SIMILKAMEEN MINING COMPANY LTD.

ABSTRACT

The 15,000 tpd Similkameen open pit copper mine, 10 miles south of Princeton, B.C., started production during 1972. The two main ore zones are separated by the deep canyon of the Similkameen River, with the Ingerbelle or western deposit being mined first. The location, design and construction of the plant were complicated by the steep terrain and the situation of the orebodies.

Mining, utilizing 10 cu.yd. electric shovels and 100 ton electric-wheel trucks, is conventional. Closely integrated with the preproduction mining was the construction of a 4 mile section of main highway to bypass the Ingerbelle pit. This entailed a very large fill, placed with mine equipment.

Ore is crushed to minus 9 inches, stockpiled and reclaimed for direct delivery to three 32-ft-diameter by 14 ft. single-stage autogenous grinding mills, each driven by two 4000 hp motors. Because of the friable ore in the upper part of the mine, 4 inch balls are added, with higher than design throughput attained. Classification is by 96 inch spiral classifiers and cyclones. The flotation section comprises three parallel lines of ten 400 cu. ft. rougher-scavenger cells and a single line of 100 cu. ft. cleaner and recleaner cells. Concentrate is transported in end-dump, closed trucks to Vancouver for dockside storage prior to shipment to the smelter.

Tailings are piped across the canyon on a suspension bridge and through a tunnel to an impoundment area. Water is reclaimed and returned to the concentrator, forming a closed system. Dams are raised with cycloned sands, with the downstream section compacted.

INTRODUCTION

The Similkameen project would have involved a fairly routine low-grade open pit copper mine and treatment plant except that the two main ore deposits are separated by a deep canyon, the concentrator and tailings impoundment areas are on opposite sides of the canyon and a highway traversed one of the orebodies. Also, the concentrator was designed for fully autogenous grinding with very large mills.

These factors, together with the steep, rugged topography, presented some interesting problems in design, construction and logistics. This paper will mainly describe these problems and how they were handled, with only a brief description of mining and milling practice.

LOCATION AND HISTORY

The operation of Similkameen Mining Company Limited, a wholly owned subsidiary of Newmont Mining Corporation, is located in southern British Columbia about 170 miles east of Vancouver. It is 10 miles south of the town of Princeton and about 20 miles north of the U.S. border.

The Princeton area has a long history of mining and many of the claims now owned by Similkameen were staked around 1900. The Granby Mining Company operated the Copper Mountain mine from 1923 until its closure in 1957. In 1966 Newmont acquired the Ingerbelle property on the west side of the Similkameen River and in 1967 purchased all of Granby's assets in the Princeton area and formed Similkameen Mining Company Limited. After an extensive program of surface and underground drilling, metallurgical testwork and engineering studies, a decision was made in June 1970 to place the property in production. Preproduction mining and construction of a concentrator and related facilities to treat 15,000 tons of ore per day were started. In April 1972, the first of the three grinding units was run in and by September 1972 the mine was in full production.

DESCRIPTION OF PROPERTY

The Similkameen property consists of two main ore zones, the "Ingerbelle" deposit on the west slope of the Similkameen valley and the "Similkameen" deposits on the east slope, adjacent to the old Copper Mountain mine. These two areas are separated by the deep canyon of the Similkameen River. Ore reserves developed to date total 76 million tons minable by open pit methods, with a grade of 0.53% copper and an average ratio of 2.2 tons of waste to 1 ton of ore. In addition, an appreciable tonnage of ore of similar grade will likely be recoverable by open pit operations from the caved area of the old Copper Mountain mine. Ore mineralization is chiefly chalcopyrite, with minor but important amounts of gold and silver.

The topography in the vicinity of the ore deposits varies from fairly steep on the upper slopes of the valley to nearly vertical in the river canyon, with elevations ranging from 3,700 feet at the top of the Ingerbelle pit and 4,200 feet at Copper Mountain to 2,500 feet at river level. The only suitable area for tailings storage was a valley north of the orebodies and east of the river. Also, the total ore tonnage had to be considered as a whole in order to justify a large enough mining and treatment rate to obtain the necessary low operating costs. This combination of rugged terrain, widely separated orebodies, transportation of tailings and economic considerations required a great deal of investigation and study before the plant location and mining plans were finally decided.

It was decided to mine the Ingerbelle deposit first, with the ore trucked from the pit to a crushing plant and concentrator located on the same side of the river and about 1 mile to the north. Tailings are transported by pipeline across the canyon on a suspension bridge to an impoundment area and reclaimed water is pumped back over the same bridge to the mill for re-use. The mine repair shop is close to the Ingerbelle pit, with the offices, warehouse, laboratories and machine shop adjacent to the concentrator.

Toward the completion of the Ingerbelle pit, mining operations will be started on the Similkameen orebodies on Copper Mountain. A second crushing plant will be built east of the river and crushed ore from Copper Mountain will be carried by belt conveyor across the canyon on a second suspension bridge to the existing concentrator.

The Southern Transprovincial highway, a heavily travelled route across British Columbia, crossed almost over the center of the Ingerbelle orebody. In order to mine this area, it was necessary to relocate a 4 mile section of highway west of the pit limits. Designing and constructing this road, which was built at Similkameen's expense and largely by company forces, was an important part of the preproduction program.

Design of the plant electrical system presented a number of difficult problems, particularly in regard to starting the very large mill motors. Power for the plant is supplied by B.C. Hydro over a new 68 mile 138 Kv transmission line financed by Similkameen.

MINING

Mining to prepare the Ingerbelle pit for production was started in December 1970 and about 23.5 million tons of waste rock and alluvium were removed during preproduction operations. Mining is currently proceeding at the rate of 85,000 tons of ore and waste per day on a three-shift schedule, five days per week, to supply the concentrator, which operates on a continuous basis.

The Ingerbelle pit has a bench height of 40 feet. Drilling is on a 22- by 22-ft pattern using three electrically powered, 60-R rotary drills. Hole size is 9-7/8 inches and the holes are drilled 9 feet below grade. Blasting is mainly done with ANFO, with plastic sleeves used in wet holes.

Four 10 cu. yd. electric shovels are provided for loading, with three normally used at one time. Pit cleanup is done with three rubber-tired bulldozers. A 15 cu. yd. front-end loader is used to supplement the shovels and for loading jobs outside the pit area. The hauling fleet consists of fifteen 100 ton capacity, electric-wheel trucks powered with 1,000 hp engines.

Mining during the early stages of development was complicated by the proximity of the old highway, which was very heavily travelled, particularly during tourist season. Traffic was stopped daily during blasting operations, but by careful co-ordination and the use of radio communication this delay was eventaully reduced to less than five minutes per day.

HIGHWAY CONSTRUCTION

As previously mentioned, a new section of main highway a little over 4 miles in length was constructed west of the pit to replace the existing highway which traversed the Ingerbelle orebody. It was necessary

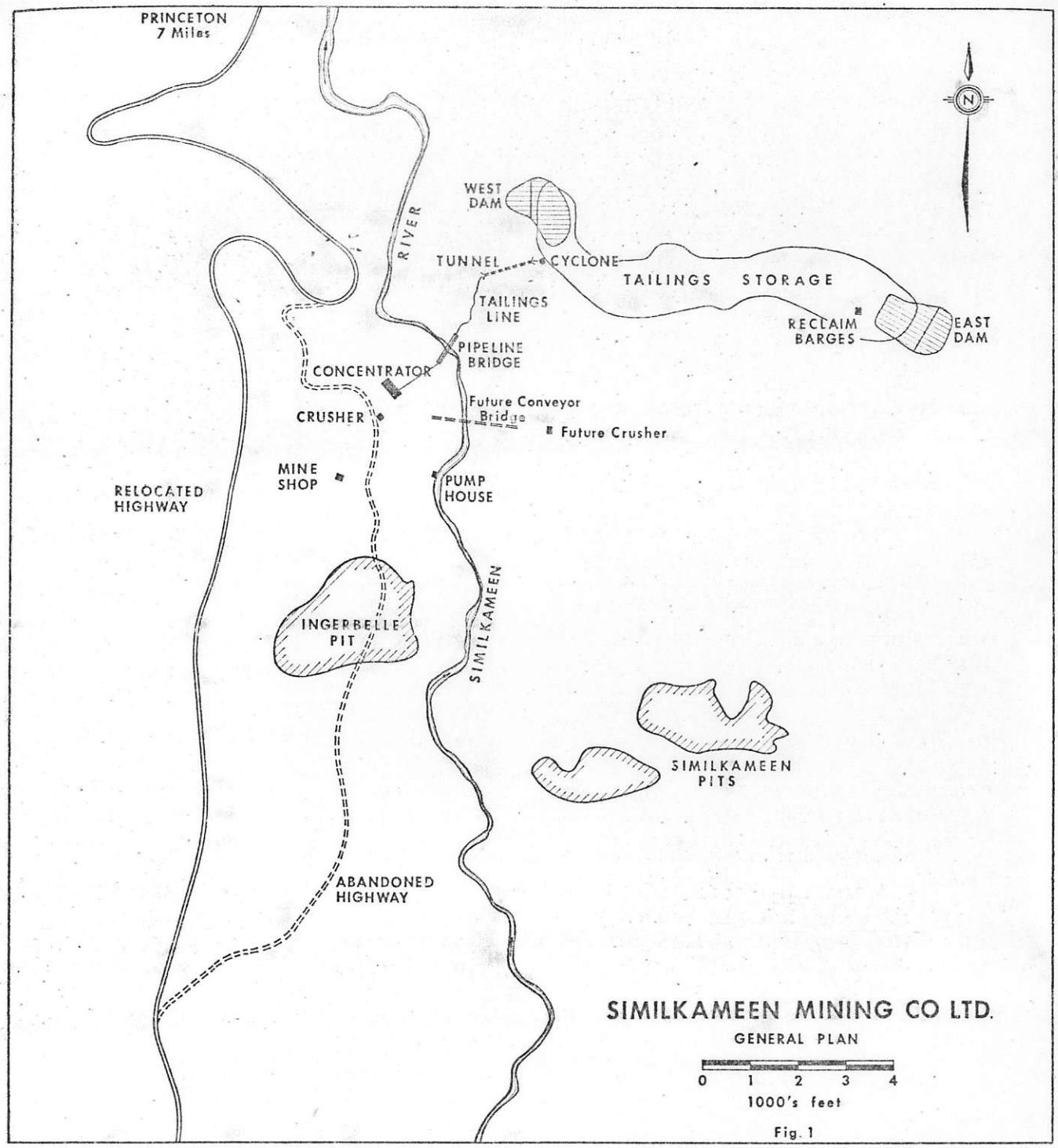

FIGURE 1 — General Plan — Similkameen.

to complete this new road, including paving it, by September 1971 in order that the old road could be removed before the concentrator start-up early in 1972. Because of late delivery of equipment this resulted in a very tight schedule.

To obtain the grades and alignment specified by the B.C. Department of Highways the route required several large fills. As it was decided to build these with mine equipment, using waste material removed while stripping the orebody, the road construction was closely integrated with the mining program.

The right-of-way was cleared and the road grade was constructed, except for the fills, by a contractor. Access roads were then built from the pit to the fill areas and construction of the fills started by mine personnel.

The fill material, composed of well-graded blasted rock and alluvium, was placed in 10 foot thick layers. Continual travel of the single axle mine trucks, with a gross weight of about 165 tons, over the surface of the layers produced excellent compaction. The first two fills were relatively small, containing 250,000 tons and 800,000 tons respectively, and were fairly easy to build.

The third fill, however, was in the form of a curve which crossed and partially followed a deep ravine. This fill, believed to be one of the largest ever built for highway purposes, was 300 feet deep at its deepest part and, when finished, contained almost 7 million tons of compacted material. Constructing access roads and placing this amount of material in 10 foot layers was a major job.

A haul road at minus 10% grade was built down the sides and along the bottom of the ravine. The material was then placed in layers to the required limits, retreating successively up the haul road to the final elevation. As each layer was put down it was capped with alluvium to help prevent tire wear. Trucks were routed over the entire surface of each layer to obtain uniform compaction.

After completion of the new highway, a safety berm built of mine waste rock was constructed on the lower side of the road. This berm, about 100 feet wide and 15 feet higher than the road surface, parallels the highway for about 4,000 feet. The slope facing the highway has been planted with grass and the surface planted with grass and trees. This forms a "green belt" and an effective screen between the highway and the mining operation.

PROCESS DESCRIPTION

Pit-run ore is delivered by 100 ton capacity trucks to a 54- by 74-inch gyratory primary crusher with an open side setting of 9 inches. The crushing plant is designed for one man operation and has no superstructure except the operator's control cab. Servicing of the crusher