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REPORT
ON THE
MINERAL POTENTIAL
OF THE
MOUNT MCKINLAY PROSPECT
SML 530
FLINDERS RANGES
SOUTH AUSTRALIA

FOR

K.K. EULER, ESQ.

BY

A.A. DAY

30.4.71

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INTRODUCTION

The following report is submitted in response to your request on 1st February, 1971. It supersedes written preliminary reports dated March 20th and March 26th, 1971.

The report coordinates with previous work by others the results of a rapid geological reconnaissance of the more accessible parts of the prospect area, coupled with a limited geochemical orientation program. Slightly more than one day was spent inspecting relevant reports and maps in the Mines Department, Adelaide, and three and three-quarter days were spent in the prospect area during the period Febraury 17th to 21st. Part of the afternoon of 20th February was lost due to flooding of creeks following a heavy thunderstorm.

TENEMENT

The Special Mining Lease is numbered 530 and the date of commencement was 14th January, 1971. The area covered is about 100 square miles.

Exclusions. Enquiries by the writer in the Mines Department, Adelaide, did not reveal the existence of any prior mineral rights in the area.

A small portion of the Gammon Wilderness, which is reserved from all mining, adjoins the prospect at its north-western corner, and a Reserve for Aborigines, also reserved from mining, adjoins about two miles of the eastern boundary

of the prospect in the neighbourhood of Italowie Gorge.

Previous Holders. The area or part of it has been held previously as follows:

Date	Holding	Licensee	Minerals
1964/65	Part SML 73	Broken Hill Pty	phosphate
1968/69	Part SML 184	Electrolytic Zinc Co.	zinc, lead, copper
1968/69	Part SML 202	C.R.A. Explor'n.	lead, zinc, copper, cobalt, silver
1969	Part SML 259	- ditto -	

LOCATION, ACCESS, FACILITIES, LANDUSE

The boundaries of the SML are 30° 30' and 30°40' South latitude and 139° 00' and 139° 10' East longitude, less a rectangle defined by 30° 36' S. and 30° 40' S., 139° 07' E. and 139° 10' E. , and less a small triangular area in the northwest corner, the boundary of which runs on a slight curve from 30° 30' S., 139° 00½' E. to 30° 30½' S., 139° 00' E.

The SML is situated in the Northern Flinders Ranges of South Australia. The western boundary is 41 miles by road east of the small village of Copley which is about 374 miles north of Adelaide.

Vehicular access within the area is limited to one formed earth road and two tracks. Creek crossings are not bridged. Four-wheel-drive vehicles can traverse a limited portion of the area away from the tracks but much of the country is too rough for them and creek beds are usually too bouldery

or overgrown with vegetation.

Copley is on the standard gauge railway from Stirling North to Marree. No water, power or labour supply is readily available in the immediate vicinity. It is not impossible that a suitable damsite may exist in the neighbourhood.

About two-thirds of the area is in use for open-range sheep grazing. The precipitous remainder is unused.

GENERAL GEOLOGY

Reference Material. The general geology is shown on the Geological Survey of South Australia geological and aeromagnetic maps "Balcanoona", at a scale of 1:63,360, published in 1967. The corresponding explanatory notes have not yet been published.

There are numerous Government and some other publications relating to aspects of the geology of the Flinders Ranges and their mineral deposits, but none deal specifically with the SML. Unpublished material perused in the Geological Survey Office, Adelaide, included a series of open-file reports in varying degrees of detail on the Special Mining Lease areas which have been previously held and relinquished (see list above).

Summary of Geology. A simplified geological plan of SML 530, based on the published "Balcanoona" geological map is appended to this report (plan S/KE/102).

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A series of gently folded late Precambrian and lower Cambrian sedimentary strata is exposed in the area. Rock-types include quartzitic sandstones, shales, marls, limestones and dolomites. About one third of the licence area is occupied by the lower Cambrian Wilkawillina Limestone which is of economic geological interest, and about one third is occupied by the late Precambrian Pound Quartzite, which is of little economic interest inthis area.

The strata are gently folded into the bnad Nepabumna Syncline on which are superimposed more localised folds.

The north-westerly trending Mount John Fault Zone enters the area near Italowie Gorge and traverses about 2½ miles of the northeastern corner. Copper and mercury ofcur in this fault zone about 10 miles to the southeast of Italowie Gorge, outside SML 530. Two other long faults traverse the Pound Quartzite in the northeastern corner of the area.

Three small diapiric masses, of the type characteristic of Flinders Ranges geology, occur in the area. Progressively intruded during the deposition and folding of the adjoining strata, they consist of a jumble of large and small blocks with a wide variety of compositions. Nantawarrina Diapir is the largest of the three diapirs but only its northern quarter is included in SML 530.

As far as is known the area has been subject to subaerial erosion and weathering since its folding in

the lower Ordovician.

Residuals of Telford Gravel, silcrete, laterite and ironstone are found capping hills and ridges throughout the area. Modern gravel deposits occur along the courses of the main streams.

The topography is dominated by a high ridge of Pound Quartzite which forms the perimeter of the prospect and reaches elevations of 3442 ft. at Mt. McKinlay and 2017 ft. at Hawker Hill. Within the saucer-shaped area so created the topography is hilly, with steep slopes common in the limestone areas. Extensive flats are rare.

The drainage is highly dendritic. Water flow is restricted to short periods immediately following the rare heavy falls of rain. The principal watercourse is Mount McKinlay Creek which rises in hills about four miles west of the area, enters it at about the middle of the western boundary, curves around to the south and leaves when traversing the Nantawarrina diapir on the southern boundary. Mt. McKinlay Creek is joined by three substantial tributaries from the north. The west fork of Italowie Creek rises around Mount McKinlay and flows out of the area through Italowie Gorge.

ECONOMIC GEOLOGY

A small number of minerals of economic interest ~~is~~ are known to occur in the area but no mining or quarrying has taken place hitherto.

Of principal interest are the long-known association of:

(1) lead, zinc, silver and copper with the lower Cambrian strata in the Flinders Ranges. Recent prospecting in adjacent areas (puttapa, Moro, Ediacara and others) has been summarized by Johns (1970).

(2) copper and minor barite with diapiric piercement structures in the Flinders Ranges. Of the three diapirs falling within SML 530, only for the Nantawarrina diapir is a metallic mineral occurrence recorded - as a 'copper occurrence', on the Balcanoona Sheet.

Work by previous leaseholders on various parts of SML 530 and described in their open-file reports was mainly devoted to geochemical soil, stream sediment and rock sampling of the lower Cambrian area. Little attention seems to have been paid to the diapirs. None of the investigations were pursued to the stage of employing geophysics or drilling and none revealed significant mineralization.

A small area of Umberatana Group dolomitic strata is shown on the Balcanoona Sheet outcropping in the extreme northeastern corner of SML 530. It is possible that these strata may include a magnesite bed similar to that which is worked intermittently in a rather inaccessible locality some six miles to the northeast. Since adequate supplies of magnesite are already available and the locality in question is extremely inaccessible any deposits there are unlikely to

be economically workable.

A search undertaken in 1964/65 by the B.H.P. Company appears to have established that phosphate is not present in economic concentrations.

RESULTS OF THE PRESENT STUDY

In the light of available data the two principal targets adopted for exploration were the lower Cambrian Parachilna Formation and the lower half of the overlying Wilkawillina Limestone, and the diapiric masses. A third exploration target was the short section of the Mount John Shear Zone which lies within the prospect, north of Italowie Gorge. Finally, evidence of faults and shear zones in the axial regions of the second-order folds affecting the Nepabunna Siltstone and Parara Limestone was sought since such fractures could have provided suitable sites for the deposition and concentration of any sulphides mobilized at depth by the folding processes.

Outcrop in the area is generally excellent. Since areas distant from the few tracks had to be reached on foot, coverage was restricted. 140 rock and two soil samples were collected; nineteen were submitted for "scan" type geochemical assay. The results are given in Table I and sampling locations are shown on the accompanying plan S/KE/102.

Wilkawillina Limestone: Individual beds are buff-grey in colour, from two to forty feet thick, laminated to

massive in structure, and in composition range from limestones to dolomites and marls with occasional shale and siltstone intercalations. A variety of depositional structures are present and it is evident that some tectonic disturbance of the strata occurred during their deposition. Being on the whole very competent, the beds have suffered some strike faulting in zones of tight folding in the second-order synclines near Italowie Gorge and southeast of Mount McKinlay. Some beds are dark grey and apparently highly carbonaceous. The assay of Sample Y.41 shows no anomalous metal content, but does suggest that the dark colour of the rock may rather be due to the presence of manganese, perhaps as finely disseminated oxide.

Bands containing limonitic pyrite pseudomorphs in varying degrees of abundance are widespread. The pseudomorphs are mainly ½ to 2 mm. in size, a few reaching 5 mm. They commonly occur along preferred bedding planes and rarely transverse to them. Sample Y.34, consisting largely of pseudomorphs, was assayed in order to obtain an estimate of the maximum probable non-ferrous metal content. The values obtained are not encouraging and support the findings of previous leaseholders.

Only a little fresh pyrite and scattered grains of other sulphides were found. Joints and minor fault fractures were found to be partially filled with secondary iron and manganese oxides. There was no evidence that they had ever

contained sulphides.

Samples were collected at 100-foot intervals along a one-mile traverse of the Parachilna Formation and lower Wilkawillina Limestone in the area northwest of Hawker Hill. In the absence of obvious sulphides two samples containing pyrite pseudomorphs, Y.113 and Y.128, were selected for assay. Neither had anomalous metal content.

All samples collected were examined in ultraviolet light for willemite, scheelite and autunite, but none showed anomalous colours.

The Parachilna Formation, composed of thin red and green sandstones, siltstones and sandy dolomites usually occupies a half-mile wide strip in the foothills bordering the Pound Quartzite ranges. Sample Y.85, obtained on the one-mile traverse mentioned above, had a slightly high zinc content, confirming previous findings and representing the most zinc enriched sample obtained in the area. Taken with previous results showing this slight enrichment to be confined to a narrow belt, further investigation does not appear justified.

The Parachilna Formation is marked by a chain of discontinuous manganiferous laterite cappings, two to five feet thick. Their non-ferrous metal content appears not to be anomalous (sample Y.5). The duricrusted Tertiary land surface is well developed on the formation in the southern part of the area and excellent sections of the lateritic soil profile

are exposed in gullies, the pallid zone giving the appearance of a quarry or spoil heap when viwed from a distance. They do not appear to be of economic interest (sample Y.44).

Diapirs. The part of the Nantawarrina Diapir within SML 530 has an area of about two square miles. It is hilly to undulating and composed of a jumble of blocks ranging in dimensions from one hundred yards downwards. Lithologies observed embraced sedimentary, igneous and metamorphic types. The diapir appears to resemble other better studied diapirs of the region. Of the results for samples Y.5201, 5202, 53 and 54 only that for copper (540 ppm.) for Y.5201 was abnormal. These samples were collected near Mount McKinlay Creek.

The only substantial signs of mineralization found were situated at the "copper occurrence" marked in the Balcanoona Sheet and consisted of malachite-green stains in buff ?calc-silicate hornfels scattered over an area of about one hundred square yards. Of the samples tested (Y.57, 58, 59, 62, 68, 69) only Y.58 with obvious green staining yielded a significant result - 1.48% copper. A tin result, 0.13%, for Y.62, an aplite, was barely anomalous. Neither soil sample (Y.68, 69) gave other than background values, although Y.68 was obtained from a site only a few inches from Y.58.

An aeromagnetic survey of the region by the Bureau of Mineral Resources at 500 feet above ground revealed a distinct positive anomaly with local relief of 220 gammas

over the northwestern margin of the diapir. The flight-line which yielded this anomaly lay about a quarter of a mile south of the southern boundary of the SML, placing the anomaly half a mile south of the copper showing. Since no abnormally magnetic rock types were observed at the surface in that part of the diapir it is possible that the magnetic anomaly derives from a magnetic body at depth - perhaps a basic intrusive mass which could have been responsible for the copper mineralization.

It must be emphasized that the inspection of the complex diapir was restricted by circumstances to about five hours and was at best cursory. A thorough follow-up study requiring about two weeks' work is required and could best be carried out by an experienced prospector with detailed geological mapping of any discoveries he might make.

The diapir at the southern foot of Mt. McKinlay was found to be smaller than is shown on the Balcanoona Sheet, and no promising indications were discovered (sample Y.12).

The diapir in the far northeastern corner of the prospect was inaccessible in the available time. It also is small and no published record of mineralization in it is known.

The Mount John Fault Zone lies in rough country on the eastern flanks of the Pound Quartzite ridge and is not easily accessible. It was reached at a point about one third of a mile northwest of Italowie Well. It is characterized by assorted rock fragments enclosed in a foliated green matrix.

No evidence for mineralization (sample Y.28) was found at this locality but disseminated chalcopyrite and pyrite were observed in the hill adjacent to Italowie Well, in the Aboriginal Reserve.

Nepabunna Siltstone and Parara Limestone. Apart from a well-developed cleavage in the less competent shaley beds, and some minor shears no significant structures and no evidence of mineralization was found.

CONCLUSIONS AND RECOMMENDATIONS

1. The data confirm results obtained previously by other licensees which indicate that the Cambrian sedimentary area is unprospective for economic mineralization.

2. The Nantawarrina Diapir contains a proven copper showing the detailed geology of which and relationship to the local aeromagnetic anomaly require investigation.

3. The Nantawarrina Diapir, due to its complexity, deserves thorough surface prospecting.

4. The northern diapirs and the Mount John Fault Zone appear on the basis of limited sampling to be unprospective, but it would not be unreasonable to pursue further prospecting in order to improve the extent of the existing sampling.

5. Work under items 3 and 4 should receive priority and could best be carried out by an experienced prospector, who could usefully spend about three weeks on the work if

the full program were adopted. Geological follow-up could then proceed if the results warranted it.

REFERENCE

Johns, 1970. Exploration for Base Metals within Lower Cambrian Sediments of the northern Flinders Ranges. S.Aust. Mineral Resources Review, 128: 8 - 10.

A.A. Day

30.4.71

ASSAY LABORATORIES PTY. LTD.

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NICKELMINESAUST.

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Phone:
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March 24, 1971.

Mr. A.A. Day,
P.O. Box 90,
ROSEVILLE. N.S.W. 2069.

Dear Sir,

Herewith are the results of 35 samples received from you. Our Ref. No. S 876/1233/1234/1235/1236.

Sample Euler.	Cu. ppm	Pb. ppm	Zn. ppm	Ag. Oz/T	Mn. ppm	Ni. ppm	Mo. ppm	Sb. ppm	Sn. ppm	W. ppm	As. ppm	U. lb/T	P_2O_5. %
Y5	75	30	230	0.09	1645	180	NIL	47	262	NIL	NIL		
Y12	90	47	65	NIL	35	100	32	NIL	525	100	NIL		
Y28	20	NIL	20	0.04	150	110	32	47	NIL	120	193		
Y34	1300	1275	820	Insufficient Sample	800	320	Insufficient Sample		NIL	NIL	Insufficient Sample		
Y41	40	200	75	0.09	1445	50	32	95	NIL	NIL	386		
Y44	65	30	40	Insufficient Sample	70	240	32	47	NIL	287	NIL		
Y53	40	15	15	NIL	257	200	32	47	525	245	193		
Y54	40	65	20	Insufficient Sample	1755	40	32	NIL	NIL	30	386		
Y57	82	15	45	0.04	1250	75	NIL	47	NIL	15	386		
Y58	1.48%	65	82	0.07	1695	30	32	47	NIL	150	579	0.047	
Y59	152	30	45	0.04	1097	75	32	95	NIL	110	386		
Y62	120	100	125	Insufficient Sample	1645	62	32	47	1312	15	386		
Y68	120	47	57	0.02	550	100	65	47	525	150	NIL		
Y69	65	30	45	0.04	700	100	32	47	525	NIL	386		
Y85	145	30	915	0.04	485	180	65	NIL	NIL	15	193		
Y113	152	330	160	Insufficient Sample	1590	320	32	47	787	70	193	0.051	
Y128	65	130	75	0.09	460	50	32	142	NIL	45	193		
Y5201	540	30	25	NIL	190	62	32	47	NIL	10	193	0.027	
Y5202	40	15	25	0.02	135	62	65	47	525	30	NIL		

MINLAB Pty. Ltd.

MINERAL ANALYSTS
CNR. ALEXANDER STREET AND BALGOWLAH ROAD,
P.O. BOX 401, MANLY, N.S.W. 2095
TELEPHONE: 97-4192

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Mr. K. Euler,
6 Beacon Ave.,
BEACON HILL. N.S.W.

28th October, 1971.

ASSAY RESULT - MT. McKINLAY S.A.

SAMPLE	CU ppm	Pb ppm	Zn ppm
7	75	30	185
9	160	90	95
10	105	45	110
15	45	70	70
16	60	75	85
17	35	60	20
23	85	40	65
26	52	35	80
27	76	15	110
30	4140	1110	540
31	3185	780	1180
34	210	160	230
37	3180	40	970
40	94	55	85
41	150	110	75
43	60	70	15
45	140	85	25
48	180	30	25
50	90	NIL	70
51	75	15	45
52	105	35	180
56	75	48	30
58	82	210	210
60	90	80	95
64	1115	635	882
65	1205	210	245
66	870	185	670
69	84	15	140
73	100	30	70
75	86	85	215
77	2194	438	885
79	35	70	40
80	215	30	35
83	165	416	115
85	90	110	75

MINLAB Pty. Ltd.

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ASSAY RESULTS - MT. McKINLAY S.A. CONT'D.

SAMPLE	CU ppm	Pb ppm	Zn ppm
86	100	70	110
87	40	185	40
92	1360	75	160
94	2810	90	140
95	1560	110	85
98	3420	75	200
100	1.08%	300	85
101	1.35%	210	175
102	0.94%	85	860
104	0.68%	300	780
106	1.64%	165	610
107	1.02%	180	105
108	2820	385	265

Yours faithfully,

E. Stevens

ERIC L. STEVENS

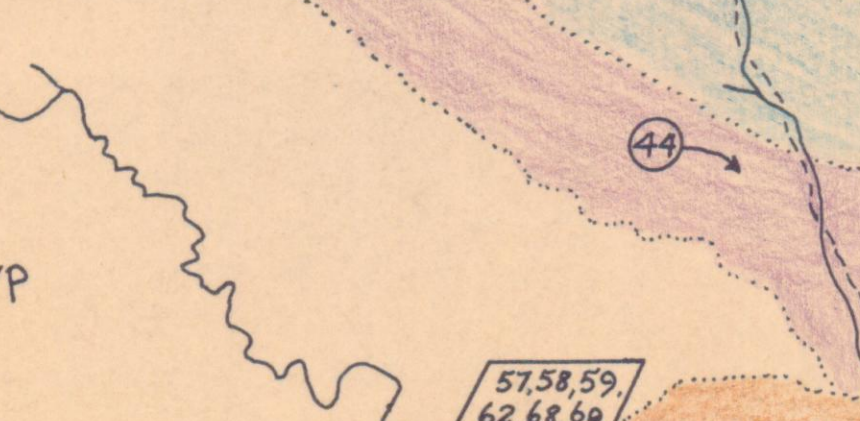
MANAGER.

MOUNT McKINLAY AREA

NORTH FLINDERS RANGES, STH. AUST.

SML 530

GeologicalMap



EXCLUDED

30°30'

Mt. McKinlay 3442

Mt. McKinlay Creek

Nepa-bunna Syncline

Italowie Creek

Italowie Gorge

CRUSH ZONE

Mt. McKinlay Creek

Hawker Hill

30°36'

30°40'

139°00'

139°07'

139°10'

12 5 28 128 113 85 34 41 44 57,58,59, 62,68,69 54 52,53

Cambrian

- €hr Parara Limestone
- €hn Nepabunna Siltstone
- €hw Wilkawillina Limest.
- €hp Parachilna Form'n.

Precambrian

- Pwp Pound Quartzite
- Puc Balcanoona Form'n.
- Pub Bolla Bollana Form'n.
- Pc Diapiric Breccia

Geological Boundary

Fault

Specimen Location (at tip of arrow)

Road, track

Watercourse

Tertiary & Quaternary not shown.
Geology based on Geological Survey of South Australia Sheet 6/641 'Balcanoona'.

Compiled and drawn: AA Day
April 1971

S'KE'102

ENV 1611-1

MOUNT McKINLAY AREA

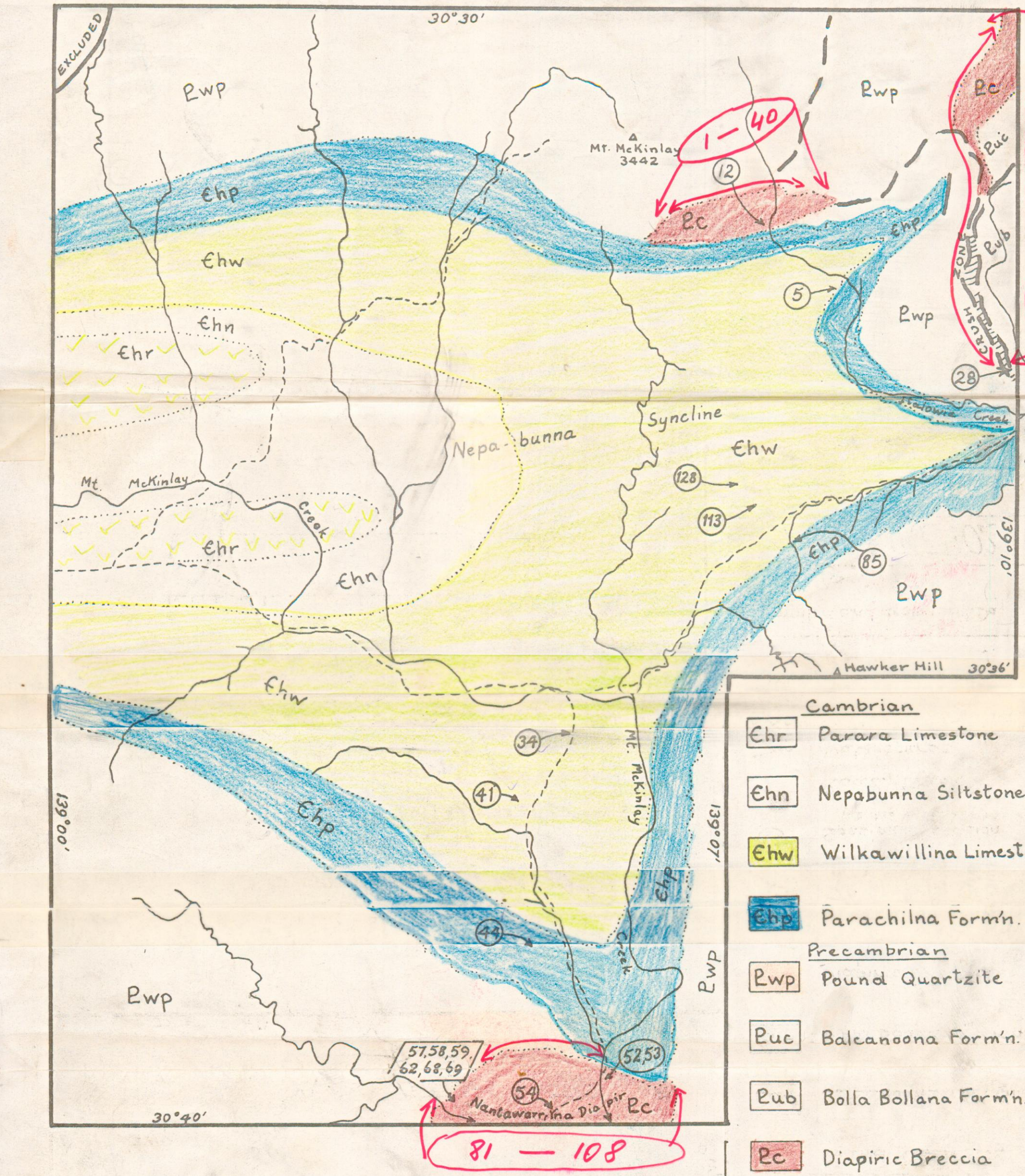
NORTH FLINDERS RANGES, STH. AUST.

SML 530

Geological Map

1 — 40

SAMPLE LOCATIONS
BY K. EULER
NOV. 1971



Cambrian

- Ehr — Parara Limestone
- Ehn — Nepabunna Siltstone
- Ehw — Wilkawillina Limest.
- Ehp — Parachilna Form'n.

Precambrian

- Pwp — Pound Quartzite
- Puc — Balcanoona Form'n.
- Pub — Bolla Bollana Form'n.
- Pc — Diapiric Breccia

- ..... Geological Boundary
- —·— Fault
- (44)→ Specimen Location (at tip of arrow)
- — — Road, track
- Watercourse

Tertiary & Quaternary not shown.
Geology based on Geological Survey of South Australia Sheet 6/641 'Balcanoona'.

Compiled and drawn: AA Day
April 1971

S'KE'102

0 1 2 3 4 MI.

0 1 2 3 4 5 6 KM.

ENV 1611-2