Open File Envelope No. 1106

SML 259

MOUNT MCKINLAY CREEK

PROGRESS REPORTS TO LICENCE EXPIRY/SURRENDER FOR THE PERIOD 1/11/1968 TO 31/7/1969

Submitted by
CRA Exploration Pty Ltd
1969

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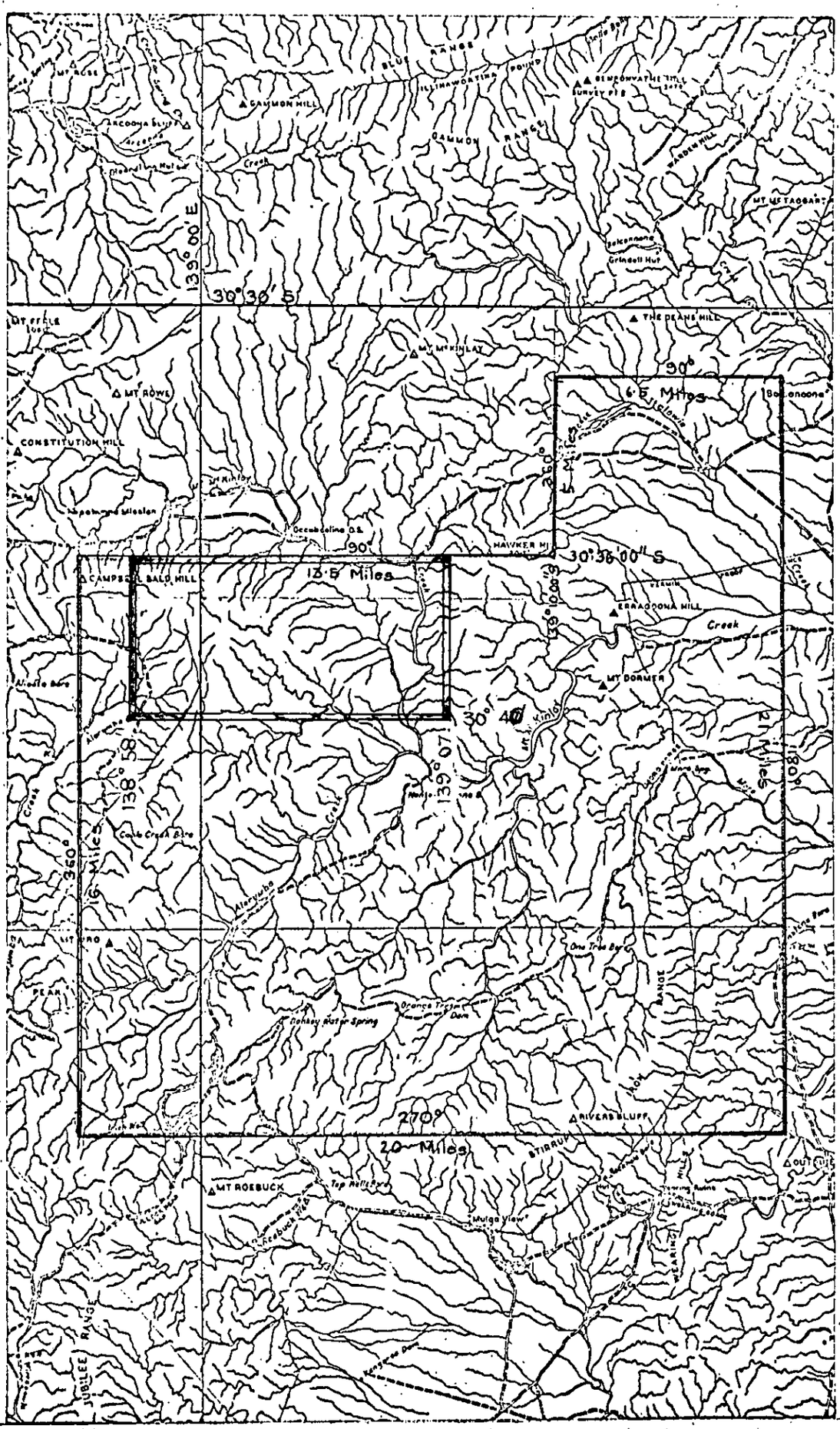
Government of South Australia
Primary Industries and Resources SA



SCALE 1:250000

C.R.A. EXPLORATION PTY. LTD.

(NOTE - BEARINGS RELATIVE TO TRUE NORTH)

D.M. 1670/68

S.M.L.259

CONTENTS ENVELOPE 1106 DOCKETS: 1670/68

TENEMENT: S.M.L. 259 Mt. Mckinely Creek

TENEMENT HOLDER: C.R.A. Exploration Pty. Ltd.

REPORTS:

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REPORTS:

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C.R.A. Exploration geochemical drainage sampling ledger (Mt. McKinlay Creek) (1106-8)

C.R.A. EXPLORATION PTY. LIMITED

003

30th June, 1969

MEMORANDUM TO : C. L. KNIGHT

Copy to : D. S. Carruthers

From : F. E. Hughes

Examination of Geochemical Lead Anomaly Mt. McKinlay Creek, Balcanoona Area, South Australia

INTRODUCTION

Detailed geochemical sampling could not confirm the weak geochemical drainage lead anomaly, noted by A. F. McQueen*, in a small drainage basin in a tributary of the Mt. McKinlay Creek.

PREVIOUS INVESTIGATIONS

The appearance of three weakly anomalous zinc values in drainage in tributary streams in the area, noted by A. F. McQueen in his original semi-detailed geochemical investigations (See Plan No. S.A. 55/2*) caused him to re-sample the area in more detail. Two of these anomalous values (in the same stream) were traced to the head of the drainage system, and it was concluded that they stemmed from a source of no economic importance. Three more samples (Nos. 121856, 857, 859, See Plan No. S.A. 55/1*) from another tributary, however, all returned values in the range 100-140 p.p.m. zinc, and 300 to 500 p.p.m. lead, values that were not detected in the original survey.

This small drainage basin and its surrounding ridges and slopes were examined in considerable detail.

The 134 samples taken by A. F. McQueen in the area, that were originally assayed by AMDEL, were re-assayed by Zinc Corporation for lead and zinc, and, with two unimportant exceptions, all values were confirmed. (See memorandum FEH-BWH, 30th June, 1969).

* McQueen, A.F. S.M.L. 202. Flinders Ranges, South Australia. Geochemical Prospecting for Zinc Silicate Deposits, Ref. No. S.A. 50/4, 7th November, 1968.

The ground is currently held under S.M.L. 259, (See attached Plan No. S.A. 102) which is approved for extension until 31st July, 1969, and was re-examined on 13th and 14th May, 1969.

DETAILED GEOCHEMISTRY

The small drainage basin under study is about $\frac{1}{4}$ square mile in extent, and 38 stream sediment samples were collected from the minor tributaries and those in adjacent catchments. One hundred and seven soil samples were collected from the dividing spurs at 100 foot spacing, and one rock sample was collected, of gossanous material from a small exposure. The samples were dry screened at 80 mesh, and analysed for lead, zinc, copper, cobalt and silver by the Zinc Corporation laboratories. The tabulated results are given on the attached data sheets, and the sample locations and zinc-lead results are shown on the attached Plans Nos. S.A. 101/1 and S.A. 101/2.

GENERAL OBSERVATIONS

The rocks in the area are gently dipping, medium to finely bedded limestones, near the base of the Lower Cambrian Wilkawinna Limestone. They are grey buff-coloured, and cream coloured limestone beds, with a few thin red-brown members, occasionally showing graded bedding. Algal remains are common. Certain members carry small masses of fine anhedral pyrite, small discrete cubes of pyrite, and cubic pseudomorphs of limonite after pyrite, up to 5 m.m., but normally about 1 m.m. These commonly occur along preferred bedding planes, and in certain laminae, but rarely cross them.

In a location shown at sample position No. 141902, pale yellowish-brown cellular gossanous material up to 12 inches wide occupies a fracture plane that strikes east-west, and dips about 60° to the south, almost at right angles to the plane of bedding in the area. This feature cuts two thin bedded features, $\frac{1}{2}$ inch and 4 inches wide, about 3 feet apart, that are filled with similar gossanous material, and can be traced for about 30 feet. The gossan has been weathered and scratched out by animals to form a narrow cave of about 15 feet long. Lead and zinc values of the above rock sample were 43 p.p.m. and 117 p.p.m. respectively, and are not anomalous.

In another location, shown at sample position No. 142000, spoil from a collapsed shallow excavation 15 feet long, showed no visible mineralisation or gossan. Lead and zinc values for this sample were 22 p.p.m. and 60 p.p.m. respectively, and of no interest.

DISCUSSION OF RESULTS

Apart from bedded pyrite, which is fairly widespread in the area, and a small occurrence of gossan of unknown origin, no sign of mineralisation was seen. The area of the lead/(zinc)anomaly, defined by A. F. McQueen's Samples Nos. 121856, 857 and 859, with values in the range 300 p.p.m. to 500 p.p.m. lead, and 100 p.p.m. to 140 p.p.m. zinc, was checked by 24 drainage samples, of which the highest values were only 38 p.p.m. lead and 82 p.p.m. zinc. These values are consistent with the 30 p.p.m. lead and 62 p.p.m. zinc from Sample No. 119656, the first sample from this stream.

The accuracy of analysis of all samples from the original work was confirmed, so it must be concluded that there was a sampling or map reading error in A. F. McQueen's re-sampling of the Mt. McKinlay Creek area.

In the course of conversation the E.Z. geologist at Puttapa remarked that they knew of a small lead anomaly in this area, which was one of the many that they had come across in geochemical studies in the Lower Cambrian in the Flinders Ranges. They have so far been unable to trace any of them to a source, and assume for the time being that they derive from small occurrences of Ediacara-type mineralisation.

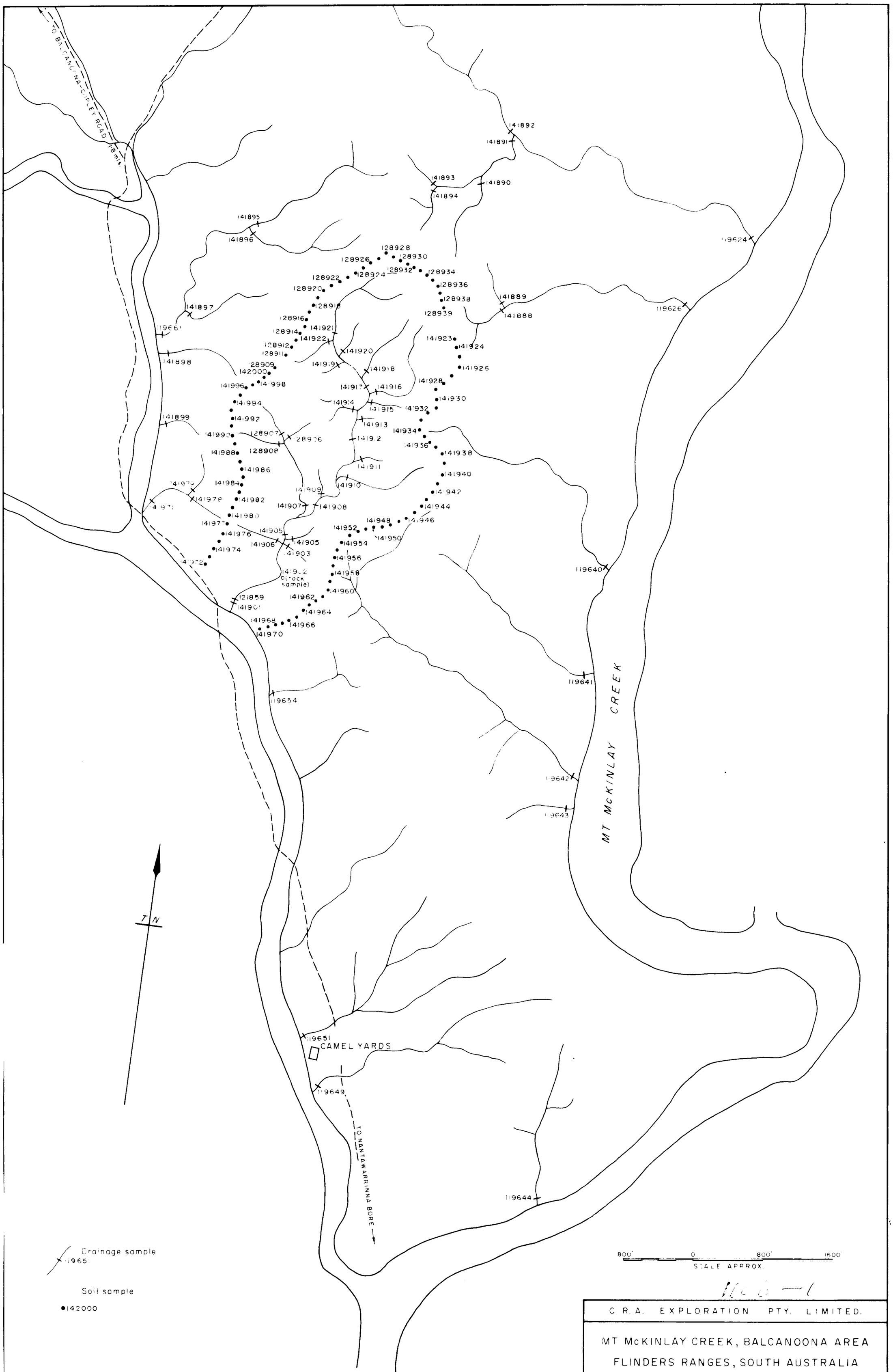
Since the above field investigations were completed, it has been suggested that E.Z. know of a zinc silicate deposit in this area, and E.C. Kostlin had undertaken some further work on S.M.L. 259, which is to be reported separately.

F. E. Hughes

FEH:RY

LIST OF PLANS

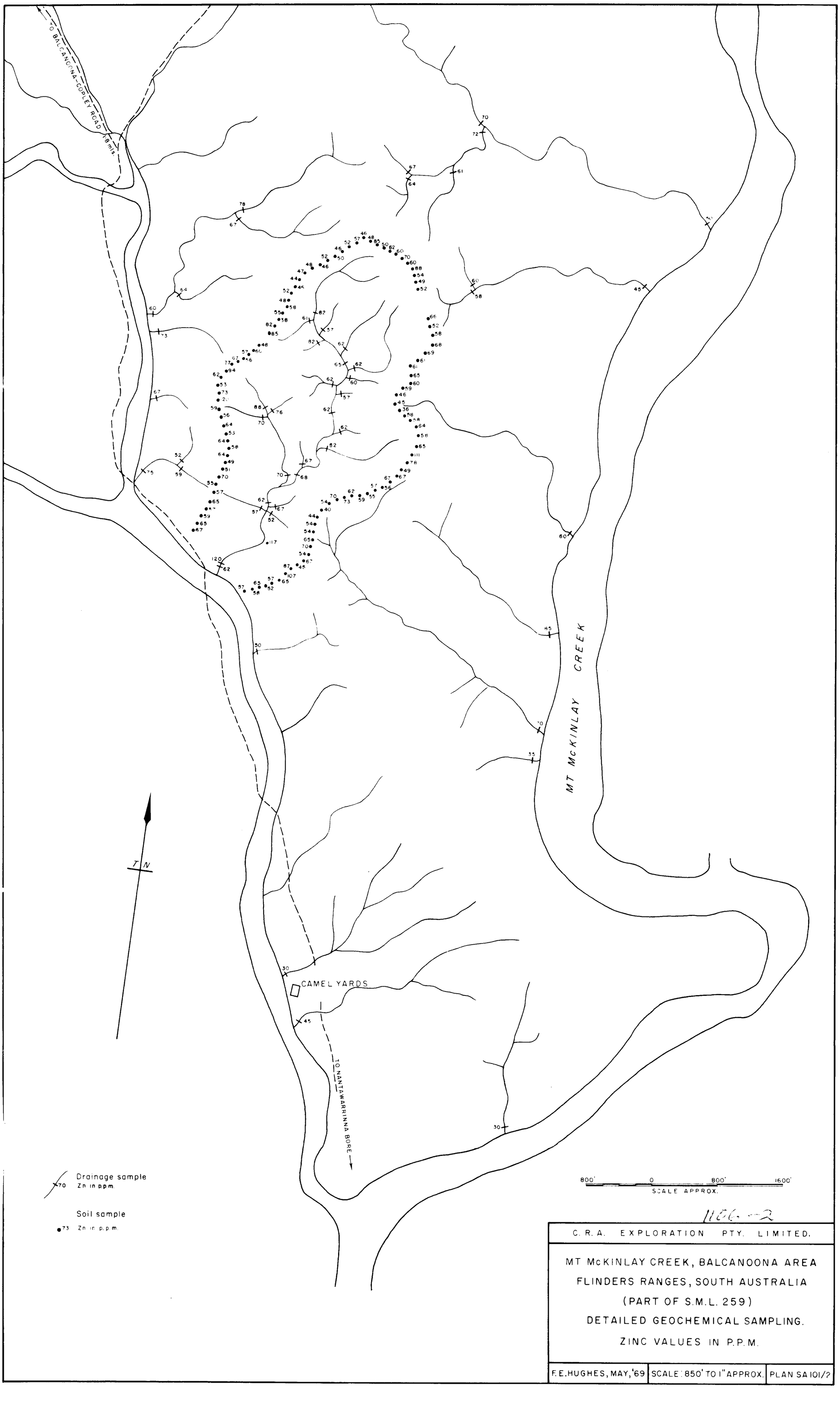
Plan No.	Title	Scale
S.A. 101/1	Mt. McKinlay Creek, Balcanoona Area, Flinders Ranges, South Australia (Part of S.M.L. 259). Detailed Geochemical Sampling. Sample Numbers.	850 ft. to 1 inch (approx.)
S.A. 101/2	Mt. McKinlay Creek, Balcanoona Area, Flinders Ranges, South Australia (Part of S.M.L. 259). Detailed Geochemical Sampling. Zinc Values in p.p.m.	850 ft. to 1 inch (approx.)
S.A. 102	Mt. McKinlay Creek Area, S.M.L. 259, South Australia, (Formerly part of S.M.L. 202)	1 inch to 1 mile



C.R.A. EXPLORATION PTY. LIMITED.

MT McKINLAY CREEK, BALCANOONA AREA FLINDERS RANGES, SOUTH AUSTRALIA (PART OF S.M.L. 259) DETAILED GEOCHEMICAL SAMPLING. SAMPLE NUMBERS

F.E.HUGHES, MAY, '69	SCALE: 850' TO 1" APPROX.	PLAN SA 101/1

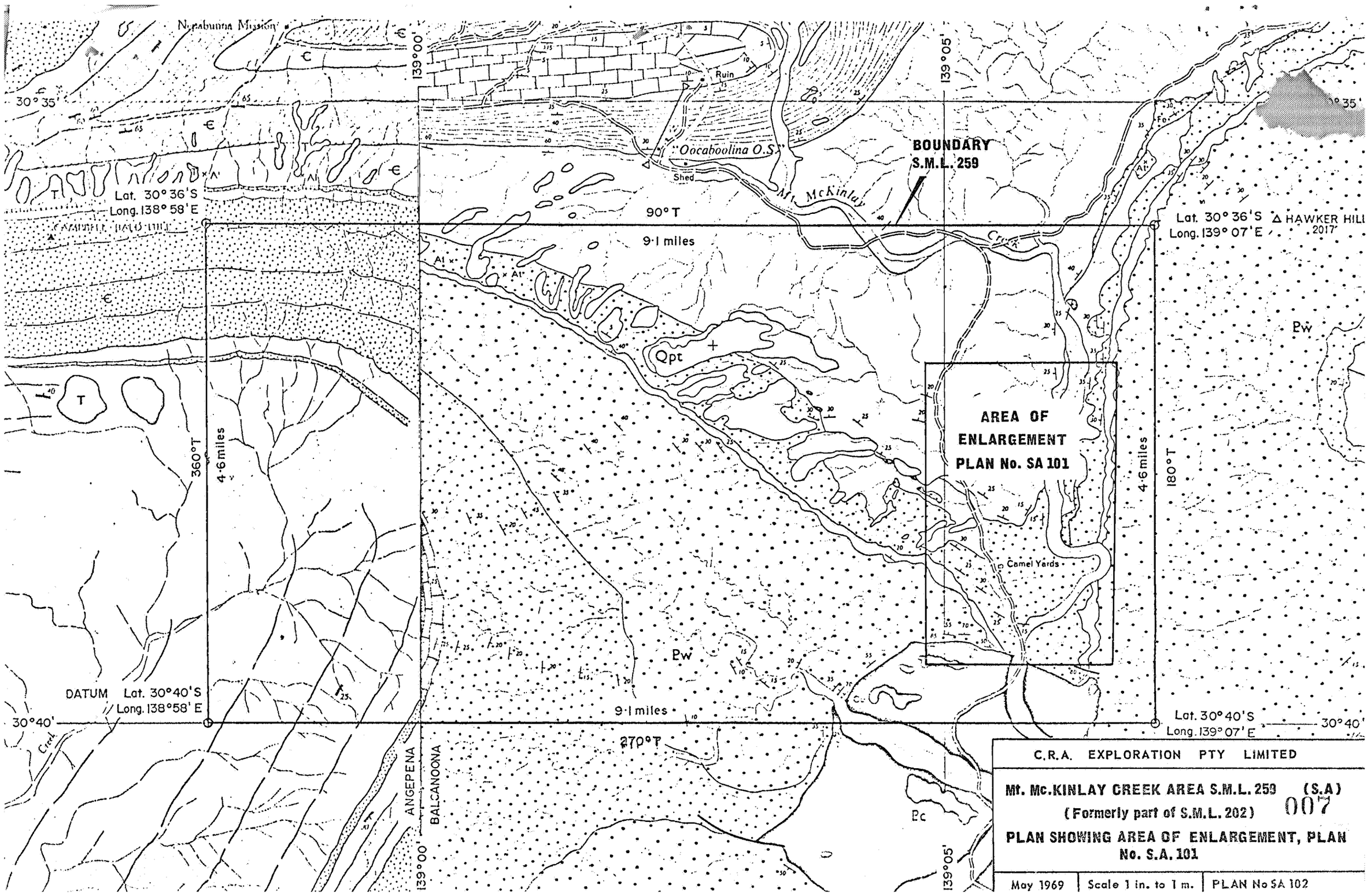


1106-2

C. R. A. EXPLORATION PTY. LIMITED.

MT McKINLAY CREEK, BALCANOONA AREA FLINDERS RANGES, SOUTH AUSTRALIA (PART OF S.M.L. 259) DETAILED GEOCHEMICAL SAMPLING. ZINC VALUES IN P.P.M.

F.E.HUGHES, MAY, '69	SCALE: 850' TO 1" APPROX.	PLAN SA 101/?



C.R.A. EXPLORATION PTY LIMITED

Mt. Mc.KINLAY CREEK AREA S.M.L. 259 (S.A.)

(Formerly part of S.M.L. 202) 007

PLAN SHOWING AREA OF ENLARGEMENT, PLAN No. S.A. 101

May 1969	Scale 1 in. to 1 m.	PLAN No SA 102

C.R.A. EXPLORATION PTY. LIMITED

19th July, 1969

MEMORANDUM TO : C. L. KNIGHT

Copies to : F. E. Hughes
D. S. Carruthers

From : E. C. Kostlin

GEOCHEMICAL DRAINAGE SAMPLING IN S.M.L. 259 - SOUTH AUSTRALIA

SUMMARY

Detailed geochemical drainage sampling of S.M.L. 259 in the northern Flinders Ranges, South Australia was completed with the objective of testing the Lower Cambrian Wilkawillina Limestone for zinc silicate deposits. Some manganiferous laterite occurrences within this area were inspected and sampled during the course of the survey. Analytical results are discussed, and the conclusion is reached that the area is of no economic importance, as far as zinc is concerned, but that further work on the laterites would be desirable.

INTRODUCTION

In July, 1968 A. F. McQueen and Miss Sandra Close undertook geochemical drainage sampling in an area, then known as S.M.L. 202, in the northern Flinders Ranges, South Australia. The objective of the survey was the search for zinc silicate deposits in the Wilkawillina Limestone of Lower Cambrian age. During this survey a small anomalous area in a tributary to Mt. McKinlay Creek was indicated by relatively high zinc values. This area is situated in what was specified by the South Australian Department of Mines as Area B of S.M.L. 202 and was resampled by McQueen (See McQueen 1968). However, he concluded that the anomaly was not an important one for zinc. Nevertheless, F. E. Hughes in May, 1969, did some further detailed work in the area, now known as S.M.L. 259 and part of former Area B, mainly to test a new lead anomaly which had arisen during McQueen's second survey. Hughes found some insignificant mineralisation but was unable to confirm McQueen's anomaly by geochemical sampling. It was felt that further work in the area was warranted before finally relinquishing the lease. Consequently, P. I. Rudd

and the author spent three days from 17th to 19th June, 1969 resampling certain parts of S.M.L. 259 which had been insufficiently covered during the earlier surveys and also investigating and sampling some outcrops of manganiferous lateritic limonite which occur in the same area.

FIELD WORK

Sampling was carried out by landrover (Reg. RBP-149) and on foot. Heavy rains at the time impeded progress somewhat, and wet sampling had to be resorted to, screening being subsequently carried out in Alice Springs.

Approximately 130 drainage samples were collected in connection with the zinc search in limestone. These represent an estimated maximum drainage area of 7 square miles, so that a sample density of over 18 samples per square mile was achieved. Of this total area Wilkawillina Limestone makes up approximately 4.5 square miles or 65%, the remainder being taken up, in approximately equal proportions, by Pound Quartzite and rocks of the Parachilna Formation.

In addition, 15 soil and drainage samples and 6 rock samples were collected in connection with the laterite deposits.

GENERAL GEOLOGY

The general geology of the area has been described by McQueen (op.cit) so that only the stratigraphic column need be shown here (after McQueen - op.cit) :

LOWER PALAEOZOIC (Lower Cambrian)	Parara Limestone	Grey limestone
	Wilkawillina Limestone	Grey limestone, algal, oolitic, silty or sandy in places
	Parachilna Formation	Siltstone, sandstone, shale, dolomitic in part
UPPER PROTEROZOIC	Pound Quartzite	White quartzite and brown sandstone

The Parara Limestone is not encountered in S.M.L. 259.

THE LATERITE DEPOSITS

Deposits of lateritic limonite, manganiferous in places, occur at or near the contact of the Parachilna Formation with the Wilkawillina Limestone. This stratigraphic control is a conspicuous feature on the Balcanoona 1-mile geological sheet. Inspection in the field, however, and thin section study revealed their lateritic nature.

Individual bodies vary in size and shape from sub circular, measuring 100 ft. in diameter, to elongate bodies the largest of which measures almost three miles in length and between 100 and 1300 ft. in width.

Little can be added to the description by Leeson (1967) of an outcrop some 10-12 miles southeast of S.M.L. 259 :-

> "The deposit is in the form of large exposures of hard craggy ironstone one to eight feet thick resting on softer yellow source rock. The ironstone is massive, banded or brecciated and often slickensided, and consists of earthy goethite cemented with fine grained haematite and siliceous matter. The manganese is in the form of the oxides (pyrolusite and wad), usually fine grained with colloform banding and occurs as concentrations varying from 0.5 to 40%, often forming an outer skin on the iron oxides."

These remarks apply equally well to the occurrences on the flanks of the Nepabunna Syncline (of which S.M.L. 259 forms a part) with only two minor modifications : manganite crystals instead of wad have been identified in thin section (C.M.S. Report 69/93 - attached); and slickensiding has not been observed by the author, a fact which is not surprising since the deposit described above is reportedly associated with a prominent fault system.

Leeson (op.cit) as well as McQueen (op.cit) describe the deposits as occurring near the top of the Parachilna Formation. However, one small outcrop - "Enterprise 2", on Plan No. S.A. 104/1, unquestionably transgresses the contact with the overlying Wilkawillina Limestone. In a partially exposed profile of this deposit ferruginization ("lateritization") can be seen to have proceeded along the bedding planes of both formations, the "mottled zone" (Close, 1968) which is marked by abundant red and yellow coloured material extending by about 50 ft. vertically

below the laterite surface before passing into the "pallid zone" of whitish clay and weathered rock. The picture presented by the geological map suggests that other deposits also transgress the contact, some in fact, are located entirely within Wilkawillina Limestone.

Associated with two of the laterite bodies within S.M.L. 259 are occurrences of white clay which were evidently derived from shale of the Parachilna Formation. Although not recognized by the author, Leeson (op.cit) reports thin lenses of alunite to occur within this clay. He states that the variable quality and small quantity of the mineral makes the deposit unlikely to be of commercial interest.

INTERPRETATION OF ANALYTICAL RESULTS AND RECOMMENDATIONS

The analytical results are shown on the attached Ledger Sheets and on Plan No. 104/1.

The following discussion is based on the assumption of an average background value of 50-60 ppm Zn. This figure was established by McQueen (op.cit) and seems to be confirmed by the present results.

The highest Zn value obtained is 137 ppm, and this from close proximity to one of the manganiferous laterite deposits from which assay values of the order of 500 ppm Zn have been obtained. It will be seen that a number of Zn values above 100 ppm can readily be traced to these deposits, and their significance must, therefore, be viewed in relation to these. It will be noted, furthermore, that the corresponding Pb values are below 25 ppm.

Sample No. 128552 which yielded 103 ppm Zn and 83 ppm Pb comes from a small channel draining an area of less than 1/10 of one square mile and is, therefore, considered to be of no importance. Similar reasoning applies to Sample No. 128570 with values of 114 and 120 ppm Zn and Pb, respectively. This latter anomaly, as far as Zn is concerned, must stem from a very small source, since a sample collected only 350 yards downstream from the previous one carried only 77 ppm Zn. At this locality the drainage area has increased to only about 1/5 of one square mile.

Somewhat more perplexing, however, are the moderately anomalous Pb values in this vicinity which all appear to be associated with relatively low Zn values. McQueen (op.cit) in the course of his second survey of the area established a Pb anomaly in the vicinity of over 10 times the value of his original sample at the same locality. Likewise, the Zn value rose to twice the original value. Hughes failed to confirm this anomaly with over 100 soil and drainage samples. Neither Hughes nor the present author have noticed any signs of mineralisation, or only very insignificant ones, in their respective areas, yet the present survey again yielded Pb anomalies of the order of 5 times average background (Sample Nos. 128535, 36, 37, 70). Considering the relatively low mobility of Pb, the seemingly perplexing relationship between Pb and Zn values of sample nos. 128570 and 128535 would indicate that we are dealing with two separate minor sources of Pb. The distribution of sample nos. 128536 and 537 and the fact that minor mineralisation was noted by Hughes substantiates this theory. Meanwhile, it is suggested that geochemical drainage sampling results for Pb be treated with caution and that more case histories be established. While the Pb anomalies obtained are not considered to be significant, it might be a stimulating exercise to trace their sources.

Attention is drawn to the somewhat higher values of Cu (2 X average background) and Ni (1.5 - 2 X average background) in sample nos. 128535, 36 and 37.

The analytical results of samples from the lateritic deposits (drainage and soil sample nos. 128587-601; chip sample nos. 29-32) indicate that they tend to act as concentrators of Zn, Cu, Ni and Co and in the case of "Enterprise 3" of Pb.It will be noted that the sample results, generally, are not very consistent. For instance, a soil sample collected from the foot of "Enterprise 1" and less than 150 feet away from it (No. 128590) failed to yield any significant values, as do several drainage samples (e.g. nos. 128591, 597, 599, 600). This may in part be due to sporadic concentration of the critical elements within a single outcrop ("Enterprise 3" seems to bear this out most clearly) and in part due to the fact that insufficient care was taken in the selection of sample localities; e.g. the two channels containing Sample Nos. 128599 and 600 may not actually reach the lateritized zone which, in this case, is located about 300 feet above the level of Mt. McKinlay Creek. In any event, the results do seem to point out the limitations of geochemical sampling, particularly when considered in terms of a general reconnaissance survey.

E. C. Kostlin

ATTACHMENTS

Geochemical Drainage Sampling Ledger Sheets

LIST OF PLANS

Plan No.	Title	Scale
S.A. 104	S.M.L. 259 Mt. McKinlay Creek - South Australia. Sample Locations.	Approx. 40 chains to 1 inch
S.A. 104/1	S.M.L. 259 Mt. McKinlay Creek - South Australia. Sample Values.	Approx. 40 chains to 1 inch

REFERENCES

Close, Miss S. E., 1968 — "Laterites in Australia - Review of Work to Date" - Memorandum to C.L. Knight, 29th May, 1968.

Hughes, F. E., 1969 — "Examination of Geochemical Lead Anomaly, Mt. McKinlay Creek, Balcanoona Area, South Australia" C.R.A.E. Report S.A. 50/4, 30th June, 1969.

Leeson, B., 1967 — "Geology of the Balcanoona 1:63,360 Map Area" - Department of Mines, South Australia. Report Bk. No. 64/92.

McQueen, A. F. , 1968 — "S.M.L. 202 - Flinders Ranges, South Australia. Geochemical Prospecting for Zinc Silicate Deposits". C.R.A.E. Report S.A. 50/4, 7th November, 1968.

CENTRAL MINERALOGICAL SERVICES
192 MAGILL ROAD, NORWOOD, S.A., 5067 Telephone 32 1708 or 31 3019

Date: 1st July, 1969.

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

IDENTIFICATION
Manganiferous Laterite.

Job No. CMS 69/93 Date Received: 25/6/69

Reference D.P.O. 5378

Sample No. 37

Nature of Sample: Hand-specimen

DESCRIPTION **SECTION No.**

a. Hand Specimen:

Colloform-banded manganese cells with soft fillings of manganese-rich sediment.

Microscopic:

The soft material filling the "cells" consists of a fine arkosic sand cemented with "wad". Naturally this would weather out very easily, leaving deep hollows.

The walls of the "cells" are composed of manganese compounds with embedded quartz grains and muscovite laths, in the fine sand grainsize range.

In polished section, there are colloform-banded areas of goethite, patches of finely-crystalline aggregates of pyrolusite, veinlets of goethite and isolated ?manganite crystals.

The manganese minerals are a difficult group to identify. If important, further examinations and XRD work can be carried out.

Remarks/Special Features

Analysis of this specimen for Cu, Co, Ni, Zn, Pb, W might be valuable, since Mn-compounds are scavengers.

N.B.: Typewritten report will follow.

H.W.Fander, M.Sc.

016

CENTRAL MINERALOGICAL SERVICES

192 MAGILL ROAD, NORWOOD, S.A., 5067 Telephone 32 1708 or 31 3019

Date: 1st July, 1969.

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

IDENTIFICATION
"Lateritised" Silt-stone.

Job No. CMS 69/93 Date Received: 25/6/69

Reference D.P.O. 5378

Sample No. 38

Nature of Sample: Hand-specimen

DESCRIPTION **SECTION No.**

a. Hand Specimen:

Fine-grained compact rock with pale-brown and black mottling and layering; manganiferous.

Microscopic:

This rock may have been a siltstone, though there is little or no indication of depositioncd features. Numerous silt-sized angular grains of quartz and flakes of sericite and clay occur; these are set in patchily-distributed limonite and manganese compounds which are late-stage and replacive. A later stage of replacement by carbonate occurs, where carbonate patches cement silt grains and vein the earlier-formed limonite and manganese areas.

The manganiferous patches consist of very fine manganite needles between silt grains-most of them only 1 X 15/4 in size; the ferruginous areas are earthy goethite.

Remarks/Special Features

N.B.: Typewritten report will follow.

H.W.Fander, M.Sc.

g33621

T. N.

139°00'

139°07'

30°36'

30°40'

to Copley

to Balcanoona

"Oocaboolina O.S."

shed

BOUNDARY OF S.M.L. 259

MT. McKINLAY CREEK

WILKAWILLINA LIMESTONE

PARACHILNA FORMATION

POUND QUARTZITE

to Nantawarrinna bore

Fe

At

" ENTERPRISE 1 "

" ENTERPRISE 2 "

" ENTERPRISE 3 "

No 29 & No 30

No 31 & No 32

ENLARGED AREA

SCALE APPROX. 20ch. to 1in.

20 15 10 5 0 20 40ch.

SEE INSET ABOVE

SCALE APPROX. 40 chains to 1inch

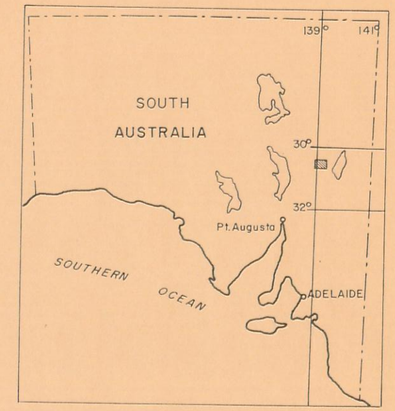
40 30 20 10 0 40 80 120ch.

½ 0 1 mile

INDEX TO S.A. MINES DEPT. 1:63 360 GEOLOGICAL MAPS

SERLE	WOOLTANA	CALDINA
ANGEPENA	BALCANOONA SML 259	ARKAROOLA
CADNIA	ARROWIE	FROME

LOCALITY PLAN



LEGEND

- 128600 — Drainage sample location
- × 128596 — Soil sample location
- ⊗ No 29 — Rock sample location
- Geological boundary (approximate & simplified)
- Fe — Laterite
- ×At — Allanite
- Road or track

1106-3

C R A EXPLORATION PTY LIMITED

S.M.L. 259

MT. McKINLAY CREEK – S.A.

SAMPLE LOCATIONS

E.C.K.

July, 1969	Scale :– 40 ch to 1 in	PLAN No S.A.104

T. N.

139°00'

to Copley

"Oocaboolina O.S."

shed

30°36'

BOUNDARY OF S.M.L. 259

to Balcanoona

MT. McKINLAY CREEK

WILKAWILLINA LIMESTONE

PARACHILNA FORMATION

POUND QUARTZITE

Fe

At

SEE INSET ABOVE

139°07'

30°40'

to Nantawarrinna bore

BOUNDARY OF S.M.L. 259

"ENTERPRISE 1"

"ENTERPRISE 2"

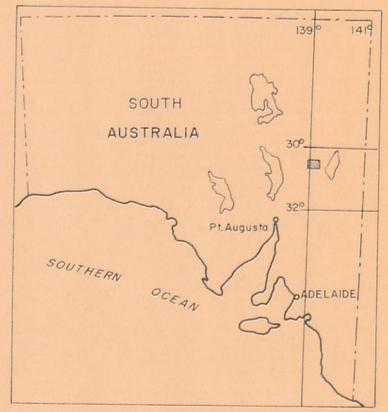
"ENTERPRISE 3"

ENLARGED AREA

SCALE APPROX. 20ch. to 1in.

20 15 10 5 0 20 40ch.

LOCALITY PLAN



LEGEND

- 66 Zn, 32 Pb — in ppm of drainage samples
- × 125 Zn, 21 Pb — in ppm of soil samples
- ⊗ 580 Zn, 38 Cu, 58 Ni, 41 Co — in ppm of rock samples
- Geological boundary (approximate & simplified)
- Fe — Laterite
- ×At — Allanite
- Road or track

INDEX TO S.A. MINES DEPT. 1:63 360 GEOLOGICAL MAPS

SERLE	WOOLTANA	CALDINA
ANGEPENA	BALCANOONA SML 259	ARKAROOLA
CADNIA	ARROWIE	FROME

SCALE APPROX. 40 chains to 1inch

40 30 20 10 0 40 80 120ch

½ 0 1mile

1106 — 4

CRA EXPLORATION PTY LIMITED

S.M.L. 259
MT. McKINLAY CREEK — S.A.
SAMPLE VALUES

E.C.K.

July, 1969	Scale :— 40 ch to 1 in	PLAN No S.A.104 / 1

CRAE 16.

C.R.A. EXPLORATION PTY. LIMITED

GEOCHEMICAL DRAINAGE SAMPLING LEDGER

1106-5

AREA Mt. McKinlay Creek (Balcanoona) - S.A. SAMPLE Nos. 128460-601 ; 25-32 COLLECTED BY E.C. Köstlin & P.I. Rudd SHEET No. 1

MAP OR PHOTO REFERENCE Balcanoona 1:63,360 - S.A. Geol. Survey. ANALYSED BY E.C. DATE June '69

Map or photo No.	Sample No.	Sediment: Gravel	Sand	Silt/mud	Organic	Channel: Flow	Width	Alluvial	Colluvial	pH	Metal content, p.p.m.: Pb	Zn	Cu	Ni	Co	Cr	Mn	Ag	Mo	As	Geological observations
	128460	80	20	0			60				27	69	12	25				1			gravels: mainly gthte; limst, calc. shale.
	61	60	40	0			8				22	50	9	19				1			dark blue banded limst.
	62										25	50	9	22				2			
	63										27	59	10	19				2			
	64										22	50	10	19				1			
	65										22	52	10	19				1			
	66										22	92	11	43				1			
	67										25	54	10	22				1			
	68										47	77	21	31				1			
	69										27	66	10	25				<1			
	70										40	80	13	25				1			
	71										30	56	9	22				1			
	72										27	43	9	19				1			
	73										27	58	9	19				<1			
	74	60	20	20		3	✓	✓			30	54	7	19				1			limst. outcrop.
	75										43	69	10	22				1			
	76										38	74	10	22				1			
	77										38	63	9	19				1			
	78										32	69	8	22				2			
	79	70	25	5		6					25	66	13	22				1			limst. outcrop
	80	70	25	5		3					25	61 57	9	19				1			- do - limst-ss. st. in gravels.
	81										11	51 89	7	16				<1			
	82										21	117 56	11	30				<1			
	83										19	84	11	25				<1			
	84										16	60 58	9	19				<1			
	85										14	59 66	9	19				<1			
	86										16	63	10	22				<1			
	87										17	63 48	17	19				<1			
	88										18	61 58	8	19				<1			
	89										27	66	13	22				1			
	90										25	57 63	11	19				1			
	91										14	60 56	12	13				<1			
	92										43	77 80	11	22				1			
	93										50	77 54	12	19				1			
	94										50	69 54	11	25				1			
	95										19	58 63	8	16				<1			
	96										40	46 86	7	13				<1			

CRAE 16.

C.R.A. EXPLORATION PTY. LIMITED

GEOCHEMICAL DRAINAGE SAMPLING LEDGER

1106-6

AREA Mt. McKinlay Creek SAMPLE Nos. COLLECTED BY SHEET No. 2

MAP OR PHOTO REFERENCE ANALYSED BY DATE

Map or photo No.	Sample No.	Sediment: Gravel	Sand	Silt/mud	Organic	Channel: Flow	Width	Alluvial	Colluvial	pH	Metal content, p. p. m.: Pb	Zn	Cu	Ni	Co	Cr	Mn	Ag	Mo	As	Geological observations
	128497										22	57	6	19				<1			
	98										50	84	10	25				1			
	99										38	56	9	19				1			
	500	10	90	0			1	✓			22	48	12	22				1			
	01	40	60	0			3	✓			25	58	14	25				<1			some pebbles of concretionary limonite mainly goethite in gravels
	02	50	40	0			20	✓			25	66	11	25				<1			
	03	50	50	0			3	✓			25	53	11	25				1			
	04	50	50	0			3	✓			25	48	10	22				1			thinly banded & bedded dk. blue limst.
	05	70	30	0			70	✓			25	58	10	22				<1			gravels: mainly goethite.
	06	50	50	0			3	✓	✓		27	66	17	27				<1			
	07	80	20	0	±		30	✓			30	63	10	22				1			
	08	80	20	0	±		30	✓			22	56	7	19				<1			
	09	50	50	0			3	✓			40	80	14	27				1			grey limst.
	10	50	50	0			3	✓	✓		27	54	9	22				1			
	11	40	50	10			5	✓			32	54	9	22				1			outcrop of grey massive limst. in creek.
	12	50	50	0			3	✓	✓		33	63	9	22				1			
	13	80	20	0			120	✓			19	56	7	16				<1			gravels: mainly goethite.
	14	50	50	0			35	✓			10	26	5	8				<1			gravels: mainly goethite, some calc. rubble.
	15	10	80	10			5	✓			8	94	9	8				<1			goethite.
	16	50	50	0			7	✓			10	106	17	13				<1			goethite & siltstone in gravels.
	17	40	60	0			6	✓	✓		12	94	15	20				<1			
	18	50	50	0			4	✓	✓		19	80	11	22				1			gravels: limst. & goethite.
	19	90	10	0			15	✓			16	50	7	16				<1			} goethite > limst.
	20	70	30	0			25	✓			21	65	7	22				1			
	21	70	30	0			8	✓	✓		30	60	7	22				1			limst. > goethite } in gravels.
	22	90	10	0			20	✓			23	60	9	20				1			goethite = limst.
	23	90	10	0			~~20~~ 30	✓			21	60	7	20				1			— do —
	24	80	20	0			~~25~~ 35	✓	✓		37	71	7	25				1			mainly limst.
	25	80	20	0			~~12~~ 30	✓			23	57	7	22				<1			goethite - limst.
	26	0	90	10			~~10~~ 12	✓			23	57	9	22				<1			
	27	90	10	0			~~50~~ 10	✓			21	50	11	22				1			gravels: some black calc. shales.
	28	70	30	0			50	✓			23	54	9	22				<1			limst.
	29	90	10	0			~~5~~ 25	✓			25	50	11	22				<1			
	30	90	10	0			5	✓			25	57	11	25				1			
	31	90	10	0			2	✓			25	54	9	22				1			
	32	80	20	0			7	✓	✓		20	50	9	20				<1			limst. goethite in gravels
	33	80	20	0			7	✓	✓		28	42	7	22				2			— do —

CRAE 16.

C.R.A. EXPLORATION PTY. LIMITED

GEOCHEMICAL DRAINAGE SAMPLING LEDGER

1106-9

AREA Mt. McKINLAY CREEK SAMPLE Nos. COLLECTED BY SHEET No. 3

MAP OR PHOTO REFERENCE ANALYSED BY DATE

Map or photo No.	Sample No.	Sediment: Gravel	Sand	Silt/mud	Organic	Channel: Flow	Width	Alluvial	Colluvial	pH	Metal content, p. p. m.: Pb	Zn	Cu	Ni	Co	Cr	Mn	Ag	Mo	As	Geological observations
	128534	90	10	0			150	✓	✓		16	50	9	20				<1			gravels: gthe > limst.
	35							✓			100	77	19	33				1			
	36							✓			120	87	21	33				1			
	37							✓			120	87	24	42				<1			
	38							✓			42	62	9	22				1			
	39							✓			30	71	11	26				1			
	40							✓			87	62	11	22				1			
	41							✓			87	62	9	20				1			
	42							✓			23	60	9	20				1			
	43							✓			35	65	13	30				1			
	44	50	50	0			6	✓			23	48	9	20				1			concentrates of actic magnetite thats in sand.
	45							✓			28	57	13	26				1			
	46							✓			25	54	9	22				1			
	47							✓			28	57	15	22				1			
	48							✓			21	45	7	16				<1			
	49							✓			25	54	7	22				1			
	50	50	50	0			3		✓		32	57	9	22				2			
	51	40	50	10			15	✓			32	62	11	22				1			
	52										83	103	9	22				2			
	53										18	65	13	26				1			
	54										18	48	11	20				1			
	55										30	62	11	26				1			
	56										23	50	11	20				2			
	57										23	54	11	22				2			
	58						5	✓	✓		12	62	15	22				1			
	59						40	✓			10	33	7	13				<1			
	60						60	✓			16	48	11	16				<1			
	61	50	50	0			5	✓			32	62	15	22				<1			
	62	50	50	0			15	✓			25	62	11	20				1			
	63						60	✓			14	45	9	16				<1			
	64										34	60	15	30				<1			
	65										38	71	13	22				1			
	66										35	57	19	26				1			
	67										20	42	15	20				<1			
	68										20	45	15	22				1			
	69										45	68	9	22				1			
	70										120	114	17	27				1			

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C.R.A. EXPLORATION PTY. LIMITED

GEOCHEMICAL DRAINAGE SAMPLING LEDGER

1106-8

AREA Mt. McKINLAY CREEK. SAMPLE Nos. COLLECTED BY SHEET No. 4

MAP OR PHOTO REFERENCE ANALYSED BY DATE

Map or photo No.	Sample No.	Sediment: Gravel	Sediment: Sand	Sediment: Silt/mud	Sediment: Organic	Channel: Flow	Channel: Width	Channel: Alluvial	Channel: Colluvial	pH	Metal content, p. p. m.: Pb	Zn	Cu	Ni	Co	Cr	Mn	Ag	Mo	As	Geological observations
	128571										48	65	11	26				1			
	72										39	62	7	20				<1			
	73										45	62	9	27				1			
	74										42	54	9	20				1			
	75										47	77	9	26				1			
	76										34	87	9	26				2			
	77										38	60	11	22				1			
	78										42	60	11	22				1			
	79										39	77	15	27				1			
	80										50	77	13	22				1			
	81										28	48	7	20				1			
	82										45	65	9	22				2			
	83										48	77	13	26				2			
	84										34	87	13	27				1			
	85										39	84	18	30				1			
	86										37	97	11	30				1			
	87										21	125	15	39				<1			soil sample
	88										39	136	42	65				<1			
	89										29	137	22	55				<1			
	90										16	48	11	19				<1			soil sample
	91										16	58	15	27				<1			
	92										13	54	19	25				<1			
	93										18	66	26	30				<1			
	94										16	66	26	27				1			
	95										29	100	20	39				<1			
	96										26	72	20	27				<1			
	97										18	39	10	16				1			
	98										91	94	28	42				<1			soil sample
	99										13	39	10	19				<1			
	600										13	55	17	25				<1			
	601										23	60	15	30				1			soil sample
											1										
	29										880	580	38	58	41			3			
	30										670	460	49	75	52			3			
	31										770	1040	42	190	150			2			
	32										1150	550	36	66	9			2			