



Case Study

Valuables covered for Environmental Protection - Domes over the 7th Largest Copper and Moly Development

Edited by on 8. Apr. 2020

[Published in bulk solids handling, Vol. 35 \(2015\) No. 4](#)

Keeping the environment safe from impacts of stored copper ores as well as minimising material losses due to deflation were the main reasons for building two storage domes at a newly developed copper and molybdenum mine in Northern Chile.

(From the archive of "[bulk solids handling](#)", article published in Vol. 35 (2015) No. 4 , ©2015 bulk-online.com)Sierra Gorda, a community in the Antofagasta Province of far north Chile, sits in the Atacama Desert 1,700 meters above sea level. The arid landscape evokes an otherworldly mystique complete with sand, salt lakes, felsic lava and stone. As the driest non-polar desert in the world (and possibly the oldest), it boasts a sweeping terrain stretching 1,000-kilometers west of the Andes. With a population of less than 2,000, this remote region has gained a surprising amount of global attention. Sierra Gorda's desolate beauty became an ideal setting for scenes included in the Quantum of Solace movie starring Daniel Craig, a 2008 James Bond thriller. But what lies beneath the landscape may be more impressive, as Sierra Gorda's brush with celebrity pales in comparison to the ongoing achievements of the Chilean mining industry.



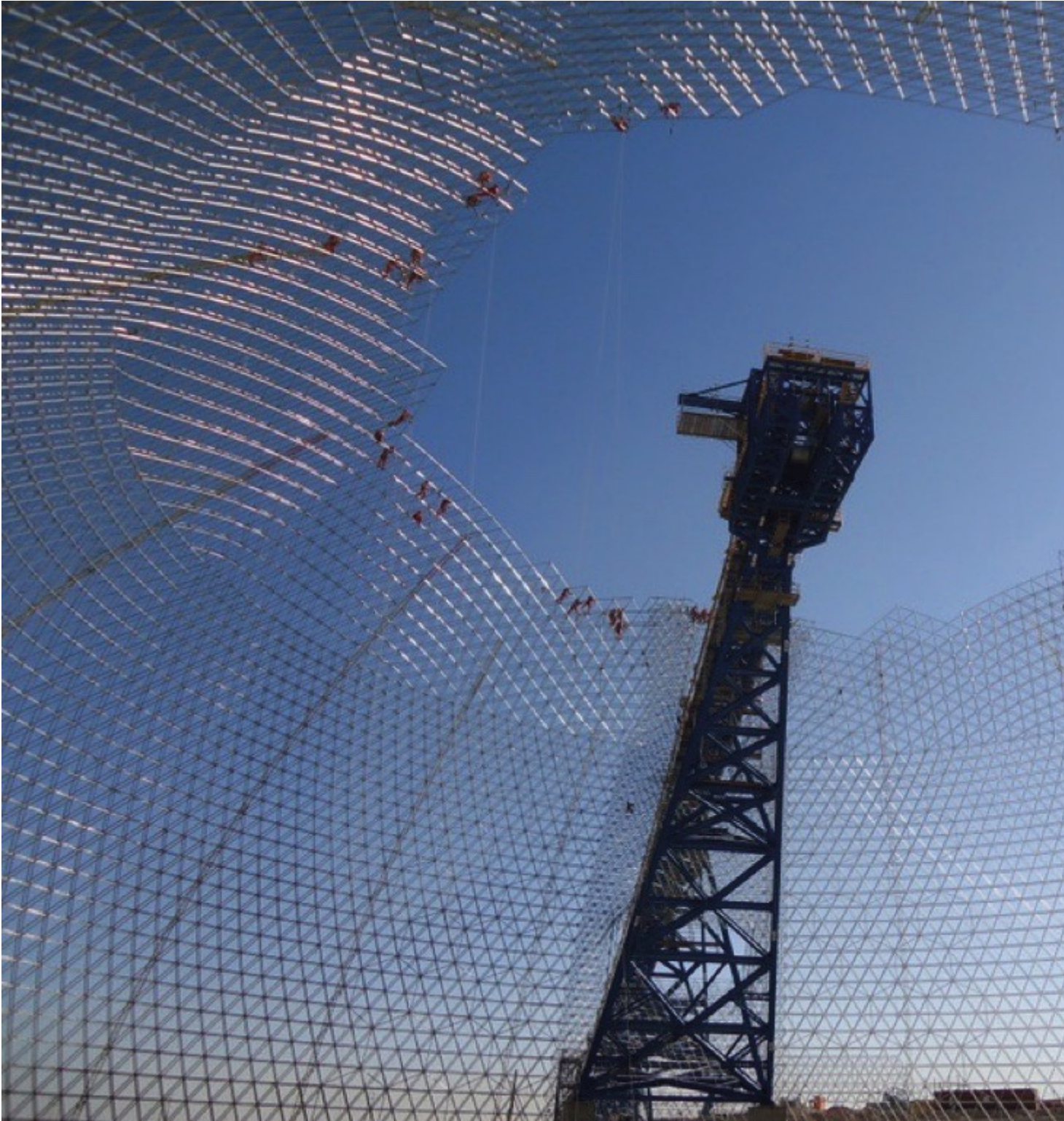
7th Grande development (Pictures: © Geometrica/Sierra Gorda)

Sierra Gorda Sociedad Contractual Minera (Sierra Gorda SCM) is acclaimed as the seventh largest copper and molybdenum development on planet earth — a distinction demonstrating the demand for copper, the strength of copper prices, and the dominance of northern Chile as a coveted copper producing region. In fact, Sierra Gorda is a joint venture between KGHM International, Sumitomo Metal Mining and Sumitomo Corp., and has successfully intertwined the economies of three countries: Chile, Poland and Japan. Concentrate was first produced in July 2014, followed by an opening ceremony October 1 attended by dignitaries from the Republic of Chile headed by President Bachelet, the Republic of Poland government, the Japanese government, as well as representative construction and operational partners. In December the mine produced approximately 700 daily tons of concentrate. According to KGHM Polska Miedź, production will ramp up to 120 000 metric tons of copper, 50 million lbs. of molybdenum and 60 000 oz. of gold annually.

An Eco-Friendly Dome-Duo

Certainly, sustainable mining principles with regard for surrounding eco-systems is a foremost concern at Sierra Gorda's open pit mining operation, which encompasses crushing, grinding, flotation and drying processes. Herbert Wirth, President and CEO of KGHM, noted the company's uncompromising respect for people and constant dialogue with local communities, along with modern

methods and management systems to responsibly extract and process copper ore and other resources. Maciej Ściążko, General Manager of the Sierra Gorda project, stated that the mine will help feed the demand for copper and molybdenum around the world, as well as provide local jobs for years to come as a great employer and a great neighbor.



Under construction

Copper and molybdenum ore and concentrates require special storage solutions. It was imperative that the storage buildings safeguard nearby habitat from air, particulate and water pollution — a principle mandated by all the parties involved. Based on its robust portfolio of applications throughout the Andes, Geometrica was hired to provide ore and concentrate storage for the Sierra Gorda project. Two circular domes were designed to store the stockpiles while protecting the surrounding flora and fauna, including indigenous foxes, birds, lizards and geckos. One application spans a remarkable 122 m over the copper ore stockpile — an immense structure longer than a football field. A second dome, for concentrate, spans 62 m and was welded to embedded plates on a retaining wall. It features internal cladding to protect the galvanized steel structure from any possible corrosive attack by potentially humid copper concentrate stored within the building.

Design Freedom

Covering stockpiles under these harsh regional conditions would have been a monumental challenge in years past. But with Freedom technology, today's domes can be constructed in a variety of dimensions spanning up to 300 m on virtually any topography.



Dome aesthetics: a blue conveyor in the foreground complements the orange cladding of buildings in the distance.

Freedomes provide an effective and efficient cover for crushed mineral stockpiles in Sierra Gorda and other mines the world over. Geometrica's building system is versatile. It features an extruded, universal and strong joint, human-scale modules, dense packing volume, and easy installation with minimal equipment needs. The connecting hub is an extruded aluminum cylinder with several threaded slots. Each tube is formed at the ends into a linear thread that slides into the matching hub's slot. When all the tubes in a certain hub have been assembled, the joint is completed with washers and a single bolt. Once complete,

the joint is strong, sometimes even more than the joined tubes themselves. Most importantly, the tubes resist bending moments at the joint. This allows for the deck or cladding of the structure to be affixed directly to the space frame members, without secondary structural purlins that can be as heavy as the frame itself in other construction systems. This feature also permits many variations on basic geometries that are simply not possible with conventional bolted or welded connections. These virtues allow for unlimited forms, and the judicious selection of form results in beautiful and efficient long-span structures.



Internal cladding protects the 62m building from a stockpile of concentrate.

In the case of Sierra Gorda, the required storage volume and necessary stockyard equipment dictated the shape and size of the domes. All requirements were incorporated into the design by Geometrica to accommodate the needs of the mining operations and protect the surrounding terrain. The domes were erected by SALFA Corp, a Chilean company with 16 years of experience that had previously participated in several Geometrica dome installations, aided by Geometrica consultants. Local labor was used to build both domes within 5 months. Very little equipment was needed during the installation of the domes. A couple of manlifts were used to lift crew members, tools and structural elements during installation, and a crane was required while closing the apex of the stockpile dome. The resulting maximum capacity of space was achieved due to the absence of internal barriers. This allows for the free flow of traffic, personnel, equipment and inventories. Intermediate columns were simply not required. The dome's geometry was weaved around a complex conveyor support structure. Yet the resulting structure is incredibly strong... strong enough for the most challenging climates, brutal wind velocity, and seismic loads of the Sierra Gorda region.



A football field could easily fit inside this 122m dome.

Even in their rugged industrial setting, there is a certain architectural beauty inherent in the Sierra Gorda domes. The larger building's blue conveyor complements the dynamic orange on nearby buildings — opposite hues on the color wheel that please the senses. The cladding on both Sierra Gorda domes was designed with compatible profiles and installed over the course of six weeks without the need for special framing or equipment. Translucent panels contribute natural lighting, energy cost savings and customized symmetrical patterns for additional aesthetic beauty. The result is a continuous surface that provides effective sealing and water drainage

Safety in Sierra Gorda

There were no setbacks during either installation, and both domes began operating as scheduled. Nearby surroundings remain pristine, as has Geometrica's and Salfa's safety records. This segues nicely with KGHM's core values of "Zero Harm," "Success Through Teamwork," and "Results Driven and Courageous Leadership." From non-slip surfaces to safety exits and OHSAS 18001 certified construction processes, Geometrica's built-in features and accessories ensure the highest levels of safety performance. Each application is engineered to meet or exceed health, safety and environmental standards. Among Geometrica's options for material equipment are openings at the apex or circumference as practical solutions for natural ventilation. Access openings for equipment, vehicles and personnel can be designed in any shape or size, including customized doors, frames, canopies and hatches. Penthouse enclosures can be used to protect top loading conveyors, while flashing can be used for side penetrations. Domes can be engineered to partially support the conveyor, or allow independent conveyor movement. Galvanized steel ladders are built for safety using non-slip threads. Galvanized steel walkways are provided with OSHA-approved guide rails and nonslip grating. These ladders and walkways provide access to electrical and ventilation systems, mechanical penthouses, conveyors, galleries and safety exits.

The Global Dome Experts

Geometrica specializes in designing efficient long spanned domes so that local crews can construct the most durable long span domes without welding requirements or heavy equipment. Bulk storage structures are customized to suit each project's specific site and storage requirements, handling equipment, and design preferences.

About the Author

Victor Cavazos Geometrica, Inc., USA