DEPARTMENT OF MINES
SOUTH AUSTRALIA

RB 66/8

GEOCHEMICAL DRAINAGE SURVEY

BLINMAN DOME DIAPIR

Hd. Carr

by

P.J. BINKS
GEOLOGIST
GEOCHEMICAL EXPLORATION SECTION

CONTENTS **PAGE**

PLANS

For ~~[illegible]~~ G' No. Location see plan no. 76-140 1"=20ch

Rept. Bk. No. 66/8
G.S. 3870
B.M. 658/65

11th January, 1968

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept. Bk. No. 66/8
G.S. 3870
D.M. 658/65

GEOCHEMICAL DRAINAGE SURVEY

BLINMAN DOME DIAPIR

__Md. Carr__

ABSTRACT

All creeks in the Blinman Diapir have been sampled and the -80 mesh fraction analysed for Cu, Co, Ni, Pb and Zn. Several anomalous areas not associated with known Cu mineralisation have been found and further soil sampling is recommended to delineate mineralisation in these areas. Due to the lack of mobility of metal ions in the Blinman environment it is apparent that further sampling should be carried out in some areas. There is practically no correlation of Co, Ni, Pb and Zn with Cu and in general the content of these elements is low and uniform.

INTRODUCTION

The Blinman Diapir was chosen for an exploration project by G.F. Whitten (Supervising Geologist, Exploration Services Division) for several reasons, including:-

.... copper mineralisation is associated with the diapir (the Blinman Mine was the largest copper mine in the Flinders Ranges producing 10,000 tons of copper).

.... more is known about the geology of this diapir than any other in South Australia; an excellent geological map at a scale of 1:24,000 and a Report of Investigation were prepared by R.P. Coats (1964).

... access to the area is excellent.

.... to try and establish the reasons for the common association of copper mineralisation with diapiric structures.

Sampling of stream sediments was carried out in October and November, 1967, and the results and conclusions from this survey form the subject of this report. No follow up to this initial step in the exploration programme was carried out as a Special Mining Lease covering the area was granted to Noranda Exploration Co. Ltd. in November, 1967. (S.M.L. No. 162).

LOCATION AND ACCESS

The Blinman Diapir, which is about 17 sq. mls. in area, is situated in the central part of the Flinders Ranges, about 300 road miles north of Adelaide. The standard-gauge railway between Port Augusta and Marree lies 20 miles to the west of the township of Blinman, which is situated in the eastern part of the diapir. Port Augusta is the nearest port approximately 112 miles by rail from Parachilna. A two-wheel drive vehicle is adequate for access to most parts in the east of the diapir but a four-wheel drive vehicle is necessary for the northwestern parts of the diapir.

REFERENCES

COATS, R.P. 1963. Geological Atlas of South Australia, Special Series. The Blinman Dome Diapir. 1" = 2,000'.

COATS, R.P. 1964. The Geology and Mineralisation of the Blinman Dome Diapir. Rep. Invest. geol. Surv. S.Aust. 26.

DICKINSON, S.B. 1944. The Structural Control of Ore Deposition in some South Australian Copperfields. Bull. geol. Surv. S.Aust. 21 pp.28-40.

MUMME, I.A. 1961. Geophysical Investigation of the Blinman Dome. Trans. roy. Soc. S.Aust. 85 pp.7-11.

WEBB, B.P. 1960. Diapiric Structures in the Flinders Ranges, South Australia. Aust. Journ. Sci. 22 (9) pp. 390-1.

PREVIOUS WORK

Dickinson (1944) investigated the Blinman Mine and concluded that ore reserves were negligible. He considered that most of the ore mined was a product of secondary enrichment.

A diapiric origin for the Blinman Dome Structure was first suggested by Webb (1960) who compared the rock types occurring within the diapir to rocks of Willouran age. A magnetic survey and detailed gravity survey were carried out by Mumme in 1961. Coats (1963) has prepared an excellent geological map of the diapir at a scale of 1:24,000 and written a Report of Investigation (1964) dealing with the geology and mineralisation of the area.

The diapir was held under a Special Mining Lease by South Alligator Uranium N.L. during 1966 and 1967. This company surveyed in a 5000 feet grid and carried out soil sampling and magnetic surveys along the grid lines. On the basis of an induced polarisation survey carried out for South Alligator by McPhar Geophysics Pty. Ltd. two diamond drill holes were put down. The first hole was drilled to 1,143 feet in siltstones

(Tapley Hill Formation) on the northern flank of the diapir near "Oratunga". No economic mineralisation was found. The other hole was drilled near "Alpana" in diapiric breccia, the hole was completed at 381 feet and again no economic mineralisation was found.

CLIMATE AND PHYSIOGRAPHY

The average annual rainfall for Blinman over the last 90 years is 11.15 inches with a marked winter maximum. However, rare torrential summer thunderstorms probably cause the only marked erosion in the area (7.68 inches fell in a few days in February, 1950). The mean maximum temperature for January is about 90°F and the mean minimum temperature for July is approximately 35°F. Thick mallee scrub covers the western, central and southern parts of the diapir but in the north and east much of the mallee has been cleared (probably for fuel for the smelter at the Blinman Mine).

The western part of the diapir is quite rugged but in the north and east the topography is lower and more subdued with a thicker soil cover. Alluviated areas occur in the south flanking the Blinman Creek. The steeply dipping ~~co~~-rocks form a prominent ridge surrounding the diapir. Blocks of several different rock types within the diapir are generally more resistant to erosion than the carbonate breccia and frequently stand out as prominent hills.

Drainage is radial from the diapir and generally all creeks are incised into solid rock with active creek gravels in their channels. The Blinman Creek is the largest creek in the area and the only one with appreciable alluvial deposits. Soils in the rugged parts are thin skeletal soils but are thicker in areas of more subdued topography. Probably the only transported soils in the area occur in the alluviated areas along the Blinman Creek.

GEOLOGY

As the geology of the Blinman Diapir has been mapped and discussed in detail by R.P. Coats (1964) it is proposed to give only a very brief resumé of the geology in this report. No geological map is included with this report but geochemical results have been plotted on the same topographical base map used by Coats to prepare the geological map, thus facilitating easy comparison between results and geology.

The Blinman Diapir consists of a mass of brecciated and crumpled sedimentary rock, believed to be of Willouran age, intruded into younger Sturtian rocks. Within the breccia are blocks of varying size and rock type. The largest block is nearly a mile long but blocks are of all sizes down to a few feet in diameter. Rock types include siltstone, sandstone, shale and dolomite; blocks of volcanics and associated tuffs are common. Plugs of dolerite have intruded the breccia but not the surrounding Sturtian and Marinoan rocks.

The rim-rocks consist of dark, well bedded siltstones (Tapley Hill Formation) of Sturtian age overlain by the usual Marinoan sequence found in the central Flinders Ranges. Contemporaneous movement of the diapir is indicated by lenticular bands of conglomerate containing fragments of rock derived from the diapir and by slumping within the lower part of the Tapley Hill Formation. Later movement, of uncertain age, is indicated by the upturning of the rim rocks and the intrusion of diapiric breccia into the rim-rocks.

MINERALISATION

As pointed out by Coats (op. cit.) mineral occurrences within the diapir are associated with three rock types;- melaphyres, dolerites and dolomites. Coats considered that carbonates and primary sulphides occurring as veins within the melaphyres resulted from the alteration of the melaphyres. Similarly Coats considered that mineralisation associated with the dolerites, including the iron ore (martite after magnetite) deposit three miles northwest of Blinman, resulted from alteration of the dolerites. Stratiform chalcopyrite, bornite and pyrite together with cross-cutting veins of primary sulphides occur within the "mine-type" dolomite at the Blinman Mine. Coats considered that the stratiform mineralisation was probably of sedimentary origin and that the associated vein material may have been derived from the latter mineralisation by mobilisation during metamorphism.

Low grade stratiform mineralisation occurs in other blocks of "mine-type" dolomite within the diapir. In one locality (¼ mile east of the well in Breakneck Gorge) a block of "mine-type" dolomite is in contact with a mass of brecciated dolomite. Stratiform copper mineralisation occurs in the "mine-type" dolomite but there is no mineralisation in the brecciated dolomite. This supports the suggested sedimentary origin of the copper within the "mine-type" dolomite as the two dolomites are so close it seems inconceivable that if the copper had been introduced after sedimentation it should be entirely confined to one of the dolomites, especially as the non-mineralised dolomite is brecciated.

However stratiform copper in the "mine-type" dolomite is generally very low grade and it is suggested that where higher grade concentrations occur (e.g. at the Blinman Mine) this dolomite was a favourable host rock, either chemically or structurally, for the addition of vein type sulphides possibly derived from nearby doleritic bodies.

GEOCHEMISTRY

An orientation survey was carried out by R.G. Wright and P.J. Binks early in October, 1967. The systematic sampling of creeks in the diapir was carried out by field assistants G. Griffen and A. Duck during October and November, 1967. A total of 450 samples was collected in 44 man days giving an overall density of about 25 samples per square mile.

Orientation Survey

This survey was undertaken to check that creeks draining known mineralised areas could be picked out from background creeks, also to check which size fraction gives the best contrast and largest drainage train. Bank alluvium samples were taken to check the possibility of contamination from old workings.

Two samples were taken at 200 foot intervals downstream from known Cu occurrences; where possible a bank alluvium sample was also taken. Similarly two samples were taken at 200ft. intervals in a creek draining an area apparently devoid of Cu mineralisation. A total of 52 samples was collected in this survey. The samples were dry-sieved into six different size fractions and submitted to the Australian Mineral Development Laboratories for analysis by atomic absorption spectrophotometry for Cu, Co, Ni, Pb and Zn. Results were remarkably similar in each size fraction, though occasional high values occurred in the coarsest fraction (-9+16 mesh). Duplicate samples of the coarse material did not give similar results indicating the lack of reliability in the coarsest fraction. Samples of bank alluvium from creeks draining Cu prospects gave similar results to the active creek gravel illustrating the lack of contamination from old workings. Contrast between the background creek and the "mineralised" creeks chosen for this survey were in the order of 2 to 4.

From the results of this orientation survey it was concluded that stream sediment sampling is capable of detecting mineralised zones in the area and that the -80 mesh fraction was suitable for the systematic survey. Dilution effects in major creeks were very pronounced and indicated the importance of sampling minor tributaries.

Systematic stream-sediment sampling

Samples were collected at ¼ ml. intervals, particular attention being paid to sampling minor tributaries; some of the major creeks were not sampled because of the effects of dilution. At each sample site a surface channel was dug across the active gravel in the creek with a pelican pick and material collected representatively across the channel. Preliminary sizing of the material was carried out on the spot by dry-panning. Sample sites were recorded on 1" = ½ ml. aerial photographs and the site marked with yellow tape and a brass tag bearing the sample number. Notes were taken on the sample location, usually recording creek width and depth, nature of creek debris degree of colluvial dilution and any possible contamination. Samples were dry-sieved to -80 mesh at Thebarton Depot and sent to ANDEL for analysis by atomic absorption spectrophotometry for Cu, Co, Ni, Pb and Zn.

RESULTS

Results were plotted on a topographical base at the same scale as the aerial photographs (1" = ½ ml.). Worm diagrams showing increasing metal contents by different colours have been prepared for Cu (Fig. 1), Co and Ni (Fig. 2), and Pb and Zn (Fig. 3). Mean values and threshold values (here taken as the mean plus twice the standard deviation), were calculated for each metal as following:-

Cu	mean value	=	25 ppm.	threshold value		=	50 ppm.
Co	"	" =	12 ppm.	"	"	=	25 ppm.
Ni	"	" =	20 ppm.	"	"	=	35 ppm.
Pb	"	" =	17 ppm.	"	"	=	30 ppm.
Zn	"	" =	30 ppm.	"	"	=	45 ppm.

Copper

Several anomalous areas have been located, not all of them associated with known Cu mineralisation. Two high values (195 and 315 ppm.) occur in separate minor tributaries in the northwest of the diapir (17,000N, 7,500E). These values are not associated with known Cu occurrences but several small Cu prospects occur in a block of "mine-type" dolomite to the west. Two anomalous Cu values (70 and 55 ppm.), not associated with known Cu mineralisation, occur in minor tributaries ENE of Mt. Elkington (12,000N, 5,000E). One isolated high value (115 ppm.) occurs in a small tributary just to the north of the Parachilna road (13,250N, 25,750E). A group of Cu values in a creek system ½ ml. SW of Blinman are interesting as most of the values are near threshold and three are anomalous. No copper mineralisation is known to occur in this creek system but some contamination from nearby settlements can be expected. Anomalous values are associated with several known Cu occurrences:- Blinman Mine, Doctor Mine, Young Cobalt Mine, Wheal Friendship Mine, and prospects in grid squares 15,000N, 20,000E and 15,000N, 30,000E. Only one value in creeks draining the Blinman Mine was anomalous, this is disturbing as it illustrates the extreme immobility of Cu in this environment and the possibility of missing a body of Cu ore in the area. Similar lack of mobility is shown downstream from other Cu workings where the dispersion train is usually less than ¼ ml. in length.

Cobalt and Nickel

Results for Co and Ni are low with remarkably little variation. Anomalous nickel occurs in only two creeks:- downstream from the Doctor Mine and in a creek in grid square 15,000N, 10,000E. The latter creek is not associated with a copper anomaly and the creek draining the Doctor Mine has only one anomalous Cu value. Both these creeks were sampled in the course of the orientation survey and both were submitted to AMDEL in the same batch.

As no other sample points in the area are anomalous, there is some doubt about the validity of these results. Duplicate samples should be collected in these creeks and Co, Ni values checked.

Lead and Zinc

There is no correlation between Pb and Zn values and Cu anomalies. Generally Pb and Zn values are low and uniform but there are a few high Zn values. Two very high Zn values (270 and 290 ppm.) occur 1 mile north of Blinman, these could be due to contamination from old settlements in the area. A few scattered anomalous Zn values occur in the west of the diapir and a group of anomalous values occur in a creek system draining a Cu occurrence at 12,500N, 14,250E.

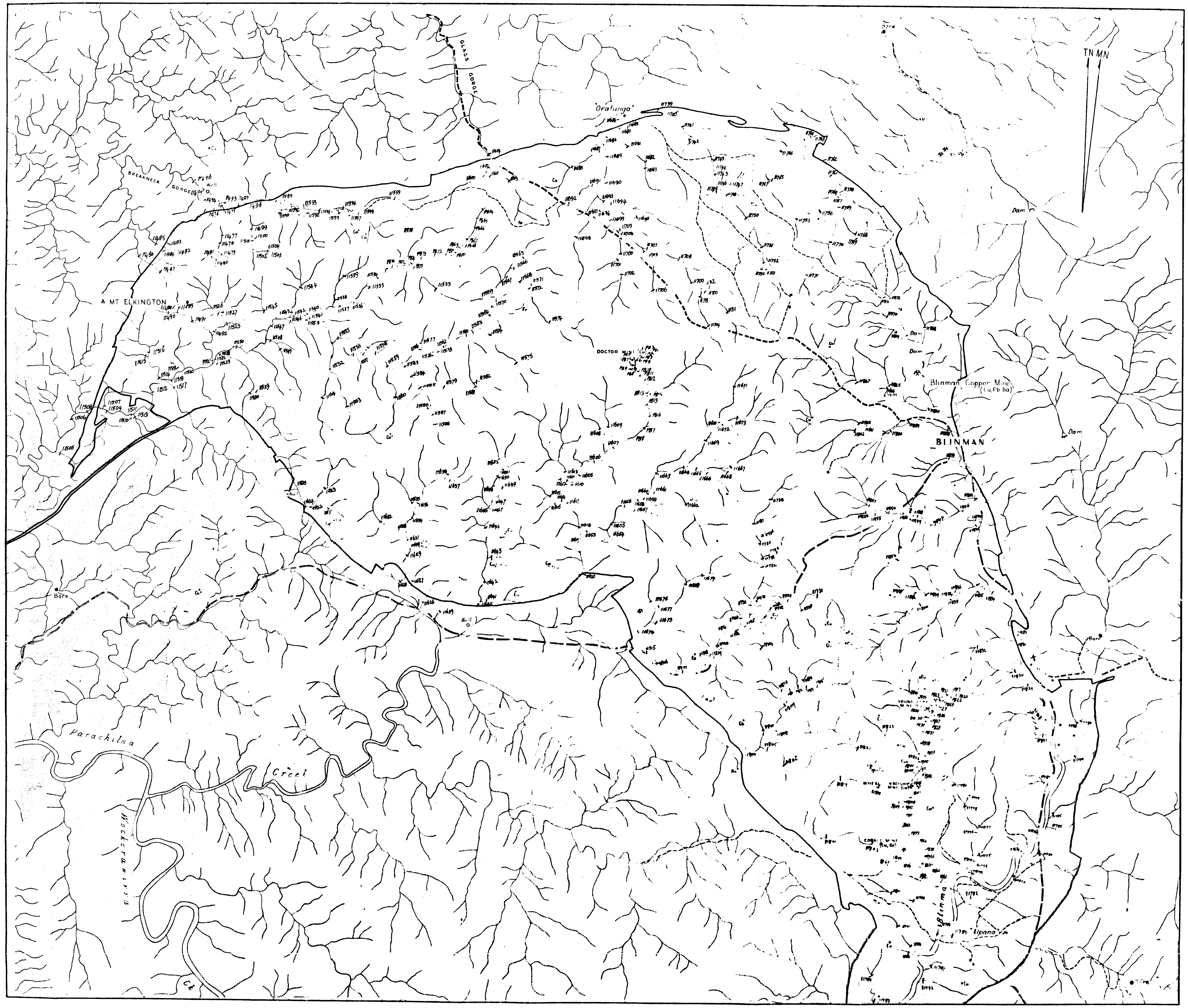
CONCLUSIONS

Several areas of anomalous copper not associated with known mineralisation have been delineated in this project. These areas should be checked for possible contamination and soil samples collected to give further information on the extent of possible mineralisation.

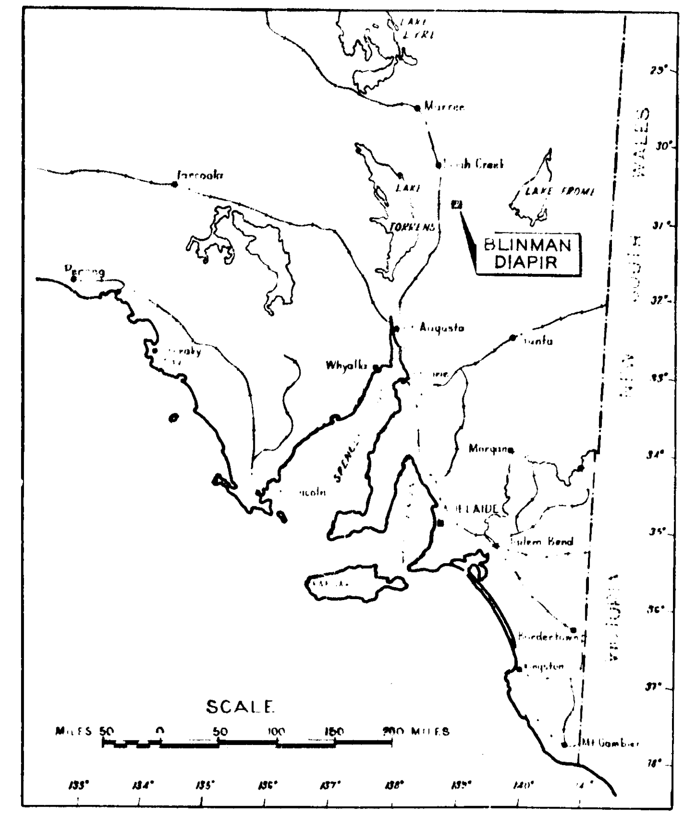
Due to the lack of mobility of metal ions in the Blinman environment it is apparent that the sample density of 25 to the square mile taken in this survey is insufficient. Some areas, particularly on watersheds, require closer sampling, and here a sample of colluvium would be adequate.

P.J. BINKS
GEOLOGIST
GEOCHEMICAL EXPLORATION SECTION

PJB:SMA
11.1.1968



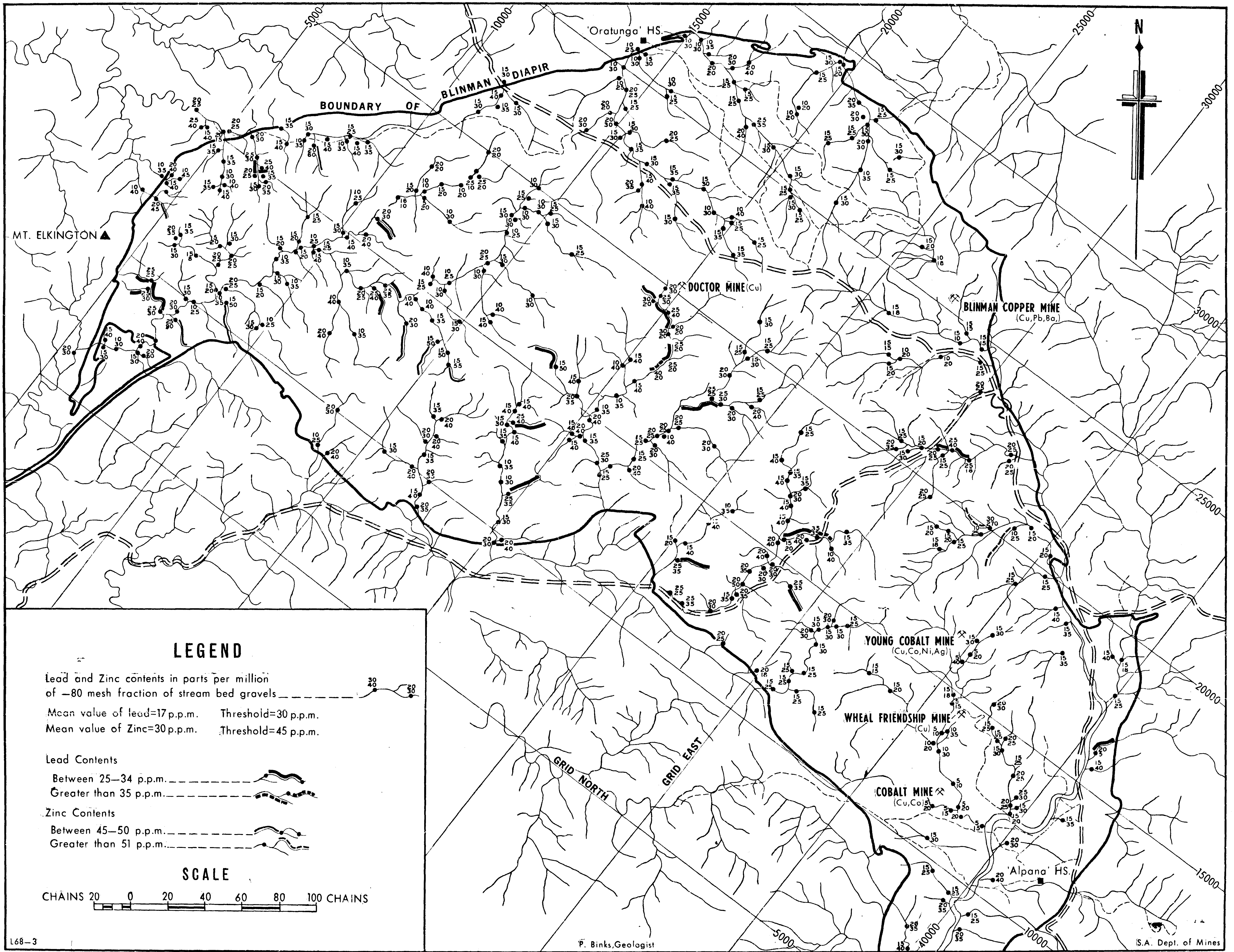
LOCALITY MAP



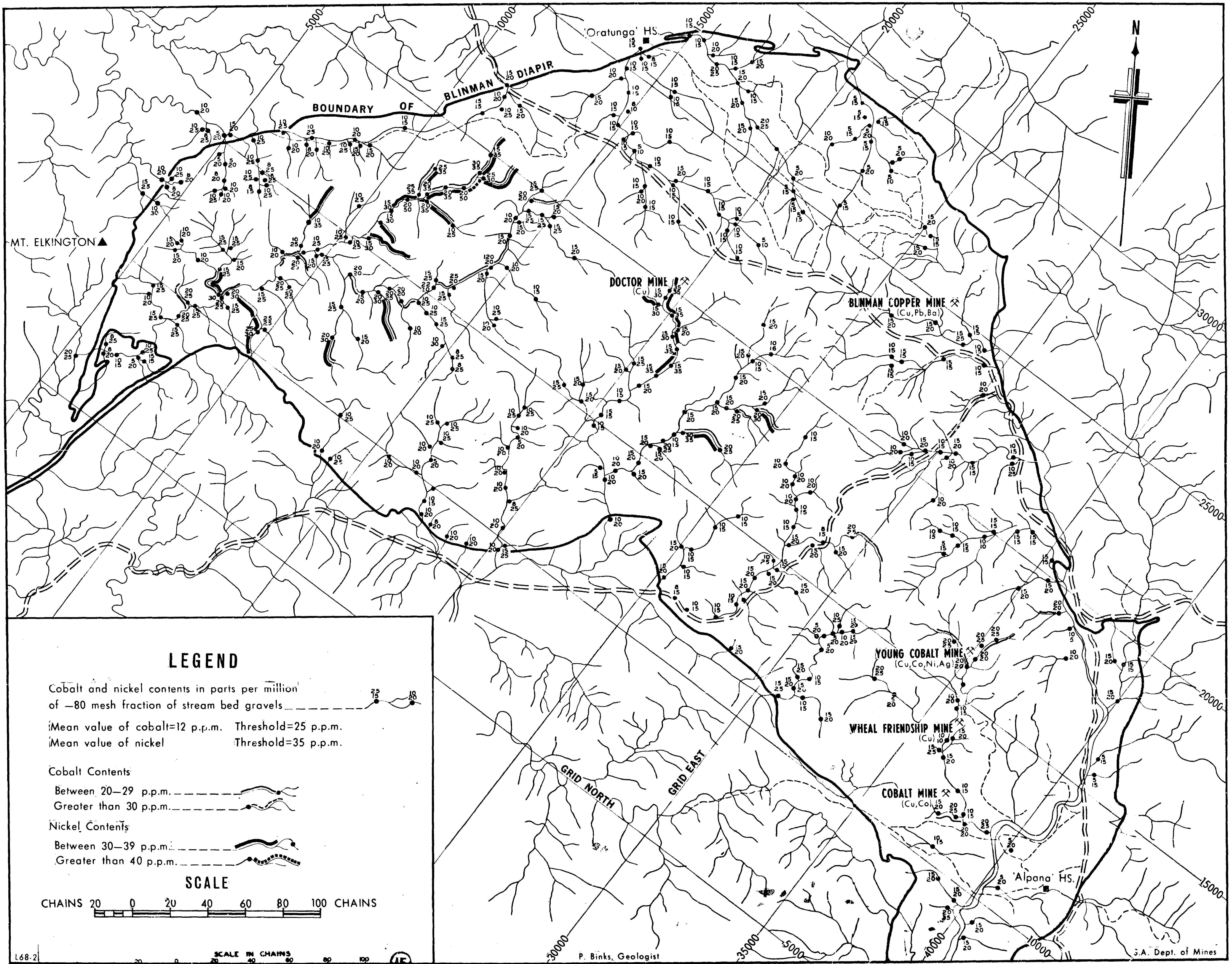
SCALE

CHAINS 20 10 0 20 40 60 80 CHAINS

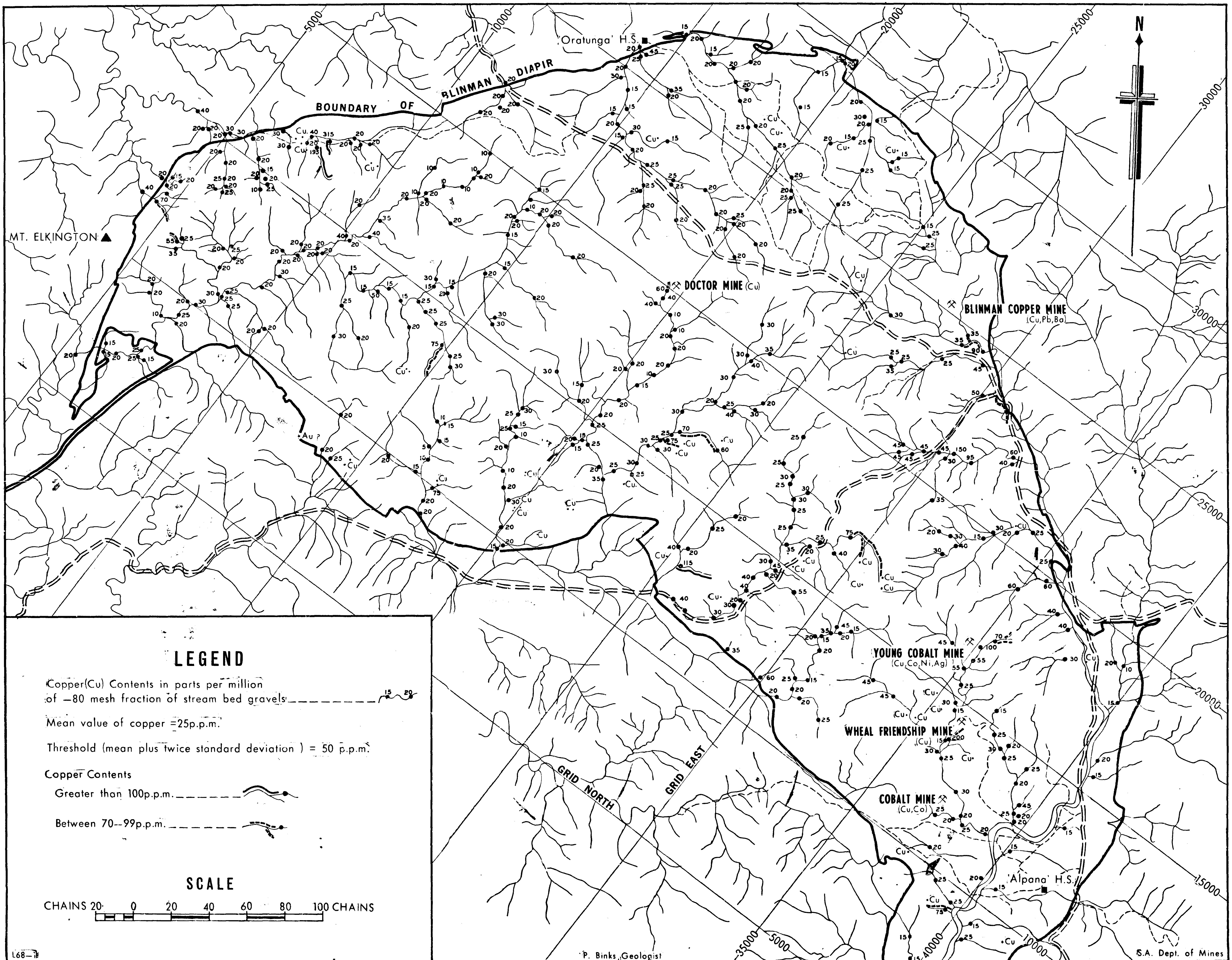
DEPARTMENT OF MINES – SOUTH AUSTRALIA			
BLINMAN DIAPIR SAMPLE LOCATION PLAN OF 'G' Nos. 1967			
76-140		Drn PB	SCALE: 1inch=20chains
		Tcd RH	
ORIGINAL.		Ckd	
		Exd	DATE



'Oratunga' HS.
BOUNDARY OF BLINMAN DIAPIR
MT. ELKINGTON
DOCTOR MINE (Cu)
BLINMAN COPPER MINE
(Cu,Pb,Ba,)
YOUNG COBALT MINE
(Cu,Co,Ni,Ag)
WHEAL FRIENDSHIP MINE
(Cu)
COBALT MINE
(Cu,Co)
'Alpana' HS.
GRID NORTH
GRID EAST
N
LEGEND
Lead and Zinc contents in parts per million of —80 mesh fraction of stream bed gravels
Mean value of lead=17 p.p.m.
Threshold=30 p.p.m.
Mean value of Zinc=30 p.p.m.
Threshold=45 p.p.m.
Lead Contents
Between 25—34 p.p.m.
Greater than 35 p.p.m.
Zinc Contents
Between 45—50 p.p.m.
Greater than 51 p.p.m.
SCALE
CHAINS 20 0 20 40 60 80 100 CHAINS
L68—3
P. Binks, Geologist
S.A. Dept. of Mines



BOUNDARY OF BLINMAN DIAPIR
'Oratunga' HS.
MT. ELKINGTON
N
DOCTOR MINE (Cu)
BLINMAN COPPER MINE (Cu,Pb,Ba)
YOUNG COBALT MINE (Cu,Co,Ni,Ag)
WHEAL FRIENDSHIP MINE (Cu)
COBALT MINE (Cu,Co)
'Alpana' HS.
GRID NORTH
GRID EAST
LEGEND
Cobalt and nickel contents in parts per million of −80 mesh fraction of stream bed gravels
Mean value of cobalt=12 p.p.m. Threshold=25 p.p.m.
Mean value of nickel Threshold=35 p.p.m.
Cobalt Contents
Between 20—29 p.p.m.
Greater than 30 p.p.m.
Nickel Contents
Between 30—39 p.p.m.
Greater than 40 p.p.m.
SCALE
CHAINS 20 0 20 40 60 80 100 CHAINS
SCALE IN CHAINS
L68-2
P. Binks, Geologist
S.A. Dept. of Mines
15



BOUNDARY OF BLINMAN DIAPIR
'Oratunga' H.S.
MT. ELKINGTON
DOCTOR MINE (Cu)
BLINMAN COPPER MINE (Cu,Pb,Ba)
YOUNG COBALT MINE (Cu,Co,Ni,Ag)
WHEAL FRIENDSHIP MINE (Cu)
COBALT MINE (Cu,Co)
'Alpana' H.S.
GRID NORTH
GRID EAST
N
LEGEND
Copper(Cu) Contents in parts per million of −80 mesh fraction of stream bed gravels
Mean value of copper =25p.p.m.
Threshold (mean plus twice standard deviation) = 50 p.p.m.
Copper Contents
Greater than 100p.p.m.
Between 70--99p.p.m.
SCALE
CHAINS 20 0 20 40 60 80 100 CHAINS
L68-
P. Binks, Geologist
S.A. Dept. of Mines