



CASE STORY · WR-STEEL® GRINDING RODS · DRAGON MINING OY

GRINDING FOR GOLD

Tough, carbon-hardened grinding rods made from WR-Steel® are helping a gold production plant in southern Finland maintain reliability and low costs in the critical grinding process.

In today's gold mining industry, producing even the tiniest amount of gold requires the mining and processing of enormous amounts of ore. At Dragon Mining Oy's Vammala production plant at Sastamala, Finland, 160 miles northwest of Helsinki, about 300,000 tons of extracted ore result in approximately 1,000 kilograms of gold annually. Consequently, the production team headed by Mill Manager Jaakko Larkomaa is always looking for ways to run the production process as efficiently as possible.

Each of the key plant processes – crushing, grinding and flotation (and leaching) – have their own challenges. In the grinding process, which involves two separate steps – rod milling followed by ball milling – key challenges are reliability and maintaining low costs. In the rod mill, the grinding rods used for this process consist of WR-Steel®, tough, carbon-hardened steel from Ovako's Imatra mill in Finland, which has been supplying the plant for at least a decade.

"Predictability of the grinding process is vital," Larkomaa says. "By predictable, we mean the ability to achieve a certain particle size. When we load Ovako grinding rods we know they will work and do the job we expect. We don't want any surprises."

He adds: "Energy consumption is also affected by the quality of the rods. Bad quality rods would take up a lot more energy – an important consideration in all of our processes, but especially grinding."

Briefly, the size of the ore delivered to the plant from the mines is typically between 20 to 70 centimeters in diameter. These



Mill Manager Jaakko Larkomaa at Dragon Mining Oy

particles are pulverized in jaw, cone and gyratory crushers, reducing them further to about 20 millimeters before being processed in the rod mill. The mill uses a combination of water and rods to perform the grinding function. When the particles emerge from this process, they average about 3 millimeters. The rod mill is followed by the ball mill, where particles are further reduced to about 90 microns.

Grinding is followed by gravity separation and flotation – processes that separate gold grains and sulfide associated gold from gangue material.

Fed manually into the mill on a weekly basis, the grinding rods last about a month until they disintegrate. About 20 to 30 new rods are added every week. (Each rod, which is mounted manually, measures 75 mm in diameter by 4 meters long and weighs 200 kilos.) Not unlike boron steel, an excellent bearing steel, these grinding rods contain about one percent carbon, which accounts for their exceptional toughness and strength. That's why WR-Steel is ideal for applications requiring extreme resistance to wear and tear such as the bucket edges of a wheel loader or the edge of a leveling blade in a road grader.

Currently, the plant draws from two nearby mines – Orivesi and Jokisivu that are wholly owned by Dragon Mining Oy. The company is in the process of developing a third gold mine, Kaapelinkulma, in same area. However, the total amount of ore processed at the Vammala mill is expected to remain at the same level during the coming years.

Janne Mäntylä, Purchasing Officer for the company, has been purchasing grinding rods from Ovako since he joined Dragon Mining Oy 10 years ago. Every year he checks prices for similar products offered by competing suppliers but can't match the quality. Not only does he consider Ovako's grinding rods "extremely good," but acknowledges the convenience and low transportation costs of having a "local" supplier. Deliveries from Ovako's Imatra mill, he says, have always been on time. Chinese suppliers are cheaper, he concedes, but transportation costs plus quality uncertainty mitigate against buying from Asia.

Furthermore, every two or three years, Ovako has tested the steel and tweaked it to strengthen or harden the material, according to Mäntylä. These rods are not heat treated in any way before they are delivered to the plant. As Ovako's Björn Olsson, Segment manager Rock Tool applications, describes Ovako's WR-Steel grinding rods: "it's the chemistry and steel process doing the work."

"For many years now, we have been able to count on the grinding rods to do their job," Mäntylä adds.

With its broad portfolio of products covering a wide range of applications, Ovako's engineered steel has played a critical role in the entire mining and construction process. In addition to the grinding rods for mining companies, Ovako's offer ranges from ultra-clean steel bars for pistons, to all parts of the complete drill string, among many others.



Janne Mäntylä, Purchasing Officer

WR-Steel® benefits

- Proven superior wear resistance
- Broad range of hardness intervals (350-650 HV)
- Right properties after rolling and heat treatment
- Cost-effective due to optimized alloy content for different end applications
- Wide range of steel grades in different dimensions

Ovako facts and figures

- A leading producer of engineering steel for customers in the bearing, transportation and engineering industries
- Products: low-alloy steels and carbon steels in the form of bars, tubes, rings and pre-components
- Locations: Ovako has ten production plants and a number of sales companies in Europe and the USA
- Net sales 2017: EUR 921 million
- Employees: 3,040
- Since June 2018, Ovako is part of the Japanese steel corporation Nippon Steel & Sumitomo Metal Corporation

About Dragon Mining

- Dragon Mining is listed on the Australian Stock Exchange (ASX) and is an established gold producer in the Nordic region with two production centers in Svartliden, Sweden and Vammala, Finland.
- The company was founded in 1987 and commenced activities in the Nordic region in 2000. It has a total of 85 employees.
- Since 2005, these two production centers have produced more than 700,000 ounces of gold.
- The Vammala Production Centre* consists of the production plant as well as the Jokisivu and Orivesi gold mines and the Kaapelinkulma Gold Project.
- Total annual turnover (2017): 41 MAUD
- Dragon Mining maintains a strong safety focus at its operations and ensures that all activities carried out are undertaken in a manner that minimizes environmental impacts.

* The Vammala Production Centre produces two types of products: a direct sell gravity concentrate (minor) and a flotation concentrate (major). The majority of the flotation concentrate stream is transported to Svartliden for processing through the company's carbon in leach (CIL) plant to produce doré bars, a super high gold content alloy.