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"Technical Support for Grassroots Public Interest Groups"

FACT SHEET

PEBBLE - FORT KNOX COMPARISON[1]

FORT KNOX / PEBBLE -- KEY DIFFERENCES		
	Fort Knox	**Pebble**
Target Metals	**Gold Mine**	**Copper Mine with Gold and Molybdenum**
Production Rate	**36,000 - 50,000 tons/day**	**100,000 - 200,000 tons/day**
Tailings	**200 million tons**	**2.5 billion tons**
Water Usage	**4.9 cfs**[2]	**114 cfs**[3]
Processing	**Cyanide Vat Leach**	**Xanthate Floatation**
Potentially Acid Generating Waste?	**No**	**Yes**

Background

The Fort Knox mine is being cited as an analog to the Pebble mine. Similarities cited are a large open pit, a tailings dam for processed ore disposal, and waste rock piles for unprocessed mine waste. However, as the proposal for the Pebble mine continues to develop, the similarities between the two mines continue to lessen.

Fort Knox is a gold mine, utilizing open pit mining methods. The ore is crushed and ground, then processed using cyanide to extract gold in a series of vats. A gold-silver brick is the final product of the mine processing. Tailings remaining after the gold has been extracted are pumped to a tailings pond. Waste rock[4] is placed in waste rock dumps adjacent to the open pit. Neither the tailings nor the waste rock at Fort Knox are potentially acid generating.

Pebble is a polymetallic mine (copper-gold-molybdenum), which will use xanthate-assisted floatation to produce several metal concentrates. The metal concentrates will be shipped offsite for final metals recovery. It is likely there will be little or no cyanide used at Pebble because of the refractory (cyanide consuming) nature of the ore. A portion of the tailings and waste rock will be potentially acid generating (PAG), and will require special storage and monitoring. Most of the PAG material, both tailings and waste rock, will be placed behind the tailings dam so that a water cover can be maintained over this material. The water cover is designed to limit the amount of available oxygen, hence limiting the amount of acid and metals produced. This cover must be permanently maintained in order to prevent acid generation.

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[1] This Fact Sheet was prepared by David Chambers, Center for Science in Public Participation, Feb 2007. It reflects information published by Kinross Gold (Fort Knox) and Northern Dynasty Mines (Pebble) from 2004 -2006.
[2] Fort Knox-True North Annual Activity Report, Kinross Gold. February 2005, Table 9, p. 13 of 14.
[3] ADNR Application for Water Right, for the North Fork Koktuli River, South Fork Koktuli River, and Upper Talarik Creek - Northern Dynasty Mines Inc., 7 Jul 06, (p. 3 of 4 on all 3 applications)
[4] Waste rock is rock that does not contain gold, or in which the grade of gold is too low to justify processing.

Size

The Fort Knox mine produces 36,000 - 50,000 tons/day of ore, and an equal amount of waste rock. The open pit at Fort Knox is projected be cover approximately 0.4 square miles at mine closure.[5] The tailings dam at Fort Knox is 330 feet in height, and will impound 200 million tons of tailings,[6] and the tailings dam and pond will cover approximately 1.75 square miles.[7] As of 2004 there was slightly more that 270 million tons of waste rock placed outside the pit at Fort Knox.[8]

Using presently available information, which is based on the open pit only, production at Pebble is projected to be between 100,000 and 200,000 tons per day of ore.[9] The open pit at Pebble will be approximately 1 x 2 miles in horizontal dimension,[10] and would be approximately 1500 feet deep. The largest of the tailings dams at Pebble will be 740 feet in height and will store approximately 2 billion tons of tailings, as well as approximately 900 million tons of potentially reactive waste rock.[11] The tailings area will cover 6.6 square miles.

Fort Knox is a medium-sized open pit mine. Pebble will be one of the largest mines in North America.

Open Pit vs. Block Caving

As of early 2007 Northern Dynasty has proposed that the Pebble mine will use the underground block caving mining method.[12] The primary disadvantage of block caving is that it removes much of the supporting rock from underneath the overburden, which often leads to subsidence of the surface.

Once the surface is ruptured, water can percolate down through the rubble-rock material remaining in the mine. If there are contaminants in the rock, either due to the decomposition of sulfide minerals (e.g. heavy metals like copper, zinc, lead, cadmium, or mercury) or from flushing neutral drainage metalloids (e.g. arsenic, selenium, thallium or antimony), these contaminants can flow downgradient to mix with groundwater and/or surface water. With block caving, as with open pit mining, it is very important to understand the hydrology around the minesite. If water is likely to migrate from the minesite through groundwater paths, offsite water contamination is likely to result.

Fort Knox is an open pit mine, and the open pit is upgradient from the tailings pond, so all surface and subsurface drainage from the pit reports to the tailings pond.

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[5] Fort Knox Mine Environmental Assessment, CH2M Hill, August 1993, p. 2-27.
[6] Fort Knox mine statistics from Project Description for the Fort Knox Mine, Fairbanks Gold Mining, Inc., July 1997.
[7] Fort Knox Mine Environmental Assessment, CH2M Hill, August 1993, p. 2-40.
[8] 2004 Annual Activity Report, Fairbanks Gold Mining, Inc., February 2005
[9] 2004 Summary Report on the Pebble Porphyry Gold-Copper Project, Northern Dynasty Minerals, March 31, 2005, p.24
[10] Facilities Description In Support of a Water Rights Application, South Fork Koktuli River, Northern Dynasty Mines, Inc. no date, Figure 2.4
[11] Ibid., Section 2.1.1.
[12] Even if underground block caving is utilized as a mining method, it is still highly likely that the ore located in the original Pebble deposit (now being called Pebble West), which is somewhat lower grade than the ore at Pebble East, outcrops on the surface, and will probably be mined by open pit methods.

Potentially Acid Generating vs. Non-Acid Generating Ore

The ore at Fort Knox is relatively low in sulfur with little other non-gold mineralization. In the mineralized zones at Pebble, sulfur mineralization is typically between 1 and 5 percent sulfur, up to maximum concentrations near 9 percent.[13] Although sulfide mineralization at this level does not guarantee that acid mine drainage will occur, there are many examples of mines with similar levels of sulfide mineralization with this problem.

The Pebble ore will be processed to produce copper, molybdenum, gold and silver. There are also significant amounts of iron (the most common sulfide mineral), with some antimony, arsenic, and selenium.[14] These metals are not present in large enough quantities to justify economic recovery, so they will remain in the waste. In addition, mine rock that does not contain enough economic mineralization, but still has elevated levels of sulfide minerals, will become waste rock. This PAG waste rock must be carefully identified and segregated from the non-PAG waste rock, and placed in the tailings pond where it can be permanently covered with water. If this material were to be placed in the normal waste rock piles, oxygen and water would be readily available, and metals could be leached from this waste.

The mineralized rock at Pebble contains enough sulfide mineralization to be classified as Potentially Acid Generating, the mineralized rock at Fort Knox does not.

Greenfield Development vs. Existing Infrastructure

The Fort Knox mine is located on Gilmore Dome 25 miles northeast of city of Fairbanks, Alaska's second largest metropolitan area. It is adjacent to an existing road system, and all of the necessary supporting infrastructure, including housing and power, is available in Fairbanks.

The Pebble mine is located in a remote area, and would require construction of a road to supply construction and operating materials, a power plant, and the infrastructure necessary to provide lodging and services for at least some of the mine work force. Unlike the Fort Knox situation, Pebble would necessitate major changes to the area around the mine. A road roughly 104 miles long would be built to connect the mine to Cook Inlet. The socioeconomic, and potentially the environmental impacts associated with the infrastructure needs at Pebble would cause far more change than did those at Fort Knox/Fairbanks, both due to the present undeveloped nature of the Lake Iliamna area, and the relatively large scale of the Pebble mine.

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[13] "Draft Environmental Baseline Studies 2004 Progress Reports, Chapter 8, Geochemical Characterization & Metals Leaching/Acid Rock Drainage," Northern Dynasty Mines, Inc., June 2005, p. 8-10.
[14] Ibid., Table 7.