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MC 5463 AND MC 5464

MOUNT COFFIN

GEOLOGICAL REPORT, OCTOBER 1971

Submitted by
Tapley Mining Co.
1971

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TENEMENT HOLDER: Tapley Mining Ltd.

REPORT: Geological Report - October 1971 (Pgs 3-11)

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GEOLOGICAL REPORT

ON

MINING CLAIMS Nos. 5463 & 5464

TAPLEY MINING COMPANY

October, 1971

By:
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GENERAL:

The two Mineral Claims namely, 5463 and 5464 are held by Tapley Mining Company and are bounded by a Special Mining Lease No. 366, held by Booloorоо Mining Company. It is situated along the main Copley to Serle Angepena Road, about 350 miles due north of Adelaide. As these two claims cover some old mines namely, West Jubilee, Elsie Adair and South Adair Mines, this report will deal only with these old mines and the recent work in the surrounding of these mines.

HISTORY OF AREA:

The mining history of the area could be traced back to 1860's, when copper was mined on a small scale.

Three copper mines of note namely Elsie Adair, South Adair and West Jubilee mines are within the two claims and were worked between 1880 and 1920. They are located in stratigraphically restricted zone along the southern and eastern edges of the Mt. Coffin diapir. These mines occur in siltstones at the top of the Yudnamutana Sub-Group and in the overlying Tindelpina Shale Member.

Although production figures and mine details are incomplete, a description of the mines within the claims is compiled from the records of the South Australian Mines Department.

ELSIE ADAIR MINE:

These workings, adjoining Mt. Coffin Mines to the east were first worked about 1899 with three shafts each of 50 feet depth, in the "clayslate" carrying strings and bunches of green carbonates and grey ore. By 1900 when about 140 tons of 14% copper were sold, one shaft had been deepened to 100 feet in the ore zone which was between 4 and 11 feet wide and dipped to the south at about 50 degrees. It is of interest that the early records refer to narrow north south trending "veins of quartzose"grit with iron oxide and copper mineralisation". These veins were associated with areas of good quality ore containing up to 32% copper, and are now known to be brecciated quartz-iron oxide veins that carry primary copper minerals. In 1901, 500 tons of ore were sent away but arsenic proved to be a difficulty in treatment. The main shaft was deepened to 150 feet with workings at the 30, 70, 100, 114 feet levels. The property was then idle for a short time until taken up and worked sporadically by tributors between 1902 and 1906 when a small amount of ore was won from the adjacent open workings and pits. Recently the presence of vanadium at the Elsie Adair Mine occuring as yellowish vanadic ochre in association with malachite has been reported.

HOLMES BLOCK (SOUTH ADAIR WORKINGS):

A large open cut and several shallow shafts were opened up in thin bedded clayslates and sandstones with seams and nodules of copper carbonates. The spotty nature of ore meant difficulty in concentration, and an early report suggested leaching as the best method of concentration. Arsenic was again a problem in treatment.

WEST JUBILEE:

At least three shafts were sunk in Tapley Hill Siltstones. Jones (1909) reported that six shallow open cuts had been opened up "in silicious formation impregnated with green carbonate for a width of 10 feet." A small amount of ore from this mine was treated at Blinman.

Earliest mine report was by J.B. Austin in 1863 after which later mines report were given by Professor G.F. Uerich (1872) and H.Y.L. BROWN (1887 - 1908).

More detailed accounts of these mines, together with brief descriptions of their geological settings, appeared in the Inspector of Mines reports, recorded in the reviews of Mining of the South Australian Department of Mines from 1904 to 1921.

From 1950's to 1968 the Mines Department have done a fair bit of detail geological work in the surrounding of Mt. Coffin diapir. Serle Angepena 1" = 1 mile and Copley 1" = 4 miles series were prepared and the general geology was described fully.

Modification of Adelaide system stratigraphic column by Thompson et al (1964) and the discovery that some of the complex crush structures in the Flinders Ranges are of diapiric nature (Webb, 1960) has brought about some revision of mapping on Serle and Angepena sheets by R.P. Coats, during regional mapping of Copley 1" = 4 miles sheet.

The geology of the surrounding and hence of the lease area itself became more up to date when, in 1967-68 Geochemical and Geophysical surveys were carried out by the Mines Department of South Australia. These surveys are followed by Diamond and Percussion drilling around Mt. Coffin which gave valuable information.

Southern Cross Exploration carried out the most recent exploration work after an arrangement was reached for the exploration of the two claims, with Rare Earth Corporation of Australia and Tapley Mining Company.

GEOLOGY OF THE CLAIMS:

Though the two claims cover a very small area still some detail of the local geology is given here.

CLAIM 5363 covering West Jubilee Mine, have only two types of rocks exposures. The diapiric dolomitic breccia in the central section and on either side bounded by Yudnamutana Sub-Group which is pebbly shales and siltstone and is finely laminated.

CLAIM 5364 covering Elsie Adair and South Adair Mines have different rock types from that of West Jubilee Mine area. Dipping towards the south, are Yudnamutana Sub-Group of rocks, which are in contact with Tindle Shale Member which is a black carbonaceous, pyritic shale with basal yellow dolomite. This is followed by Tapley Hill Formation which is laminated Shales and Siltstones with interbedded yellow brown dolomites.

The rocks along the immediate boundary of the diapir are dipping steeply towards the south while they gradually flattens out further south. Shear and tension cracks and joints are very common in the Yudnamutana Sub-Group of rock along the contact zone of the diapir.

EXPLORATION WORK:

The only systematic exploration work in recent years is carried out by the Mines Department of South Australia. They have prepared a geological map of Mount Coffin diapir area on a surveyed grid plan of 1" = 800 feet.

Mines Department of South Australia have carried out soil sampling survey, stream sediment survey, aeromagnetic survey, ground magnetic, induced polarisation and self potential surveys, around Mt. Coffin diapir area which included the area covered by the two claims. As a result of these surveys quite a few anomalous zones were delineated which were drilled later on by percussion drilling.

Southern Cross Exploration N.L. through its own technical staff prepared a grid plan of the area on a 1 = 1000 scale. Percussion holes were drilled over the areas recommended by the preliminary investigations of the Mines Department or on the locations where drilling programme of the Mines Department showed some encouraging results.

DRILLING PROGRAMME:

Rotary Percussion drilling programme was carried out by the Department of Mines, South Australia, in 1968, to test several geochemically anomalous areas outside the Mt. Coffin diapir, along its eastern and southern flanks. Also it was designed to investigate the nature and source of mineralisation in the vicinity of the old Elsie Adair, South Adair and West Jubilee Mines, along the southern and eastern flanks of the diapir.

Southern Cross Exploration N.L. carried out its own percussion drilling programme in 1970 and 1971. Here a separate account of drilling by the Mines Department and Southern Cross Exploration N.L. will be given.

ROTARY PERCUSSION DRILLING OF THE MINES DEPARTMENT

Mines Department of South Australia have drilled a total of 41 drill holes in 1968, in the area covered by the two claims. The machine used was a "Halco 150, down the hole hammer". Of these 41 drill holes, 24 were drilled in the Elsie Adair and South Adair mine area for an average depth of 146 feet; 10 drill holes were drilled in the West Jubilee mine area for an average depth of 143 feet, and 7 holes were drilled over a soil anomaly within the diapir to the south of West Jubilee for an average depth of 141 feet.

Samples were collected at six feet intervals and tests were carried out in the field and at AMDEL'S Laboratories.

Elsie Adair and South Adair Mine area:- 24 holes were drilled in the vicinity of these mine workings, most of which are along two lines AA, BB (Plan 69-174 of the Mines Dept.)

Encouraging results were encountered in holes No. CW11, 12, 13, 14, 15 and 39, which were drilled in Pyritic Tindelpina Shale Member. It was considered that the pyrite has played a vital role in the migration and fixation of secondary copper in veinlets and stringers after having leached from the primary quartz carbonate-iron oxide veins. The distribution of secondary copper is very erratic and is probably closely related to the distribution of the primary copper veins.

The most encouraging intersections were in the area of the South Adair workings, and probably related to a network of primary veins and their associated secondary copper.

The following is table showing intersections of drill holes in which copper was detected:-

Hole No.	From	To	% of Copper
CW 1	54'	84'	0.25 Cu
CW 1	120'	150'	0.15 Cu
CW 4	108'	150'	0.22 Cu
CW 6	114'	150'	1.55 Cu
CW 6	138'	144'	4.0 Cu
CW 7	72'	108'	0.36 Cu
CW 9	36'	72'	0.38 Cu
CW10	0'	36'	0.49 Cu
CW11	0'	126'	0.36 Cu
CW12	0)	116'	0.58 Cu
CW12	108'	116'	3.12 Cu
CW13	6'	24'	0.24 Cu
CW13	48'	132'	0.33 Cu
CW14	0'	108'	1.50 Cu
CW14	0'	36'	2.93 Cu
CW14	0'	12'	4.1 Cu
CW15	54'	126'	0.40 Cu
CW36	126'	150'	2.2 Cu

Hole No.	From	To	% of Copper
CW39	6'	36'	0.39 Cu
CW39	90'	150'	2.13 Cu
CW39	96'	126'	4.06 Cu
CW39	108'	114'	6.5 Cu

West Jubilee Area: 10 holes were drilled in the vicinity of West Jubilee workings along four lines AA', BB', CC', and DD' (Plan 69-178 of Mines Department).

The zone of mineralisation lies in a fairly stratigraphically restricted zone just above the upper boundary of the Yudnamutana Sub-Group. The study of the chips from the drill hole showed that the mineralised zone corresponds to a zone of secondary copper mineralisation that has been leached from a net work of primary veins to the south of the mines and fixed in a position corresponding to the Tindelpina Shale.

The following table shows the copper content in the mineralised sections of the individual drill holes.

Hole No.	From	To	% of Copper
CW18	72'	150'	0.62 Cu
CW18	114'	150'	1.12 Cu
CW19	0'	120'	0.49 Cu
CW19	0'	48'	0.96 Cu
CW20	24'	150'	0.33 Cu
CW21	24'	72'	0.01 Cu
CW21	42'	66'	1.61 Cu
CW23	42'	108'	0.49 Cu
CW24	6'	96'	0.52 Cu
CW24	30'	54'	1.1 Cu
CW25	126'	150'	0.14 Cu
CW26	0'	150'	0.35 Cu

Conclusions drawn, based on the results obtained from the Mines Department drilling programme:-

Outside Mount Coffin diapir sporadic copper mineralisation occurs in the Tindelpina Shale Member as secondary malachite, chalcocite and cuprite around narrow quartz, carbonate, iron oxide, copper sulphide veins which apparently originate from the diapir and are more common on the eastern and southern flank in the area covered by the two Mineral Claims.

The erratic nature of the mineralisation makes it difficult to determine the overall grade of ore in the area. Further drilling would be required in zones where primary veins are common, close to or within the Tindelpina Shale horizon to outline limits of economically recoverable ore.

Drilling programme by Southern Cross Exploration over the claims held by Tapley Mining Company.

Southern Cross Exploration N.L. carried out extensive drilling programme around Mt. Coffin diapir area to follow the work started by the Mines Department of South Australia. The drilling was carried out over the grid lines laid out by Southern Cross Exploration. As the most obvious surface mineralisation was in the vicinity of Elsie Adair workings, vertually all the drill holes planned for the two mineral claims were drilled to the South of Elsie Adair workings.

A total of 35 percussion drill holes were drilled. The depth of the holes ranged from 200 feet to 500 feet, with an average of 275 feet.

The following table shows the mineralised intersections in the individual holes.

Hole No.		From	To	Intersection	% of Copper
402/376	70°N	10'	20'	10' Feet	2.2 % Cu
400/392	70°N			Negligible amount	
400/388	70°N	110'	120'	10' Feet	.99% Cu
400/384	70°N	150'	160'	10' "	1.35% Cu
399/384	70°N	175'	180'	5' "	1.1 % Cu
399/380	70°N	150'	170'	20' "	1.88% Cu
399/376	90°	115'	180'	65' "	.55% Cu
399/376	90°	260'	270'	10' "	1.6 % Cu
399/376	60°N			Negligible amount	
399/372	70°N			Negligible amount	
398/380	90°	305'	315'	10' Feet	1 % Cu
398/380	70°N	185'	200'	15' "	1.5 % Cu
398/380	70°N	225'	260'	35' "	2.07% Cu
398/376	70°N	120'	145'	25' "	.63% Cu
398/376	70°N	145'	195'	50' "	2.47% Cu
398/376	70°N	215'	245'	30' "	1.3 % Cu
398/372	70°N	105'	115'	10' "	1.2 % Cu
398/372	70°N	150'	175'	25' "	1.02% Cu
398/368	70°N	105'	115'	10' "	1.00% Cu
398/360	70°N	80'	95'	15' "	.78% Cu
398/356	80°N	130'	150'	20' "	.78% Cu
398/356	80°N	170'	180'	10' "	1.1 % Cu
397/380	90°			Negligible amount	
397/376	90°			Negligible amount	
397/372	70°N	20'	40'	20' Feet	1.7 % Cu
397/372	70°N	70'	115'	45' "	1.93% Cu
397/372	70°N	165'	180'	15' "	1.19% Cu
396/372	70°N			Negligible amount	
396/368	70°N	10'	30'	20' Feet	1.2 % Cu
396/368	70°N	35'	75'	40' "	1.05% Cu
396/368	70°N	205'	230'	25' "	2.1 % Cu
396/364	70°N			Negligible amount	
396/360	80°N	15'	35'	20' Feet	2.6 % Cu
396/356	80°N	175'	210'	35' "	1.09% Cu

Hole No.		From	To	Intersection	% of Copper
396/356	80°N	220'	230'	10' Feet	2.1 % Cu
396/352	90°	280'	295'	15' "	.66% Cu
396/352	60°N	190'	225'	35' "	1.7 % Cu
395/368	90°	170'	180'	10' "	.69% Cu
394/356	90°				Negligible amount
392/368	90°	180'	235'	55' Feet	1.48% Cu
392/364	70°N	5'	10'	5' "	2.5 % Cu
392/360	70°N				Negligible amount
392/356	90°				Negligible amount
392/352	70°N	225'	230'	5' Feet	2.5 % Cu
390/356	90°	140'	160'	20' "	1.12% Cu
389/368	90°	50'	60'	10' "	1.5 % Cu
389/368	90°	245'	275'	30' "	1.12% Cu

The drilling results obtained by Southern Cross Exploration N.L. were vertually the same. There is mineralisation associated with diapirism, erratic in nature and without any set pattern. The study of the samples showed that the weathering zone extends up to 150 feet and the mineralisation is principally malachite and some cuprite with minor chalcocite. Below 150 feet beyond the weathered zone the secondary copper tends to be confined to joints and cracks only. Due to erratic nature of the mineralisation it is very hard to make an assessment of the ore reserves and further pattern drilling would be needed to make that assessment.

SETTING UP OF A PILOT PLANT:

Some good recoverable ore was intersected in quite a few drill holes near the surface, and the mineralisation was a mixture of various oxides and carbonates of copper. It was decided that some leaching, metallurgical and recovery tests should be made on a small scale to check upon any possible recovery or metallurgical difficulties in the future.

At the moment a pilot leaching plant with a production capacity of 100 tons a day and which could be expanded when desired at an appropriate time, is being set up and trial production have started already. The pilot plant has been designed and built by Southern Cross Exploration N.L. own technical staff.

MINERALISATION:

Mineralisation in the area covered by the two mineral claims is essentially a secondary mineralisation. It is in the form thin chalcocite, cuprite and malachite veins generally parallel to the bedding, although some cross cutting veins were noticed. Some malachite was noticed on joints and bedding planes. This type of mineralisation is almost entirely restricted to the upper siltstones of the Yudnamutana Sub-Group and the Tindelpina Shale Member of the Tapley Hill Formation.

Pyrite in the Tindelpina Shale is the controlling influence in the migration and fixation of the secondary copper leached from the primary veins by acidic solution. Weathering have caused considerable dispersion of copper in the area.

CONTROLS OF ORE LOCALISATION:

Mineralisation in the area covered by the two mineral claims is associated with the Mount Coffin diapir which is situated towards the west and outside the boundary of the two claims. However mineralisation in the mineral claims area cannot be described without a proper reference to the diapir itself. The diapiric movement played a great part by uplifting and crushing of the overlying and bordering sediments and creating void space and cracks to be filled up by the mineral carrying fluids, associated with the movements.

STRATIGRAPHIC CONTROLS:

Outside the diapir all the major mines and many small workings are located at the same stratigraphic level, in siltstone at the top of the Umbratana Sub-Group, mainly along the Southern edge of the diapir. Mineralisation occurs in layers parallel to the bedding, with rare cross cutting veins.

STRUCTURAL CONTROL:

Outside the diapir an extensive area of secondarily dispersed malachite occurs to the south of the diapir, particularly around the South Adair workings. The malachite probably owes its origin to a set of copper bearing, geothite, siderite quartz veins.

There is little doubt that the copper mineralisation is related to the diapir, and that intrusion of the diapir caused considerable fracturing of the rim rocks to provide channelways for the vein type mineralisation. This has been proved by the drill holes on the southern rim of the Mt. Coffin diapir over SML 366, held by Booloocroo Mining Company. In hole No. 397/324 70° at 275 depth some diapir material was encountered which was assumed to be a diapiric tongue. This diapiric material caused fracturing of the rim rocks, which acted as channel ways for mineral fluids.

CONCLUSIONS:

In the light of the results obtained to date, from the work carried out over the two mineral claims 5463 and 5464, the following conclusions were drawn.

(1) Mineralisation in the area covered by the two claims is essentially a secondary type mineralisation. Mineralisation is by far more abundant around Elsie Adair Mine and South Adair Mine, than West Jubilee Mine. Due to weathering considerable dispersion of copper mineralisation has occured.

(2) Secondary mineralisation occurs in the form of malachite - chalcocite - cuprite - limonite assemblages along the bedding and joint planes. The best mineralised intersections were encountered in drill holes 398/380 with 35 feet intersection of 2.07% copper, hole 398/376 with 50 feet intersection of 2.47% Cu, hole 397/372 with 45 feet intersection of 1.93% Cu, and hole 392/368 with 55 feet intersection of 1.48% Cu. All these mineralised intersections dip towards the south, away from the diapir and apparently thins out at depth.

(3) The mineralisation is erratic and follow haphazardly the general boundary of the diapir with the sediments. Still being near the surface, would be easy to make an overall assessment by shallow percussion drilling.

(4) Being a variety of carbonate and oxide mineralisation, a comprehensive leaching and metallurgical tests would be required before a method of exploitation of the ore is adopted.

RECOMMENDATIONS:

(1) Though quite a few drill holes are drilled but all of them are away from the immediate boundary of the diapir and the younger Yudnamutana Sub-Group rocks. A few deep (400 feet) drill holes should be drilled near the boundary of the diapir with the younger sediments to check, if there is any economic primary mineralisation near Elsie Adair and South Adair workings. Primary mineralisation is known to occur west of the above mentioned working on SML 366, along the boundary of the diapir.

(2) The present leaching and metallurgical studies on the present pilot plant should be continued, so that any metallurgical difficulties should be known.

RECOMMENDATIONS (Contd.)

(3) To check and determine the ore reserves a drilling programme on grid pattern is needed to suppliment the previous drilling and according to the ore reserves a leaching plant set up.

(4) In view of the depressed copper prices great budgets should not be allocated for mining purposes at this stage. Budgets should be allocated for ore reserve estimation, leaching and recovery methods.