CRU

2026

World Copper *Yearbook*

Featuring interview with:

Gary Agnew,

Co-Founder & CEO, Ideon

INTERVIEW

ideon™

Gary Agnew

Co-Founder & CEO

*by **Natalie Noor-Drugan,** Senior Editor, Communities, CRU.*

> A major bottleneck is our limited understanding of the Earth's subsurface, which can mean a decade of "needle in a haystack" drilling.

Copper miners face a widening gap between the metals the energy transition requires and what current exploration and project pipelines can deliver. In this interview, Gary Agnew, Co-Founder & CEO of Canada's Ideon Technologies, explains how cosmic-ray muon tomography and high-resolution subsurface intelligence can help close that gap by de-risking caving operations, shortening recovery timelines, optimizing production cycles, and unlocking more copper from existing tier-one assets.

Q: Global copper demand is accelerating, yet discovery rates, grades, and project timelines are under pressure. How do you see that tension playing out, and where does subsurface intelligence fit?

Agnew: Over the next few decades, copper demand will be driven by three major forces: energy transition, the rewiring of global supply chains, and the AI data centre build-out. Together they create powerful structural tailwinds, even as discovery rates fall, grades decline and new deposits become deeper and more complex, which is already reflected in copper prices that are at all-time record highs.

A key reason for the supply constraint is the 20-plus-year journey from discovery to production. Policy and permitting are part of that, but a major bottleneck is our limited understanding of the Earth's subsurface, which can mean a decade of "needle in a haystack" drilling before mining begins followed by another decade of drilling in resource characterization. Subsurface intelligence helps close what we see as a 12-trillion-dollar supply gap by compressing time: if you provide better, higher-quality subsurface information earlier, companies can move faster from discovery to production and bring more copper to market sooner.

Image: This shows an in-mine panel muon sensor deployed and activated inside a mine tunnel at a site in Nevada. Copyright Ideon Technologies

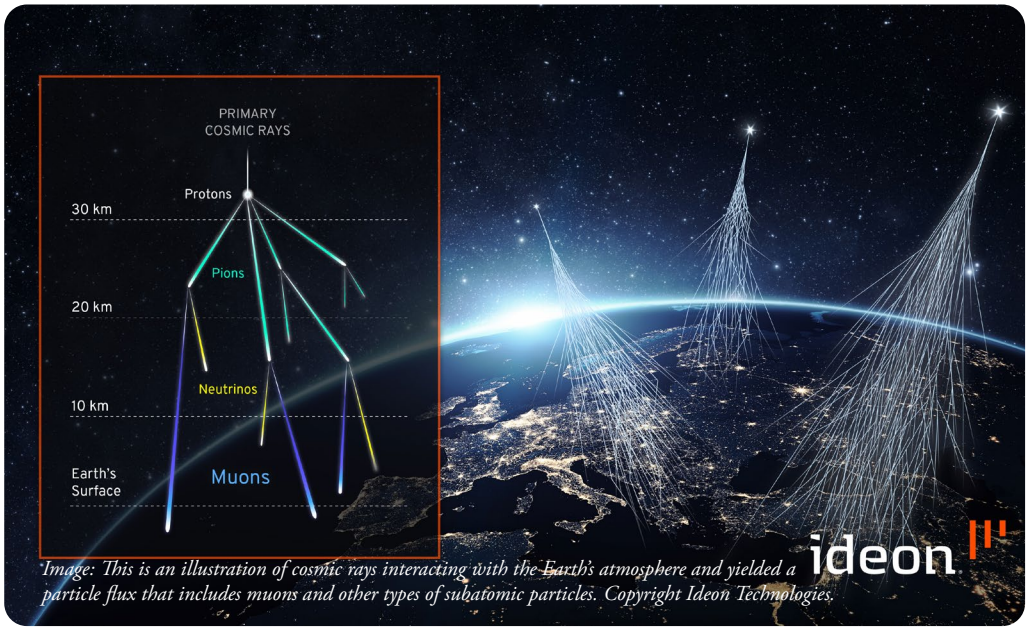

Image: This is an illustration of cosmic rays interacting with the Earth's atmosphere and yielded a particle flux that includes muons and other types of subatomic particles. Copyright Ideon Technologies.

Q: When copper producers talk to you about secure supply, what worries them most – discovery risk, schedule slippage, social licence or something else?

Agnew: Permitting is certainly in the top three, because getting projects approved and into production has become increasingly complex in western economies.

Social licence is also critical; mining has sometimes had a difficult reputation, so our customers are very focused on working with local communities to build trust with the essential community support to bring new production online.

The third major concern is an inadequate level of subsurface understanding – they need high-resolution, decision-grade intelligence sooner to make confident mine planning and production decisions. Traditional methods of imaging the Earth no longer suit to the demand cycle we face today. We're trying to solve a 21st century problem using 20th century tools.

Q: For readers who don't know you, how do you explain what the Ideon REVEAL™ subsurface intelligence platform does?

Agnew: We use the energy from supernova explosions in space, in the form of a small subatomic particle called a cosmic-ray muon, to image the subsurface of the Earth in very high resolution. That imaging gives our customers the confidence to deploy capital more quickly, accelerate production, and get metals to market sooner – and more safely, as it helps them better understand the geotechnical dynamics of their underground operations.

Q: Cosmic ray muon tomography sounds like science fiction. For non-physicists, how does it work in practice?

Agnew: The best analogy is medical imaging. Think of going to the dentist: they put an X ray source on one side of your face and a detector plate inside your mouth. X rays pass through, and your teeth and gums block some of them, creating a shadow on the detector plate that highlights any anomalous features.

Our technology works in much the same way, just at a far larger scale. We use a naturally occurring beam of subatomic particles – muons – playing the role of the X ray, and place our detectors deep underground (in borehole or mining drives). High-density rock blocks more muons from reaching our detectors; low-density rock lets more through. That variation creates an image of the subsurface and the geological features present in the area of interest

A 2D X ray or 3D CT scan are good analogues, but there are two key differences: we work at the scale of hundreds of millions or billions of cubic metres rather than a small part of the human body, and we do not generate any harmful radiation. Unlike at the dentist, you don't need a lead vest – the universe is continuously "serving up" muons for free and without harm. A muon is passing through your head every second of every day – that has been happening since the day you were born.

> We can operate in active and noisy mining operations and still provide high-resolution subsurface intelligence.

Q: What exactly are you measuring underground, and what does the output from the Ideon REVEAL™ platform look like to a geologist or mine planner?

Agnew: We're providing the density of the Earth's subsurface – the geological backbone if you will. Once you understand density at high resolution, you can fuse other geophysical datasets in a much more intelligent way.
The Ideon REVEAL™ Platform provides density mapping of the subsurface in 2D, 3D and 4D – that is, 3D over time – and includes a multi-physics data fusion capability. We bring multiple geophysical datasets together into what we call a dynamic Earth model, giving geologists and mining engineers much greater fidelity understanding and, in turn, much greater planning and operational precision.
The more precisely you understand the subsurface, the more the industry's vision of precision mining becomes possible. Today, with low-resolution information, operators are often interpolating what's happening between widely spaced drill holes, which drives significant variability in performance and makes high-precision mining almost impossible to achieve. Whereas high-resolution, decision-grade intelligence reduces environmental impact, lowers costs, and accelerates production.

Q: Muon tomography is still new to many in mining. Why are muons such a powerful tool for imaging deep ore bodies compared with drilling, seismic or EM, and where are their limits?

Agnew: Many traditional geophysics techniques give you 50 metre, 100 metre or even kilometre scale resolution and offer a lack depth penetration below the first few hundred meters of cover, so you are left with a very coarse picture and understanding of the Earth. Muon tomography can deliver from 10-meter scale to sub-metre-scale resolution, which is what unlocks the kind of precision I've described and a wide range of use-cases across the mining value chain.
Another big advantage is that muons are essentially impervious to operational and environmental noise. Drilling and blasting, power lines, trains, heavy equipment – all of that activity can confound other geophysical methods. Muons don't care; they travel through hundreds of metres to kilometres, of rock. That means we can operate in active and noisy mining operations and still provide high-resolution subsurface intelligence, which is not the case for most other techniques.

Q: You've launched a dedicated Ideon REVEAL™ for Caving solution. What problems were block and panel cave operators asking you to solve that existing monitoring tools couldn't?

Agnew: It comes back to high-resolution understanding of the subsurface in caving environments. Block cave operators rely heavily on point data from drill holes, beacons, and seismic systems. Those datasets are important and complementary to muon tomography, but none of them provides high-resolution 4D imaging – or even any reliable full-scale imaging of what's really happening inside their caves.
We deliver 3D imaging over time of the cave back, cave propagation behaviour, the air gap and the evolving muck pile. That gives operators a much clearer picture of how to run the cave safely and productively over time.

Q: Block caving is attractive for large, low-grade, deep copper deposits, but once the cave initiates it is hard to see and control. What new visibility can you give operators on cave shape, propagation and ore flow?

Agnew: Caving is a very attractive method for recovering low-grade deposits deep in the Earth cost-effectively. Today it accounts for about 15% of global copper production and is on track to reach around 30%, so it is central to closing the supply gap we've been discussing. We provide high-resolution images of the cave back, air gap and muck pile, and we go beyond just cave shape. With the integration

Caving is a very attractive method for recovering low-grade deposits deep in the Earth cost-effectively. Today it accounts for about 15% of global copper production and is on track to reach around 30%, so it is central to closing the supply gap we've been discussing.

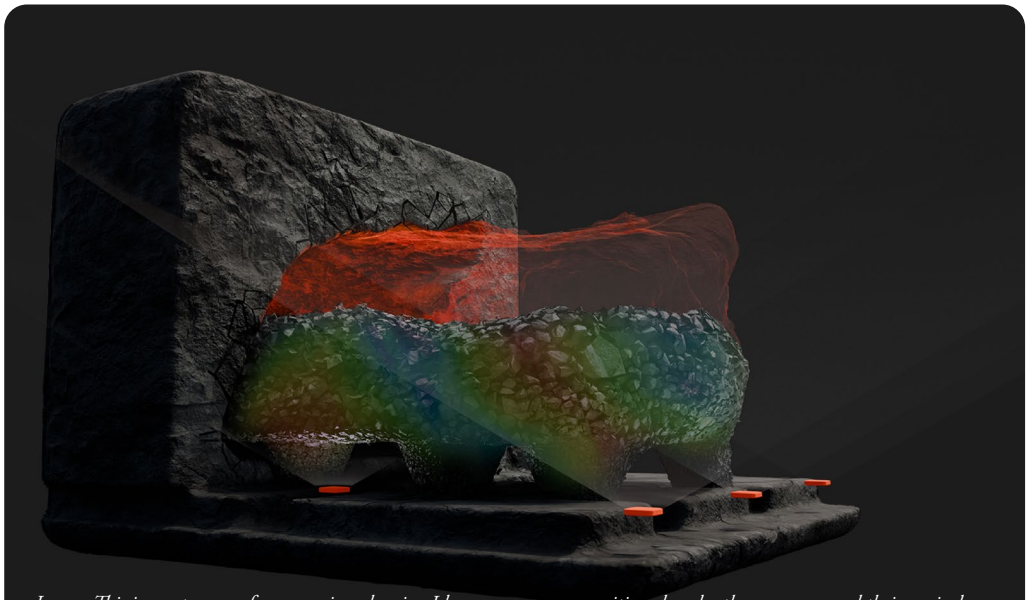

Image: This is a cut-away of a cave mine, showing Ideon muon sensors positioned under the cave zone and their conical imaging fields (light gray), as well as the internal muckpile of the cave shaded by density values. Copyright Ideon Technologies'

of our new subsurface beacon technology into REVEAL™ later this year, we will be able to accurately track rock flow and see how material moves through the cave. That greatly improves customer's ability to understand safety, improve productivity and production predictability, allowing cave mine operators to truly optimise material flow and productivity in the cave.

Q: Can you give an example from a recent caving deployment of how this changed decisions on the ground?

Agnew: A good example is our deployment with Evolution Mining at Northparkes Operations in Australia. The site has a difficult history: nearly 30 years ago, several fatalities resulted from an underground air blast. The Evolution team wanted to understand the size and magnitude of any current air gap, and whether they needed to change production scheduling as a result.
We confirmed that the air gap was smaller than the threshold of concern from a safety perspective. That allowed the mine to keep producing without taking additional stand-off measures on perceived safety grounds. Safety is a great starting point, but it quickly flows into production and production predictability. The information we provided enabled fundamentally different decisions – and that's our focus: helping customers make faster, better, safer decisions than they could have made without our technology.

Q: Across the copper mine life cycle, where do you see the strongest business case today – brownfields exploration, resource expansion, or in-mine monitoring and optimisation?

Agnew: There is a strong business case in brownfield exploration and resource expansion, but we've learned that the closer we are to real business value crystallisation, the more responsive customers are to change.
If we help map additional ore that may not be mined for five or ten years, there is interest, but the urgency is low. If we help a heap leach operation make decisions that result in more copper next month, customers are far more receptive because the impact is immediate and tangible.

Q: When you talk about measurable ROI for REVEAL, what does that look like on a copper producer's scorecard?

Agnew: It's all of the above: fewer drill holes, improved conversion of resources to reserves, better cave performance, better safety performance – and ultimately more copper. More recovery is what our customers want to see.
Safety is the thread that runs through everything. Our customers put safety first, and by improving safety – and then production and environmental performance – we are directly supporting their top-level metrics.

> Subsurface intelligence is a key unlock for mining to become the critical, technologically enabled, industry the world needs.

Q: How does Ideon integrate muon data, multi physics and AI into existing geological models and mine planning workflows so teams get clear, actionable insight rather than just more data?

Agnew: Geologists are said to spend 60–80% of their time just stitching data together in CSV files and spreadsheets. A big part of our value is taking that problem away, by allowing customers to onboard and integrate all relevant data into the Ideon REVEAL™ platform.

We bring those datasets together seamlessly, but our goal is not to create more data – it's to deliver decision-grade subsurface intelligence. At Northparkes, high confidence clarity on the air gap enabled a very different operational decision. That's our litmus test is if the customer can't confidently make a different decision because of the intelligence we provide, we're not adding value. It is the anchor for how we use multi physics and AI and for how we relieve the data fusion burden on our customers.

Q: You moved from leading large industrial technology businesses at Finning, a Caterpillar franchise, to building a deep-tech mining company. What has that journey taught you about how the industry should approach subsurface imaging?

Agnew: At Finning, I was involved in selling large autonomous mining fleets –trucks with no operator, self-guided around the mine. It dawned on me that we were giving customers sophisticated new equipment and guidance systems, but our understanding of the Earth itself hadn't changed. Even after investing hundreds of millions of dollars in autonomous fleets, the error bars on the subsurface were the same as before, which put a ceiling on returns – no matter how good the fleet was. When I was introduced to Ideon, a penny dropped: we could close the loop. High-efficiency equipment on the surface, combined with high-resolution understanding of the subsurface, it became clear to me that with muon tomography and REVEAL™ that we could help unlock a step change in overall mining system-level performance.

Looking ahead 10 years, I believe that – alongside permitting reform – the industry must transform how it understands the Earth's subsurface. That will unlock hidden value from almost every other subsequent process in the mining value chain. I genuinely believe subsurface intelligence is a key unlock for mining to become the critical, technologically enabled, industry the world needs.

Image: CRU

Q: Ideon spun out of TRIUMF, Canada's particle physics lab. What have been the biggest challenges in taking a laboratory technology into everyday mine operations?

Agnew: In many ways we are productising particle physics. When we spun Ideon out of TRIUMF, the detectors were about the size and weight of a small car – not something you could easily send down an industry-standard drill hole. Miniaturising the technology 50x and ruggedizing it to operate in harsh and unforgiving mining environments has been a major focus.

The people side was just as important. The team you need in a government lab for fundamental R&D is very different from the team you need to solve complex technological and operation problems, and be able to partner effectively with the world's largest mining companies. Building a team that could productise particle physics and then take it to market with major miners has been both a challenge and an opportunity – but on both fronts, technology and team, I couldn't be prouder, we've made remarkable progress in a relatively short time.

Q: Looking ahead, what would you most like copper industry leaders to understand about the role of subsurface intelligence in securing supply and operating more sustainably?

Agnew: I often ask executives to imagine a world where they have perfect understanding of the subsurface, then reimagine their whole business in that context. The mind really does

boggle when you consider how different mining could be with high-confidence, detailed knowledge of the Earth beneath our feet.
Decision-grade subsurface intelligence opens up extraordinary possibilities: producing more metal, faster, with greater social licence and reduced impact on our environment. I would encourage leaders to think in terms of possibilities and how fundamental these changes could be for their businesses.

Q: Finally, bringing this to the topic of the World Copper Conference in Santiago, how is Ideon thinking about Chilean copper and your global expansion?

Agnew: Chile is a hugely important part of global copper production, and we're excited to announce our expansion into the Chilean market, especially in block caving and panel caving operations. Our focus is on major and intermediate mining companies. Coming back to that 20-year journey from discovery to production, we've realised that existing tier one and tier two assets are the engines of global copper production. Many junior projects are still 20 years away from first metal and won't materially help close the near-term 12-trillion-dollar supply gap. So we've placed a bet on majors and intermediates, who already have the infrastructure, capital, people and social licence, and who are focused on increasing output from those assets. Expanding into Chile this year is a critical part of our strategy to help unlock additional copper supply for the world ■

Chile is a hugely important part of global copper production, and we're excited to announce our expansion into the Chilean market, especially in block caving and panel caving operations.

Visit ideon.ai to learn more and download case studies showing how Ideon is unlocking subsurface potential™.

Scan the QR code to watch a how REVEAL transforms cosmic-ray muon measurements into decision-ready subsurface intelligence for mining operations.

English **Spanish**

CRU Communities

25th

World Copper Conference

Santiago, Chile // 5 - 7 April, 2027

Part of **CESCO** Week

Join the *world's definitive* Copper Conference

See you *next year!*

80+ Speakers

420+ Attendees

26+ Countries

195+ Companies

For more information visit:
www.copper.events.crugroup.com