UR 1963/30-41

GREAT PYRAMID TIN MINE - UPPER SCAMANDER

INTRODUCTION

The Great Pyramid Tin Mine is situated approximately two miles north of the bridge crossing the Scamander River at Upper Scamander. The area is at present held under two leases 23/62M of 10 acres and 33/62M of 18 acres by R.D.L. Palmer and L. Price.

Twelvetrees (1911) recorded that tin was first discovered in the area in the year 1909 and that the Great Pyramid Tin Mine operated until the end of 1910. The work done was exploratory and there is no record of production. Apparently the tin values were too low and work ceased towards the end of 1910.

Leases over the area were again taken up in 1912 and held until 1920. During 1914 an option was taken by the Troy Tin Syndicate and more exploratory work was done, some of the adits were extended and cross-cuts driven to delineate the ore further. Extensive sampling of both walls at 10 foot intervals was done in all the new work and over the old workings where values had been obtained by the previous leasees.

The leases were surrendered in 1920 and held under a consolidated lease until 1925 when they again became vacant. Apparently no further work was done during this period

In 1925 the area was taken up by H. Aulich and held until 1936 when it was transferred and became vacant again in 1941. Departmental records show that during the period 1925 - 1936 some mining activity was carried on by H. Aulich. A small five head stamp battery was constructed on the Scamander River during 1926-27 and during 1928 the first ore was treated. There is a record of production in 1933 and 1934, and in 1935 the mill was removed. The next recorded production, in 1936, was from a parcel of ore sent to Waratah for treatment.

The recorded production of the mine is as follows:

Year	Ore (tons)	Conc.(tons)	Tin (tons)	Recovery Grade (%Sn)	Valu (£)
1928	55	0.650	0.407	0.74	97.04
1933	103	1.359	0.779	0.75	168.25
1944	152	3.000	1.500	0.99	350.00
1936	21	0.370	0.245	1.17	48.6
1928-1936	331	5.379	2.931	0.88	663.90

The total recorded production 1928-1936 gives a recovery grade of 0.88% and it is presumed from this that the grade of ore mined would be approximately 1.5% as losses would be very high with the crude crushing and tabling

methods used.

In 1957 the area was again taken up and at the request of the lessee some check sampling was done on selected areas by the Department of Mines (Keid, 1957). This check sampling showed lower values than the sampling by the Great Pyramid Company in 1909 and also that by the Troy Tin Syndicate in 1914. However, all the samples show that while overall the values are low some small high grade patches of ore occur irregularly throughout the lower grade material.

The current lease holders have taken bulk samples of some of the higher grade material for comparison with the older sampling and also for milling and recovery tests. The area has also been geologically mapped and an interpretation of the structure attempted.

GEOLOGY

The host rocks for the tin mineralization are the Mathinna group of sediments of Silurian age. On the leases they are mainly sandstone, mudstone, siltstone and quartzite resulting from local alteration of sandstone. The general strike of the rocks is NW-SE and the dip is steeply SW, but many variations of strike and dip occur due to the folding and faulting present.

The mudstone and siltstone are generally thin bedded and occur as bands from an inch to several feet in width. They are sometimes blocky and may grade into sandstone. Locally they are highly sheared but faulting in these beds is difficult to determine. The beds are occasionally lenticular and others pinch and swell along the strike.

The sandstone is fine to medium grained and occasionally feldspathic, generally blocky to massive. There are all gradations present between soft sandstone and hard quartzite and it is sometimes difficult to define a boundary. The bedding is not as evident as in the mudstone and siltstone and is not seen when the sandstone is massive.

The quartzite is hard, massive and generally shows no bedding. It is locally well fractured, usually at a steep angle and at or near right angles to the strike of the rock. The fractures are filled by quartz, limonite and sometimes by cassiterite.

No granitic rocks can be seen on the leases but there are large areas of granite a few miles NW.

The only igneous rock in the lease area is a quartz dolerite or altered 'basic' dyke, which occurs at 42 feet from the entrance to No. 1 South Low Level adit. The dyke strikes at 65° and dips steeply SW. It is finely crystalline and contains a little pyrite and chalcopyrite but no tin was seen in the rock (see appendix for description). The dyke is probably a late differentiate from the porphyritic granite. As elsewhere these dykes can be seen cutting through the porphyritic granite. It is also probably earlier than the tin granite and is unlikely to have any bearing on the tin present unless it has displaced favourable beds before mineralization. The dyke is not seen at the surface though this is probably due to its easier weathering and the surface cover of quartzite rubble.

MINERALIZATION

This consists mainly of cassiterite, pyrite and chalcopyrite, the chalcopyrite being inferred from the presence of copper staining. No pyrite was seen but a a vein of pyrite was reported by Twelvetrees (1911). Much of the limonitic iron staining has probably been derived from pyrite, and cubic cavities present in the siltstone and mudstone probably once contained pyrite. The cassiterite present is generally finely crystalline though some crystals were seen approximately one sixteenth of an inch across. The cassiterite is generally associated with limonite, sericite and a little introduced silica. It also occurs as a coating on some joints and faults and it has been reported to occur in the gouge material from the fracturing. As the strongest fracturing is associated with the hard quartzite the best tin values are obtained in these beds. Tin values also occur in the sandstone beds but these are generally of less importance while only very low values are present in the mudstone and siltstone.

While most of the quartzite shows good fracturing it does not all contain good tin values and some other factor must have influenced mineralization. This could have been the presence of faults and/or the degree of folding which provided an easy access for the mineralization.

SAMPLING

The earliest sampling was done by the Great Pyramid Company in 1909. Surface trenches and pits were sampled across the trend of the mineralization, and the adits sampled at ten feet intervals. All shafts were

sampled at varying intervals probably to coincide with a change in rock type or mineralization.

In 1914 the whole of the workings were resampled. This time both walls of the adits were sampled where values had been found previously and all new development was sampled on both walls. There is no record of the shafts being resampled though the surface trenches and pits were again sampled.

Check sampling over some of the higher tin values by the Department of Mines in 1957 showed generally lower values than previous sampling. Keid (1957).

Bulk samples were taken from the North Adit and surface workings and assayed by the Department of Mines in 1963. Each sample weighed approximately half a ton and a comparison with previous sampling is as follows:

Dept.	Great Pyramid	Troy Tin	Workings
1963	1909	1914	
% Tin	% Tin	% Tin	
2.17	6.37	3.55	Surface pit
0.69	0.80	0.6(approx.)	Over 25 feet in North A

MINE WORKINGS

The exploration appears to have been done in two stages, firstly to intersect the high values found in surface trenching and then to prove a continuation of values down the dip of the orebodies. With these objects in view two levels of adits were driven, the upper ones at from 90 to 130 feet below the top of the hill and the lower ones 90 to 170 feet below the upper adits.

North Adit Elevation 630-7 feet

This adit on the eastern side of the hill has been driven 300 feet in a SW direction. It was apparently intended to intersect the high values found on the surface. At the entrance the rocks are mainly mudstone and sandstone dipping steeply SW, and at 35 and 40 feet two faults with small displacement occur. From 40 to 65 feet a hard well fractured quartzite occurs with a little limonite staining and visible cassiterite filling some of the fractures. This is one of the zones of highest tin values and a bulk sample taken here gave 0.69 % Tin. At 65 to 100 feet the rocks are mudstone, sandstone and quartzite dipping less steeply NE and the adit has passed through a faulted synclinal trough. A strong fracture at 100 feet shows high tin assays. Massive quartzite occurs from 100 to 140 feet but contains little tin. Bands of siltstone, mudstone and

sandstone, dipping steeply NE occur to 200 feet where there is a 12 foot band of moderately iron stained sandstone. This is followed by a highly iron stained sandy mudstone intensely fractured to 242 feet. A strong fault dipping SW at 45° at 250 feet brings mudstone against quartzite and this quartzite dipping steeply SW persists to the end of the adit. A small cross-cut driven SW from the adit at 50 feet was probably put in along a strong fracture and has encountered high tin values. Structurally this adit has passed through a faulted synclinal trough, then through a broader anticlinal structure ending on the western limb of the anticline.

E Adit. Elevation 595.5 feet

This adit at the NW end of the hill has been driven SE for 220 feet. At the entrance the mudstone and sandstone dip steeply NE and appear to be folded. At 65 feet the dip is SW and this rapid change also suggests minor folding. A strong fracture and probable fault occurs at 70 feet and has been driven on to the south but apparently contained little tin. Interbedded mudstone and quartzite occur dipping steeply NW from 70 to 150 feet. At 150 to 165 feet is a fractured zone in quartzite and beyond this the mudstone and sandstone dip at 30 to 45° to the SE. The adit ends in hard massive quartzite. The structure of this adit is difficult to interpret and may result from later cross folding of the original anticlinal structure.

No. 1. North Low Level Adit. Elevation 522.5 feet

The adit is on the NE side of the hill and has been driven 290 feet SW. It was apparently intended to test at depth the northerly extension of the values found in the North Adit. At 260 feet a cross cut was driven SE and this is in values comparable with those found in the end of this adit but much lower than those of the North Adit. The rocks are mainly mudstone and sandstone excepting the last 80 feet of the adit which is moderately well fractured quartzite. The dip of the beds is SW until a fractured zone is reached at 125 to 130 feet. After this the bed is steeply NE. The adit appears to have passed through the faulted synclinal structure.

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No. 2. North Low Level Adit. Elevation 529.3 feet.

This adit is parallel to No. 1 North Low Level and was driven 270 feet to the SW in order to test the downward extension of the values in the North Adit and also their southerly extension. A crosscut 190 feet long has been driven NW from the adit and comes within 25 feet of the crosscut driven SE from No. 1 North Low Level. The values found in the crosscut are encouraging, the highest grade material being just north of and 100 feet below the high grade section of the North Adit. At the entrance the rocks are mainly mudstone with the dip varying from SW to NE and a small syncline is passed through. A band of quartzite occurs from 60 to 95 feet after which the mudstone and sandstone again dip steeply SW. Another small faulted syncline occurs between 170 and 200 feet and the dip is then steeply NE in mudstone and quartzite to the end of the adit. In the beginning of the crosscut the beds are displaced by strong fractures and the general dip of the mudstone and sandstone is south. Near the end of the crosscut two fractures were followed but these apparently contained no tin.

Structurally this adit appears to pass through a series of tight synclines and broader anticlines all of which are extensively faulted. However, a rise from this adit to the North Adit could prove a useful block of high grade ore and possibly help to determine the structure more accurately.

No. 3 North Low Level. Elevation 467.3 feet.

This adit on the NE side of the hill was driven easterly for 100 feet; a crosscut from near the end went southerly for 150 feet. The rocks are mainly mudstone and sandstone with some quartzite towards the end of the crosscut. This area is more fractured and carries a little more tin than elsewhere in the adit. There appears to be an anticlinal structure with N-S axis which is passed through in both the adit and the crosscut off the adit.

C Adit. Elevation 591.5 feet.

This adit on the west side of the hill was driven 290 feet in a NE direction and has the best tin values apart from the North Adit. The rocks are mainly mudstone sandstone and quartzite. Fracturing is well developed in the massive quartzite and it is in these areas that high tin values occur. A strong fault dipping NW crosses the adit at 100 feet but the amount of movement is unknown. A winze was put down 16 feet at 220 feet

but contained no tin. The last 50 feet of the adit is in ferruginous mudstone and quartzite bands probably sheared and similar to bands occurring in the North Adit and B Adit. The dip of the rocks in this adit is steeply SW. There is no suggestion of folding but the fault at 100 feet may have repeated the ore bearing quartzite beds and given a larger mineralized zone than that found in No. 2. South Low Level Adit which is 150 feet below this adit.

No. 1. South Low Level Adit. Elevation 453.7 feet.

The adit is on the SW side of the hill and was driven NE for 370 feet. It was apparently designed to test at depth the high values found in surface trenches and also to test the southerly extension of C Adit. The values found were low but extend over a considerable length of the adit. The rocks passed through are mainly quartzite with a few bands of sandstone and mudstone. The dip is generally towards the SW though it is disturbed by the fracturing. At from 40 to 67 feet from the entrance an altered dolerite dyke is passed through. On the contact it shows concentric weathering and a slight copper staining, probably derived from a very minor chalcopyrite content. The dyke does not appear to offset the bedding to any marked extent and it has probably had no effect on the mineralization.

Tin values are found in the quartzitic beds from 110 feet to the end of the adit but the values are low. At 250 feet a steeply dipping fracture crosses the adit, this may possibly be a continuation of the fracture driven on in No. 2 South Low Level Adit.

No. 2. South Low Level. Elevation 435.0 feet.

This is parallel to No. 1 South Low Level adit and was driven 380 feet in a NE direction. It was designed to prove the continuation down dip of the values found in C Adit and surface trenching. Two areas of low to medium grade mineralization occur, one from 100 to 190 feet and the other from 290 to 390 feet.. The latter may represent the downward extension from C Adit. The position of the former is probably due to faulting as a very strong fracture occurs on the SW boundary of the quartzite containing the tin values. There is considerable iron staining associated with this fracture and the fracture was driven on for 12

feet NW and for 85 feet SE before the crosscut was turned NE. The dips in the adit are all steeply SW and the rocks are dominently quartzite with some mudstone and sandstone.

No. 3. South Low Level. Elevation 453.7 feet.

This adit was driven 140 feet NE probably to test the extension of tin values found in C Adit and Nos. 1 and 2 South Low Level Adits. The beds at the entrance are very flatly dipping, 10° to the SE, and are interbedded mudstone and sandstone. A steeply dipping fault crosses the adit at 23 feet but does not appear to affect the bedding which continues dipping flatly to the SE. The rocks are mainly sandstone with massive quartzite from 82 feet to the end. Very low tin values are shown on the assay plan.

D Adit. Elevation 555.2 feet.

This adit on the Northern slope of the hill was driven 50 feet in mudstone with some sandstone bands. The rocks dip steeply SW but no significant mineralization was encountered.

F Adit. Elevation 600.0 feet.

This is a short adit driven to test for a continuation of values between surface trenching. The rocks are sandstone and mudstone with quartzite at the end. The dip is steeply SW. Sample values are high and there is a marked differance between this adit and No. 1 South Low Level Adit 147 feet below.

A Adit. Elevation 586.6 feet.

This adit was driven 230 feet in a NE direction from the SW side of the hill. The beds are mainly quartzite and mudstone and are dipping steeply SW over most of the adit. At 20 feet from the end the beds change to dip steeply NE and a small anticline is probably passed through. Only low tin values are recorded.

B Adit. Elevation 610.0 feet.

This adit was driven 190 feet in a NE direction from the SW slope of the hill. At the entrance is a zone of interbedded mudstone, sandstone and quartzite. The beds dip steeply SW and become nearly vertical towards the end of the adit. At 144 to 156 feet two fractures cross the adit and between these some folding is seen. A highly iron stained bed occurs for the last 8 feet of the adit.

Magazine Adit. 365 feet

This adit was apparently driven to prospect

for copper and is south of the main hill. The rock is pink mudstone with some massive quartzite towards the end of the adit. An iron stained brecciated fault zone crosses the adit dipping flatly north and brings mudstone against quartzite. No tin values are recorded from here.

Brocks Adit. Elevation 430 feet

This adit is situated approximately 1,500 feet NE of the North Adit and has been driven in a southerly direction to intersect at depth values found in Brocks shaft on the crest of the ridge. The adit is 420 feet long and has been driven through mudstone, sandstone, quartzite and shale.

At the month of the adit the dip is steeply NE. Several strong fractures are seen and a strong fracture dipping SW at 140 feet in the adit has an inch of gouge material in it and is a probable fault line. Beyond this the mudstone and sandstone appear shattered and dip less steeply (45°-50°) to the SW. The mudstone and sandstone with a few quartzite beds continue to 245 feet where a probable fault has moved mudstone against quartzite. Beyond this the quartzite is iron stained and there is a dark grey bed of sheared and silicified mudstone showing marked copper staining. At 280 feet there is a reversal of dip to steeply SW and this dip direction continues to the end of the adit.

At 330 feet a small crosscut has been put in to the east on several strong fractures in a zone of shattered ferruginous quartzite and at 345 feet the same fractures have been driven along for 40 feet in a SW direction. These fractures were further explored by a shallow winze and several cross fractures also driven along. A little stoping was done above the back of the adit and crosscut mainly on an upward continuation of the fractures. However, sample values across the fractures were low and values vary considerably along the fractures. At 380 feet there are more small crosscuts on the boundary of ferruginous quartzite and pink and grey sheared copper stained mudstone. At 400 feet the sheared mudstone ends and relatively undisturbed well jointed shale continues to the end of the adit.

Sampling of the adit shows very erratic values. Two samples showing a moderate tin content, one in sandstone at 50 to 75 feet in and the other in iron stained quartzite from 350 to 360 feet. Sampling of the fractures in the crosscut to the SW gave only low values. To give a better indication of the values present sampling at shorter intervals is needed, especially in the areas

showing the higher values, or bulk sampling of these areas undertaken to give an estimate of the mineable grade.

Shafts.

Six shafts were sunk by the Great Pyramid Company near the summit of the hill. The only sampling information is from a very early plan done by the company. Samples were taken at 10 foot intervals or at a change of rock type. Some moderately high values were recorded from shafts Nos. 1 and 3 in quartzite, No. 4 shaft is not shown on the plan and there is no assay information available although it is probable than the shaft had already been sunk when the plan was prepared. No. 1 shaft has been deepened to 70 feet and No. 6 shaft and possibly others also deepened. All the shafts are accessible and could be mapped and resampled if necessary.

Brocks Shaft.

This shaft on the ridge NW of the Pyramid Hill was sunk on values found in surface trenching. It is approximately 30 feet deep and at this level a tunnel was driven easterly for 30 feet. Several strong fractures can be seen in this tunnel and an assay of material from the fractured zone gave 0.35 % Tin.

Conclusions

Tin mineralization occurs irregularly over the leases; it appears to be controlled by a combination of fracturing and bedding. The strong fractures providing access for the mineralization which was deposited mainly in the brittle quartzite beds that were well fractured by the contemporaneous folding and faulting.

The best tin mineralization appears to be confined to the areas around the North Adit, C Adit and Brocks Adit. Further underground development of these areas may prove useful blocks of ore and also give more information on the structure of the deposits.

8th March, 1963

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GEOLOGIST

62-481 Pyramid Mine, Upper Scamander

The specimen is a strongly sheared, fine grained, grey rock, weathered to a yellow-brown on affected surfaces. There is a fracture cleavage at a high angle to the schistosity and a coarse rock cleavage at high angle to both the schistosity and fracture cleavage.

In thin section the schistose structure is well marked, the fine grained sericite of matrix being oriented so as to give aggregate extinction, and opaque white, fine grained clay minerals are also oriented. Irregular, sub-angular quartz grains up to .25 mm. across are common, and the sericitic laminae curve round these grains, showing that they are original and not porphyroblasts.

The rock is a schistose mudstone.

62-483 Pyramid Mine, Upper Scamander

The specimen is a pale grey siliceous rock with a little limonitic staining.

In thin section it is a mass of angular quartz grains, the interstices being filled with later formed quartz. The grain size varies from 2 mm. down to very small fragments, all being cemented together in a compact mass. There is also structureless and sub-radiating sericite in places and occasionally minute grains of cassiterite.

The rock is a quartzite.

62-491 Surface working near No. 1 shaft, Pyramid Mine, Scamander.

The rock is a siliceous breccia consisting of angular pieces of quartzite up to 1" long, the interstices being filled with dark crystalline cassiterite with which is associated a little limonite.

In thin section the breccia fragments consist of very fine grained quartzite composed of angular quartz grains in a siliceous and sericitic matrix. Grains of brownish zoned cassiterite vary from 1mm. to .2 mm.

62-492 No. 1. S.L.L. adit, Pyramid Mine, Scamander

In handspecimen the rock is pale grey, medium to fine grained, and predominantly siliceous. There is some limonitic staining.

In thin section the specimen consists of sub-angular grains .5-1 mm. across, mainly of quartz, in a very fine grained matrix of silica and clay minerals. There are also grains merging into the matrix and of

the same composition, which may represent in part original felspar. There is also some brown opaque oxide of iron in minute grains and clumps of grains.

The rock is a quartzite of sedimentary origin.

62-493 Brock's adit, Pyramid Mine, Scamander

The handspecimen is a fine grained dark yellowish green rock with fine white veinlets of quartz and patches of limonitic staining.

In thin section the rock consists of sub-angular quartz grains from 1 mm. in length down to very small sizes merging into a siliceous matrix. The grains show signs of orientation and exhibit cleavage cracks and undulose extinction. There is also some very fine grained interstitial epidote associated with limonitic stains and a little haematite, and occasional minute zircons.

The rock is a quartzite.