TECHNOLOGY FOR THE RECEIVING AND CRUSHING OF OXIDIZED ORE AT THE MARJONBULOQ GOLD RECOVERY PLANT

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ABSTRACT

This article highlights the technological features of ore reception, batching, blending, and crushing processes at the Marjonbuloq Gold Recovery Plant. It provides a technological justification for the separate storage of ores based on their mineralogical composition, with sulfide ores supplied from the Zapad Peremichka and Zapad Tangi open-pit mines and oxide ores from the Sariqbel open-pit mine. The article emphasizes that the processing scheme is directly influenced by the form in which gold occurs: in sulfide ores, it is associated with pyrite and arsenopyrite, whereas in oxide ores, it is found in a free state or associated with iron hydroxides. The processes for forming 300-ton batches in production, along with sampling and preparation for analysis using the coning and quartering method, are described. Based on laboratory analyses, it is demonstrated that blending is performed to create a technological mixture with a stable granulometric and chemical composition. At the coarse and fine crushing stages, a jaw crusher and a ball mill are utilized, and the importance of maintaining pulp density within the 1900-2000 g/l range is substantiated. The research results highlight the significance of the technological control system in optimizing the granulometric composition, increasing the degree of mineral particle liberation, and ensuring the stability of subsequent cyanidation-sorption processes.

Ore is a naturally occurring mineral formation containing a metal or its compounds in quantities that are economically viable for industrial-scale extraction. Based on its mineralogical composition and metal content, it is classified into rich (high-grade) and poor (low-grade) types. Ores are also categorized by their mineral composition into silicate, oxide, sulfide, carbonate, and mixed types. This classification is crucial for selecting the appropriate technological scheme and processing method. The Marjonbuloq Gold Extraction Plant is supplied primarily with sulfide ores from the Zapad Peremichka and Zapad Tangi quarries, and oxide ores from the Sariqbel quarry, as shown in Figure 1.

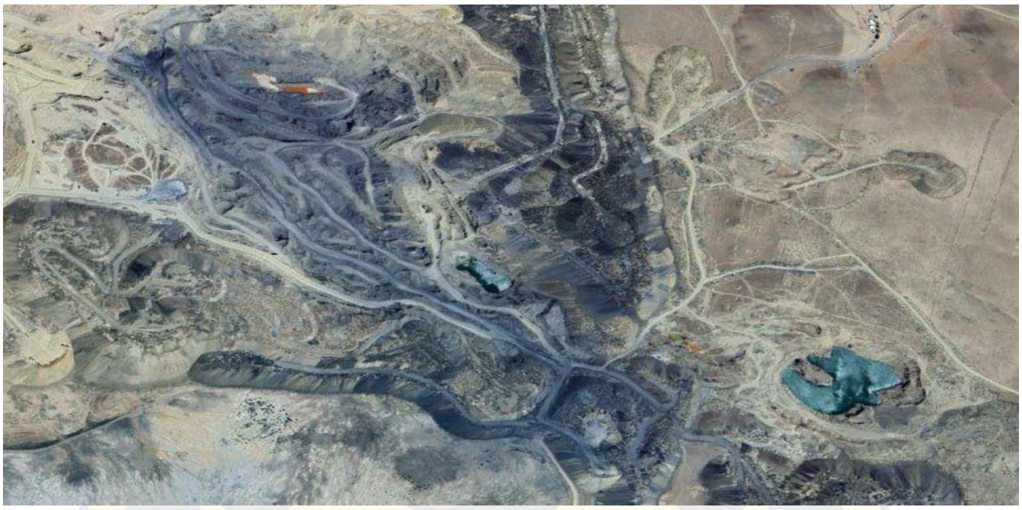

Figure 1. Zapad Peremichka, Zapad Tangi, and Sariqbel quarries.

In sulfide ores, gold is primarily found in association with pyrite and arsenopyrite, whereas in oxide ores, it occurs in a free state or is associated with iron hydroxides. Therefore, it is technologically crucial to store the ores separately and avoid mixing them, as their grinding characteristics, reactivity in subsequent hydrometallurgical processes, and overall processing properties differ. The ore delivered to the plant is first weighed and stockpiled in a designated ore yard. According to the technological parameters established for the production process, a single ore set should not exceed 300 tons. Each 300-ton set is registered as a separate batch and assigned a batch number. The Quality Control department takes a sample from each truckload, which are then combined until a full batch is formed. These composite samples are mixed, reduced using the coning and quartering method as shown in Figure 2, then crushed and submitted to the analytical laboratory.

Figure 2. Quartering method

Based on laboratory analyses, the average gold and silver content of a batch is determined. This data serves as the basis for subsequent charging and technological planning. During the charging process, various batches are mixed in specified proportions to create a technological mixture with a stable granulometric and chemical composition. This procedure is performed to ensure the stable operation of the crushing and cyanidation processes, increase the degree of gold liberation, and reduce reagent consumption. In the coarse crushing stage, the ore is processed in a SHDP-12x15 jaw crusher, as shown in Figure 3. The initial size of the ore chunks must not exceed 1000 mm. As a result of crushing, the product size is reduced to approximately 300 mm. The crushed ore is then transferred to a collection bunker with a capacity of 1100 tons via a conveyor that is 94.1 meters long, 1200 mm wide, and has an incline angle of 16°, ensuring a continuous transport process.

Figure 3. SHDP-12×15 type crusher and conveyor

The ore is ground to liberate the mineral particles and separate the gold from the ore matrix. The ore, crushed to a size of 300 mm, is fed into an MMS 70×23 model ball mill. Here, the ore is processed with water. The amount of water is selected so that the density of the pulp exiting the mill is approximately 1900-2000 g/l. Controlling the pulp density is a critical parameter for grinding efficiency and the subsequent hydrometallurgical stages. As a result of grinding in the ball mill, 35-40% of the ore is ground down to the -0.074 mm fraction. Figure 4.

Figure 4. MMS 70x23 ball mill

This level of grinding ensures sufficient liberation of gold particles from the mineral matrix. The resulting pulp is the finished product of the grinding section and is transferred to the next technological stage: the cyanidation and sorption processes. Thus, at the Marjanbulak plant, the processes of ore reception, batching, blending, and grinding rely on a scientifically-based control system. Optimizing the particle size distribution, maintaining a stable pulp density, and accounting for mineralogical characteristics determine the plant's overall metal recovery rates and ensure technological efficiency.

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