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THE SHELL COMPANY OF AUSTRALIA LIMITED

METALS DIVISION

Exploration Licence 28/80 - Borradaille Plains

Progress Report on Exploration During the Period

18/3/81 to 1/7/82

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13 AUG 1982
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Author P.A. Ruxton

Report No 08-1065

Date : 1/7/82

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1. Department of Mines
 2. BXHE/AHO
 3. BXH/Devonport

AMG REFERENCE POINTS ADDED

CONTENTS

	<u>Page No.</u>
SUMMARY	
1.0 INTRODUCTION	1
1.1 The Exploration Licence	1
1.2 Access and Topography	1
1.3 Previous Investigations	1
2.0 REGIONAL GEOLOGY	2
2.1 Stratigraphy	2
2.2 Structure and Metamorphism	3
2.3 Intrusives	3
3.0 ECONOMIC POTENTIAL	4
3.1 Dove Granite Association	4
3.2 Devonian Granite Association	4
4.0 CURRENT EXPLORATION	5
4.1 Stream Sediment Sampling	6
4.2 Rock Chip Sampling	7
4.3 Conclusions	7
5.0 RECOMMENDATIONS & CONCLUSIONS	8
REFERENCES	

002

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LIST OF FIGURES

<u>Figure No.</u>	<u>Title</u>	<u>Scale</u>	<u>Plan No.</u>
1	Borradaile Plains E.L. 28/80	1:250,000	D/MW 97/001A
2	Regional & Local Stratigraphy		D/MW 97/013

LIST OF PLANS

<u>Title</u>	<u>Scale</u>	<u>Plan No.</u>
Borradaile Plains E.L. 28/80, Geology	1:31,680	D/MW 97/002A
Borradaile Plains E.L. 28/80, Stream Sediment Sample Locations	1:31,680	D/MW 97/008
Borradaile Plains E.L. 28/80, Sn, W in -20 + 80# fraction Stream Sediment	1:31,680	D/MW 97/007
Borradaile Plains E.L. 28/80, Mo in -20 +80# fraction Stream Sediment Bi in -80# fraction Stream Sediment	1:31,680	D/MW 97/004
Borradaile Plains E.L. 28/80, Cu, Ni in -80# fraction Stream Sediment	1:31,680	D/MW 97/003
Borradaile Plains E.L. 28/80, Pb, Zn in -80# fraction Stream Sediment	1:31,680	D/MW 97/006
Borradaile Plains E.L. 28/80, As, Sb in -20 + 80# fraction Stream Sediment	1:31,680	D/MW 97/005
Borradaile Plains E.L. 28/80, Geology of Campbell's River & Sardine Creek Areas plus Stream Sediment Re-sampled Localities	1:31,680	D/MW 97/009
Borradaile Plains E.L. 28/80, Stream Sediment Re-sampling Sn/W/Mo in Panned Concentrate	1:31,680	D/MW 97/010
Borradaile Plains E.L. 28/80, Stream Sediment re-sampling As/Zn in -80# fraction	1:31,680	D/MW 97/011
Borradaile Plains E.L. 28/80, Stream Sediment Re-sampling Cu/Ni in -80# fraction	1:31,680	D/MW 97/012
Borradaile Plains E.L. 28/80, Au/Ag/Sb in Panned Concentrate	1:31,680	D/MW 97/014

SUMMARY

The Borradaile Plains licence, E.L. 28/80, was granted to the Shell Company of Australia Ltd. in March, 1981.

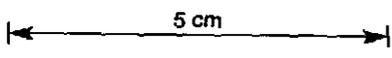
The area was considered prospective for tin, tungsten, molybdenum and possible gold/silver mineralization, related to high level Devonian granite intrusions into Precambrian sediments exposed on the northern margin on the Tyennan nucleus.

A regional stream sediment sampling programme was undertaken over the past two summer seasons to try to locate zones of significant mineralization.

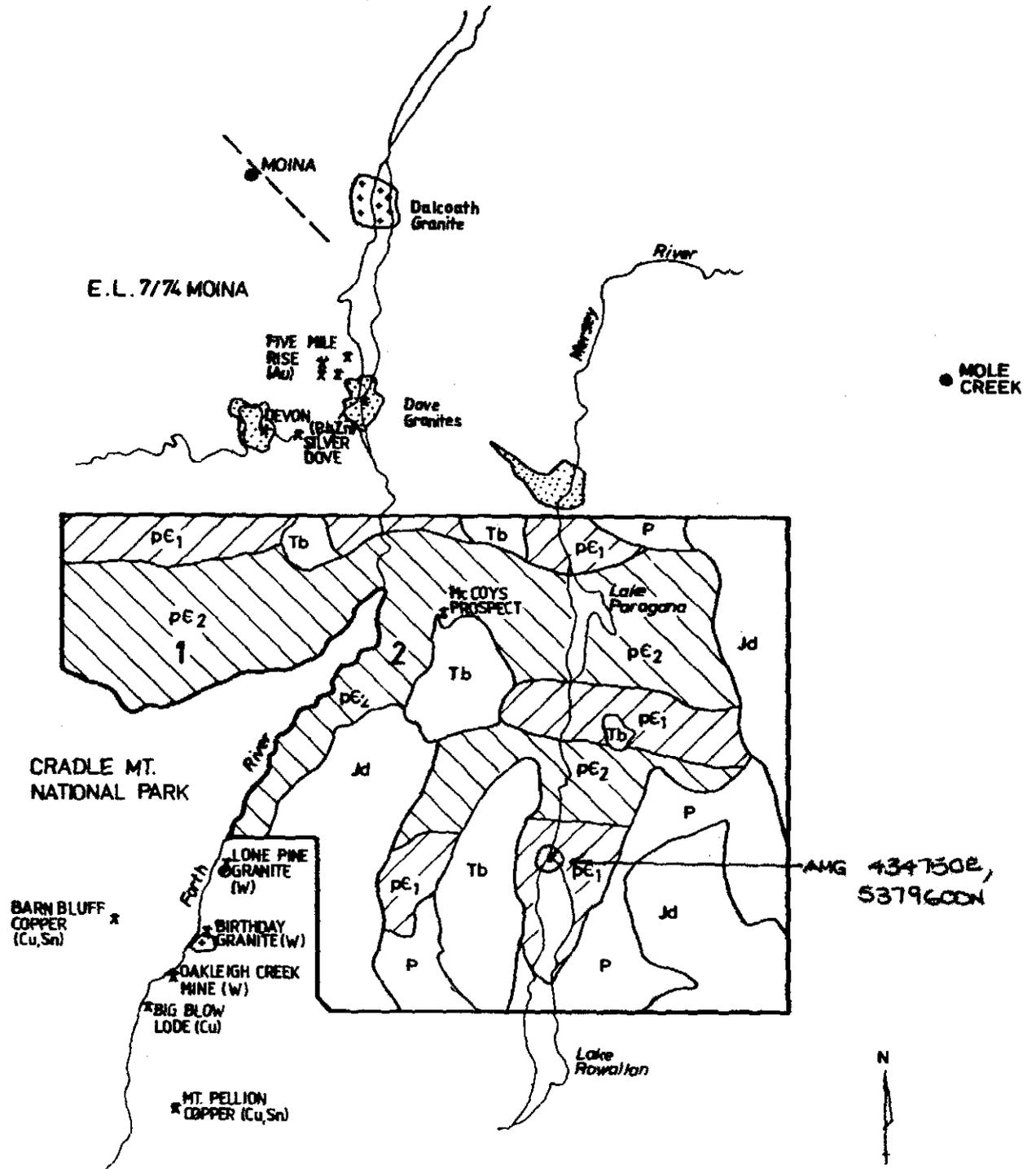
Only two localities appeared to be of interest, at Sardine Creek and in tributaries of Campbell's River. Follow-up in these areas has downgraded them both and further investigation is considered low priority.

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AMG REFERENCE POINTS ADDED



LEGEND

- 1 Campbells River Area
- 2 Sardine Creek Area
- Tb Tertiary basalt
- Jd Jurassic dolerite
- P Permian sediments
- * Devonian granite
- Ordovician granite
- pE2 Precambrian quartz schists
- pE1 Precambrian quartzites



The Shell Company of Australia Limited METALS DIVISION	
E.L. 28/80 BORRADAILE PLAINS	
SCALE 1:25000	DATE 24-6-82
AUTHOR PRAXTON	DRAWN H.L.N.
OFFICE Devonport	REP.No.
DRG No DMW92801A	

1.0 INTRODUCTION

1.1 The Exploration Licence

Borradaile Plains, E.L. 28/80, was granted to Shell by the Department of Mines on 18/3/81. It covers 451 sq. km. south of Moina and east of the Cradle Mountain National Park in central northern Tasmania (Refer Fig. 1).

1.2 Access & Topography

Access is provided by sealed HEC roads to the Rowallen and Parangana Dams in the Mersey Valley and by unsealed logging tracks and Paton's Road to the Oakleigh Creek Mine in the Forth Valley.

Topographically the area is extremely rugged as a result of the deep incision of the Forth, Mersey and Arm Rivers through dolerites of the central plateau. The valley sides and floors are heavily forested in contrast to the swampy moorlands of the plateau areas such as February Flats and Borradaile Plains.

Outcrop is generally good with only glacial till and post glacial scree accumulations obscuring the underlying rocks.

1.3 Previous Investigations

The licence is covered by the 1:250,000 scale Burnie geological sheet compiled by Williams and Turner, 1974 and the 1" to 1 mile geological sheets of Middlesex and DuCane formulated and reported on by Jennings (1963) and MacLeod, Jack and Threader (1961) respectively.

Initial company exploration of the region was carried out by BHP who flew an aeromagnetic survey followed by ground magnetic and EM studies of anomalous areas. Little of this work is recorded and no areas of great interest were outlined. The International Mining Corporation later contracted Webb and Associates from Victoria to conduct a stream sediment sampling programme in the Forth, Mersey and Arm Valleys during 1971 (Owen, 1971). Several anomalous areas were recognised and attempts to follow-up these features were made.

Previous to this, prospectors late last century discovered tungsten at McCoys Prospect in the licence area, tungsten, tin and molybdenite in the Lone Pine and Birthday granites and tungsten at Oakleigh Creek to the SW of the licence. Gold was located in the Campbell and Dove Rivers to the north. In addition small zinc, copper, tin deposits have been located in the Cradle Mountain National Park to the SW.

2.0 REGIONAL GEOLOGY

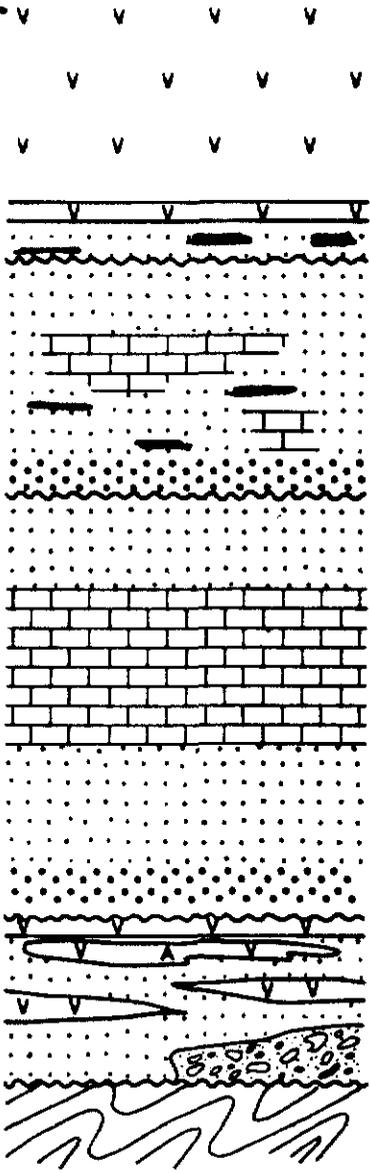
2.1 Stratigraphy

Precambrian rocks outcrop over most of the licence and consist of a highly deformed and metamorphosed sequence of quartzites and schists. Three divisions of the Precambrian have been made by previous workers. Quartzites of the Howells Group outcrop in the south, quartzites and schists of the Fisher Group in the centre and quartz-sericite schists of the Dove Group lie to the north.

Ordovician conglomerates (the Roland Conglomerate) rest unconformably on the Precambrian and are themselves overlain unconformably by Permian sediments and Tertiary volcanics (Refer Fig. 2). Permian fossiliferous sediments consist of a fluvio-

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REGIONAL GEOLOGICAL SUCCESSION (Sheffield Area)



DOLERITE

BASALTS
SEDIMENTS

MARINE
+ CONTINENTAL
SEQUENCE

GORDON
LIMESTONE

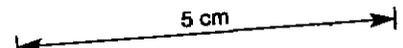
MOIRA
SANDSTONE

ROLAND
CONGLOMERATES

VOLCANICS/CHERTS
TURBIDITES

QUARTZITES +
SCHISTS

STRATIGRAPHY IN THE BORRADAILE PLAINS LICENCE



TERTIARY

TRIASSIC

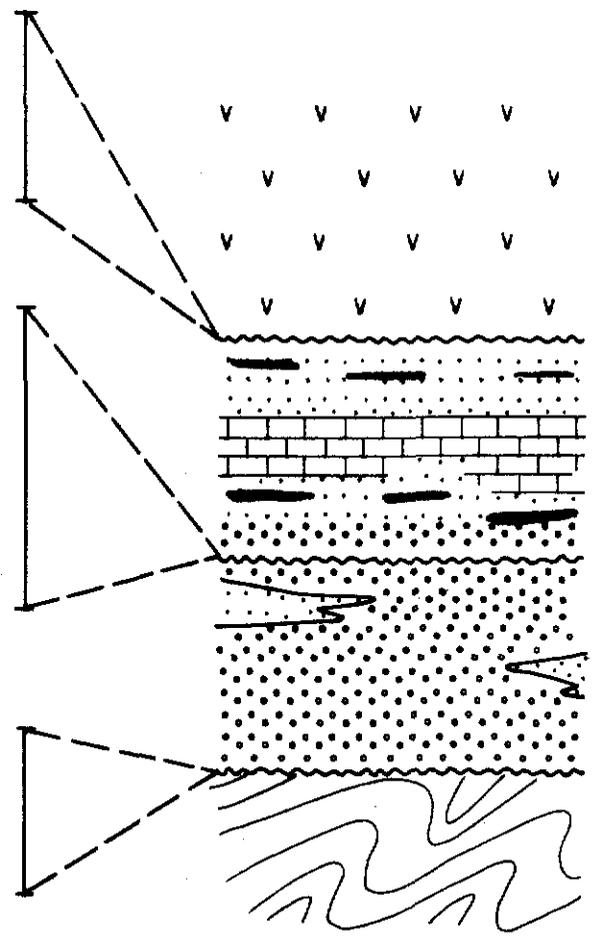
PERMIAN

SILURIAN

ORDOVICIAN

CAMBRIAN

PRECAMBRIAN



TERTIARY
DOLERITE

PERMIAN
SEDIMENTS

ORDOVICIAN
CONGLOMERATES

PRECAMBRIAN
QUARTZITES & SCHISTS

The Shell Company of Australia Limited
METALS DIVISION

E.L. 28/80 BORRADAILE
PLAINS
STRATIGRAPHY

SCALE	DATE	25-6-87
AUTHOR	P.R.	DRAWN M.L.H.
OFFICE	Devonport	REP. No.
DRG No		DPMW 77/013

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deltaic succession with two marine and two continental interludes. Coal measure sequences and soil shale deposits occur in these sediments. Tertiary dolerite and basalt cap the hilltops.

Pleistocene glaciation produced surficial moraine, till and later scree deposits. Ice movements were essentially valley-controlled in the licence area with a dominant northerly movement direction.

Around Moina to the north geological succession includes Cambrian volcanics and volcanoclastics, Ordovician Moina Sandstone and Gordon limestone deposits plus Silurian and Triassic sediments (Refer Fig. 2). The reduced succession on the licence area reflects deposition on the edge of the Cradle Mountain Cratonic nucleus.

2.2 Structure & Metamorphism

Three phases of deformation are recognisable in the Precambrian metasediments. Two phases are parallel to bedding and a later E-W trending open fold phase. Two metamorphic events exist with a maximum grade of Upper Greenschist Facies. Devonian Tabberabberan Orogenic movements produced NW trending folds and faults which probably account for the last deformation recorded in the Precambrian rocks.

2.3 Intrusives

Two granitic intrusive events are recognised:

- NO 1
- a) the Dove Granite which was emplaced during the Upper Ordovician/early Silurian (Dating of 450-487 MYR, McDougall & Leggo, 1965) and which metamorphosed Moina Sandstone and Roland Conglomerate.

- 010
- b) Devonian granites (340-390 MYR) principally the Dalcoath Lone Pine, Birthday and Oakleigh Creek granites. No granite outcrops are known in the licence area (Refer Fig. 1).

3.0 ECONOMIC POTENTIAL

Mineralization in and around the licence is essentially granite related. Two main associations are recognizable.

3.1 Dove Granite Association - Au/Ag/Pb/Zn/As/

Numerous disused mines and prospects of principally Au and Pb/Ag association (Five Mile Rise, Devon, Silver Dove etc.) are essentially surficial concentrations due to weathering of sulphides in fractures and small veins. These prospects occur north of the licence, around the Dove granite intrusion. Four points of evidence suggest the association of these deposits with the Dove Granite:

- a) they form a halo around the granite outcrop
- b) the sulphides and weathering products are associated with structural fractures formed during the emplacement of the Dove Granite.
- c) the deposits occur only in Middle Ordovician or older sediments.
- d) mineralization occurs in the Dove Granite itself at the Devon prospect (Ag - Pb).

3.2 Devonian Granite Association - Sn/W/Mo/Bi(?)⁺Cu/Pb/Zn/As

Two styles of mineralization are associated with the Devonian granites in the region:

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a) Quartz & greisen veins

Sericite, chlorite and quartz-bearing greisen veins contain wolframite, minor cassiterite, molybdenite, fluorite, arsenopyrite and chalcopyrite in the Dalcoath(?), Lone Pine and Birthday granites. Wolframite-bearing quartz veins typified by the Oakleigh Creek Mine and the McCoys prospect also occur.

b) Skarn deposits - Cu/Pb/Zn/Sn/As [±]Ag/Au

*White-
marble?*

These deposits are typified by the Big Blow Lode in the Cradle Mountain National Park in which dolomitic zones contain alteration of chlorite, epidote, actinolite and talc with sphalerite, galena, chalcopyrite, cassiterite, arsenopyrite, pyrite, magnetite, hematite, fluorite and calcite. Similar mineral associations occur at the Mt. Pelion Copper prospects. Both these deposits are considered to be skarns related to metasomatism of Precambrian dolomites or basic volcanics. Minor dolomitic units have been recognised in the Precambrian around Granite Tor to the SW and thin calcite layers were found around Sardine Creek in the licence area.

4.0 CURRENT EXPLORATION

Exploration was undertaken in the Borradaile Plains licence in the hope of locating Sn/W mineralization either as stockworks or sheeted vein systems related to small granite cusps or channelled by large fault structures into limestone stratigraphy. Au/Ag mineralization was considered to be a possible target in the northern part of the area associated with fractures and veins in Moina Sandstone. This exploration philosophy is supported by a sizeable gravity low trending east into the EL and suggesting the presence of a large granite batholith at depth. (Refer Sheehan, 1969).

Current exploration has consisted of geological mapping, rock and stream sediment sampling.

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4.1 Stream Sediment Sampling

Three phases of stream sediment sampling have been completed, details of each survey and results are presented in Appendix 1. Prior to the sampling an orientation study was carried out by Max Baker, Shell, at 17 localities around the Mt. Pelion and Moina areas in which the most repeatable and highest contrast results were obtained using:

-20 + 80# fraction for Sn, W, Mo, Sb, As

-80# fraction for Cu, Pb, Zn, Ni, Bi

Panned Concentrate for a) Ultra Violet lamp for scheelite

b) Sn, W, Au, Nb, Ta

The initial survey of 500 samples essentially covered the drainage over Precambrian rocks exposed in the licence. Only the -20# to +80# and -80# fractions were analysed for Cu, Pb, Zn, Ni, Bi, Sn, W, Mo, Sb and As. Two anomalous areas were located:

a) Campbell's River = W = 200 ppm (maximums)
Mo = 95 ppm
As = 55 ppm

b) Sardine Creek = W = 600 ppm (maximums)
Sn = 55 ppm
Mo = 95 ppm
As = 115 ppm

A re-sampling programme of 35 samples taken in the vicinity of anomalous values failed to repeat the initial results (Refer Appendix 1). Again -20 to +80# and -80# samples were analysed.

A further more extensive re-sampling programme with closer sampling involving 97 samples was completed. The -20 to +80#, -80# and panned concentrate sediment fractions were analysed with generally disappointing results. Re-sampling failed to repeat previous W, Mo and generally As values but did reproduce scattered Sn highs with a maximum of 105 ppm, principally in the

Sardine Creek/Forth Valley area and elevated As values in the Campbell River.

A wide range in the values of Cu, Pb, Zn and Ni was recognised in all surveys and over the whole licence, Cu varies from 20 to 100 ppm, Pb from 30 to 85 ppm, Zn from 5 to 590 ppm and Ni from 50 - 185 ppm.

In addition elevated Zn values in the northern Campbell River area were obtained (400 to 590 ppm), offset from the initial W, Mo, As anomaly. (Refer Plan D/MW 97/006).

4.2 Rock Chip Sampling

Several rock chip samples were analysed to establish background geochemical values of outcropping and surficial rock types. Of particular interest were large, rounded granite boulders (upto 1.5 m across) in glacial till deposits in the Sardine's Creek area and quartz vein pebbles from Campbell's River. Assay results are presented in Appendix 1.

4.3 Conclusions

Many of the variable and anomalous stream sediment samples can be explained by various features in the licence area:

1. Variable Cu/Pb/Ni/Zn values

The wide range in Cu, Pb, Zn and Ni values are probably explained by:

- a) high Cu/Zn/Ni values in Tertiary basalts and dolerites (Refer Appendix 2)
- b) high base metal values in chloritic schists and black shales (Refer Appendix 2)

c) the concentration of base metals by organic matter in low ph swampy environments.

2. Sn/W/Mo Anomalies

The anomalous W and Mo values detected in the initial survey in Campbell's River were not repeated in subsequent surveys and are now put down to analytical error. However, the occurrence of quartz vein pebbles in Campbell's River itself may indicate the presence of quartz veins perhaps associated with minor W/Mo and Sn mineralization.

? | The elevated W, Mo values in the Sardine Creek area were not repeated although isolated high Sn values were. These Sn values and low order mo assays are considered to be derived from transported granite material in glacial till deposits derived from the headwaters of the Forth Valley. Values of upto 14 ppm Mo were obtained by E.A. Webb & Associates from Tertiary volcanics producing a further source of Mo (Refer Owen, 1971).

3. High As/Zn values

The association of As and Zn with Sn/W/Mo quartz and greisen veins has long been recognised in this region. The elevated As values and anomalous Zn results (400 ppm [±]) in the Campbells River area plus the additional discovery of quartz vein pebbles probably points to Devonian granite related quartz veins in the area.

5.0 RECOMMENDATIONS & CONCLUSIONS

Stream sediment sampling in the Borradaile Plains licence has failed to locate significant Sn/W/Mo/Au mineralization. Results imply the existence of a quartz vein system in the Campbell River area, perhaps with associated minor W/Sn/Mo. The indications suggest that mineral-

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ization in any such vein system would be uneconomic and possibly similar to the McCoys prospect and the Oakleigh Creek Mine.

Further investigation of stream sediment anomalies should be considered of low priority.

per 
P. A. RUXTON
Exploration Geologist

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LIST OF APPENDICES

- Appendix 1A Stream Sediment Sampling Details
- Appendix 1B Petrology on two panned concentrates
- Appendix 2 Rock chip assays

APPENDIX 1

Stream Sediment Sampling Details

and

Petrology Results from Two Panned Concentrates

APPENDIX 1A

STREAM SEDIMENT RESULTS

1.0 Orientation Survey - 17 samples

2.0 Initial Stream Survey - 500 samples

a) -20 +80# fraction assayed by XRF for Sn, W, Mo, Sb and As

b) -80# fraction assayed by AAS for Cu, Pb, Zn, Bi and Ni

3.0 Resampling 1 - 35 samples

a) -20 to +80# fraction

b) -80# fractions

4.0 Resampling 2 - 97 samples

a) -20 +80# fraction

b) -80# fraction

c) Panned concentrate

all assayed for AAS1 Cu, Pb, Zn, Ni
AAS2 Fe, Mn
XRF1 As, Sn, W, Mo

and Campbell River area panned concentrates XRF for Au, Ag, Sb

5.0 Plans showing results - Initial survey and first re-sampling results.

<u>Plan</u>	<u>Plan No.</u>
Sample Locations	D/MW 97/008 ✓
Sn/W	D/MW 97/007 ✓
Mo/Bi	D/MW 97/004 ✓
Cu/Ni	D/MW 97/003 ✓
Pb/Zn	D/MW 97/006 ✓
As/Sb	D/MW 97/005 ✓

6.0 Second re-sample survey

<u>Plan</u>	<u>Plan No.</u>
Geology & Sample Locations	D/MW 97/009 ✓
Sn/W/Mo	D/MW 97/010 ✓
As/Zn	D/MW 97/011 ✓
Cu/Ni	D/MW 97/012 ✓
Au/Ag/Sb	D/MW 97/014 ✓

7.0 Background values (by inspection - data not treated statistically)

Sn	4 - <4 ppm
W	10 - 20 ppm
Mo	<4 ppm
Bi	<4 ppm
As	<5 ppm
Pb	30 - 40 ppm
Zn	50 -150 ppm
Cu	20 - 50 ppm
Ni	to -100 ppm

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APPENDIX 1B

Petrology on Two Panned Concentrates

Petrological analysis of two panned concentrate samples was done by Central Mineralogical Services to determine the minerals present.

BP 085 (Sardines Creek area)

- Dominant (>60%) Quartz
- Accessory (1 - 10%) Ilmenite
- Pyroxenes
- Trace (<1%) Geothite
- Rutile
- Zircon
- Garnet
- Tourmaline
- +Cassiterite or sphere splinters

(Assayed at 10 ppm Sn - probably sphere)

BP 195 (Hanson's River)

- Dominant (>60%) Quartz
- Minor (10 - 30%) Rock fragments
- (Graphitic schists)
- Accessory (1 - 10%) Pyroxenes

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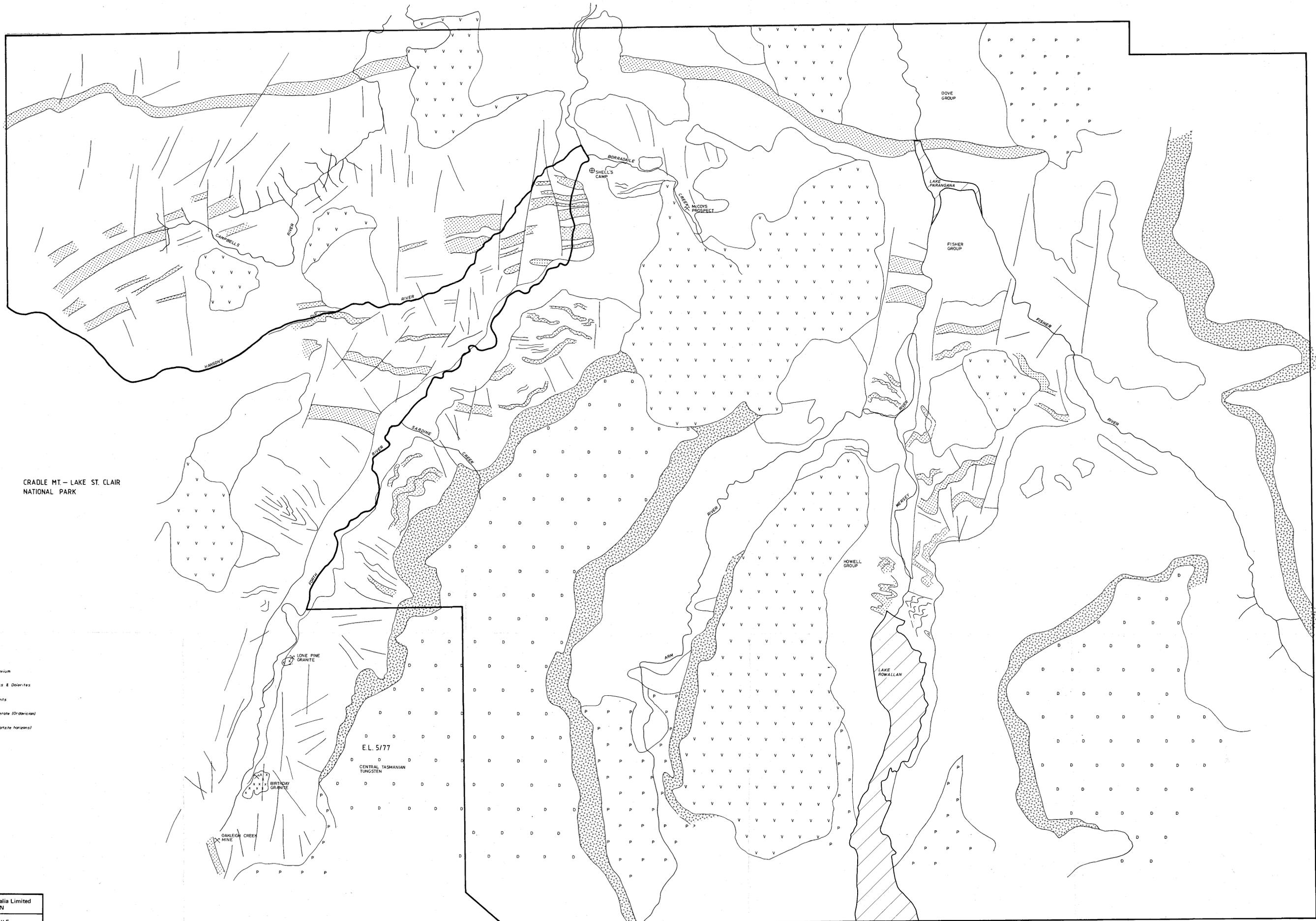
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APPENDIX 2

Rock Chip Assay Results

APPENDIX 2ROCK CHIP ASSAYS

<u>SAMPLE</u>		<u>Sn</u>	<u>W</u>	<u>Mo</u>	<u>Bi</u>	<u>Sb</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn</u>	<u>Ni</u>	<u>As</u> ppm
<u>Granites</u>											
Lone Pine	1)	26	60	4	4	4					
Granite	2)	8	100	4	12	6					
	3)	44	10	4	4	8					
Birthday	1)	28	10	4	4	4					
Granite	2)	280	1400	4	18	4	(Greisen vein)				
	3)	55	25	4	8	8	(Greisen vein)				
Oakleigh Ck Granite	1)	24	15	4	105	6					
Granite	1)	16	45	4	10	4					
Till	2)	22	35	4	12	10					
(Sardine Ck)	3)	55	45	4	8	10					
<u>Campbell's River</u>											
Qtz vein	1)	4	10	4	4	6					
pebbles	2)	8	10	4	4	4					
	3)	6	10	4	4	4					
	4)	4	10	4	4	6					
	5)	6	10	4	4	4					
Dolerite	1)	4	10	4	4	8	48	4	12	28	3
Basalt	1)	4	10	4	4	4	46	4	65	150	2
	2)	4	10	4	4	12	50	4	115	150	4
Black	1)	36	10	4	4	4	22	22	20	8	14
Shale	2)	10	10	4	4	6	6	4	16	6	2
Micaceous Schist	1)	4	10	4	4	4	4	4	12	12	3



CRADLE MT - LAKE ST. CLAIR
NATIONAL PARK

LEGEND

-  Glacial till/alluvium
-  Tertiary volcanics & Dolerites
-  Permian sediments
-  Roland conglomerate (Ordovician)
-  Precambrian (Quartzite horizons)

LONE PINE
GRANITE

BIRTHDAY
GRANITE

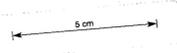
OAKLEIGH CREEK
MINE

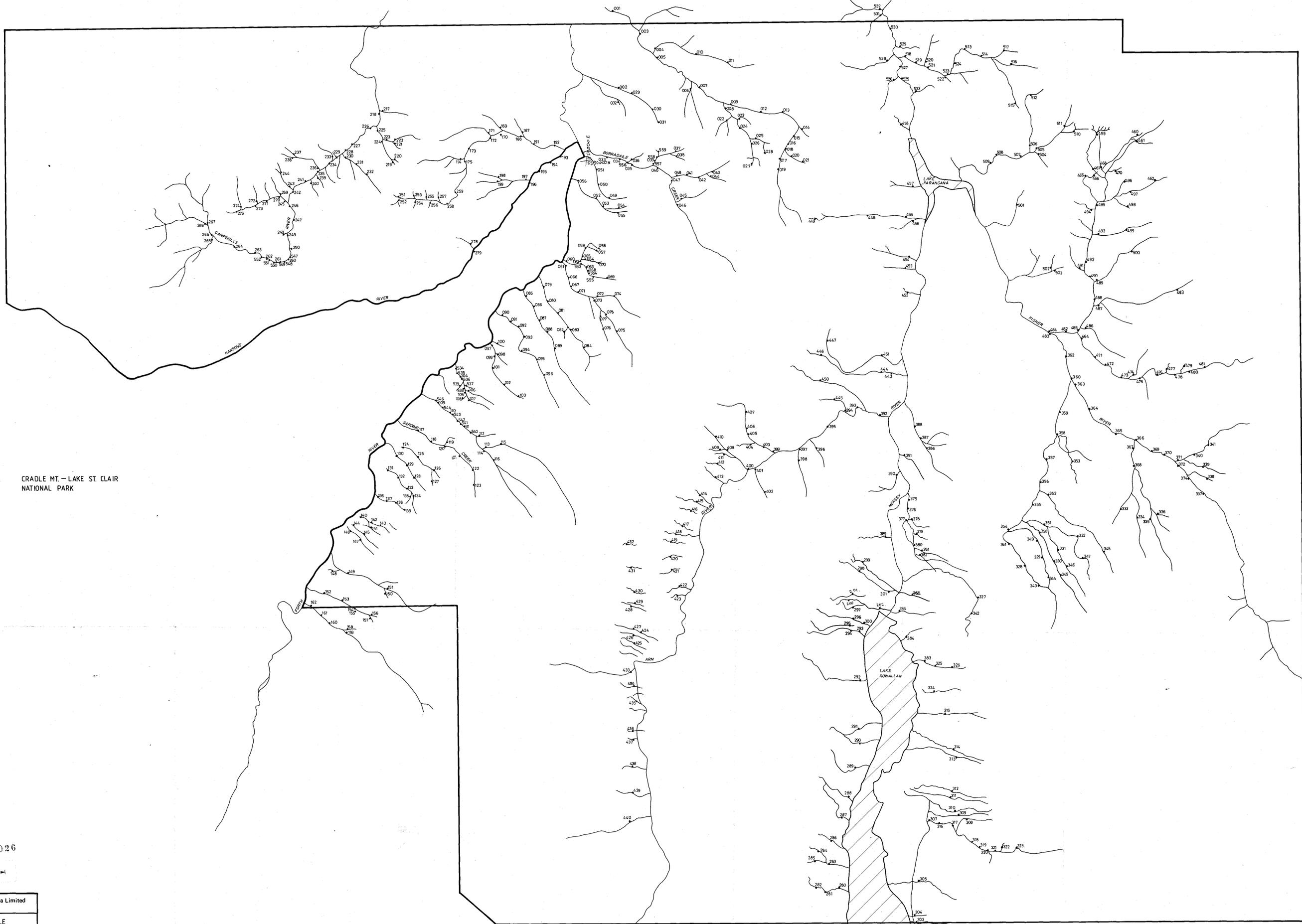
E.L. 5/77

CENTRAL TASMANIAN
TUNGSTEN

The Shell Company of Australia Limited METALS DIVISION	
E.L. 28/80 BORRADAILE PLAINS GEOLOGY	
2701	
SCALE 1:25000	DATE 1-7-82
AUTHOR P. RIXTON	DRAWN H.L.H.
OFFICE DEVONPORT	REP. No.
DRG. No. 5/MW97/002 A	FIG. No.

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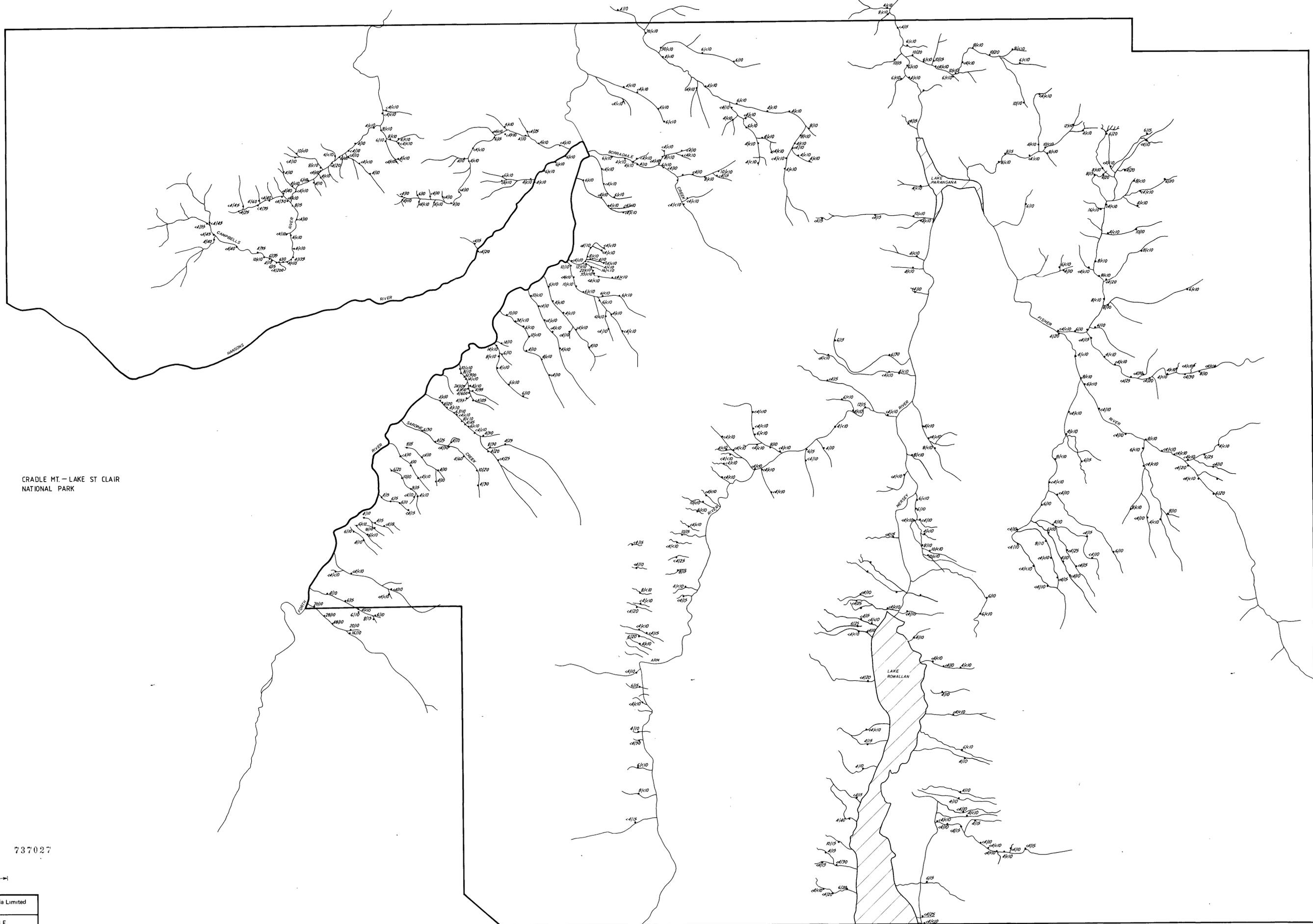
CRADLE MT - LAKE ST. LAIR
NATIONAL PARK



27026



The Shell Company of Australia Limited METALS DIVISION	
E.L. 28/80 BORRADAILE PLAINS	
STREAM SEDIMENT SAMPLE LOCATION	
2702	
SCALE 1:31680	DATE 19-7-82
AUTHOR P. RUXTON	DRAWN H.L.S.
OFFICE DEVONPORT	REP. NO.
DRG. NO. DMW97/008	FIG. NO.

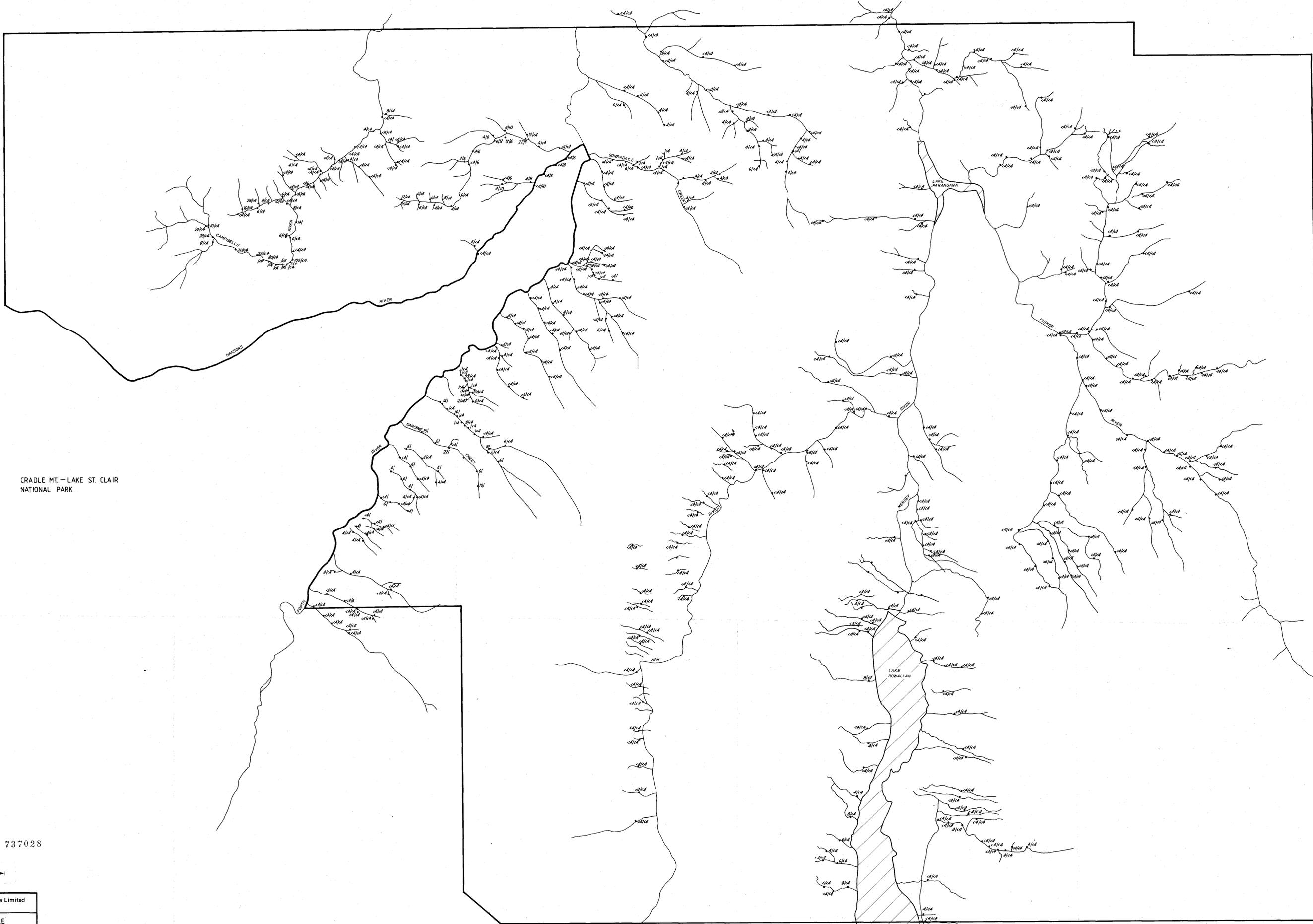


CRADLE MT. - LAKE ST CLAIR
NATIONAL PARK

737027

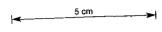
5 cm

The Shell Company of Australia Limited METALS DIVISION			
E.L. 28/80 BORRADAILE PLAINS			
Sn, W in -20* - +80* fraction stream sediment			
2703			
SCALE 1 31680	DATE 19-7-82		
AUTHOR P. RUXTON	DRAWN H.L.S.		
OFFICE DEWONPORT	REP No.		
DRG No. D/MW97/007	FIG No.		



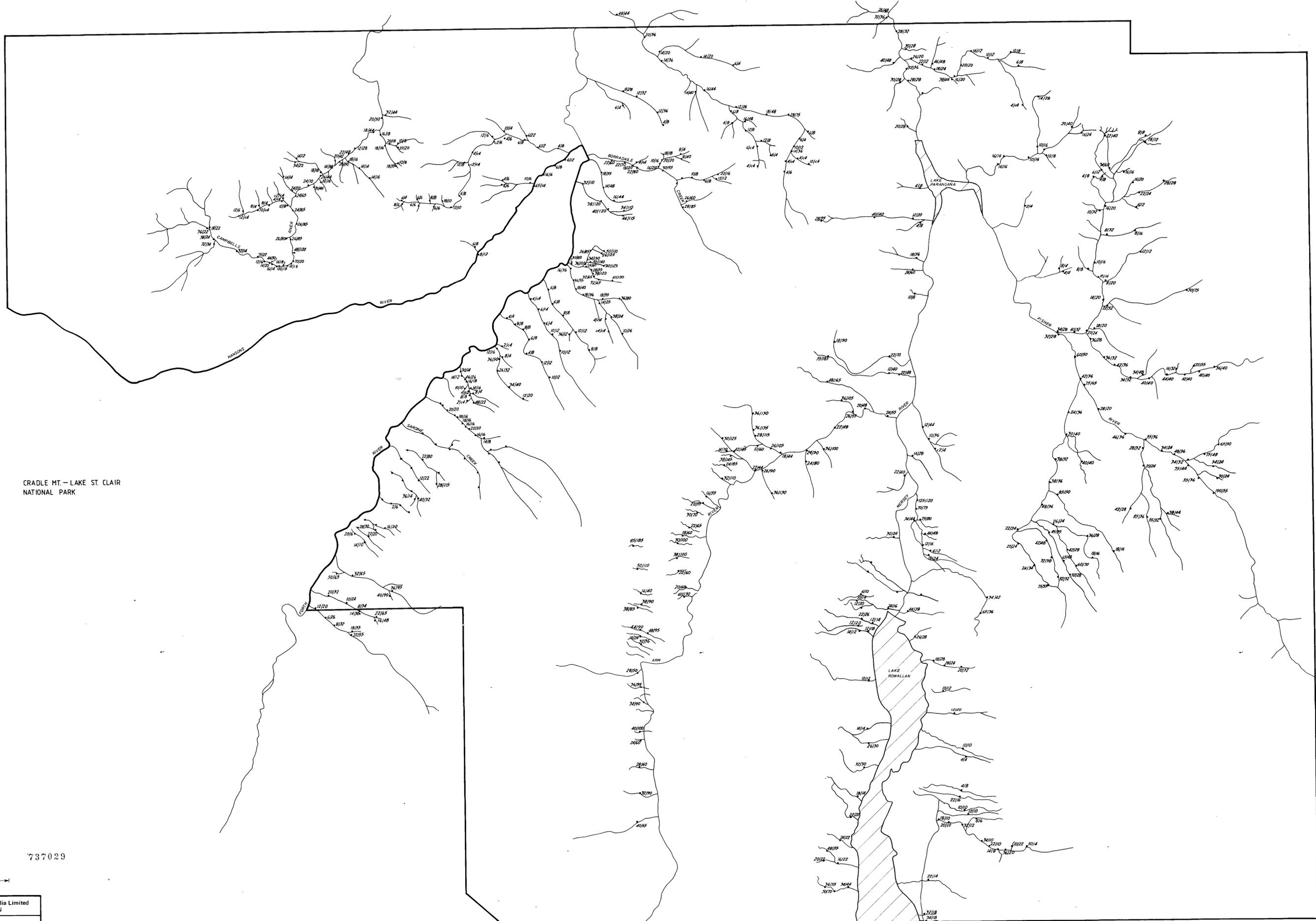
CRADLE MT - LAKE ST. CLAIR
NATIONAL PARK

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The Shell Company of Australia Limited METALS DIVISION	
E.L. 28/80 BORRADAILE PLAINS	
Mo in -20" - +80"	
Bi in -80"	
Fraction stream sediments 2704	
SCALE 1:31680	DATE 20-7-82
AUTHOR P. RUXTON	DRAWN H.L.S.
OFFICE DEWHURST	REP. No.
DRG. No. DMW97/004	FIG. No.

82-1803

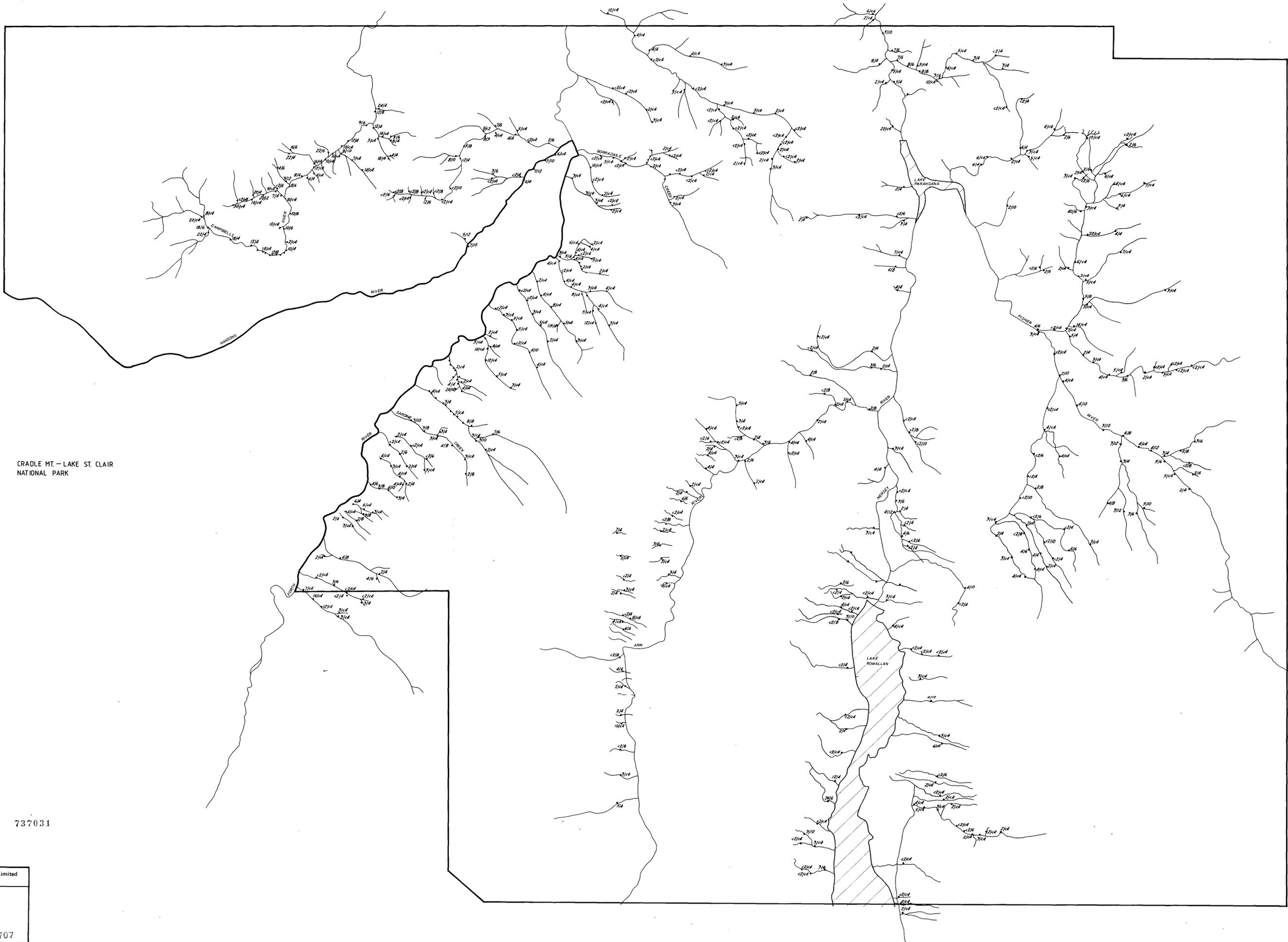


CRADLE MT. - LAKE ST. CLAIR
NATIONAL PARK

737029



The Shell Company of Australia Limited METALS DIVISION	
E.L. 28/80 BORRADAILE PLAINS	
Cu, Ni in -80* fraction stream sediment	
2705	
SCALE 1:31680	DATE 20-7-82
AUTHOR P. RUSTON	DRAWN H. L. S.
OFFICE DEVONPORT	REP No.
DRG No. D/MW97/003	FIG No.

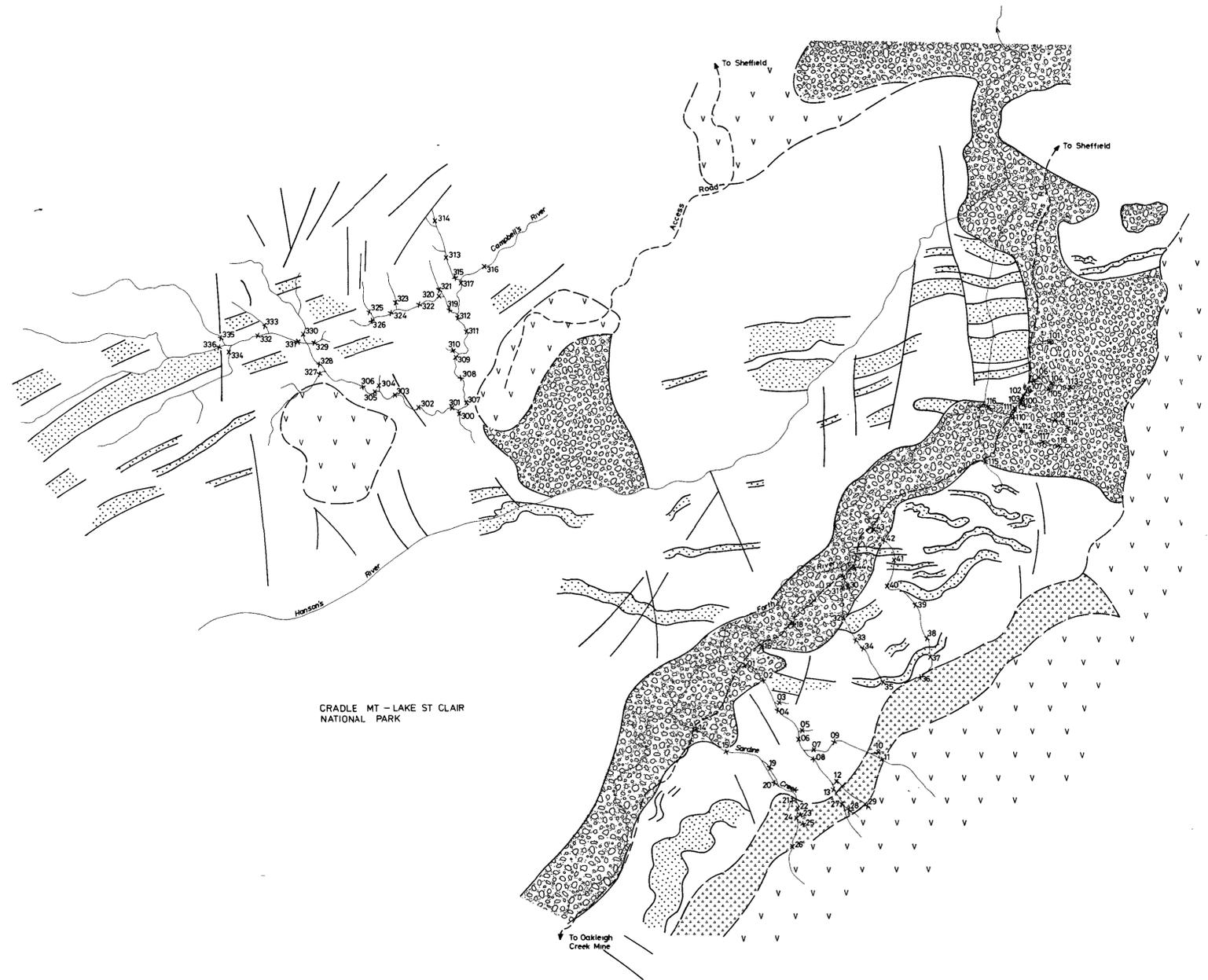


CRADLE MT. - LAKE ST. CLAIR
NATIONAL PARK

737031



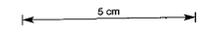
The Shell Company of Australia Limited METALS DIVISION	
E.L. 28/80 BORRADAILE PLAINS	
As, Sb in -20 ^{mm} -+80 ^{mm} fraction stream sediment	
2707	
SCALE 1:31660	DATE 21-7-82
AUTHOR P. RUXTON	DRAWN W.L.S.
OFFICE DEVONPORT	REP No.
DRG No D/MW97/005	FIG No.



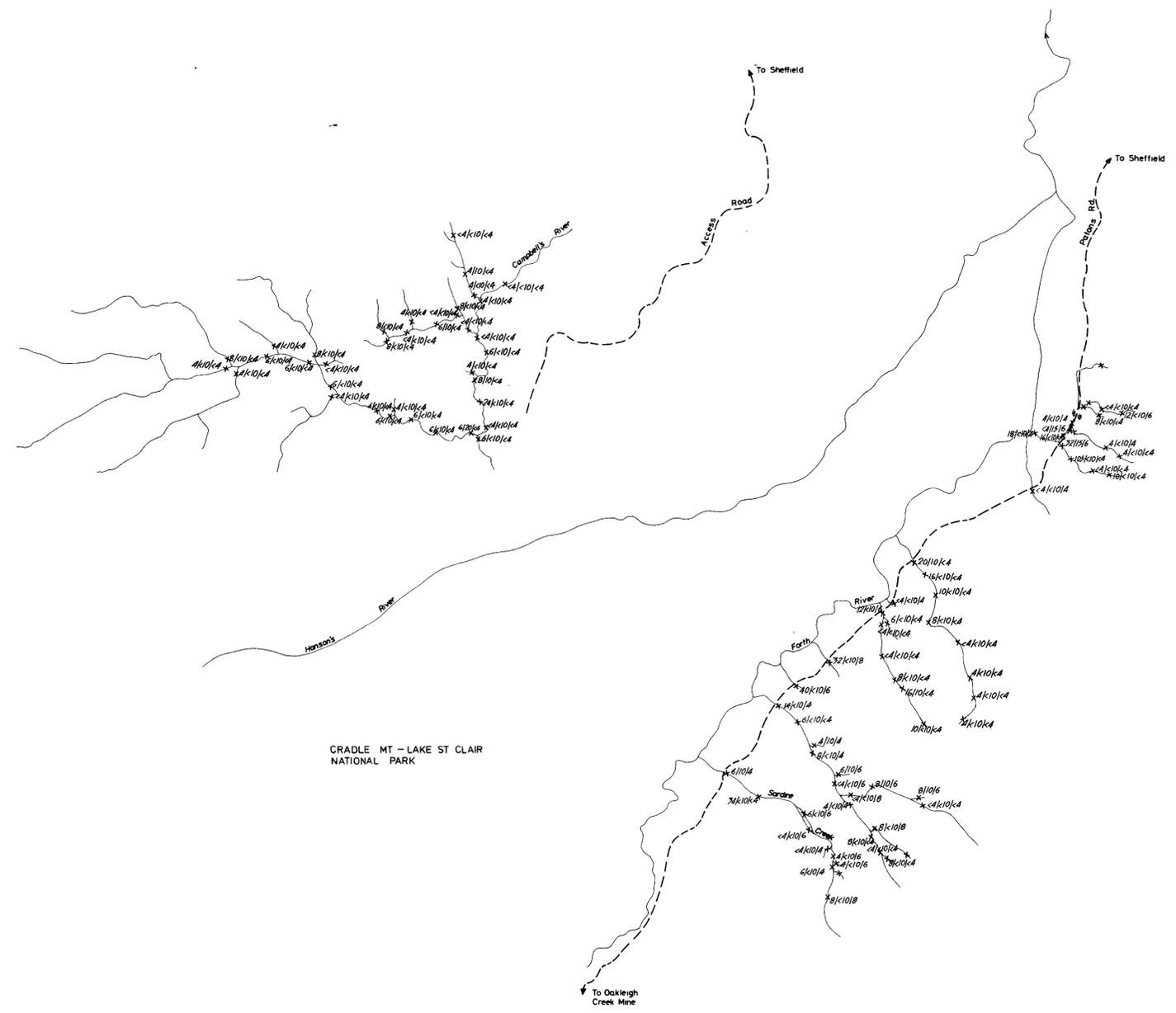
GRADLE MT - LAKE ST CLAIR
NATIONAL PARK

- LEGEND**
-  Fluvio-Glacials
 -  Tertiary Dolerite
 -  Ordovician Conglomerate
 -  Precambrian Shales & Sandstones

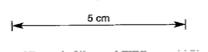
737032



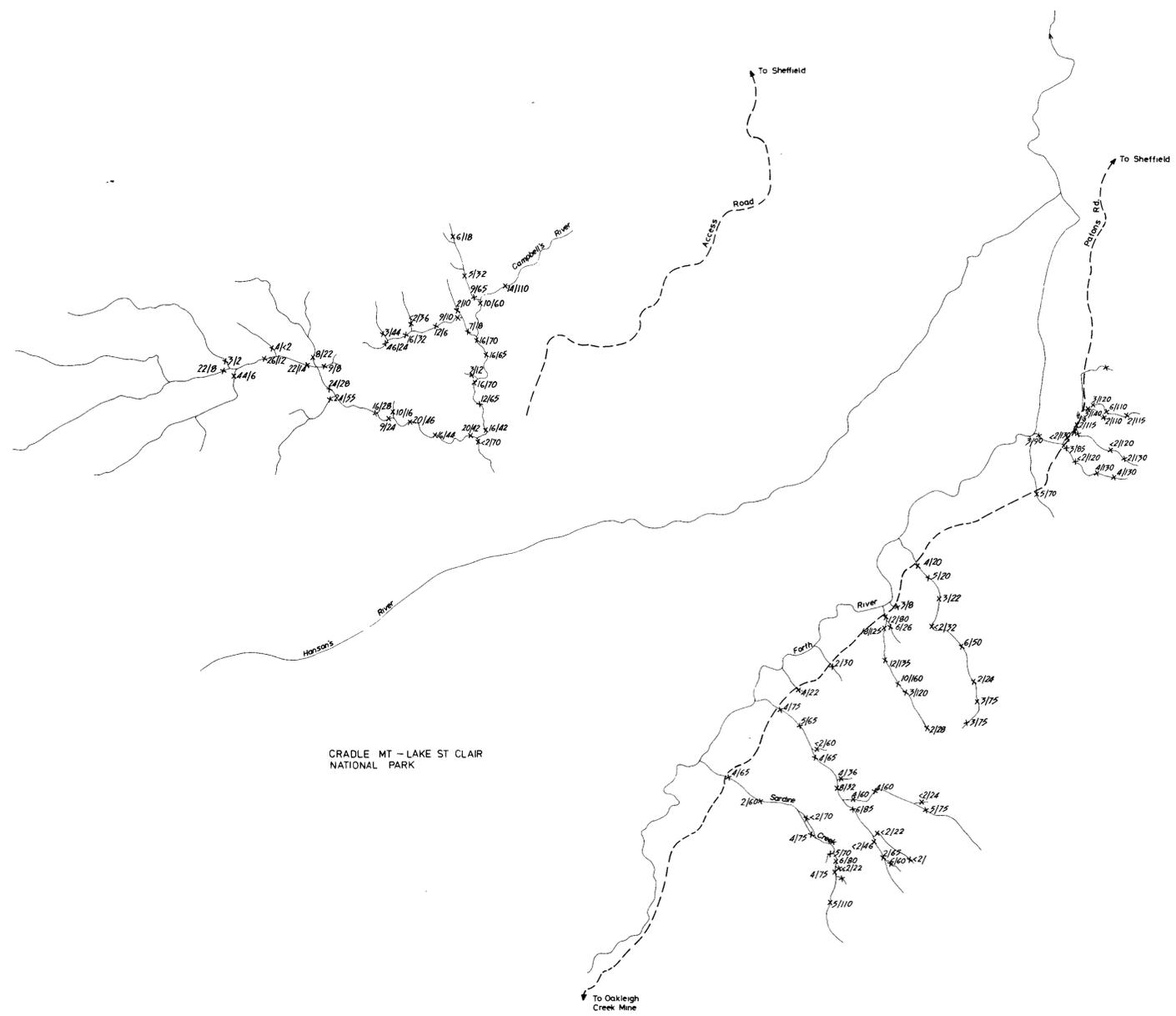
The Shell Company of Australia Limited METALS DIVISION	
E.L. 28/80 BORRADAILE PLAINS Geology of Campbells River & Sardine Creek Areas + Stream Sediment Re Sampled Localities	
Scale	1:31680
FIG No	REPORT No
ENCL No	DRG No D/MW97/009
DATE 13-5-82	AUTHOR P RUXTON
DRAWN H L H	OFFICE DEVONPORT



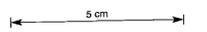
737033



The Shell Company of Australia Limited METALS DIVISION	
E.L. 28/80 BORRADAILE PLAINS STREAM SEDIMENT RE SAMPLING Sn/W/Mo PANNED CONCENTRATE	
2703	
Scale 1:31680	
FIG No	REPORT No
ENCL No	DRG No D/MW97/010
DATE 13-5-82	AUTHOR P RUXTON
DRAWN H L H	OFFICE DEVONPORT



737034



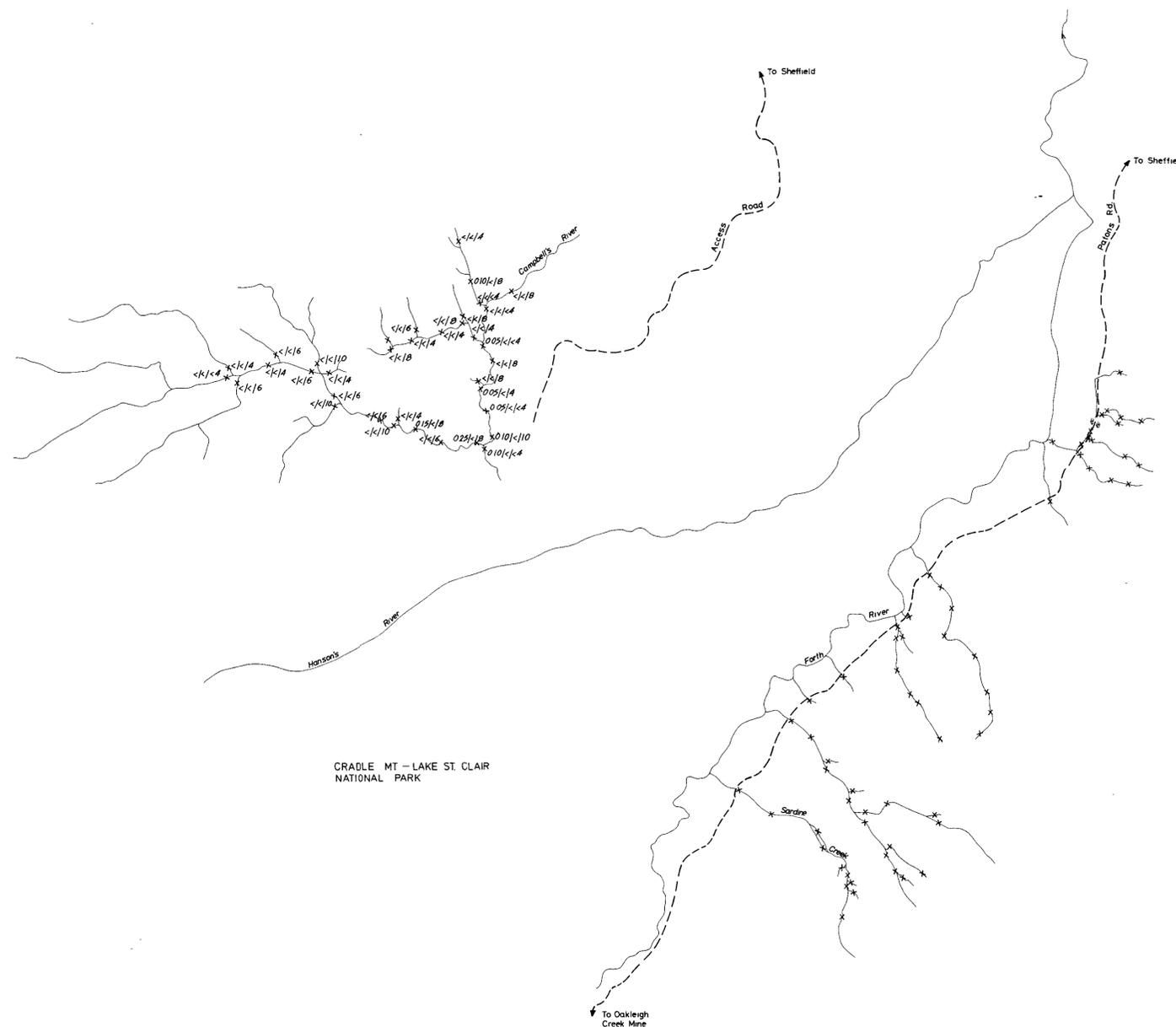
The Shell Company of Australia Limited
METALS DIVISION

E.L. 28/80 BORRADAILE PLAINS
STREAM SEDIMENT RE SAMPLING
As/Zn
-80* FRACTION

Scale 1:31680 2710

FIG No	REPORT No
ENCL No	DRG No D/MW97/011
DATE 13-5-82	AUTHOR P RUXTON
DRAWN H L H	OFFICE DEVONPORT

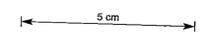
82-1803



CRADLE MT - LAKE ST. CLAIR
NATIONAL PARK



$k/14 = k/05/k/14$



737036

The Shell Company of Australia Limited METALS DIVISION	
E.L. 28/80 BORRADAILE PLAINS Au/Ag/Sb PANNED CONCENTRATE	
Scale 1:31680	
FIG No	REPORT No
ENCL No	DRG No D/MW97/014
DATE 13-5-82	AUTHOR P RUXTON
DRAWN H L H	OFFICE DEVONPORT