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COMSTAFF PROPRIETARY LIMITED

REPORT ON THE BISCHOFF SOUTH PROJECT

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WINTER 1970

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ANGLO AMERICAN CORPORATION (AUSTRALIA) LIMITED

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THE BISCHOFF SOUTH PROJECT

A reconnaissance of the Arthur River and its tributaries.

1. INTRODUCTION

The area covered by this project lies to the west and south-west of Mt. Bischoff, and within a five mile radius thereof (Map No.1). The project took the form of a stream sediment sampling and a regional geological mapping programme covering the Arthur River drainage.

One of the main objectives was to delimit any possible extensions of the Mt. Bischoff mineralisation, whilst another was to see whether determination of the structure in this area might lead to a greater understanding of that of Mount Bischoff and its relationship, if any to the Cleveland (Sn, Cu) and, now abandoned, Magnet (Pb, Ag) Mines to the south-west. In addition to these specific aims, the programme also forms part of the regional approach to the entire lease areas.

In topography, climate and vegetation the area is typical of the north-western part of Tasmania, namely well-dissected and drained, very wet, cool and thickly forested. Access to most of the tributaries is fairly good, largely due to the existence of the old Magnet Mine Tramway, now a good four wheel drive track known as the Magnet Line, but access to the Arthur River itself is more difficult and involves more lengthy traverses.

The project was begun in mid April, and by mid-June by far the greater part of the programme had been carried out. However, geological mapping was continued after this time, and the project was not finalised until almost the end of July, when results were received, plotted and evaluated.

The staff involved in this programme comprised one geologist and from two to six field-assistants.

2. PREVIOUS WORK.

The area is described in Geol. Survey Bulletin 34 "The Mount Bischoff Tin Field" by A. McIntosh Reid, published in

1923, and various other papers dealing with the area in part or in full are also in existence. Most of these publications are more or less contemporaneous with Bulletin 34. Old workings are in existence at Mt. Bischoff, on Tinstone Creek, and at Magnet Mine, and it seems likely that most of the area has been well "fossicked".

Prior to this programme work by Comstaff Pty. Ltd. was restricted to the geological mapping of Tinstone Creek and the geochemical sampling of part of Ritchie Creek. Since neither of these activities has previously been reported, they are incorporated in this report.

3. WORK CARRIED OUT.

3.1. Geochemical sampling (Map No. 2)

The Arthur River and its major tributaries were cut out and sampled at 500 ft. intervals, whilst minor tributaries encountered were sampled at their confluence with the major drainage and at 200 ft or 500 ft upstream of the confluence according to size. Most of the tributaries were surveyed by tape and compass since no suitable base map was available, but on the Arthur River and three tributaries sample intervals were estimated and only rough bearings taken.

3.2. Geological mapping (Map No. 3)

As can be seen from the map, the geological mapping is incomplete, with the greater part of the Arthur River and two tributaries yet to be mapped. In winter the Arthur, which is a large river (c. 50ft wide) is swollen by melted snow and heavy rain, with the result that much of the bedrock "exposed" in its bed and banks is under water, it was therefore decided to leave this mapping until summer, when a far greater proportion of the outcrop will be accessible.

In addition to the drainages mapped, the Magnet Line was also traversed.

3.3. Drafting.

In the absence of a suitable alternative, the geologist involved, in conjunction with the draftsman, prepared a 1:10,000 scale base map, on which all geological and geo-

chemical data were originally recorded. This map was compiled from field surveys and checked by air photo interpretation. Wherever possible the end points of field surveys were fixed from aerial photography, and although some adjustment was necessary, it is felt that the base map thus produced is more accurate than any available alternative.

4. GEOLOGY.

4.1. Field Observations (Map No. 4)

By far the greater part of the rocks seen to date are mixed sediments of (presumed) late Pre-Cambrian/early Cambrian age, which show a marked and rapid lithological variation. Almost any short traverse across strike will reveal a number of lithological changes, and it is apparent that the sediments are (relatively) thinly bedded. Almost without exception the sediments exhibit some signs of metamorphism, generally of very low grade. Argillaceous rocks often appear to be slightly baked and indurated, and many exposures show the effects of low-grade dynamo-thermal metamorphism, with the development of jointing, cleavage, possible weak preferred orientation within the petrofabric, and the growth and/or recrystallisation of micas and feldspar.

Well developed cleavage and jointing is so prevalent that bedding is often almost totally obscured, except at the junction of differing lithologies. Fortunately a unit of one lithological type often contains a thin band or bands of another type, thus enabling the orientation of bedding to be determined.

Sediments of the following lithological types are represented within the area, with the observed variation within type being as described:

(a) Sandstone - Generally fine-medium grained, grey, grey-brown, grey-green, orange, orange-brown, dark brown, buff and khaki in colour, the rocks are often micaceous and/or feldspathic and/or tuffaceous, sometimes quartzitic or argillaceous. Most commonly present is a dark brown feldspathic and tuffaceous type, in which some of the feldspar appears secondary (i.e. recrystalline), or as a grey micaceous and feldspathic type.

(b) Quartzite - Usually grey and fine-grained, sometimes argillaceous. It is present throughout the area but is not

common. Occasionally it occurs as small boudin within shaley beds.

- (c) Greywacke - rare, grey or green, sometimes ^{re-} crystallized.
- (d) Siltstone - common throughout. Grey, grey-green, dark green, orange, orange-brown, brown, chocolate and khaki, these rocks are sometimes shaly, laminated, fissile, flaggy or banded, less commonly phyllitic or hornfelsic, rarely recrystalline, often argillaceous and micaceous, sometimes felspathic and tuffaceous.
- (e) Mudstone - common. Usually khaki or chocolate, also grey, orange-brown and red-brown in colour the rocks are often shaley or massive and well jointed, sometimes phyllitic with secondary (recrystalline) mica.
- (f) Shale - true shales are uncommon. When present they are black and carbonaceous, or grey and sometimes phyllitic and/or micaceous.
- (g) Slate - rare, grey.
- (h) Phyllite - grey, micaceous and restricted in occurrence.

Other rock types seen within the area are quartz-porphry, serpentine, dolerite and basalt. The porphyry is seen at the eastern end of Tinstone Creek, and is part of the dyke swarm intruding Mount Bischoff whilst the basalt is Tertiary in age and is seen in the south of the area. Exposures of serpentine and dolerite are few in number and scattered in occurrence; the serpentine appears to be restricted to the western part of the area, being exposed only in AR 8250 Creek, MC 132 Creek and MC 4050 Creek.

The most common strike direction is approximately north-east - south-west, with dips being both to the north-west and south-east and varying from 25° to 90° (vertical beds), although predominantly steep. In addition to the north-east - south-west strikes, others trending more nearly north-south and east-west were recorded, suggesting structural breaks of some kind.

Some small-scale (drag) folding was recorded in the field. In all cases the fold axes were approximately north-east -

south-west. A very tight almost parallel-sided isoclinal antiform in which both axial plane and limbs almost correspond to bedding was recorded near the southern end of the Magnet Line. This axis also trended north-east - south-west, and the fold was slightly overturned to the north-west.

Such faulting as was observed appears to be of minor magnitude and consequence.

No significant mineralisation was recorded. Whilst not common, minor quartz veining is seen throughout the area, but such veins appeared barren in all instances. The recrystallised siltstones seen on AR 8250 Creek are pyritised, with pyrite occurring as pods and veinlets, and also disseminated along joint planes. Also on this creek, close to Butler's Road, are two occurrences of gossanous material, one developed along minor fault planes in recrystallized siltstone and carrying pyrite and pyrrhotite, the other occurring on a joint (?) plane in siltstone and containing haematite and minor marcasite.

4.2. Structure and Stratigraphy.

In view of the profusion of lithological types observed in the area, and the rapid changes from one to another, it is difficult to arrive at any correlation between beds, or any stratigraphic sequence, for the area as a whole. However, when lithology is considered in terms of structure, some degree of correlation is possible within each structural unit. Thus before discussing correlation and stratigraphy, it is necessary to describe the structure of the area.

4.2.(a) Structure (Map No. 5)

The dominant feature of the area's structure is the north-east - south-west "grain" imparted by the many strike trends in this direction. The grain is seen in a broad band extending across the north of the area from MC4050 creek in the west to the junction of Tinstone and Ritchie Creeks in the east, and also intermittently along the Magnet Line between this major band and the Waratah-Savage River Road.

Within the major NE-SW band, one major and several minor structures are in evidence. The drag folds mentioned in Section 4.1. lie within this zone, and it is thought that ~~these~~ in Mine Creek, lie close to or on the axis of a

the M folds seen

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major antiform, the presence of which is indicated by opposing dips on the northern and southern side of the zone. The approximate trace of the antiformal axis is indicated on the map, and conforms approximately to the general NE-SW trend, although appearing to be flexured. Strikes on MC 4050 Creek indicate that the outcrop of the axial zone is closing, and it therefore seems likely that the structure is plunging to the south-west. Since the Arthur River is still to be mapped, it is not possible to trace the antiform beyond the Mine Creek-Arthur River confluence at this time. However, since the zone of NE-SW trending beds extends at least across to the Ritchie Creek-Arthur River junction, it seems likely that the anticline will also extend this far. The postulated extension is indicated on the map, but it is possible that the actual axial trace may lie north or south of the line shown.

In addition to the dominant NE-SW trending block, minor but nevertheless definite trends in other directions are also observed, and there must obviously be some kind of discontinuity between the various structural units.

Although transverse structural trends are apparently indicated by the strikes recorded on the two southernmost Arthur River Tributaries (A3155 and AR8250 Creeks), data within the south western part of the area is very limited, and this will not be discussed further. In the east, however, more information is available, and here at least three cross-cutting trends are present.

At the southern end of the Magnet Line and Ritchie Creek, close to the Waratah-Savage River Road, some strikes trend north-south, cutting across others close to the dominant NE-SW trend. These N-S trending beds are themselves "truncated" to the north by a series of beds trending approximately east-west, as indicated by strikes recorded in Ritchie Creek and on the Magnet Line. To the north of this lineament the beds as seen in Ritchie Creek adopt a north-north-west - south-south-east orientation, until they come up against the major NE-SW block in the north, whilst on the Magnet Line strikes appear disorientated at first, and then as one progresses northwards gradually swing round to conform to the dominant NE-SW trend.

The N-S orientation as observed at the southern end of Ritchie Creek is also seen at the eastern end of Tinstone Creek, and another E-W lineation may occur on the Magnet

Line just east of MLC ⁶⁵⁵⁰~~650~~ Creek.

The relationship between the various structural units described here is, at this time, rather obscure, but will be discussed briefly in section 6 of this report.

4.2. (b) Stratigraphy. (Map No. 4)

As was noted above, any correlation or stratigraphic succession derived from information currently available can be applied only within that discrete structural unit from which it is derived. It is therefore necessary to consider each of these units in turn.

In the case of the 'minor' units (i.e. those with a grain other than NE-SW), the available data is rather too restricted to draw many conclusions. However the following suggestions are tentatively advanced:-

- (i) The southernmost area of N-S trending rocks comprises a dominantly argillaceous sequence, whilst the northern area with this trend has a sequence of argillites and fine-grained arenites.
- (ii) The E-W trending unit is a succession of thinly-bedded mudstones and sandstones below, and laminated mudstones with minor siltstone above.
- (iii) The NNE-SSW unit is apparently dominantly arenaceous below and becomes more argillaceous above.

Within the major NE-SW block more information is available, and this, together with its structural configuration, allows a more detailed analysis to be made. No evidence of "younging" was seen, but, assuming these beds to be right way up, the succession here is:-

- | | |
|----------------|--|
| <u>Younger</u> | (iii) Felspathic and tuffaceous sandstones and siltstones, mudstones, minor shales. |
| | (ii) Dominant felspathic and tuffaceous sandstones, minor mudstones. |
| <u>Older</u> | (i) Grey shales, phyllites, semi-phyllitic sediments, subordinate quartzites, very minor slates. |

In the southern limb of the antiform, group (i) and (iii) may be seen extending across MC 132 Creek, the Magnet Line, the Arthur River and (in part) MLC 6550 Creek. Because of the plunge of the structure, only group (iii) is seen on MC 4050 Creek, whilst group (ii) is only observed on the Magnet Line and may represent a facies variation within group (iii).

5. GEOCHEMISTRY.

The samples collected were analysed for Ag, Cu, Pb, Sn and Zn, and on receipt of these results selected samples were subsequently analysed for Au, Bi, Co and Sb. Selected samples were also analysed for Mo, Nb, Ta and W.

The analytical results received were plotted as histograms. In the first instance massive "anomalies" in all analysed elements in Mine Creek and Arthur River, which result from the old Magnet Mine tailings, swamped any other anomalies. Histograms were therefore replotted, excluding the results of samples on the drainages (and in the case of Sn also excluding results from Tinstone Creek, which drains Mt. Bischoff), and thresholds are calculated from them.

Thresholds were as follows:-

<u>Ag</u>	7 ppm
<u>Cu</u>	110 ppm
<u>Pb</u>	360 ppm
<u>Zn.</u>	240 ppm
<u>Sn</u>	100 ppm

and samples with results in excess of these values are shown as anomalous (Maps No. 6 and 7).

In the case of the selected samples analysed for additional elements, the numbers involved were too small for histogram-derived thresholds to be statistically acceptable, and in these instances arbitrary levels have been selected to distinguish between anomalous and non anomalous values. Gold was not detected in any of the samples, and no antimony values (maximum 300 ppm) were considered to be anomalous. One bismuth value (300 ppm)

was considered anomalous, as were all cobalt values in excess of 60 ppm (5 samples). No anomalies were recorded in Mo, Nb and Ta, but certain results in W may approach threshold.

Anomalous drainages are indicated on Maps 6 and 7, and are:-

(i) Mine Creek and the Arthur River Downstream of Mine Creek.

These are anomalous for Ag, Cu, Pb, Zn and Sn, presumably as a direct result of tailings from the Magnet Mine. Maxima are extremely high, being:-

Ag	810 ppm ?
Cu	1,200 ppm
Pb	1.7%
Zn	16.0%
Sn	1.94%

It is, of course, quite possible that these massive "anomalies" derived from tailings mask true anomalies within these drainages.

One point to be noted concerning these anomalies is that tin mineralisation has not been reported from the Magnet Mine, so that the tin values here may indicate a substantial anomaly. However, if this is the case the anomaly is open-ended and appears to originate outside the lease boundary.

(ii) A 32 Creek

Anomalies in Ag, Cu, Pb, Zn and Sn are also recorded on this tributary of the Arthur River. They are restricted to the lower reaches, within a low-lying swampy area adjacent to the Arthur, and are considered to result from contamination by the Arthur.

(iii) MLC 6550 Creek

Anomalies in Ag, Cu, Pb and Zn are considered to result from contamination from the Magnet Line.

(iv) MC 4050 Creek

Low level anomalies in Zn and one anomalous sample in copper near the head of this creek may be basalt-derived.

(V) MC 132 Creek

The lower reaches of this creek show low level anomalies in Zn. These are restricted in occurrence to an area that is in all probability an old flood plain of Mine Creek, and can therefore be disregarded.

(VI) The Arthur River Upstream of the Mine Creek Confluence.

Between Mine Creek and the Magnet Line anomalies in Ag, Pb, Zn and Sn were recorded, whilst upstream of the Magnet Line are anomalies in Zn, Sn and Co. Those in the latter element may be of interest as they appear to occur on a NE-SW trend reflecting the grain of the major structural block. However it is possible that they may only indicate a raised background over a particular rock type.

It may be noted that the Zn anomalies on the Arthur River just south of the Mine Creek confluence, on lower MC 132 Creek and on upper MC 4050 Creek also follow the NE-SW structural trend.

(VII) AR 8250 Creek

This creek shows anomalies both in Zn and Sn. In the case of the former, the anomaly is low level, and probably relates to the Tertiary Basalt seen near the head of the creek. The anomaly in tin is open-ended, and probably originates outside the lease boundary just to the south of the Waratah-Savage River Road, where there is an area with several small alluvial tin workings on Devonian granite.

(VIII) Ritchie Creek upstream of Tinstone Creek.

Two tributaries show minor anomalies in Zn, possibly dolerite - or basalt-derived, whilst a third has a low - level anomaly in Sn.

(1X) Tinstone Creek and Ritchie Creek downstream of its confluence.

These are anomalous for Sn throughout and for Zn in their lower reaches. Some of the tin values may result from Mount Bischoff, but values fall coming downstream from there and then rise sharply to 1% along a zone extending for about 1,000 ft. on either side of the Tinstone Creek-Ritchie Creek confluence (Map No. 8). This zone corresponds with the anomaly in zinc, and one or two samples here may also be anomalous for tungsten.

Samples taken on a right-hand tributary of Tinstone Creek, almost due south of Mt. Bischoff showed anomalies in Ag, Cu, Pb, Zn, Sn and Bi which may be related to the Mount Bischoff ore-bodies.

6. CONCLUSIONS.

It was seen in section 4 that the majority of the rocks within this area are of sedimentary origin, that their lithologies are very mixed and varied, and that many of the sediments are felspathic and/or tuffaceous. It would therefore appear that the sediments were derived from a nearby landmass that was undergoing rapid erosion, that they were transported rapidly, and that they were deposited in an environment of fluctuating sea-level. It also appears that the period of deposition was one in which volcanic activity was occurring, and since deep water sediments are almost entirely lacking that the depositional environment was relatively near shore.

The presence of three or four cross-cutting structural trends indicates some measure of structural complexity, and some form of structural and/or depositional discontinuity must be postulated between each of the structural units. Unfortunately, there is no evidence to indicate the relationship between these units, but the fact that the NNW-SSE block appears to be cut off by the main NE-SW block could be explained by the former overlying the latter unconformably. This, however, is an extremely tentative hypothesis. Completion of geological mapping within the area and that of Mount Bischoff itself may enable a more comprehensive structural interpretation to be made.

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From the evidence currently available, it seems that there is no direct structural link between the Mt. Bischoff Mine Area and the Magnet Mine. The latter lies to the north of the antiformal axis, whilst this axis passes to the north of the Bischoff Mine Area.

It is significant that the dolomite which is host rock to the Mount Bischoff mineralisation has not been observed within the area mapped. This would suggest that the dolomite at Mount Bischoff is structurally or depositionally a discrete body.

The geochemical data obtained from this project indicates that an extension of the Bischoff mineralisation may possibly occur near to the junction of Tinstone and Ritchie Creeks.

7. PLANS

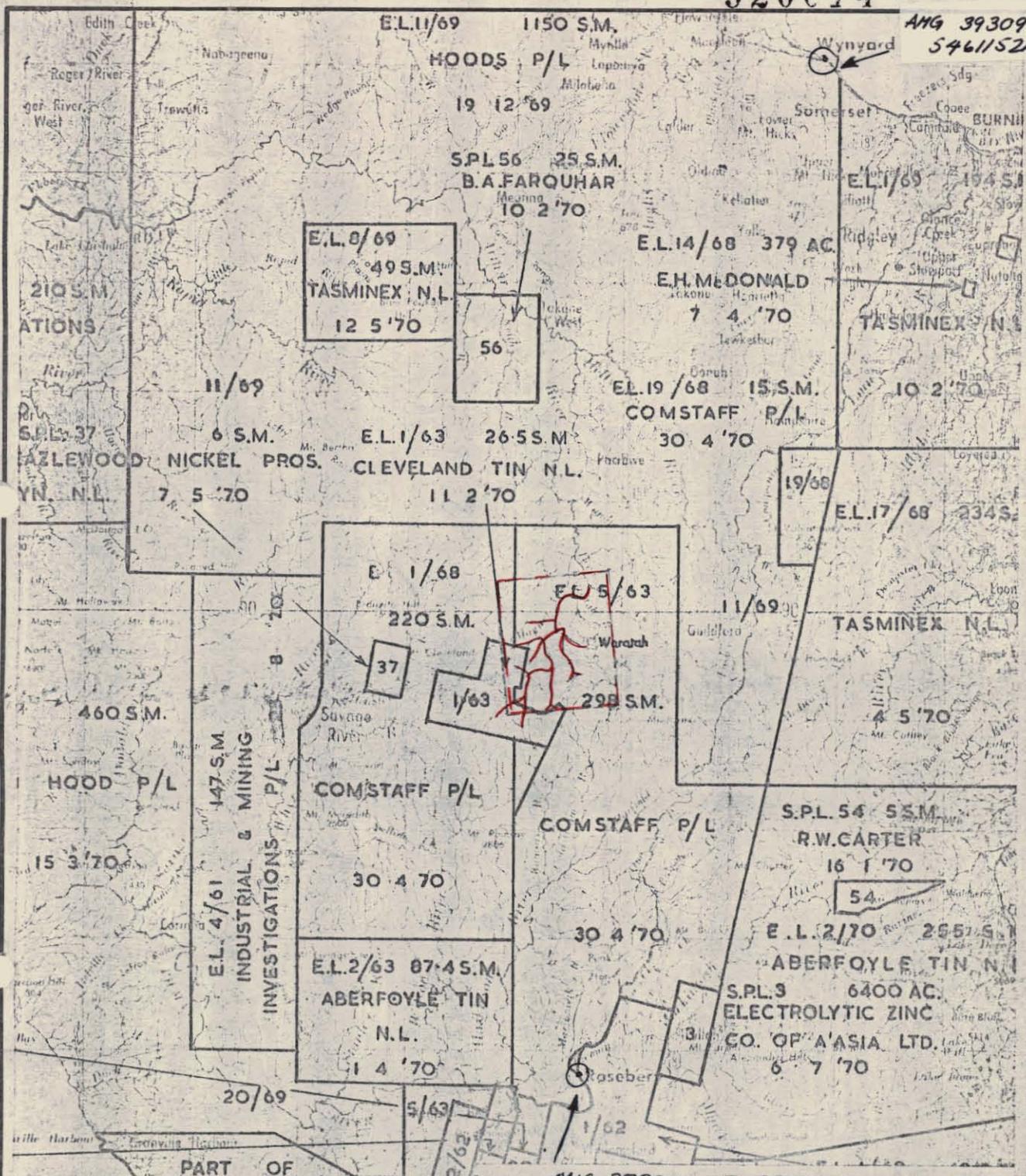
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1	Mt. Bischoff Area Regional Locality Plan	1:500,000
2	Mt. Bischoff South Geochemistry	
3	Mt. Bischoff South Geology (Extent of Mapping)	
4	Mt. Bischoff South Geology	1:20,000
5	Bischoff South Geology - Structural Interpretation	1:20,000
6	Mt. Bischoff South Anomalies Stream Sediment Samples - Ag, Pb, Zn, Bi.	
7	Mt. Bischoff South Anomalies Stream Sediment Samples - Co, Cu, Sn, W.	

Ramona Armfield
for H. R. Robison

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AMG 393099mE,
5461152mN



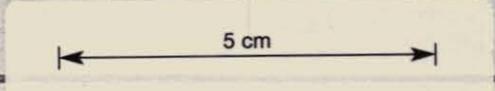
AMG 379000mE, 5373050mN

Map 1

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AMG REFERENCE POINTS ADDED

MT. BISCHOFF SOUTH
LOCALITY PLAN

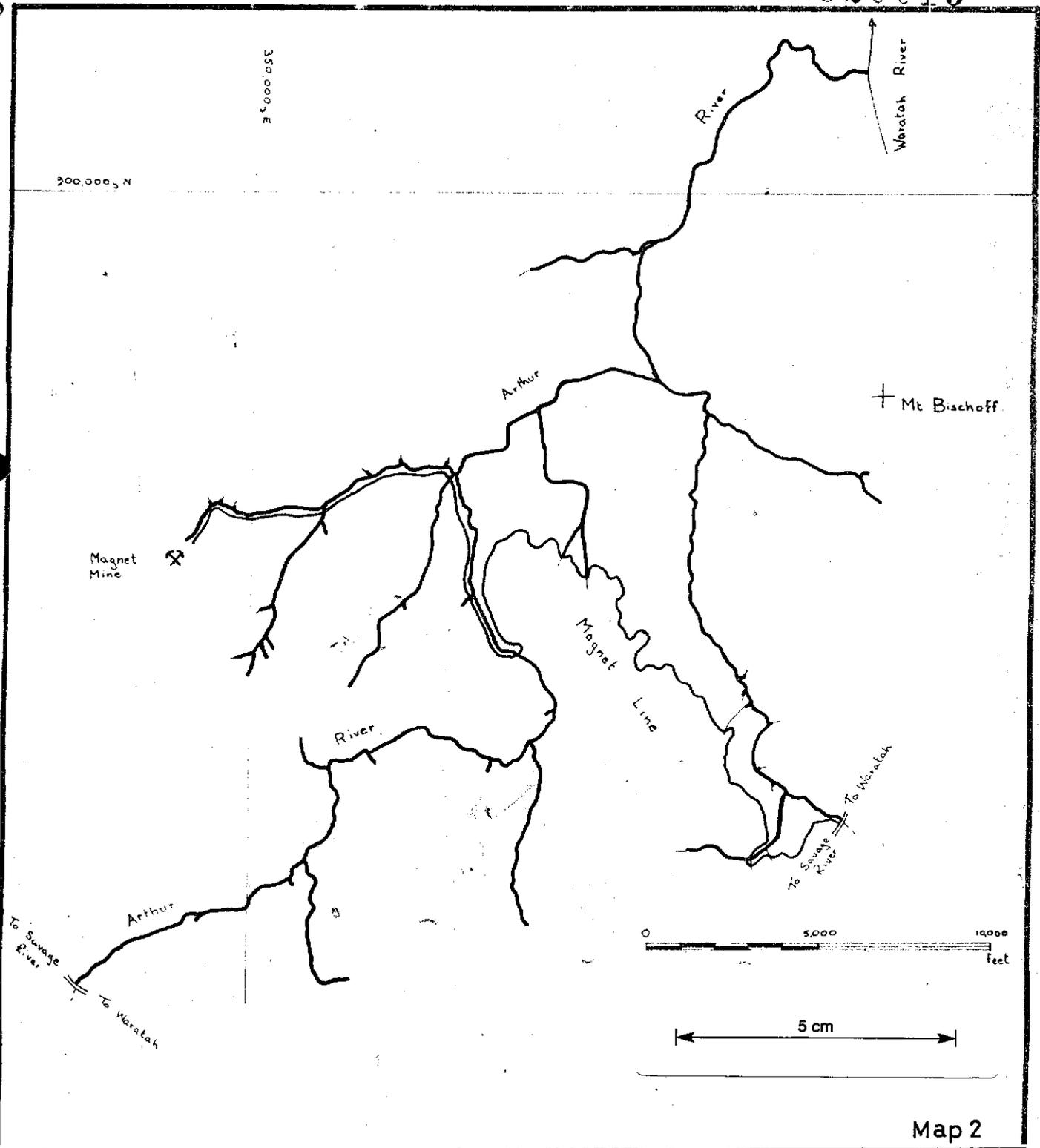


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Map 2


 Drainage covered by Stream Sediment Sampling.

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MT BISCHOFF SOUTH
GEOCHEMISTRY

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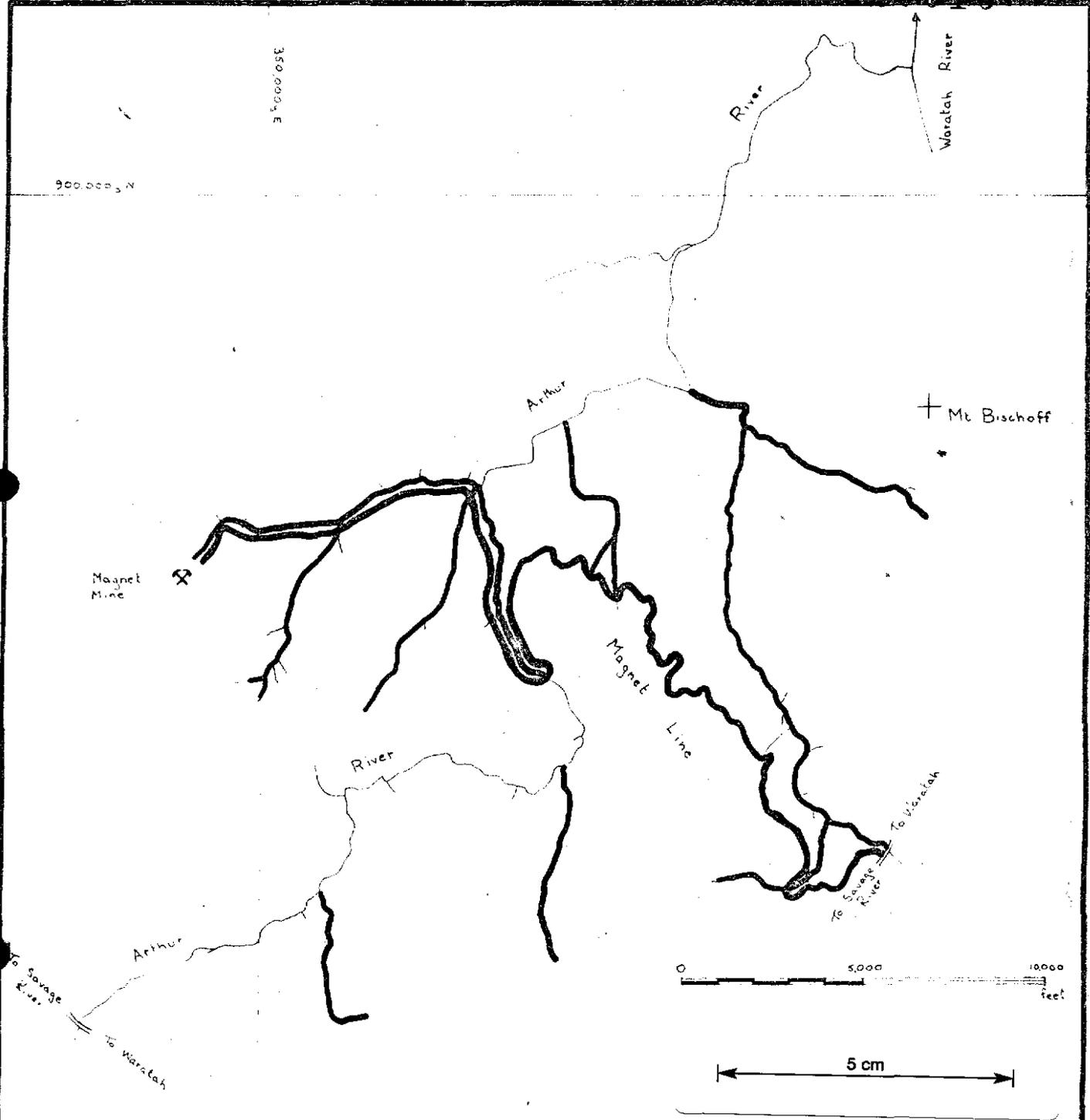
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51A

350,000 E

900,000 N



Map 3

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MT BISCHOFF SOUTH
GEOLOGY
(EXTENT OF MAPPING)

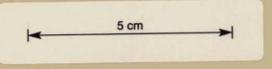
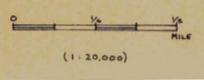
Mapped Traverse

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350,000₃E

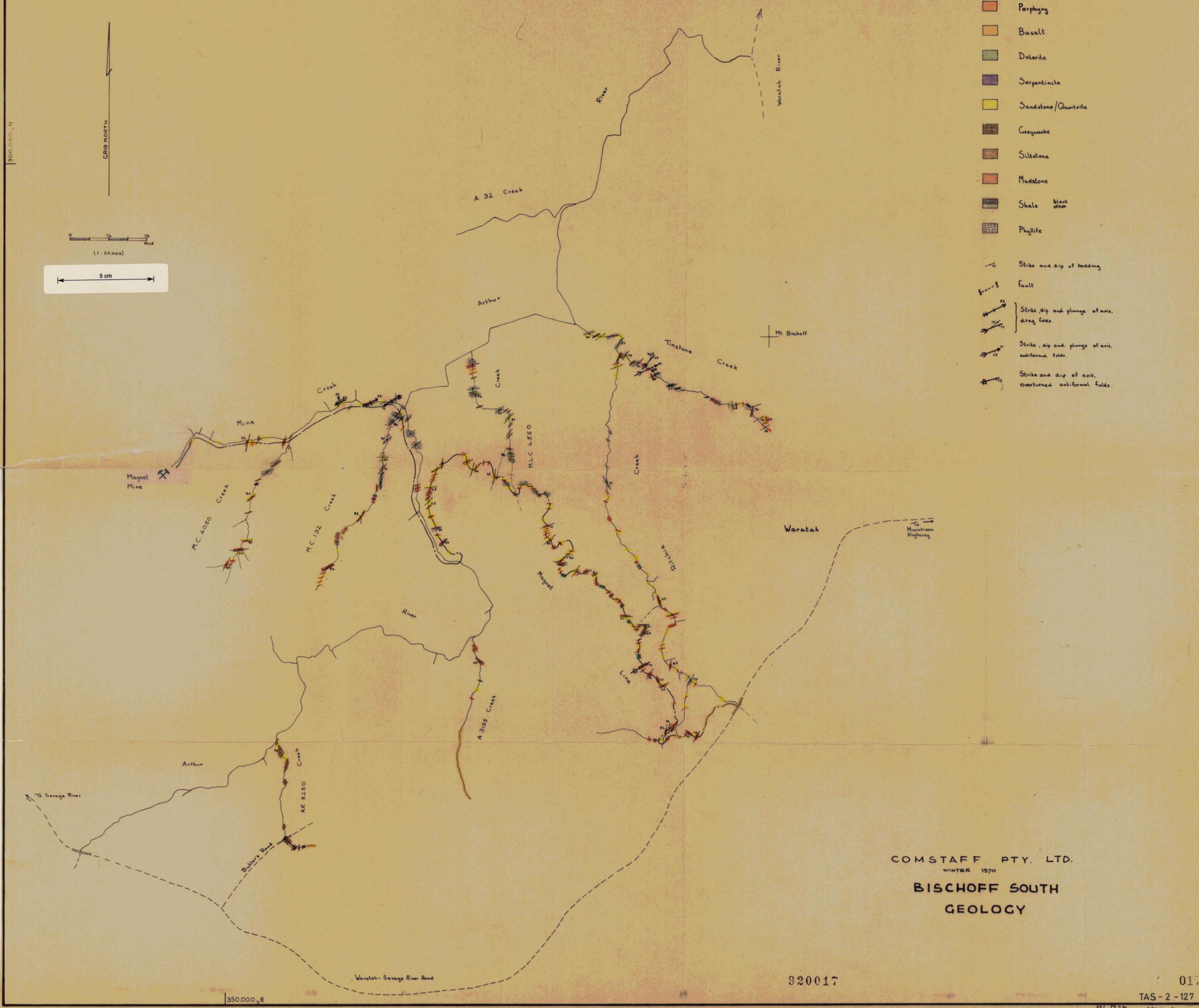
900,000₃N

GRID NORTH



- Porphyry
- Basalt
- Dolerite
- Serpentinite
- Sandstone/Quartzite
- Gneiss
- Siltstone
- Mudstone
- Shale black
other
- Phyllite

- Strike and dip of bedding
- Fault
- Strike, dip and plunge of axis,
drag folds.
- Strike, dip and plunge of axis,
antiformal folds.
- Strike and dip of axis,
overturned antiformal folds.



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**BISCHOFF SOUTH
GEOLOGY**

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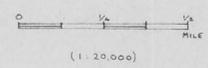
M1-12b Map 4

350,000₃E

350,000 E

9000000 N

GRID NORTH



- Generalised dip and strike of bedding.
- Axis of major antiformal structure, showing supposed direction of plunge.
- Dip and strike of axis, minor overfolded antiform.
- Dip (vertical) strike and plunge of axis, minor 'right way up' drag folds.



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BISCHOFF SOUTH

GEOLOGY
STRUCTURAL INTERPRETATION

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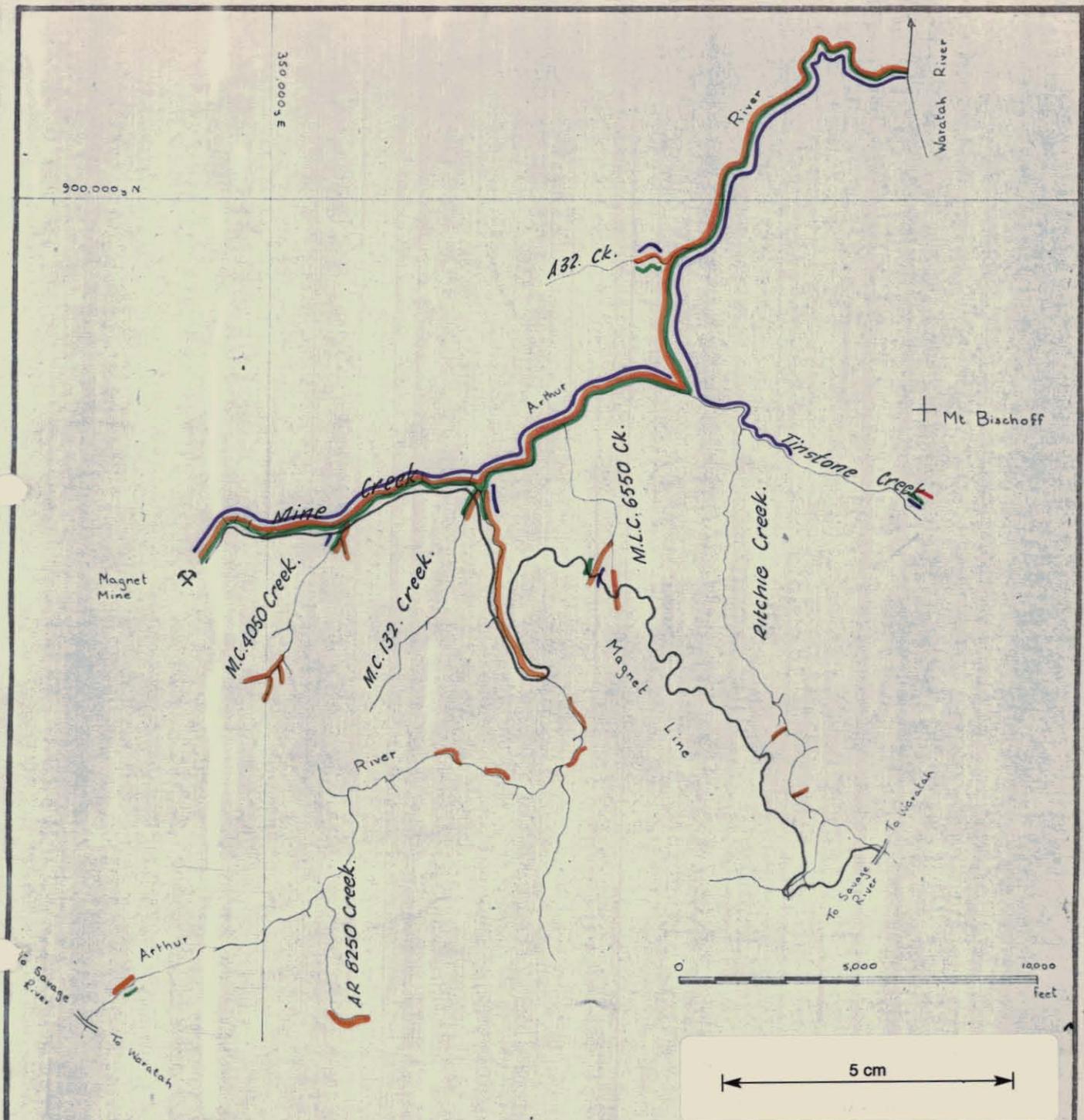
TAS-2-128

350,000 E

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MAP 5

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Map 6

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MT. BISCHOFF SOUTH
ANOMALIES
STREAM SEDIMENT SAMPLES

Ag	—	Pb	—
Zn	—	Bi	—

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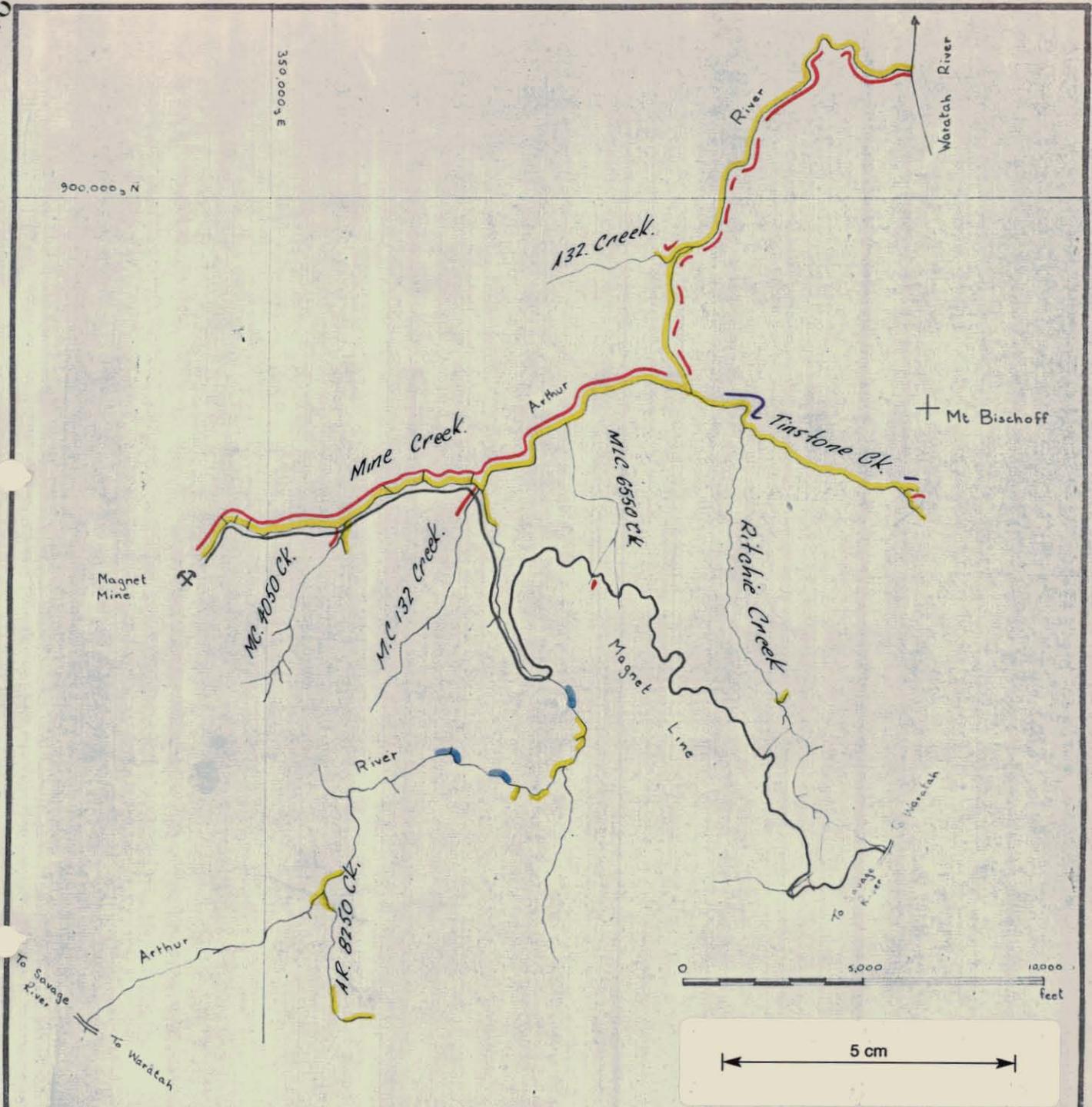
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Map 7

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MT BISCHOFF SOUTH
 ANOMALIES
 STREAM SEDIMENT SAMPLES

- Co
- Cu
- Sn
- W

DRAWN	COMPILED	SCALE	TAS-2-125
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