along the escarpment and along the coastal plain at its base.

The sample vegetation was subjectively classified into:

(1) 5 coastal heath community types (as described by Kirkpatrick 1977)

(2) a Halophytic Headland community, and

(3) a Coastal Bench community.

3.2 The heath communities have all been described as being adequately reserved elsewhere in Tasmania by Kirkpatrick (1977) and none are restricted to Hunter Island.

3.3 Of the approximate 170 species listed for Hunter Island in Appendix II, 116 species were recorded in the primary drill target zone (Map 2). None is considered a rare or endangered species of plant in Brown et al (1977). In fact nearly all the plant species recorded were very common. Swainsonia lessertifolia was of some botanical interest, only through its geographical restriction to the north west coast. The species is described by Curtis (1975) as being "local in the north west at Woolnorth and in the islands of Bass Strait". Within the study area it is restricted to the coastal bench area and is not found on the escarpment proper. Hence its habitat is not threatened to any large extent by the proposed mining activities.

3.4 On purely botanical grounds it is difficult to state where on the escarpment the maximum impact on vegetation will occur if mining proceeds. The whole scarp has a very uniform and simple representation of heath communities that are also found on Hunter Island north of Cave Bay along the coastline to Shepherds Bay. The only exception to uniformity of the vegetation occurred in site (8) just above the southern end of Cave Bay. The vegetation here differed in having a substantial proportion of halophytic species. These succulent species develop in response to the prevailing exposure to wind and seaspray due to the rocky outcrops close proximity to the sea. The rest of the escarpment that was sampled (sites (12), (1), (2), (3), (4), (5), (6), (7) and (20) ) contained a very similar vegetation cover and would be the best general location for minimum impact on the vegetation if mining proceeds.

It is therefore recommended that the southern end of the escarpment be given priority for mining if practically possible. This region (see site (12) on Map 3) is less exposed to north easterly weather than Cave Bay and may even provide better sea access. This potential quarrying locality at the northern end of Ainslie Beach would not be as visually prominent as elsewhere along the escarpment, particularly to Cave Bay and its associated rocky headlands, which aesthetically form, the focal point of the island.

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APPENDIX 1

FOR SITE LOCATIONS SEE MAP 3

| SITE 1 | | COVER ESTIMATE | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 1-10 | 10-30 | 30-70 | 70-100 |
| 1. | ACACIA MUCRONATA | | X | | | |
| 2. | LEUCOPOGON COLLINUS | | X | | | |
| 3. | LEPTOSPERMUM SCOPARIUM | | X | | | |
| 4. | CASUARINA MONILIFERA | | X | | | |
| 5. | LEPTOSPERMUM GLAUCESCENS | | X | | | |
| 6. | EPACRIS IMPRESSA | | x | | | |
| 7. | AOTUS ERICOIDES | | X | | | |
| 8. | BANKSIA MARGINATA | X | | | | |
| 9. | EUCALYPTUS NITIDA | X | | | | |
| 10. | LEUCOPOGON ERICOIDES | | X | | | |
| 11. | DILLWYNIA GLABERRIMA | X | | | | |
| 12. | ERIOCHILUS CUCULLATUS | X | | | | |
| 13. | AGROSTIS SP | X | | | | |
| 14. | ROCK COVER | | | X | | |
| 15. | MOSS COVER | | | X | | |

DRAINAGE: EXCESSIVE
HEIGHT: 0.7m

---

| SITE 2 | | | | | | |
|---|---|---|---|---|---|---|
| 1. | LEUCOPOGON AUSTRALIS | | X | | | |
| 2. | MELALEUCA SQUARROSA | | X | | | |
| 3. | BANKSIA MARGINATA | | X | | | |
| 4. | AOTUS ERICOIDES | | X | | | |
| 5. | EPACRIS IMPRESSA | | X | | | |
| 6. | SPRENGELIA INCARNATA | X | | | | |
| 7. | SELAGINELLA ULIGINOSA | | | | X | |
| 8. | AMPEREA XIPHOCLADA | X | | | | |
| 9. | LEPTOSPERMUM GLAUCESCENS | X | | | | |
| 10. | HIBBERTIA PROCUMBENS | | X | | | |
| 11. | SHOENUS TENUISSIMUS | | | X | | |
| 12. | DILLWYNIA GLABERRIMA | X | | | | |
| 13. | MELALEUCA SQUAMEA | X | | | | |
| 14. | LEUCOPOGON COLLINUS | X | | | | |

HEIGHT: 0.5m
DRAINAGE: EXCESSIVE

| | | COVER ESTIMATE | | | | |
|---|---|---|---|---|---|---|
| SITE 3 | 1 | 1-10 | 10-30 | 30-70 | 70-100 |
| 1. CASUARINA MONILIFERA | | X | | | |
| 2. LEPTOSPERMUM GLAUCESCENS | | X | | | |
| 3. LEPTOSPERMUM SCOPARIUM | | X | | | |
| 4. *LEUCOPOGON COLLINUS* | | X | | | |
| 5. ACACIA MUCRONATA | X | | | | |
| 6. PERSOONIA JUNIPERINA | X | | | | |
| 7. EPACRIS IMPRESSA | X | | | | |
| 8. DILLWYNIA GLABERRIMA | X | | | | |
| 9. BANKSIA MARGINATA | X | | | | |
| 10. AOTUS ERICOIDES | X | | | | |
| 11. ROCK COVER | | | X | | |
| 12. MOSS COVER | | | X | | |

HEIGHT: 0.7m
DRAINAGE: EXCESSIVE

---

| | | | | | |
|---|---|---|---|---|---|
| SITE 4 | | | | | |
| 1. MELALEUCA SQUARROSA | | | | X | |
| 2. LEUCOPOGON AUSTRALIS | | X | | | |
| 3. LEPTOSPERMUM SCOPARIUM | | X | | | |
| 4. DILLWYNIA GLABERRIMA | | X | | | |
| 5. SPRENGELIA INCARNATA | | X | | | |
| 6. CASSYTHA PUBESCENS | | X | | | |
| 7. PTERIDIUM ESCULENTUM | X | | | | |
| 8. RESTIO COMPLANATUS | | X | | | |
| 9. SELAGINELLA ULIGINOSA | | | | X | |
| 10. LEPTOSPERMUM GLAUCESCENS | | X | | | |
| 11. LEPYRODIA TASMANICA | | | X | | |
| 12. EUCALYPTUS NITIDA | X | | | | |
| 13. BAUERA RUBIOIDES | | X | | | |
| 14. LEUCOPOGON COLLINUS | X | | | | |
| 15. EPACRIS IMPRESSA | X | | | | |
| 16. MELALEUCA SQUAMEA | X | | | | |
| 17. BANKSIA MARGINATA | X | | | | |
| 18. SHOENUS TENUISSIMUS | | | X | | |
| 19. HIBBERTIA PROCUMBENS | X | | | | |
| 20. THELYMITRA SP | X | | | | |

NO ROCK OR MOSS COVER

HEIGHT: 0.6m
DRAINAGE: IMPEDED

| SITE 5 | | COVER ESTIMATE 1 | 1-10 | 10-30 | 30-70 | 70-100 |
|---|---|---|---|---|---|---|
| 1. | ACACIA MUCRONATA | X | | | | |
| 2. | DILLWYNIA GLABERRIMA | | X | | | |
| 3. | MELALEUCA SQUAMEA | | X | | | |
| 4. | SPRENGELIA INCARNATA | | X | | | |
| 5. | EPACRIS IMPRESSA | | X | | | |
| 6. | LEPTOSPERMUM SCOPARIUM | | | X | | |
| 7. | MELALEUCA SQUARROSA | | X | | | |
| 8. | SELAGINELLA ULIGINOSA | | | X | | |
| 9. | LEPTOSPERMUM GLAUCESCENS | | X | | | |
| 10. | SHOENUS TENUISSIMUS | | | X | | |
| 11. | BAUERA RUBIOIDES | | X | | | |
| 12. | AOTUS ERICOIDES | | X | | | |
| 13. | BANKSIA MARGINATA | | X | | | |
| 14. | PERSOONIA JUNIPERINA | | X | | | |
| 15. | RESTIO COMPLANATUS | | X | | | |
| 16. | LEUCOPOGON AUSTRALIS | | X | | | |
| 17. | LEUCOPOGON COLLINUS | | X | | | |
| 18. | LEUCOPOGON ERICOIDES | | X | | | |
| 19. | EPACRIS LANUGINOSA | | X | | | |
| 20. | LEPYRODIA TASMANICA | | X | | | |
| 21. | CASSYTHA PUBESCENS | | X | | | |
| 22. | EMPODISMA MINUS | | X | | | |
| 23. | THELYMITRA SP | X | | | | |
| | NO ROCK COVER | | | | | |
| | MOSS COVER | | X | | | |

HEIGHT: 0.7m
DRAINAGE: IMPEDED

| SITE 6 | | 1 | COVER ESTIMATE 1-10 | 10-30 | 30-70 | 70-100 |
|---|---|---|---|---|---|---|
| 1. | MELALEUCA SQUARROSA | | X | | | |
| 2. | SELAGINELLA ULIGINOSA | | | | X | |
| 3. | HIBBERTIA PROCUMBENS | | | X | | |
| 4. | DILLWYNIA GLABERRIMA | | X | | | |
| 5. | EPACRIS IMPRESSA | | X | | | |
| 6. | SHOENUS TENUISSIMUS | | | | X | |
| 7. | SPRENGELIA INCARNATA | | | X | | |
| 8. | AOTUS ERICOIDES | | X | | | |
| 9. | AMPEREA XIPHOCLADA | | X | | | |
| 10. | BANKSIA MARGINATA | X | | | | |
| 11. | LEUCOPOGON AUSTRALIS | X | | | | |
| 12. | EMPODISMA MINUS | | X | | | |
| 13. | PATERSONIA FRAGILIS | | X | | | |
| 14. | PULTENAEA SP | X | | | | |
| 15. | BAUERA RUBIOIDES | | X | | | |
| 16. | LEPTOSPERMUM GLAUCESCENS | X | | | | |
| 17. | EPACRIS LANUGINOSA | X | | | | |
| 18. | GOMPHOLOBIUM HUEGELII | X | | | | |
| 19. | PIMELEA LINIFOLIA | X | | | | |
| 20. | MELALEUCA SQUAMEA | X | | | | |

(Little rock or moss cover)

HEIGHT: 0.1m

DRAINAGE: IMPEDED

| SITE 7 | | COVER ESTIMATE 1 | 1-10 | 10-30 | 30-70 | 70-100 |
|---|---|---|---|---|---|---|
| 1. | HIBBERTIA PROCUMBENS | | | | x | |
| 2. | EPACRIS LANUGINOSA | | X | | | |
| 3. | SHOENUS TENUISSIMUS | | | | X | |
| 4. | DILLWYNIA GLABERRIMA | | X | | | |
| 5. | MELALEUCA SQUAMEA | | X | | | |
| 6. | MELALEUCA SQUARROSA | | X | | | |
| 7. | SPRENGELIA INCARNATA | | | X | | |
| 8. | SELAGINELLA ULIGINOSA | | | | X | |
| 9. | BAUERA RUBIOIDES | | X | | | |
| 10. | PATERSONIA FRAGILIS | | X | | | |
| 11. | CASSYTHA PUBESCENS | | X | | | |
| 12. | LEUCOPOGON AUSTRALIS | | X | | | |
| 13. | LEUCOPOGON COLLINUS | | X | | | |
| 14. | EPACRIS IMPRESSA | | X | | | |
| 15. | BANKSIA MARGINATA | X | | | | |
| 16. | AMPEREA XIPHOCLADA | X | | | | |
| 17. | ACACIA SUAVEOLENS | X | | | | |
| 18. | RESTIO COMPLANATUS | X | | | | |
| 19. | XYRIS SP | X | | | | |
| 20. | GOMPHOLOBIUM HUEGELII | X | | | | |
| 21. | EMPODISMA MINUS | | X | | | |
| 22. | LEPTOSPERMUM SCOPARIUM | | X | | | |

No Rock or Moss Cover

HEIGHT: 0.1m

DRAINAGE: INTERMEDIATE

| SITE 8 | | 1 | COVER ESTIMATE 1-10 | 10-30 | 30-70 | 70-100 |
|---|---|---|---|---|---|---|
| 1. | LEPTOSPERMUM SCOPARIUM | | X | | | |
| 2. | ACACIA SOPHORAE | X | | | | |
| 3. | MONOTOCA SP (ELLIPTICA OR GLAUCA) | | X | | | |
| 4. | LEPTOSPERMUM LAEVIGATUM | | X | | | |
| 5. | CYATHODES JUNIPERINA | | X | | | |
| 6. | STIPA SP | X | | | | |
| 7. | EPACRIS IMPRESSA | | X | | | |
| 8. | AGROSTIS SP | X | | | | |
| 9. | CRASSULA SIEBERIANA (?) | X | | | | |
| 10. | CARPOBROTUS ROSSII | X | | | | |
| 11. | CASUARINA MONILIFERA | X | | | | |
| 12. | CORREA ALBA | X | | | | |
| 13. | ASTROLOMA HUMIFUSUM | X | | | | |
| 14. | PELARGONIUM AUSTRALE | X | | | | |
| 15. | DIANELLA REVOLUTA | X | | | | |
| 16. | MICROSORIUM DIVERSIFOLIUM | X | | | | |
| 17. | THELYMITRA SP | X | | | | |
| 18. | LEUCOPOGON COLLINUS | X | | | | |
| 19. | DANTHONIA SP | X | | | | |
| 20. | GNAPHALIUM SP | X | | | | |
| | Rock Cover | | X | | | |
| | Moss Cover | | X | | | |

HEIGHT: 0.3m
DRAINAGE: EXCESSIVE

| | | | COVER ESTIMATE | | | |
|---|---|---|---|---|---|---|
| SITE 9 | | 1 | 1-10 | 10-30 | 30-70 | 70-100 |
| 1. | ACACIA MUCRONATA | | X | | | |
| 2. | CASUARINA MONILIFERA | | X | | | |
| 3. | LEUCOPOGON ERICOIDES | | X | | | |
| 4. | LEPTOSPERMUM GLAUCESCENS | | X | | | |
| 5. | LEPTOSPERMUM LAEVIGATUM | | X | | | |
| 6. | BANKSIA MARGINATA | | X | | | |
| 7. | LEPTOSPERMUM SCOPARIUM | | X | | | |
| 8. | EPACRIS IMPRESSA | | X | | | |
| 9. | MONOTOCA SP (ELLIPTICA OR GLAUCA) | | X | | | |
| 10. | PTERIDIUM ESCULENTUM | X | | | | |
| 11. | AOTUS ERICIODES | | X | | | |
| 12. | LEPIDOSPERMA CONCAVUM | X | | | | |
| | Rock Cover | | X | | | |
| | HEIGHT: 1.4m | | | | | |
| | DRAINAGE: EXCESSIVE | | | | | |
| SITE 10 | | | | | | |
| 1. | LEUCOPOGON COLLINUS | | | X | | |
| 2. | LEPTOSPERMUM SCOPARIUM | | X | | | |
| 3. | LEUCOPOGON ERICOIDES | | X | | | |
| 4. | CASUARINA MONILIFERA | X | | | | |
| 5. | CORREA ALBA | X | | | | |
| 6. | EPACRIS IMPRESSA | X | | | | |
| 7. | DANTHONIA SP | X | | | | |
| 8. | BANKSIA MARGINATA | X | | | | |
| 9. | BAECKEA RAMOSISSIMA | X | | | | |
| 10. | DILLWYNIA GLABERRIMA | | X | | | |
| 11. | ACACIA MUCRONATA | | X | | | |
| 12. | DIANELLA REVOLUTA | X | | | | |
| 13. | PERSOONIA JUNIPERINA | X | | | | |
| 14. | ERIOCHILUS CUCULLATUS | X | | | | |
| 15. | STIPA SP | X | | | | |
| | Rock Cover | | | X | | |
| | Moss Cover | | X | | | |
| | HEIGHT: 0.3m | | | | | |
| | DRAINAGE: EXCESSIVE | | | | | |

| | | COVER ESTIMATE | | | | |
|---|---|---|---|---|---|---|
| SITE 11 | | 1 | 1-10 | 10-30 | 30-70 | 70-100 |
| 1. | EUCALYPTUS NITIDA | | X | | | |
| 2. | ACACIA MUCRONATA | | X | | | |
| 3. | LEUCOPOGON ERICOIDES | | X | | | |
| 4. | CORREA ALBA | | X | | | |
| 5. | PTERIDIUM ESCULENTUM | | | | X | |
| 6. | RUMOHRA ADIANTIFORMIS | X | | | | |
| 7. | CYATHODES JUNIPERINA | X | | | | |
| 8. | MICROSORIUM DIVERSIFOLIUM | X | | | | |
| 9. | BANKSIA MARGINATA | X | | | | |
| 10. | OLEARIA RAMULOSA | X | | | | |
| 11. | DIANELLA TASMANICA | | X | | | |
| 12. | LEUCOPOGON AUSTRALIS | X | | | | |
| 13. | MUEHLENBECKIA ADPRESSA | X | | | | |
| 14. | LEPTOSPERMUM GLAUCESCENS | X | | | | |
| 15. | EPILOBIUM SP | X | | | | |
| 16. | SELAGINELLA ULIGINOSA | X | | | | |
| | Rock Cover | | | X | | |
| | No Moss Cover | | | | | |
| | HEIGHT: 4.5m | | | | | |
| | DRAINAGE: EXCESSIVE | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| SITE 12 | | | | | | |
| 1. | BANKSIA MARGINATA | | X | | | |
| 2. | LEPTOSPERMUM GLAUCESCENS | | X | | | |
| 3. | LEPTOSPERMUM SCOPARIUM | | X | | | |
| 4. | AOTUS ERICOIDES | | X | | | |
| 5. | DILLWYNIA GLABERRIMA | | X | | | |
| 6. | LEUCOPOGON COLLINUS | | X | | | |
| 7. | ACACIA MUCRONATA | | X | | | |
| 8. | EPACRIS IMPRESSA | | | X | | |
| 9. | CASUARINA MONILIFERA | | X | | | |
| 10. | LEUCOPOGON ERICOIDES | X | | | | |
| 11. | PIMELIA LINIFOLIA | X | | | | |
| 12. | AMPEREA XIPHOCLADA | X | | | | |
| | Moss Cover | | | X | | |
| | Rock Cover | | | X | | |
| | HEIGHT: 0.7m | | | | | |
| | DRAINAGE: EXCESSIVE | | | | | |

| | | COVER ESTIMATE | | | |
|---|---|---|---|---|---|
| SITE 13 | 1 | 1-10 | 10-30 | 30-70 | 70-100 |
| 1. BOSSIAEA CINEREA | | | | X | |
| 2. PTERIDIUM ESCULENTUM | | | | X | |
| 3. AOTUS ERICIODES | | | X | | |
| 4. EPACRIS IMPRESSA | | X | | | |
| 5. LEUCOPOGON ERICOIDES | | X | | | |
| 6. LEUCOPOGON AUSTRALIS | | X | | | |
| 7. EUCALYPTUS NITIDA | X | | | | |
| 8. LEPTOSPERMUM GLAUCESCENS | X | | | | |
| 9. BANKSIA MARGINATA | X | | | | |
| 10. LEPTOSPERMUM SCOPARIUM | X | | | | |
| 11. MELALEUCA SQUARROSA | X | | | | |
| 12. CASSYTHA PUBESCENS | | X | | | |
| 13. PULTENAEA DAPHNOIDES VAR OBCORDATA | X | | | | |
| 14. MELALEUCA ERICIFOLIA | | X | | | |
| 15. AMPEREA XIPHOCLADA | X | | | | |

No rocks, moss cover

HEIGHT: 0.6m
DRAINAGE: IMPEDED

SITE 14

| | | | | | |
|---|---|---|---|---|---|
| 1. SCIRPUS NODOSUS | | X | | | |
| 2. STIPA SP | | | | X | |
| 3. LEUCOPOGON PARVIFLORUS | X | | | | |
| 4. MUEHLENBECKIA ADPRESSA | X | | | | |
| 5. OXALIS CORNICULATA | X | | | | |
| 6. SCIRPUS SP | | X | | | |
| 7. DICHONDRA REPENS | X | | | | |
| 8. SONCHUS MEGALOCARPUS | X | | | | |
| 9. APIUM PROSTRATUM | X | | | | |
| 10. DIANELLA REVOLUTA | X | | | | |
| 11. EPILOBIUM SP | X | | | | |
| 12. MELALEUCA ERICIFOLIA | X | | | | |
| 13. LEPTOSPERMUM LANIGERUM | X | | | | |
| 14. LEPTOCARPUS TENAX | | X | | | |
| 15. AGROSTIS SP | | X | | | |
| 16. SELLIERA RADICANS | X | | | | |
| 17. ACAENA ANSERINIFOLIA | X | | | | |
| 18. PERSOONIA JUNIPERINA | X | | | | |
| 19. CARPOBROTUS ROSSII | X | | | | |
| 20. ACACIA VERTICILLATA | X | | | | |

HEIGHT: 0.6m
DRAINAGE: IMTERMEDIATE

| SITE 15 | | COVER ESTIMATE 1 | 1-10 | 10-30 | 30-70 | 70-100 |
|---|---|---|---|---|---|---|
| 1. | LEUCOPOGON ERICOIDES | | X | | | |
| 2. | CORREA ALBA | | X | | | |
| 3. | ACACIA VERTICILLATA | | X | | | |
| 4. | LEPTOSPERMUM SCOPARIUM | | X | | | |
| 5. | MELALEUCA ERICIFOLIA | | X | | | |
| 6. | STIPA SP | | | X | | |
| 7. | CENTAURIUM SP | X | | | | |
| 8. | DILLWYNIA GLABERRIMA | X | | | | |
| 9. | ACACIA SOPHORAE | X | | | | |
| 10. | CARPOBROTUS ROSSII | X | | | | |
| 11. | EPACRIS IMPRESSA | | X | | | |
| 12. | DIANELLA TASMANICA | X | | | | |
| 13. | BANKSIA MARGINATA | X | | | | |
| 14. | PULTENAEA DAPHNOIDES VAR OBCORDATA | X | | | | |
| 15. | POA SP | X | | | | |
| 16. | LEUCOPOGON PARVIFLORUS | X | | | | |
| 17. | SCIRPUS NODOSUS | X | | | | |
| 18. | LEPTOSPERMUM GLAUCESCENS | X | | | | |
| 19. | ASTROLOMA HUMIFUSUM | X | | | | |
| 20. | LEUCOPOGON COLLINUS | X | | | | |
| 21. | LEUCOPOGON AUSTRALIS | X | | | | |
| 22. | DIANELLA REVOLUTA | X | | | | |
| 23. | CASUARINA MONILIFERA | X | | | | |
| 24. | CENTAURIUM SP | X | | | | |
| 25. | PIMELEA LINIFOLIA | X | | | | |
| 26. | PULTENAEA SP | X | | | | |
| 27. | ACAENA ANSERINIFOLIA | X | | | | |
| | Rock Cover | | X | | | |
| | Bare Ground | | | X | | |

HEIGHT: 0.3m
DRAINAGE: EXCESSIVE

| | | COVER ESTIMATE | | | | |
|---|---|---|---|---|---|---|
| SITE 16 | | 1 | 1-10 | 10-30 | 30-70 | 70-100 |
| 1. | LEUCOPOGON PARVIFLORUS | | X | | | |
| 2. | LEPTOSPERMUM LAEVIGATUM | | | | X | |
| 3. | CARPOBROTUS ROSSII | | X | | | |
| 4. | MUEHLENBECKIA ADPRESSA | X | | | | |
| 5. | LEPTOSPERMUM GLADIATUM | | X | | | |
| 6. | ACACIA VERTICILLATA | | X | | | |
| 7. | MELALEUCA ERICIFOLIA | | X | | | |
| 8. | CENTAURIUM SP | X | | | | |
| 9. | STIPA SP | | X | | | |
| 10. | CASUARINA MONILIFERA | X | | | | |
| 11. | AGROSTIS SP | | X | | | |
| 12. | LEUCOPOGON ERICOIDES | | X | | | |
| 13. | BANKSIA MARGINATA | | X | | | |
| 14. | PTERIDIUM ESCULENTUM | X | | | | |
| 15. | SONCHUS MEGALOCARPUS | X | | | | |
| 16. | DIANELLA REVOLUTA | X | | | | |
| 17. | DICHONDRA REPENS | X | | | | |
| 18. | SCIRPUS NODOSUS | | X | | | |

HEIGHT: 0.7m
DRAINAGE: EXCESSIVE

| | | | | | | |
|---|---|---|---|---|---|---|
| SITE 17 | | | | | | |
| 1. | LEPTOCARPUS TENAX | | | | X | |
| 2. | LEPTOSPERMUM SCOPARIUM | | | X | | |
| 3. | MELALEUCA ERICIFOLIA | | X | | | |
| 4. | DIANELLA REVOLUTA | | X | | | |
| 5. | DICHONDRA REPENS | X | | | | |
| 6. | EPILOBIUM SP | X | | | | |
| 7. | STIPA SP | | | | X | |
| 8. | ACAENA ANSERINIFOLIA | X | | | | |
| 9. | MUEHLENBECKIA ADPRESSA | X | | | | |
| 10. | LEUCOPOGON PARVIFLORUS | X | | | | |
| 11. | SELAGINELLA ULIGINOSA | | X | | | |
| 12. | SONCHUS MEGALOCARPUS | X | | | | |

Very Little rock cover

HEIGHT: 0.6m
DRAINAGE: IMPEDED

| | | COVER ESTIMATE | | | | |
|---|---|---|---|---|---|---|
| SITE 18 | | 1 | 1-10 | 10-30 | 30-70 | 70-100 |
| 1. | LEUCOPOGON PARVIFLORUS | | X | | | |
| 2. | LEPIDOSPERMA CONCAVUM | | X | | | |
| 3. | MUEHLENBECKIA ADPRESSA | | X | | | |
| 4. | BANKSIA MARGINATA | X | | | | |
| 5. | POA POIFORMIS | | | | X | |
| 6. | CORREA ALBA | X | | | | |
| 7. | DIANELLA REVOLUTA | X | | | | |
| 8. | CARPOBROTUS ROSSII | X | | | | |
| 9. | LEPTOSPERMUM GLAUCESCENS | X | | | | |
| 10. | ACACIA VERTICILLATA | | X | | | |
| 11. | OLEARIA RAMULOSA | | X | | | |
| 12. | AGROSTIS SP | | X | | | |
| 13. | MELALEUCA ERICIFOLIA | | X | | | |
| 14. | ACAENA ANSERINIFOLIA | X | | | | |
| 15. | SCIRPUS NODOSUS | X | | | | |
| 16. | LAGENOPHORA SP | X | | | | |
| | Rock pebble cover | | x | | | |
| | HEIGHT: 0.3m | | | | | |
| | DRAINAGE: EXCESSIVE | | | | | |
| SITE 19 | | | | | | |
| 1. | SELAGINELLA ULIGINOSA | | | | | X |
| 2. | MELALEUCA SQUARROSA | | X | | | |
| 3. | LEPTOSPERMUM SCOPARIUM | X | | | | |
| 4. | BAUMEA JUNCEA | | X | | | |
| 5. | SHOENUS TENUISSIMUS | | X | | | |
| 6. | AMPEREA XIPHOCLADA | X | | | | |
| 7. | PIMELIA LINIFOLIA | X | | | | |
| 8. | LEUCOPOGON AUSTRALIS | X | | | | |
| 9. | GONOCARPUS TETRAGYNA | X | | | | |
| 10. | BANKSIA MARGINATA | X | | | | |
| 11. | AOTUS ERICOIDES | X | | | | |
| | HEIGHT: 0.1m | | | | | |
| | DRAINAGE: IMPEDED | | | | | |

| SITE 20 | | COVER ESTIMATE 1 | 1-10 | 10-30 | 30-70 | 70-100 |
|---|---|---|---|---|---|---|
| 1. | LEPTOSPERMUM SCOPARIUM | | X | | | |
| 2. | MELALEUCA SQUAMEA | | X | | | |
| 3. | SPRENGELIA INCARNATA | | X | | | |
| 4. | MELALEUCA SQUARROSA | | X | | | |
| 5. | RESTIO COMPLANATUS | | X | | | |
| 6. | DILLWYNIA GLABERRIMA | | | X | | |
| 7. | EMPODISMA MINUS | | | | X | |
| 8. | SELAGINELLA ULIGINOSA | | | X | | |
| 9. | LEUCOPOGON COLLINUS | X | | | | |
| 10. | EPACRIS IMPRESSA | | X | | | |
| 11. | BAUERA RUBIOIDES | | | X | | |
| 12. | LEUCOPOGON AUSTRALIS | | X | | | |
| 13. | LEPTOSPERMUM GLAUCESCENS | X | | | | |
| 14. | PIMELEA LINIFOLIA | X | | | | |
| 15. | SHOENUS TENUISSIMUS | | X | | | |
| 16. | EPACRIS LANUGINOSA | | X | | | |
| 17. | BANKSIA MARGINATA | | X | | | |
| 18. | ACACIA MUCRONATA | | X | | | |
| | Moss | | X | | | |

HEIGHT: 0.7m
DRAINAGE: INTERMEDIATE

| SITE 21 | | | | | | |
|---|---|---|---|---|---|---|
| 1. | LEUCOPOGON COLLINUS | | X | | | |
| 2. | AOTUS ERICOIDES | | | X | | |
| 3. | AMPEREA XIPHOCLADA | | | X | | |
| 4. | LEPIDOSPERMA CONCAVUM | | X | | | |
| 5. | LEPTOSPERMUM GLAUCESCENS | | X | | | |
| 6. | PTERIDIUM ESCULENTUM | | X | | | |
| 7. | LEUCOPOGON ERICOIDES | | X | | | |
| 8. | EPACRIS IMPRESSA | | X | | | |
| 9. | DILLWYNIA GLABERRIMA | | X | | | |
| 10. | PATERSONIA FRAGILIS | | X | | | |
| 11. | BANKSIA MARGINATA | X | | | | |
| 12. | ASTROLOMA HUMIFUSUM | X | | | | |
| 13. | DANTHONIA SP | X | | | | |
| 14. | CORREA ALBA | X | | | | |
| 15. | ACACIA SUAVEOLENS | X | | | | |
| | Bare Soil | | X | | | |

HEIGHT: 0.3m
DRAINAGE: EXCESSIVE

| SITE 22 | | COVER ESTIMATE 1 | 1-10 | 10-30 | 30-70 | 70-100 |
|---|---|---|---|---|---|---|
| 1. | GYMNOSCHOENUS SPHAEROCEPHALUS | | X | | | |
| 2. | BAUERA RUBIOIDES | | X | | | |
| 3. | EPACRIS IMPRESSA | | X | | | |
| 4. | LEUCOPOGON COLLINUS | | X | | | |
| 5. | MELALEUCA SQUAMEA | | X | | | |
| 6. | MELALEUCA SQUARROSA | | X | | | |
| 7. | SPRENGELIA INCARNATA | | | X | | |
| 8. | BANKSIA MARGINATA | X | | | | |
| 9. | SHOENUS TENUISSIMUS | | X | | | |
| 10. | SELAGINELLA ULIGINOSA | | | X | | |
| 11. | PATERSONIA FRAGILIS | | X | | | |
| 12. | DILLWYNIA GLABERRIMA | | X | | | |
| 13. | PIMELEA LINIFOLIA | | X | | | |
| 14. | LEPTOSPERMUM SCOPARIUM | X | | | | |
| 15. | LEUCOPOGON AUSTRALIS | | X | | | |
| 16. | HIBBERTIA PROCUMBENS | | X | | | |
| 17. | PERSOONIA JUNIPERINA | X | | | | |
| 18. | THELYMITRA SP | X | | | | |
| 19. | RESTIO COMPLANATUS | X | | | | |
| 20. | CASSYTHA PUBESCENS | | X | | | |
| 21. | COMESPERMA CALYMEGA | X | | | | |

HEIGHT: 0.2m
DRAINAGE: IMPEDED

| SITE 23 | | | | | | |
|---|---|---|---|---|---|---|
| 1. | AMPEREA XIPHOCLADA | | | X | | |
| 2. | LEPTOSPERMUM GLAUCESCENS | | X | | | |
| 3. | LEUCOPOGON COLLINUS | | X | | | |
| 4. | CASUARINA MONILIFERA | | X | | | |
| 5. | DILLWYNIA GLABERRIMA | | X | | | |
| 6. | LEPIDOSPERMA CONCAVUM | | | X | | |
| 7. | BANKSIA MARGINATA | | X | | | |
| 8. | HYPOLAENA FASTIGIATA | | X | | | |
| 9. | EPACRIS IMPRESSA | | X | | | |
| 10. | HIBBERTIA PROCUMBENS | | X | | | |
| 11. | AOTUS ERICOIDES | | X | | | |

HEIGHT: 0.2m
DRAINAGE: EXCESSIVE

| SITE 24 | 1 | 1-10 | COVER ESTIMATE 10-30 | 30-70 | 70-100 |
|---|---|---|---|---|---|
| 1. EPACRIS IMPRESSA | | X | | | |
| 2. AOTUS ERICOIDES | | X | | | |
| 3. DILLWYNIA GLABERRIMA | | X | | | |
| 4. BANKSIA MARGINATA | | X | | | |
| 5. SPRENGELIA INCARNATA | | X | | | |
| 6. AMPEREA XIPHOCLADA | | X | | | |
| 7. LEUCOPOGON COLLINUS | X | | | | |
| 8. HIBBERTIA PROCUMBENS | X | | | | |
| 9. LEPTOSPERMUM GLAUCESCENS | X | | | | |
| 10. BAUERA RUBIOIDES | | X | | | |
| 11. SHOENUS TENUISSIMUS | | X | | | |
| 12. MELALEUCA SQUARROSA | | X | | | |
| 13. LEUCOPOGON PARVIFLORUS | | X | | | |
| 14. SELAGINELLA ULIGINOSA | | X | | | |
| 15. ACACIA SUAVEOLENS | X | | | | |
| 16. PERSOONIA JUNIPERINA | X | | | | |
| 17. CASSYTHA GLABELLA | | X | | | |
| 18. EMPODISMA MINUS | | X | | | |
| 19. XYRIS SP | X | | | | |
| 20. LEPTOSPERMUM SCOPARIUM | | X | | | |
| 21. MELALEUCA SQUAMEA | | X | | | |
| 22. PATERSONIA FRAGILIS | X | | | | |

HEIGHT: 0.4m
DRAINAGE: IMPEDED

SITE 25

| | | | | | |
|---|---|---|---|---|---|
| 1. LEPTOSPERMUM GLAUCESCENS | | X | | | |
| 2. LEPTOSPERMUM SCOPARIUM | | X | | | |
| 3. SPRENGELIA INCARNATA | | X | | | |
| 4. BANKSIA MARGINATA | | X | | | |
| 5. LEUCOPOGON COLLINUS | | X | | | |
| 6. SHOENUS TENUISSIMUS | | | X | | |
| 7. MELALEUCA SQUAMEA | | X | | | |
| 8. BAUERA RUBIOIDES | | X | | | |
| 9. SELAGINELLA ULIGINOSA | | X | | | |
| 10. DILLWYNIA GLABERRIMA | | X | | | |
| 11. AOTUS ERICOIDES | X | | | | |
| 12. CASUARINA MONILIFERA | | X | | | |
| 13. PERSOONIA JUNIPERINA | X | | | | |
| 14. HIBBERTIA PROCUMBENS | | X | | | |
| 15. CASSYTHA GLABELLA | | X | | | |
| 16. EPACRIS IMPRESSA | | X | | | |
| Moss | | X | | | |

HEIGHT: 0.5m
DRAINAGE: IMPEDED

APPENDIX II

ALPHABETICAL SPECIES LIST FOR HUNTER ISLAND

| | | | |
|---|---|---|---|
| ACACIA MELANOXYLON | * | | |
| ACACIA MUCRONATA | * | O | |
| ACACIA MYRTIFOLIA | * | O | |
| ACACIA SOPHORAE | * | O | |
| ACACIA SUAVEOLENS | * | O | |
| ACACIA VERTICILLATA | * | O | |
| ACAENA NOVAE-ZELANDIAE | * | O | |
| AGROSTIS SP | * | O | |
| AMMOPHILIA ARENARIA | | O | |
| AMPEREA XIPHOCLADA | * | O | |
| AOTUS ERICOIDES | * | O | |
| ASPLENIUM FLABELLIFOLIUM | * | O | |
| ASPLENIUM OBTUSATUM | | O | |
| ASTROLOMA HUMIFUSUM | * | O | |
| ASTROLOMA PINIFOLIUM | * | O | |
| ATRIPLEX CINEREA | | | X |
| BAECKEA RAMOSISSIMA | * | O | |
| BANKSIA MARGINATA | * | O | |
| BAUERA RUBIOIDES | * | O | |
| BAUMEA ACUTA | * | O | |
| BAUMEA JUNCEA | * | O | |
| BLECHNUM WATTSII | | O | |
| BORONIA ANEMONIFOLIA | * | O | |
| BORONIA PARVIFLORA | * | | |
| BOSSAEA CINEREA | * | O | |
| BURSARIA SPINOSA | * | | |
| CALOCEPHALUS BROWNII | * | | |
| CALYTRIX TETRAGONA | * | | |
| CAREX SP | * | | |
| CARPOBROTUS ROSSII | * | O | |
| CASSYTHA GLABELLA | * | O | |
| CASSYTHA PUBESCENS | * | O | |
| CASUARINA MONILIFERA | * | O | |
| CENTAURIUM SP | * | O | |
| CENTELLA CORDIFOLIA | * | | |
| CENTROLEPIS STRIGOSA | | O | |
| CHENOPODIUM GLAUCUM | * | O | |
| CLEMATIS ARISTATA | * | | |
| COMESPERMA CALYMEGA | * | | |
| CORREA ALBA | * | O | |
| CORYBAS SP | * | | |
| COTULA SP | * | | |
| COTULA CORONOPIFOLIA | * | O | |
| CRASSULA SIEBERIANA | | O | |

KEY: * Recorded by J. B. Kirkpatrick (Easter 1976)

O Recorded in this survey in "primary drill target zone" (See Map 2)

X Recorded on Hunter Island outside "primary drill target zone".

| | | | |
|---|---|---|---|
| CYATHODES JUNIPERINA | | O | |
| DANTHONIA SP | * | O | |
| DEYEUXIA SP | * | | |
| DICHELACHNE CRINITA | * | | |
| DICHONDRA REPENS | * | O | |
| DIANELLA REVOLUTA | * | O | |
| DIANELLA TASMANICA | * | O | |
| DILLWYNIA GLABERRIMA | * | O | |
| DIPLARRHENA SP | | | X |
| DISPHYMA AUSTRALE | | O | |
| EMPODISMA MINUS | * | O | |
| EPACRIS IMPRESSA | * | O | |
| EPACRIS LANUGINOSA | * | O | |
| EPACRIS OBTUSIFOLIA | * | O | |
| EPILOBIUM SP | * | O | |
| ERIOCHILUS CUCULLATUS | | O | |
| EUCALYPTUS NITIDA | * | O | |
| EUCALYPTUS OVATA | * | | |
| EUCALYPTUS VIMINALIS | * | | |
| FESTUCA LITTORALIS | * | O | |
| GAHNIA FILUM ? | * | | |
| GAHNIA SIEBERANA ? | * | | |
| GERANIUM SOLANDERI | * | O | |
| GNAPHALIUM SP | * | O | |
| GNAPHALIUM CANDIDISSIMUM | | O | |
| GOMPHOLOBIUM HUEGELII | * | O | |
| GONOCARPUS TETRAGYNA | * | O | |
| GYMNOSCHOENUS SPHAEROCEPHALUS | | | X |
| HELICHRYSUM DENDROIDEUM | * | O | |
| HELICHRYSUM PARALIUM | * | | |
| HIBBERTIA FASCICULATA | | O | |
| HIBBERTIA PROCUMBENS | * | O | |
| HIBBERTIA SERICEA | * | | |
| HISTIOPTERIS INCISA | | O | |
| HYDROCOTYLE JAVANICA | * | O | |
| HYDROCOTYLE MUSCOSA | * | | |
| HYPOLAENA FASTIGIATA | | O | |
| IMPERATA CYLINDRICA | | O | |
| JUNCUS SPP | * | | |
| JUNCUS KRAUSSII | * | | |
| KENNEDYA PROSTRATA | * | O | |
| KUNZEA AMBIGUA? | | | X |
| LAGENOPHORA SP | * | O | |
| LEPIDOSPERMA CONCAVUM | * | O | |
| LEPIDOSPERMA ELATIUS | * | O | |
| LEPIDOSPERMA FILIFORME | * | O | |
| LEPIDOSPERMA GLADIATUM | * | O | |

| | | |
|---|---|---|
| LEPTOSPERMUM LAEVIGATUM | * | O |
| LEPTOSPERMUM LANIGERUM | * | O |
| LEPTOSPERMUM SCOPARIUM | * | O |
| LEPYRODIA TASMANICA | * | O |
| LEUCOPOGON AUSTRALIS | * | O |
| LEUCOPOGON COLLINUS | * | O |
| LEUCOPOGON ERICOIDES | * | O |
| LEUCOPOGON PARVIFLORUS | * | O |
| LIMOSELLA LINEATA | * | |
| LINDSAYA LINEARIS | * | O |
| LOBELIA ALATA | * | O |
| LUZULA SP | | O |
| LYCOPODIUM LATERALE | | O |
| MARIANTHUS PROCUMBENS | * | |
| MELALEUCA ERICIFOLIA | * | O |
| MELALEUCA SQUAMEA | * | O |
| MELALEUCA SQUARROSA | * | O |
| MICROSORIUM DIVERSIFOLIUM | | O |
| MITRASACME PILOSA | * | O |
| MONOTOCA SP (ELLIPTICA OR GLAUCA) | * | O |
| MUEHLENBECKIA ADPRESSA | * | O |
| MYOPORUM INSULARE | * | |
| OLEARIA GLUTINOSA | * | |
| OLEARIA LEPIDOPHYLLA | * | O |
| OLEARIA RAMULOSA | * | O |
| OPERCULARIA VARIA | * | O |
| OXALIS CORNICULATA | * | O |
| PATERSONIA FRAGILIS | * | O |
| PELARGONIUM AUSTRALE | * | O |
| PERSOONIA JUNIPERINA | * | O |
| PHYLLOTA DIFFUSA? | | X |
| PIMELEA DRUPACEA | * | |
| PIMELEA LINIFOLIA | * | O |
| POA LABILLARDIERI | * | |
| POA POIFORMIS | * | O |
| POMADERRIS APETALA | * | |
| PTERIDIUM ESCULENTUM | * | O |
| PTERIS (TREMULA?) | | O |
| PTEROSTYLIS SP | * | |
| PULTENAEA DAPHNOIDES VAR. OBCORDATA | * | O |
| PULTENAEA DENTATA | * | |
| PULTENAEA TENUIFOLIA | * | |
| PULTENAEA SP | | O |
| RANUNCULUS SP | * | |
| RHAGODIA BACCATA | * | |
| RHAGODIA NUTANS? | * | |
| RESTIO COMPLANATUS | * | O |
| RESTIO TETRAPHYLLUS | | |
| RUMOHRA ADIANTIFORMIS | | O |

| | | | |
|---|---|---|---|
| SALICORNIA QUINQUEFLORA | * | O | |
| SAMBUCUS GAUDICHAUDIANA | * | | |
| SAMOLUS REPENS | * | | |
| SCHIZAEA SP | * | | |
| SCIRPUS SP | * | O | |
| SCIRPUS NODOSUS | * | O | |
| SCHOENUS NITENS | * | O | |
| SCHOENUS TENUISSIMUS | * | O | |
| SELAGINELLA ULIGINOSA | * | O | |
| SELLIERA RADICANS | * | O | |
| SENECIO SP | * | O | |
| SOLANUM LACINIATUM | | | O |
| SONCHUS MEGALOCARPUS | * | O | |
| SPINIFEX HIRSUTUS | * | O | |
| SPRENGELIA INCARNATA | * | O | |
| STACKHOUSIA SPATHULATA | * | | |
| STICHERUS TENER | | O | |
| STIPA SP | * | O | |
| STIPA TERETIFOLIA | * | O | |
| STYPHELIA ADCENDENS | * | O | |
| SWAINSONIA LESSERTIFOLIA | * | | |
| TETRAGONIA INPLEXICOMA | * | | |
| TETRATHECA PROCUMBENS | * | | |
| THELYMITRA SP | * | O | |
| TRIGLOCHIN PROCERA | * | | |
| TRIGLOCHIN STRIATA | * | | |
| URTICA INCISA | * | | |
| UTRICULARIA DICHOTOMA | * | | |
| VILLARSIA EXALTATA | * | | |
| VIOLA HEDERACEA | * | O | |
| XANTHOSIA DISSECTA | * | | |
| XANTHOSIA PUSILLA | * | | |
| XYRIS AFF. GRACILIS | * | | |

# HUNTER ISLAND

## ARCHAEOLOGICAL RESOURCES KNOWN ON THE EAST COAST, CAVE BAY TO AINSLIE BEACH

A Report To

TEMCO, TASMANIAN ELECTRO METALLURGICAL CO. PTY. LTD.

By

SANDRA BOWDLER

March, 1981

Hunter Island lies 6 kilometres off the northwest tip of Tasmania at latitude 40°34' south and longitude 144°45' east. It is an island of great significance to the study of the Tasmanian Aborigines, in both historic and prehistoric times. The oldest known Tasmanian archaeological site is located here.

TEMCO, the Tasmanian Electro Metallurgical Co. Pty. Ltd. intends to carry out explorations for quartzite in the area indicated on maps 1 and 2. In this report, I describe known archaeological sites in this area and nearby, in an historical, archaeological and environmental context. Recommendations are made, primarily to the effect that two sites of scientific importance lie within this region, and that these must not be disturbed. It is also suggested that the region, for historical reasons, may be of interest to Tasmanian Aboriginal people today.

## HISTORICAL BACKGROUND

The documentary history of Hunter Island has been researched by Bowdler (1980). It is one of a group of islands named the Hunter Islands by Matthew Flinders in 1798, in the course of his circumnavigation of Tasmania with George Bass. Hunter Island itself he named Barren Island. It has however been known as Hunter Island since at least 1803 (Bowdler 1980: 7).

In 1816, Captain James Kelly of Hobart Town also circumnavigated Tasmania, going in the contrary direction to Flinders and Bass. He encountered a group of Aborigines on the south end of Hunter Island. This

encounter was not overwhelmingly successful as an exercise in public relations, but Kelly's account is useful in that it describes a party of Aborigines who either lived on Hunter Island, or who had got there by their own devices. As Flinders had noted, most of the Bass Strait islands were unoccupied and unvisited at the time of European discovery. The observations of Flinders, Kelly, and other early explorers and sealers confirmed that the Hunter Islands were unique in this respect: they were the only group of Bass Strait islands inhabited or exploited by Tasmanian Aborigines at the time of European contact.

By 1828, the European settlement of Tasmania was well under way, and conflict between the settlers and the Tasmanian Aborigines had become serious and violent, with many losses on both sides. Governor Arthur declared martial law and initiated unsuccessful military schemes, including the notorious 'Black Line'. In desperation, he hired George Augustus Robinson to go off into the bush and persuade the Aborigines to come in and be civilised. This was Robinson's own idea. He was an extremely obdurate and opinionated bricklayer, with a firm belief in fundamentalist Christian principles. The scheme was successful, in that Robinson did indeed persuade the Tasmanian Aborigines still at large to return with him to European civilisation. There were pitifully fewer of them than had been expected. The problem then arose, of what to do with these people. They were eventually incarcerated on Flinders Island. Some however remained at liberty; these were the Aboriginal women living with European sealers, mainly on Bass Strait islands, and the offspring of these de facto unions.

In 1830, Robinson visited Hunter Island for the first time. He was accompanied by Aborigines from eastern Tasmania who usually travelled with him, and who acted as

interpreters and go-betweens. One of these was Truganini (Trucanini, Trugannanner etc.). Robinson's reason for this initial visit was to contact some sealers who were living there with Aboriginal women. The party landed on the east side of Hunter Island, '... on a beautiful sandy beach about three miles long and half a mile wide, with a fine stream of water frequented by ducks running through it' (Robinson, 18th June, 1830, in Plomley 1966: 176). Only Ainslie Beach comes anywhere near fitting this description. The party then crossed to the west side of Hunter Island, to where the sealers had their huts. A sketch of these huts (Plomley 1966: plate 4) has enabled the site to be identified (see below). Robinson and his group left Hunter Island that same day.

Robinson returned to northwest Tasmania in 1832. He intended to try to round up such Aborigines as remained at large on the west coast. He was also concerned about the final location of the Aboriginal establishment, and Hunter Island seemed a possibility. He arrived at Cape Grim early in June, and set off south down the west coast. He spent the following month between Cape Grim, Bluff Hill Point, and the upper reaches of the Welcome River, and recruited twenty-three 'new' Aborigines by peaceful means. These people belonged to groups (usually called 'bands') which had their headquarters at Robbins Island ( one of the Hunter group, the nearest to the mainland), West Point, the Arthur River, and Sandy Cape. One woman, included in the group by marriage, came from Macquarie Harbour. After returning with them to Cape Grim, Robinson determined to shift his entire party to Hunter Island, as he feared the new acquisitions would otherwise abscond.

The group moved to Hunter Island on the 22nd July, 1832. Robinson relates that 'an encampment was formed

near the east beach at a place called TID.DEE.BEEN.ER, near a small stream' (in Plomley 1966: 635). This again seems to be Ainslie Beach. Several of the Aborigines were unwell. On the 30th July, 1832, one woman died, and was cremated in the traditional Aboriginal fashion, about 200 yards west of the camp. The following day, the deceased woman's elderly husband died, and his remains were similarly disposed of.

'In order to divert the minds of the Aborigines from that grief into which they had been thrown by the deaths of the two persons before referred to, I proposed to remove the encampment to the west side of the island to which they most readily acquiesced' (Robinson in Plomley 1966: 638). Most of the Aborigines moved across the island on 1st August, 1832; Robinson himself followed three days later. The encampment at TID.DEE.BEEN.ER was thus occupied for less than two weeks.

The proximity of Hunter Island to the main, and the ease of Aboriginal passage between the two, did not suit Robinson's plans for an Aboriginal 'colony' on the island. Robinson left for Hobart on 27th October, 1832. The Aborigines stayed a little longer, under the command of one Anthony Cottrell, until they were despatched to Launceston and, ultimately, Flinders Island.

Robinson's sojourn on Hunter Island is important for several reasons. It was an important episode in the history of those Aborigines rounded up by Robinson, and should indeed have indicated what would happen in any future establishment. There is no doubt that the episode crystallised Robinson's own ideas about isolating any such establishment from as many external influences as possible, and in making it difficult for the Aborigines to escape.

Robinson recorded much useful information about the Aboriginal exploitation of Hunter Island, especially when it is considered in conjunction with the accounts of Kelly and others. It seems from these sources that Hunter Island was not occupied permanently, but visited regularly, probably in summer, by people from the west coast, as far south as Sandy Cape. One of the main inducements for these seasonal visitations, carried out on bark 'canoe rafts' or 'catamarans', was to exploit the muttonbirds present there in summer.

## ARCHAEOLOGICAL BACKGROUND

I have been carrying out archaeological research on Hunter Island over the last eight years, with major field trips in the summer 1973-4, summer 1974-5, and summer 1979-80, with shorter trips at other times (Bowdler 1974, 1979). In that time, I have carried out a detailed site survey of some parts of the island, and excavated five sites. The site survey was carried out in order to establish in some way the nature of the archaeological resource base on Hunter Island. That is, to establish the number of sites likely to be present, their size and nature. It was also hoped that patterns of land use might be indicated by this sort of information.

Excavations were carried out at five selected sites to answer questions which could only be answered in this way. Such questions include, for how long had the island been being visited? Can we establish the object of such visits? Has the nature of the visits changed in any way over time? and so on.

The Tasmanian Aborigines were a hunting-gathering people, who had no metal tools before the

arrival of Europeans, and who grew no crops and had no domesticated animals. Families did not reside permanently in a single dwelling the year round. While we know that the Aborigines of western Tasmania built relatively large and substantial huts, these were made of grass and saplings, and leave little permanent archaeological trace. Prehistoric archaeological sites in Tasmania, as in Australia, are largely of two sorts: open sites on the one hand, and sites formed in caves or rockshelters on the other. Open sites might consist of a few stone tools scattered on the ground, or large and substantial undisturbed piles of marine shell, called 'middens', such as we find at West Point. In western Tasmania, these may have large round depressions on their surface, indicating the previous presence of huts.

Both kinds of site are found on Hunter Island. They provide evidence of Aboriginal presence in the prehistoric past, and are important repositories of scientific information, particularly when there is any depth of undisturbed deposit. Midden sites usually contain large amounts of archaeologically useful material (stone tools, animal bones and the shells themselves) but are relatively young; cave and rockshelter sites may have been less intensively occupied, but may contain deposits of considerably greater antiquity.

A case in point is Cave Bay Cave, located on the east side of Hunter Island (see maps). It contains the oldest evidence for the presence of human beings in Tasmania, dated to 23,000 years ago. It is thus a site of considerable scientific significance.

The distribution of known archaeological sites on Hunter Island needs to be discussed in the light of environmental factors. The west coast of Hunter Island

resembles the west coast of Tasmania proper; it is a rocky, exposed, high energy coastline. Such a coastline might appear inhospitable, but is in fact extremely productive of edible resources, and thus attractive to hunter-gatherers. In the southern part of Hunter Island (that is, south of Cuvier Bay), the western half of the island is of fairly low relief and covered with gently undulating, mostly grass-stabilised, Holocene sand dunes. There are few quartzite cliffs and large outcrops, and thus few rockshelters. An exception is the Rookery Rockshelter, one of the excavated sites (map 1).

The eastern half of the southern part of Hunter Island on the other hand has a quartzite-siltstone ridge running parallel with the shore for most of its length, presenting a cliffed face to the coastline. Several caves and rockshelters occur. This coastline however is more like the north coast of Tasmania, in being protected from the prevailing westerlies, and being overall a lower energy coastline.

Bearing in mind these environmental differences, it is not surprising that more sites overall are to be found on the west side of the southern part of Hunter Island than on the east side; that most of the sites on the west side are open midden sites; and that there are relatively more rockshelter sites than midden sites on the eastern side. The lessee of Hunter Island, Pat Maguire, has lived there for over twenty years, and has a good eye for middens. He confirms this observation, that there are many more middens on the west coast than on the east coast, where he has seen very few.

Midden sites are also to be found in the <u>middle</u> of the southern part of Hunter Island. One example is the Stockyard Site (map 1), one of the excavated sites.

O'Connor (1980) has analysed a large collection of faunal remains (mostly bones of seals and land mammals) from recent excavations at this site, and interpreted her results in the light of the known distribution of sites. She concluded that 'although the west coast is a more productive coastline, it is possible that when weather conditions on this coast were particularly severe, the Stockyard Site was occupied and the more productive east coast was also exploited' (O'Connor 1980: 110). If this interpretation is correct, it explains the lack of sites on the east coast. Such sites as do occur on the east coast however must therefore be considered important: if they are middens, because of their very rarity; if they are caves or shelters, because of their possible antiquity.

ARCHAEOLOGICAL SITES KNOWN IN AREA OF PROPOSED EXPLORATION

(Maps 1 and 2)

Archaeological sites and other areas or places of interest within the region indicated for exploration prior to quartzite mining are listed here. I have traversed this coastline at least three times on foot, and have made several forays away from the coast during such traverses. My specific aim was to locate and document all visible, identifiable Aboriginal sites. While it is unlikely that I have located all sites, and note that some I could not locate (see below), I think the pattern of sites accords well with what might be expected, and what is found elsewhere on the island.

Note that on the east side of Hunter Island there are numerous banks of shell composed primarily of bivalves, mainly dog cockles (Fam. Glycymeridae) and Venus shells (Fam. Veneridae). These are NOT middens, but

natural phenomena. They may be distinguished from middens using several criteria. Firstly, the species of shells present were not usually consumed by Aborigines in large quantities. Middens in Tasmania usually contain large numbers of abalones (Notohaliotis ruber), warreners (Subninella undulata), limpets (various species), mussels (various species), Austrocochlea spp., and dog winkles (Dicathais textilosa); mostly gastropods, except the mussels. These species are found in varying percentages, with small amounts of other species. Natural shell beds usually contain little sediment except clean sand; middens are usually characterised by black, organic sediements forming the matrix for the shells. Natural shell beds do not usually contain charcoal or animals bones; middens often do. The shells in natural shell beds are usually complete and fairly clean. Shells in middens are often broken, and often show signs of having been burnt. For further technical information see Bowdler (1981).

## Prehistoric Sites

(map 2)

The numbers used here are those used in my original site register, a copy of which is lodged with National Parks and Wildlife Service in Hobart.

Hunter Island, Site no. 1 Cave Bay Cave: a large stranded sea cave in the siltstone cliff overlooking the rocky foreshore north of Cave Bay. This site has been excavated, and contains deposits with evidence of human occupation dating to 23,000 years ago. This site is of exceptional scientific significance, and is listed by the Australian Heritage Commission. It is located well north of the region of exploration, and should be well out of the way of any access roads etc.
Grid reference on Tasmanian 1:100,000 topographical map, Welcome sheet is CR117110.

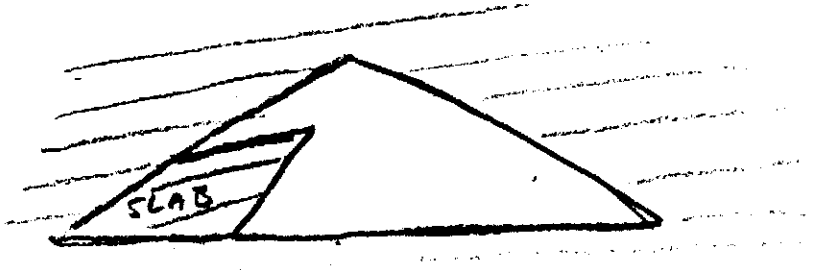
Hunter Island, Site no. 63 Cave Bay, on the road to the jetty: a slight surface scatter of midden material. About 150 metres south of the jetty, on the bank of a dried-up creek. Just a patch of very thin eroding midden consisting of abalone and warrener shells. If there ever was a substantial site here, it is now destroyed.
Grid reference on Tasmanian 1:100,000 topographical map, Welcome sheet, is CR112108.

Hunter Island, Site no. 23 Cave Bay, in from beach, south of jetty: a small eroded midden of mussel shells. About 200 metres south of jetty, 10 metres in from the beach, creek south of small beach lagoon, the midden is on top of the sand dune on the north side of the creek. The site has little or no depth, and measures about 15 metres by 1.2 metres in area, and is about 2 metres above sea level. It consists of many mussel shells with some abalone, warrener and limpet. A bone and two possible stone artefacts were sighted. The site is not of great scientific significance, as it appears to be completely eroded; it is also unlikely to be in the way of any access roads.
Grid reference on Tasmanian 1:100,000 topographical map, Welcome sheet, is CR112105.

Hunter Island, Site no. 100 Between Cave Bay and Ainslie Beach: a midden which appears to be relatively undisturbed. On the rocky point north of Ainslie Beach, at the place where the coast to the south swings back east towards Ainslie Beach. Overlooks the rocky foreshore about 30 metres from high water mark, and is about 2 or 3 metres above sea level. Consists of warrener and limpet shells with a few bivalves, with some small flakes of quartz and quartzite. Traces can be seen to cover an area about 20 by 20 metres, but there is a central concentration of about 2 by 2 metres, where there is about 10 cms of depth to

the deposit. This is the only really substantial, undisturbed midden known to me on the east coast of Hunter Island. It falls within the proposed region of exploration, and must be protected.
Grid reference on Tasmanian 1:100,000 topographical map, Welcome sheet, is CR113086.

Hunter Island, Site no. 101 Ainslie Beach: a small rockshelter in the cliff behind the north end of Ainslie Beach. This consists of a small fissure at the top of a teep scree slope, about 150 metres from the shore and about 20 metres above sea level. It is a fissure in bedded quartzite whose entrance is partly blocked by a slab. The entrance is about 1 metre high and 2 metres wide.




It contains a deposit of loose sandy soil, with limpet, warrener and mussel shells visible on the surface. There is a small depression in the deposit near the front of the shelter. Also visible on the surface were a wallaby (pademelon, Thylogale billardierii) tibia, and some quartzite artefacts (flakes). The deposit is soft and loose. It is not possible to assess the depth of the deposit. The shelter runs back at least 2 metres into the cliff, but the deposit seems to run back under the rock, where it slopes back to the northeast. It is possible therefore that there could be a considerable depth of deposit filling up what was a larger chamber. I consider

this to be an important site with great potential for future research. It must not be disturbed; the deposit is very soft and therfore vulnerable. It lies within the area of proposed exploration, and must be protected. Grid reference on Tasmanian 1:100,000 topographical map, Welcome sheet, is CR111083.

Hunter Island, unlocated site(s) Pat Maguire, who leases Hunter Island, told me of a large midden or middens at Ainslie Beach, at the southern end of the beach on the south side of Boat River, in a gully, under scrub, in a hollow in the sand dunes. I was unable to locate this site(s), and he commented that it would be impossible to see if the vegetation were not burnt off. Boat River lies south of the area of proposed exploration, but if access tracks are likely to be put through here, it would be worthwhile to consult the lessee, who has a good understanding of middens and their location.

Hunter Island, non-sites These are rockshelters which do not appear to contain any deposit.
Non-site A is at Cave Bay, a fissure in the cliff to the east of the road, more or less opposite the large sand dune behind the beach, about 100 metres north of the popint where the road turns towards the jetty. I could see no deposit within it.
Grid reference on the Tasmanian 1:100,000 topographical map, Welcome sheet, is CR 110108.
Non-site B is the group of rockshelters in the quartzite cliffs at the south end of Cave Bay. No deposit was seen in any, although one or two shells lay on the rocky floor. Sites such as these should however be examined carefully for signs of deposit before they are disturbed in any way; this applies to all caves and rockshelters.
Grid reference on Tasmanian 1:100,000 topographical map, Welcome sheet, is CR111101.

## Historic Site?

As mentioned above, in 1830 Robinson visited sealers resident on the west side of Hunter Island. A sketch of their huts survives, showing islands on the horizon. From this sketch, Pat Maguire was able to locate the remains of these huts, and his son Tony took me to the site, at a place known to the Maguires as Stinking Creek (map 1). At the north end of Ainslie Beach, about 800 metres inland on the northeast side of a lagoon, are two piles of quartzite blocks (site x, map 2). They are reminiscent of the remains of the sealers' huts at Stinking Creek. The only artefacts I could find in the vicinity consisted of modern-looking glass, as from beer bottles, and an iron bar. It is tempting to ascribe this site to Robinson's 1832 encampment at TID.DEE.BEEN.ER, but there is no real evidence for this. It is possible that the site dates to a later period, but might still have historical value. It lies within the region of proposed exploration, and is best left undisturbed.

Grid reference on the Tasmanian 1:100,000 topographical map, Welcome sheet, is CR109082.

## RECOMMENDATIONS

Midden site no. 100 and rockshelter site no. 101 lie within the region within which mineral exploration is proposed to take place. Both sites have considerable scientific importance and should not be disturbed. Also within the proposed exploration area is a site, site x, which may have some historic significance, and which should also be left undisturbed.

No known sites of importance lie just outside the proposed exploration area. It is possible that there is a large midden(s) near Boat River. The lessee of Hunter Island, Pat Maguire, should be consulted about this. In fact the lessee should be consulted anyway, as he may know of more sites than are listed here.

North of the proposed exploration area is Cave Bay Cave, one of the most important archaeological sites in Tasmania. It seems unlikely that it would be affected in any way. It is imperative that this site remains undisturbed.

ANY midden or rockshelter sites encountered during exploration should be left exactly as found. The deposit should not be disturbed in any way; no items should be removed from the surface or from within the deposit. These sites are protected by law.

It is my understanding that the sort of exploration to be carried out will not of itself lead to any great disturbance. If however mining operations are to be carried out subsequently, it will be necessary to define exactly where this will occur, and commission a more detailed archaeological site survey of that region.

It is perhaps worth making one final comment. Hunter Island, and the encampment at TID.DEE.BEEN.ER, constitute an important episode in the later history of the Tasmanian Aborigines. It may be that this area may represent, or may come to represent, an area of some significance to Aboriginal people today. I would suggest that the Tasmanian Aboriginal Centre in Hobart be contacted before any major disturbance of this area takes place.

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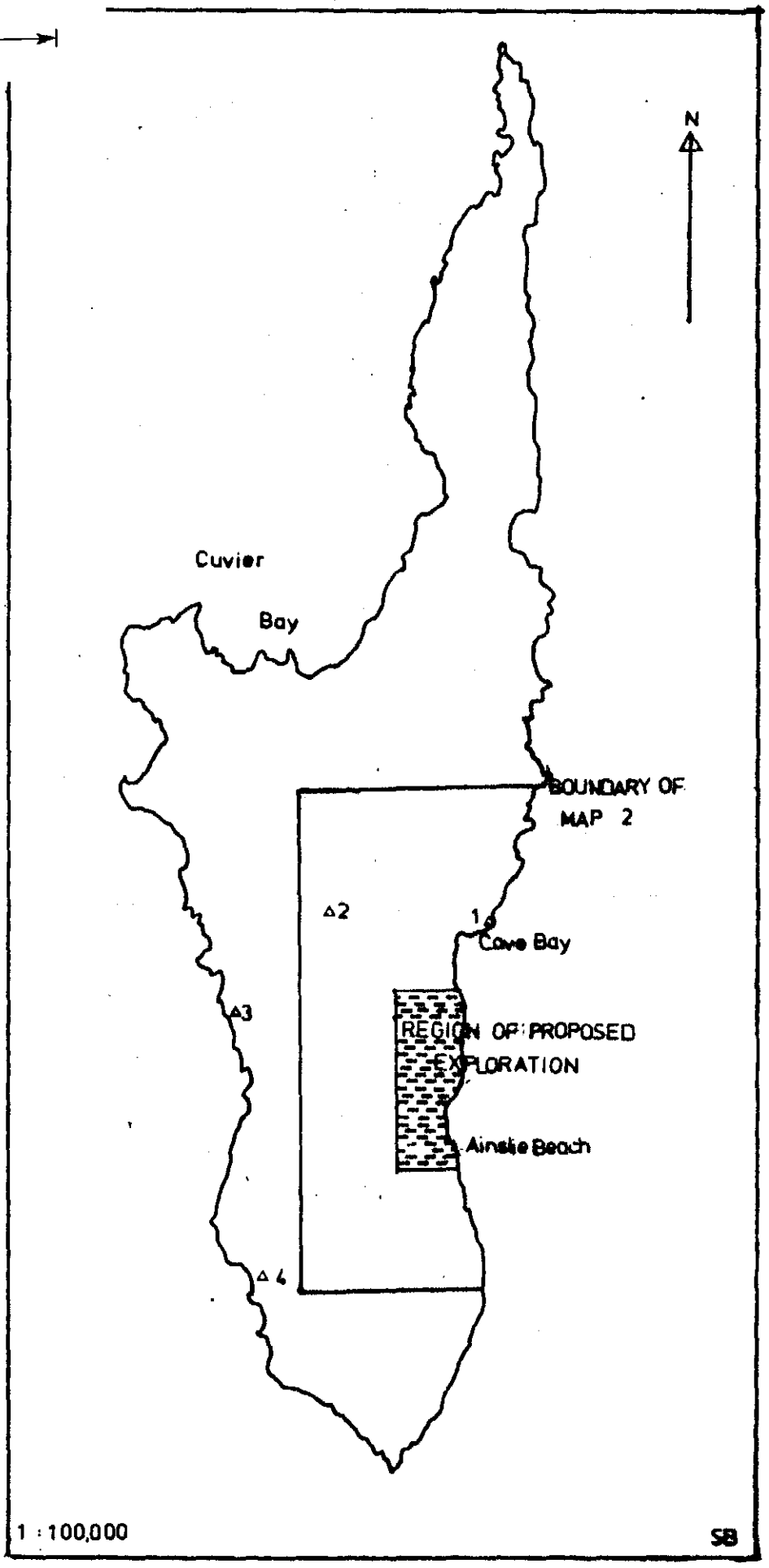
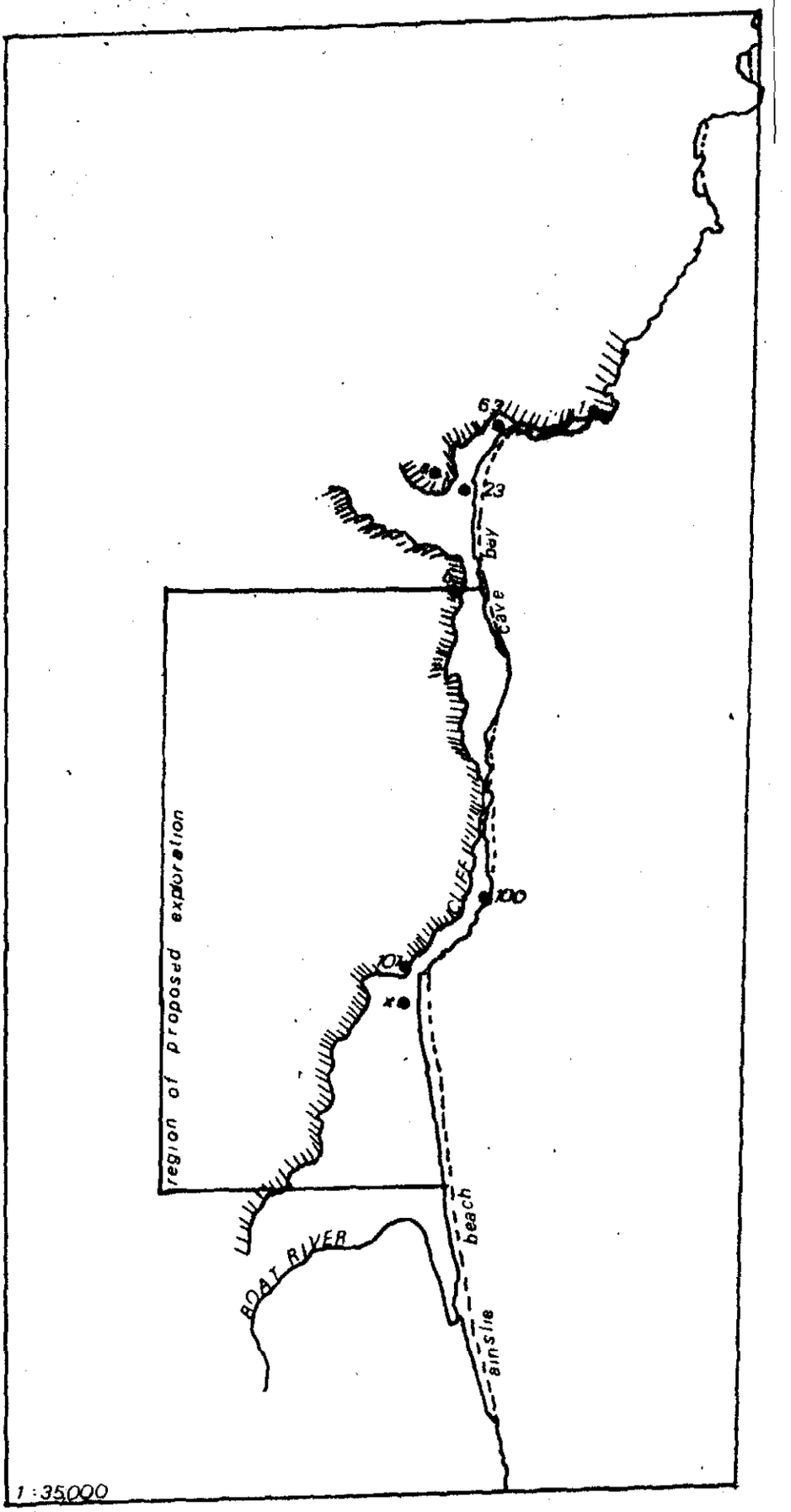



MAP 1. HUNTER ISLAND 1.Cave Bay Cave

2. Stockyard Site 3. Rookery Rockshelter

4. Stinking Creek




MAP 2. HUNTER ISLAND from aerial photographs.

● = sites mentioned in text

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