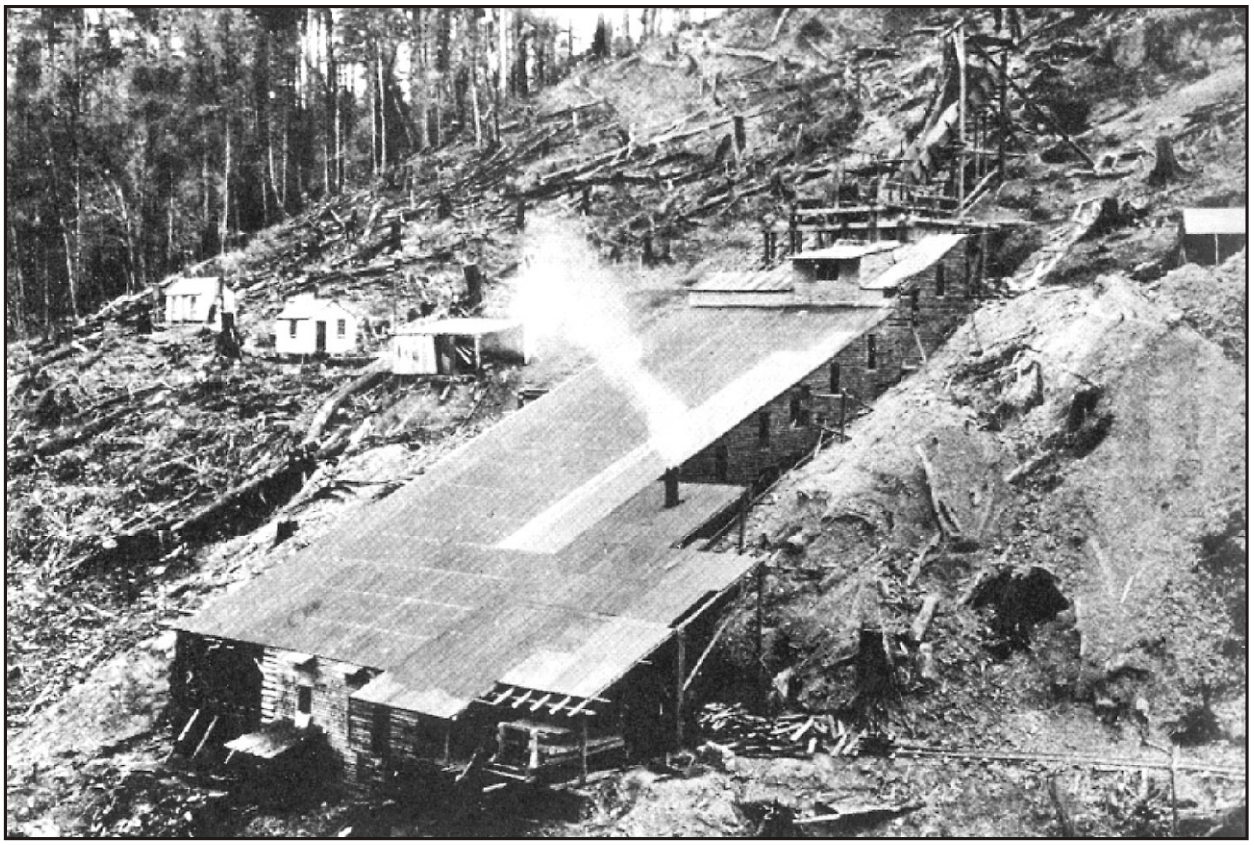
Tasmania

MINERAL RESOURCES TASMANIA

Archaeological Survey Report 2000/01

An archaeological survey of the historic Cleveland Mine concentrating mill

By Parry Kostoglou



A report to Mineral Resources Tasmania
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Tasmania
MINERAL RESOURCES TASMANIA
DEPARTMENT *of* INFRASTRUCTURE, ENERGY *and* RESOURCES

ARCHAEOLOGICAL SURVEY REPORT 2000/01

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Acknowledgements

The consultant wishes to gratefully acknowledge the assistance provided by Mr Robyn (Shorty) Halfacre of Mineral Resources Tasmania. In addition to his profound knowledge of west coast mining sites, Shorty proved a great companion in the field.

Introduction

Job brief

This archaeological inspection of the historic Cleveland mine mill was commissioned by Mineral Resources Tasmania as a result of a field inspection relating to the nearby Luina township. The verbal brief for this assignment called for a survey of the mill site and a report on its significance as an artefact of historic West Coast mining activities. This report goes beyond the brief in further describing related infrastructure such as the mine workings, water race and pipeline.

Methodology

Field work was undertaken over a half day period on 1 December 1999. A further half day was also spent at the MRT library and map rooms in order to compile background information on the history of this mine site. This report was subsequently authored over a two-day period.

Location of survey area

The historic mill site described in this report lies on the southern slope of Crescent Spur, which is situated one kilometre due south of the former Luina township. The site is accessed along the former Cleveland mine road, and is situated 50 m short of the main portal at the very end of the road. Plate 1 shows the location of the mill site.

Statement of significance

Although historically the Cleveland mine was not an exceptional operation on the west coast of Tasmania, the exceptional physical integrity of its resident concentrating mill raises the significance of this site quite considerably. The surviving *in situ* plant and equipment at this site appears to be regionally unique, as all other known tin mines in the northwest, such as the Zeehan group, have been extensively disturbed during subsequent salvage or mining efforts. Such a good state of preservation further allows the site to convey the manner in which ore was historically crushed and refined for shipment. As a result, the Cleveland mill site is deemed to be of High Local significance. This site is further deemed to have Regional Significance.

Recommendations

As a result of this survey, it is recommended that :

- ☐ The Cleveland mill site be protected from all future mining-related activities by Mineral Resources Tasmania.
- ☐ The mill site also be protected from any future logging-related activities undertaken by Forestry Tasmania, in the event that the surrounding land is once again used for wood production purposes.
- ☐ Consideration be given to nominating this site for the State Heritage Register.

In the event of further development related activity at the mine itself, it is further recommended that additional survey work be undertaken on the following features deemed to comprise parts of the Cleveland mine workings.

- ☐ The Cleveland mill water race;
- ☐ The Cleveland tramway;
- ☐ The numerous peripheral adit workings to the northeast of the main mine.

Plate 1. *Map showing location and extent of survey area.*

Historical overview

According to Reid (1923*a*), the Cleveland ore deposit was first discovered in 1898, and leased by a Mr. S. C. Coundon of Waratah. At first the resident gossan outcrops were assumed to be the cappings of silver lead lodes until government geologist Harcourt Smith made an inspection of the new mine in 1900 and noted the presence of tin oxide or cassiterite in the resident gossan. When this was further assayed and found to be payable, a company titled the Cleveland Tin Mining Company No Liability was expressly formed to work the lease as a tin mine by 1907.

In his report for that year, the Secretary for Mines reported that: *"The Cleveland Company is busy constructing a tramline into the mine. When completed, the battery will be placed in position. The mine is being well opened up, and the manager is confidently looking forward to good results when crushing commences"*. The following year, the same source noted that: *"The Mt. Cleveland Company has erected a 10-head battery and concentrating plant, capable of treating 1000 tons of ore per month. The battery was started in September, and during the last quarter of the year 22 tons of tin ore were obtained"*.

By 1911 the Cleveland mine was being operated as an open-cut operation providing ore assaying at slightly over one per cent tin oxide. The increasing tonnages of ore required to make the mine profitable were already putting a strain on the mill plant. By 1913, this problem had become all to apparent, and the mine's management condemned the mill publicly. At the same time, regional water shortages during the summer months compelled the mine owners to install steam-powered power plant for the battery/mill, which had been previously powered by pelton wheels.

In 1914 the Cleveland mine was let on tribute, but even these more marginal operators could not make a success of the mine. Most critics chose to blame the existing mill plant for the tributers woes, including the visiting Mines Inspector who penned the first of several annual diatribes condemning the mill to his masters in Hobart. In 1916 for example, he bemoaned that *"the lack of finance to equip it with a suitable crushing plant is the trouble"*.

The following year saw the failure and closure of the Cleveland mine, which came as no surprise to most government sources who steadfastly blamed the poor milling facility as the root of all the mine's problems. During its nine or so years of life to date, the Cleveland mine had produced 344 tons of concentrated tin oxide, but despite its proven ore body, no new lessee could be found to re-start the mine and its mill plant.

By 1923 the relevant mineral leases to the former Cleveland mine had been acquired by Messrs J. Luck and C. Thompson of Devonport. A systematic inspection of the mine property by Government Geologist A. M. Reid that same year found the mine plant in terrible condition. Certainly of the mill itself, he was moved to write: *"Very little of the existing plant is of any use now, the ironwork having been seriously damaged by fumes from the calcining plant"* (Reid, 1923*a*).

Reid also now blamed the mine's demise on the mill plant, although he at least acknowledged international commodity pricing and over-investment by the parent company as equal culprits:

> "Although the collapse of the tin market directly brought about the cessation of operations, the erratic nature of the ore-bodies and the inefficient methods employed in the transport and treatment of the ore contributed largely to the failure of the company…The initial expenses of the undertaking were so great that the company was taxed to the limit of its resources before the enterprise had been fairly launched. Under the circumstances it is not surprising to learn that the enterprise failed".

In 1935 the Mount Bischoff Tin Mining Company acquired the leasehold rights to the former Cleveland mine and then spent 5000 pounds on new works which included driving three new adits and several surface trenches. When after two years, these works failed to excite further investment, various Mines Department staff became increasingly critical of the nature of the mining itself. Q. J. Henderson for one wrote that: *"The future of the property depends more upon the results of future development than on the perfection of an effective and inexpensive method of treatment"*. Another source, writing at the behest of the Mount Bischoff Company, was even more blunt.

> "There is no reason why the exploitation of the Cleveland mine, under expert control, should not prove a profitable undertaking. The writer has some diffidence in critically referring to the methods of mining employed by the successive engineers in charge of these works realising fully the great difficulties contended with and overcome during the early history of the mine. Now, the mine is easily accessible and the errors of the past can be obviated in the future. The design of the works is bad and shows a misconception of the nature of the lodes, on the part of the operators. Under the circumstances it is not surprising that the company failed to operate the mine at a profit. The successful exploitation of these deposits depends largely on the initiative possessed by the operators to apply the most suitable methods of mining according to the requirements of the particular case in hand. Unfortunately the hard pyrrhotite ore-bodies were attacked while the reserves of high grade oxidised material were still fairly large. No

> organised attempt was made to keep development work ahead of mining in order to ensure continuous and economical operation, by providing reserves of ore. This was largely due to the poor financial condition of the company at the time. Before any attempt is made to resume production a large amount of development work should be done, preferably by tunnelling and rising.

Now the mining methodology and the managers who had implemented it were seen as the mine's main problem, rather than its milling technology, which had traditionally garnered the bulk of the blame! It soon became evident that the Mount Bischoff Company would not stay to perfect new plans for the mine and a replacement mill. The Cleveland mine was once again derelict.

In 1943, a Mr C. E. Gray successfully applied for two leases covering the former Cleveland workings, which he held until the mid/late 1950s. Throughout this period, the mine's potential wealth was being stressed to several potential lessees. In 1952, a Mines Department assessment calculated that the Cleveland mine retained a 197,000 ton ore reserve. This in turn inspired a geophysical survey of the Cleveland leases by the Commonwealth Government Geophysicist. Ultimately these efforts proved successful, as a consolidated lease to all the old Cleveland workings was acquired by Aberfoyle Ltd in the late 1960s. This company subsequently re-opened and operated the new Cleveland mine until the early 1990s, when the site was closed and rehabilitated.

Site reports

CLEVELAND MINE MILL ARCHAEOLOGICAL SURVEY — Cleveland concentrating mill

Site/Feature number: 01

Location:

This site is situated 50 m west of the Cleveland mine road's terminus.

Site type:

Mine concentrating plant

Historic description:

In his 1923 report on the Cleveland mine, the government geologist A. M. Reid elaborated on the milling and concentration technology employed at the resident mill, which has been reproduced verbatim below.

> In 1908, a 10-head battery of stamps and concentrating machinery was erected by the Mt Cleveland Tin Mining Co. to treat high grade non-pyritic ore. As mine development progressed, it was found that the material consisted of a mixture of gossan and sulphide ores, and that it contained tin oxide in the proportion of 1 per-cent only. Ore of such low grade and complex nature is difficult to treat in a plant except one specially designed for that class of material, therefore good results could not be expected of the original plant. Careful sampling and testing showed that the loss of tin oxide in the process of concentration was excessive, and that operations under such conditions could not be conducted at a profit to the company. The necessary alterations to the plant were made, and better results were obtained. The following is a brief description of the process:
>
> > The ore is conveyed from mine bins in half-ton buckets along an aerial ropeway, self dumping over a grizzly to the stone crusher floor. The original plant did not include a rock breaker, the large lumps of ore being spalled to a size suitable for feeding to the stamps. The expenditure incurred in breaking the ore and feeding the battery by hand amounted to half the cost of milling and concentration. Wire battery screens of 25-mesh (linear) were used in the mill, and the concentrating plant, besides hydraulic classifiers and spitzkasten, included two Card tables, one Wilfley, and four slime tables of the rotary type, 16 feet in diameter…
> >
> > At this stage, as the ore delivered to the mill was becoming very sulphidic, it was decided to erect a small roasting furnace. A single-hearth furnace with two Leggo mechanical rabbles was built. The capacity of this furnace was five tons per week of concentrate containing 7 per cent of sulphur. Alterations and improvements brought the capacity to 18 tons per week (of seven days)…The roasted ore was re-treated on the Wilfley table, and a recovery of 93 per cent, was obtained.
> >
> > On referring to the sizing test of the tailing, the losses are found in the coarser sizes to be wholly combined or occluded tin, and the slimes to be principally free tin. This pointed to the necessity of grinding finer and adding more efficient slime saving appliances. Accordingly, a Bigelow positive pan, Callow Revolving screen, two Card tables, and a double belt vanner were erected. The addition of this machinery reduced the tailing loss from 0.4 per cent to 0.13 per cent tin (by vanning assay)…The battery screens were changed from 25 to 8 mesh, the pulp went direct to the Callow screen (50 mesh), screen undersizes to hydraulic classifiers, oversize to the grinding pan, and from the pan back to the screen; all the ore being finally ground to pass 50 mesh. The heading from the Card and rotary tables contained 12 per cent tin, 30 per cent sulphur and from 8 to 9 per cent copper, the last derived from the chalcopyrite-pyrrhotite ore-bodies. After treating the roasted ore the concentrate contained from 0.1 to 0.4 per cent copper.
> >
> > Power was supplied by Pelton wheels working under a head of 290 feet, and employed as follows:
> >
> > One 4 feet diameter, with 1.25 inch tip, driving the battery, pan screen, elevator, and breaker.
> >
> > One 3 feet diameter, with half inch tip, driving tables, calciner, and vanner.
> >
> > One two feet diameter, with half inch tip, driving generator for lighting[1].

Current site description:

The Cleveland mill site has been dug into the southern slope of Crescent Spur. The stepped/multi-tiered rectangular excavation containing the mill remains measures 45 x 18 m in dimension with a total fall from top to bottom of at least 35 metres. A scaled plan of the mill site as it is today appears overleaf with the following features marked upon it.

Mill tramway

A short 20 m long tramway right of way linked the upper battery adit at the Number 3 lode workings to the ore bins/primary crushing precinct at the Cleveland mill. The only remains of the tramway today consist of a five metre long dry stone retaining wall which prevented the embankment from collapsing in to the adjacent mill excavation.

Post holes

A number of sequential post holes between the Number 3 lode adit tramway and a set of discarded grizzly bars indicate the location of several uprights formerly supporting the mill building fabric. A pair of large ore bins and ore feed chute would have stood beneath this uppermost section of the mill.

Grizzly bars

A set of grizzly bars, used for sorting material prior to its conveyance to the primary crushers, lies partially buried some five metres above the battery plant site.

Ore bin chute doors

Likewise a pair of doors from the ore bin chutes lie discarded between the grizzly bars and the battery site.

Crusher

A Blake type crusher for breaking rock down to a suitable size for feeding to the stamp battery stands slightly askew immediately south of the battery site.

Stamp battery components

A variety of component parts to a ten-head stamp battery lie scattered around the two mortar boxes standing adjacent to the crusher. These components include the camshaft, stamp shafts and attached shoes. The mortar boxes are still *in situ* on their masonry/timber footings, whereas the other components have been discarded around the boxes during the salvage of the main battery body.

Grinding pan

The remains of machinery relating to the fine grinding process occur at the level below the crusher/battery. Such machinery further reduced the particle size of material removed from the battery prior to its introduction to the classifying and concentrating levels. The 'Bigelow positive' grinding pan still stands on its timber footings. Other features on this level include a sump and drain sunk into the floor below the grinding pan footings and other machinery components such as a pinion and gear wheel. A number of timber uprights formerly supporting the mill building also survive to two metres in height on this level.

Classifying floor

The level below the fine grinding/amalgamating pan is dominated by a parallel sequence of timber footings, stone platform and a number of machinery items. The timber footings consist of three five-metre long squared beams and a number of smaller timbers laid in a similar parallel fashion. All have been splintered during the salvage of resident equipment and then charred after bushfires. A 3 x 5 m long pile of stone rubble is probably a crude built stone footing/foundation. The shaft of a double round table and two matching halves of a belt pulley are the paltry remains of the regime of classifiers and Spitzkasten.

Concentrating floor

The lowest surviving level of the mill consists of more parallel squared timbers serving as machinery footings. This set of four footings, individually measuring 5 x 0.75 m in dimension, each retain matching sets of six anchor bolts, where machinery was formerly bolted down. A couple of squared beams which have fallen from the level above lie alongside these footings. This level most probably hosted the various vanners and tables.

Interpretation:

A reconstructed schematic of the mill plant appears overleaf. Essentially, the Cleveland mill consisted of six separate levels hosting various processes employed to recover and refine ore dispatched from the Cleveland mine. Commencing at the uppermost tier of the mill site, the following working levels were once in operation.

1. Ore delivery level

Historic sources indicate that material from the main open-cut mine was delivered to the mill via an aerial ropeway. The half ton aerial skips/buckets conveyed down this ropeway emptied automatically onto a grizzly erected over a stone crushing floor at the very top of the mill site. Large pieces of rock were hand spalled with sledge hammers to break them down into smaller pieces which would subsequently be fed to the primary crushing plant in the level below. A set of ore feed doors beside the grizzly bars suggests that the material was stockpiled on some type of ore bin and gradually fed to the crushing plant.

2. Primary crushing

Once reduced by hand spalling, material was fed to a Blake type crusher for further reduction, although Reid (1923) noted that originally, the Cleveland mill did not possess one of these items, and all primary crushing had to be done by hand[(2)].

3. Secondary crushing

Secondary crushing was typically achieved using a stamp battery, and the Cleveland mine was no exception. The remains of the resident ten-head battery at this mill indicate the use of the most common type of battery, although the battery screen size was modified from 25 mesh (linear) to 8 mesh size during a refit at the mill. A Callow revolving screen then sorted the stamp pulp. The fine undersizes went straight to the classifiers located two levels down, whereas the oversize was re-ground in the grinding pan situated one level below.

4. Fine grinding

A grinding/amalgamating pan was set up to further reduce the crushed material removed from the battery boxes above. Reid refers to this device as a Bigelow positive pan, which was added to the mill after tests proved that tin was being lost in the oversize material moved directly from the stamps to the concentrating tables. Material from the grinding pan was then placed to run through the Callow screen again before its removal to the double belt vanner located on a lower level.

5. Classifying/concentrating

Two sets of equipment treated two different by-products from the stamping and fine grinding processes.

- An hydraulic classifier and Spitzkasten received screen undersizes from the Callow revolving screen.
- Two Card tables, a Wilfley table and a Double belt vanners sorted 50 mesh finely ground material resulting from the previous levels/treatments and returned material from the calciners.

6. Slimes/tailing treatment level

Reid refers to four rotary slime tables with a diameter of 16 feet[(3)]. Two of these had a surface slope of 9/16 inch per foot, while the other two had a slope of one inch per foot. These tables treated the fine slimes from the previous level produced from the refining activities undertaken on the various shaking appliances.

7. Calciners

As the ore being delivered to the mill from the mine became increasingly sulphidic, calcination became necessary to burn off the sulphides. A single hearth furnace with two Leggo mechanical rabbles was accordingly purchased and installed to treat the headings from the card and rotary slime tables at the mill. Reid tells us that initially, the capacity of this plant was five tons per week of concentrate containing 7 per cent sulphur[(4)]. Modifications initially increased treatment to 18 tons a week, but as sulphide levels in the ore rose to 30%, this fell to 15 tons per week. Ore thus calcined was returned to the mill for re-treatment on the Wilfley table, which produced a tin concentrate of 93% purity. The location of this plant remains uncertain.

8. Power plant

Reid stated that power for the mill was initially generated totally by a set of three Pelton wheels[(5)]. When water flow in nearby Deep Creek was found to be insufficient in summer, an auxiliary steam plant was added. This was situated at the very southeastern corner of the mill and can be seen in the historic photograph of the mill.

Statement of Significance:

This site is one of the best preserved concentrating mill sites in Tasmania boasting an *in situ* selection of historic milling machinery rarely seen today. In addition to this machinery, the site itself remains well defined and as such still conveys the manner in which historic ore dressing operations were conducted at this site.

Significance rating:

This site is deemed to be of Regional Significance.

Recommendations:

This site should be protected from all future impacts. Considerations should also be given to nominating the site for inclusion on the State Heritage register.

Level of recording:

This level of recording is deemed to be sufficient.

References:

1. Reid, 1923*b*, pp. 160–161.
2. Reid, 1923*b*, p. 161.
3. Reid, 1923*b*, p. 161.
4. Reid, 1923*b*, p. 162.
5. Reid, 1923*b*, p. 163.

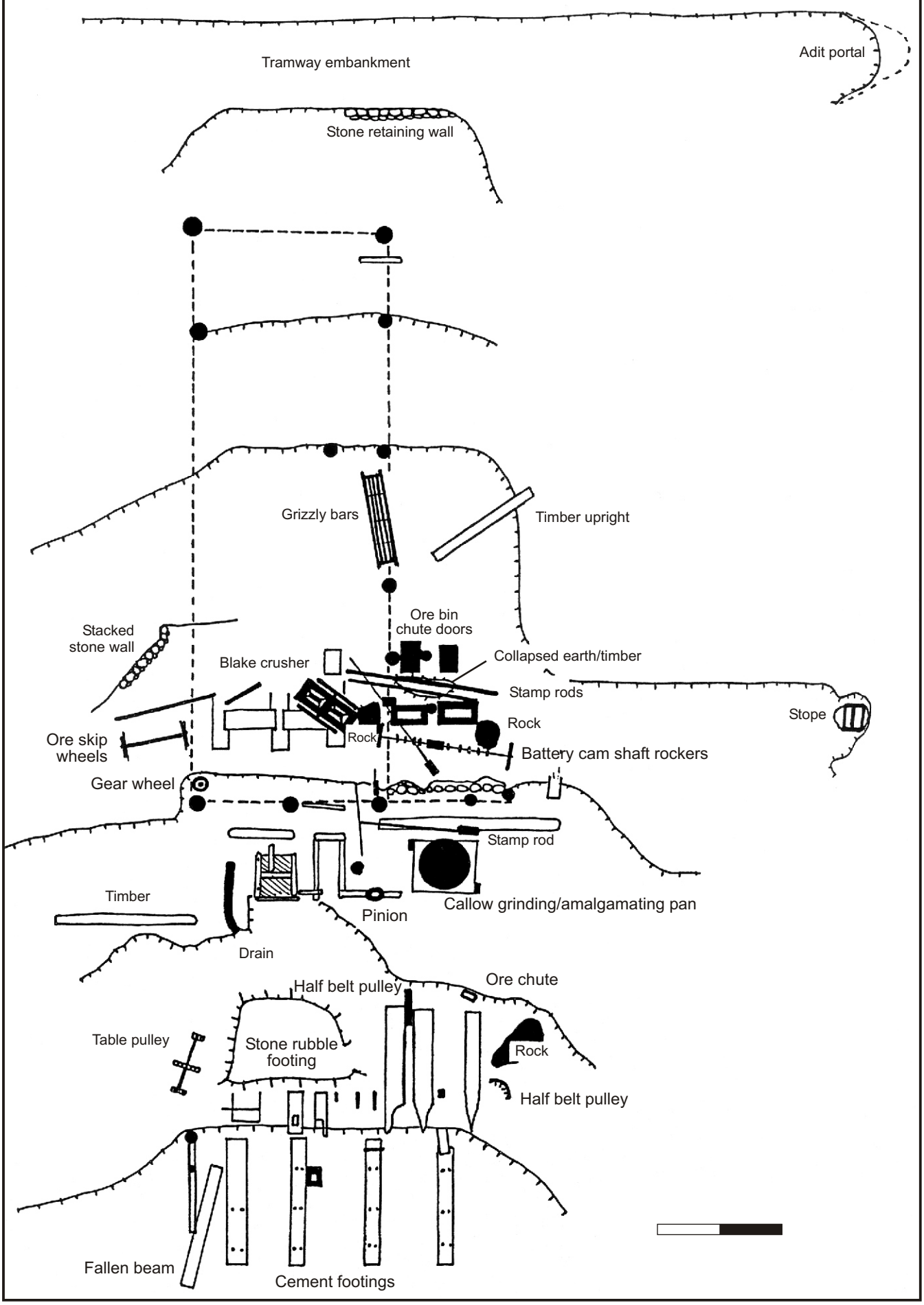
Recorded by:

P. Kostoglou/R. Halfacre

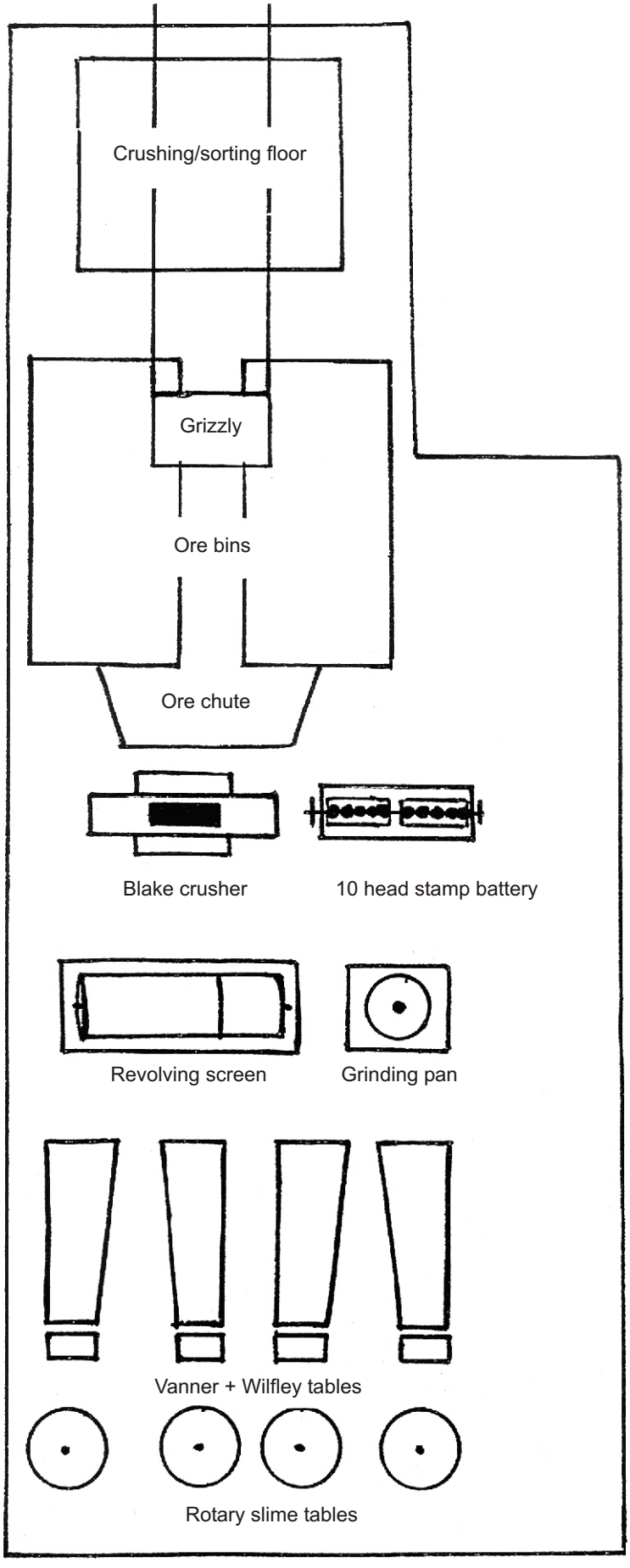
Photograph:

View of grinding pan at the Cleveland mill.

Scaled site plan: Plan of the Cleveland mill site showing current disposition of constituent features.



Reconstruction: Illustration showing former location and disposition of plant comprising the Cleveland concentrating mill.



PRIMARY CRUSHING

SECONDARY CRUSHING

CONCENTRATING

SLIMES TREATMENT

CLEVELAND MINE MILL ARCHAEOLOGICAL SURVEY — Historic mill-side mine workings

Site/Feature number: 02

Location: These workings are situated 20 m northeast of the Cleveland mill footings.

Site type: Adit portal and underhand stope.

History:

In 1923, Reid noted that:

> No. 3 or Mill Workings — This lode was discovered shortly after the milling plant had been erected. It passes underneath the mill in a south-westerly direction, and extends unbroken 200 feet to the north-east. It has been opened by means of two adits and a winze, and has been stoped to the surface. The adits are 110 and 160 feet in length, and are 20 feet apart. According to reports received, the material removed from these workings contained tin in the proportion of 4 per cent. In the north end of the lower workings the ore-body is 3 feet wide, and consists of partly replaced white and grey slates, with a white slate footwall and blue slate hanging-wall…It is reported that a 60-feet winze sunk from the floor of these workings, exposed ore containing 6 per cent tin[1].

Description:

Two mine-related openings were located immediately northeast of the Cleveland mill site. The largest of these, occurring above the top-most level of the mill, is a 2.5 m high adit portal connected to the mill by means of a short tramway. The second opening, found 20 m northeast of the stamp battery remains, is a partially collapsed stope, although some form of timber collar is evident amongst the fallen debris.

Statement of Significance:

These mill side mine workings are unremarkable examples of hard-rock mining activity. Their significance lies principally in their location so close to the pre-existing mill facility.

Recommendations:

These workings should be protected as part of the mill precinct.

Level of recording:

This level of recording is deemed to be sufficient.

References:

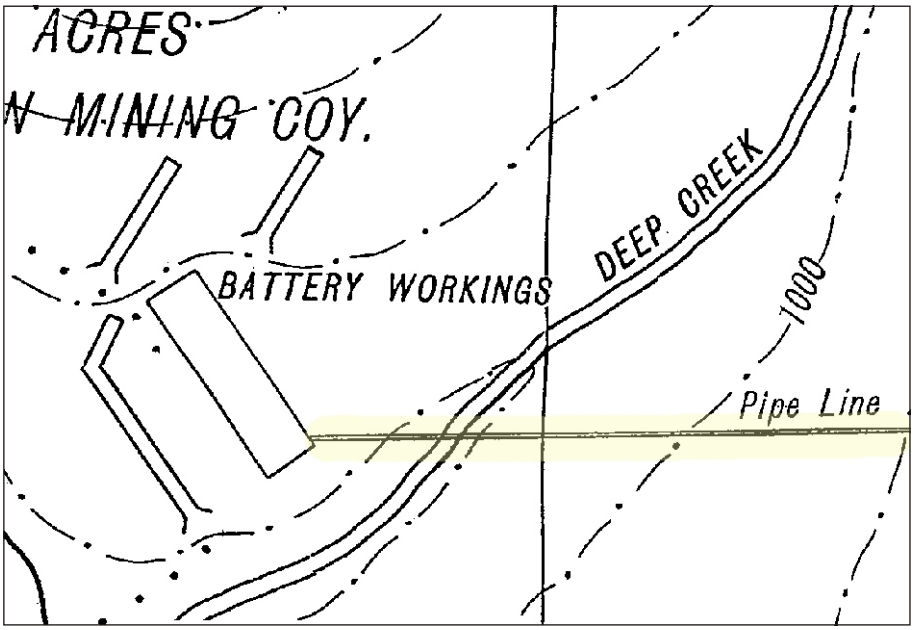
1. Reid, 1923*b*, p. 155.

Recorded by:

P. Kostoglou/R. Halfacre

Historic map:

1923 map from Reid showing location of so-called Battery workings.



CLEVELAND MINE MILL ARCHAEOLOGICAL SURVEY — Aerial ropeway

Site/Feature number: 03

Location:

This feature would appear to have linked the top end of the Cleveland mill to the Cliff open-cut workings some 300 m to the northeast.

Site type: Ore conveyance (aerial ropeway).

History: This conveyance was constructed between c1917 and 1923.

Description:

A. M. Reid's 1923 description of the Cleveland mill stated that ore was conveyed from bins at the open-cut mine in half ton buckets along an aerial ropeway. These buckets were self dumping, and emptied over a grizzly at the stone crusher floor situated on the upper most level of the mill[1].

Statement of Significance:

Not applicable.

Recommendations:

None made.

Level of recording:

This level of recording is deemed to be sufficient.

References:

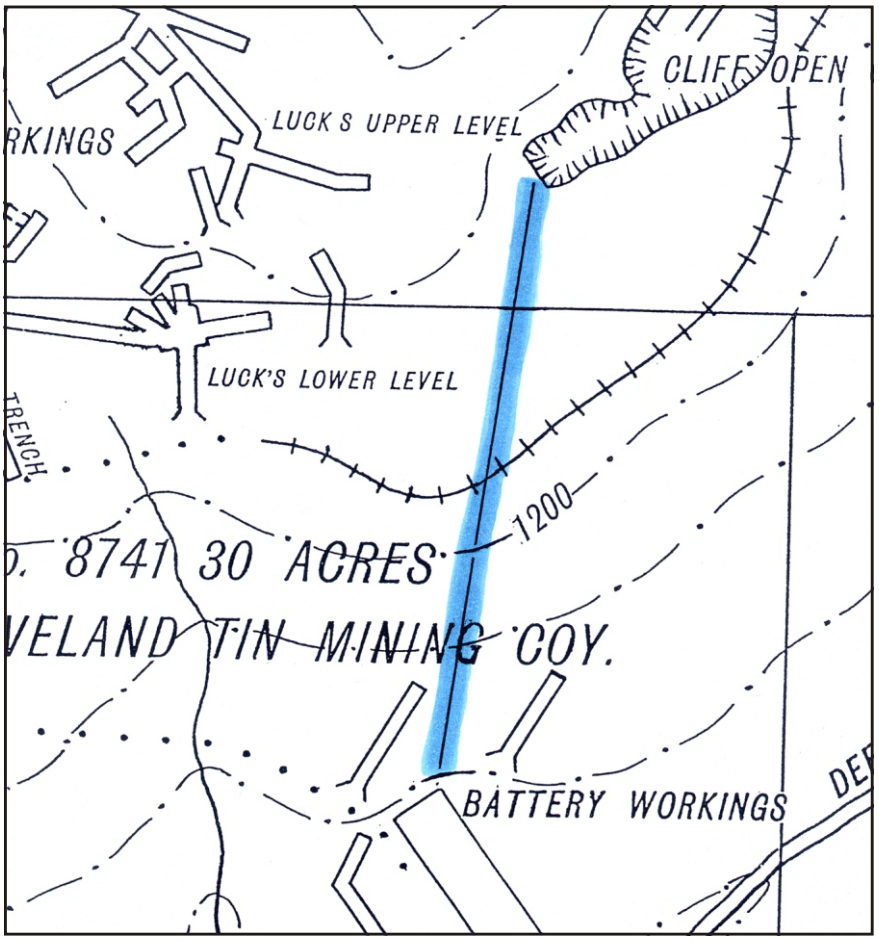
1. Reid, 1923*b*, p. 154.

Recorded by:

P. Kostoglou/R. Halfacre

Map:

Historic 1923 map showing most likely orientation of ropeway superimposed.



CLEVELAND MINE MILL ARCHAEOLOGICAL SURVEY — Mill water race

Site/Feature number: 04

Location:

This feature follows the 450 m contour around the hillside opposite/to the south of the Cleveland mill.

Site type:

Water conveyance (earthen race).

History:

This feature was excavated between 1907 and 1911 in order to provide a maximal fall/pressure to the pipeline feeding the pelton wheel power plant at the mill site. This was superseded in 1911 by a steam power plant after drought led to water shortages in the relevant catchment[1].

Description:

Although not inspected close up, this feature was plainly visible from the uppermost level of workings at the Cleveland mine. The race was seen to consist of a continuous earthen channel supplemented by sections of consolidated timber fluming at selected locations.

Statement of Significance:

None made.

Recommendations:

This race should be inspected/recorded in the future.

Level of recording:

This level of recording is deemed to be sufficient.

References:

1. Reid, 1923*b*, p. 163.

Recorded by:

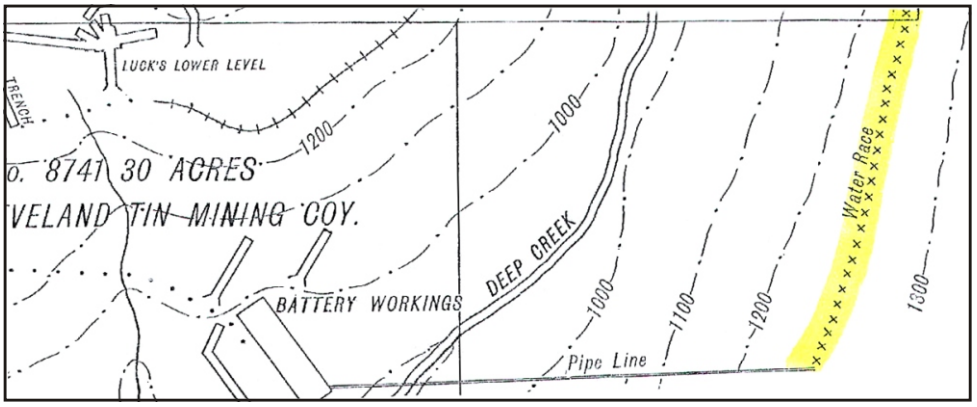
P. Kostoglou/R. Halfacre

Photograph:

Southerly view of water race from upper level of the Cleveland mine.

Map:

1923 map showing orientation of water race.



CLEVELAND MINE MILL ARCHAEOLOGICAL SURVEY — Battery pipeline

Site/Feature number: 05

Location: Remains of this pipeline were found on the hillside slope on the south side of Washington Creek opposite the former mill site.

Site type: Water conveyance (pipeline).

History:

This feature was installed between 1907 and 1911 in order to carry pressurised water from a water race to the pelton wheel power plant driving the Cleveland mill. It presumably became redundant after 1911 when a steam power plant replaced the pelton wheels.

Historic description:

In his 1923 report, Reid noted that water to power the mill's pelton wheel power plant "*was conveyed in a line of pipes, 800 feet long and 13 inches in diameter, from a race connecting with Deep Creek. In summer the water supply was too small to be of use for power purposes, and an auxiliary steam plant was employed instead*"[1].

Current description:

This site is evidenced by a succession of remnant timber trestles proceeding southerly up the hillside away from the mill site. These formerly supported the metal pipeline, which has since collapsed.

Statement of Significance:

This site is deemed to be of High Local significance.

Recommendations:

This site should be protected from all impacts.

Level of recording:

This level of recording is deemed to be sufficient.

References:

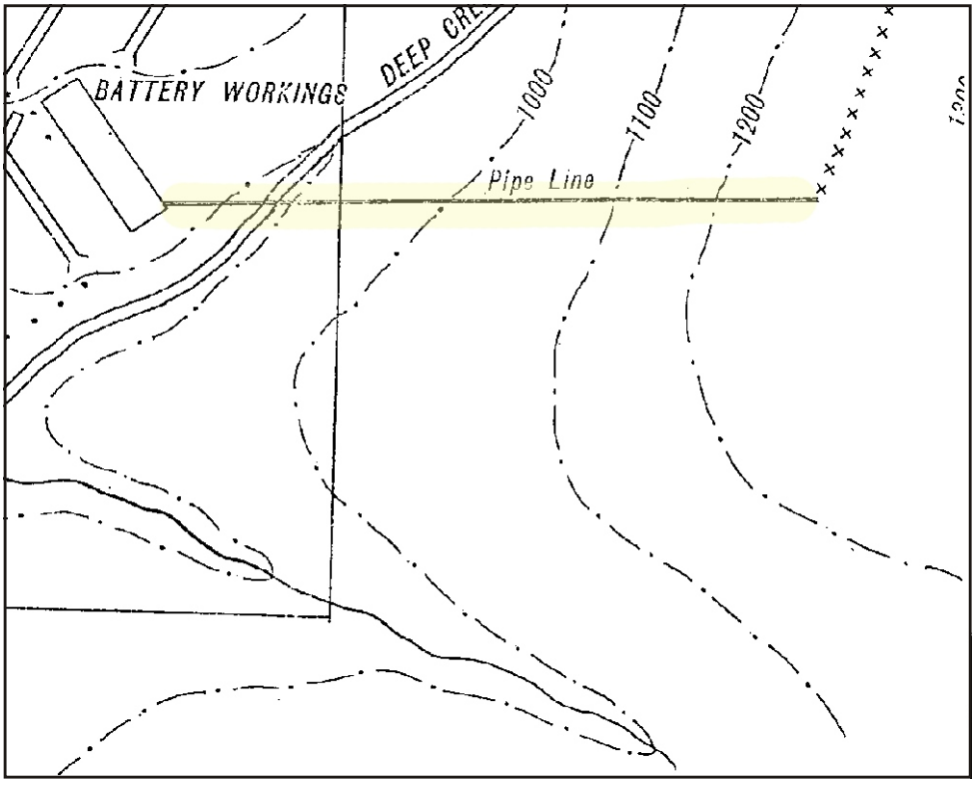
1. Reid, 1923*b*, p. 163.

Recorded by:

P. Kostoglou/R. Halfacre

Historic map:

1923 survey showing pipe line connecting water race to the Cleveland mill site.



CLEVELAND MINE MILL ARCHAEOLOGICAL SURVEY — Firewood tramway

Site/Feature number: 06

Location: This feature is situated immediately east of the lowest tier comprising the Cleveland concentrating mill.

Site type: Tramway (timber).

History:

This facility was presumably constructed in 1911 when a steam power plant was installed at the Cleveland concentrating mill after the failure of the original water driven infrastructure. It would have become abandoned by the early 1920s.

Description:

This feature consists of a 1.5 m wide benched right of way cut into the hillside immediately east of the lowest mill footing. A number of sequential timber sleepers can still be seen along the old formation. This tramway can be plainly seen in the lower right hand corner of the historic photograph appearing below.

Statement of Significance:

This modest tramway is an unremarkable and poorly preserved example of its type.

Recommendations:

None made.

Level of recording:

This level of recording is deemed to be sufficient.

References:

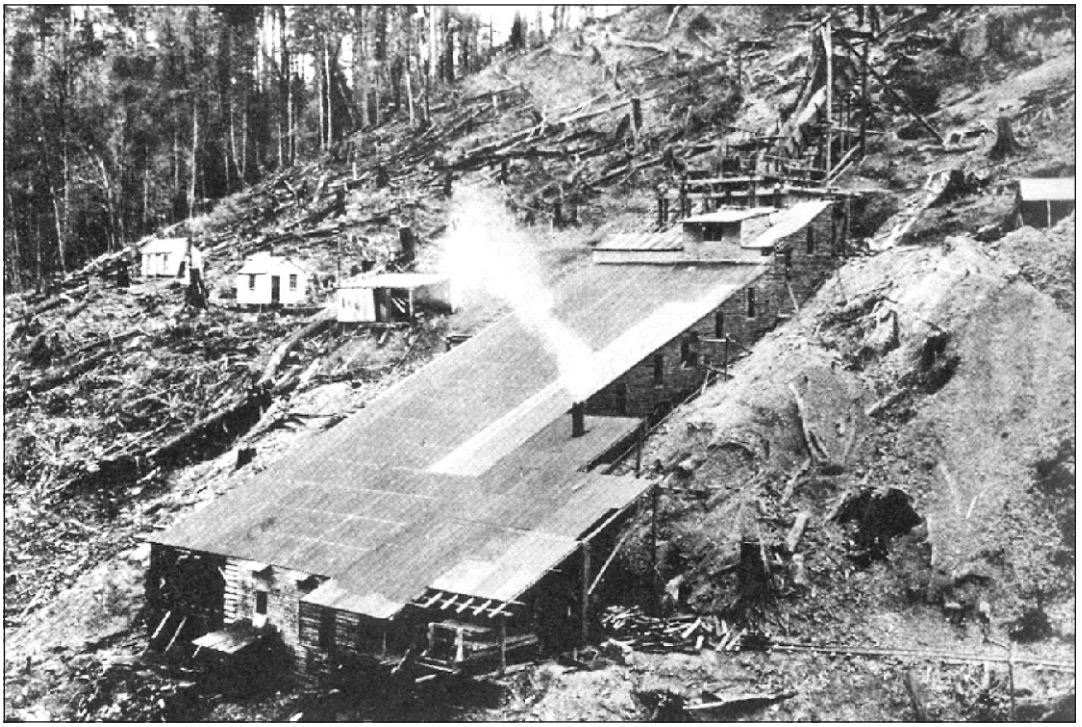
Not applicable.

Recorded by:

P. Kostoglou/R. Halfacre

Historic photograph:

Undated black and white photograph appearing in Pink (1982) showing the Cleveland mill and its firewood tramway.



CLEVELAND MINE MILL ARCHAEOLOGICAL SURVEY — Cleveland mine

Site/Feature number: 07

Location: This group of workings is situated on the summit and slopes of Crescent Spur, some 700 m due south of the former Luina township.

Site type: Mineral workings (assorted).

History:

After the discovery of tin oxide in 1900, a company titled the Cleveland Tin Mining Company No Liability was expressly formed to work the lease as a tin mine by 1907. By 1911, the Cleveland mine was being operated as an open-cut operation providing ore assaying at slightly over one per cent tin oxide. In 1914, the Cleveland mine was let on tribute, but even these more marginal operators could not make a success of the mine. The closure of the Cleveland mine in 1916 came as no surprise to most government sources who steadfastly blamed the poor milling facility as the root of all the mine's problems. During its nine or so years of life to date, the Cleveland mine had produced 344 tons of concentrated tin oxide, but despite its proven ore body, no new lessee could be found to re-start the mine and its mill plant. By 1923, the relevant mineral leases to the former Cleveland mine had been acquired by Messrs J. Luck and C. Thompson of Devonport. A systematic inspection of the mine property by Government Geologist A. M. Reid the same year found the mine plant in terrible condition[1]. In 1935, the Mount Bischoff Tin Mining Company acquired the leasehold rights to the former Cleveland mine and then spent 5000 pounds on new works which included driving three new adits and several surface trenches. In 1943 a Mr C. E. Gray successfully applied for two leases covering the former Cleveland workings, which he held until the mid/late 1950s. In 1952, a Mines Department assessment calculated that the Cleveland mine retained a 197,000 ton ore reserve. This in turn inspired a geophysical survey of the Cleveland leases by the Commonwealth Government Geophysicist. Ultimately these efforts proved successful, as a consolidated lease to all the old Cleveland workings was acquired by Aberfoyle Ltd in the late 1960s. This company subsequently re-opened and operated the new Cleveland mine until the early 1990s, when the site was closed and rehabilitated.

Description:

The current Cleveland mine workings comprise four levels on Crescent Spur which are linked by a vehicular road/ incline. Only a very brief inspection of the workings alongside this road was carried out, as the mine lay outside the dictates of this job brief. Those workings inspected consisted of substantial and unstable hillside mullock dumps and related sealed adits. A number of large open-cut pits were also seen at the summit of the Spur.

Statement of Significance:

None made.

Recommendations:

In the event of further development, this mine should be assessed.

Level of recording:

This level of recording is not deemed to be sufficient.

References:

1. Reid, 1923*b*, p. 151.

Recorded by:

P. Kostoglou/R. Halfacre

Photograph:

View of sealed adit portal and hill side mullock.

CLEVELAND MINE MILL ARCHAEOLOGICAL SURVEY — Cleveland mine tramway

Site/Feature number: 08

Location: This extensive tram network originally straddled the upper slopes of Crescent Hill and its resident workings comprising the Cleveland group of mines.

Site type: Tramway (timber).

History:

After the cutting of a pack track to the Cleveland field during prospecting work, this tramline was the first piece of infrastructure erected at the Cleveland mine after the commencement of operations in 1907. The tramline appears to have operated periodically moving equipment to the mine and ore back to Waratah as required. By 1923 government geologist A. M. Reid found the Cleveland mine abandoned. In his report of that year, he blamed the mine's demise on *"the inefficient methods employed in the transport of the ore…"*[1]. After their 1935 takeover of the Cleveland mine, the Mount Bischoff Mining Company built a road into the mine, thus rendering the old tramway redundant.

Description:

Reid described the Cleveland mine's tramway as being 2.5 miles in length[2]. It connected the mine to the eight mile peg on the Corinna/Waratah road via the south side of Crescent Hill. This tramway was not searched for during this survey as it was deemed to fall well outside the mill precinct.

Statement of Significance:

None made.

Recommendations:

In the event of further development at the Cleveland mine, the location and condition of this entity should be clarified.

Level of recording:

This level of recording is not deemed to be sufficient.

References:

1. Reid, 1923*b*, p.163.

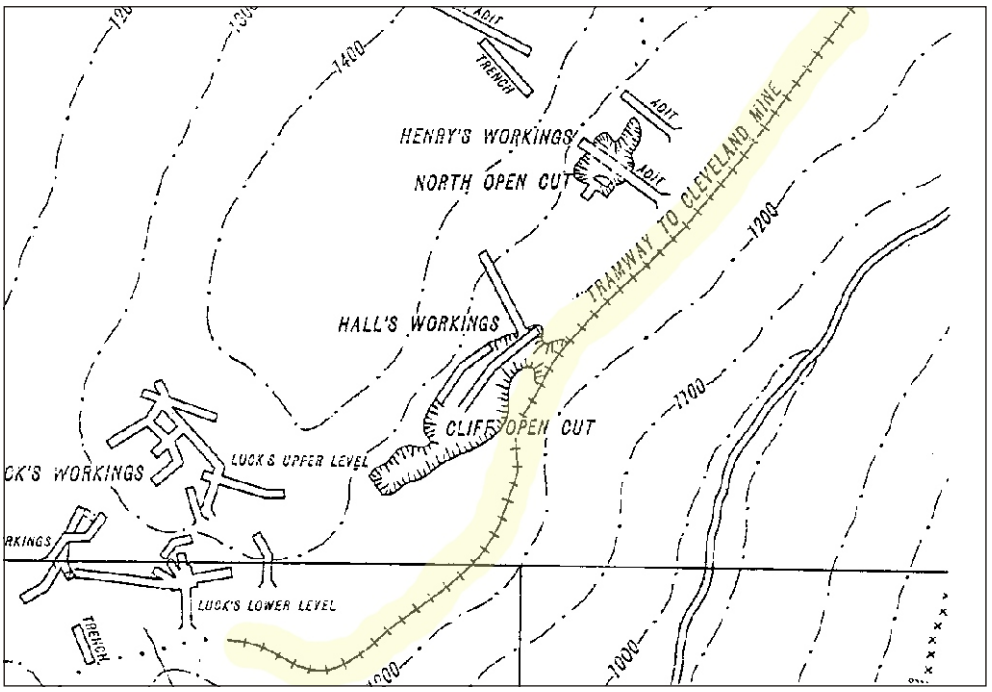
2. Reid, 1923*b*, p.151.

Recorded by:

P. Kostoglou/R. Halfacre

Map:

Reid's 1923 survey of the Cleveland mine showing the extent and orientation of its tramway.



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Glossary

Adit (also drive or drift)	Horizontal or gently inclined passage or tunnel of underground mine that is driven from the surface. The slight grade enabled ore carts to run downhill out of the mine under their own weight and mine water to be self draining.
Blake crusher	Manufactured by Blake-Marsden, this type of rock crusher reduced material using direct pressure between a fixed plate and a swinging jaw.
Calcining	The process of roasting or burning any ore in order to physically break it down and further burn off or remove unwanted impurities such as sulphides.
Classifier	A device used to separate or classify the coarser particles of stamp pulp. Classifying processes were often alternated with concentrating processes in a mill because concentration works more efficiently with particles of uniform size.
Collar	Timbering, steelwork, concrete or masonry erected around the entrance to a shaft, to reduce the risk of things falling down and prevent fretting of the entrance.
Concentrates	Processed finely crushed ore containing a mixture of metallic sulphides and heavy desired metals such as tin.
Frue Vanner	Ore dressing/concentrating machine incorporating a wide fabric or rubber belt stretched between two rollers. Crushed ore fed onto the belt was carried against a current of water which washed away the light waste. The desired heavy material was carried over the end of each belt and collected. Vanners were replaced by the more efficient Wilfley table (see below).
Grinding/ amalgamating pan	Fixed drum with powered grinding plate which further reduces the size of material emptied into it prior to concentrating.
Grizzly bars	Metal grate onto which trucks or mined material are dumped in order to sort it by size. Fine material flowed through the gaps in the grate whereas coarser chunks and pieces were hand spalled with a hammer and/or removed and fed into the rock crusher.
Lode	Part of an ore zone or rock mass containing several veins spaced closely enough so that they and the intervening rock can be mined as one unit.
Mortar box	Large cast iron box at the base of a stamp battery fitted with heavy cast iron dies in which generally five head of stamps were dropped onto ore, thus reducing it to a pulp which then passed through a mesh screen to the next crushing or concentrating process.
Open cut	Method of mining where a lode or ore body outcrops at or near the surface and can be mined without resorting to underground methods.
Ore bin	Hopper for storing ore in above and below ground mining practices. At mill sites such bins were erected near the summit of the building to hold ore prior to its passage down through the various crushing regimes.
Pelton wheel	Water wheel used for motive power which employed small replaceable cups or buckets regularly spaced around its outside circumference. A pressured jet of water was directed at the buckets, thus turning the wheel and the shafting/pulleys attached to it.

Pulp	Material produced by stamp batteries and other ore crushing machinery consisting of finely crushed ore mixed with water. The two constituent fractions (coarser sand and slimes) were routinely separated for further treatment.
Rabble	An agitating arm for mixing ore deposited in a calcining/roasting furnace.
Shaft	A vertical passage to provide access from the ground surface to underground levels. Shafts were usually subdivided into three sections. Typically two were used as winding/haulage compartments for lift cages while the third contained a ladder way and drainage/ventilation piping.
Slimes table	Slightly graded table employing a continuous belt or number of shallow trays with a canvas base which are lightly agitated and sprayed with water to separate the contents of slimes. The lighter worthless material flow is separated from the heavier metallic slimes which are captured in the canvas surface and retained for further treatment.
Spitzkasten (initial classifier)	A device consisting of inverted pyramid shaped troughs into which a water current and ground material was introduced. As the material settled in the troughs, the coarse sand fraction became separated from finer slimes.
Stamper battery (Stamp mill)	A mill for crushing ore by means of a sequence of stamping motions achieved by the alternating lifting and dropping of heavy stamps by means of a powered camshaft.
Stope	An underground excavation from which ore is extracted, usually above or below a drive or working level.
Tailings	Portions of washed and crushed ore (usually in a fine ground state after processing) which are considered too poor to treat further, and are discarded.
Tributers	Miners who work a section of an ore body belonging to a company which pays as royalty a percentage of the value they recover.
Wilfley table	Shaking tables invented by Rittinger in 1844 and developed by Wilfley for use in separating or concentrating the heavy pulverised ore from lighter material.
Winze	A generally small cross section vertical or steeply inclined shaft or passage excavated from one level to another in underground workings. Winzes do not reach the surface, and were usually excavated downwards from an upper level to a lower one.

APPENDIX 1

Illustrations of historic ore dressing machinery used in the Cleveland mill

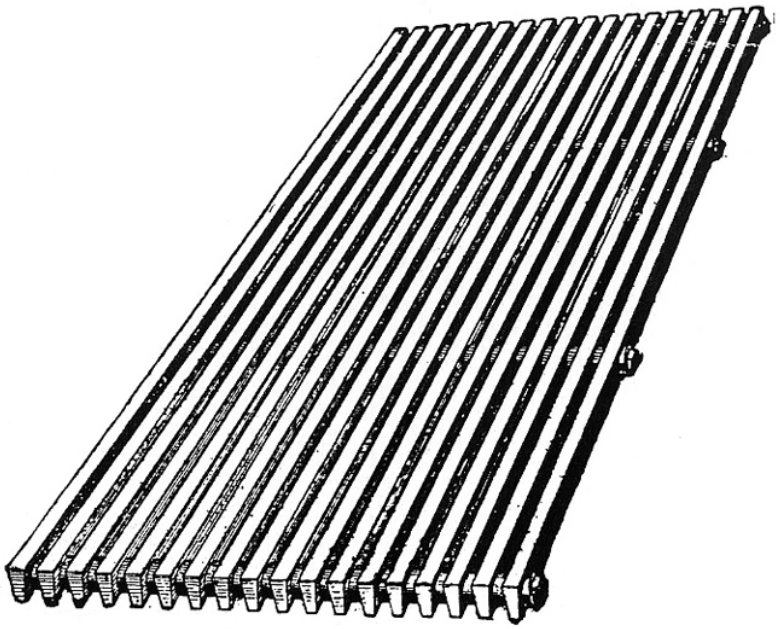


Plate 4

Historic Illustration showing set of grizzly bars (Louis, 1909)

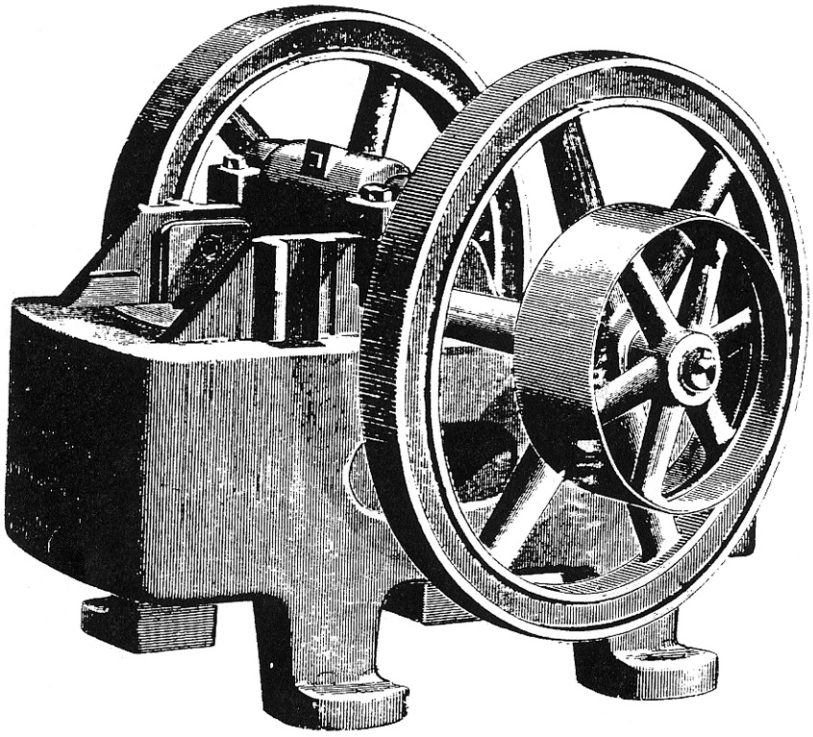


Plate 5

Historic illustration showing Blake's patented ore crusher (Louis, 1909).

AUSTRALIAN MINING AND METALLURGY.

W. ANDERSON & SONS,

ENGINEERS,

IRON & BRASS FOUNDERS, BOILERMAKERS.

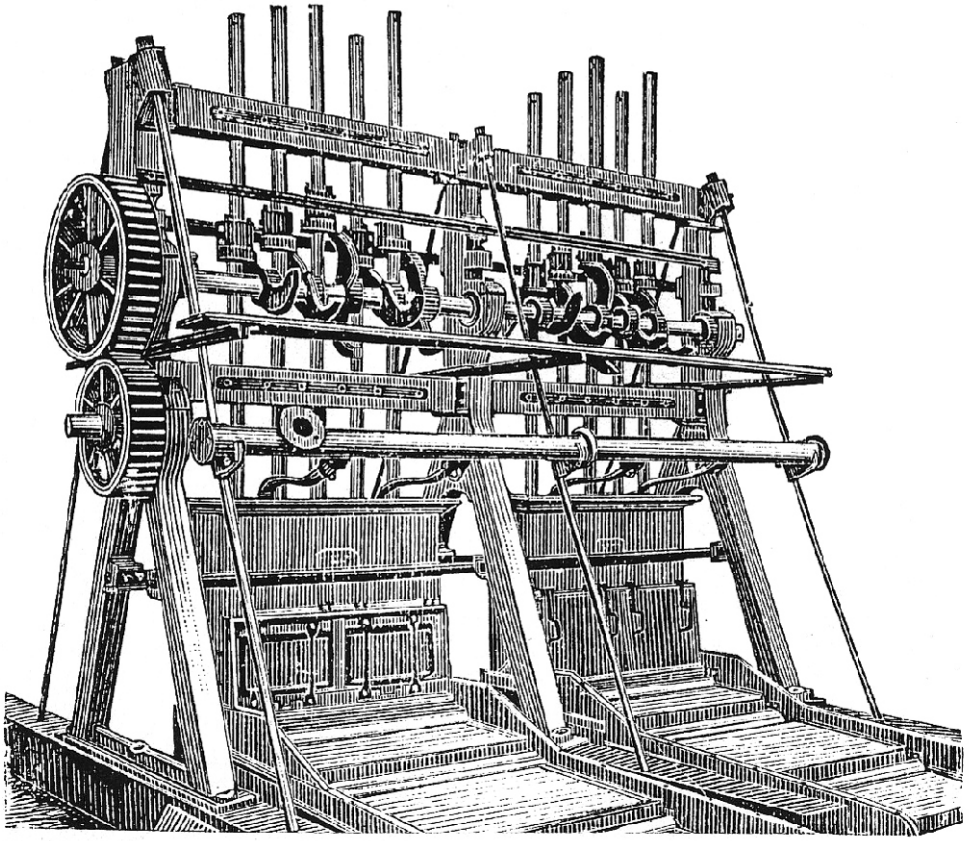


Plate 6

Historic advertisement showing 10-head stamp battery.

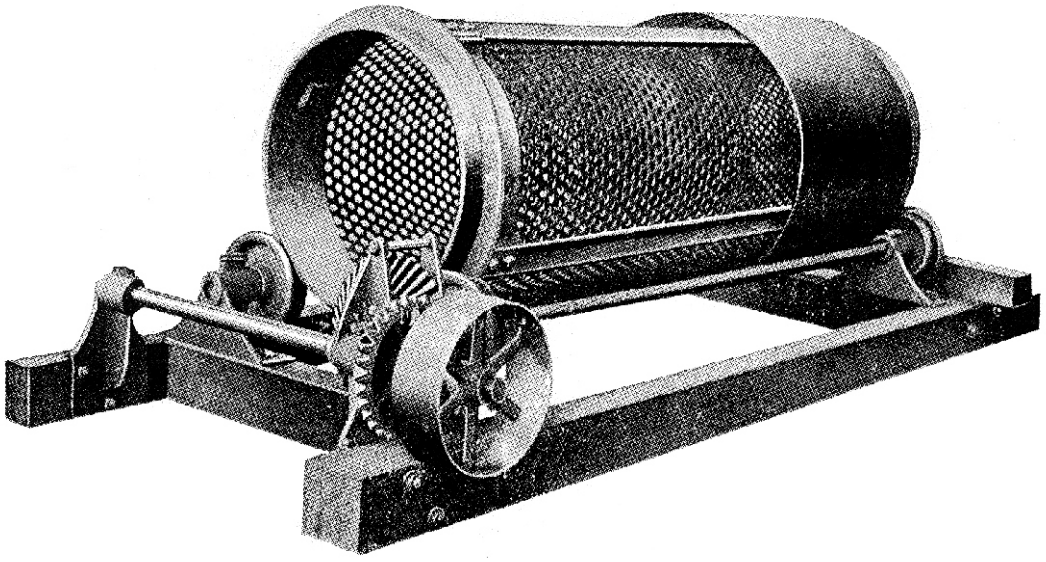


Plate 7

Historic illustration showing a typical revolving screen or trommel (Louis, 1909).

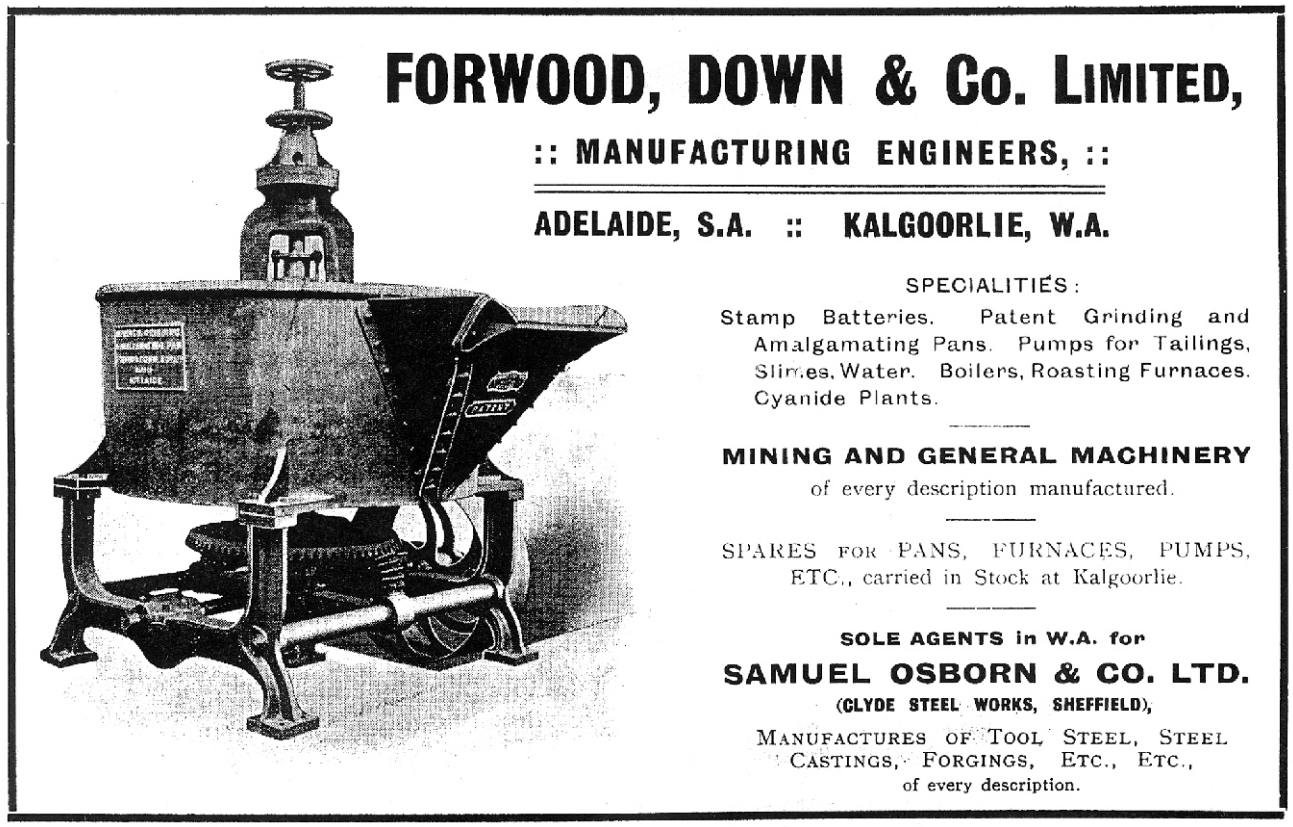


Plate 8

Historic advertisement with illustration showing grinding/amalgamating pan.

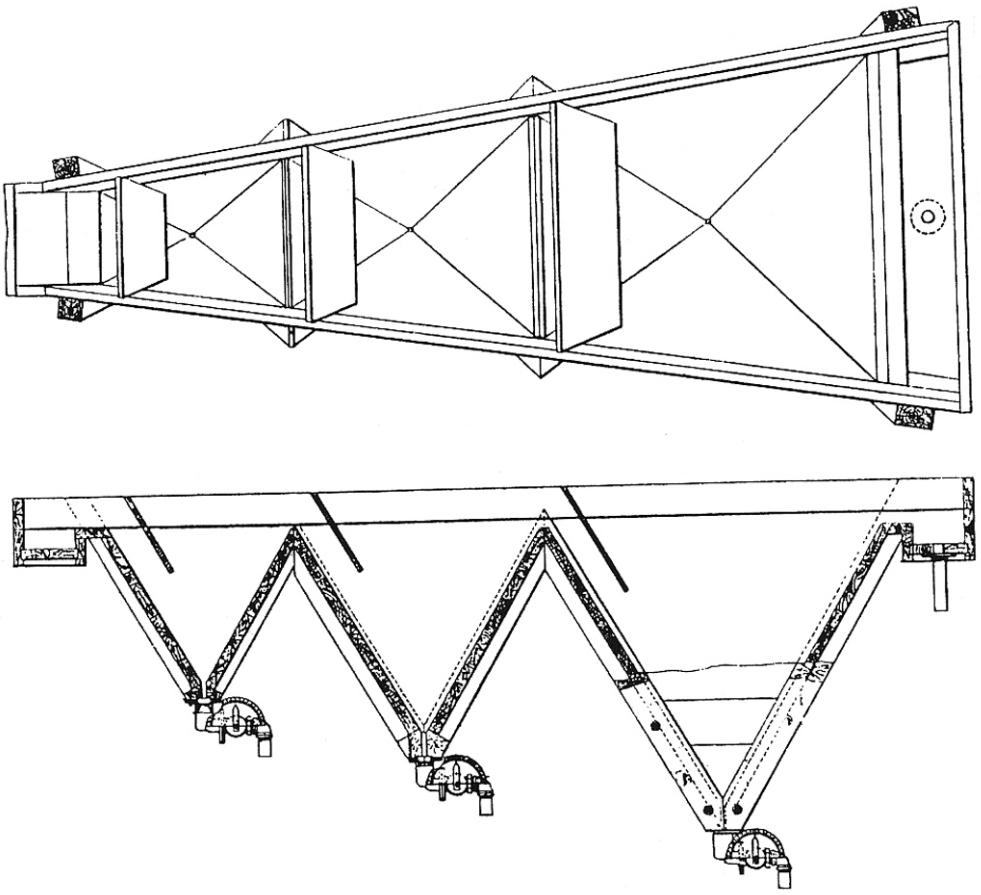


Plate 9

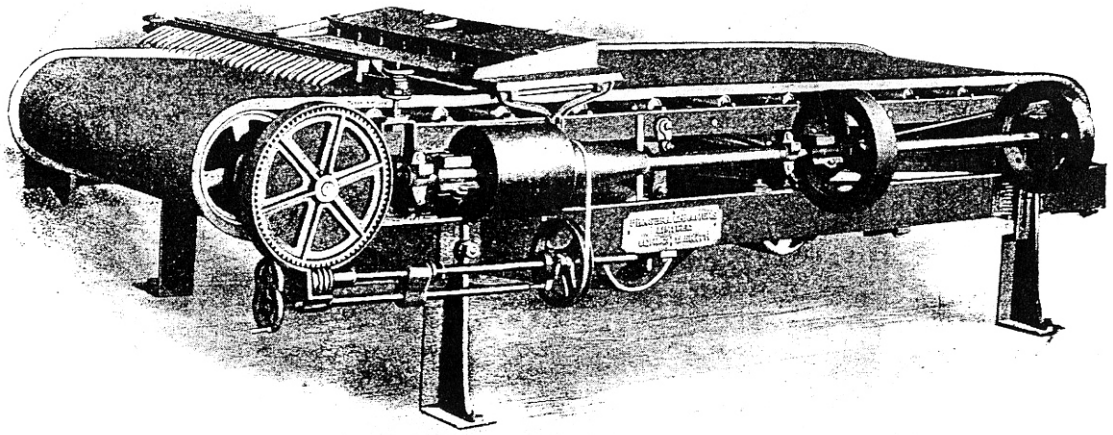
Plan and vertical section of Spitzkasten (Louis, 1909).

STAMP BATTERIES

With Mortar Boxes specially adapted to
Preparing Ores for Concentration

FRUE VANNERS, VANNING BUDDLES, WILFLEY TABLES AND WILFLEY SLIMERS,

FOR DRESSING TIN ORES.



(FRUE VANNER)

WATER JACKET SMELTING FURNACES,

Of Latest Approved Design for Tin Slags and Copper, Lead, and Nickel Ores.

REVERBERATORY FURNACES,

AND

Equipment for **ROASTING** & **SMELTING** Tin Concentrates.

All kinds of

MINING, MILLING & SMELTING PLANTS.

FRASER & CHALMERS, Ltd.,

3, LONDON WALL BUILDINGS, E.C.

Works:
ERITH, KENT, ENGLAND.

Cable Address:
"VANNER, LONDON."

Catalogues on Application.

Plate 10

Historic advertisement showing belted frue vanner.

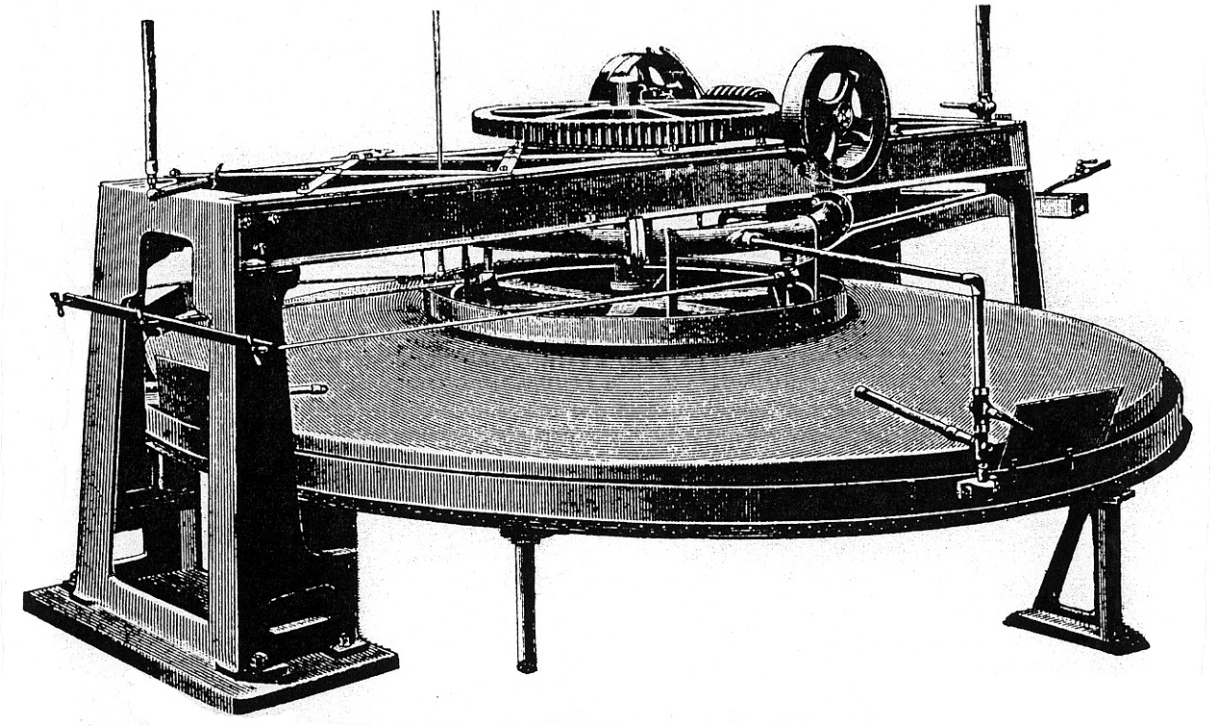


Plate 11

Historic illustration showing revolving slime table (Louis 1909)

APPENDIX 2
Historic survey photograph

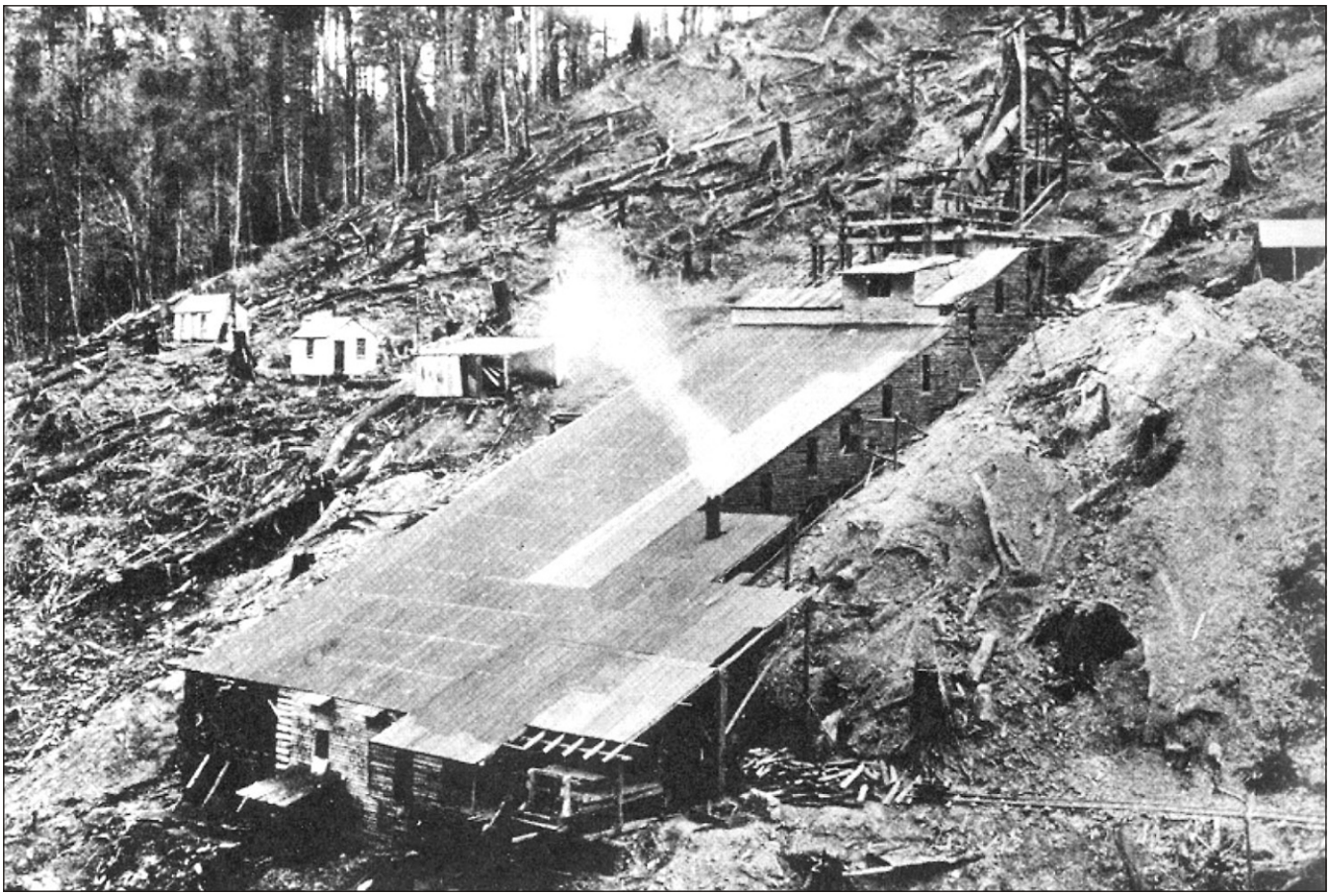


Plate 12

Undated view of the Cleveland mill taken between 1907 and c1918.

Appendix 3

Historic map

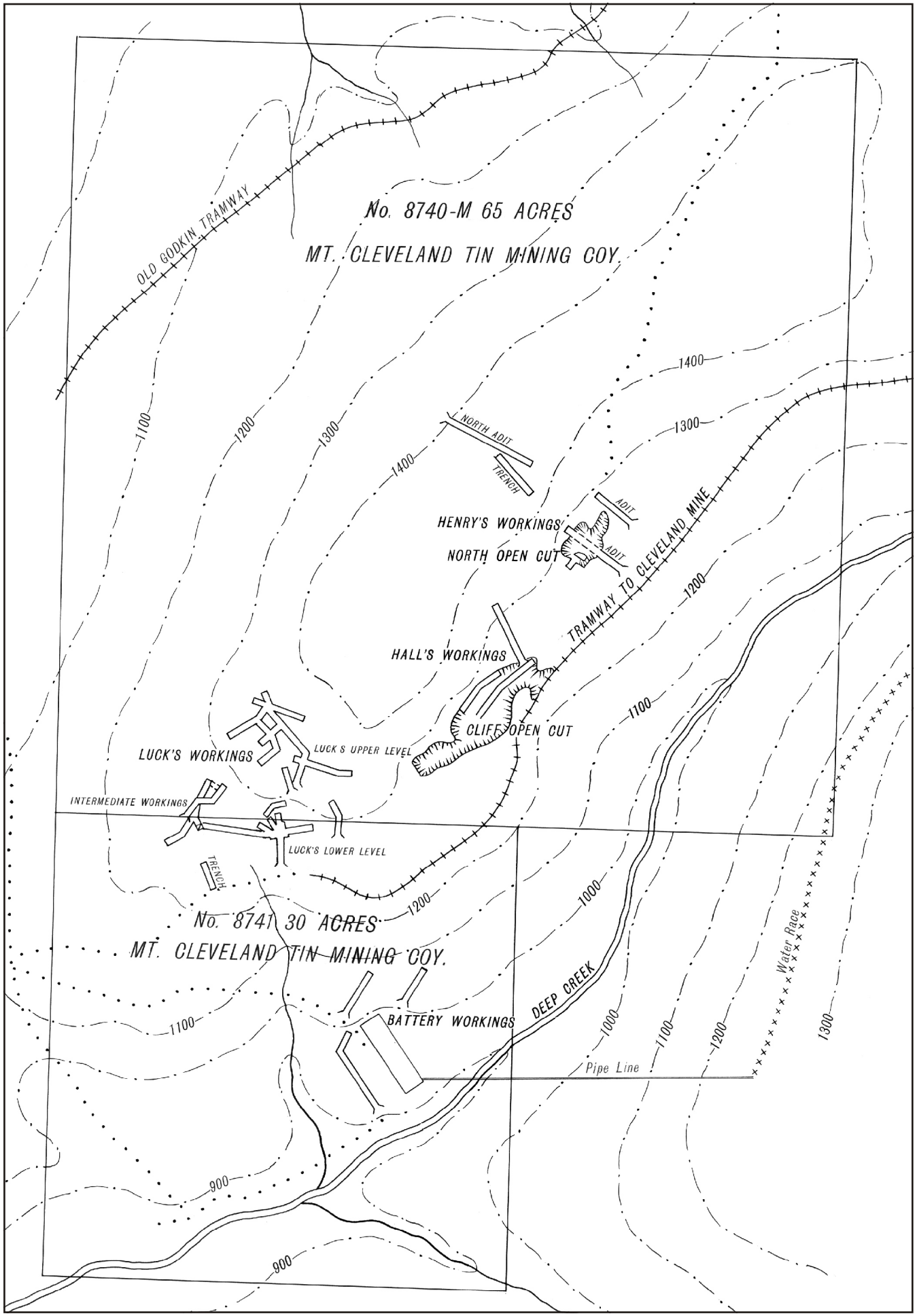


Plate 13

Geologist A. M. Reid's 1923 map of the Cleveland mine showing mine workings, mill/battery and water conveyance.

APPENDIX 4

Contemporary survey photographs

Plate 15

Grinding/amalgamating pan at the Cleveland mill.

Plate 14

Grinding/amalgamating pan at the Cleveland mill.

Plate 17

Stamp battery shafts and shoes.

Plate 16

Stamp battery shafts and shoes.

Plates 18

Ten-head stamp battery flywheel and cams.

Plates 19

Ten-head stamp battery flywheel and cams..

Plate 20

Detail view of grinding/amalgamating pan gearwheel.

Plate 21

In situ mortar box from ten-head stamp battery.

Plate 22

Blake crusher lying upside down beside stamp battery remains.

Plate 23

Pulley wheel to one of the Wilfley-type sorting tables.

Plate 24

Southwesterly view of timber retaining wall supporting secondary crushing plant.