Open File Envelope No. 1294

SML 377

BLINMAN

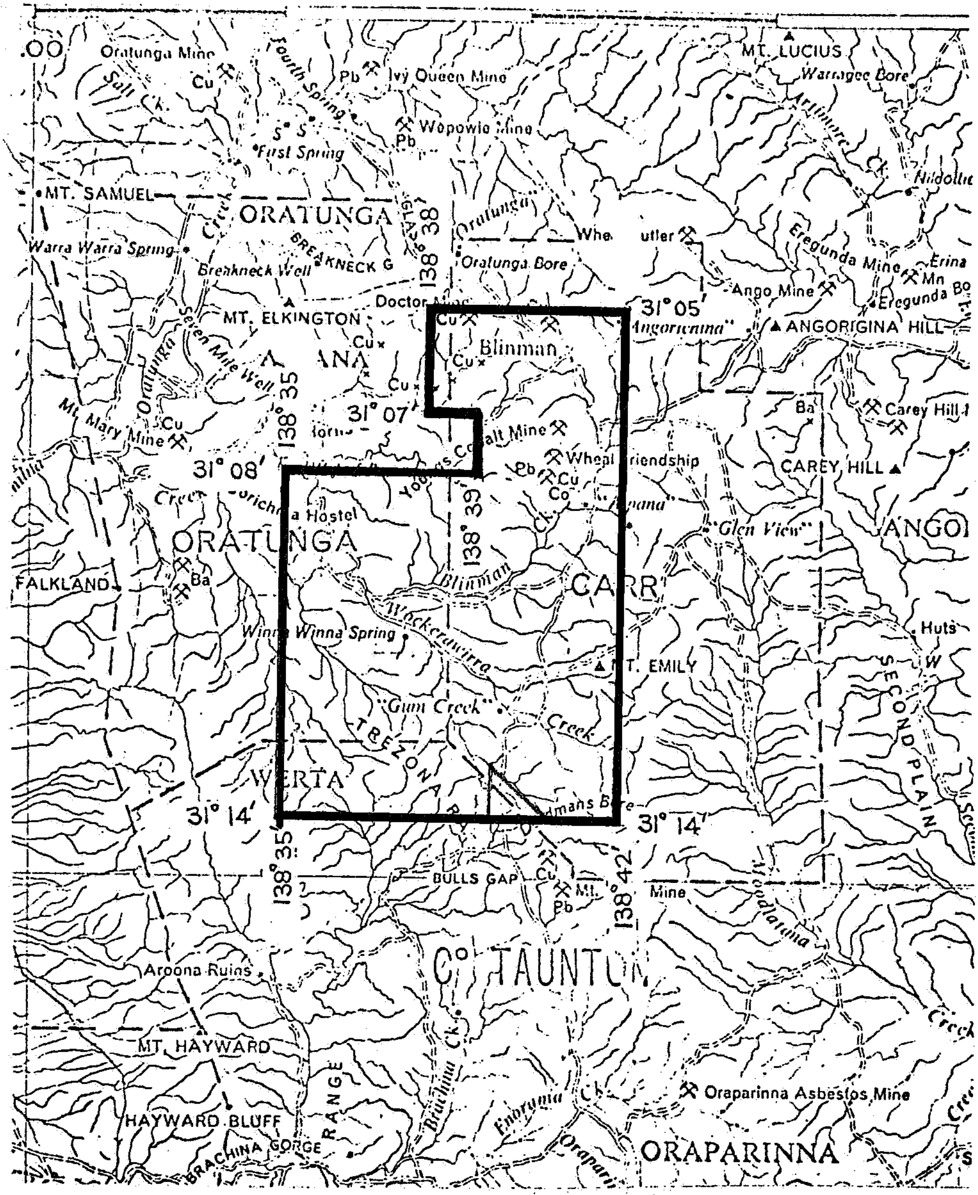
PROGRESS, ANNUAL AND FINAL REPORTS TO LICENCE EXPIRY/SURRENDER FOR THE PERIOD 29/1/1970 TO 28/1/1972

Submitted by
Gold Copper Exploration Ltd
1972

Enquiries: Customer Services Branch
Minerals and Energy Resources
7th Floor
101 Grenfell Street, Adelaide 5000

Telephone: (08) 8463 3000
Facsimile: (08) 8204 1880

Government of South Australia
Primary Industries and Resources SA



GOLD COPPER EXPLORATION PTY. LTD.

DOCKET D.M. 1365/69 AREA 60 SQ MILES

1:250000 PLANS . PARACHILNA.

LOCALITY

S.M.L. No. 377 EXPIRY DATE 28·1·71

CONTENTS ENVELOPE 1294

TENEMENT: S.M.L. 377 - Blinman

TENEMENT HOLDER: Gold Copper Exploration Pty. Ltd.

(1294 continued)

ENV. 1294

0003

GOLD COPPER EXPLORATION PTY. LTD.

S.M.L. 377

BLINMAN AREA S.A.

REPORT ON MINERAL PROSPECTS

By

P. HASLETT.

MINOIL SERVICES

CONTENTS.

INTRODUCTION.

The Blinman Dome Diapir and contained mineral occurrences have been investigated extensively in the past. This report encompasses a study of the previous work in co-ordination with brief field work carried out in the area. The S.M.L. 337 consists of an area of some 60 square miles, the most northern portion of which covers the southern part of the Blinman Dome diapir. To the south, the area of the S.M.L. does not quite reach to the Oraparinna diapir. (See locality map Plate I).

Extensive geophysical and geochemical surveys have been carried out in the area by other companies, since 1967, and detailed mapping of all reported mineral occurrences has been done. The S.A. Dept. of Mines also mapped the entire diapir, in detail, in 1964.

Field work for the present report was aimed mainly at checking information available from other sources, especially with respect to the larger mines of the area. As was expected in an area such as this, which has received so much attention in the past, further work tends to be a re-interpretation of existing information, rather than an addition of any substantial amounts of new geological information.

This report will give a broad account of the geology of the area, with a summary of previous work by other companies. A section will deal with each of the more important old workings within the diapir. Comments and recommendations will follow.

GENERAL GEOLOGY OF THE AREA

The Blinman Dome diapir consists of a zone of extensively brecciated sediments, predominantly siltstones and carbonates. Within the brecciated material are rafts of rock of a wide variety of origins. The rafts have varying lithology, shape, size and distribution. The largest raft is of the order of miles in size but the vast majority range from several hundred feet down to a few inches. The diapiric core complex is rimmed by upwarped "country" rock.

Copper mineralization may be found within this heterogeneous assemblage of rocks constituting the diapir core. The bulk of the mineralization occurs in rafts, although minor amounts may be found in the breccia. Rafts of dolomite or dolomitic siltstone have yielded most copper, but low grade mineralization is known to exist in rafts of basic volcanics and in so-called dolerites (Coats 1964). No significant copper mineralization has been reported from the rim rocks of the diapir.

SUMMARY OF PREVIOUS WORK

This area has received considerable attention since the earliest days of the discovery of copper in the Flinders Ranges. However, despite such attention, no economic deposit of any size, except the Blinman Copper Mine, has been discovered. More modern geophysical and geochemical techniques also, to the present time, have been unsuccessful.

Detailed geological mapping of the area by Coats (1964) did not result in the discovery of any new major mineralization, although the work was done in a critical and thorough manner. Subsequently the lease over the area was taken up by Metals

Exploration in 1966. An induced polarization survey was undertaken, seeking a large "porphry copper type deposit". Three anomalies were located, two of which were drilled with negative results. Neither anomaly coincided with old workings or any known surface mineralization. That is, no anomalous values were found over any mines, including the Blinman Copper Mine.

The same company also undertook broad gravity and magnetometer surveys. The earlier gravity survey showed a regional low over the diapir centre and bore no particular relationships to areas of known mineralization. Magnetometer results did not show any relation to old workings or to the I.P. anomalies, and in general only registered high values over dolerites and heavy mineral layered sediments.

A geochemical soil sampling orientation survey done at points of magnetometer readings, yielded negative results. A general stream sediment geochemical survey which was carried out in 1967 by the S.A. Dept. of Mines, was supplimented by a detailed survey carried out by Noranda Aust. Ltd. Theresultant information was found to indicate a number of anomalous areas, some of which are associated with old workings. (See Plate Vl) All the anomalies were investigated but no new deposits of significance were found. The method was considered to be unreliable due to the fixing of copper released from dolomites close to the source, thereby limiting dispersion. However, slightly mineralized breccia, which weathers easily, is thought to release copper and cloud any anomalous results. Soil sampling was also attempted but abandoned.

Noranda reviewed the earlier geophysical work and considered that the I.P. anomalies were not satisfactorily explained. They undertook further shallow drilling in the area of the Alpana anomaly.

The subsequent explanation of the anomaly also seems inadequate (See below). A very detailed consideration of the geology and geochemistry around old workings in the area was carried out by Noranda. This work was checked during the present field work, and in the most part confirmed with regard to the major mines. A detailed consideration, both on surface and underground, of the Blinman mine resulted in the recommendation to Noranda that a hole should be drilled to test possible northern extensions of the lode horizon. This hole was not drilled, apparently because the option on the claim over the Blinman Copper Mine was taken over by Mr A.E. Norris in August 1968.

SUMMARY OF THE LARGER MINES WITHIN S.M.L. 377

As stated above, detailed investigations of all known mineralization was undertaken by Noranda Aust. Ltd. Soil and grab samples were collected around major workings, and in the present study, this previous work could not be challenged in any significant respects. In some cases additional facts were noted, but in most cases recent work was in close agreement with the work done by Noranda. For mine locations see Plate 11.

Blinman Copper Mine (See Plate 111)

This mine is the largest in the area, penetrating some 600' into a raft of dolomite and dolomitic siltstones, which extend over a length of some 1400' on the surface, in an approximate N-S direction. The "Mine Dolomite" is up to 100' thick (although this thickness was not mined) and dips almost vertically at the surface, with dips flattening off slightly to the east at depth. The dolomite appears to be cut off by a fault at the southern extremity of the mine, the southern block being displaced east. No evidence of direction of fault displacement was seen by the writer. The extension of the dolomite horizon for some 250'-300' north of the old workings, as reported by ~~Anaconda~~ Noranda, has been confirmed by the present survey. The mine dolomite however becomes considerably thinner, and was apparently not worked below the 35 fathom level at the northern limit of the mine.

Noranda recommended in a comprehensive report produced on the mine that a 500' diamond drill hole be drilled to test the existance of the northern orebody at depth. There is a possibility that such a hole would reveal mineralization in amounts which would warrant re-opening of the mine. However the possibility does not seem very good. Such mineralization, if present in the first hole, would need to be proved over a much larger area by extensive diamond drilling. However at the present stage, expenditure on one diamond drill hole, as recommended by ~~Anaconda~~ Noranda, is warranted.

YOUNG COBALT MINE

This prospect consists of two shafts and several shallow workings in a small dolerite plug within diapiric breccia and around its margins. Mineralization is reported to have occurred in thin quartz-ironstone veins within the dolerite. Copper, cobalt, nickel and silver were apparently mined in small amounts from the dolerite. The small size of the prospect makes it unlikely that it would be of any economic importance.

WHEAL FRIENDSHIP MINE (See Plate 1V)

This mine is located on a small contorted block of "mine type" dolomite. Two shafts and numerous shallower workings have been sunk on the block, and secondary copper minerals may be found on the surface around the old workings. Malachite and azurite occur along joints and fractures in the rock. Blebs of chalcopyrite and chalcocite have been reported by Noranda but were not seen by the writer. Good outcrop of the dolomite is not seen in the region of the mines, most material being highly broken up and weathered. Geochemical samples were taken from the bedrock surface during the survey by Noranda, by auger drilling through the widespread alluvial cover. The samples did not reveal any significant extensions of the small raft. In agreement with previous workers, the writer feels that this prospect is also unlikely to prove suitable for future development.

COBALT MINE (See Plate V)

Narrow stoping to a depth of some 40' has been undertaken in places along a band of dolomite and dolomitic siltstones, which extend along strike for a distance of some 500'. The stopes are almost vertical and up to 6' in width. Coats (1964) considers the dolomite to be of the "Mine type" although it seems that any dolomite in the area which is mineralized, will qualify to being called "mine type" ddomite. The dolomite in this case has no particular distinctive qualities except that it contains secondary copper minerals in joints and fractures on the surface. The grade of the mineralized band is generally low. The length of the raft is certainly restricted to 500', as good breccia outcrop exists at both ends of the mineralized zone. It is considered that the low grade and restricted extent of the lode, detracts from the possibility that this prospect could be developed economically.

BROWN'S PROSPECT

A shaft and a pit have been sunk on a relatively large raft of shales and dolomitic siltstones which contain secondary copper minerals disseminated over a width of up to 30', but generally much less. The length of the mineralized zone may be up to 200', being cut off by a dolerite dyke to the north-west, and diapiric breccia to the south-east, under alluvial cover. The variable width and low grade make this prospect unattractive.

DOCTOR MINE

A number of shallow workings have penetrated a very small (150') dolerite plug which contained some copper mineralization. It seems unlikely that a significant orebody would exist in a prospect this size.

GENERAL COMMENTS ON SOME ASPECTS OF S.M.L. 377

GEOLOGY

As has already been stated, the geology within the diapir core is complex, and a purely geological approach to exploration is unlikely to be successful. However some possibilities still exist. An example of this is the discovery of chalcopyrite in a presumed meta-quartzite, just north of the road leading from Blinman to Oratunga, during the present field work. The sample S1, appears to contain significant mineralization, and if assay results are favourable, more detailed investigations of the outcrop, including mapping, may be warranted. In general however, surface mapping at this stage is considered very unlikely to reveal any new mineralization of significant economical importance.

MINERAL CLAIMS AND OLD WORKINGS

All of the old mines examined by the writer showed little or nothing to recommend them for further investigation. This is with the exception of the Blinman Mine itself, where a diamond drill hole to test for the northern extension of the lode at depth is warranted.

GEOCHEMISTRY

Judging by the experience gained by earlier detailed soil and stream sediment surveys, it seems that such geochemical techniques are not suited to the particular geological environment of the area. Geochemistry would therefore seem to be an unreliable exploration tool for further work.

GEOPHYSICS

Induced polarization is the only geophysical method used thus far to produce any reasonable anomalies, during a broad scale survey. However drilling of the anomalies has been negative in both cases. The explanation that graphite in shears caused the Oratunga anomaly seems feasible. However neither explanation for the negative drilling results over the Alpana anomaly seems particularly satisfactory. After completing a 380' hole, Metals Exploration N.L. explained the anomaly by heavy mineral layering in sandstones. However such sandstones are found in surface outcrop over wide areas of the diapir (See Coats' Map 1964) and these did not register on the I.P. survey. Noranda subsequently drilled 12 Auger holes of average depth 23' over the anomaly area. This merely enabled geochemical sampling at the top of apparently flat-lying bedrock. The anomaly was explained by the possibility that a stratum of coarse hematite boulders may be present in the overburden because 5 of the 12 holes recorded hematite present. This explanation does not seem particularly convincing.

Reinterpretation of the I.P. anomaly at the Alpana Anomaly is warranted as it may not have been satisfactorily tested. Geophysical reassessment of the Central Anomaly detected by I.P. by Metals Exploration N.L., but never drilled is suggested.

RECOMMENDATIONS

Taking into consideration the amount of work which has been done on the area and the contained mines, it is not likely that any further significant copper mineralization will be found at the surface, or at shallow depth in the area. However, some possibilities still exist. Recommendations for further exploration are as follows:

1. Depending on assay results, mapping and geological investigation of the meta-quartzite outcrop north-west of Blinman.
2. A 500' diamond drill hole, as planned by Noranda Aust. Ltd. to test for extensions of the northern lode at the Blinman Copper Mine.
3. Reinterpretation of the I.P. results for the Alpana Anomaly, and for further geophysical exploration in the area, particularly with regard to the Central I.P. Anomaly.

Adelaide
10th April, 1970

for E R Hillwood
P. Haslett,
Geologist,
MINOIL SERVICES.

REFERENCES.

McPhar Geophysics Ltd., March 1966.
Report on I.P. and Resistivity surveys for Metal Exploration N.L. - (7pps + plates)

R. Hare & Associates, March 1966
Progress report No 1 for Metals Exploration N.L. (9 pps + 5 plates)

R. Hare & Associates, March 1967
Progress report No 3 for Metals Exploration N.L. (12 pps + 3 plates)

Noranda Aust. Ltd., August 1968
Report on S.M.L. 377 (4 pps)

Noranda Aust. Ltd., November 1968
Report no 107 on S.M.L. 377 (41 pps + 17 plates)

Noranda Aust. Ltd., June 1969
Final report no 116 on S.M.L. 377 (10 pps + 1 plate)

S.A. Dept. of Mines, 1964
The geology and mineralization of the Blinman Dome diapir, by R. P. Coats (51 pps + map)

APPENDIX I.

Descriptions of Sample S1.

Hand Specimen

The hand specimen is a dense, highly indurated, crystalline rock, of reddish brown colour and with some minor, irregular areas of chalcopyrite.

Thin Section

On microscopic examination the rock was found to be almost monomineralic. The major mineral was isotropic, and had the optical properties expected of a garnet. Minor quartz was also present, but opaque minerals were completely absent. The texture was unusual but did not seem indicative of any particular rock history.

Mineral Present	Estimated Proportion
Garnet	95%
quartz	5%
Opaque (e.g. sulphides)	Nil

X-ray Analysis

An X-ray Powder Photograph was taken of the rock using a cobalt tube and iron filter. This confirmed the microscopic identification of the major mineral as being the garnet, andradite, with minor quartz also present. Andradite $Ca_3Fe_2(SiO_4)_3$ is apparently commonly found in contact metamorphosed limestones.

CONYNGHAM ST. FREWVILLE SOUTH AUSTRALIA 5063 TELEPHONE 79 1662 TELEGRAMS 'TELEX' AA82520

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

PLEASE ADDRESS ALL CORRESPONDENCE TO THE DIRECTOR.

OUR REFERENCE: AN3/306/0 3712/70
YOUR REFERENCE:

21 April 1970

The Chief Geologist,
Gold Copper Exploration Pty Ltd,
C/- Minoil Services,
8 Bransby Avenue,
NORTH PLYMPTON SA 5037.

APPENDIX II.

REPORT AN3712/70

YOUR REFERENCE:	Application Dated 10.4.70
MATERIAL:	Rock chips
IDENTIFICATION:	PHB 1
DATE RECEIVED:	13.4.70

Enquiries quoting AN3712/70 to Officer in Charge please.

Analysis by: A.E. Francis

Officer in Charge, Analytical Section: A.B. Timms

for N. Draper
Director.

pkm

FORM 12 JOB 3712/70

AMDEL GEOCHEMICAL SERVICE

BATCH NO. 1

TT	Sample No.		% Cu						
1	PH B-1		0·08						
2	Std 402								
3	PH B-1		0·08						
4	Blank								
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

Batch 1
Results in %

0018 Env 1294

RECEIVED
17 AUG 1970
DEPT. OF MINES
REGISTRY

on behalf of:-

GOLD COPPER EXPLORATION LTD

S.M.L. 377 - BLINMAN AREA

2nd QUARTERLY REPORT, 1970.

S.M.L. 377 covers an area of some 60 square miles surrounding the township of Blinman in the Flinders Ranges.

During the quarter, Gold Copper Exploration Ltd. terminated their agreement with Minoil Services and have appointed Robertson Research (Australia) Pty. Limited as Geological Consultants and Contractors. Due to this changeover and consequent re-orientation of geological approach, work has been largely confined to comprehensive literature surveys, re-assessment of previous work and visits to selected areas by personnel of Robertson Research (Australia) Pty. Limited. Planning of further work is well advanced, several areas of interest having been defined.

On the advice of Robertson Research (Australia) Pty. Limited, Gold Copper Exploration Ltd. has suspended plans for the drilling of the Blinman Mine until further geological studies can be made.

John Ross.

J. Ross
Chief Geologist
Robertson Research (Australia)
Pty. Limited.

13th August, 1970.

S.M.L. 377 (Blinman).

INTERIM 3 MONTHLY PROGRESS REPORT (29 JULY - 29 OCTOBER, 1970).

for

GOLD COPPER EXPLORATION LTD.

A preliminary prospect investigation and sampling programme has been carried out in the lease area. Most of the known prospects and mineral occurrences occur in the diaper zone. These areas of mineralisation have been channel or bulk (200 - 500lb) sampled. These samples are being currently analysed.

Mineralisation is predominantly associated with dolerites within the diapiric zone. This may be in the form of malachite or azurite staining along joint fractures while locally veining is developed containing calcite, siderite, malachite, azurite, chalcopyrite, pyrite, hematite or quartz. The veins in the dolerite tend to be sporadically developed, erratic in width and are locally faulted.

Mineralisation is also associated with rafts of sedimentary rocks in the diapiric ground mass. In shales and impure limestones, malachite - azurite staining along bedding and jointing occurs while occasional veining by calcite, siderite, malachite, or hematite is noted.

An orientation stream sediment survey has been carried out to study the dispersion of Cu with relation to coprecipitation effects with Fe or Mn, influence of pH, and anomaly contrast relative to grain size. Analytical results from this survey are awaited.

A study of previous literature has been completed.

The immediate programme will involve:

(i) Detailed geological and geochemical investigation selected prospects.

(ii) A regional geochemical stream sediment sampling programme in the area of the S.M.L. outside the diapiric breccia zone.

(iii) Local geochemical stream sediment sampling programme at selected areas within the diapiric zone.

Alastair G. Brown

Alastair G. Brown,
B.Sc., M.Sc., D.I.C., Ph.D.,
Senior Geologist,
Robertson Research (Aust.) Pty., Ltd.

0020

RECEIVED
8 JAN 1971
DEPT. OF MINES
REGISTRY
1294

Interim Report on Special Mining Lease 377 (Blinman)

for

Gold Copper Exploration Ltd.

1. Introduction

The lease has an area of 60 square miles and the township of Blinman is located in the north-east corner of the lease area.
Approximately 1/6th of the area (11 square miles) is underlain by rocks belonging to the Blinman diapiric mass while the southern region is underlain by sediments of the Umberatana Group of the Adelaide System of Proterozoic age.

Robertson Research (Australia) Pty. Ltd., has been in charge of the geological investigations since September, 1970.

2. Present Investigations

2.1 Stream sediment geochemical survey

During 1957, a geochemical stream sediment survey was conducted over the 17 square miles of the Blinman diapir (Binks, 1968). The survey resulted in 450 samples collected at quarter mile intervals giving a density of 25 samples per square mile. Several Cu, Zn and Pb anomalies were located not associated with known mineralisation. As only one anomalous sample was detected in the creek draining the Blinman Mine, it was concluded that a sample interval of less than a quarter of a mile is required.

In 1968, Noranda Australia Ltd. resampled the diapir zone. A total of 618 samples were collected over most of the 35 square miles of the lease, giving a density of 42 samples per square mile. No new significant mineralisation was detected.

Although the sedimentary rocks to the south of the Blinman diapir are potentially mineralised, no geochemical sampling has been carried out. Consequently a regional stream sediment programme will commence within the next two weeks and will cover the 49 square miles of the lease area which lie outside the diapir area. As a result of work carried out by previous geochemical programmes in the Blinman area, and from data obtained from orientation studies conducted in similar environments by Robertson Research (Australia) Pty. Ltd., it would appear that for the detection of anomalies of elements such as Cu, a sample density of 10 samples per stream mile is a minimum requirement. Consequently a total of approximately 1,000 samples will be collected and will be analysed for Cu, Zn, Pb, Fe, Mn, and Ba. In addition, samples selected from the main drainage areas will be analysed for 29 elements.

An examination of the results of previous geochemical stream sediment programmes is in progress. Although previous sampling has been comprehensive, a check will be carried out in selected localities while certain known stream anomalies may require further interpretation. However it is not anticipated that much stream sediment sampling will be carried out in the diapir area.

2.2 A photogeological interpretation will soon commence to determine structural features in bedrock in the lease area. Several major faults transect the sedimentary rocks near the southern section of the diapir zone and will require detailed study, as some of the known mineralisation in the Blinman area appearsto be strongly associated with major faulting.

2.3 A preliminary survey of the major prospects in the lease area has been completed, and all workings have been entered where possible. The prospects have been channel, chip or dump sampled and are being analysed for Cu, Zn, Ni, Co, Ag and Au content. In addition selected samples are being analysed for 29 elements. Results have as yet not been received.

Although the major prospects have been well investigated by previous work, further exploration is required in the vicinity of some of the prospects. The possibility of Cu mineralisation associated with doleritic intrusions in the Blinman diapir zone requires further investigation.

3. Future programme

3.1 Following the examination of the results of the regional stream sediment programme, any valid anomalous metal concentrations will be investigated. This will involve close-spaced, follow-up stream sediment sampling and, if beyond the stream bed, the source of mineralisation will then be traced by soil sampling, auger sampling and ultimately by costeaning or local percussion drilling as required.

3.2 Any prospects located during the regional geochemical programme and as yet not examined will be investigated. Further examination will be carried out at selected known prospects with emphasis on the extension of mineralisation from known workings. This may involve soil geochemistry, geophysics and limited drilling.

3.3 The investigation of the overall geological structure in the lease area will be completed. It is hoped that the ensuing interpretaion will give a better understanding of the overall controls of mineralisation in the vicinity of the Blinman diapir.

References

Binks, P.J. 1968 Geochemical Drainage Survey of the Blinman Dome Diapir. S. Aust. Mineral Resources Review, 128, 86-90.

Alastair G. Brown

Alastair G. Brown,
B.Sc., M.Sc., D.I.C., Ph.D.
Senior Consulting Geologist
Robertson Research (Australia) Pty. Ltd.

0022

ROBERTSON RESEARCH (AUSTRALIA) PTY. LTD.

TWELVE-MONTH REPORT ON SPECIAL MINING LEASE 377 (BLINMAN) ON BEHALF OF GOLD COPPER EXPLORATION LTD., FOR THE PERIOD 29TH JANUARY, 1970 TO 29TH JANUARY, 1971.

Alastair G. Brown, B.Sc., M.Sc., D.I.C., Ph.D.

David A.A. O'Connor, B.Sc.

January, 1971

Prepared for:

Gold Copper Exploration Ltd.,
28 Gover Street,
North Adelaide, Sth. Aust., 5006.

CONTENTS

1. INTRODUCTION

Special Mining Lease No. 377 is located around the township of Blinman and is 270 miles north of Adelaide. The lease area is 60 square miles, of which the Blinman diapir occupies 11 square miles.

During the early period of the lease tenure, the geological exploration programme was managed by Minoil Services, Adelaide, and since September, 1970, the geological exploration has been conducted by Robertson Research (Australia) Pty. Ltd.

Dr. Brown has carried out the preliminary prospect mapping and examination and has supervised the regional stream sediment programme carried out by Robertson Research (Australia) Pty. Ltd.. Mr. O'Connor has made a geological structural interpretation from aerial photographs.

2. PREVIOUS WORK

Various descriptions of old workings in the Blinman area are reported in the Record of Mines of South Australia (1908).

Between 1908 and 1964 the area was studied by Howchin (1922), Mawson (1942), Dickinson (1944), Howard (1951), Webb (1960), and Mumme (1961).

In 1964, Coats carried out a detailed mapping programme on the Blinman Dome diapir. He concluded that the central diapir core was composed of a breccia with a carbonate matrix and includes exotic blocks of various sizes and lithologies. The dolerites are considered to be preferentially intruded into the diapiric core and are of possible Sturtian or younger age.

Mineralisation in the rocks surrounding the diapir is regarded as conformable, bedded type deposits containing Pb or transverse vein type with Cu. Within the core complex, mineralisation is related to dolomites, melaphyres and dolerites.

In 1966, McPhar Geophysics Ltd. carried out geophysical investigations for Metals Exploration N.L. in the Blinman Dome area. Reconnaissance induced polarisation and resistivity surveys were conducted and detected two anomalous zones. One of the zones, the Alpana anomaly, occurs in the current lease area.

Further studies during 1966 - 1967 by R. Hare and Associates for South Alligator Uranium N.L. included soil geochemical and magnetometer surveys. The soil orientation survey was conducted for Cu, Pb, Zn and Co but no significant metal concentrations were located. The magnetometer survey failed to produce interesting values. Drilling was carried out on the Alpana I.P. anomaly but no sulphide mineralisation was encountered. The anomaly was ascribed to heavy mineral bands in the sandstone-siltstone sequence.

In 1966 the area was mapped as part of the regional programme by the Deptment of Mines of South Australia and is included in the Parachilna 4-mile sheet (Dalgarno and Johnson, 1966).

In 1967, a stream sediment survey was conducted by Binks over the diapir zone (1968). The survey indicated that mineralised areas could be detected by the method, using a sample interval of less than one mile. Several Cu, Pb and Zn anomalies were detected.

From 1968 to 1969, the Blinman Dome was investigated by Noranda Australia Ltd.. Further stream sediment geochemistry supplimented the work of Binks and resulted in an overall density of 42 samples per square mile. Several anomalies were detected but were the result of minor mineralisation. Prospect mapping and local soil geochemistry around the prospects did not lead to any discovery of extensions of known ore bodies. Twelve auger drill holes were sunk on the Alpana anomaly to reinvestigate the cause of the I.P. anomaly. No significant sulphide mineralisation was detected.

A report by Minoil Services for Gold Copper Exploration Ltd. (1970) is essentially an assessment of previous literature.

3. GEOLOGY

3.1 Descriptive Geology

The lease area contains the south-eastern section of the Blinman diapir dome. This zone occupies an area of some 18 square miles. The diapir dome is surrounded by sedimentary rim rocks belonging to the following formations:

Brachina Formation	Wilpena Group	Adelaide System of Proterozoic age.
Nuccaleena Formation		
Elatina Formation	Umberatana Groups	
Trezona Formation		
Enorma shale		
Etina Formation		
Wockerawirra dolomite		
Tapley Hill Formation		
Mount Caernarvon greywacke member		

Within the diapir, blocks of breccia are made up of a variey of sedimentary and igneous rocks. Near the margins of the diapir complex there is a crude preferred orientation of these remnant blocks parallel to the contact with the rim rocks. In addition to the breccia, there are numerous plug-like masses of dolerite.

Abrupt upturning of the rocks surrounding the diapir is noted near the contact of the dome with the country rocks. In some cases the bedding is overturned.

The axis of an anticline strikes southwards from the Blinman dome. In the south-east corner of the lease area horizontal bedding is located on the crest of this anticline.

There is a crude radial system of faults centered on the dome; the faults generally have only minor displacements.

Two sets of jointing occur in the lease area south of the dome structure. The major joint set strikes northnorthwest-southsoutheastwards, while the minor set strikes roughly east to west.

3.2 Structural Interpretation

The core of the Blinman dome appears to be of diapiric origin and to contain intrusive brecciated elements of Willouran rock types.

On the southern side of the Blinman diapir the rim rocks have been observed to dip under the core complex at an average angle of 45°, while on the northern side, the contact is vertical or sub-vertical. The dipping of the rim rocks indicates that the diapir is overturned to the south.

It was suggested that the intrusion of the numerous scattered doleritic plugs supplied the disturbance necessary to initiate the diapiric movement. The discovery of a gravity low over the Blinman structure indicates that there is no large basic-igneous rock body beneath the dome. As with other diapirs in the Flinders Ranges it is considered that the Blinman diapir has been formed mainly because of the plastic behaviour of the Willouran rocks under imposed tectonic stresses.

The radial faults are regarded as being tension fractures caused by the doming movement of the diapir. Variation in thickness of various rock units across these faults indicates that the faults locally controlled sedimentation during deposition of the rim rocks. These variations in thickness, together with the thinning of certain of the surrounding beds as they approach the dome, suggest a long and continuous period of uplift in the dome area.

The preferred orientation of the breccia remnants in the diapir, together with the orientation of banding and the included breccia fragments in dolomites, are considered to have developed parallel to the contact of the diapir with the country rock during emplacement of the diapir.

The emplacement of the dolerites is considered to have been controlled by unique ring structures, the development of which post-dates the youngest phase of intrusion of the Blinman dome diapir.

The major joint set which occurs in the lease area strikes parallel to the anticline axis and is probably axial-planar cleavage.

3.3 Mineralisation

The origin of the mineralisation within the core complex is uncertain. The carbonate veins of the rim rocks are identical to those associated with the dolerites and melaphyres. The absence of visible mineralisation from the carbonate breccia of the core complex suggests that this was not a source for the metalliferous minerals occurring in the carbonate veins.

The mineral occurrences within the core complex are associated essentially with three specific rock types. These are dolomites, melaphyres and dolerites.

The primary mineralisation in the dolomite occurs as small blebs of chalcopyrite, bornite and pyrite. The distribution of these minerals along bedding planes suggests that they possibly have a sedimentary origin. Narrow cross cutting primary sulphide veins which occur indicate mobilisation of the minerals at some stage.

In the melaphyres at Blinman, secondary copper occurs as coatings on joint faces, as infillings of amygdales and occasionally as primary sulphides in carbonate veins. Copper is also associated with a dark banded siltstone which is interbedded with the melaphyres. The common association of copper deposits with melaphyres suggests that the mineralisation was a primary feature associated with the extrusion of these rocks. It is also a feature that copper occurrences in the sediments are more common where they are associated with volcanics.

Metallic minerals associated with the dolerites occur as disseminations in coarsely crystalline carbonate bodies. The carbonate bodies form veins in the dolerites and also halos at the contact of the dolerites with the diapiric breccia.

Alteration of the dolerites has resulted in the liberation of secondary calcite, siderite and magnetite which occur both in the ground mass of the rock and as carbonate-magnetite veins.

Recorded metals associated with the dolerites are copper, silver, lead, cobalt, nickel and iron. The occurrence of magnetite and carbonate in the iron deposits suggests derivation of the iron minerals from a basic rock. The association of iron and other metals minerals mentioned with the dolerites indicates that these intrusives are a possible primary source of mineralisation.

Mineral occurrences in the rim rocks conform to two main types; those which occur in the cross-cutting veins and those deposits which are essentially conformable with the host rocks.

The conformable type of mineral occurrences in rim rocks is thought to have been formed by an early stage erosion of the diapir giving rise to a subsequent deposition of the minerals in the surrounding rocks. The conformable deposits include hematite which occurs in silty shale, and lead within well bedded dolomite.

All copper occurrences observed in the rim rocks in the vicinity of the Blinman dome diapir are of the vein type. The minerals of economic interest comprise disseminated chalcopyrite, pyrite and magnetite in coarsely crystalline, cross-cutting calcite and siderite veins. These veins are most abundant in the rim rocks close to the contact with the core complex. In some cases they can be traced back into the diapir clearly having their origin within this structure. The grade of primary sulphide mineralisation is usually low, but may be improved by secondary enrichment.

4. EXPLORATION PROGRAMME

4.1 Geochemical stream sediment survey

Previous geochemical stream sediment programmes by Binks and Noranda Australia Ltd. have been restricted to the diapir zone of the Blinman Dome. The combination of those two studies has resulted in an overall sample density of 42 samples per square mile. The samples of Binks were analysed for Cu, Co, Ni, Pb, Zn, while those of Noranda Australia Ltd. were analysed only for Cu. Although a greater variety of element determinations would be preferred, the samples have been taken and it is considered that the collection of further stream sediment samples in the diapir zone is not warranted at present.

The sedimentary rocks beyond the diapir margin have not been previously investigated. As shown in many similar areas in the Flinders Ranges, mineralisation associated with the diapiric structures can be located in the sedimentary sequences beyond the diapir margin, for a distance of several miles. Consequently the lease area contains 50 square miles of rocks of the Umberatana and Wilpena Groups which are potentially mineralised for Cu, Zn, Pb, Ag, Ba and Au. In this area a regional geochemical stream sediment programme is being conducted and will result in approximately 1000 samples. These samples will be analysed for Cu, Zn, Pb, Fe, Mn, Ag and Ba by atomic absorption techniques while selected samples from major creeks will be analysed semi-quantitatively for 26 elements.

4.2 Prospect Examination

All the major prospects together with the majority of the mineralised localities depicted on the geological map of Coats (1964) have been examined and sampled (Fig. 2) None of the analytical results have been received to date.

4.2a Prospect 1 (Young's Cobalt Mine)

The prospect consists of two shafts and several shallow open cuts. The southern workings are sited on dolerite while the northern open pit intersects brecciated shale. Mineralisation occurs in veins which are irregular in width and vary from 3 to 9 inches. There are at least two vein sets. Dump and channel samples have been collected from the mine.

4.2b Prospect 2 (Wheal Friendship)

The mine consists of a 60 foot vertical shaft, a collapsed 25 foot shaft, and 5 open cuts. These workings are sited on brecciated fine-grained buff shale and interbedded buff limestone. The shale and limestone contain malachite-azurite staining on bedding and joints but there is no sign of vein mineralisation. A 6 hundred-weight sample of dump material was collected.

4.2c Prospect 3 (Cobalt Mine)

The prospect consistsof a large open cut and two shafts. The open cut has been opened down to 35 foot depth. The stoping has been carried out along a band of green micaceous siltstone and dolomite. Mineralisation occurs as malachite and hematite in joints and bedding in the rocks. In addition, very narrow malachite veins are present. Three channel samples have been collected.

4.2d Prospect 4

The prospect comprises of a single small open cut in a medium-grained dolerite intrusion. Mineralisation is in the form of narrow siderite-hematite-malachite veins of variable width. Two samples have been collected.

4.2e **Prospect 5**

This prospect is a small open cut in buff coloured siltstone. Mineralisation comprises poor malachite staining on joints and bedding while occasional ¼ inch hematite-malachite veins are present. One dump sample was collected.

4.2f **Prospect 6**

The prospect consists of a 30 foot deep vertical shaft and a shallow open cut. Mineralisation is in the form of malachite, chalcopyrite and pyrite, disseminated through a limestone on a contact with a breccia zone. The width of the mineralised limestone is over 11 feet. One sample of the mineralised limestone has been collected.

4.2g **Prospect 7**

The prospect consists of a minor open cut on a dolerite intrusive. The dolerite contains sparse malachite-azurite mineralisation and does not warrant sampling.

4.2h **Prospect 8**

Three small open cuts are developed on a small dolerite body. The open cuts are sited on short, sporadic veins of siderite-malachite-azurite-specularite hematite. The veins are less than 2 inches wide. Slight malachite mineralisation appears in the dolerite adjacent to the veins. One chip sample of the mineralised dolerite was collected.

4.2i **Prospect 9**

An open cut is sited on a green dolerite. Dump material contains narrow ($<$2 inch) veins of calcite-hematite-malachite. One sample of the bedrock was collected.

4.2j **Prospect 10 (Doctor Mine)**

A number of shallow workings have been sunk on a quartz-dolerite mass. The mineralisation occurs in the form of a network of veins of ½ to 2 inches wide. These are formed of calcite-quartz-hematite while malachite appears in a shear zone. Both the dolerite and vein material have been sampled.

5. FUTURE PROGRAMME

5.1. The results of the regional geochemical stream sediment programme will be assessed. A comprehensive follow-up study will be carried out on any significant metal anomalies. This will involve close-spaced stream sediment sampling, and if beyond the stream bank, the source of mineralisation will be tested by soil sampling, augering, trenching or costeaning as warranted.

5.2 Further exploration at known prospects must await the results of the sample analyses.

5.3 Further prospects located during the regional geochemical programme will be preliminarily mapped and sampled.

0031

6. REFERENCES

Binks, P.J. 1968 Geochemical Drainage Survey of the Blinman Dome Diapir. S.Aust. Min. Resources Rev., 128, 86-90.

Coats, R.P. 1964 The Geology and Mineralisation of the Blinman Dome Diapir. Dept. Mines, S.Aust., 26, 53pps.

Dickinson, S.B. 1944 The Structural Control of Ore Deposition in Some Australian Copperfields. Bull. geol. Surv. S.Aust., 21, 28-40.

Howard, P.F. 1951 The Basic Rocks of the Blinman Dome. Trans. roy. Soc. S.Aust., 74,165-188.

Howchin, W. 1922 A Geological Traverse of the Flinders Ranges from the Parachilna Gorge to the Lake Frome Plains. Trans. roy. Soc. S.Aust., 46, 46-82.

Mawson, D. 1942 The Structural Character of the Flinders Ranges. Trans. roy. Soc. S.Aust., 66(2), 262-272.

Minoil Services 1970 Report on Mineral Prospects. SML 377, Blinman Area, S.A. unpubl. report.

Mumme, I.A. 1961 Geophysical Investigations of the Blinman Dome. Trans. roy. Soc. S.Aust., 85, 7-11.

Noranda Australia Ltd. 1968 Report on Special Mining Lease No 162, Blinman, South Australia. Report 107, Nov. (unpubl.).

R. Hare & Associates 1966-1967 Blinman Copper Project, Flinders Ranges, S.A. Progress Report 1-3 (unpubl.).

Webb. B.P. 1960 The Geological Structure of the Blinman Dome Trans. roy. Soc. S.Aust., 85, 1-6.

Alastair G. Brown.

INTERIM 3 MONTH REPORT ON SPECIAL MINING LEASE 377 (BLINMAN) ON BEHALF OF GOLD COPPER EXPLORATION LTD. FOR THE PERIOD 28TH JANUARY, 1971 - 28TH APRIL, 1971.

1. Introduction

A regional geochemical stream sediment programme was completed during the last quarter over 60 square miles of the lease area, outside the zone of the Blinman diapir. This survey resulted in 1,000 samples which have been analysed for Cu, Pb, Zn, Ba, Ag, Fe and Mn by atomic absorption techniques.

2. Preliminary results of the geochemical survey.

2.1 Cu (Fig. 1)

The overall Cu content of the sampled area is 15-20 ppm. Three anomalous zones occur and lie immediately east of Blinman township, near Gum Creek in the centre of the area, and in the extreme south - west of the lease area respectively.

Maximum values occur in a creek draining southwards, immediately east of Blinman township. The creek extends along the eastern margin of the Blinman diapir. Although this zone of the Blinman diapir has known Cu mineralisation, the anomalies in the stream are not the result of known Cu occurrences.

Cu values of up to 75 ppm occur in the vicinity of Gum Creek, in rocks of the Enorma Shale and the Etina Formation.

A zone of moderately low anomalous Cu with values of 35-60 ppm occurs in the extreme south-west on the eastern margin of the Brachina Formation.

2.2 Zn (Fig. 2)

Background Zn values in the area average 45-60 ppm.

A low anomalous zone occurs immediately east of Blinman township and coincides with the anomalous Cu values in that area.

Two isolated values of 100 and 120 ppm occur 1 mile west and 2 miles south-west of the Cobalt Mine. The absence of other high Zn values in the area suggest that these two sporadic values are insignificant.

A wide zone of values of up to 90 ppm extends in a south - easterly direction to the south of Wockerawirra Creek. These values appear to result from the Etina Formation and the Enorma Shale, both of which are dolomitic shales and could be expected to produce slightly higher than average Zn values.

2.3 Pb (Fig. 3)

The average value of Pb in the area is 15-20ppm. Only 4 low grade Pb anomalies occur. Slight enrichment is located in the stream immediately east of Blinman township and also 1 mile west of the Cobalt Mine, and corresponds with higher Zn values at those sites.

The maximum value of 60 ppm occurs 2 miles south of the Cobalt Mine in Wockerawirra Dolomite, which is known to have poor Pb mineralisation in this region.

2.4 Ag (Fig. 4)

Ag values in the area are generally below the detection limit of the method of 2 ppm. Only one area of moderately anomalous values of up to 15 ppm, occurs 3 miles west-south-west of the Cobalt Mine in the Wockerawirra Dolomite, but does not relate to higher Pb values.

2.5 Ba (Fig. 5)

Three zones have anomalous Ba values. In two creeks to the east of Blinman township, values of over 900 ppm occur and are related to the diapir marginal zone.

A second zone with up to 1,000 ppm Ba is located 1 mile south of the Cobalt Mine and is directly related to the southern margin of the Blinman diapir.

A wide zone with values up to 1,000 ppm is located in the south-west of the area. The main zone extends along an outcrop of the Nuccaleena dolomite Formation. The Brachina Formation with a siltstone lithology has a generally higher than average Ba content.

2.6 Fe (Fig. 6)

Fe values for the area average 2.0 - 3.0%. A generally wide zone of values between 3.0 - 4.0% extends south-eastwards across the area, to the south of Wockerawirra Creek. These values coincide with the higher Zn values and result from the Etina and Enorma Shale Formations.

Higher values (up to 5.9%) are located in the south-west of the area and are underlain by the Brachina siltstone Formation.

An anomalous zone with values up to 9.0% occurs east of Blinman township and coincides with the low anomalous Cu-Mn-Ba zone.

2.7 Mn (Fig. 7)

Mn values are generally less than 500 ppm. The Enorma

Shale, Etina Formation and Brachina Formation produce generally higher levels (500 to 700 ppm). Two anomalous zones are located in a creek ¾ mile east of Blinman township and one mile south of the Cobalt Mine. Both these latter zones are spacially related to the margin of the Blinman diapir.

3. Conclusions

The area of the lease outside the Blinman diapir has an overall low base metal and Ba content. Maximum concentration of sediment anomalies of Cu, Ba, Fe and Mn are in streams draining the marginal zones of the diapir.

The Pb, Zn and Ag values reveal only a few isolated minor anomalies, and indicate that known mineralisation, such as the Pb occurrences in the Wockerawirra Dolomite are minor.

4. Future work.

The isolated base-metal anomalies will be checked by a limited follow-up study, but work will be concentrated on the marginal zone of the diapir.

Alastair G. Brown.

Alastair G. Brown
B.Sc., M.Sc., D.I.C., Ph.D.
Senior Geologist
Robertson Research (Australia) Pty. Ltd.
3rd May, 1971.

INTERIM 3 MONTH REPORT ON SPECIAL MINING LEASE 377 BLINMAN FOR GOLD COPPER EXPLORATION LTD. FOR THE PERIOD 29th APRIL, 1971 - 28TH JULY, 1971

1394-II

1. Regional Geochemical Stream Sediment Programme

1.1 A regional geochemical stream sediment survey was completed during the last quarter over 60 square miles of the lease area, outside the zone of the Blinman diapir. The survey resulted in 1,000 samples which have been analysed for Cu, Zn, Pb, Ba, Ag, Fe and Mn. The results of this survey, together with a discussion of previous geochemical surveys in the diapir zone, are discussed below.

1.2 Copper (Fig. 13.3)
The values average 15-20 ppm throughout the area. Three anomalous zones with values in excess of 40 ppm occur.

Immediately east of Blinman township and in the eastern marginal zone of the diapir, values of up to 170 ppm are located, (5½-7'S/41'E).

At locality 11-12'S/38-39'E, two isolated values of 65-75 ppm occur in the Etina Formation. In the extreme southwest of the lease low, anomalous values of 30-50 ppm occur in the Brachina Formation, with a maximum of 60 ppm in the adjacent Elatina Formation. These values suggest a lithological control.

1.3 Zinc (Fig. 13.4)
Values are uniformly low and are less than 100 ppm.

Only two weakly anomalous values appear.

At locality 8'S/39½'E a value of 100 ppm occurs on the margin of the diapir while at 9½'S/39½'E, a value of 120 ppm appears in the Wockerawirra dolomite.

1.4 Lead (Fig. 13.5)
Values are generally less than 40 ppm, and values in excess of this only occur at 4 localities.

A zone with 45-50 ppm at 5½-7'S/41'E corresponds with a copper anomaly in the diapir marginal zone.

At Alpana Dam (4½'S/41'E) a value of 45 ppm may result from contamination.

At the contact of the Tapley Hill Formation with the Wockerawirra dolomite a value of 60 ppm occurs at 9½'S/40'E, while a value of 50 ppm at 8'S/39½'E is marginal to the diapir in the same site as an enhanced zinc value. The Tapley Hill Formation is known to have minor lead mineralisation south of the diapir.

1.5 Silver (Fig. 13.6)
Three anomalous silver values occur.

In the Tapley Hill Formation values of 6 and 15 ppm occur at 9'S/36½'E.

Two values of 3 ppm occur at 12½'S/37'E and appear to be related to a fault zone.

1.6 Barium (Fig. 13.7)
Three anomalous values in excess of 800 ppm have been detected.

On the eastern margin of the diapir in the extreme north-east of the lease, values of up to 1,300 ppm occur at 5-7'S/41-42'E over rocks ranging from the Tapley Hill Formation up to the Etina Formation. The variety of lithology suggests a tectonic control.

On the southern margin of the diapir a value of 1,100 ppm occurs at 9'S/40½'E.

In the south-west of the area low anomalous values of 500-900 ppm occur over a wide area in rock formations ranging from the Trezona Formation down to the Brachina Formation. The anomalous values are concentrated along the Nuccaleena Formation, a dolomite horizon. It is probable that the barium is associated with lime-rich lithological facies.

1.7 Iron (Fig. 13.8)
Values in the area average 2.0-3.0% iron and a lithological control of the distribution of the iron values is apparent. In the extreme south-west, values in the Brachina Formation siltstone are slightly elevated (3.0-5.0%). The Enorama Shale and upper Etina Formation show a similar but lower trend (2.0-4.0%).

Moderately anomalous values of 3.0-9.0% iron are located in the north-east of the area in the Tapley Hill Formation marginal to the diapir zone.

1.8 <u>Manganese</u> (Fig. 13.9)
Manganese values are generally less than 600 ppm.

An overall higher range of values in the south-west of the lease appears to be derived from the upper Etina, Enorama, Trezona and Brachina Formations. These formations consist predominantly of calcareous shales.

Slight enrichments of 400-900 ppm manganese occur around the margin of the diapir at 9'S/40½'E and 6-7'S/41'E.

A stronger anomaly has been detected fringing the eastern diapir margin at 5-7'S/41-42'E with values up to 3,300 ppm manganese. This zone coincides with weak iron/barium anomalies.

1.9 <u>Blinman Diapir Zone</u>
The results of the Noranda - Binks geochemical stream sediment survey indicated that:

(a) Five anomalous copper zones exist (100-170 ppm), which are not related to known prospects. A further five zones have low grade anomalies of between 50 and 100 ppm. Further work is required to ascertain the source of these anomalies.

(b) Cobalt, nickel and lead values are uniformly low, while sporadic high zinc values may be due to contamination.

1.10 <u>Conclusion</u>
The geochemical data suggests that mineralisation in the lease area beyond the diapiric core zone is poor.

Copper values indicate two anomalous zones which occur on the margin of the diapir and in the Brachina Formation.

No zinc or lead anomalies occur.

Two significant silver values are located in the Tapley Hill Formation.

Barium anomalies relate to the eastern and southern margins of the diapiric core.

There are no significant iron anomalies and a single manganese anomaly coincides with a weak iron/barium anomaly on the eastern contact of the diapiric core.

In general, the contact zone of the Blinman diapir, and in particular the eastern margin, appears to possess most potential.

2. Origin of Copper Mineralisation

Mineral occurrences within the core complex are associated with three specific rock types; these are dolomites, melaphyres and dolerites.

In dolomite blocks in the diapir, primary mineralisation occurs as small crystals of chalcopyrite, bornite and pyrite. The distribution of these minerals along bedding planes suggests a possible sedimentary origin. Crosscutting veins which carry sulphides, could result from mobilisation of the syngenetic minerals.

In the melaphyres, copper occurs as primary sulphides in carbonate veins, as secondary coatings on joint faces and as fillings in amygdales. The common association of cooper with the occurrence of melaphyres suggests that mineralisation was associated with these igneous extrusions.

In the dolerites, copper occurs associated with carbonate veins either in the dolerites or in the contact zone of the dolerite. The carbonate material for the veins may have been liberated by alteration of the dolerites and consequently the copper may be genetically related to the dolerites.

In the sedimentary rim rocks, mineralisation occurs as both transverse veins and bedded deposits. In some cases the latter type of mineralisation may have been formed by an early stage of erosion of the diapir giving rise to subsequent deposition in the surrounding sediments. Local development of lead in dolomites has been ascribed to this source.

All copper observed in the rim rocks occurs in vein-type deposits. These can occasionally be traced back into the diapir, and may have their origin within this structure.

3. Prospect Investigation

No work has been carried out further to that described in the twelve monthly Report, (29/1/70 - 29/1/71).

Analytical results which were not then available, are now discussed.

3.1 Prospect 1 (Young's Cobalt Mine)

Sample Number	Type	Width Ins.	Cu %	Zn ppm	Co ppm	Pb ppm	Ag ppm	Ni ppm	Au dwt/ton
80095	dolerite (dump)	-	0.02	21	40	10	1	55	<0.3
80096	vein (dump)	-	1.70	390	400	100	9	195	<0.3
80097	vein	5	1.70	150	860	70	11	135	<0.3
80098	wallrock dolerite		0.30	41	75	160	1	95	0.7

analyses by atomic absorption.

The values indicate that the dolerite does not contain encouraging copper mineralisation and although the vein contains significant copper, the vein is somewhat narrow.

3.2 Prospect 2 (Wheal Friendship Mine)

Sample Number	Type	Cu %	Zn ppm	Co ppm	Pb ppm	Ag ppm	Ni ppm	Au dwt/ton
80099	malachitic shale (dump)	0.85	390	20	80	4	55	< 0.3

The copper mineralisation is of very low grade, and associated metal values are low.

3.3 Prospect 3 (Cobalt Mine)

Sample Number	Type	Width Ins.	Cu %	Zn ppm	Co ppm	Pb ppm	Ag ppm	Ni ppm	Au dwt/ton
80100	siltstone	36	1.5	45	15	180	2	65	< 0.3
80101	siltstone	36	0.91	43	10	30	1	70	< 0.3
80102	siltstone	48	0.93	27	20	30	2	50	< 0.3

The mineralisation of 1.0% copper over a 3 feet width is encouraging especially as malachite occurs along the bedding of the siltstones, in addition to occurring in fractures and fine veins. The extensions of this deposit requires investigation.

3.4 Prospect 4

Sample Number	Type	Width Ins.	Cu %	Zn ppm	Co ppm	Pb ppm	Ag ppm	Ni ppm	Au dwt/ton
80103	veined dolerite	24	3.6	32	480	30	3	110	<0.3
80104	veined dolerite	24	0.46	82	600	50	1	205	<0.3

The average copper grade of the two samples is 2% over a 2 feet width of veined dolerite. Further work is necessary to ascertain the extent of the mineralisation.

3.5 Prospect 5

Sample Number	Type	Cu %	Zn ppm	Co ppm	Pb ppm	Ag ppm	Ni ppm	Au dwt/ton
80105	malachitic siltstone (dump)	0.98	32	20	40	1	40	<0.5

The small area of mineralisation and the low grade of copper and associated mineralisation in the siltstone bedrock does not warrant further work at the present time.

3.6 Prospect 6

Sample Number	Type	Width Ins.	Cu %	Zn ppm	Co ppm	Pb ppm	Ag ppm	Ni ppm	Au dwt/ton
80106	limestone	132	0.41	28	40	100	1	130	<0.3

Although the mineralised breccia zone in the limestone is 11 feet wide, the copper content is very low, and the prospect does not warrant further work at the present time.

3.7 Prospect 8

Sample Number	Type	Width Ins.	Cu %	Zn ppm	Co ppm	Pb ppm	Ag ppm	Ni ppm	Au dwt/ton
80107	veined dolerite	24	0.14	18	40	50	1	90	<0.3

This mineralisation is of very low grade, and the prospect does not warrant further work at the present time.

3.8 Prospect 9

Sample Number	Type	Width Ins.	Cu %	Zn ppm	Co ppm	Pb ppm	Ag ppm	Ni ppm	Au dwt/ton
80108	dolerite	12	0.01	23	15	30	3	60	<0.3

No significant mineralisation is present, and the prospect does not warrant further work at the present time.

3.9 Prospect 10 (Doctor Mine)

Sample Number	Type	Width Ins.	Cu %	Zn ppm	Co ppm	Pb ppm	Ag ppm	Ni ppm	Au dwt/ton
80109	dolerite (dump)	-	0.96	34	60	50	2	120	<0.3
80110	hematite vein	1	0.21	58	60	80	2	80	<0.3
80111	dolerite	72	0.08	43	50	30	1	85	<0.3

The mineralisation is sporadic and of low grade and the width of the mineralised zones are not encouraging. No further work should be done on this prospect at the present time.

3.10 Conclusion

The analytical data from the nine prospects indicates that the copper mineralisation is encouraging in two prospects, (3(Cobalt mine) & 4) while no work is recommended on the other seven prospects at the present time. No significant metal association was found.

4. Conclusion

The area has been divided into the Blinman diaoiric core zone, and the area of rim rocks surrounding it. The former zone has been comprehensively examined by several authors and a detailed geochemical stream sediment survey has been previously conducted. Consequently the present geochemical study has been restricted to the area outside the diapiric core rocks.

The regional geochemical stream sediment programme has resulted in three anomalous copper zones. A moderately high anomaly is associated with the eastern margin of the diapir, while low anomalous values in the Etina and Brachina Formations may reflect local lithological control of copper mineralisation.

Only two weak zinc and four weak lead anomalies were detected and are not regarded as significant.

Three anomalous silver values were located, two of which occur in the Tapley Hill Formation and one in the vicinity of a fault.

Three anomalous barium values occur, two on the margin of the Blinman diapir while the Nucaleena dolomite Formation has an overall enhanced barium content, again revealing a limestone-barium correlation.

Iron is moderately anomalous in the marginal zone of the diapir, while low widespread anomalous values reflect the Brachina, Enorama and Etina formations of siltstone-shale lithology.

Manganese anomalies occur on the margin of the diapir and indicate local iron-barium-manganese mineralisation. Shale formations in the area give rise to above average manganese values due to the general higher manganese content of these rocks.

Within the Blinman diapir, the results of previous surveys indicate that 10 anomalous copper zones require further investigation.

Copper mineralisation in the diapiric core is associated with dolomites, melaphyres and dolerites.

No further work has been carried out on the various copper prospects but analytical data has been appraised.

Only two of the prospects show sufficiently encouraging grades and extent of copper mineralisation to warrant further immediate work.

Alastair G. Brown

ALASTAIR G. BROWN

B.Sc., M.Sc., D.I.C., Ph.D.,

Senior Geologist

28th July, 1971.

INTERIM THREE MONTH REPORT ON SPECIAL MINING LEASE NO. 377 (BLINMAN) FOR GOLD COPPER EXPLORATION LTD. FOR THE PERIOD 29TH JULY, 1971 TO 28TH OCTOBER, 1971.

Regional geochemical follow-up programme.

The various stream sediment anomalies located during the previous quarter were investigated.

No significant sources of copper, zinc, lead, silver or iron mineralisation which resulted in the geochemical anomalies were noted.

Barytes anomalies in the south-west of the area are attributed to fine barytes veining in rocks of the Trezona-Brachina Formations. These veinlets are not regarded as warranting further investigation.

An extensive outcrop of manganese is located ina fault zone in the extreme north-east of the lease. This deposit gives rise to the anomalous values in creeks draining southwards to the east of Blinman township. The manganese outcrops over a length of approximately 2,000 feet with a width of 50 feet. The manganese is associated with a steeply dipping fault zone. Three samples have been despatched for assay but results have not been received to date.

Alastair G. Brown B.Sc., M.Sc., D.I.C., Ph.D.
GOLD COPPER EXPLORATION LTD.

Senior Geologist

29th October, 1971.

LOGISTICS FOR THE BLINMAN S.M.L. (377) FOR THE PERIOD 29TH JULY, 1971 TO 28TH OCTOBER, 1971.

Number of geologist days	5
Number of surveyor days	5
Number of field assistant days	-
Number of draughting days	-
Number of truck days	5
Number of caravan days	5
Number of motorbike days	-
Number of samples at $2.00	3

FINAL REPORT ON SPECIAL MINING LEASE NO. 377 (BLINMAN) FOR GOLD COPPER EXPLORATION LTD. FOR THE PERIOD 29TH JANUARY, 1971 TO 28TH JANUARY, 1972.

1. Regional Geochemical Stream Sediment Programme.

A regional programme was conducted over the lease area of 60 square miles outside the diapir margin. A total of 1,000 samples were collected (see Report January - April, 1971).

1.1 Only isolated low anomalous values were located for copper, zinc, lead and silver.

1.2 Three anomalous barium zones were located but the anomalies result from minor barytes veining (see Report July - October, 1971).

1.3 Anomalous iron-manganese anomalies were recorded in a creek ¾ mile east of Blinman township, and result from an extensive outcrop of manganese.

2. Nine prospects were appraised (see Report May - July, 1971) but none showed indicated encouraging potential.

3. An extensive outcrop of manganese occurs in a fault zone in the north-east of the lease with a length of 2,000 feet and a width of 50 feet.

Analytical results of the manganese ore are:-

Sample Number	Mn %	MnO_2%
G.C.E. 88377	7.6	12.0
88378	5.1	8.05
88379	2.0	3.16
88380	2.8	4.4
88381	7.0	11.1
88382	19.4	30.6
88383	7.5	11.9
88384	11.6	18.3
88385	13.0	20.5
88386	13.4	21.1
88387	7.0	11.1
88388	20.0	31.6
84311	6.2	9.7
84312	19.0	30.0
84313	17.0	26.9
Average	10.57	16.7

The results are discouraging and no further work has been carried out.

Alastair G. Brown.

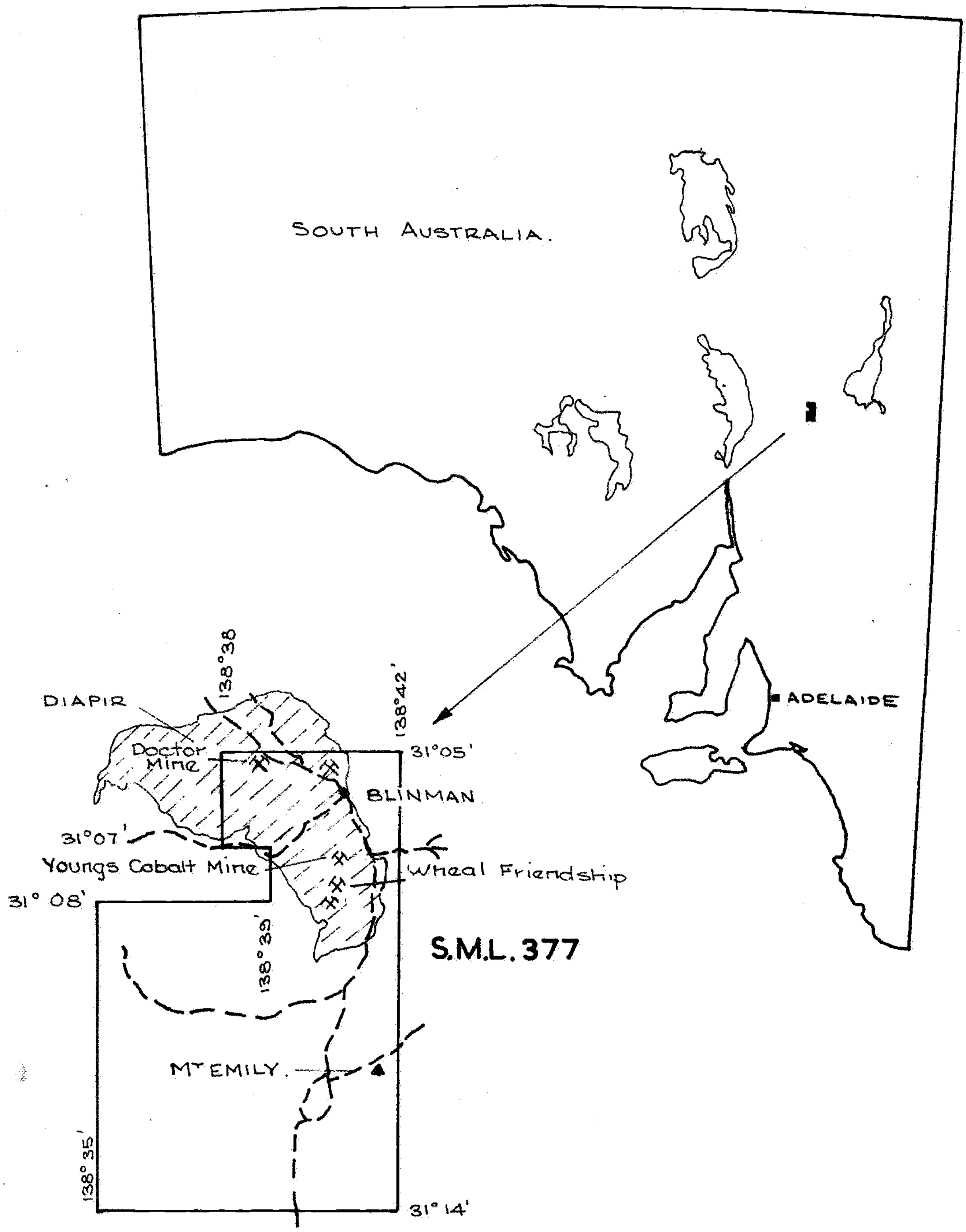
DR. ALASTAIR G. BROWN

B.Sc., M.Sc., D.I.C., Ph. D.

Senior Geologist

GOLD COPPER EXPLORATION LTD.

2nd February, 1972.



GOLD COPPER EXPLORATION PTY. LTD.

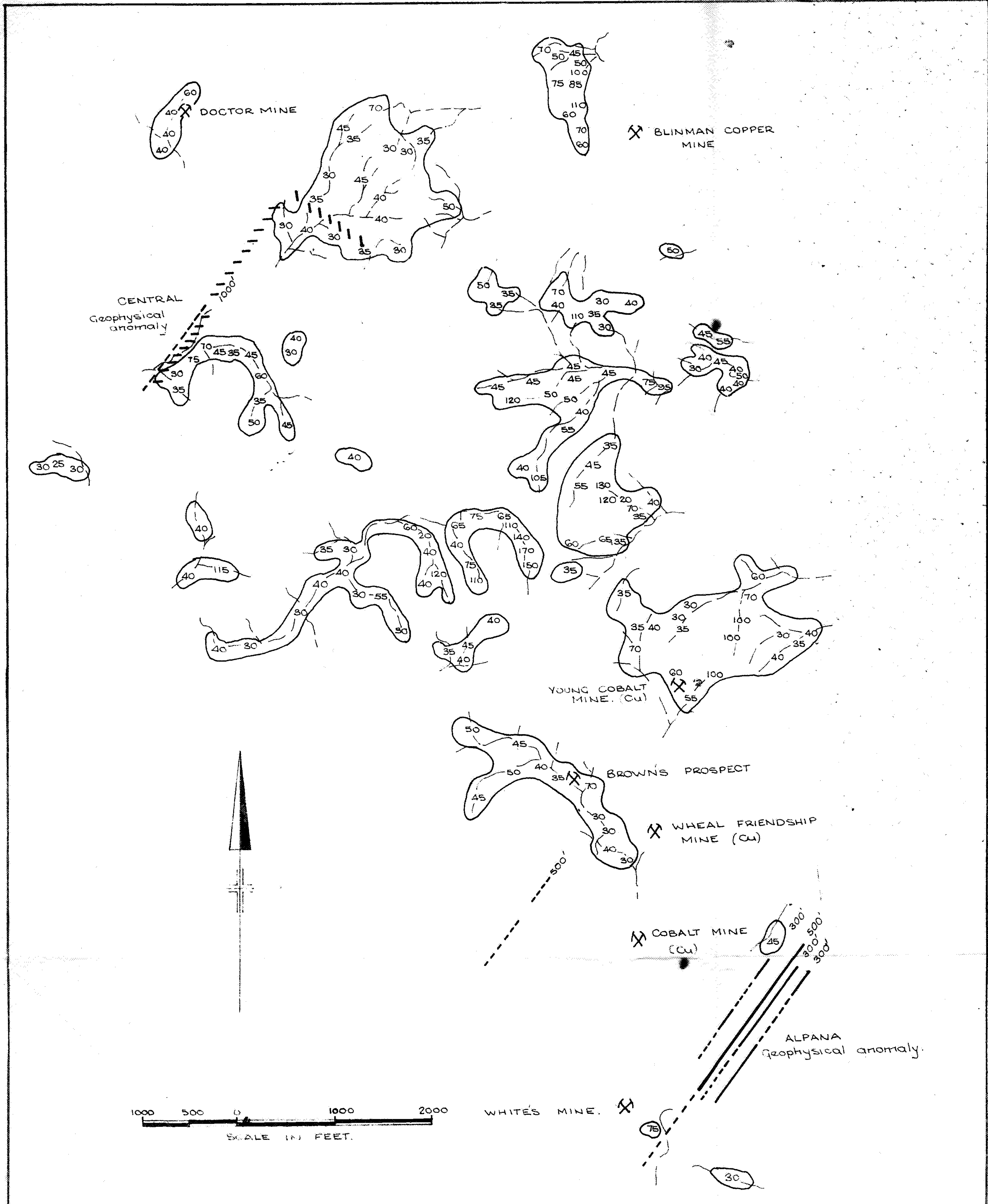
SPECIAL MINING LEASE 377

LOCALITY PLAN

BLINMAN AREA	SOUTH AUSTRALIA	GEOLOGIST P. G. HASLETT.
DATE APRIL 10th 1970		MINOIL SERVICES ADELAIDE

G.C. 377-1.

PLATE I



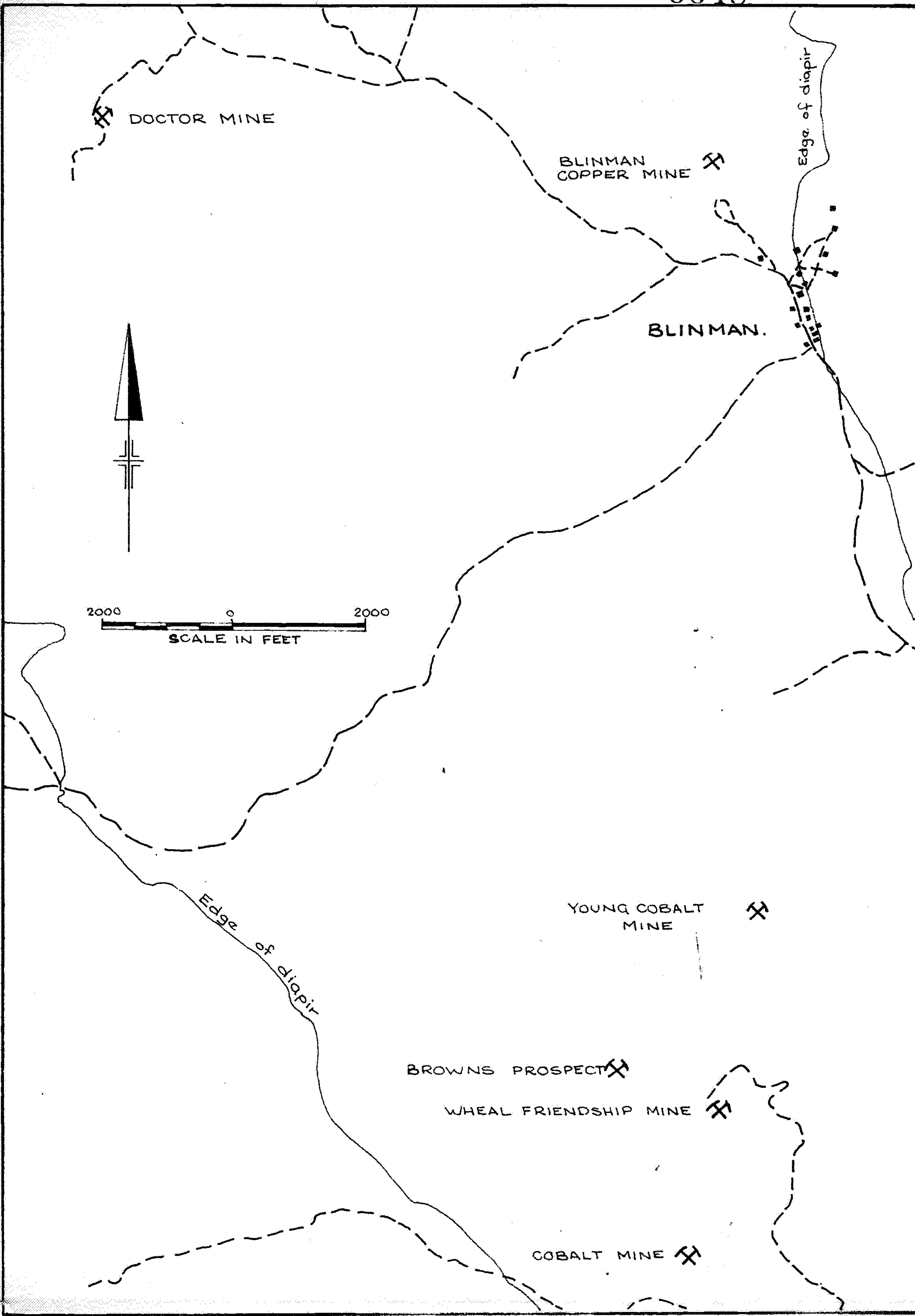
NOTE: Plan compiled from plan by Noranda Australia Ltd.

GOLD COPPER EXPLORATION PTY. LTD.

SPECIAL MINING LEASE 377

PLAN OF STREAM SEDIMENT. GEOCHEMICAL ANOMOLIES

BLINMAN AREA	SOUTH AUSTRALIA	GEOLOGIST: P.G. HASLETT.
DATE 13th April [illegible]		MINOIL SERVICES ADELAIDE



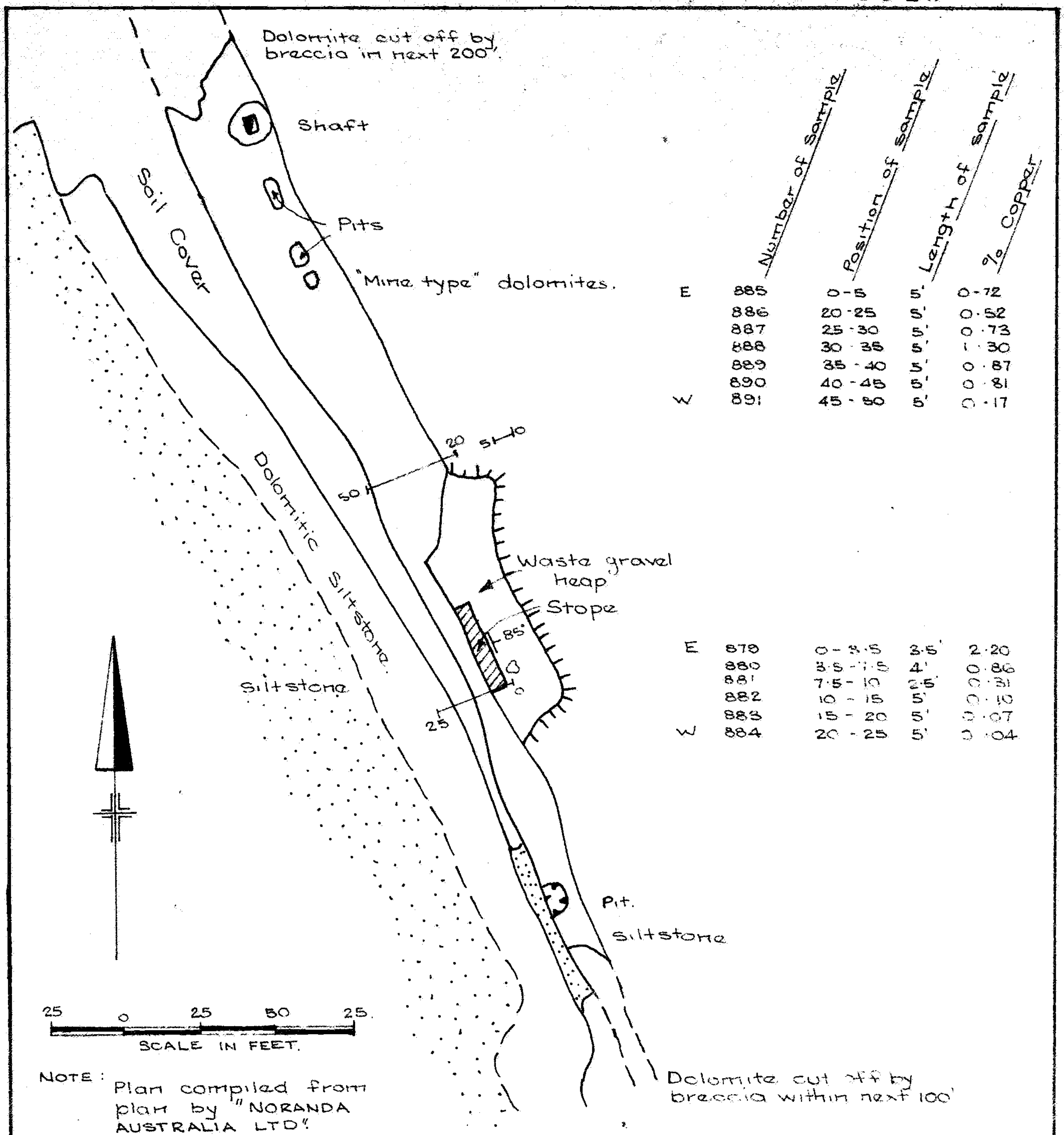
GOLD COPPER EXPLORATION PTY. LTD.

SPECIAL MINING LEASE 377

LOCALITY PLAN OF MAJOR MINES

BLINMAN AREA	SOUTH AUSTRALIA	GEOLOGIST P.G. HASLETT
DATE APRIL 10th 1970		MINOIL SERVICES ADELAIDE.

G.C. 377-2



	Number of Sample	Position of sample	Length of sample	% Copper
E	885	0-5	5'	0·72
	886	20-25	5'	0·52
	887	25-30	5'	0·73
	888	30-35	5'	1·30
	889	35-40	5'	0·87
	890	40-45	5'	0·81
W	891	45-50	5'	0·17

	Number of Sample	Position of sample	Length of sample	% Copper
E	879	0-3·5	3·5'	2·20
	880	3·5-7·5	4'	0·86
	881	7·5-10	2·5'	0·31
	882	10-15	5'	0·10
	883	15-20	5'	0·07
W	884	20-25	5'	0·04

GOLD COPPER EXPLORATION PTY. LTD.

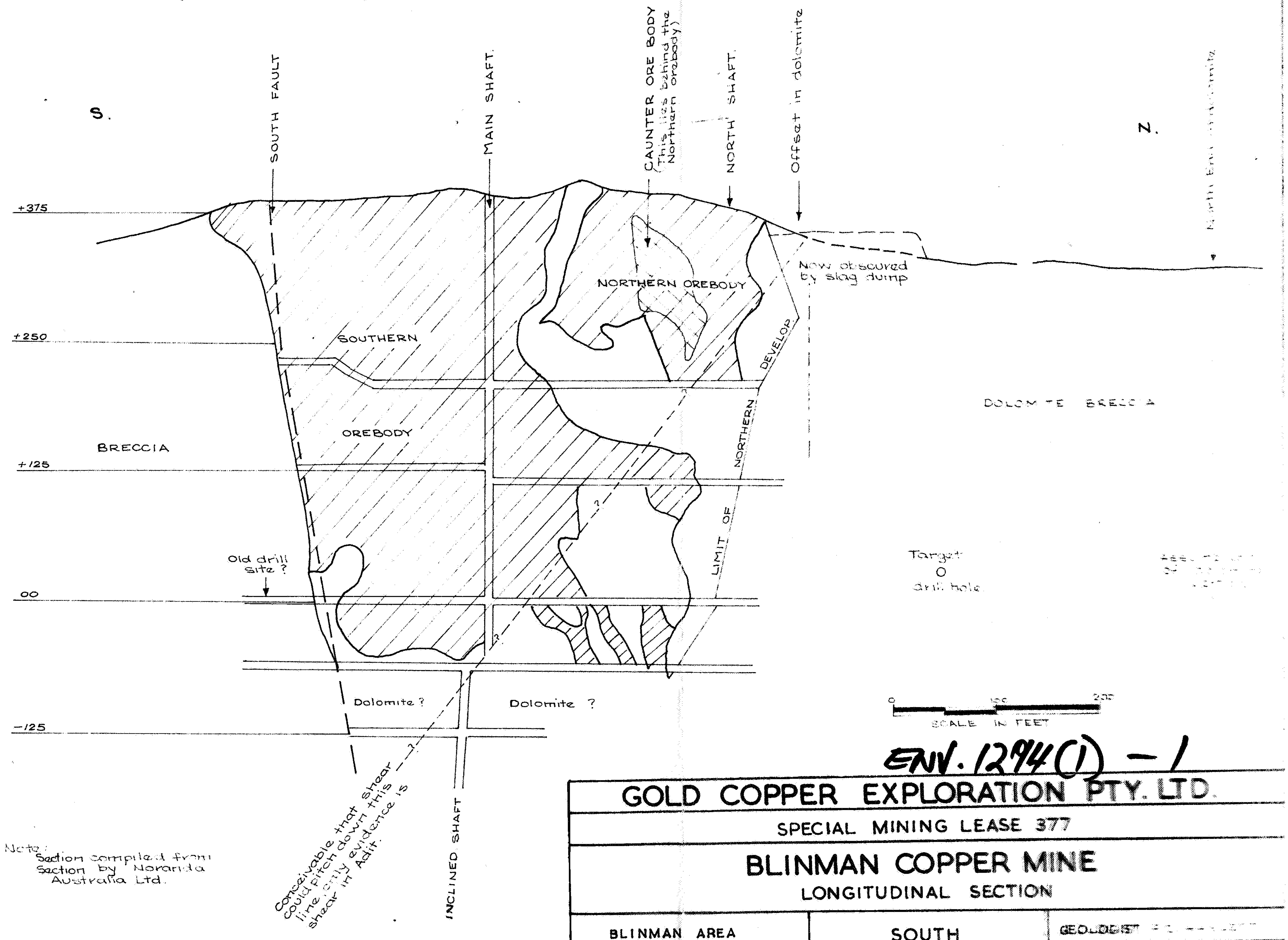
SPECIAL MINING LEASE 377

COBALT COPPER MINE

GEOLOGICAL AND GEOCHEMICAL PLAN

BLINMAN AREA	SOUTH AUSTRALIA	GEOLOGIST: P.G. HASLETT.
DATE APRIL 10th 1970		MINOIL SERVICES ADELAIDE.

G.C.377.5. PLATE. 5.



ENV. 1294(1) - 1

GOLD COPPER EXPLORATION PTY. LTD.

SPECIAL MINING LEASE 377

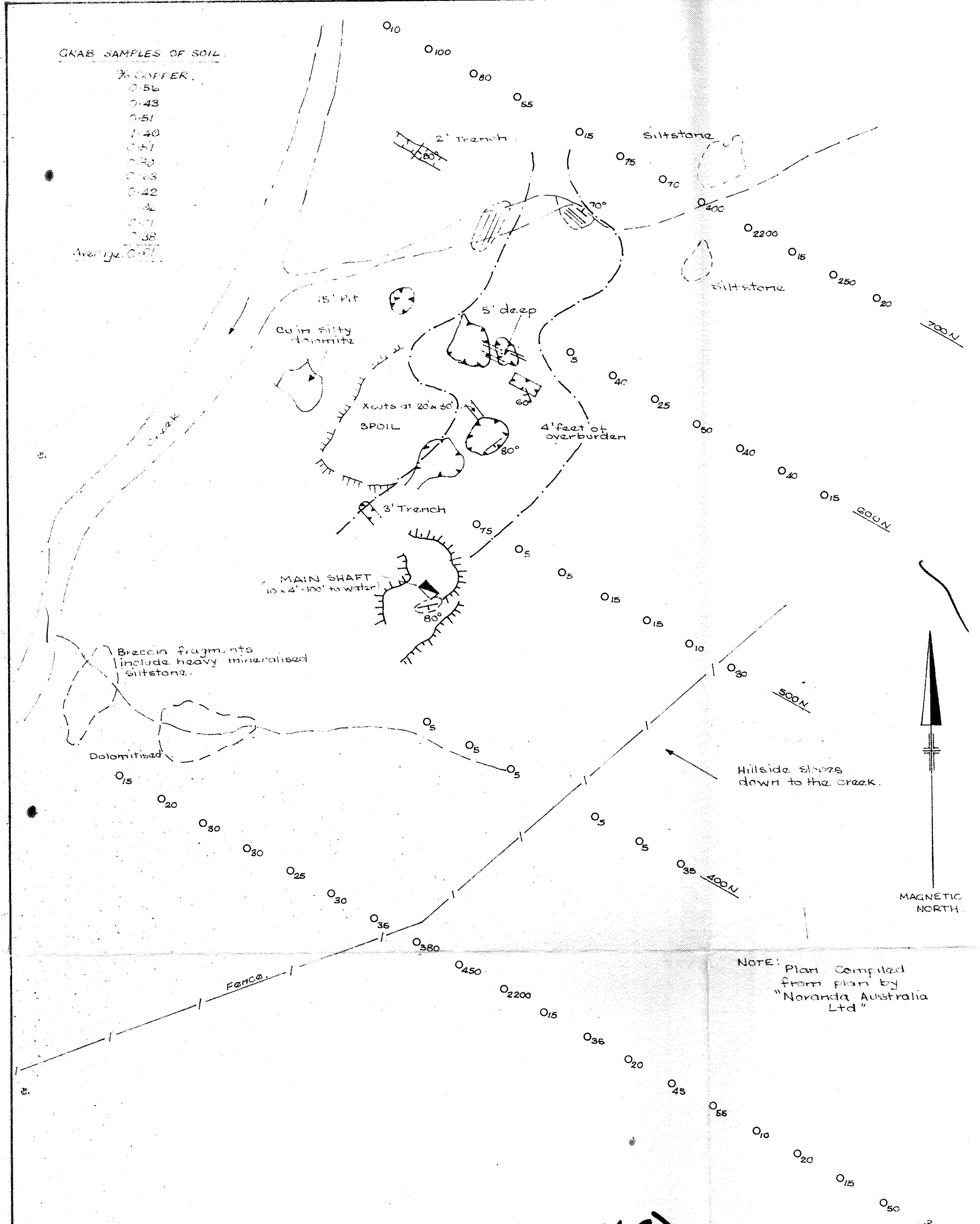
BLINMAN COPPER MINE

LONGITUDINAL SECTION

BLINMAN AREA	SOUTH AUSTRALIA	GEOLOGIST
DATE APRIL 10th 1970		MINDIL SERVICES ADELAIDE

G.C. 377. 3a

PLATE 3a



ENV. 1294(1)-2

GOLD COPPER EXPLORATION PTY. LTD.

SPECIAL MINING LEASE 377

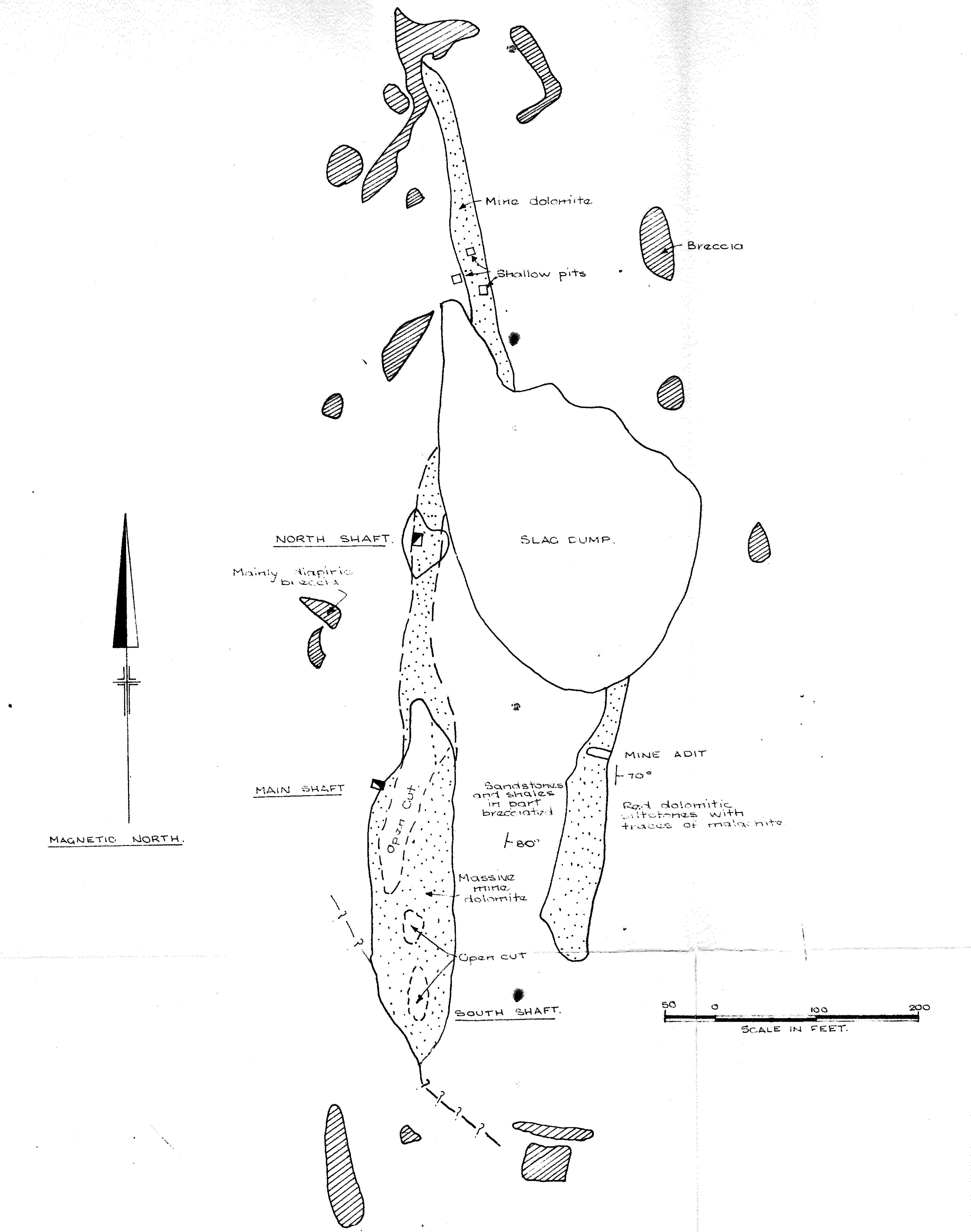
WHEAL FRIENDSHIP MINE

GEOLOGICAL AND GEOCHEMICAL PLAN

BLINMAN AREA	SOUTH AUSTRALIA	GEOLOGIST: P.G. HASLETT.
DATE APRIL 10th 1970		MINOIL SERVICES ADELAIDE

G.C. 377.4.

PLATE. 4.



ENV. 1294 (1) -3

NOTE
Plan compiled from plan by 'Noranda Australia Ltd.'

GOLD COPPER EXPLORATION PTY. LTD.

SPECIAL MINING LEASE 377

BLINMAN COPPER MINE

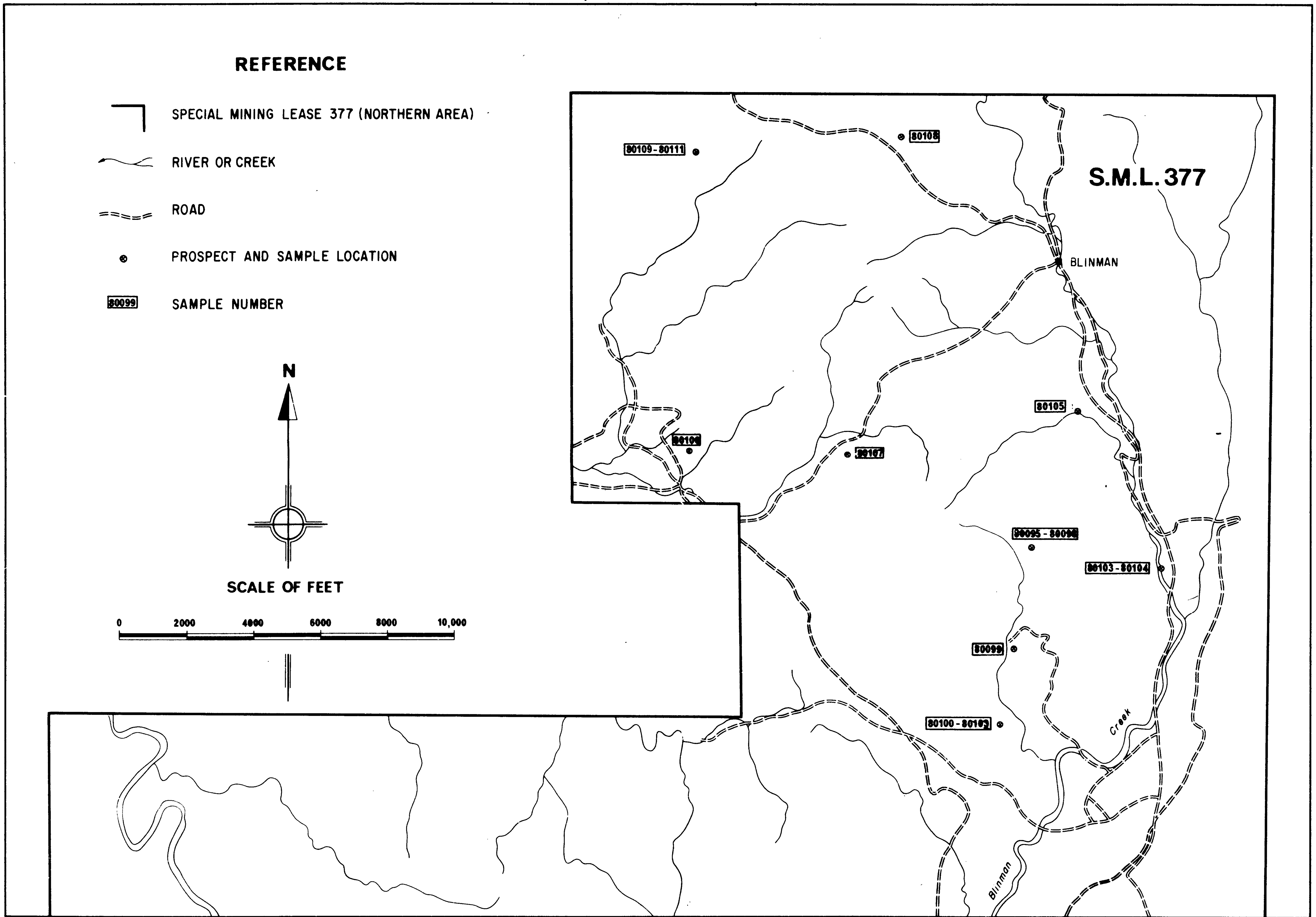
GEOLOGICAL OUTCROP PLAN

BLINMAN AREA	SOUTH AUSTRALIA	GEOLOGIST P.G. HASLETT
DATE APRIL 10th 1970		MINOIL SERVICES ADELAIDE.

G.C. 377.3 E

PLATE . 3c.

FIG. 3 — SPECIAL MINING LEASE 377 (BLINMAN) — NORTHERN AREA — LOCATION OF PROSPECTS AND SAMPLES



1294(1)-4

Fig. 1 Photointerpretation of geological structures, Blinman Special Mining Lease 377.

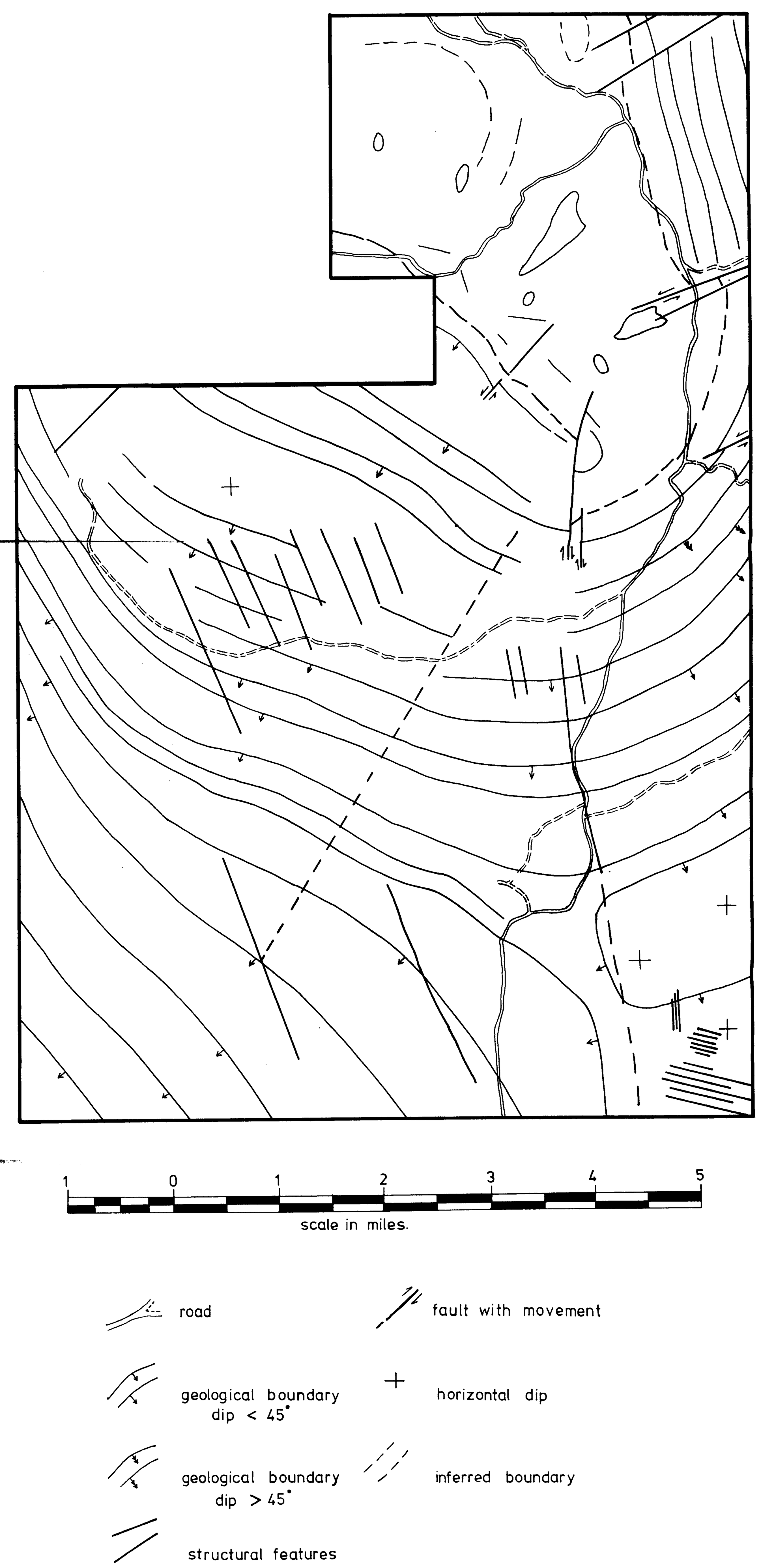
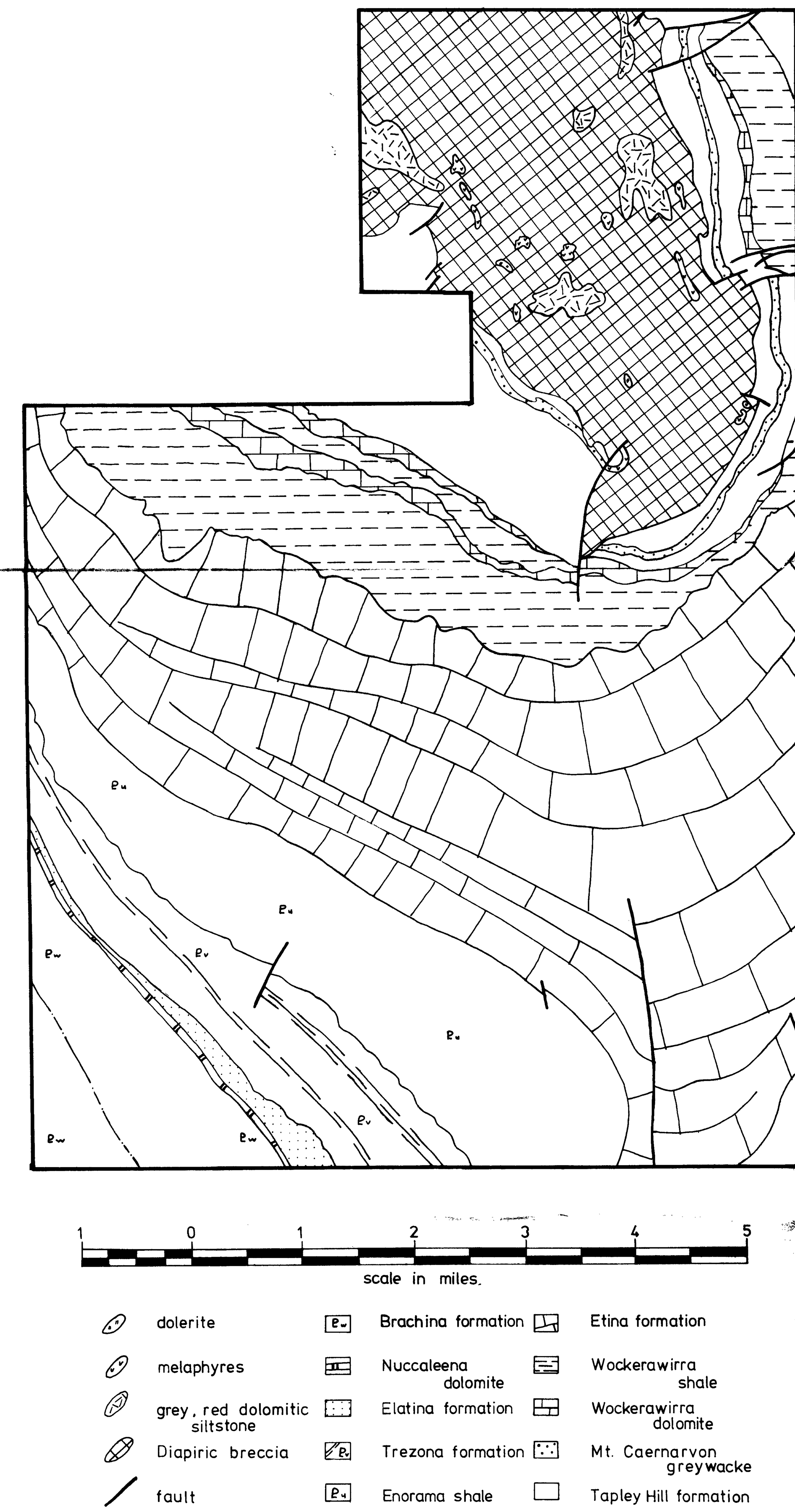


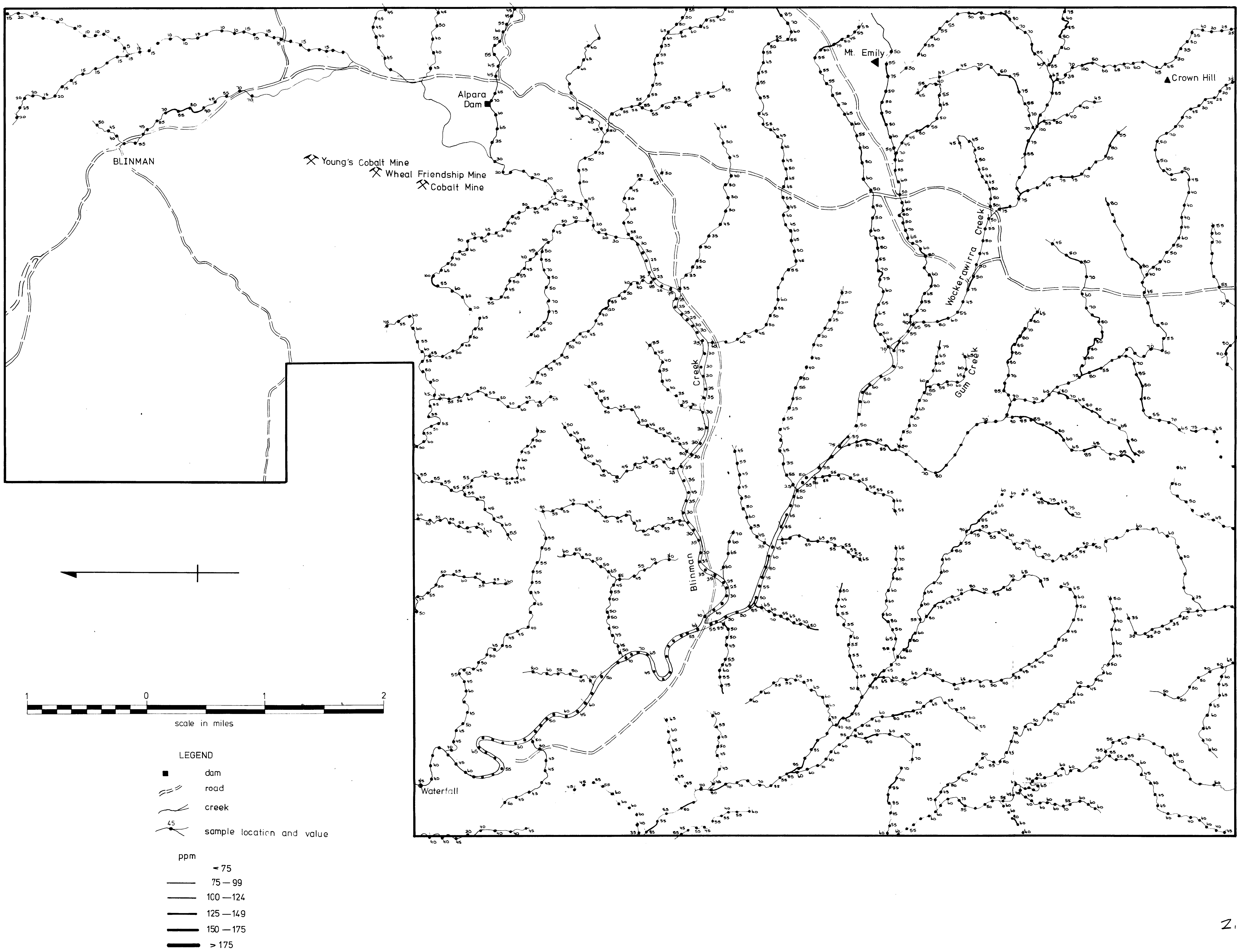
Fig. 2 Geology of lease area, Blinman, Special Mining Lease 377. (after Blinman 1 mile sheet, 1965; enlarged.)



1294(1)-5

55.13

Fig. 2. Distribution of Zn ppm in stream sediments, Special Mining Lease 377 (Blinman)



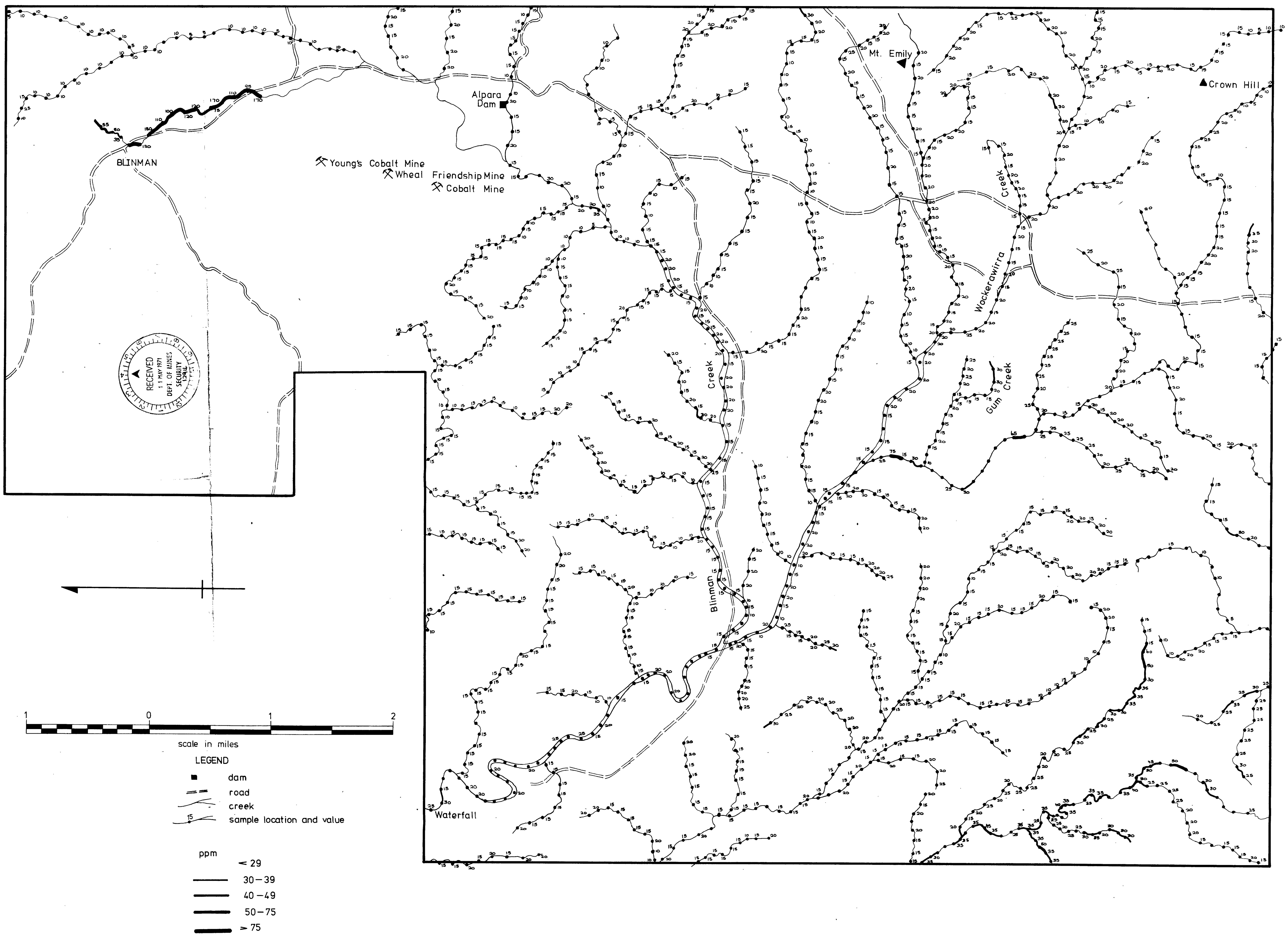
Zinc

Fig 2

114·13

1294(1)-6

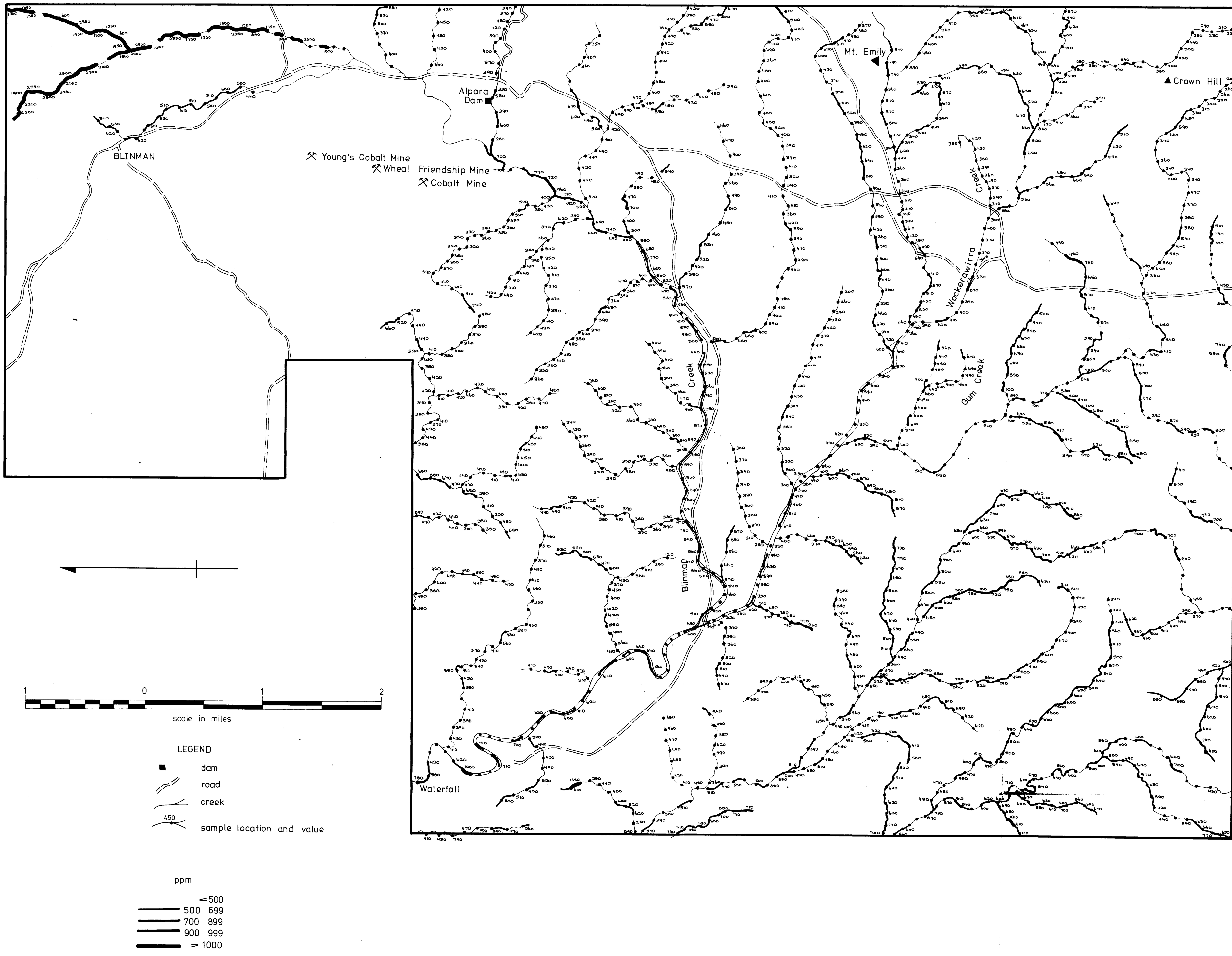
Fig. / Distribution of Cu ppm in stream sediments, Special Mining Lease 377 (Blinman)



1294(1)-7

11213

Fig 7 Distribution of Mn ppm in stream sediments, Special Mining Lease 377 (Blinman)

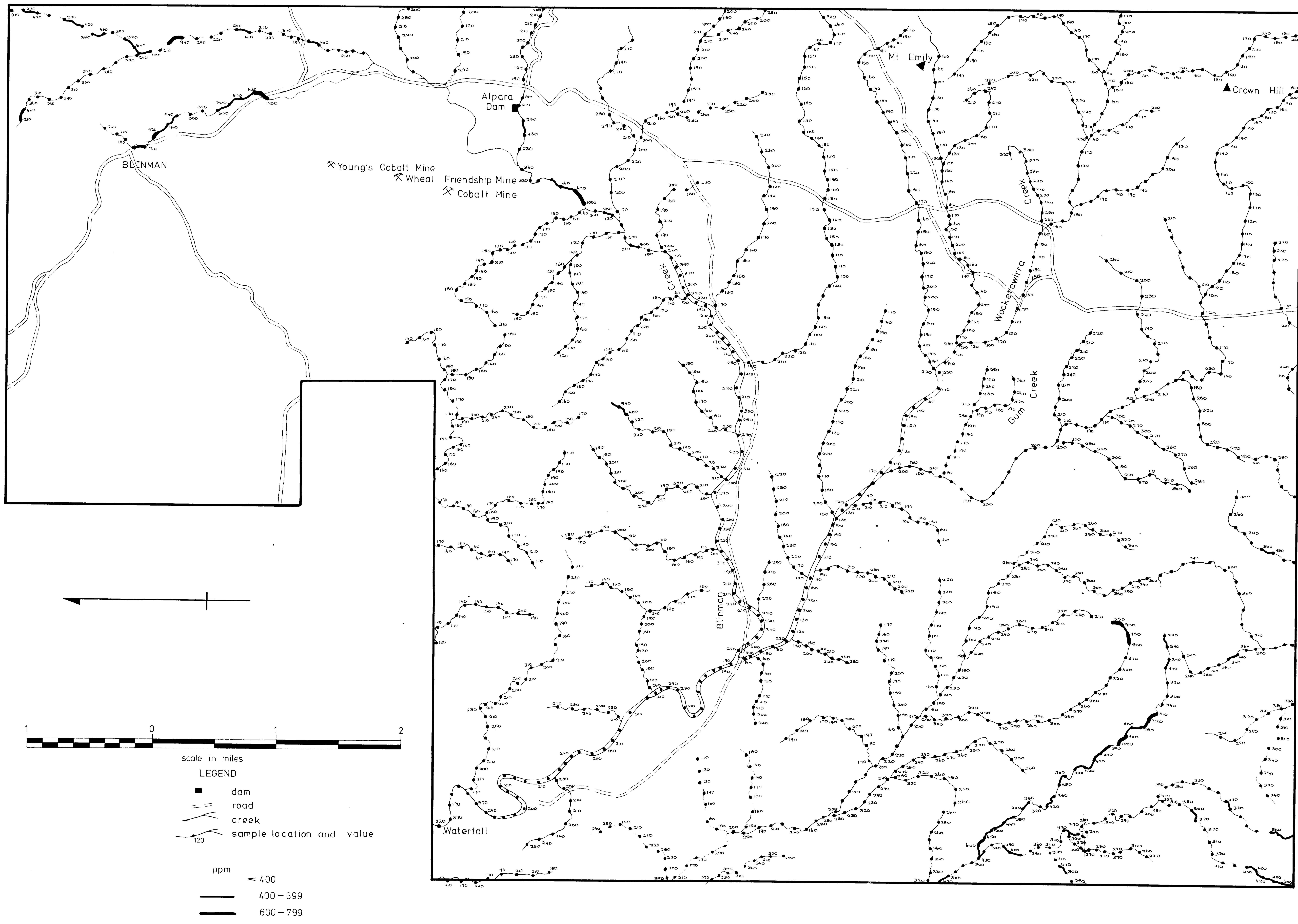


Mn

116·13

1294(1)-8

Fig. 5 Distribution of Ba ppm in stream sediments, Special Mining Lease 377 (Blinman)

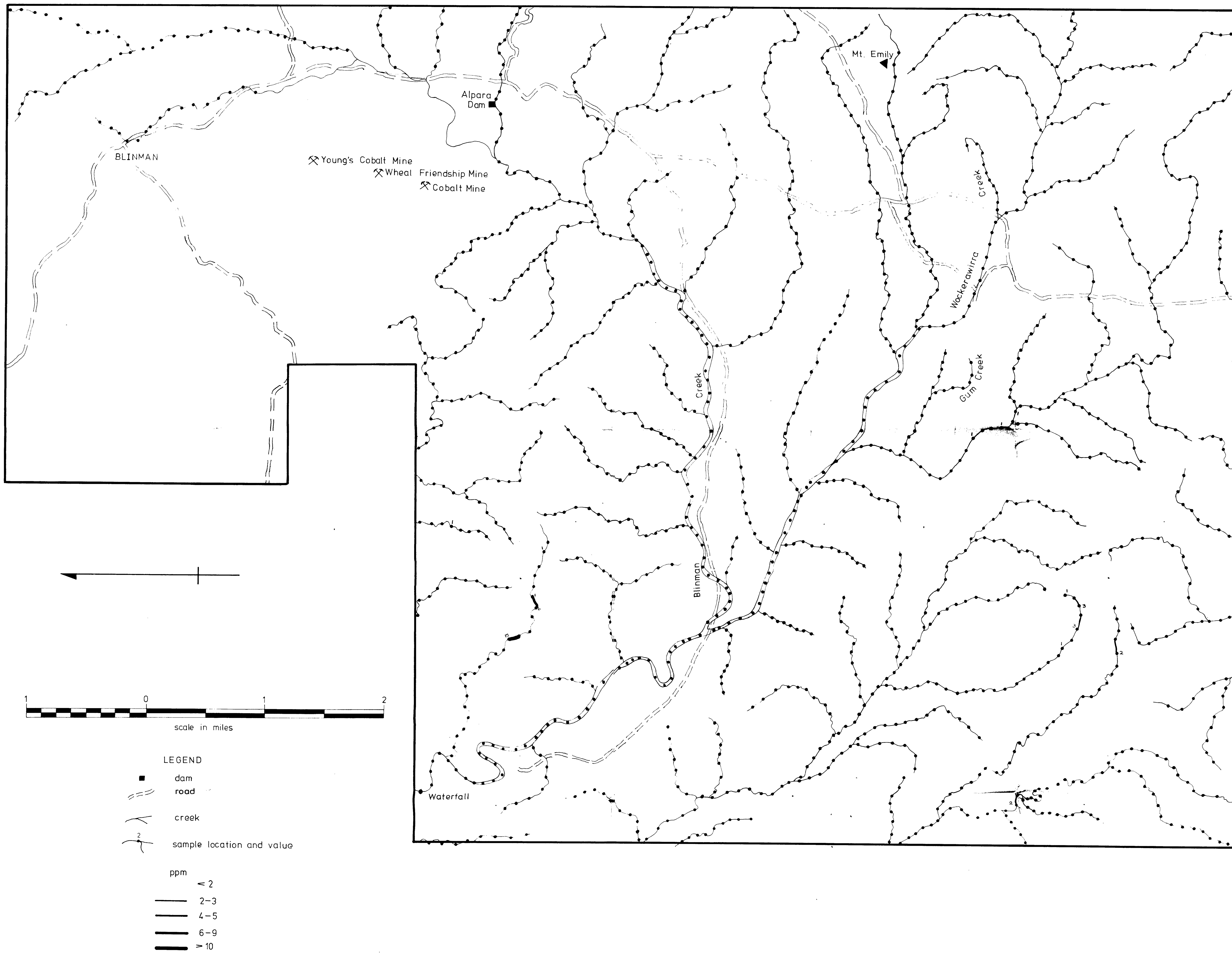


Ba

118·13

1294(1)-9

Fig. 4 Distribution of Ag ppm in stream sediments, Special Mining Lease 337 (Blinman)

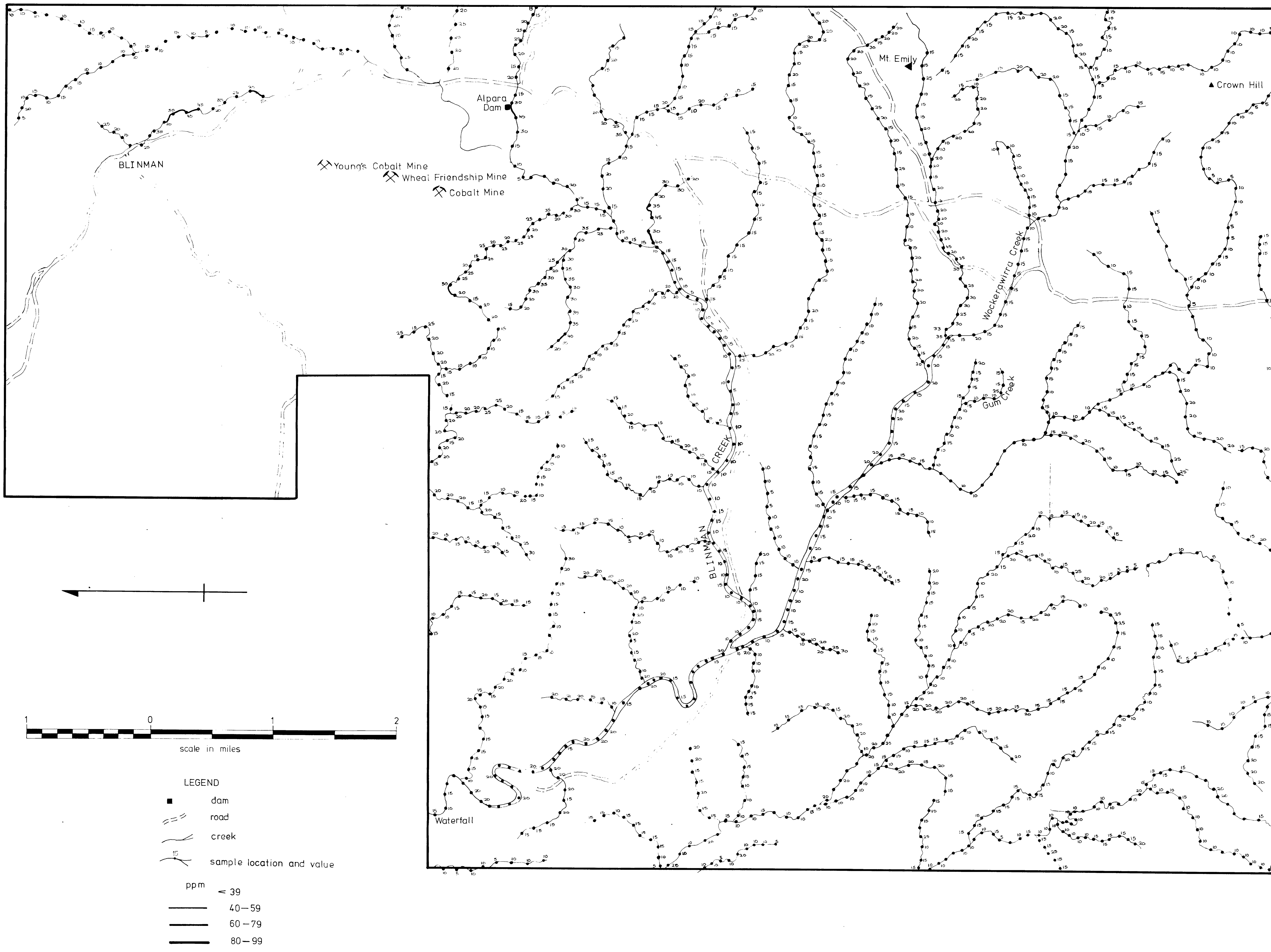


115·13

Ag

1294(1)-10

Fig. 3 Distribution of Pb ppm in stream sediments, Special Mining Lease 377 (Blinman)

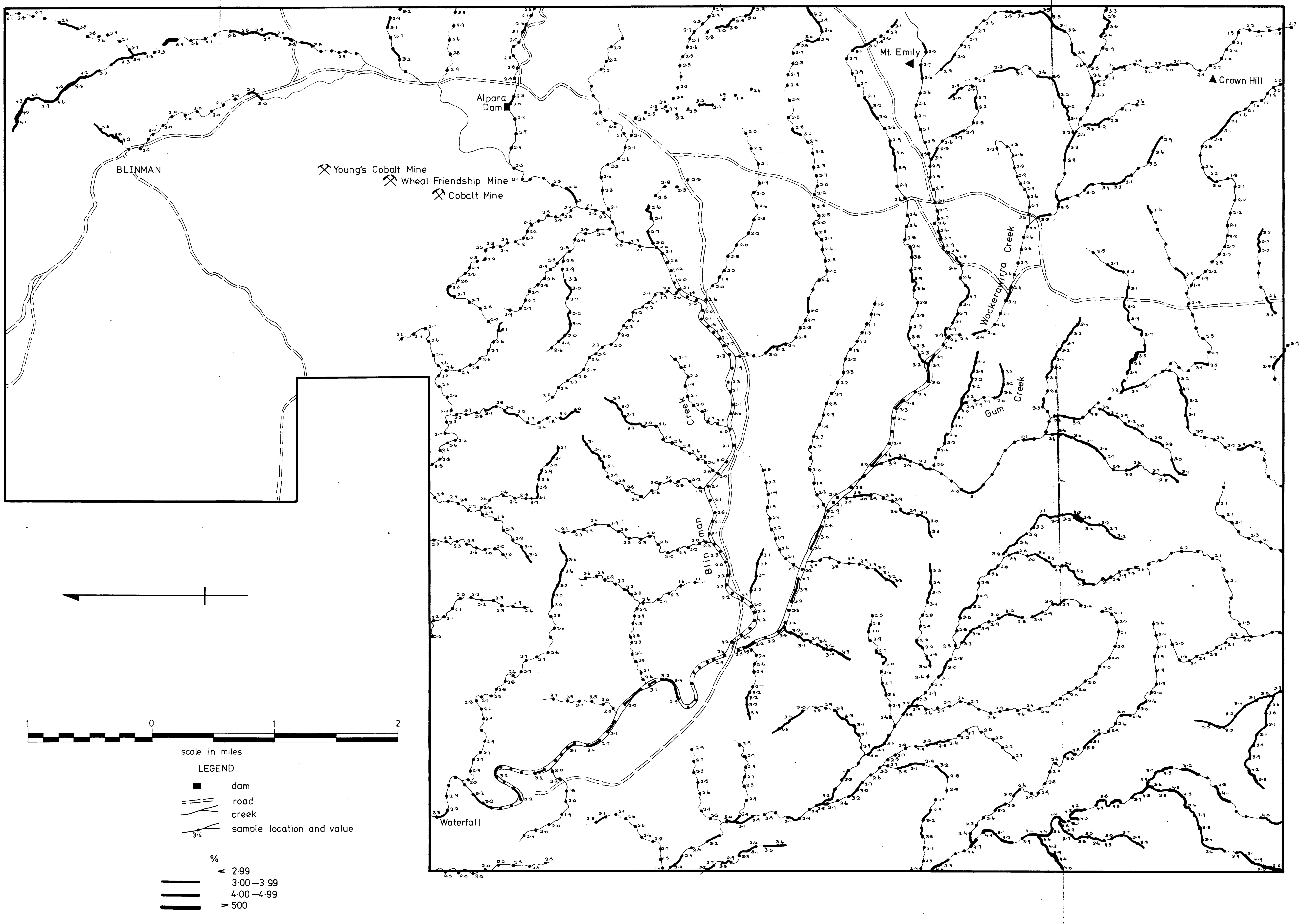


Pb

113·13

1294(1)-11

Fig. 6 Distribution of Fe% in sample sediments, Special Mining Lease 377 (Blinman)



Fe

1294(1)-12

117·13

Fig. 13·3
Geology and distribution of Cu (p.p.m.) in stream sediments, Special Mining Lease 377 (Blinman).

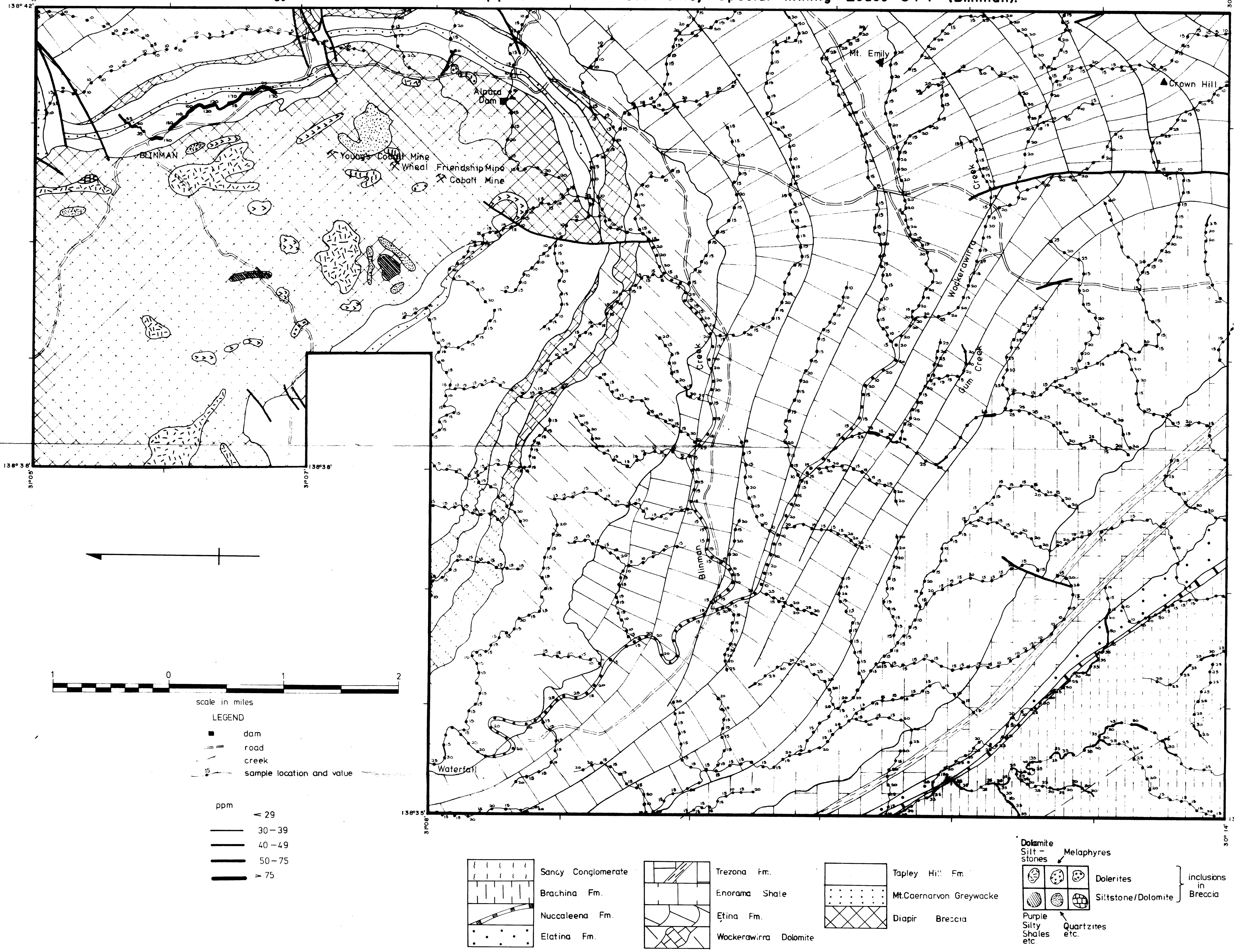
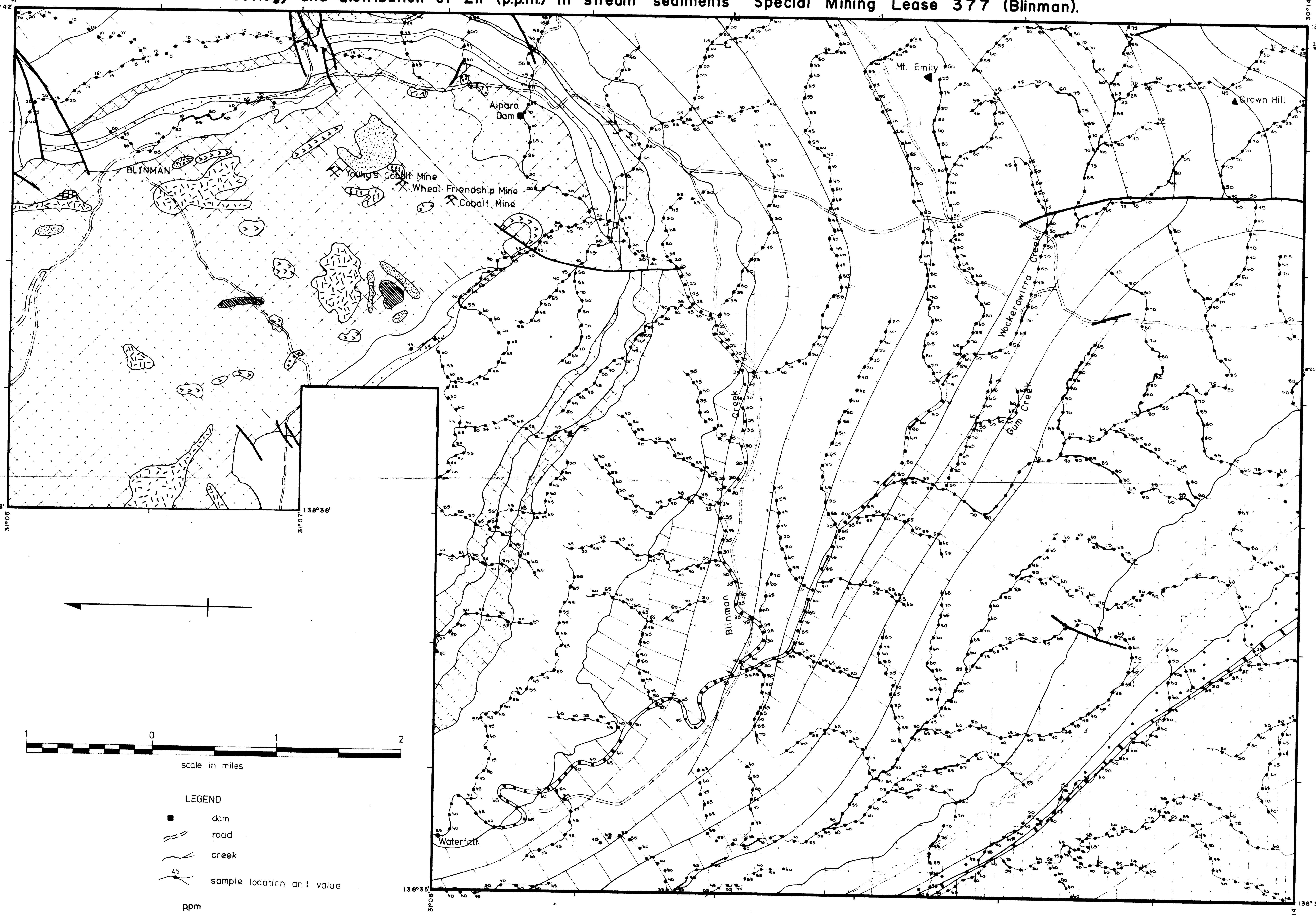


Fig. 13·4

Geology and distribution of Zn (p.p.m.) in stream sediments Special Mining Lease 377 (Blinman).



scale in miles

1 0 1 2

LEGEND

- dam
- road
- creek
- sample location and value

ppm

- < 75
- 75 — 99
- 100 — 124
- 125 — 149
- 150 — 175
- > 175

Sandy Conglomerate

Brachina Fm.

Nuccaleena Fm.

Elatina Fm.

Trezona Fm.

Enorama Shale

Etina Fm.

Wackerawirra Dolomite

Tapley Hill Fm.

Mt. Caernarvon Greywacke

Diapir Breccia

Dolomite Silt-stones

Melaphyres

Dolerites

Siltstone/Dolomite

Purple Silty Shales etc

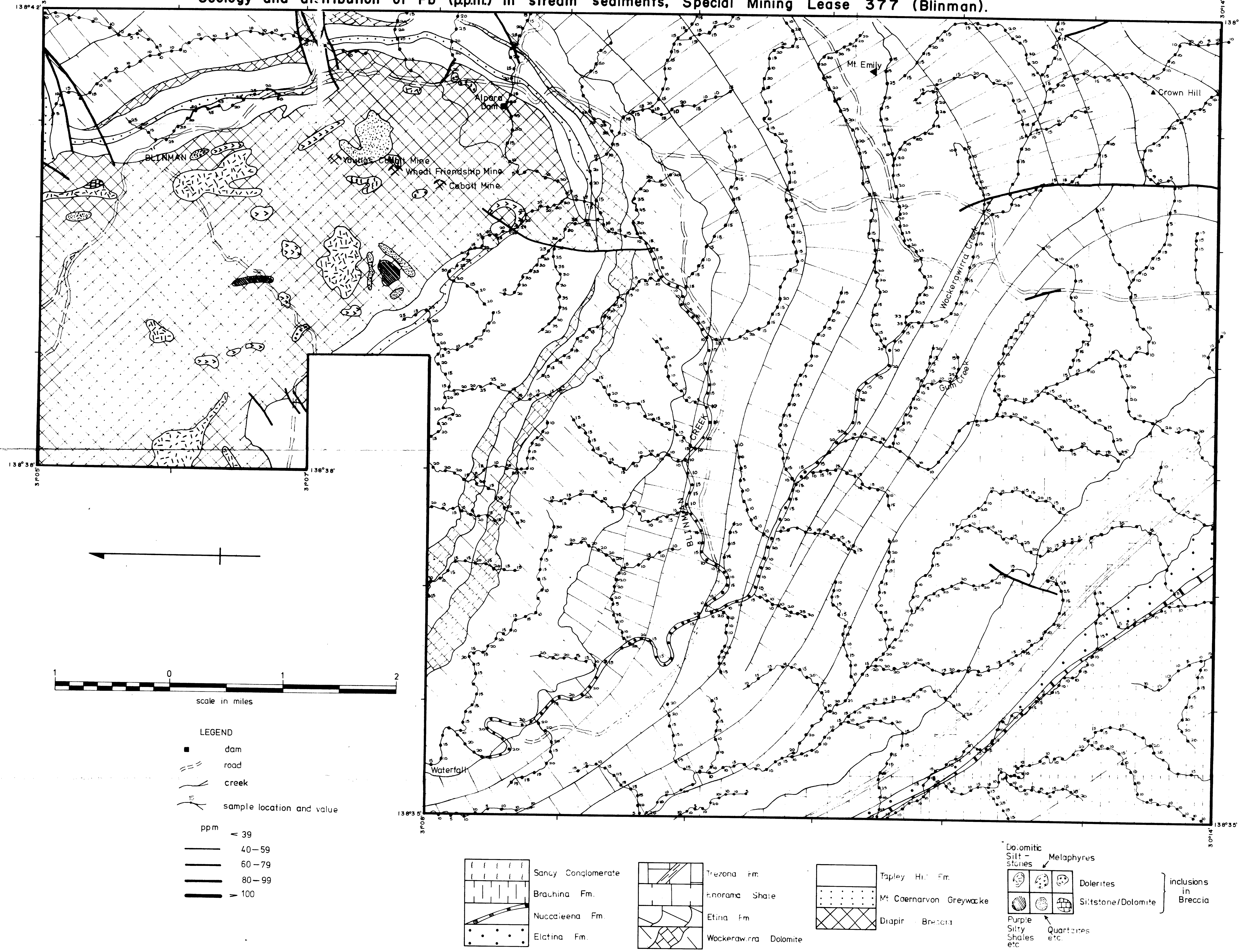
Quartzites etc.

inclusion in Breccia

1294(2)-2

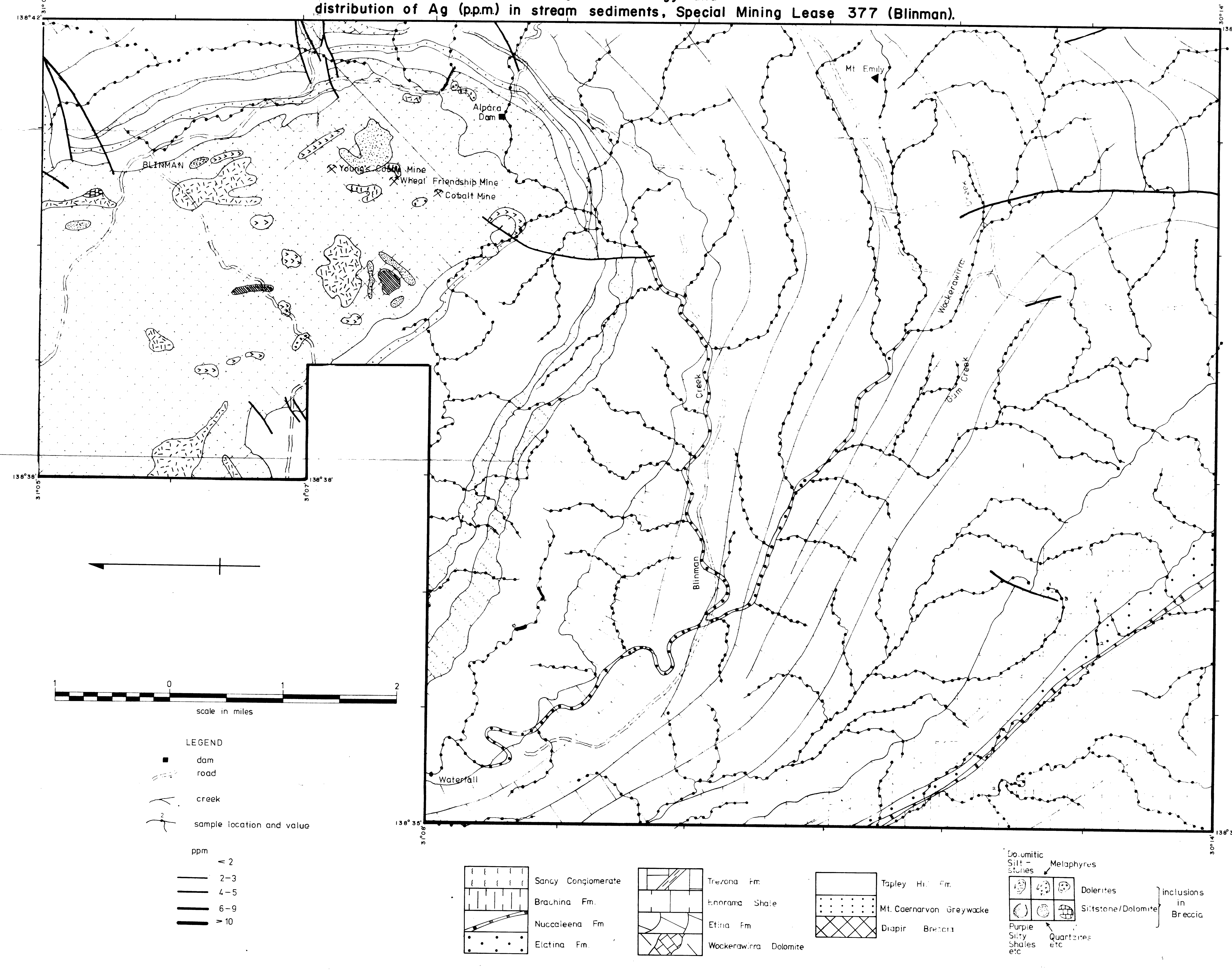
Fig. 13·5

Geology and distribution of Pb (p.p.m.) in stream sediments, Special Mining Lease 377 (Blinman).



1294(2)-3

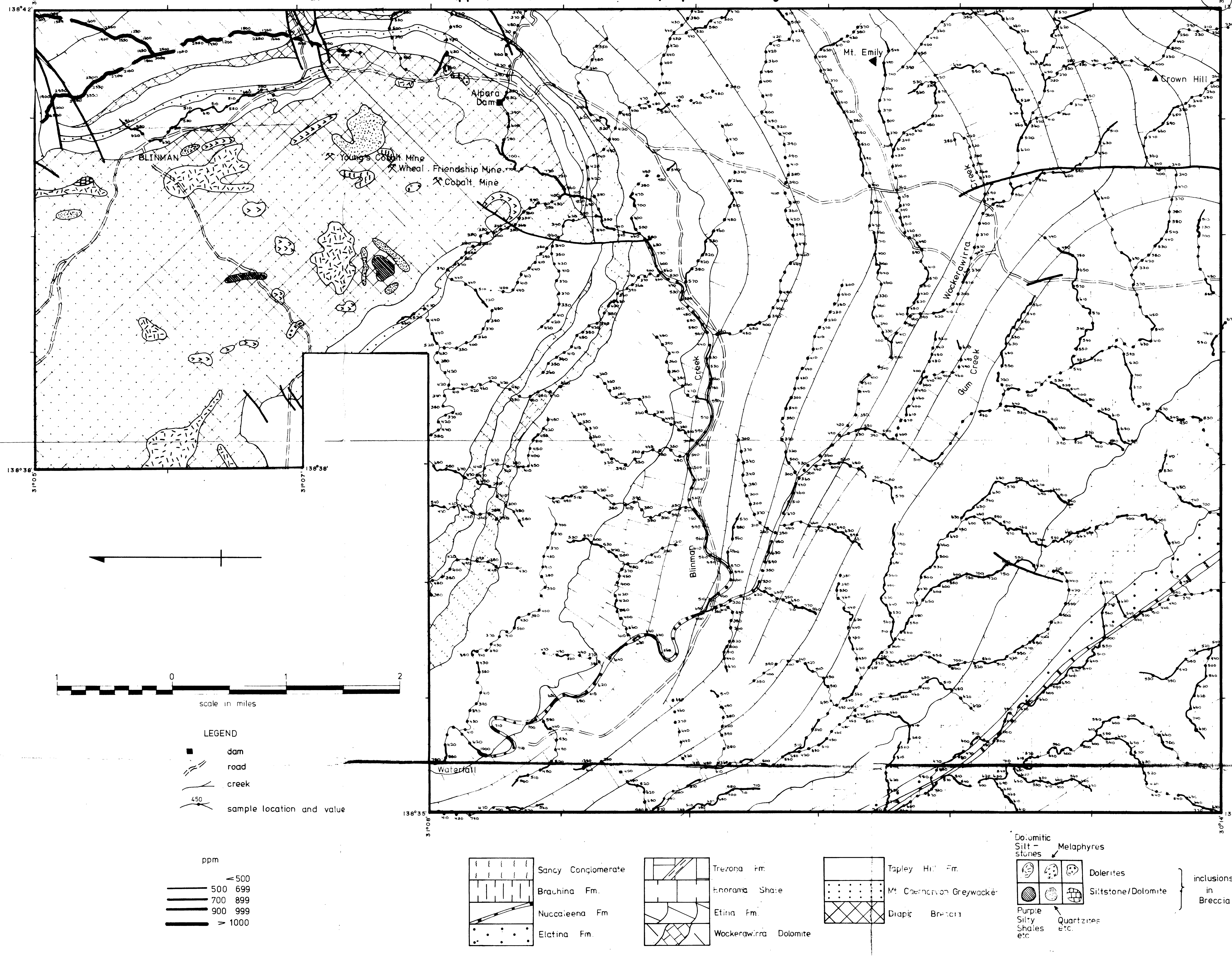
Fig. 13·6 Geology and distribution of Ag (p.p.m.) in stream sediments, Special Mining Lease 377 (Blinman).



1294(2)-4

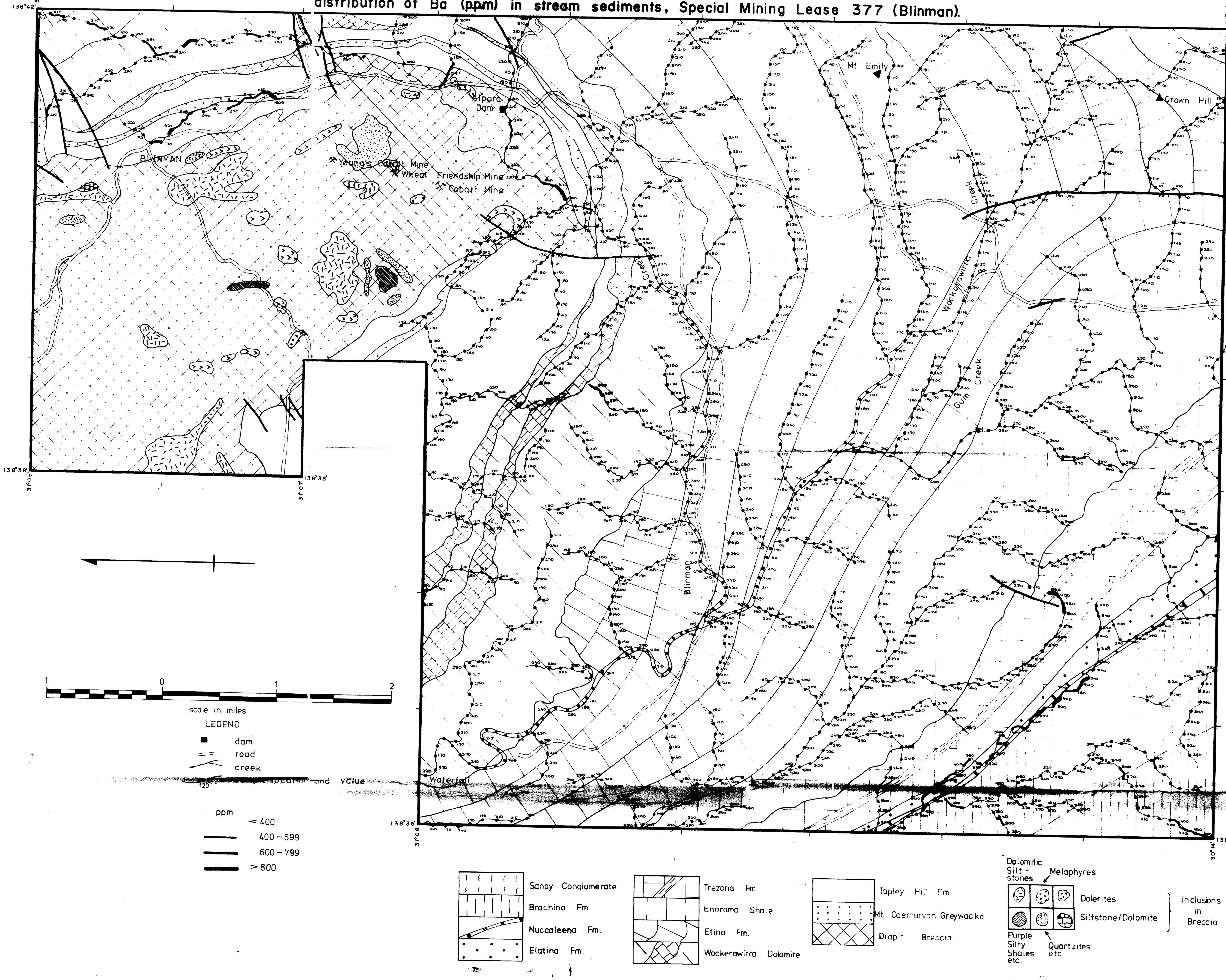
Fig. 13·8 Geology and distribution of Fe (%) in stream sediments, Special Mining Lease 377 (Blinman).

Fig. 13·9 Geology and distribution of Mn (ppm) in stream sediments, Special Mining Lease 377 (Blinman).



1294(2)-6

Fig. 13·7 Geology and distribution of Ba (ppm) in stream sediments, Special Mining Lease 377 (Blinman).



1294(2)-7