

Date	14th December, 1979	Ref	1-13-1 2-4-1 3.4.1.
To	<u>P. McGushin</u> , P. Reynolds, A. Titley	From	I. Keyes
At	<u>W. Palmer</u> , I. Pond, M. Houston	At	Rossarden
Copies to		Keep	

Subject LUTWYCHE ORE POTENTIAL

Attached is the typed copy of the Lutwyche ore reserve sheet and notes. The potential ore figures are final. Drilling is underway to verify the unexplored potential of Kookaburra and S.E. Lutwyche. If there is anything which you regard should be deleted from the notes or additional information added please let me know.

Ian W. Keyes

Ian W. Keyes
Production Geologist

ORE RESERVES

<u>Category</u>	<u>Location</u>	<u>Tonnes</u>	<u>C.M.%</u>
Indicated	13L Lutwyche		
Inferred	13L Lutwyche		

All tonnages are calculated using a density of 2.56 tonnes/m³ for both quartz veins and waste dilution.

The grade quoted is an indication only as it can not be accurately measured. It is assessed semi-quantitatively by visual grade estimation.

Potential Ore 13 Level (285 m R.L.) to 6 Level (540.5 m R.L.)

(a) Lutwyche 13 level to 6 level.

<u>Vein</u>	<u>Strike length (m)</u>	<u>Dip Extent (m)</u>	<u>Mining Width (m)</u>	<u>Tonnes</u>
Battery	150	255	1.22	120,000
Footwall	100	350	1.22	110,000
Hangingwall	150	350	1.22	164,000
Pay	60	270	1.22	<u>50,000</u>
				444,000

(b) Lutwyche unexplored potential - along strike 13 level to 6 level.

	200	350	1.22	219,000
--	-----	-----	------	---------

(c) Kookaburra unexplored potential 13 level to 6 level.

	100	350	1.22	<u>110,000</u>
--	-----	-----	------	----------------

Total: 773,000

Potential Ore below 13 level (285 m R.L.) to (185 m R.L.)

(a) Lutwyche

<u>Vein</u>	<u>Strike length (m)</u>	<u>Dip Extent (m)</u>	<u>Mining Width (m)</u>	<u>Tonnes</u>
Battery	150	100	1.22	47,000
Footwall	100	140	1.22	44,000
Hangingwall	150	140	1.22	65,000
Pay	60	110	1.22	<u>20,000</u>
				176,000

(b) Lutwyche unexplored potential 13 level to R.L. 185 m

	200	140	1.22	87,000
--	-----	-----	------	--------

(c) Kookaburra unexplored potential 13 level to 185 m R.L.

	100	140	1.22	<u>44,000</u>
--	-----	-----	------	---------------

Total: 307,000

ORE RESERVES

Ore reserve definition at the Aberfoyle Mines has two particular problems directly related to the ore type. They are the impossibility of defining ore by drilling and the difficulty of determining grade within the limits acceptable for the "measured" or "proven" ore category.

These problems are caused by the "nugget" effect, an irregular and unpredictable distribution of ore minerals within the quartz veins. Therefore exploration to demonstrate ore reserves must include both drilling and development - drilling to locate veins or vein extensions, and development to determine if the vein or portions of the vein have sufficient metal content to be economically mineable.

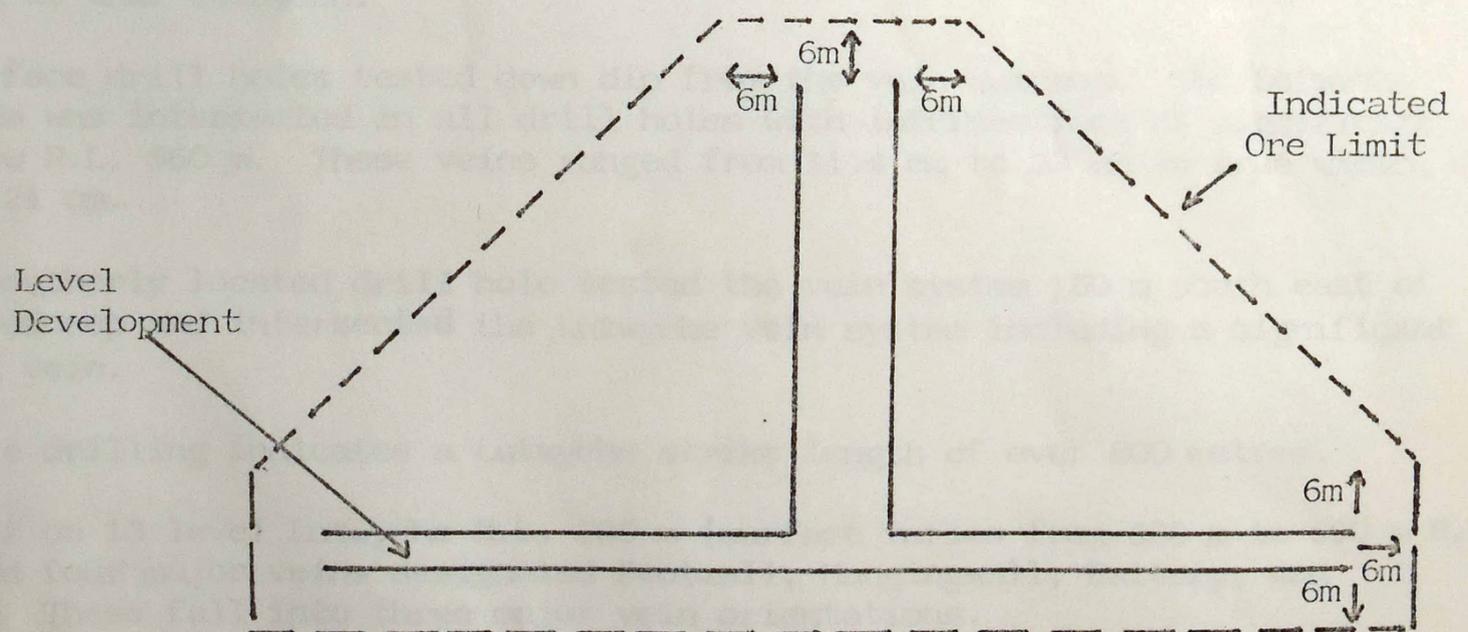
This unfortunately restricts ore reserves to be determined in the "indicated" or "inferred" categories only - within close proximity to existing development and never demonstrates the total potential ore within a vein system.

For the Aberfoyle Mines the measured, indicated, and inferred categories are defined as follows:

MEASURED RESERVES - Those whose tonnage and grade can be estimated with a high level of confidence.

Variability of grade and vein widths precludes this level of confidence, and hence no reserves are reported to this classification.

INDICATED RESERVES - Those defined at least in part by development in quartz veining. Quartz tonnages are calculated from observed vein widths and distances along strike and dip exposed by level and rise development. Indicated ore extends to 6 metres beyond such development for blocks developed on one side only (except that no strike or dip extensions are made to blind level or rise development respectively), and as shown in the diagram for blocks developed on two or more sides.



Where circumstances indicate an appropriate level of confidence, data from diamond drill holes, adjacent stoping, cross cutting etc., may be used to extend Indicated ore limits, but only in conjunction with development on at least one side of the block.

INFERRED RESERVES - Those which extend 6 metres beyond Indicated Ore limits unless development information suggests otherwise. Where extensive development and/or diamond drilling information is available, Inferred ore may be judged to extend beyond the 6 metre limit.

From the above, it can be seen that to realize a figure of potential ore for the Lutwyche and Kookaburra vein systems, on which to base a mining feasibility study, the existing knowledge gained from surface geological mapping; the along strike continuation and thickness of veins as shown by surface diamond drilling; and the economic potential of these veins as verified by development on 13 level, must all be taken into consideration, along with knowledge and experience gained from mining the genetically related and similar Aberfoyle and Storeys Creek vein systems.

The figure obtained would fall into the category of "potential ore" equivalent to "possible ore" (NOT RESERVES) defined by the Australian Institute of Mining and Metallurgy as "that for which the relations of the land to adjacent ore bodies and the geological structures warrant some presumptions that ore will be found, but where inadequate exploration and development data precludes its being classed as probable (indicated)." The "potential ore" category should never be included as reserves.

Outlined below is the current geological knowledge on which the calculations of "potential ore" for Lutwyche and Kookaburra vein systems have been based.

LUTWYCHE

The Lutwyche vein outcrop is intense over a lateral interval of 30 to 40 metres and a mapped strike length of 300 metres, apparently terminating at the NE-SW trending Battery Vein outcrop. As many as fourteen separate parallel veins, up to 15 cm wide, and commonly containing cassiterite and wolframite, have been identified striking NW-SE and dipping 50° to 60° south west.

Quartz vein outcrop is lacking north west of Battery Vein, however, surface drilling has intersected significant vein widths up to 350 metres further north west of Battery Vein. The most northerly located drill hole S36 intersected generally narrow, sparsely mineralized quartz veining, reflecting a gradual deterioration of veining at that location.

Eleven surface drill holes tested down dip from the vein outcrop. The Lutwyche vein system was intersected in all drill holes with intersections of significant veins below R.L. 560 m. These veins ranged from 11.4 cm to 33 cm in true width, averaging 21 cm.

The most southerly located drill hole tested the vein system 150 m south east of the vein outcrop and intersected the Lutwyche vein system including a significant 27 cm wide vein.

The surface drilling indicates a Lutwyche strike length of over 800 metres.

Development on 13 level Lutwyche R.L. 285 m (surface varies from 620 m to 690 m R.L.) has exposed four major veins designated Footwall, Hangingwall, Battery, and Pay Veins. These fall into three major vein orientations.

1. NW-SE, dipping 45° - 50° SW parallel to Lutwyche and Kookaburra systems (Footwall and Hangingwall).
2. NE-SW, dipping 80° SE to vertical - Battery Vein direction.
3. N-S, dipping 70° - 80° W - Pay Vein approx. parallel to Johnson Vein direction.

Development has so far defined Hangingwall Vein over a total length of 200 metres, of which 150 metres exposed potentially economic vein; Footwall Vein over 100 metres up to being displaced by a major N-S fault; Battery Vein over 150 metres in length and 35 metres up dip; and Pay Vein over a 60 metre length. Surface diamond drilling intersected mineralized veins in the Lutwyche vein system over a strike length of at least 800 metres close to the surface, and development on 13 level has tested only 300 metres of this strike length.

Three drill holes below 13 level indicate continuity of potentially mineable quartz veins down to at least R.L. 200 m. The aplite cupola or granite roof zone which at Aberfoyle and Storeys Creek Mines is regarded as the source of the mineralized veins and the lower extent of the vein systems has not yet been defined for the Lutwyche system.

From the above it can be inferred that as much as 500 metres of potentially mineable veins are yet to be explored in detail at or below R.L. 540 m and that a further but unknown down dip extent can be expected below R.L. 200 m.

LUTWYCHE ORE RESERVES

The total ore potential for the Lutwyche vein system may be estimated as follows; assuming that the veins become too narrow to be economic above 540 m R.L. (6 level) and taking a conservative lower extent of 100 m below 13 level.

$$SG = 2.56 \text{ tonnes/m}^3$$

<u>Category</u>	<u>Location</u>	<u>Tonnes</u>	<u>C.M.%</u>
Indicated	13L Lutwyche		
Inferred	13L Lutwyche		

All tonnages are calculated using a density of 2.56 tonnes/m³ for both quartz veins and waste dilution.

The grade quoted is an indication only as it can not be accurately measured. It is assessed semi-quantitatively by visual grade estimation.

Potential Ore 13 Level (285 m R.L.) to 6 Level (540.5 m R.L.)

(a) Lutwyche 13 level to 6 level.

<u>Vein</u>	<u>Strike length (m)</u>	<u>Dip Extent (m)</u>	<u>Mining Width (m)</u>	<u>Tonnes</u>
Battery	150	255	1.22	120,000
Footwall	100	350	1.22	110,000
Hangingwall	150	350	1.22	164,000
Pay	60	270	1.22	<u>50,000</u>
				444,000

(b) Lutwyche unexplored potential - along strike 13 level to 6 level.

	200	350	1.22	<u>219,000</u>
			Total:	<u>663,000</u>

ORE GRADE

The "nugget" like distribution of minerals prevents grade estimates for the mineralized veins from ever being accurately determined by diamond drilling or by development sampling and assaying.

All grades are derived from visual estimates along all development openings, of the proportion of mineralization in the quartz. These estimates are reconciled with actual production grades achieved and after the appropriate factoring, applied to the ore reserve.

Visual grade estimates for the major veins occurring on 13 level are tabled below. They have been applied to a 1.22 m mining width. Visual grades from early development on Hangingwall Vein are not available.

<u>Vein</u>	<u>No. of grade estimates</u>	<u>Grade C.M.%</u>
Battery	181	1.02
Footwall	165	1.13
Hangingwall	23	1.23
Pay	32	0.66

In view of the ore grade being critical in determining the economic viability of the orebody, a bulk sample of ore was mined and milled from Footwall and Battery Veins on 13 level. This resulted in an in-situ grade of 0.91% combined metal for the 985 tonnes milled, with individual metal grades of 0.47% Sn and 0.44% WO_3 . Recovery in the mill was good with recovery figures of 83.4% Sn and 77.3% WO_3 .

Past production at Aberfoyle and Storeys Creek has resulted in an overall grade of approximately 1% combined metal.

It is important to note that the above grades for individual veins are representative for those veins on 13 level and indicate that it is not unreasonable to expect an overall Lutwyche and Kookaburra grade of 0.91% combined metal. However, individual grades should not be taken as being representative of those veins for their full strike or up dip extent.

The proportion of cassiterite to wolframite is unknown over the vertical extent of the Lutwyche veins. The bulk sample indicates a ratio of approximately 1:1 exists on 13 level. The Aberfoyle veins show a consistent decrease in Sn: WO_3 ratio with depth from 11:1 on levels 1 and 2, through approximately 5:1 between levels 2 to 8, and 1.75:1 between levels 5 and 9.

This vertical zoning of cassiterite and wolframite has been demonstrated in mines from a number of tin fields.

Therefore it is likely that the Sn: WO_3 ratio for Lutwyche will similarly increase upwards with a possible ratio of approximately 5:1 (Sn: WO_3) on 6 level.