Surveying technology in the Edo Period

The Minamizawa Drainage Tunnel was drilled only by chisels and hammers so that it had a one-degree inclination pitch from the mine to the sea. They started drilling from six points simultaneously in order to shorten the work period. The drainage tunnel was completed in six years with only a slight difference of at most one meter from the original plan for the 922-meter tunnel.

This drilling method needed an accurate surveying technology for distance, direction and inclination. The construction was planned by a Japanese survey engineer who had learned Dutch-style surveying technology. Merging Western and Eastern technologies, he completed drilling with the world’s highest surveying technology at that time.

Smelting technology in the Edo Period

“Cupellation”
Extracting gold/silver from its ore

“Cementation process with sulfur”
Separating gold from silver by using sulfur

“Cementation process with salt”
Purifying gold further by using salt

Producing gold/silver from its ore required a process of separating gold from silver after cupellation, with which they had removed impurities by using lead. In Sado Mine, cementation process with sulfur and cementation process with salt were also implemented to separate gold from silver. Those cementation processes had been implemented in the medieval period in Europe, but they disappeared with the development of other smelting techniques. Furnaces which are supposed to have been used for cementation process with salt were excavated in Sado. This makes Sado Mine valuable remains through which one can see a smelting technique which had already vanished in Europe.
Aikawa Gold and Silver Mine – after the Meiji Restoration

When the Meiji Government took control of Sado Mine, it hired British, American and German mine engineers to develop the mine by building vertical shafts and implementing the automatic dug rock delivery system. Gold and silver production increased thanks to modern mining technology introduced by those engineers. Under the name of “Sado Mine”, Aikawa Gold and Silver Mine was governmentalized in 1869. With modernized facilities and equipment, Sado Mine was successfully reborn as Japan’s premier mining operation. The government-operated Sado Mine assumed a leading role for private mines throughout the country, and helped develop Japan’s mining technology and educate Japanese engineers. The gold and silver production greatly contributed to stabilizing and further developing the Japanese economy. In 1889, Sado Mine became property of the imperial household under the jurisdiction of the Imperial Household Agency’s Property Administration Department. The mine was privatized in 1896 when it was sold to Mitsubishi. The mine gradually became short of high-grade ore, and the operation was finally suspended in 1989.

Odate Shaft
The Odate Shaft was the first vertical tunnel made with the guidance of a German engineer along with the advent of Western technology in 1877. Inside the shaft remains an American-made air compressor as well as a whim that was installed in 1939. The headframe was built in 1938.

Thickener
The thickener was completed in 1940. It measures 50 meters in diameter. It was used to separate mine tailings and water.

Oma Port
Oma Port was constructed to facilitate the shipment of ores and materials used in mining. The construction began in 1887 and finished in 1892.

Kitazawa Flotation and Dressing Plant
Kitazawa Floatation and Dressing Plant is a system to separate minerals and waste, and was once the largest plant of its kind in East Asia in 1930s. Following modernization in the late 19th century, Sado Gold and Silver Mine’s production volume drastically increased. In order to counteract economic blockade during the Second Sino-Japanese War, the administration implemented the 1938 production enhancement plan and actualized the processing capacity of 70,000 tons per month at this plant.