

TORIGATAYAMA

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MINING CO., LTD.

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Torigatayama
Quarry Complex

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Limestone – the gift of stone material from ancient times



Limestone is an underground resource formed as long as several hundred million years ago and a gift of stone material from ancient times, used to build structures such as the pyramids of Egypt and the Great Wall of China.

The limestone mined in Japan in particular includes significant portion from Paleozoic strata, said to be of good quality with very few impurities and the volume of deposits, considered to constitute multiple billions of tons, is one of the few mineral resources with which Japan can be self-sufficient as a resource-poor nation.

Currently, limestone applications extend to various industries, including glass, paper, fertilizer, food and medical goods, as well as steel, cement and construction aggregates, etc. There, limestone is an essential material and one of the ingredients playing a key role in our daily lives.

Mt. Torigata

Mt. Torigata (Kochi prefecture) 1,000 meters above sea level

Located around 45 kilometers west of Kochi city, Mt. Torigata towers up in the precipitous Shikoku Mountains. As its shape resembles a bird spreading its wings, it has been locally known as Torigata (bird-shape) since times of yore.

Mining has been performed safely on a daily basis, at a summit site over 1,000 meters above sea level; exposed to severe climate conditions, annual rainfall of between 3,000 to 5,000 millimeters or more and heavy year-round mist, as well as winter cold and accumulated snow, comparable to northern Japan.

Torigatayama Mine is one of Japan's largest limestone mines, with around 1.0 billion tons of abundant high-quality limestone. The limestone

mined from Torigatayama is classified as Chichibu Paleozoic strata and of extremely high quality, with very few impurities. Ever since starting our business in 1971, we have shipped overseas to countries such as Australia and Taiwan as well as Japan and earned great customer trust. Ore processing and shipping are executed after the mined limestone is transported to the seaside facility in Susaki city, Kochi prefecture via a belt conveyor system approximately 23 kilometers long, reflecting a business scope which encompasses one city and two towns. The production capacity is 14 million tons a year, which is at the top of the scale in the country. Moreover, in August 2015, we achieved a total accumulated production volume of 500 million tons since opening the mine.



Mt. Torigata Overview

TOPOGRAPHY

Elevation: 1,459 m
(Current mining level: 1,145 m)
Dip: 35 to 40 degrees on the south face, 15 to 20 degrees on the north face

METEOROLOGY

Rainfall: 1,000 to 1,500 mm monthly between August and October
(Annual rainfall of between 3,000 and 5,000 mm)
Temperature: Low approx. -15°C between January and March
High between 26 and 28°C in July and August
As it snows between December and March, some years may have accumulated snow of one meter in January and February.

GEOLOGY

Upper part: Developed limestone 300 to 500 meters thick; categorized by Chichibu Paleozoic strata.
Lower part: Clayslate

DEPOSIT

The mineral deposit lies 800 meters above sea level or more, centering around the massif of Mt. Torigata and found within the range of 4,400 meters to the east and west and between 400 and 900 meters to the north and south of the mine site. The limestone mined in this area is of exceptional quality.

GRADE

CaO=55.4%	P=0.004%
MgO=0.25%	SiO ₂ =0.15%
Al ₂ O ₃ =0.04%	

This mine, boasting Japan's largest production volume, introduces cutting-edge technologies and equipment at all times, while also ensuring unrivaled safety.



Loading of limestone

Face
Transportation

1. Blasting / Mining

Mining is performed using a bench-cut method, whereby the mountain is cut off in a staircase pattern with a bench height of 15 meters and a working face of approx. 150 hectares. Exploiting one of the largest classes of heavy machinery in Japan, we mine safely and efficiently.

Prior to mining, stripping benches are set at a height of between 7.5 and 10 meters, whereupon the topsoil is completely removed by combining crawler drills, backhoes and dump trucks. To mine the limestone, inclined piercing is performed using large boring machines and rotary drills, followed by blasting with AN-FO explosives.



Rotary drill

2. Load and Haul

After blasting, the limestone is loaded onto a 180-ton dump truck, the largest of its kind in the country, using a 20 m³ wheel loader to dump into two vertical shafts respectively.



Dumping into the vertical shaft



No. 1 Vertical shaft Gyratory crusher

3. On-site Crushing

The limestone dumped into the vertical shaft is crushed 200 millimeters smaller, using either a gyratory crusher (No. 1 Vertical shaft) or a jaw crusher (No. 2 Vertical shaft) installed at the bottom of the vertical shaft and crushed a further 80 millimeters smaller using an impeller breaker. The crushed limestone is then transported to the seaside ore processing plant in Susaki city via a long belt conveyor.

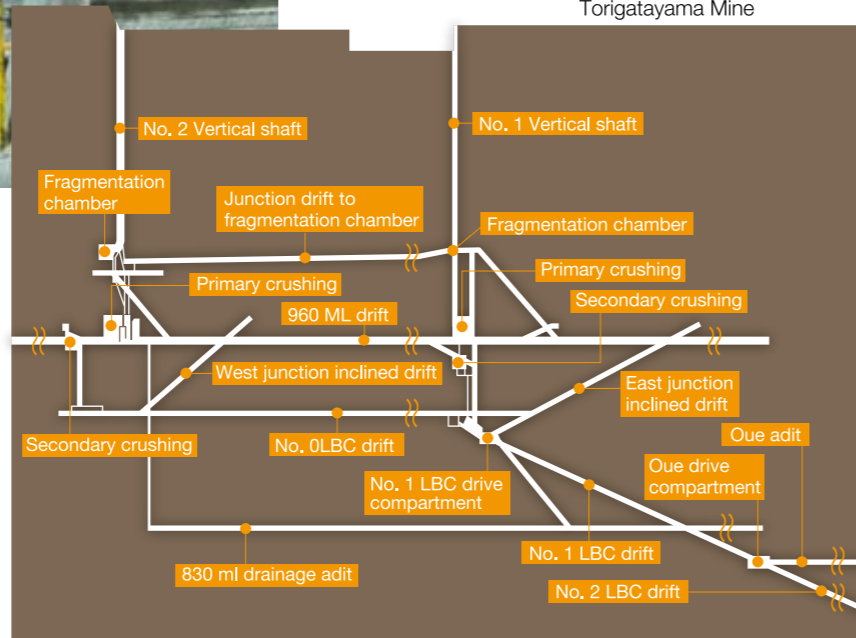
Remote-controlled fine splitting work from the central control room at the mountain base



No. 2 Vertical shaft Jaw crusher



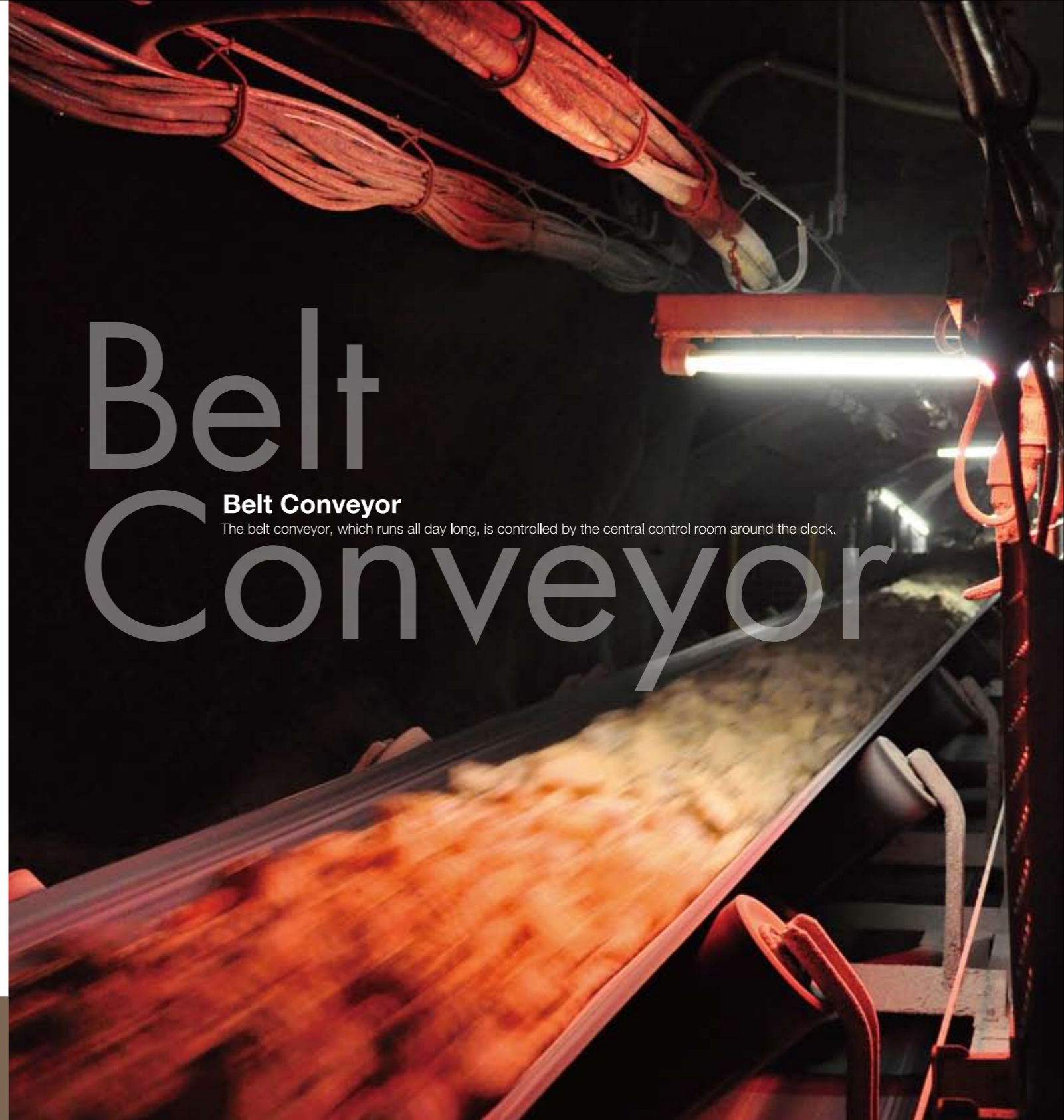
Diagram of underground Torigatayama Mine



Belt Conveyor

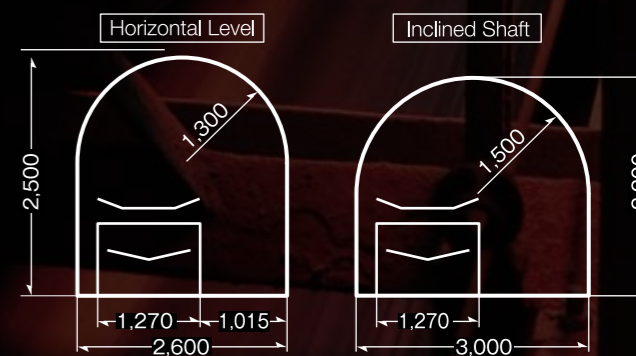
Belt Conveyor

The belt conveyor, which runs all day long, is controlled by the central control room around the clock.



Central control room at the mountain base

Conveyor Level Section



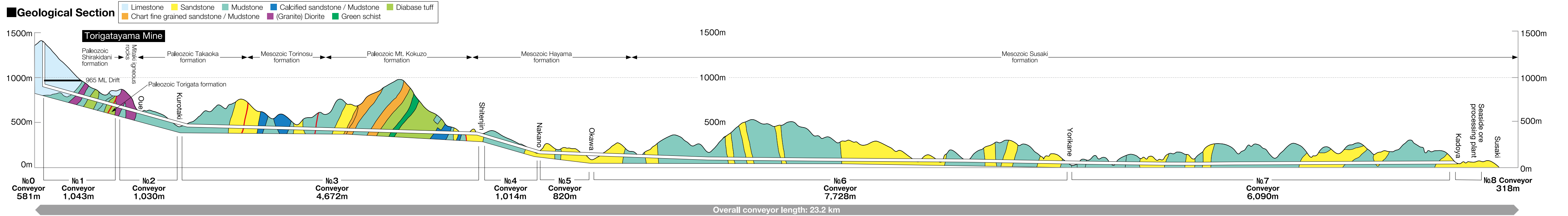
4. Transportation

The overall length of the belt conveyor between the mountain base and the seaside ore processing plant is 23.2 kilometers. The crushed limestone is loaded onto nine conveyors and then transported 850 meters down to the mountain base. Three out of the nine are steep angle conveyors, which generate power by driving a motor that also supplies the remaining six conveyors. The belt is 900 millimeters wide, runs at 300 meters per minute and can transport 2,450 tons per hour. The longest conveyor is the No. 6 belt, which is 7,728 meters long.

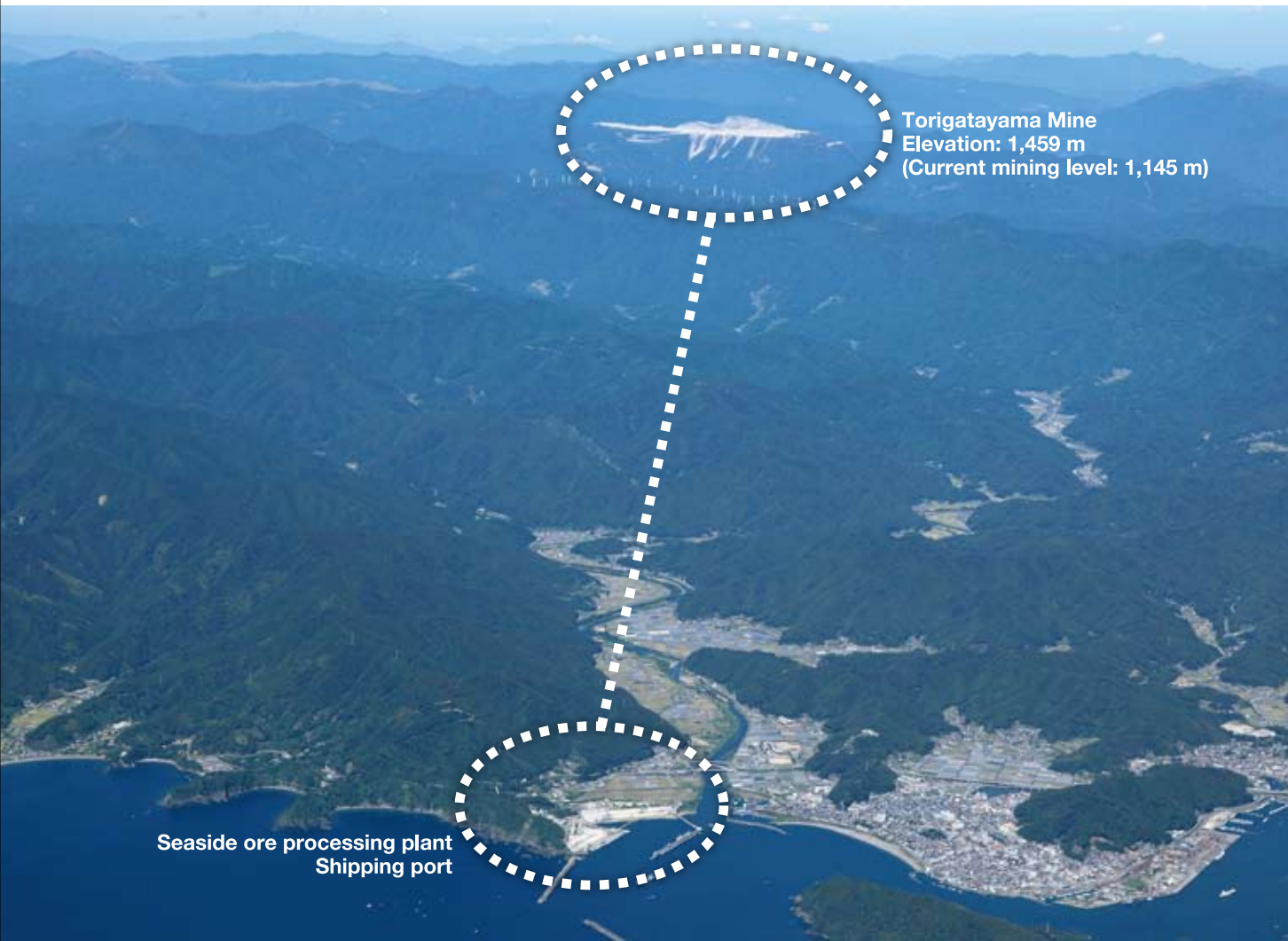
Fiber-optic cables are laid throughout the route and all the processes, i.e. operation, monitoring and control, are performed by the central control room at the mountain base.



Transport



Beneficiation



Maintenance

Regular inspection and maintenance of machinery is critical to provide stable operation. As well as consumables, we also carry a supply of spare parts to ensure we can accommodate early recovery in the event of failure.

Dedicated heavy machinery maintenance factory at the top of the mountain



Indoor ore storage facility



5. Ore Processing and Storage

The limestone transported to the seaside ore processing plant is crushed, screened and washed according to applications, including steel, cement, construction aggregate and chemicals. It is then sorted into seven categories by size, where medium, medium-small, small and sintering powder lumps are used for steel applications, extremely small lumps for cement applications and new small lumps and sand for construction aggregates and stored by each category. One of these storage facilities with dome-shape functions as an indoor ore storage facility for sintering; 32 meters high, 70 meters wide, 82 meters long and capable of accommodating 67,000 tons of ore.





Ship loader

Shipping

6. Shipping

Most finished products are shipped from the dock and pier berth established at Cape Kadoya in Susaki Port. The finished products stored at the ore storage facility are then loaded onto a shipping belt conveyor by three reclaimers (maximum capacity: 2,000 tons / h) and shipped at the dock (which can berth maximum ships up to the 60,000 ton class) and the pier berth (which can berth maximum ships up to the 17,000 ton class), using three ship loaders (maximum capacity: 2,000 tons / h).

Torigatayama Quarry Complex has a special division for boats and ships with one tugboat and two pilot boats, while also serving as a shipping agent to accommodate shipping operations. We have harbor pilots available at Susaki Port to ensure ships can berth and leave the port safely.



Tugboat



Loading limestone from the ship loader



Dock and pier berth

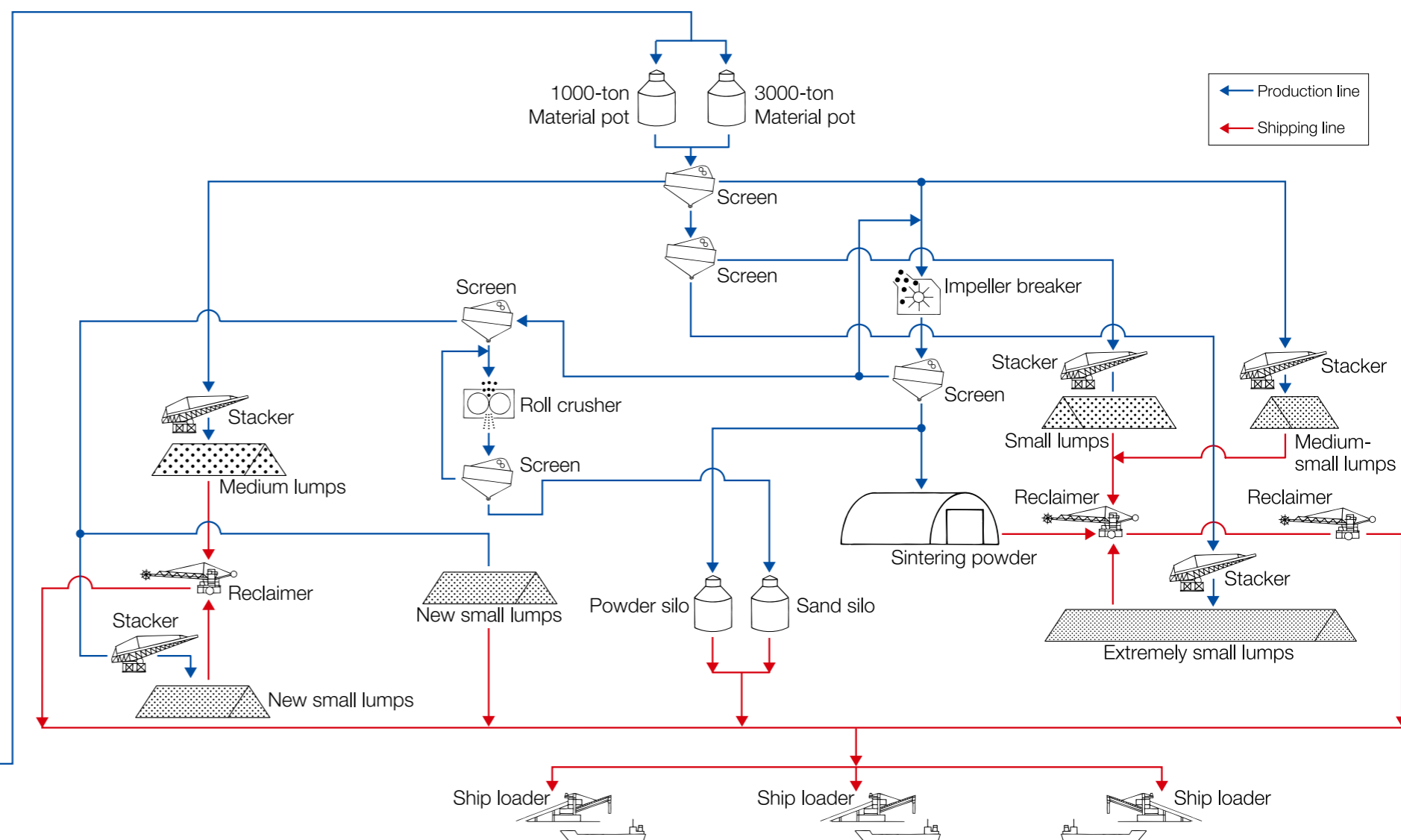
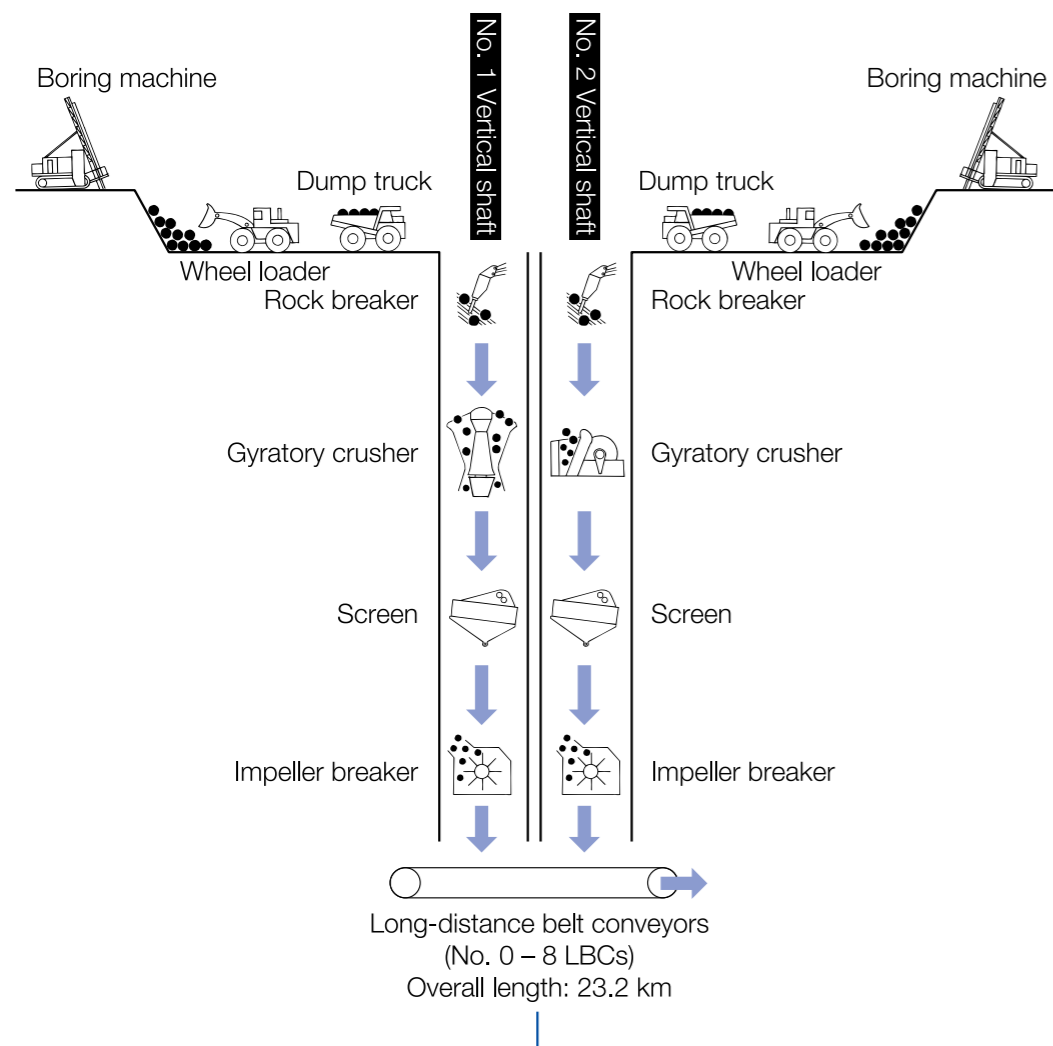


Mt. Torigata from the sky



Shipping port from the sky

Process Drawing





Helping improve people's lives by optimally exploiting valuable limestone resources

The above basic mission can be achieved by definitely delivering good-quality products which please our customers.

We stop at nothing to control the quality of components, grade, size and particle size distribution as required based on applications of each business sector, i.e. steel, cement, construction aggregate and chemicals, and responding to customer trust.



■ Finished products and applications

	Finished product	Size (mm)	Application
Categorized limestone	Medium lumps	80 - 40	Steel
	Medium-small lumps	40 - 20	
	Small lumps	30 - 10	Cement
	Extremely small lumps	30 - 0	Building materials
	New small lumps	20 - 5	
	Sintering powder	5 - 0	Chemicals
	Sand	4 - 0.15	



Acquired ISO14001 – a first in Japan for a mine complex; striving positively to conquer environmental issues.

Torigatayama Quarry Complex has been engaging in various environmental programs, including noise prevention measures during the process, building a soundproof gallery for the long-distance belt conveyors, an afforestation project at the dumping site and mudslide-control dams to prevent landslides and river contamination.

In 1999, we acquired ISO 14001, the international environmental management standard – a first in Japan for a mine complex, including the mining site and dealing with environment improvement activities at all facilities daily, while continually implementing energy-saving and waste reduction measures systematically.

Striving to become a world-class model mine complex in the 21st century –

Torigatayama Quarry Complex continually strives to improve and restructure our operational system by introducing cutting-edge technologies and equipment and ensuring and enhancing grades, efficiency, safety levels, environmental conservation and equipment maintenance to establish our ideal system.

We will continue to strongly spread our wings to become a world-class model mine complex, building on the understanding and support of the local inhabitants.