

PRECISION SURFACE MINING



Precision Surface Mining Delivering Results with Vermeer® Terrain Leveler® Surface Excavation Machine

In 2017 a prominent non-metallic mine in Iquique Chile, began using precision surface mining methods. The mine had a goal of taking a broader approach and evaluating the benefits of precision surface mining from pit to heap leach. Results have been measured and compared with traditional drill and blast methods and after almost 3 million metric tons (3.3 UST) of material cut, the benefits are sound and clear. The mining operation has reported positive results in the areas of material separation, better access in areas that were off limits before, more consistent particle sizes and gains in the heap leaching process.

César Leite, Vermeer regional manager for Chile and specialty excavation, said that surface mining operations throughout the region have put precision surface mining machines, like the Vermeer T1655 Commander® 3 Terrain Leveler® surface excavation machine (SEM), to work and been happy with the results. “All our surface mining customers start their journey into this new way of mining with a lot of questions,” he explained. We’ve helped many surface mining operations in the region deploy precision surface mining methods and helped them evaluate the results.”

To provide additional support to surface mining operations, Vermeer recently opened a dealership in Chile. Christian Egaña, Vermeer Chile general manager said the new facility gives area surface miners access to quality service, parts and support. “We have a trained team of service technicians and surface mining specialists available to help mining operations that are just getting into surface mining with precision equipment, as well as for those who have been running our machines for years.”

With the specialized equipment and dealership support, Chile surface mines using Vermeer Terrain Leveler SEMs have been able to log impressive results.

Safety

According to Leite, safety while working with explosives used for drilling and blasting has been a major focus area for the mines in Chile. “It is not just the nature of the traditional process that makes it risky, but the number of people involved,” he said. “Even with proper training and the highest safety standards, there is an inherent risk with using explosive chemicals.”

With the precision surface mining process, workers have a controlled way of extracting material, and the process does not have a single step where high levels of energy are stored and released.

Precision work

Another common issue that surface excavation machines have helped alleviate is material dilution, which is when valuable mineral ore gets mixed with sterile material to produce a mixture that makes mineral recovering harder and longer than expected.

“Precision surface mining has helped dilution issues because of the way the Terrain Leveler SEM cuts material in layers,” explained Egaña. “With a modifiable cutting depth, miners can be highly selective in the way they recover the mining ore with minimum presence – if any – of sterile material. Geological mapping of the pit can result in less dilution. It can help improve efficiencies through the whole process from loading and hauling of rich and concentrated mineral ore to a heap leaching process with a high level of mineral recovery.”

At the mine in Iquique, officials said the Terrain Leveler SEM showed the

capability to select pits with a high level of mineral concentration and exploit those areas without losing the original mineral concentration levels, as heap leaching results showed afterward.

Exclusion areas

The amount of energies stored and released by blasting can cause significant ground vibration, which is why many mines have areas that are off limits to traditional methods. These blasting exclusion areas usually are located near roads, workshops, warehouses, dormitories, cafeterias and any other location where safety is challenged by blasting operations. Depending on local regulations, blasting exclusion areas can range up to half a kilometer (0.3 mi) in distance depending on the magnitude of the blasting operation. The combined effect of several locations where blasting is not permitted, with increasing blasting exclusion perimeters, creates large areas where mining activities are simply prohibited for drill and blast activities. Selective surface mining has provided a unique solution for some Chilean mines, by exploiting these massive areas otherwise prohibited and unavailable.

Surface mining machines have opened about 80,000-square-meters (262,467.2 sf²) of new areas in Chile. These areas are near roads, warehouses, medium voltage lines and other areas previously unavailable. boreholes,” Shiliang explained. “Around a week after the drilling

Particle size

Another benefit to precision surface mining methods is more consistent and homogeneous particle sizes, which can lead to better mineral recovery. More consistent particle sizes also help reduce the amount of material that has to be processed by primary and crushing units.

Also, Leite said that in non-metallic surface mining operations the effectiveness of the leaching process can be affected by the direct particle size output of the blasting stage. “In normal conditions, blasting is simply not able to control or guarantee a consistent particle size,” he explained. “Inconsistent particle sizing can result in poor recovery during heap leaching stages. With selective surface mining, there is a high level of consistency in particle sizes, which can result in better mineral recovery in latter heap leaching stages. On top of that, avoiding big chunks of rocks – very common in blasting – increases the efficiency of the hauling process as more material is transported in a given spatial volume.”

Around 95% of the material cut with the Terrain Leveler SEM, produced particle sizes below 25.4 centimeters (10 in).

Heap leaching process

As with every mining activity, there are details that will provide a clear insight into any improvements introduced in previous stages. In some of the non-metallic mining operations, heap leaching is the key process that will clearly show the benefit of a given innovation. The heap leaching process happens slowly, so – although the insight is clear – it takes time to realize the benefit of any given change in the previous stages. The required time for a heap to deliver all the mineral



recovered may vary depending on heap dimensions, particle size consistency, leach solution and some other factors. On average, 12 months seems to be a very common time frame for a heap to deliver its benefits. Naturally, the shorter the period, the better to recover the same amount of mineral, but if there’s even more mineral recovered, then it is simply a remarkable result. This is precisely what was observed in Chile: more mineral recovered in less time.

The results of mineral recovery at heaps created exclusively by selective surface mining with Vermeer Terrain Leveler SEM showed 12% more mineral recovery than heaps with traditional mining. This mineral recovery rate was achieved in a period 33% shorter than using traditional mining methods.

Impressive results

Selective surface mining is a robust new technology that can deliver benefits to mining activities. The previous statement was already known before starting the almost 3,000,000 tons (3.3 UST) experience in Chile with the Vermeer T1655. Nevertheless, the results in the areas in dilution avoidance, new areas available to execute mineral activity, particle size consistency and mineral recovery results, help demonstrate the impact of selective surface mining.

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