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R E P O R T

ON

THE

SWANSEA MINE

ZEEHAN

93 - 3494.

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Report written for: Minstock

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ABSTRACT

Previous reports on the Swansea mine are listed and included in this report. The work carried out from January - October 1981 is also reported on. The country rock has been faulted and sheared and feldspar porphyry dykes have been emplaced, later mineralizing fluids, reacted with the porphyry dykes, which changed their PH, causing replacement lode deposits. The economic possibilities of the mine are examined and recommendations to further study made.

INTRODUCTION

The Swansea mine area has had the most vigorous examination carried out upon it throughout 1981. Amoco has completed a gravity and geochemical survey, a review of which was completed by B.H.P. and I have completed mapping, and structural interpretation for the area. Excavation work was carried out in early October, 1981 and from this emerged both new lodes and more prospective ground. This report will detail all information available on the mine, together with results of recent tests carried out upon the feldspar porphyry rock which seems to be significant to the mineralization in the area. This rock is called feldspar porphyry on the grounds of high potash and soda as well as remnant grain textures observed in thin section. There is so much alteration to the porphyry however, with the later hydrothermal fluids causing breccia dykes and the high potassium content of the porphyry rock causing pervasive sericitization, that the true nature of the original intrusion is not really certain. In this report, however, the primary intrusion will be referred to as the feldspar porphyry dyke which has secondarily been irregularly mineralized.

PREVIOUS REPORTS

A. McIntosh Reid, a Government Geologist, produced two reports on the mine, one in 1922 (Report 1) and another, four years before operations closed at the mine, in 1925 (Report 2). Both of these reports have plans of the mine workings, the most relevant being the 1925 report which records the position of the mineralization and the tunnels. A review of this information along with recommendations as to future operations, was compiled by P.B. Nye, in 1929 (Report 3). Nye was the last geologist to see the workings as the mine closed after 1929, owing to a lack of milling facilities and low metal prices, allowing the shaft to fill with water. Two later references to the mine are Blissett 1962 (Report 4) and K. Williams et al 1971 (Report 5). Blissett compiles the history of the mine up to 1961, which includes references to all known previous reports plus a production table giving a total of 3,440 tons of ore produced, yielding 1,319 tons of lead, 35,630 ounces of silver, 570 tons of zinc and 40 tons of cadmium. K. Williams et al 1971 on studying the mineralogy of the Zeehan mines covered the Swansea area, they identified four principal sulphides, sphalerite, galena, bournonite and siderite associated with minor pyrite and quartz. Their work with electron microprobe and atomic absorption analysis produced a problem in accounting for the 40 tons of cadmium obtained from the Swansea area, however, this shall be

ACTIVITIES - JANUARY - OCTOBER, 1981

The Minstock group of companies, which includes the Swansea Mining Co. Pty. Ltd., have, along with Amoco, completed a thorough surface and sub-surface examination of the lease area. Amoco constructed a fifty metre grid covering 800 metres x 800 metres which completely envelopes the Swansea lease. The grid was levelled for gravity work which was then carried out by solo-geophysics on Amoco's behalf (fig. 5). Sub-soil sampling down to bedrock was also carried out by means of an auger mounted on a bombardier. The assays for that work were plotted on figures '1,2,3 and 4.' Mapping of the grid was completed by myself in June, 1981 and on examination of all the information, excavation work was carried out in early October by a J.C.B. 808, capable of digging a trench two metres wide and seven metres deep. The results of that excavation work and subsequent changes to the map drawn on June, 1981 are included.

OBSERVATIONS AND RESULTS

Geology - General:

The Swansea mine was sunk on the hanging wall of a porphyry dyke which cuts the dip and strike of the country rock. The country rock, volcanic ash (which is kind to galena and tetrahedrite) and shale (which is kind to siderite and sphalerite) form the lode channel which is ten metres wide. The porphyry rock cuts that channel obliquely, forming lodes approximately thirty metres in length, three such lodes were mined previously, the lodes tending to be bigger in the volcanic ash than in the shale (Reid 1925).

The feldspar porphyry dyke, as reported in the old mine has been traced 200 metres north of the main shaft. At that point it is apparently faulted off, at the fault contact it is seven metres wide and dipping at 45° , therefore, causing a curved outline, because of the topography. It's footwall lode of coarse, grained spalerite and galena is up to three metres wide, and what I believe to be a greenockite and bournonite lode is .5 metre wide. This dyke rock has been followed back one hundred metres to the No. 1 prospect shaft at which point it is two metres wide, containing small Pb, Zn mineralization, however, with good greenockite. The dyke rock has not been traced back to the main shaft (100 metres south-east) on the surface, however, ground water evidence confirms that it is a connected and therefore, continuous lode channel. This confirms that the lode channel is four hundred metres long, with lode material consistently along the foot or hanging walls. This is encouraging as the porphyry dyke in the mine increased in width at depth along with the degree of mineralization and inclination of the dyke.

All lodes found are related therefore, by geochemical preparation or direct replacement by mineralization fluids, to the porphyry dyke rock. The lodes, increasing with the width of the dyke, may be a product of the degree of wall rock alteration and deformation associated with the pre-dyke faulting or the

ke entered along shears and faults, and this is evidenced by the minor displacements within the volcanic ashes bedding, and slicken-sides within the shale and slates and obvious displacements caused by faults. Surrounding and invading porphyry, therefore, are extensive areas of "Breccia dykes" which indicate large amounts of fluid coming up through the porphyrys "channel", leaving flow textures within the broken country rock. Thin sections of the porphyry dyke itself showed it to be an originally coarse grained feldspathic rock which has undergone sericitization and replacement by Pb, Zn, Fe, Qtz, etc. From table 1 below, it can be seen that this is a mesothermal deposit, that is, the ores were deposited at about 200 - 300^o C (Lindgren's classification) at moderate temperatures and pressures.

TABLE 17-A Principal minerals in ore deposits formed in different temperature zones*

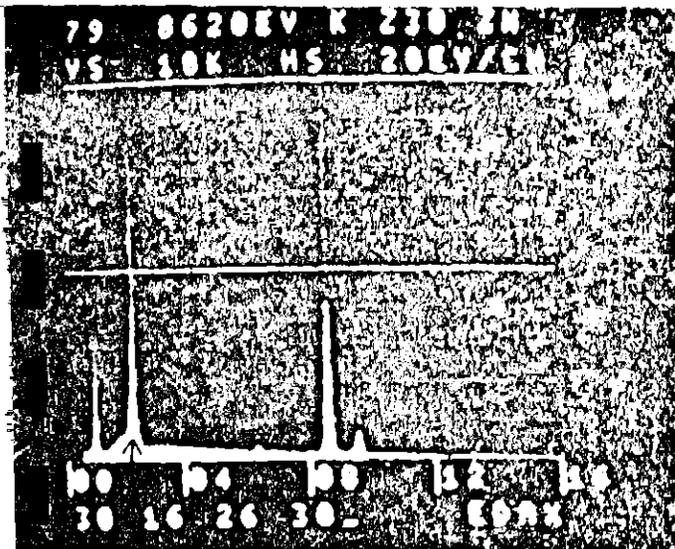
Temperature and depth decreasing		
Hypothermal	Mesothermal	Epithermal
	<i>Ore minerals</i>	
Wolframite, (Fe, Mn)WO ₄	Chalcopyrite, CuFeS ₂	Argentite, Ag ₂ S
Cassiterite, SnO ₂	Bornite, Cu ₅ FeS ₄	Silver, Ag
(Kamoharui, Fe ₂ O ₃)	Tetrahedrite, Cu ₁₂ Sb ₄ S ₁₃	Proustite, Ag ₂ As ₂
Magnetite, Fe ₃ O ₄	Enargite, Cu ₃ As ₂	Pyrrhotite, Ag ₅ SbS ₃
Arsenopyrite, FeAsS	Pyrite, FeS ₂	Pyrite, FeS ₂
Chalcopyrite, CuFeS ₂	Galena, PbS	Marcasite, FeS ₂
Gold, Au	Sphalerite, ZnS	Gold, Au
Molybdenite, MoS ₂	Gold, Au	Cinnabar, HgS
Pyrrhotite, Fe ₇ S ₈	Arsenopyrite, FeAsS	Stibnite, Sb ₂ S ₃
(Bismuth, Bi)	(Argentite, Ag ₂ S)	(Galena, PbS)
(Galena, PbS)		(Sphalerite, ZnS)
(Sphalerite, ZnS)		(Chalcopyrite, CuFeS ₂)
	<i>Gangue minerals</i>	
Quartz	Quartz	Quartz
Tourmaline	Carbonates	Albite
Garnet	Barite	Chalcedony
Topaz		Opal
Micas		Fluorite
Apatite		Nancite
		Galena

* Parentheses indicate minerals found locally or in small amounts.

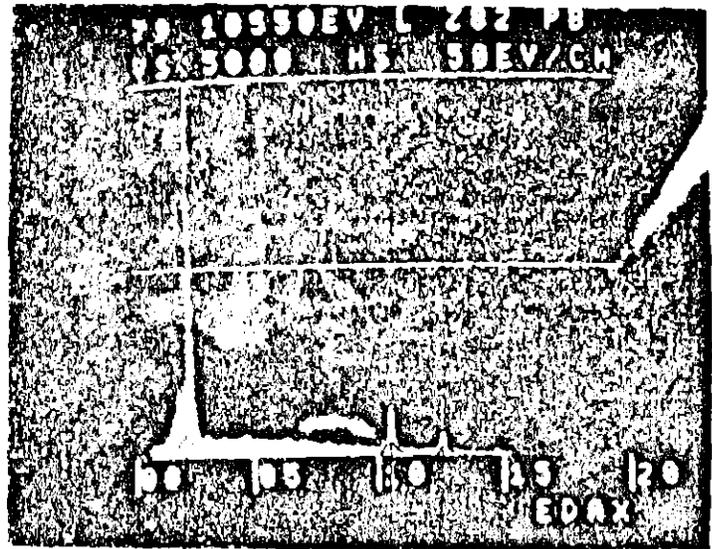
Similar deposits are noted by Charles Park in the Second Edition of ORE DEPOSITS (pp 318 - 343). Therefore, the dyke was emplaced in one set of faulting then later faulting brought mineralizing fluids (probably acidic) into the "lode channel" and the porphyry rock (high potassium and basic) reacted to the fluids producing replacement lode deposits and pervasive sericitization. The prospect of large lodes is therefore, excellent, both along strike and at depth. The fact that the lead mineralization as worked on the hanging wall of the 110 foot level (Leid 1925), occurs 125 metres north-west of the main shaft, as a one metre hanging wall lode on a .3 metre dyke, gives encouragement that the lodes may be mined.

The old mine only covered forty metres of the four hundred metre lode channel, that

over 100 tons of 60% metal every metre strike length, implying great potential for the ground in between mainshaft and No. 4 prospect shaft. The discovery of two new porphyry dykes with later brecciation and sericitization one 100 metres east of the known main shaft dyke, and another two hundred metres east, is very significant as the latter is sixty metres wide and of unknown strike length. Indications are that hydrothermal solutions reached both dykes, however, the degree of mineralization is not yet known. Assays have been taken and will be reported on later, however, the existence of two new "lode channels" presents the possibility of new replacement lode deposits. An electron microprobe of the zinc and lead found on the Swansea is given in figure 7, below. It shows the purity of the Swansea shalerite and galena,



Zn



Mu Pb line

L α βγ Pb line

both quite free of heavy contamination from other elements. Other less specific testing (i.e. XRF) at 1450N, 1350E, the top of a fault zone associated with the porphyry dyke showed the contaminating elements to occur within different minerals within the Swansea ore. A thin section taken showed that it was a tetrahedrite, galena quartz filling within a breccia zone consisting of tuffs and slates. The galena and tetrahedrite seem secondary with the primary quartz filling forming crystals growing out from the breccia (1 - 4 cm particles) and stringers of quartz occasionally cutting the breccia, the latter mineralization does not seem to cut the breccia. Anomalous Selenium 2.5 gms, antimony .1% and 20gms of tin occurred in XRF assays confirming the electron microprobe results.

Cadmium which occurred as 5% of the Swansea ore may be however, the best potential mineral on the lease. The evidence for the existence of a cadmium sulphide is gained from Blissett 1962 (pp 210) where 40 tons or 5% of the zinc ore was cadmium. This is in contrast with Williams et al (pp41) where they analysed only .37% cadmium, which itself conflicted with Reid's 1925 report of 2% cadmium. Williams et al concluded that some Swansea sphalerite did in fact,

carry 5% cadmium however, they did not sample a piece that did. I postulate, after studying the sulfide forms of cadmium, that Greenockite (CdS) or Bournonite $CdPbCuSbS$ were likely solutions to the problem. I studied the tip head of the mine and discovered a greasy green mineral identical in character to serpentine occurred preferentially with the sphalerite as did Bournonite. Reid - 1925, may have assayed some sphalerite, containing some greenockite or Bournonite obtaining a value of 2% cadmium. The later, more specific tests by Williams et al - 1971, and myself on the sphalerite showed the true cadmium content of approximately .37%. This would explain why 5% cadmium was obtained from the Swansea ore, however, results from tests will have to return to verify this.

DISCUSSION OF AMOCO'S RESULTS

The biggest anomaly in the gravity work was the fact that the old mine did not show up. The gravity survey (fig. 5) (see Appendix 5) however, did show two possible large lodes, one at 1350E 1000N and another at 1475E 1650N. The former was found to be traced on an old map (fig. 6) (see Appendix 6) as McLeans lode and therefore, taken from it of quartzite returned an assay of .1% lead, .0375% zinc, 1 gram silver, 25 gram copper and 1.93% iron. This lode is therefore, very close to the surface and should be drilled as soon as possible, because it also trends north as a broad gravitational high, suggesting the lode extends back two hundred metres at depth. The latter (1475E 1650N) southern margin was probably mined by J.J. Hills waterwheel shaft, and should also be drilled.

A N.W - S.E regional gravitational gradient may be caused by the porphyry dyke rock which at depth, may be large and cause the decreased density to the north east, in which direction the dyke in the main workings was plunging. This porphyry may also be masking some large lodes as it is not very dense itself and a lode in it would not readily be detected nor for that matter would the porphyry dyke. The old records (fig. 6) (see Appendix 6) trace the old main lode over towards McLeans Creek, where there is extensive galena mineralization still evident in the workings (1600E 1000N).

The geochemical work of Amoco (figs. 1,2,3 and 4) (see Appendixes 1,2,3 and 4), must be interpreted in light of the relative widths and depths of the porphyry dyke and the restrictions of grid sampling. The results prove a North-South trend to the mineralization, more graphically shown by fig. 3, which seems to show the zinc being more pervasive and therefore, more indicative of the real situation on surface and at depth. It shows zinc highs around the original mine area, with highs showing other areas corresponding to known lode positions. These are as follows:

1. McLeans lode (1250E 1300N, 1250E 1200N)
2. J.J. Hill's workings (1375E 1500N)
3. Main lode (1450E 1200N)

and a possible new lode associated with a porphyry dyke at 1425E 1300N.

Differences between the regional trend of the gravity and the trend of the geochemical anomalies, is explained by the fact that a major porphyry dyke at depth may come from the rough direction of the main granitic mass (Mt. Agnew). However, the structural control of the bedding, which seems very strong (i.e. defines the "lode channel") directs the porphyry intrusions and later mineralizing hydrothermal solutions in a North-South line.

SUMMARY

In summary, the Swansea mine lease covers over one kilometre of proven lode channels, 90% of which are as yet unexplored. Drilling has never been done on the Swansea mine, however, on the strength of the information now together, both old and new it would be recommended that drill tests be undertaken, the results of which should be fruitful. The re-opening of the old workings would be recommended, as Reid's report indicated it finished on a solid ore channel and with modern equipment further driving on the lode would be possible. Further geochemical work will be done on the exact composition of the feldspar porphyry dyke by J.C. Vanmore and its regional implications must also be studied. The ramifications of the discovery of a cadmium bearing sulphide will also have to be thought of in economic terms.

RECOMMENDATIONS

1. Drill along strike of the porphyry dyke remembering that it starts off at a 45° inclination to the North-East, however increasing in inclination at depth.
2. Drill the two large gravity anomalies.
3. Open old main shaft and inspect it underground, guarding against rotten timber in the first ten metres and foul air pockets underground. Driving at the 150 foot level to find the two last lodes and driving North West at the 110 foot level to find new ones is strongly recommended.

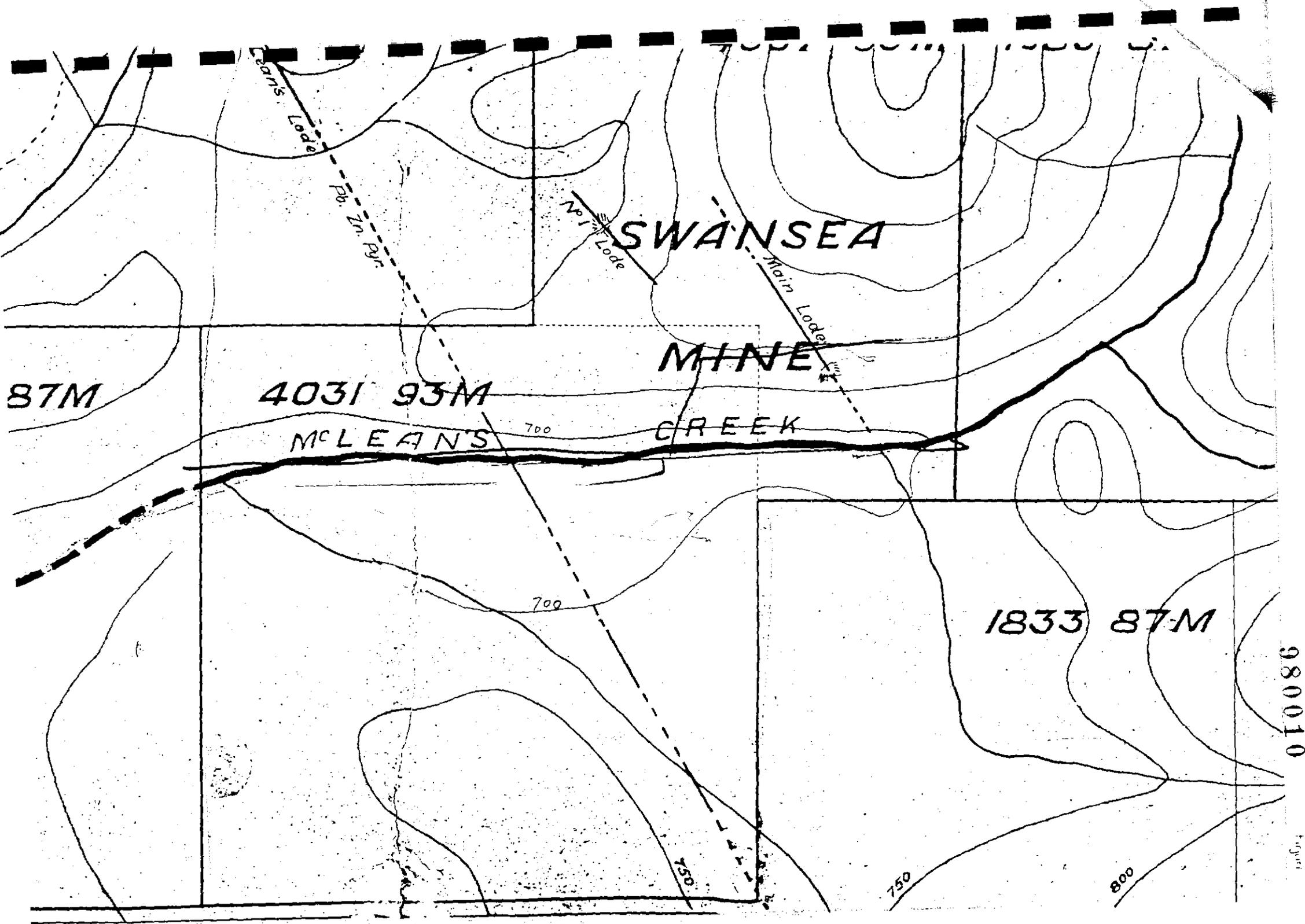
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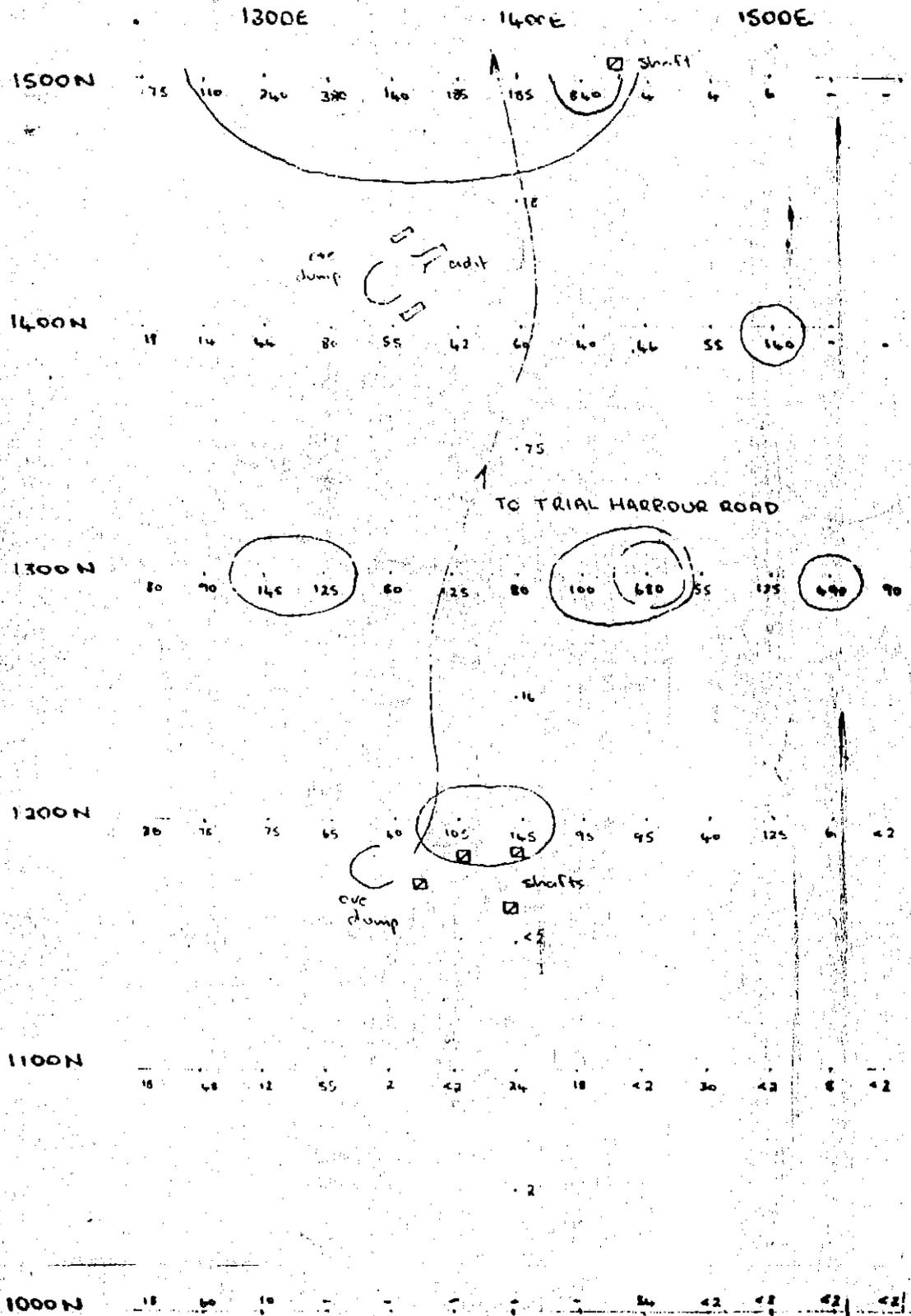
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Figure

Copper in Soil (ppm)
Swansea Mine

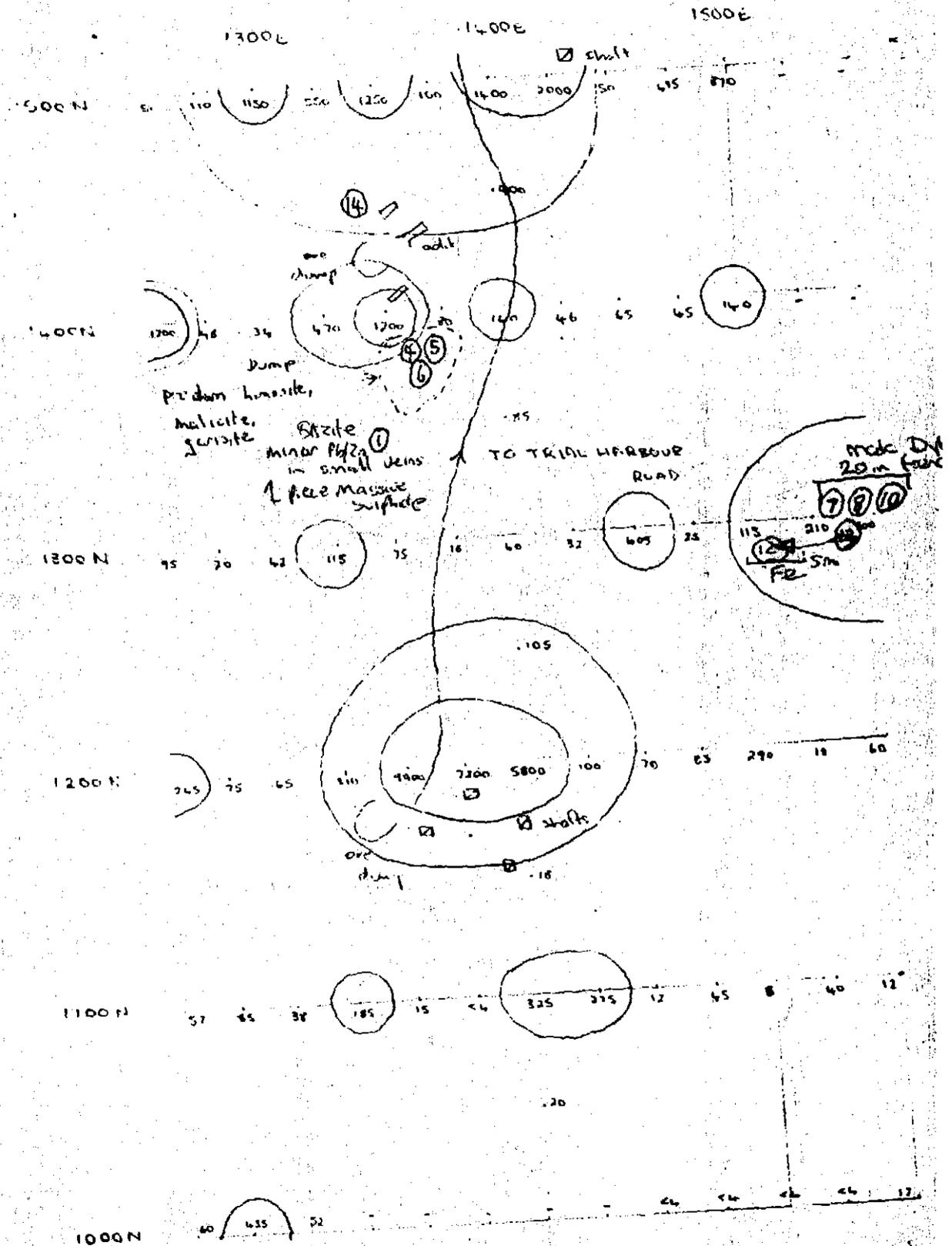
1:2500

- >500ppm Cu
- >100 ppm



Lead in Soil (ppm)
Swansea Mine
1.2500

- >1000 ppm Pb
- >100 ppm Pb



Zone from ⑭ - ① 1450 - 1350

Zinc in Soil (ppm)

Sampling Time

1/20/68

□ 2100-2500

□ 2500-3000

