



amira

EMC2023

Conference Pack

Natural History Museum | London UK

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Amira Welcome

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Session 1 Day 1 | Welcome & introduction ‘Exploring Exploration.’

Title/ Speaker: How should we explore to ensure truly net positive outcomes Prof Richard Herrington, Natural History Museum

(Double Click to View presentation)



2.6 Ga old BIF, Tom Price Mine WA

AMIRA Exploration Managers Conference 23-24 August 2023



Exploring for truly net positive outcomes

Professor Richard Herrington

Science Lead, Resourcing the Green Economy
The Natural History Museum
Cromwell Road
London SW7 5BD, UK

Title/ Speaker: Critical Minerals and Critical Thinking for Sustainable Development. Dr Karen Hanghoj, Director, British Geological Survey

Title/ Speaker: A Geothermal Perspective on Mineral Resources Prof Stuart Simmons, Consulting Geologist, SEG.

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Geothermal Perspective on Mineral Resources



Stuart F. Simmons <ssimmons@egi.utah.edu>



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Title/ Speaker: What does disruption look like for the Exploration Industry Mr Paul Agnew, Chief Geologist, Rio Tinto.

(Double Click to View presentation)



Session Notes: In this session there was an overview of the EMC event provided, with clear instruction around the need for a safe space and our sector to be able to engage in challenging conversation to understand what the main challenges facing industry are. Inclusion of supplier members has been facilitated to assist with building an understanding of the main challenges and their potential role in the conversation and subsequent solutions. Main themes discussed in this session included: resilience to change and progressive thinking in the industry as highlighted by Jacqui Coombes. A need to move from the 'cradle to grave' current approach to mining towards a 'cradle to cradle' approach which embraces a social, circular economy, by Prof Richard Herrington. Dr Karen Hanghoj provided a unique perspective of the determination of criticality being an issue beyond geological resource and supply and encompassing geopolitical issues as well. Professor Stuart Simmons presented a perspective that Engineering thermal systems may provide an additional source of mineral resources which could be investigated. The session wrapped up with the most popular talk in the session as voted on slido, about the forces of disruption in our industry. This provocative talk suggested people & timing are critical in considering disruptive forces and preparing for change, to adapt and survive.

1. Amira's strategy was explained with initiatives such as CollarateOre, P-ADI & Centers of Excellence.
2. One aim in this conference is for suppliers to understand what the key industry issues are.
3. Jacqui Coombe's touching welcome with a focus on change: being resilient to change, showing adaptability, being forward thinking and progressive.

4. Mining needs to move away from the traditional “cradle to grave” approach, embrace social circular economy & move to “cradle to cradle” approach.
5. In determining what is a critical mineral, “criticality” considers both supply risk & economic vulnerability. It is not a geological resource issue. It encompasses geopolitical issues.
6. Engineering thermal systems may provide an additional source of mineral resources that needs investigating.
7. The forces of disruption discussed & pictured colorfully by Paul Agnew. People & timing are critical in considering disruptive forces and preparing for change, to adapt and survive.

Slido Questions & Reaction:

- How do we encourage the sharing of biological data in jurisdictions where the government may not have the people’s or environment’s best interests in mind? There is no consistent approach to reporting biological data. Projects do undertake studies, but these are rarely published in a peer reviewed manner
- On the matter of biological data - most jurisdictions in the world require environmental (&social) impact assessments for major projects. We can build on this.
- Both speakers have mentioned the UN SDGs. There is a concept termed sustainable development license to operate (SDLO) taking SLO further. Needs discussion!
- Q. Karen - the largest (by tons) commodities mined are almost never considered - that’s sand & aggregate - why not? Both difficult to recycle & left off models I actually had figures of UK production and aggregates are by far largest by tonnage (metals tiny) but took it out to keep it shorter. Will put in shared copy.
- General Q - will slide decks be provided to participants? Yes- all speakers who are happy to share their slides have been linked within this agenda.
- How do we educate our stakeholders, communities, societies about govt- and industry-level standards? How do we encourage society to subscribe to those standards We also need to ask are government and industry standards ‘future proved’ adequately. As we know, 1960s standards don’t work for today - e.g., Portugal · Possibility for extraction of metals in geothermal fluid system, what are the pinch points for extraction.
- Stuart- how can we best integrate learnings from geothermal to k future mining · Paul... How much will the search for space resources change the future of terrestrial mining? Is it part of the answer?
- Should education and research be more focused on developing new production and extraction technologies rather than deposit model and exploration methods?
- Question for Paul: Instead of grade and tonnage driving economic value, do you think the carbon score of a deposit will take a leading role?
- Paul, how do we get unlimited energy to mine critical minerals without the critical minerals to build renewable energy resources? It has to be nuclear....
- Very good Paul, one question, who will own the industry in 20 years? Can the current owners, their boards and shareholders 'pivot' to this, I have my doubts.
- How do we balance good mine closure and reclamation with potential for future reprocessing? It may be an excuse for delaying or avoiding reclamation.

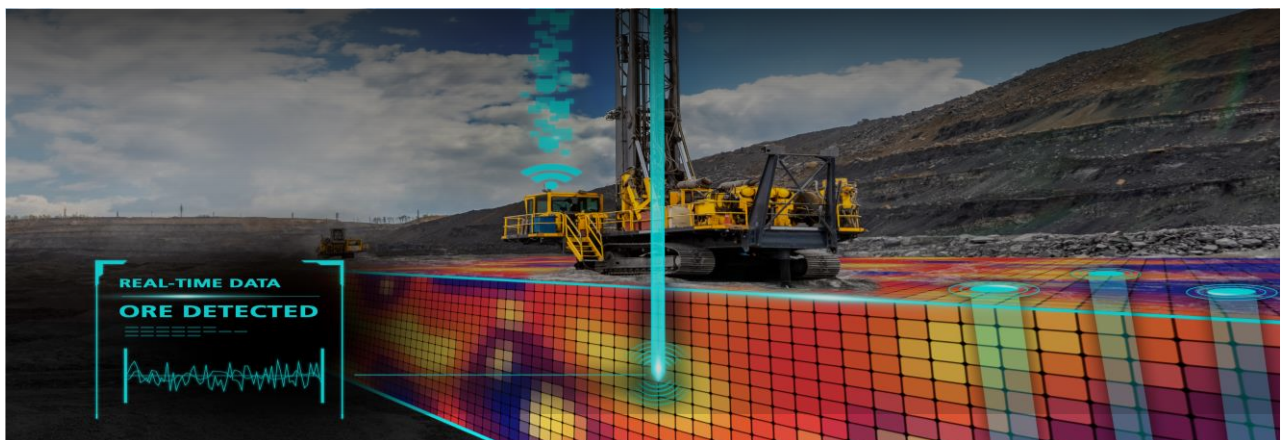
- How do we build up the legislation for the 20–30-year tech horizon? Do we need an intl mining lobby group?
- More selective mining or more massive block caving?
- Stuart, what is “stimulation”? Same as fracking?
- There have been talks on the global mining industry & SDG but no mention of the largest workforce-ASM. How do we make our science more accessible & ensure inclusion?
- Paul- Instead of fast mining, is it more sustainable to slow mine high value metals (Au) w intermediate technologies to ensure communities have time to develop?

Session 2 Day 1 | Next Generation: The Exploration Journey

Title/ Speaker: The road to net zero for miners: Opportunities and setbacks. Dr Kwasi Ampofo, Head of Metals and Mining, Bloomberg.

Title/ Speaker: Data (Past) to Insights (Now) to Intelligence (Future) in Orebody Knowledge Mr Raj Mathiravedu, Orica Digital Solutions.

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AUGUST 2023

DI² IN OREBODY KNOWLEDGE

RAJ MATHIRAVEDU
DARREN PALMER



Title/ Speaker: BHP Xplor: Partnering for Success Dr Libby Sharman, Exploration Geologist, BHP.

Session Notes: In this session there was a series of talks which gave a high-level perspective of new insights to the industry. Dr Kwasi Ampofo provided some of the driving factors associated with net zero and what are observed opportunities and potential hurdles from an economic perspective. Following this a more tangible talk provided evidence of one of these changes in adoption of a data driven approach to ore body knowledge, which provides a step change in the way in which we work. Finally, Dr Libby Sharman shared the way BHP is partnering with the supply chain, including exploration juniors, to develop new opportunities. The talk highlighted the multi-faceted nature of the engagement, and the way BHP is engaging with the cohort and results seen from the first round.

Slido Reaction & Questions:

- I like what you said Raj 'data doesn't have emotions. It's food for thought when we think about the quantification of S for ESG, when we need more qualitative.
- What is the logic of geographically selecting one company from each continent in the Xplor program?
- Hi, we are talking about collaboration among juniors, but what about collaboration among majors in the exploration area.
- Libby, does BHP take applications from peer companies/miners?
- For Libby: Do you think a 6-month duration is sufficient to achieve your goals?

Discussion: Exploration Technology

Panelist:

1. Dr Fabian Kohlman, Managing Director, Lithodat,
2. Dr Kathryn Hadler, Director, (European Space Resources Innovation Centre)
3. Mr Richard Inglis, Chief geoscientist, Newmont
4. Mr Raj Mathiravedu, Orica Digital Solutions

Session Notes: Technology providers and end users cannot talk to one another because:

- providers provide data. Someone has to turn that into knowledge. Many end Technology users don't have the time/resources to do that themselves. So, it's stranded data with no value as it doesn't turn into knowledge.
- Existing providers move too slowly because they are trying to protect their capital investments, but new providers often create solutions without a clear marketplace. There's a gap for new real innovation and development.
- It is the essence of a consultative business model. However, it does take time and energy, and needs to be built on a shared future.
- Technology providers are fixed on specific problem(s) they are focused to find solutions for and overlook the end-users needs.
- Technology providers are in the business of selling their technology - end users need technology to implement critical work. This difference in objective makes it difficult for the groups to communicate. Tech providers need to be more familiar with the subject matter for which we seek solutions.

- They do but sometimes the priorities might not be the same for everyone, it feels like change is slow.
- It can feel like the definitions of success are different but really, they're not. Tech providers only succeed if end users are more successful.
- We can, it just takes a long time to get to a trusted and meaningful level of relationship between individuals who have the vision and authority to make change happen. Often this fails, or is blocked by procurement, legal etc.

Slido: Seventy eight percent of respondents define the "valley of death" as a commercialization nightmare.

- What has been the most disruptive technology enabler in exploration in the last 10-20 years?
- What has been the most disruptive technology enabler in exploration in the last 10-20 years?
- What promising innovation is there beyond AI (drilling, sensors)?
- There a danger in exploration of getting into a feedback loop of AI generating targets in areas with high data density so these are the areas where we explore.

Questions for the panel speakers?

- I think multidisciplinary geoscientists are trendy 😊
- Industry does a great job usually at collecting big data, and there is an appeal to then use "AI" to try and synthesise this into a target as a type of silver bullet by some, but we need to ensure we value the fundamental geoscientist too. How do we do this? These skills are now far less trendy than AI topics.
- Is there a danger in exploration of getting into a feedback loop of AI generating targets in areas with high data density so these are the areas where we explore keeping so keeping us exploring in mature terrains.
- What kind of data do you need from Geological Surveys? Should it be free? How about legacy data from previous exploration?
- Does anyone want to comment on new technologies that might help us find new deposits in areas without any data?
- Who needs to fund exploration technology development? Large companies internally from their larger revenues? Startup technology companies with access to venture capital? Governments? Or does it have to be collaborations?
- What does the commercial model for our technology developers and "end-users" ecosystem look like in 5 years' time?
- One way of using AI is to build a deep learning model specifically for Geoscience, a Geo-ChatGpt.
- Do you think AI will make a significant impact in mineral exploration resulting in discoveries?
- Do you think our industry does a good job of knowing which problems are better addressed by AI vs those that are better for humans?

Breakout Session Day 1 Session 2

Title/ Speaker: Smaller, high grade deposits Dr Kathryn Moore, Senior Lecturer, Camborne School of Mines.

(Double Click to View presentation)



Mines of the future: a question of scale in ore bodies?

Kathryn Moore

Senior Lecturer in Critical and Green Technology Metals

Camborne School of Mines



Session Notes:

- A discussion about economic and socio-economic drivers for smaller-scale mining. What is the opportunity?? What is needed to progress these opportunities?
- Key conversation was about how to structure companies that are suitable to pursue this. If they are privately owned, do they require the same amount of drilling as is governed by reporting for JORC?
- What information is key to understanding orebodies? - discussion between good geological models and sections, more geophysics or increased drill holes.

Session 2 Day 1 | Next Generation: ESG in Exploration
The Nexus of ESG and Exploration

Title/ Speaker: Empowering geologists in the exploration process – The importance of human technology interoperability Mr Anthony Harris, Chief Geoscientist Newcrest Mining Limited.

Title/ Speaker: A window into emerging economies playing the critical minerals game – A view from South Asia: opportunities and challenges Mr Biplob Chattergee, CEO Geovale Services.
(Double Click to View presentation)



Emerging Economies in the Critical Minerals Value Chain Opportunities and Challenges - A View From India



**Biplob Chatterjee, Director Geovale Services,
August, 23, 2023, AMIRA EMC 2023**

<http://www.geovale.com>

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Title/ Speaker: Critical metals and the minerals industry; challenges and opportunities Assoc Prof Simon Jowitt, Director, Ralph J. Roberts Centre for Research in Economic Geology. (Double Click to View presentation)



Critical metals and the minerals industry; challenges and opportunities

Simon Jowitt

Ralph J. Roberts Center for Research in Economic Geology
Nevada Bureau of Mines and Geology, University of Nevada Reno

sjowitt@unr.edu @The_Jow

We acknowledge that the University of Nevada, Reno is situated on the traditional homelands of the Numu (Northern Paiute), Wašiw (Washoe), Newe (Western Shoshone), Nuwu (Southern Paiute) peoples.

Session Notes:

Mr Anthony Harris provided a case study about the importance of human-technology interactions in the exploration process and the way that all parties must be empowered in order for new ways of working to be supported.

Geologists remain the critical to unlocking value across the mining value chain.

Exploration success required people.

Geologists with new skills sets (that enhance “traditional” core skills

Newcrest has successfully explored and discovered multiple Au-Cu deposits that outcrop beneath hundreds of meters of barren rock.

Technology-led machine-driven mineral mapping

Need to invest in upskilling to better use new tools.

Sensor technology to guide core-based observation – business case.

- Scanning core at cm-scale resolution has helped to minimize ambiguity.
- Eliminates the laborious process of manual core photography.

Future discoveries remain with the creative opportunities recognized by geologists\Machine – driven products facilitate the distillation and integration of complex data that geological teams need to combine with their mineral systems knowledge to increase the probability of discovery.

Unlocking the knowledge from geological data, irrespective of data source, requires better interoperability between systems and platforms and algorithms and People.

A perspective from the emerging economy of India was provided by Biplob Chatterjee, are the opportunities and challenges different? And what are the critical minerals opportunities and challenges?

- Emerging economies have nearly no presence in the midstream and downstream part of the value chain.
- Large prospective regions in the global south are Unexplored.
- Many emerging economies would become new critical mineral suppliers.

Final Assoc Prof Simon Jowett provided some perspective on thinking critically about the critical metals bubble. Suggesting We already have significant unrealized potential for critical metal production.

Slido:

- Have you tried to map jungle by identifying different trees growing on different soils, i.e. Reflecting different lithologies?
- With core scanning technology, how to get the scanning capacity to keep up when we have hundreds of meters being processed in the core shed daily?
- WRT India, the challenge is not one of endowment, but of explorability and whether if a discovery can be developed given social and land ownership issues.
- India: What is the main reason for a lack of foreign investment in exploration in India over the years?
- How do we manage the future uncertainty around if Li ion Ni Co etc will be in demand, eg is the industry talking/tracking battery research groups well enough?

- The last presentation noted greenhouse gases, water use and mining waste as areas needing significant improvement. What role do geologists play in this?

Discussion: ESG Exploration Nexus

Panelist:

Mr Mike Ravella, Chief Innovation Officer, Veracio,

Dr Rose Clarke, Consultant, Satarla,

Dr Murray Hitzman, Director, SFI Research Centre in Applied Geosciences (iCRAG).

Mr Patrick Redman, Snr Vice President, Copper Mountain Mining Corp

Session Notes:

In future the first mover advantage may be more related to social/community acceptance rather than geological potential only.

Get as much community involvement as possible to manage expectations from the beginning and to keep educating the communities about exploration which is the biggest challenge to understand what's involved. We need dedicated hands on ESG professional to manage company's business in this arena.

Involve ESG in the project quickly.

Just like we should all be responsible for our own safety we should also all be responsible for the ESG legacy we leave behind, from execs down to onsite geos.

- Without good ESG strategies we don't mine.
- Environmental part of ESG, industry don't do well in this part of ESG
- ESG is perceived as a challenge but shouldn't be like this.
- G is the accountability and is the worst / Environmental is the best, but it is a project by project case

ESG FLOW ON SESSION (DAY 2)

Notes:

The missing word was greenwashing. We are exploiting finite resources and calling ourselves renewable; this is a disconnect.

Is there value in the ratings? They don't reflect exploration activity well. It is very hard to school well on pure exploration.

This is about short-term vs long-term goals. Short-term coal makes money, but long-term reputation matters.

How do we quantify net positive biodiversity and make that happen at the drill pad? It can't be it has to be a balance in other areas near by e.g., reforestation of a similar area size.

Net positive is more suited to Europe than Australia, where the majority of ground has been disturbed, and to return to natural is positive. In Australia, that is more challenging due to large undisturbed areas.

How do we quantify the biodiversity baseline? Is natural capital the next pre-competitive dataset? Further challenges, as this is dynamic, not static.

Why do we always talk about the E.... more on the S & G needed.

Slido: Regarding the Environmental part of organization ESG performance, from 44 responses: 52% feel there is room for improvement and 30% are still learning. With respect to the social part of ESG performance, from 42 responses: 55% reported that it is an emerging space for them and 26% feel they are leaders in that space. Regarding who is responsible for Governance in the organization in exploration, from 43 responses: 49% are the Executive team, 23% are onsite geos and 14% are those in reporting.

- Why is ESG only seen as a challenge? (Asked to panel)
- What's the role/importance of data governance and digital capabilities in future of 'G' for exploration? (Asked to panel)
- We hear conversations about ESG in relation to mining applied to mining and mineral processing... Not often with exploration... Why?
- People resources is fundamental to the success of ESG. Exploration teams on the ground can have too much placed on them reducing their bandwidth for discovery
- What role do you think underground mining plays in achieving environmental goals?
- Is the social side about changing the perceived predatory nature of mining and mining companies?

What words do you associate with ESG?

Cost, Waste reduction, Mine waste, Responsibility, compliance, social license, managing expectations with communities we work in and environment., care, Value, Communication,

Environment sustainability, Common outcome, Shared value, not negotiable, Showstopper, Exploration program delays underestimated, Sustainability, People, Accountability

Opportunity, Investment risk management, collaboration, transparency, communication, responsibility, Challenging, Stakeholders, Social data census involvement being loved by communities, Society, communications, Regulations, not sure it has a definition, complexity.

Undervalued, often too little too late, Community issues, Our inevitable future, Critical today, corporate responsibility, Equity, Environment sustainability governance, Problems.

Takes a lot of time, Challenge, Community, Development, Challenges.

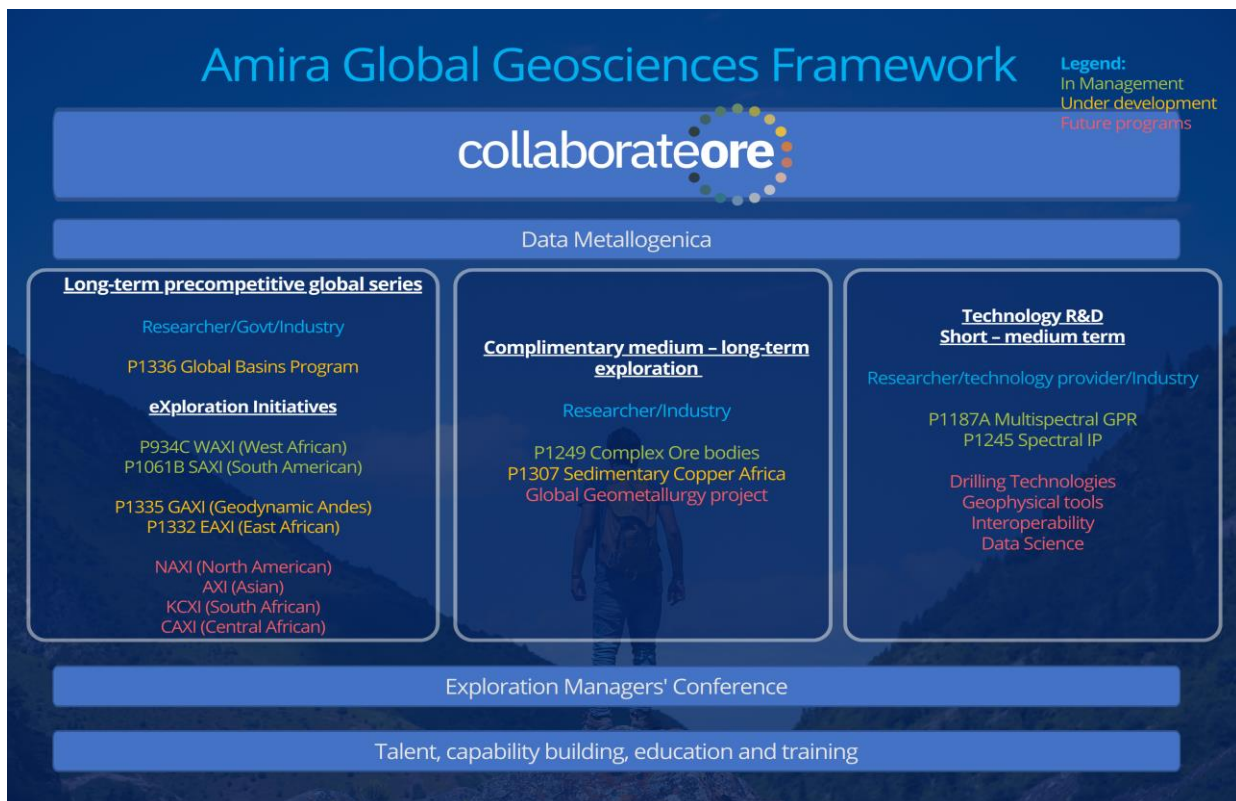
What is one take-away or action you will take forward from this session?

- In future the first mover advantage may be more related to social/community accep rather than geological potential only.
- Resource teams appropriately. Engage communities from the outset, set expectation listen to understand their needs. Start locally and expand as projects develop

- I'm thirsty is it time for a pint?
- Improve
- Get as much community involvement as possible to manage expectations from the beginning and to keep educating the communities about exploration which is the biggest challenge to understand what's involved. We need dedicated hands on ESG professional to manage company's business in this arena.
- ESG makes business sense
- Involve it in the project quickly
- We should all be responsible for ES and G, from execs down to onsite geos, just like we should all be responsible for our own safety we should also all be responsible for the ESG legacy we leave behind
- More action needed.
- ESG happened after criticality- why is it not placed front and centre?
- Increased awareness
- Thinking
- New ideas
- Education
- I think the fact that all speakers in the session sidelined ESG In favour technology, geology, and economics is telling!
- Without good ESG strategies we don't mine

Session 1 Day 2 | Welcome Back | Geoscience Framework.

Session Note: The Amira Geoscience framework was shared.



Slido Question and Reactions: Suggested areas that Amira should focus on next are:

Suggested areas that Amira should focus on next are:

- ESG tools/ monitoring/reports.
- Drilling technology - improved costs and value Precompetitive data in areas without good coverage (e.g., Africa).
- New regional exploration initiatives are good. Need to be phased to ensure resources not overstretched. Automated geological logging / touch core once is a key area that needs a coordinated effort to establish workflow, etc.
- Mineral economics and geomet/mineral resource management.
- More of the regional XI Programs broaden and add Programs as they succeed and fail.
- Hyperspectral satellite vs ground observation; petrophysics vs airborne geophysics.
- Precompetitive series & deformed basins.
- Orebody knowledge as a multifaceted approach Tailings as a Resource.
- Metallurgy.
- Orebody knowledge across disciplines (need to get engineers, metallurgists, biologists, etc. on these projects).

We are revisiting Data Metallogenica- what would you like to see on it?

- Geochem, quantitative mineralogy, multispectral response, physical properties
- As much information as possible, including any potential downstream (e.g., geomet) or non-technical data available
- Access for non-destructive analysis
- More info on department
- What is Data Metallogenica? As a member should I know what it is?
- Copper deposits
- Analytical data, mineral mapping

How can Amira help de-silo the mining value chain?

- Inter-disciplinary projects that clearly present the value proposition. We are generally poor at putting \$ to research outputs
- More interdisciplinary research conferences that focus on whole of supply chain issues. Broaden research provider network.
- Not sure Amira should be outside of geoscience related to exploration.
- Working with several mines in parallel
- Create data sharing platform on collaborateore
- Emphasize collaborative and multidisciplinary projects.
- Get other disciplines/teams involved

Session 1 Day 2 | Welcome | Where are we now?

Diamond Keynote Talk: The Evergreens of Exploration and Green skills Mr Wolfram Schuh,
Vice President Exploration Latin America, Freeport McMoran

Evergreens in Exploration and Green Skills for finding Green Minerals

examples from
Tenke-Fungurme,
DR Congo

Wolf Schuh
08 2023



Kwatebala, DR Congo

Title/ Speaker: Next Generation Exploration – Key trends and challenges Professor John Hronsky, Principal, Western Mining Services:
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Next Generation Exploration: Key Trends and Challenges

Jon Hronsky – Western Mining Services
Amira-Exploration Managers Conference
London, UK – Natural History Museum
24 August 2023



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Amira Exploration Manager's Conference - London August 2023

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Title/ Speaker: Title: Using mining's past and present to shape an industry fit for the future,
Ms Carly Leonida, Editor, The Intelligent Miner
(Double Click to View presentation)

Using mining's past and present to shape an industry fit for the future

A generalist's view



Presented by:
Carly Leonida

Amira Global
Exploration
Manager's
Conference
August 24th, 2023



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Title/ Speaker: Title: Moving from social anxiety to successful positive developments, Prof.
Murray Hitzman SFI Research Professor UCD ICRA Director
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MOVING FROM SOCIAL ANXIETY TO SUCCESSFUL POSITIVE DEVELOPMENTS



PROF. MURRAY HITZMAN
SFI RESEARCH PROFESSOR UCD
ICRAG DIRECTOR



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Session Note:

In this session we considered where our industry has come from and the way this influences it moving forward. Mr Wolfram Schuh provided a case study of exploration in the Congo, demonstrating that while we have new ways of working, it is the exploration geologists who are often first on ground and they need to engage with communities from exploration stage. This is an 'evergreen' of exploration which needs to be recognized and considered. While we have new formal roles and skills emerging, recognition of the role which exploration geologists play, and have always played, at the earliest stage is critical.

Consideration of Data science and AI may be suitable for data rich areas but is perhaps less suited for data poor areas and traditional methods remain of importance. Suggestion: Amira to play a role in developing standards for ESG reporting, similar to what has been done with JORC.

The industry is under intense fundamental change. The risks are in the negative impact that mining can generate. We need to re-think the way we mine. Perfection is the enemy of progress. There is value in revisiting historical information and performing "data mining" & case examples were presented. "Data is the new oil" data mining the past for new discoveries. Major companies are already scouring historic data. There is huge value in re-examining the past. The mining industry has

the attention of governments and the community like never before. Industry should not wait for regulators and policy makers and needs to be more proactive.

Dr Murray Hintzman suggested generalists are of importance and social scientists should work along with the experts with communities. The mining industry needs a general media champion (like David Attenborough). ESG reflects corporate behaviour. It's seen as a vehicle for transparency and trust. Ethics should also be considered. Amira projects & programs focus on: (i) digital and innovation and (ii) costs & products but should focus on ESG matters & understand the social anxieties. Need to understand the level of acceptance of different people. The issues facing the industry stem from social issues. How to best communicate, it's all about communication. Besides doing "geological mapping" should also be doing "social mapping".

Slido Question and Reactions:

- What are the top 3 skills that early career geologists and emerging geoscientists require to start strong in exploration geology?
- Next Generation: what is the risk of the cyclic nature of exploration budgets to ensuring we secure and foster talent for the future?
- Consider what we meant by poor quality projects, there is an opportunity to upgrade 'poor quality' ore by unlocking the technical barrier that makes it poor.
- How do we as an industry make public statements to the media about our commitment and partnership to global transition?
- Is it important to tell the public something like "the future of mining is also green" and "we will never do the kind of mining from the previous generation"?
- Should the mining industry look to modern platforms like tiktok as a form of communication to begin to show mining isn't as "evil" as the media often portrays?
- An example of an outreach program in BC for educating young people and elementary school teachers. <https://mineralsed.ca/>
- Do we need to develop better, and standardised ways of talking about ESG risk. In many risk frameworks ESG is tacked onto the technical analysis

Next Generation: Future Talent

Session chair welcome: Topic: Defining and Nurturing the Next Generation

Discussion session

Dr Shaun Barker, Director Mineral Deposit Research Unit,

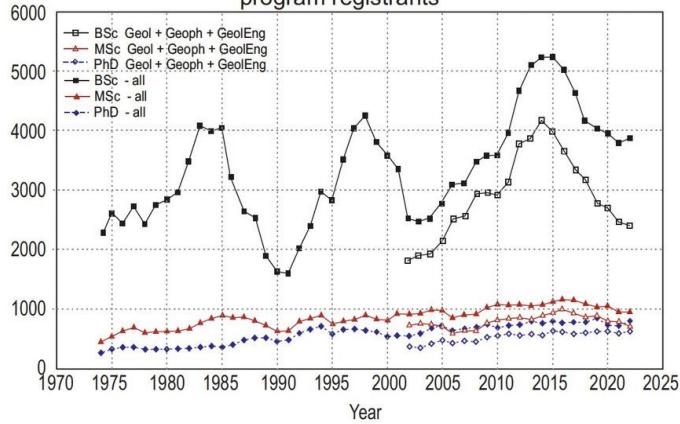
Prof David Cooke, Director, Centre for Ore Deposit and Earth Sciences

Mr Anthony Anyimadu, VP Mineral Processing, Amira Global

(Double Click to View presentation)

Training and people –the challenge and opportunity

Fig. 1. Number of BSc (> year 1), MSc and PhD program registrants



1. Significant recent retirements in the minerals industry – loss of experienced people
2. Falling undergraduate geoscience / mining engineering enrolments since 2016
3. Universities are not hiring faculty with core “hard rock” skills and knowledge – not a research focus
4. Diversity challenges – “leaky pipeline”
5. A booming industry – driven by high commodity prices and “critical” metals
6. Key need for Indigenous capacity in the sector

– All of these factors are a “perfect human resources storm” for Canada (and globally)
 – Greater technical expertise than ever is required for improved outcomes from mining projects



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Session Note:

This lively panel provided an overview of the talent focused challenges which we have in the mining sector. These include lots of retirements, falling enrolments since 2016, challenges with diversity and a need for indigenous capacity.

In consideration of technical diversity geophysics is taught only as a major at one Australian university (Adelaide). Australian Geoscience departments are being closed due to low enrolments. Globally this is not the same in emerging countries, such as Indonesia. China delivers more geoscientists than the rest of the world.

Many Geoscience departments in Australia rely heavily on research to survive which is an unsustainable funding model. This is the perfect storm – declining student numbers / retirements in faculty / fewer faculties that can train and supervise students / active and demanding industry.

Title/ Speaker: Title: Development Partnership, Ms Allison George, Director/ Head of Programs, and initiatives Development Partner Institute

(Double Click to View presentation)



- Development Partnership
- Building Collective Impact for Sustainable Development
- Accelerating Mining for Development

Pilot Initiatives:

- *Mining Innovation and Research Battlefield*
- *Responsible Sourcing Coalition*

Head of Programs and Initiatives
Allison George



Contents Table

Discussion session

Emerging Talent & PhD Students

Ms Cassia Johnston, CSM,
Dr Cassady Harraden UCB,
Ms Helen Twigg Icrag,
Mr Matt Loader, NHM

Session Note:

Emerging talent panel- overarchingly, they are thinking about the same things as we are.

How do we diversify the landscape of what mining industry is? And that will attract more talent.

There is training on social engagement and outreach and that is helping and of value. Each of the emerging talent remains in the industry because they love it and support the vision of what it can be.

Slido Question and Reactions:

- I think inviting govt, other sector guests to this kind of conference, and indeed SEG a great idea. How else can we start the conversation?
- What is the right balance in terms of informing the public about mining versus listening to their concerns and leveraging the principles of Dialogue?
- There was a great Australian TV series about mining, called Dirt Game: <https://m.imdb.com/title/tt1325886/>
- How do we get the rest of the geosciences (eg societies like AGU, EGU) to realise the global need for mining, especially relating to climate change mitigation. We need to have a more unified front for the rest of society.

- What's the global equivalent to something like the Milk Marketing Board for Geosciences?
- How do we get the general public to consider our industry a solution to climate change?
- Wonderful to hear from this cohort! How do we co-create the future?

Breakout Session

Title /Speaker: Innovation in training models Prof Stefen Hagemann, Director of Centre of Exploration Technology University of WA

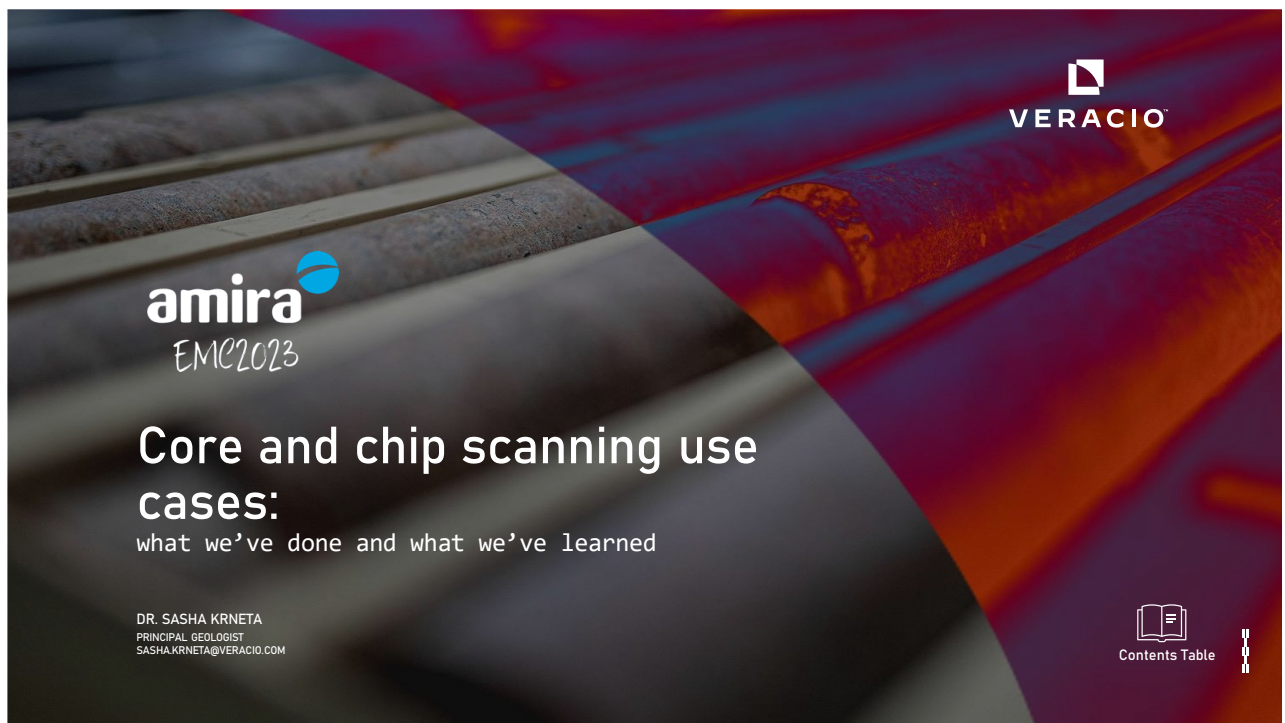
Session Facilitator: Anthony Anyimadu Osgood Room

Next Generation: Data Science and Exploration

Title /Speaker: Maximising predictability in porphyry exploration using data analytics and AI Prof Jamie Wilkinson, Natural History Museum

Title /Speaker: Sensor development, deployment on different sites, use cases and general philosophy with what we are trying to achieve in the industry Dr Sasha Krneta, Principal Geologist, Veracio:

(Double Click to View presentation)



Title /Speaker: An introduction to Machine Learning / Deep Learning with an example for a IOCG manto style Chilean Cu/Au deposit Mr David First, Chief Geologist, Stratum AI:

(Double Click to View presentation)



STRATUM AI



EXPLORATION MANAGER'S
CONFERENCE 2023

INTRODUCING DEEP LEARNING & INTERPRETING THE PATTERNS: AN OREBODY KNOWLEDGE PERSPECTIVE

David First (Chief Geologist) &
Daniel Mogilny (Co-Founder), Stratum AI



Contents Table

Slido Question and Reactions:

- Sasha does Truscan recognize orientation line and automatically collect structural measurements?
- Let's start with a standardised assay result file.
- We could have technology companies and mining companies lobby OSDU to become members and add a hard rock component. We don't need to recreate the ecosystem.

Title /Speaker: *What does industry want for technology development* Dr Michelle Carey, Head of Product Management and Marketing, Imdex and Alan Kobussen, Senior Manager Technology Development, Rio Tinto .
(Double Click to View presentation)



Slido Question and Reactions:

Why can't technology providers and end users talk to one another?

Why do end users have the upper hand?

- Because technology providers provide data. Someone has to turn that into knowledge. Many end users don't have the time/resources to do that themselves. So, it's stranded data with no value as it doesn't turn into knowledge.
- Existing providers move too slow because they are trying to protect their capital investments, but new providers often create solutions without a clear marketplace. There's a gap for new real innovation and development.
- Don't they? That is the essence of a consultative business model. However, it does take time and energy, and needs to be built on a shared future.
- Technology providers are fixed on specific problem(s) they are focused to find solutions for and overlook the end user's needs.
- Technology providers are in the business of selling their technology - end users need technology to implement critical work. This difference in objective makes it difficult for the groups to communicate.
- Tech providers need to be more familiar with the subject matter for which we seek solutions
- They do but sometimes the priorities might not be the same for everyone, it feels like change is slow
- It can feel like the definitions of success are different but really, they're not. Tech providers only succeed if end users are more successful.
- We can, it just takes a long, long time to get to a trusted and meaningful level of relationship between individuals who have the vision and authority to make change happen. Often this fails, or is blocked by procurement, legal etc.

Thank You & Close

Slido Question and Reactions:

What worked?

- Wide range of talks and types of presenters. Technology talks. ESG talks.
- Discussions between presenters, facilitators & participants.
- I liked the high level strategic talks, some other talks seemed out of place. The India talk, the geothermal talks for example.
- Mix of tech and explorer companies. Diverse topics
- Collaborative forum and networking ease
- Collaboration of multiple stakeholders
- The venue was inspiring and the sessions where the speakers provoked debate were great
- Relax environment
- Presentations

- The forward looking approach
- Small conference made for better discussions
- Great venue, good scale for effective networking, topics of relevance to managing in the sphere of exploration
- Smaller venues promote more dialog
- Interesting to have greater breadth of input.
- The panel discussion sessions
- The discussion
- Interaction and networking
- The presentations, the interaction and breakouts.
- Good panel discussion and breakouts
- Presentations on future, debates on ESG
- Panels
- Everything
- Presentations, discussions
- Open discussion
- Small group, open discussion
- A few new talks from industry. Excellent debate. A few provocative talks.
-

What didn't work?

- The education section was pretty dry.
- - Breakout sessions
 - not sure about the actual theatre as a location
- Questions through Slido seemed distracting at times.
- Bit too much promotion

More discussion would be good

- Breakout sessions
- Needed some more focus on some of the topics
- I don't think we need technical content in this forum. There are plenty of other conferences doing that.
- More technical content
- Breakout meets
- Break-out sessions could have been better planned and defined
- Too few tables during good breaks
- Breakout sessions were weird and weren't well explained or shared.
 - Almost no connection between discussions and what Mira's role is. I guess it is implied, but there needs to be a session to explicitly connect the issues discussed to MIRA'S agenda.
- Some of the providers talks
- Stick to the session theme 😊
- A joint conference dinner would have been nice
- Using slido and listening to the talks at the same time is disruptive.
- Perhaps too many very similar presentations.
- Case studies
- Breakouts
- Nothing
- Talks too long preventing questions
- Too many academic talks that have been presented before. Too many generalities. Far too much time given to small scale and artisanal mining.

Do you like the new EMC2023 format?

- First time attending.
- I think the more inclusive guest list is important, but I do think it's critically that the spirit of a safe space for exploration managers is preserved.
- My first one, I liked it
- It was ok. Would have preferred to hear more about recent AMIRA projects, planned AMIRA projects, and future AMIRA focuses of attention.
- Definitely
- I am new but I like it. I have no idea what the past one was like.
- Not sure. This was the first I attended
- Keep going, keep developing the format.
- Yes

Appendix

Additional resources discussed and provided:

A 2021 manuscript that does a good job of summarising what we got up to in the IMP@CT project (in Appendix).

Two pdf documents (D2.1 and D2.2) that detail the development and access to the small deposit query tool on the Minerals4EU database. They have "how-to-query" information that is very helpful when using the tool. (In Appendix).

Access to the platform is here <http://minerals4eu.brgm-rec.fr/>

The Cordis summary of the IMP@CT project is here <https://cordis.europa.eu/project/id/730411>



D2.1 Baseline
database.pdf



Moore et al
2021.pdf



D2.2 database
update.pdf