Talk given at Pacific Northwest Regional AIME meeting April 18, 1958 in Spokane

THE GEOLOGY OF THE LOVITT GOLD MINE

WENATCHEE, WASHINGTON.

INTODUCTION

After nine years of continuous operation it is a good time to take stock of the geological concepts that guide the operation of a mine. We therefore welcome the opportunity to talk about this gold mine that has been a challenge in both the geological and the operational fields.

As is frequently the case the more data that becomes available as the workings expand the more complicated the geology appears ~~to get~~.

In this brief account statements are made that in a more expanded paper would be hedged in by various qualifications.

It is a common saying that no two geologists agree and we must admit that we do not on a number of details but we have endeavoured to present a united front which may, however, be cracked by the discussion afterwards!

SITUATION

The mine is ideally situated about three miles from the centre of the city of Wenatchee, in Washington State and one and a half miles from the Columbia River. It is alongside the paved highway that extends up the Squilchuck valley and it receives electric power from Chelan County P. U. D.

The elevations on the property range from 1000 feet up to 2200 feet. These pictures show the appearance of the terrain at the mine. (1-6) Prominent ridges are formed from silicified zones and Rhyolite dykes.

Wenatchee is the county seat and the principal shipping point of the local apple industry for which the area is justly famous.

The district is fortunate in the abundance of hydro-electric power that is available on the Columbia River.

The mining operation is unusually well off not only because of the power but also excellent road and rail transportation, modern living conditions, plentiful supplies, varied repair services and experienced miners.

HISTORY

The ground was first staked in 1885 as the Gold King mine but it was not until 1894 that a small stamp mill was erected containing five stamps weighing 500 pounds each. A very poor recovery was obtained so that milling soon stopped and has never been resumed. The reason for the low recovery we now know was due to the finely divided state of the gold which the comparitively coarse grinding of the stamps would not release for amalgamation to be effective. Cyanidation had only just been introduced and was probably not appreciated by the small operators at this mine.

The two key claims were always kept in good standing however and Mr. J. Keegan of Wenatchee obtained an option in 1934. He explored the holdings and interested various mining companies in his findings so that considerable sampling and tunnelling was done but it was not until 1949 that it became a successful mine under the management of the Lovitt Mining Company.

Since the first production in August 1949 until the end of 1957 a total of 446,025 tons were shipped to the Tacoma Smelter where this highly siliceous ore is found to be an excellent flux.

The gross content of this ore amounted to 189,404 ounces of gold and 217,328 ounces of silver with a total value of $6,612,569 or an average of $15.27 per ton.

GENERAL GEOLOGY

The Wenatchee area is mostly underlain by gently folded Eocene continental deposits known as the Swauk Formation which consists of sandstones, shales and conglomerates that are often only partially consolidated.

Above an elevation of 2000 feet there are flat-lying Miocene Volcanics known as Columbia River Lavas which once must have covered the whole area.

The sediments of the mine formation are the oldest rocks exposed in the area. They ressemble the usual Swauk sediments but are more indurated and fractured. They were tilted up on edge to form an island chain against which the Swauk sandstones were piled.

The map and section (slide 7) show the distribution of the rock types in the mine area. The belt of mine rocks stands at a steep angle with about 1000 feet of older coarse conglomerate to the east and a sandstone - shale series overlying it in the form of synclines on both sides. In the past lignite seams have been explored in these younger sediments. They also contain a layer of silica sand that was once exploited.

The area was sliced up by a northerly trending zone of steep faults probably before the younger sediments were deposited.

Then rhyolite with perlitic facies and minor andesite were intruded as dykes along some of these faults. The sediments in the mine belt became pyritised, silicified and permeated by numerous quartz veins over a distance of two miles and a width of 300 feet.

The next slides illustrate the geology as seen on the surface. (8-15)

M I N E G E O L O G Y

A typical section from east to west through the mine shows several hundred feet of conglomerates with mostly vertical dips. (slide 16) Then about 100 feet of feldspathic and arkosic sandstones with minor clay seams. Next there is the important Footwall Fissure which is a clay bed with associated argillaceous sandstone up to 50 feet wide and dipping steeply west. This is followed by more feldspathic sandstone with some pebbly layers for a few hundred feet; it is usually pyritised and often highly silicified. Clay partings and thin argillaceous beds often show signs of movement. (slide 17)

Completely carbonized plant material such as leaves, twigs and small logs are common in the sandstones, especially near the footwall fissure. (slide 18)

Cross-bedding both on a large and small scale is typical in these sandstones which are of lacustrine origin.

No intrusives have been found in the mine workings apart from some perlitic rhyolite near the portal of the main haulage tunnel on the 1150 level.

At times a fine textured dark arkose with scattered feldspar grains simulates a bedded dike rock.

S T R U C T U R E

The major fault zone in which the mine is situated consists of more than ten parallel tear faults in a width of 1½ miles as shown on the geological plan in this slide.(19) The movement was apparently such that the east side of the area moved ½ mile south relatively to the west side. The weak clay beds and seams took up some of the movement and so became faults as well.

Between two of the main faults a block about 1000 feet wide has moved south on a flat-lying fault. The amount of movement is not yet known and only recently has ore been found below this fault. Where it has cut obliquely across the weak clay with interbedded sandstones it has produced a zone of lustrous shale fragments with blocks of broken sandstone.

As mentioned above a shale horizon near the base of the older sandstones became a strong fault that is known as the Footwall Fissure. The sandstone beds adjacent to it were severely dislocated in several directions to produce fractures that were subsequently filled with quartz to form veins and systems of veinlets.

V E I N S

The mine is divided into two areas by a strong north-south fault in the southwest area the auriferous veins always have a dip to the north of 60° to 80° and in the northeast area it is 30° to 50°. Only this latter area is underlain by the flat fault described above.

In the southwest area there are later south dipping and vertical barren veins that offset the auriferous veins whilst in the northeast area a series of northerly trending vertical veins also offset the ore bearing veins.

There is a fairly regular pattern of major veins especially in the southwest area that have been mined as separate entities but the bulk of the tonnage produced is from zones of veins and veinlets that extend for as much as 300 feet along the footwall fissure on the level, for a vertical range of 200 feet and extending out from the fissure for an average of 50 feet. Much of this ore is mined en masse by rings of long holes. Where the average grade is too low it is sometimes possible to stope out selectively a high grade vein. In the next slide (20) it was found that only the flater vein on the left was economic to mine.

Here (slide 21) is a simplified plan of the 1250 level and the corresponding longitudinal section.

Next (slide 22) a close up of the south end of this plan followed by (slide 23) a cross-section in this area.

The next two slides (24 & 25) show the ore-body located in the angle between the footwall fissure and the flat fault and also a new ore area recently located alongside a secondary faulted clay bed.

Now here is (slide 26) a close up of the south end of the 1250 plan and section showing the principal ore-body in this area. It consists of innumerable veinlets and some extensive veins as shown in greater detail in this slide (27) of a plan and cross section.

Significant gold values have been found on the surface up to an elevation of 1800 feet and underground down to the lowest exploration drill hole at 750 feet giving a vertical range of at least 1050 feet for the occurrence of ore.

So far stoping has been done from an elevation of 850 feet up to 1600 feet.

M I N E R A L O G Y

The vein quartz is cherty and usually pure white with vague patches and banding that are slightly grey in colour. Sometimes a vein consists partly or wholly of black chert which is often a sign of good ore. In some areas large masses of sandstone have been irregularly replaced by black chert that may or may not be auriferous. As much as 30% of a vein may be calcite.

Usually there are about equal parts by weight of gold and silver in the ore. No visible gold is seen and the vein quartz is almost free of sulphides so it is suspected that electrum is the valuable mineral.

One small vein in the mine assays about 25 oz of silver and only 0.20 oz of gold per ton. Tiny nests of a silvery mineral that could be argentite can be distinguished in this ore by means of a lens.

The oxide ore near the surface usually carries two to three times as much silver as gold by weight. This may be due to secondary enrichment or to an original condition near the top of the ore-bodies.

The sandstone country rock, particularly near the veins, is usually impregnated with fine pyrite that could amount to 1% by weight of the rock. The oxidation of the pyrite gives the outcrops of the sandstone a pronounced red and yellow stain as seen in the photographs.

CONCLUSION

This mine is still responding to development and the geological picture that has been presented here suggests that it could continue to do so for many years. However the factor of a gradual increase in costs with no compensatory increase in the price paid for the product that has bedevilled gold mining for the past 12 years will inevitably shorten the life of the mine.