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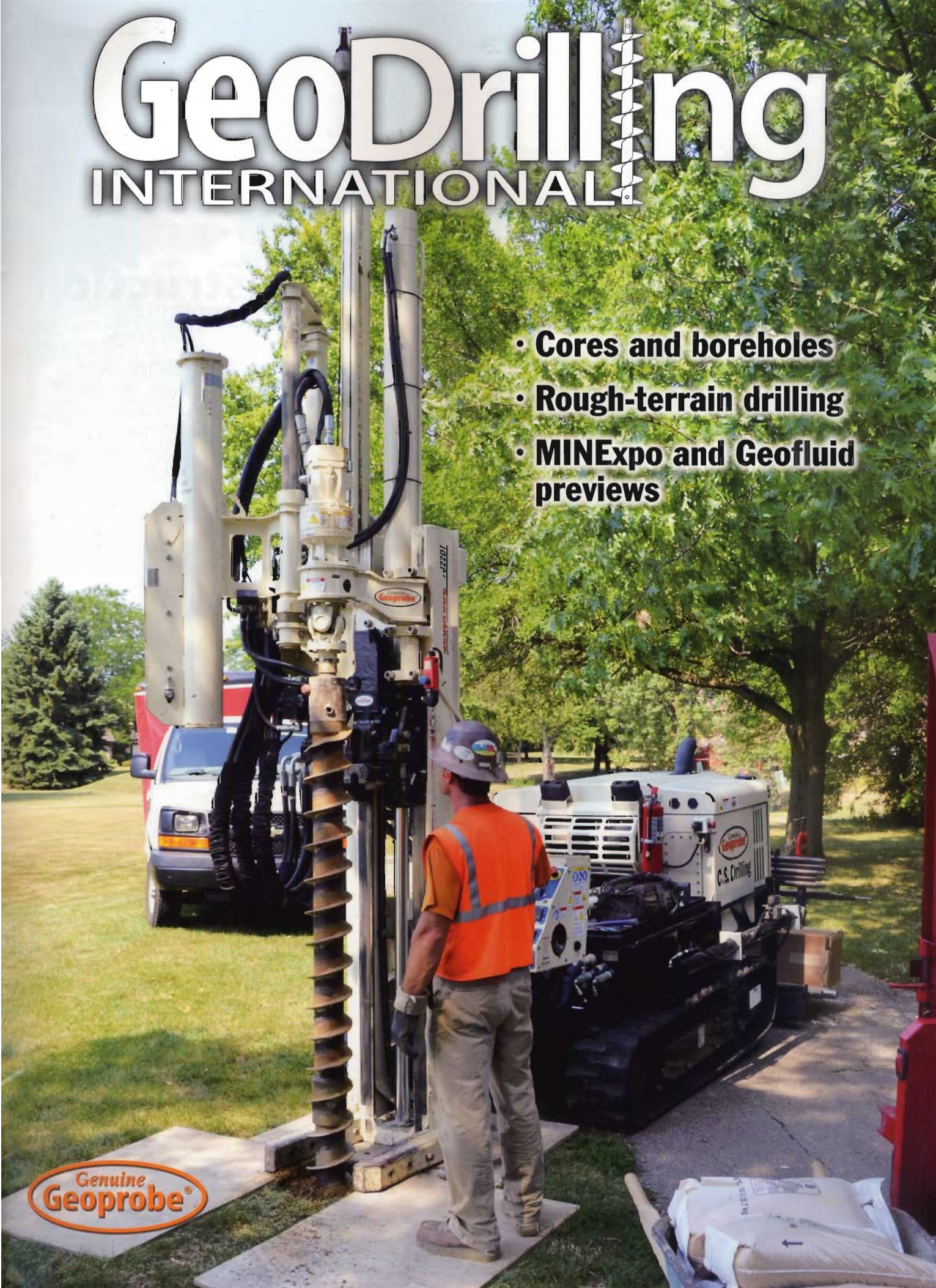

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Waste not

Sonic drilling can determine the physical and chemical characteristics of waste-rock dumps

Project particulars

Company:	Boart Longyear
Customer:	Kennecott Copper Mine
Product:	Trusonic
Rig:	SR-121
Location:	Bingham Canyon, Utah, US
Application:	Sonic drilling

Sonic drilling enables the collection of highly representative samples and excellent sample recovery of waste rock dumps, which are often placed adjacent to mine pit areas, and as mining expands more room is needed for the waste rock.

Waste rock dumps consist of mainly unconsolidated material – and it is often difficult to know how deep they are or what types of material they contain – which can lead to challenges in drilling.

Sonic drilling has been used for the re-exploration of dumps, tailings and heap-leach pads. Now Trusonic technology, provided by Boart Longyear, provides a technique that can produce accurate in-situ core samples through varied ground conditions.

The challenge

Boart Longyear Drilling Service took on the challenge of drilling core samples from the unconsolidated waste rock dump at Kennecott's Bingham Canyon mine in the US.

The intention was to define the contents of the wasterock dump. The dump consisted of rock-blast material ranging in size from 254 to 304.8mm (10 to 12in) in diameter and was made up mainly of porphyry deposits (granite-like rocks).

With a targeted depth of 213.36m (700ft), the main goal was to provide a detailed continuous sample of the waste material and confirm bedrock depth. Boart Longyear also needed to install piezometers (water-level monitors) and lysimeters (moisture-content monitors). Geotechnical samples would also need to be taken every 6.096m (20ft) to confirm stability and moisture content for the first 60.96m (200ft).

> "The main goal was to provide a detailed continuous sample of the waste material"

The method

Sonic drilling is a successful method for unconsolidated material, such as the waste rock at the Bingham Canyon mine, because of its sample recovery rate, straight cased borehole and ►

Kennecott Copper mine

The Utah Copper Company was formed in 1903 and mass production started in 1906. The site eventually became the Kennecott Copper Mine, also known as the Bingham Canyon Mine.

Located southwest of Salt Lake City, Utah, it is one of the world's largest open-pit copper mines and is owned and operated by Rio Tinto. Noted as an engineering marvel of the world, the Bingham Canyon Mine is more than 1.2km (3/4 mile) deep and more than 4.42km (2-3/4 miles) wide at the top.

During the 100-plus years of operation, the Bingham Canyon Mine has yielded more than 19 million tons (19.3 million metric tonnes) of copper metal, plus significant by-products gold, silver and molybdenum.

the flexibility to offer geotechnical sampling via the split spoon sampler. Boart Longyear chose its Truonic system consisting of the SR-121 sonic rig.

"Leaving only the bit for the final push to 274.32m (900ft) – and setting a new Boart Longyear record for sonic drilling – the team reached a 28% greater depth than initially targeted"

As drilling began, Boart Longyear took on the task one step at a time by tackling the depths in stages. For the first 106.68m (350ft), the team drilled a 228.6mm (9in) borehole while tripping the drill string every 6.096m (20ft) to pull a split-spoon geotechnical sample for the first 60.96m (200ft).

For the second stage, the team drilled to 152.4m (500ft) using a 203.2mm (8in) bit with casing. Moving deeper to 228.6m (750ft), Boart used a 177.8mm (7in) bit with casing for the third stage. Surpassing the targeted drill depth of 213.36m (700ft), the drillers still had not reached the bedrock formation.

Boart Longyear needed to find the true depth of the waste rock dump and felt the Trusonic rig still had the capability and pullback to go deeper. Easing forward, the team drilled to 264.261m (867ft) using a 152.4mm (6in) bit with casing.

The last stage could not be drilled with casing as the drillers needed to move to a 101.6mm (4in) borehole. Leaving only the bit for the final push to 274.32m (900ft) – and setting a new Boart Longyear record for sonic drilling – the team reached a 28% greater depth than initially targeted.

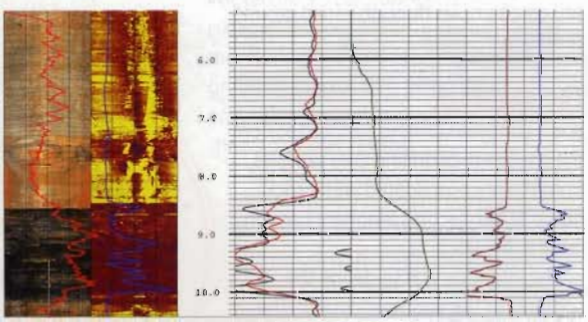
It took 16 shifts of 12 hours (192 hours) to accomplish the record depth for sonic drilling. Boart Longyear lost two of those shifts (24 hours) to rain. Another key accomplishment was that the entire depth was reached through dry drilling and achieved 100% in-situ core samples at less than 1% hole deviation.

Safety was the number one concern every day, with lead driller Gabe Caredenas determining whether it was OK or not before drilling to a greater depth.

"With the perfect conditions, technology and a well-trained crew, we were able to prove the strengths of sonic technology," Ronald Cain, project manager for Boart Longyear, said.

"We always knew we had the potential to go deeper with sonic drilling, and with constantly improving technology we'll continue to set new standards," Mr Cain added.

For more information: www.boartlongyear.com



A cheaper option

Operators need to look elsewhere when costs grow

"Non-cored drilling is cheaper, and rock samples (chips) are quicker to obtain"

Core drilling is a time-consuming and expensive process, particularly when the the cost of core drilling, core preparation, core orientation and geological description are taken into account.

In comparison, non-cored drilling is cheaper, and rock samples (chips) are quicker to obtain.

Taking this into consideration, exploration and exploitation programmes do take a hard look at the option of more non-core drilling, complemented with borehole

Top US gold producers 2010

Company	Production (kg)	Production ('000oz)
Barrick Gold	89,200	2,868
Newmont Mining	55,000	1,768
Kinross	22,639	728

Source: National Mining Association

- Pedestal Boom System RB600XD, which is part of the extreme duty series that offers nine models from light to heavy duty; the Unigrout Flex-E grouting system that can pump at low or high pressure; and the Swellex rock bolts, made with patented materials and manufacturing techniques.

The manufacturer will also be exhibiting some of its exploration products, including the Diamec U8 APC, which is designed for deep-hole drilling, and the Excore line of premium diamond tools.

"The world's first monitoring system for the bottom of the hole will feature"

The company says the Secoroc Edge, which will also be on show, is the world's first continuous monitoring system that shows the driller what the bit is doing at the bottom of the hole.

Other tools that will be on display include the PARD hammer, raise-boring cutters, tricone bits, COP 44 Gold Secoroc COP hammer, Rocket Bits, COPROD system, sharpening systems and SmoothDrive shock absorbers.

Atlas Copco's new division, Mining and Rock Excavation Service, will be at MINExpo showing customers new and improved parts and service delivery systems.

Booth: 2121

www.atlascopco.com

Above, right: The Boart Longyear LS600. Below: Energold in action

Boart Longyear: Boart Longyear offers mineral exploration services and drilling products for the mining industry, as well as water exploration, environmental sampling, energy and oil-sands exploration services. The company's drilling service is active in more than 40 countries and its mining products are in use in more than 100 countries.

At MINExpo Boart Longyear will give attendees a first-hand impression of the recently released LS600 sonic rig. With advanced sonic-drill technology featuring patented designs, the LS600 delivers continuous, undisturbed core samples.

Product experts will be on site to highlight the latest releases in drilling equipment and tools, including the new 10UMX – a high-performance diamond coring bit with a freeset-cutting matrix.

The 10UMX is part of the award-winning Ultramatrix (UMX) diamond-coring bit family, which includes the S5UMX, O7UMX and 09UMX.

Booth: 23018

www.boartlongyear.com

Cubex: Canadian player Cubex is an Underground in-the-hole (ITH) drill rigs designer and manufacturer. At MINExpo the company will reveal its new ITH production drill, delivering advances in comfort and safety for the operator, ease of use, a more rapid learning curve and a platform for drilling automation. The drill has been developed through more than three decades of ITH drilling experience and maintains Cubex's high build quality.

Booth: 1475

www.cubex.net

Energold: Dando Drilling International, which Energold acquired in January 2011, will be presenting information on its multi-purpose mineral exploration drilling rigs – in particular the Mintec range comprising three top-drive hydraulic multi-purpose drill rigs capable of conducting multiple techniques including reverse circulation (RC), rotary air blast (RAB) and deep wireline diamond core drilling.

A new addition to Dando's product line is the 6-ton capacity multi-purpose rig, the Dando Multitec 6000, which is suitable for mineral exploration, water well, geotechnical and geothermal drilling applications, the company says. This is a new rig developed from earlier models in response to customer feedback, and one of the first rigs has already been supplied to a client for mineral exploration and geotechnical investigation in Uganda.

Dando has recently supplied three Mintec 12.8 mineral drilling rigs to coal mining companies in Kalimantan, Indonesia. This follows many exploration rigs supplied to another major Indonesian coal mines. The company has a strong history within the country, which first started in the early 1980s with the supply of drilling rigs to one of Indonesia's large mining companies.

A further two Mintec 12.8s are also set for shipment in the next month to west Africa.

A Dando Terrier rig has been supplied to Namibia for conducting sampling on open-pit Uranium mine sites and has successfully taken core samples from 21.9m deep – close to the maximum drilling capacity for that diameter and geological conditions.

Dando is currently supplying four 40-ton capacity water drilling rigs, the Dando Watertec 40 to the Ministry of Water, Borno State Government in Nigeria.

These machines are capable of drilling to depths of over 1,000m with 4.5-inch drill rods and will be providing fresh, clean water for the villages and towns in the state.

At the moment Dando has less presence in the US mining market than it does in other geographical areas, particularly