DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL INVESTIGATION OF SULPHIDE MINERALISATION NEAR THE TILLITE/SLATE CONTACT STURT RIVER AREA

by

M. Johnson

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D.M. 2111/61
30/11/61

Dept. Bk. No. 59/155
G.S. No. 2191

N.P.M. 109

Dept. Bk. No. 53/155
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D.M. 2111/61
R.F.M. 109

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ABSTRACT

A zinc sulphide lode with a quartz/ calcite gangue, 6 to 9 feet true thickness, was penetrated by two drill holes in the left abutment of the proposed flood control dam on the upper site in the Sturt River. The lode is in a brecciated tillite believed to be part of a slump breccia.

The lode is one instance of wider spread mineralisation associated with the calcareous facies of the upper Sturt Tillite/lower Tapley Hill Slate succession near the contact. A syngenetic origin is put forward for this mineralisation. The calcareous facies of the contact zone is believed to represent an original favourable environment for sedimentary sulphide formation.

Further exploration of the lode and of regional mineralisation is recommended.

INTRODUCTION

This investigation was initiated when a hole being drilled to test the foundations of a proposed flood control dam in the Sturt River Gorge intersected a sulphide bearing brecciated quartz lode. A second hole drilled at a lower level to determine the structural condition of the brecciated lode below the water table also intersected heavy sulphide mineralisation.

As the true width of the lode was 6 to 9 feet it was decided to map the area in some detail to determine ore controls. During the course of this mapping old workings were discovered at the contact of the Sturt Tillite and Tapley Hill Slate and the mapping was extended to cover the significant portions of the contact zone. As can be seen by comparison of the 10 chain map accompanying this report and the Echunga 1-mile sheet some interesting new facts have been disclosed. Tapley Hill Slate is

infolded northwards practically to the Sturt River and the brecciated sulphide bearing material is close to this infolded contact. The report discusses the new geological data obtained and the observed relation of the mineralisation to various sedimentary features. The association of the mineralisation with the Sturt Tillite/Tapley Hill Slate contact is believed to have more than local implications.

PREVIOUS WORK

A short list of the more relevant reports and papers making references to the area is given below. All of these except that of Johnson are of a general geological or physiographic character.

The most important is that of Sprigg who describes the regional geology in some detail with most specific reference to the Hallett Cove area. Physiography is described by Fenner and the Geological Society volume yields incidental references to the area. This volume and Sprigg's paper have comprehensive references. The mines outside the area to the east are described in the "Record of Mines".

FENNER, C., 1931: "South Australia: A Geographical Study." Melbourne.

HOSKIN, W., 1906: "The Geology of the Mt. Lofty Ranges. Part I. The Coastal District." Trans. Roy. Soc. S. Aust., 28, pp. 253-280.

1906: "The Geology of the Mount Lofty Ranges. Part II." Trans. Roy. Soc. S. Aust., 30, pp. 227262

JOHNSON, W., 1956: "Preliminary Geological Report on the Proposed Stormwater Reservoir on the Sturt River." Unpub. Rep. D.M. 43/57.

PARKIN, L.W., & GLAESSNER, M.F., (ED.) 1957. "The Geology of South Australia." Journ. Geol. Soc. Aust. 5. Pt. 2.

SPRIGG, R.C., 1942: "The Geology of the Eden Moana Fault Block." Trans. Roy. Soc. S. Aust., 66. Pt. 2. pp. 185-214.

LOCATION AND TOPOGRAPHY

The area mapped lies between the Sturt River and the Happy Valley Reservoir and is bounded on the west by the Main South Road and on the east by an indefinite line extending from 1 mile west of Craigie Burn (Minda Home) to 1½ miles northeast of Happy Valley.

It lies wholly on the Eden-Keswa fault block which is bounded on the west by the Eden-Burnside Fault, and on the east by the Clarendon-Echre Cove Fault. This block, like the other westerly fault blocks comprising the Adelaide Hills, has a tilt southwards and eastwards.

In the area investigated the Sturt River and its tributaries, have carved deep gorges in the western portion of the block, while the tributaries of the unnamed stream, on which the Happy Valley reservoir wall is built, flow in broad, shallow, flat bottomed valleys. Between the valleys the remnants of the flat surface of the block form broad divides.

The geomorphological history of the block is complex and of some importance in considering possible secondary alteration of ore bodies in the area. Sprigg (1942), Fenner (1931) and others have discussed it as part of more general accounts and the reader is referred to these publications for basic information. In the area mapped weathering, or rock alteration, appears to be more intense and to extend deeper in the zone around the Happy Valley Reservoir from which Tertiary or late deposits have only recently been removed by erosion. This deeper weathering may be partly Tertiary in origin.

GEOLOGY

The country surrounding the Sturt Gorge and extending south to the coast constitutes one of the classical areas of exposures of the Adelaide System. As such it has been described in whole, and part, by many geologists, including Sprigg (1942), Howchin (1904), and others. It is also depicted on the Echunga Sheet of the 1 mile Geological Series.

The Sturtian Tillite is of course named for its excellent exposures in the Sturt Gorge. This is overlain by the thick, and monotonous, Tapley Hill Slate, on top of which lie the more varied rocks of the Marinoan Series.

In the southern part of the Eden - Keswa Fault Block the Sturt Tillite and overlying rocks are folded into a large asymmetrical anticline plunging southeast beneath the sea at Christies Beach. The axis of this anticline is slightly curved and convex north-westwards. It passes through Christies Beach and O'Halloran Hill. In the Marinoan rocks the structure is relatively simple, with a northern limb modified only by faults and minor drags. An indication of a complementary syncline appears in the southern limb

before it disappears beneath Tertiary deposits of the Noarlunga Basin. North-eastwards the structure becomes increasingly complex as indicated on the Echunga Sheet and confirmed by the detailed mapping carried out during the present investigation.

This mapping has altered the rock distribution as shown on the Echunga Sheet. No continuous outcrops of tillite are traceable from the Sturt Gorge to the vicinity of Happy Valley Reservoir. Instead the outcrops of tillite south of the O'Halloran Hill - Coromandel Valley Road, in the area shown as tillite on the Echunga Sheet, are confined to two patches near, or on, the subsidiary road running around the east side of the reservoir. On the other hand tillite has been mapped on the shores of the reservoir much further to the southwest and southeast than shown on the Echunga Sheet and it must extend still further southeast beneath the waters of the reservoir.

Conversely to the discovery of the extension of the tillite southwards the Tapley Hill Slate has been mapped much further north-eastwards than previously realised, extending as a crenulated embayment into the tillite near the proposed dam site.

That portion of the Sturt Tillite/Tapley Hill contact which is exposed is thus shown to be folded in an extremely complex manner and it is possible that the tillite mass revealed on, and adjacent to, the northeastern shores of the reservoir is entirely isolated from the main tillite in the Sturt Gorge. If it is connected physically, beneath the concealing younger deposits, it is only by an extremely thin tongue.

This highly convoluted contact may be due partly to original sedimentary features and partly to later tectonic effects.

Other writers have pointed out that rapid variation in tillite thickness should be expected and it is highly probable that isolated deposits of tillite were formed in the ancient seas. Then contortions observed in the bedding of occasional shale lenses in the tillite and overlying Tapley Hill Slate, show that slumping is a feature of the sediments in this area. Such slump folding can be seen in drill core from the right abutment of the dam site and in the Tapley Hill Slate immediately overlying the tillite in the

Sturt Gorge. Finally later tectonic effects are undoubtedly present, as witness the mapped folds and faults.

DISCUSSION OF MINERALISATION

GENERAL

On a previous investigation, (Johnson 1956), some old workings were noted at the contact of Tapley Hill Slate with underlying Sturt Tillite well downstream of the present dam site, and during the present investigation E. W. S. officers reported hearsay evidence of an old mine "in the Sturt Gorge". The significance of this was not appreciated until the drill penetrated the sulphide bearing lode. At the time of drilling the dam site was thought to be stratigraphically over 1000 feet below the tillite/slate contact. Subsequent mapping showed that the lode is in fact probably within 500 feet of the contact stratigraphically, and between the two discontinuous arkose horizons in the tillite. During the mapping the old "mine" was discovered and it is situated practically at the contact some 900 feet geographically southwest of the lode.

All this evidence of mineralisation is on the western side of the tillite mass in the calcareous facies of the Tillite/Tapley Hill Slate at or close to the contact of the two formations.

It therefore seems probable that this contact

marks a former favourable environment for sedimentary sulphide formation in the old Proterozoic seas.

The association of mineralisation with sediments affected by slump folding and brecciation should be noted also. This is another instance of a relationship being observed at an increasing number of mineralised localities in the Adelaide Geosyncline. So far the exact genetic significance of the relationship has not been worked out but it could be of assistance if used empirically in the search for new favourable areas for mineral occurrence.

Another occurrence of mineralisation recorded during the present mapping is that of abundant gossanous quartz veins in the Tapley Hill Slate outcrops mapped on the northern and western shores of Happy Valley Reservoir. These too are relatively close to the tillite/slate contact and this area becomes of interest also in the search for new ore bodies.

THE MINERALISED LODE

The brecciated tillite outcrops as shown on the accompanying map, in the left abutment spur of the proposed dam. It is associated with a banded laminated boulder free tillite or shale showing slump bedding.

Its strike is approximately 280°, parallel to the strike of a set of major joints cutting the tillites on both abutments. A section drawn using the two diamond drill holes shows that its true width varies from 6 to 10 feet and its apparent dip is 80° to the south.

The outcrop area is small. To the east the breccia disappears under soil and the alluvium of the valley bottom and has not been detected where tillite again outcrops along the line of strike 1000 feet south of the dam site in the second reach of river upstream. To the west the breccia apparently lenses out, as unbrecciated tillite outcrops across the line of strike 100 to 150 feet west of S.D.D.3.

The mineral composition of the lode and the assay results are given in detail in the attached reports from the Australian Mineral Development Laboratories. The unusual composition of predominantly zinc sulphide, low percentage of lead, and even lower percentage of copper, reduces the immediate economic value of the discovery and poses a number of questions on genesis of the lode.

An indicated ore reserve has been worked out for the block of lode between the two drill holes and an arbitrary bounding surface parallel to, and 10 feet below the existing land surface to the east (see Section CC on Plan 61-842). It is 256 tons of metallic zinc valued at approximately $25,600, current market value. This excludes the value of the silver, lead and copper in the ore. Though this amount of ore would not in itself justify the commencement of a mining operation the reasonably high values in the lower drillhole give confidence that good grade mineralisation persists below the drill hole and therefore the lode should be explored at deeper levels.

ORE CONTROLS AND ORE GENESIS

All evidence of mineralisation so far discovered within two mile radius of the dam site are confined, in the vertical stratigraphic direction, to a few hundred feet thickness (150-250 feet) of beds on either side of the contact of the Tapley Hill Slate and the Sturtian Tillite. Empirically then, this contact becomes a regional ore control. Furthermore the mineralisation appears to be restricted in a lateral stratigraphic direction also. None has yet been discovered along that section of the contact zone where the Tapley Hill Slate contains abundant quartzose clastic beds. In contradistinction the mineralisation has been found where the Tapley Hill Slate and the arkosic lenses in the upper part of the tillite are calcareous. This gives another empirical regional ore control, which, together with the previous control, of course, must be tested by reference to other mineralised localities in the Adelaide System.

Although these regional ore controls are described as empirical in fact it is believed that together they represent an original favourable environment for the syngenetic formation of sulphide bodies. This has been adopted as a working hypothesis which again must be tested by further work.

On a smaller scale ore formation appears to have been controlled by brecciation which is believed to be of slump origin. This belief is based on the association of the brecciated lode at the dam site with slump contorted bedding in varve like shales and the lack of any tectonic feature leading into the breccia.

No mineralogical work other than purely descriptive has yet been done on the lode and it is not possible to demonstrate whether the sulphide mineralisation is post-brecciation or contemporaneous with it. However, the coarseness of the sphalerite crystals would in my opinion tend to indicate at least some concentration and transport of the sulphides. The chief function of the breccia may then have been to form a favourable permeable environment for the concentration, by secondary processes, of the original low grade disseminated sulphides in the upper part of the tillite and lower part of the Tapley Hill Slate succession.

It is not the intention of this report to erect a whole theory of mineralisation on the occurrences along the Sturt River as obviously insufficient work has been done. Nevertheless the evidence which has been found gives encouragement to follow up the work done so far by an investigati with syngenetic sulphide formation in a favourable environment, as outlined above, as the working hypothesis.

FUTURE EXPLORATION

Some drilling to test for extensions of the lode has been recommended in a separate minute. In addition to this work the following work is recommended.

1. The possible concealed extensions of the lode along the strike should be tested for by geophysical means, either EM or IP, or both.

2. The contact zone of the Tapley Hill Slate/Sturtian Tillite extending west and south from the dam site should be tested geophysically again either by E.M. or I.P. or both.

3. Concurrently, or later, reconnaissance geochemical prospecting should be done along the contact, in the same area, in an endeavour to select favourable locations for more detailed geochemical prospecting.

4. A search should be made for slump breccias, again within the same favourable area, as a possible localising control for further ore bodie

5. Some reconnaissance geophysical prospecting is a worthwhile lower priority project along the shores of Happy Valley Reservoir in the vicinity of the gossanous quartz lodes.

The broader implications of the Sturt River discovery as discussed in previous sections would be better investigated in the course of compiling the mine and mineral information maps referred to in other papers.

CONCLUSION AND RECOMMENDATIONS

The quartzose zinc sulphide lode penetrated in the left abutment of the Sturt River upper dam site occurs in a brecciated tillite body of probable slump origin. It occurs stratigraphically a few hundred feet below the contact of the tillite with the Tapley Hill Slate in the calcareous facies of these two formations. It is concluded that this facies in the contact zone could mark former favourable environment for sedimentary sulphide formation.

The reason for concentration of sulphides in the slump breccias is not known. It may be that the breccia formed a structurally favourable environment for secondary concentration of low grade disseminated sulphides.

It is recommended that the exploratory work detailed in the previous section be done in addition to the two drill holes previously proposed.

W. Johnson
Senior Geologist
NON FERROUS METALS SECTION

WJ:AGK
30/11/61

GEOLOGICAL INVESTIGATION OF SULPHIDE MINERALISATION

NEAR THE TILLITE/SLATE CONTACT

STURT RIVER AREA

APPENDIX X

MINERALOGICAL DESCRIPTION OF LODE INTERSECTIONS

REPORT OF INVESTIGATION

AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

YOUR REFERENCE:	P1061/61 to P1066/61
MATERIAL:	Rock specimens
LOCALITY:	Hundred of Adelaide, Section 21 Sturt Creek Dam Site
DATE RECEIVED:	8/7/61
INFORMATION REQUIRED:	Identification of all sulphide and gangue minerals.

RESULTS

The rock samples submitted are all specimens of tillite. The sulphide minerals sphalerite, chalcopyrite, pyrite, and covellite occur in veins transgressing the specimens. Gangue minerals also present in these veins are quartz calcite and goethite.

P1061/61 T/S 8301 SDD 3 14'2" to 16'2"

This specimen consists predominantly of angular quartz and felspar grains with interstitial sericitic material. Both microcline and plagioclase felspars are present. Several rock fragments are also present in the section. The particles are unsorted and are all less than 4 mm. in size. The rock is transgressed by veins containing calcite, reddish brown, iron oxide and occasionally quartz.

The features observed indicate the rock is a tillite.

P1062/61 T/S 8302; P/S 6512 SDD 3 16'2" to 19'0"

This specimen is similar to the above in appearance. The majority of the grains are angular and of coarse sand size. Quartz, microcline and plagioclase are the predominant minerals with minor sericite occurring interstitially. The veins which cut this specimen are smaller but again contain calcite and opaque iron oxide. Malachite is also present.

Goethite, occurring in small veins, is the most common opaque mineral. Minute chalcopyrite and pyrite grains occur occasionally in the gangue.

P1063/61 T/S 8303 SDD 3 19'0" to 21'0"

This is again a similar rock type to the previous two specimens. However veins which transgress the rock contain pyrite and malachite in addition to quartz, calcite and goethite. The pyrite in most cases has partially altered to goethite.

P1064/61 T/S 8304 SDD 4 40'7" to 45'0"

This specimen is a tillite in which the particles are unsorted and within the pebble to sand size range. They consist predominantly of various angular rock fragments with angular quartz, microcline and plagioclase. Sericite occurs interstitially. Fine grained calcite occurs interstitially and in veins cutting the rock.:

The predominant opaque mineral present is sphalerite which occurs as coarse grained crystalline aggregates. The internal reflection is a pale orange brown indicating a low iron content. Minute inclusions of pyrite and chalcopyrite occur in the sphalerite but are not common. Veins of carbonate gangue transgress some sphalerite. Chalcopyrite occurs coarse grained, occasionally enclosing idiomorphic pyrite, and also as segregations along some sphalerite grain boundaries. Pyrite also occurs as idiomorphic crystals in the gangue material. Covellite occurs rarely rimming chalcopyrite.

P1065/61 T/S 8305; P/S 6614 SDD 4 45'0" to 49'0"

This specimen is again similar to T/S 8302 although goethite is not present. The quartz and felspar fragments are again angular and are of sand size. Veins containing coarser quartz, sphalerite and calcite cut the rock. Calcite also occurs interstitially.

In polished section sphalerite is observed in veins up to 5.0 mm. wide cutting the rock. Occasionally some grains contain numerous oriented chalcopyrite inclusions but mostly the sphalerite is free of these inclusions. Pyrite occurs as idiomorphic grains in sphalerite and gangue and also as corroded grains in gangue. Chalcopyrite is a minor sulphide mineral present in the gangue.

P1066/61 T/S 8306; P/S 6615 SDD 4 49'0" to 49'0"

A similar rock type to the previous specimen. However calcite is more common in veins with quartz and some calcite crystals have been broken and recemented.

Opaque minerals present are sphalerite and chalcopyrite with minor pyrite. A second generation of pyrite occurs in small veins in both sphalerite and chalcopyrite.

Investigated by: D.E. Ayres

Officer-in-Charge, Mineralogy Section: H.W. Fender

15/9/61

L. Wallace Coffer
Director

GEOLOGICAL INVESTIGATION OF SULPHIDE MINERALISATION NEAR THE TILLITE/SLATE CONTACT STURT RIVER AREA

APPENDIX II

ANALYSES OF LODE INTERSECTIONS

REPORT OF ANALYSIS

YOUR REFERENCE: P1061-P1066/61. (A544/61-A549/61).

LOCALITY: Hd. Adelaide, section 21, Sturt Creek Dam Site.

INFORMATION REQUIRED: Analysis

Mark	Drill Hole & Depth		Silver (Ag) dwt.	Copper (Cu) %	Lead (Pb) %	Zinc (Zn) %
A 544/61	SDD 3	14'2" to 16'2"	2.0	0.02	0.24	15.3
A 545/61	"	16'2" to 19'0"	2.0	0.92	2.34	9.85
A 546/61	"	19'0" to 21'0"	2.0	0.86	3.12	7.35
A 547/61	SDD 4	40'7" to 45'0"	1.5	0.63	0.06	27.0
A 548/61	"	45'0" to 48'0"	Nil	0.05	0.02	4.65
A 549/61	"	48'0" to 49'0"	0.5	0.025	0.01	18.25

(NOTE - Specimens were assayed for gold. None was detected in any specimens).

SPECTROGRAPHIC

Mark	Drill Hole & Depth		Nickel (Ni)	Cobalt (Co)
A 544/61	SDD 3	14'2" to 16'2"	25 p.p.m.	4 p.p.m.
A 545/61	"	16'2" to 19'0"	35	12
A 546/61	"	19'0" to 21'0"	30	10
A 547/61	SDD 4	40'7" to 45'0"	50	15
A 548/61	"	45'0" to 48'0"	30	4
A 549/61	"	48'0" to 49'0"	30	3

Spectrographic Analysis by: A.B. Timm.

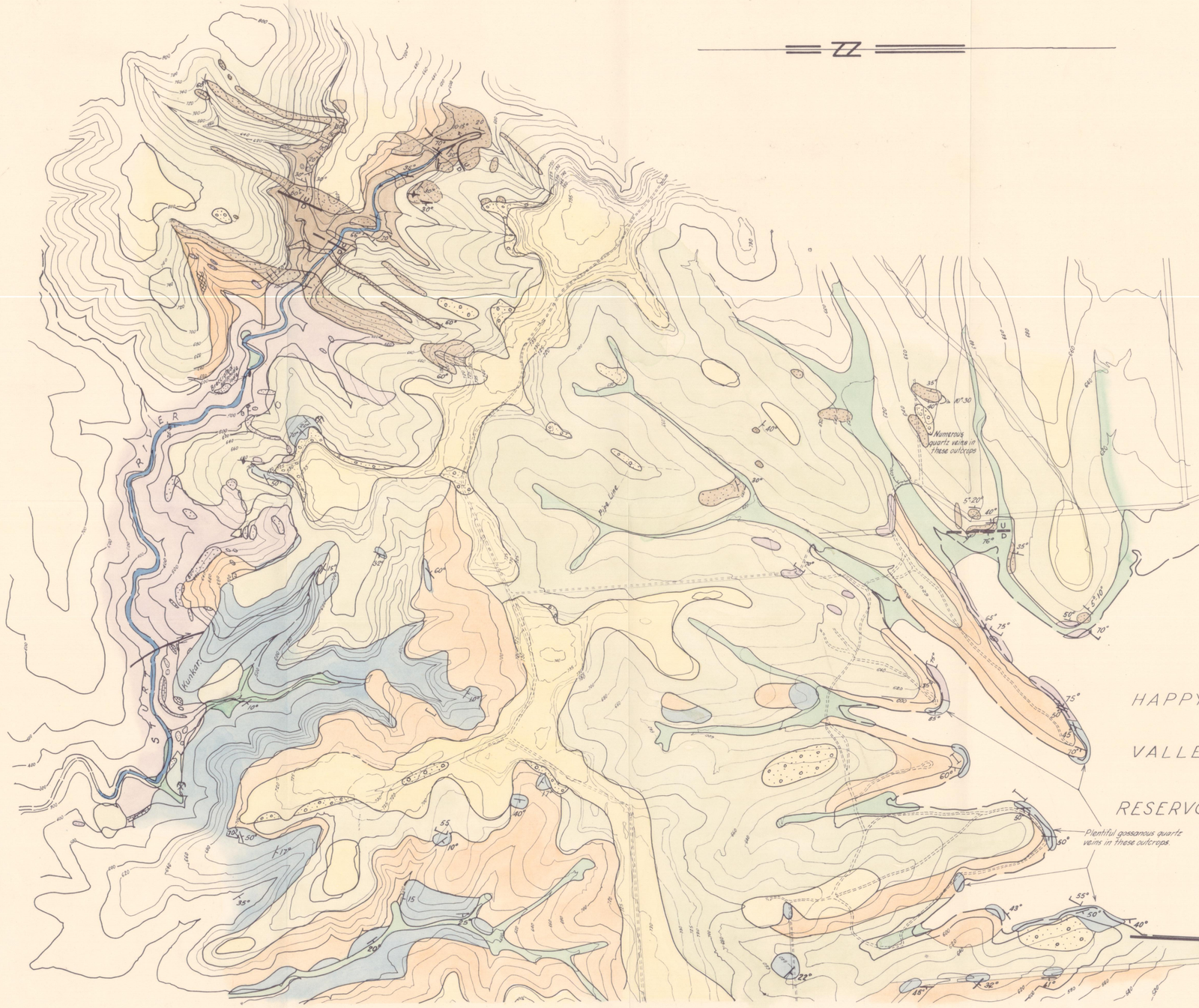
Note: Selenium (Se) not possible.

Analysis by: R.G. Stafford & S. Alexander

Officer in Charge Analytical Section: T.R. Frost

26th September, 1961.

L. Wallace Coffer
DIRECTOR



— LEGEND —

RECENT

ALLUVIUM Black, grey-brown fine to medium sand, grey to black silt and organic silt white fine sand some boulders ironstone & quartzite-yellow brown sandy clays.

QUATERNARY TERTIARY

White, grey and brown-grey sand, fine to coarse grained sand overlying bright yellowish to reddish brown sandy clay. The sand and clay in turn rest on weathered slate or Tertiary? sand and soft clayey sandstone. Some floaters of white medium grained sandstone and brown to dark brown ferruginous pebbly coarse grained sandstone – includes some Pleistocene to Recent buff brown to pink brown sandy clay infillings of older gullies.

TERTIARY?

Black reactive clay soils, white, grey and grey brown sands some buff brown to red brown sands – Overlying white silty sandstone with brown ferruginous mottled patches. Dark brown ferruginous coarse to very coarse grained sandstone occasionally with abundant white quartz pebbles.

Grey brown to brown soil with floaters of slate & tillite (near Sturt River) probably mostly soil cover over Proterozoic rocks - some may cover Tertiary rocks.

PROTEROZOIC

TAPLEY HILL SLATE
Blue grey laminated calcareous shale interbedded or interlaminated with buff grey siltstone and shale.

STURTIAN TILLITE Blue grey to dark grey calcareous tillite with boulders - Lenticular brown weathering blue grey limestone and dolomite at contact with Tapley Hill Slate - Lenticular buff pebbly arkose beds near contact also greenish arkose with rounded very coarse quartz grains & calcareous matrix.

BELAIR SLATES & QUARTZITES
Quartzites, black and grey-green slates siltstones and calcareous siltstones

Strike and dip of bedding . . . . . 60°
. . . . . cleavage . . . . . 50°
Fault . . . . . U D
Contours - various intervals - datum L.W.O.S.T. = 100' 750 725 700

— SCALE —
Chains 10 5 0 10 20 30 40 50 Chains.

To accompany report by W. Johnson.

S.A. DEPT. OF MINES

GEOLOGICAL INVESTIGATION - SULPHIDE MINERALIZATION
AT STURTIAN TILLITE – TAPLEY HILL SLATE CONTACT
STURT RIVER AREA

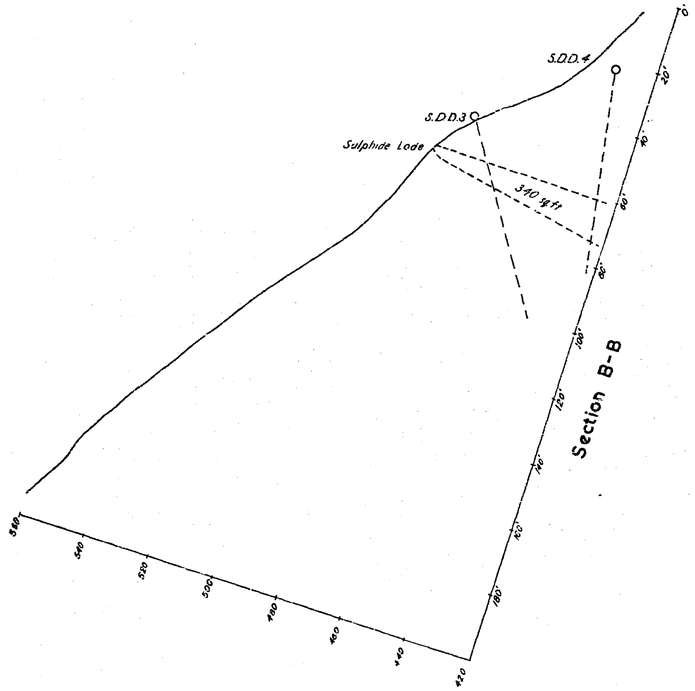
Associated Drawing	No.	No.	Amendment	Exd.	Date

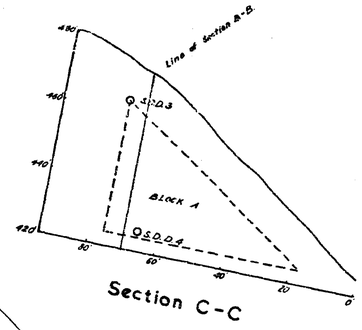
Req. No.
D.M.
Compiled from

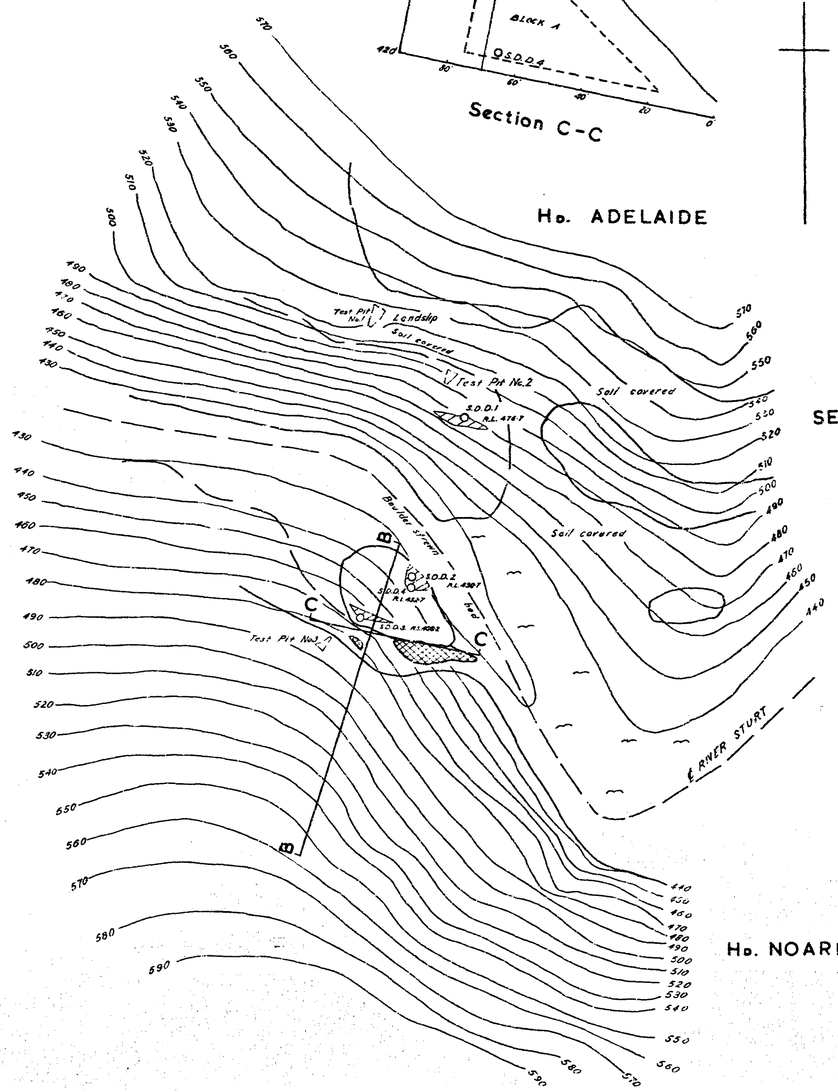
Approved	Passed	
		Drn.
		Tcd. M.B.L.
		Ckd.
Director of Mines		Exd.

Scale : 10 chains to 1 inch
61 - 838
Ha 9
Date 23·11·61.

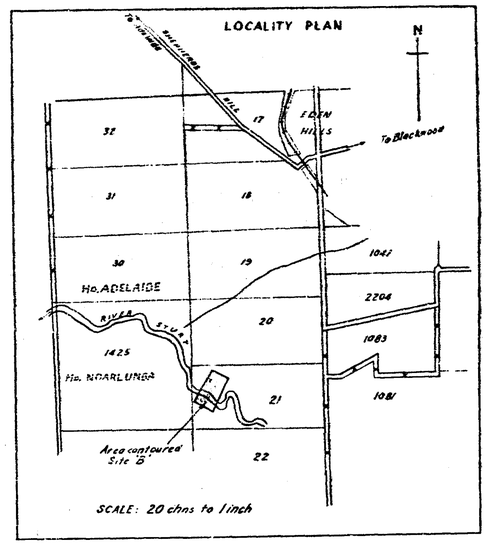
Volume Block A = 60 x 340 ÷ 2 = 10200 cu.ft.
Weighted Av. % Zn = 13·6
Volume of Zn = 1356·6 cu.ft.
Weight of Zn = 256 tons.







SEC. 21



LEGEND

Alluvium
Sturtian tillite outcrop
Outcrop breccia lode
Level bench
Scout diamond drill

Geology by E.R. Hillwood with additions by W. Johnson.

To accompany report by W Johnson

S.A. DEPT. OF MINES

GEOLOGY OF STURT RIVER DAMSITE
WITH CROSS-SECTIONS AND OUTCROP
OF SULPHIDE LODE

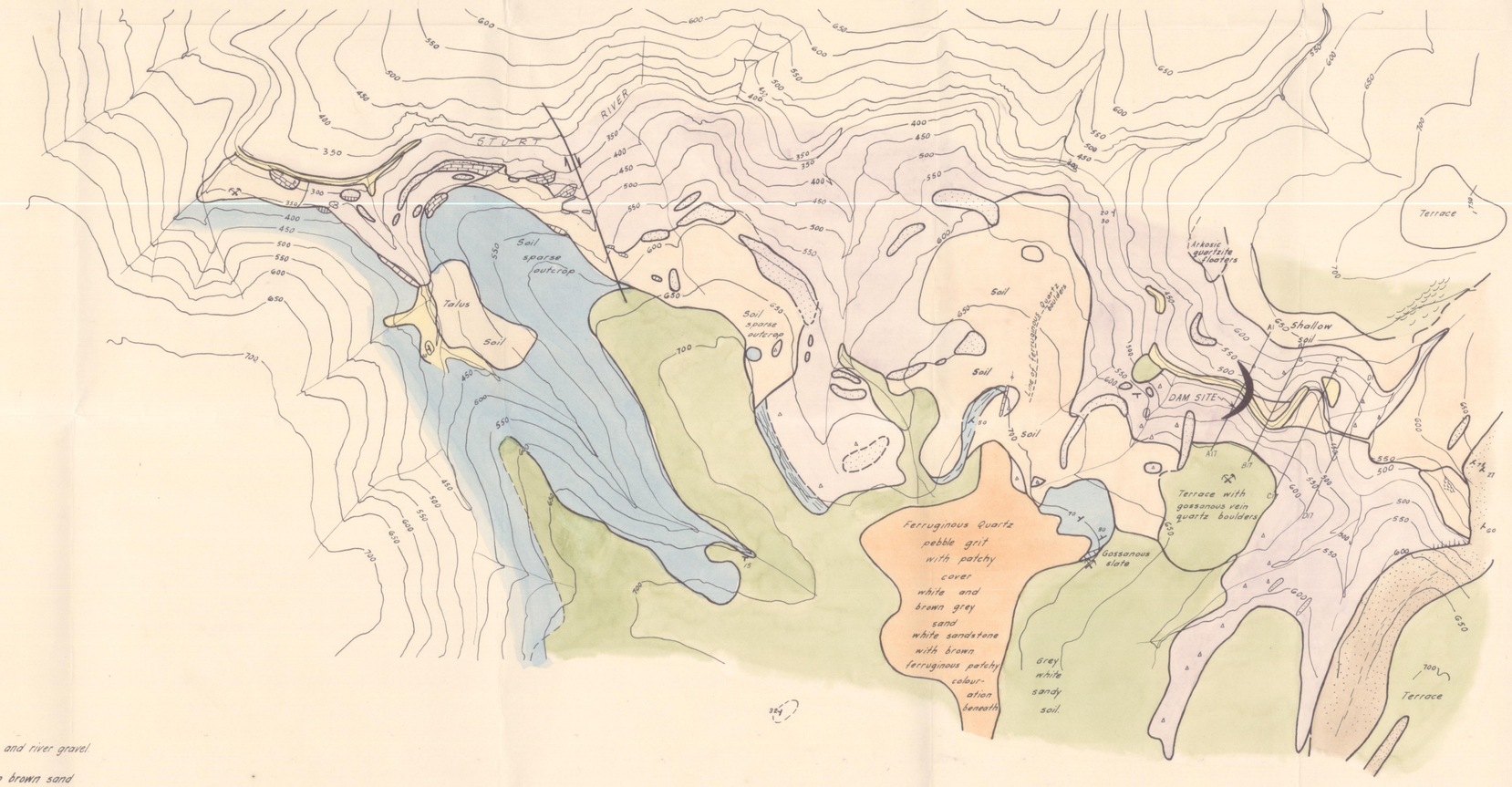
Associated Drawing	No.	No.	Amendment	Exd.	Date

Req. No.
D.M.
Compiled from

Approved	Passed
Director of Mines	

Drn.
Tcd. C.W.F.
Ckd.
Exd.

Scale: 40' to 1"
61-842
Ho 6
Date 5-12-61



LEGEND

TERTIARY QUATERNARY

ALLUVIUM Organic silt, grey brown sand pebbles and river gravel

White grey and grey brown sand, some pink to brown sand with pebbles of old high level river terraces - pink and yellow brown clayey sand mostly residual from weathering of Tertiary sandstone.

White grey semi-cemented sandstone overlain in places by ferruginous coarse granule sandstone and ferruginous vein quartz pebble sandstone. Some reactive black soils.

Grey brown soil and rock talus, principally overlying Proterozoic bedrock.

PROTEROZOIC

TAPLEY HILL SLATE Blue grey laminated calcareous shale interbedded or interlaminated with buff-grey siltstone and shale.

STURTIAN TILLITE Blue grey to dark grey calcareous tillite with boulders. Lenticular brown weathering blue grey limestone and dolomite at contact with Tapley Hill Slate. Lenticular buff pebbly arkose beds near contact also greenish arkose with rounded very coarse quartz grains and calcareous matrix.

REFERENCE TO SIGNS

Strike and Dip of Bedding

Workings

Fault

Landslide

PROTEROZOIC

BELAIR SLATES AND QUARTZITES Quartzites, black and grey-green slates, siltstones and calcareous siltstones.

SCALE

CHAINS 5 0 5 10 15 20 25 CHAINS

To accompany report by W. Johnson

S.A. DEPT. OF MINES

GEOLOGY OF STURT RIVER GORGE IN THE VICINITY OF SULPHIDE LODE

Associated Drawing	No.	No.	Amendment	Exd.	Date

Req. No.
D.M.
Compiled from

Approved	Passed		
		Drn.	
		Tcd. A.W.	
Director of Mines		Ckd.	
		Exd.	

Scale : As shown

61-843
Ha 6

Date 5-12-61