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Saudi Arabia

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Dear Readers,

It is with great pride that we welcome you to the Second issue of Mining Saudi Arabia Magazine, a platform launched at a defining moment in the Kingdom's transformation. Mining in Saudi Arabia is no longer a supporting sector; it is emerging as one of the strategic pillars of the Kingdom's economic future. Under Saudi Vision 2030 and the Vision 2040, mining has been positioned as the third pillar of industry, unlocking an estimated SAR 9.4 trillion in mineral resources and creating unprecedented opportunities across exploration, development, services, technology, and investment. From critical minerals powering the global energy transition to expanding gold, copper, and phosphate projects across the Kingdom, the scale of ambition is remarkable. Regulatory reforms, world-class geological mapping, infrastructure investment, and global partnerships are accelerating growth at a pace the region has never witnessed before. Mining Saudi Arabia exists to connect this dynamic ecosystem including miners, investors, service providers, policymakers, innovators, and all those interested in the sector both locally and internationally. Through insights, field stories, technical advancements, and investment perspectives, we aim to contribute meaningfully to shaping the future of mining in the Kingdom.

We are not only documenting this transformation.
We are part of it.

Mining Saudi Arabia Team

MINING Saudi Arabia

Digital mining intelligence and networking. We're publishing from the land of opportunities where mining businesses canscale.

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PDAC talk:

Abdulrahman Al-Belushi

on Building Resilient Mineral Value Chains

Saudi Arabia's Abdulrahman Al-Belushi, Deputy Minister for Mining Resources Management, Ministry of Industry and Mineral Resources, delivered a foundational message at a PDAC panel: resilient value chains begin not at processing facilities or mines, but with exploration and discovery.

Despite surging demand for minerals like copper, which is expected to double to 40-45 million tons by 2030, Al-Belushi warned that grassroots exploration spending will decrease from 45% in 2015 to 20% in 2025. For true supply resilience, he urged policymakers, majors, midcaps, and juniors to prioritize stable discovery pipelines.

Saudi Arabia is uniquely positioned to lead this shift, leveraging high-grade copper deposits that deliver competitive economics. At Jabal Sayid mine, copper grades average 2.5%, well above the global average, which significantly lowers cash operating costs per pound, according to Kevin Murphy, Director of Mining Studies & Mine Economics & Emissions at S&P Global Energy.

These advantages amplify the impact of the Kingdom's strategic investments.

Saudi Arabia is deploying three key levers to accelerate exploration enhanced geological data (systematic surveys through 2040), financing support ($2 million per exploration license, covering experts, geophysics, and Saudization training), and land access (45,000+ sq km via tenders and 25,000 sq km on a first-come, first-served basis since 2021).

As a result of these efforts, exploration spending doubled from 2023 to 2024, with 67% of the funds allocated to grassroots efforts.

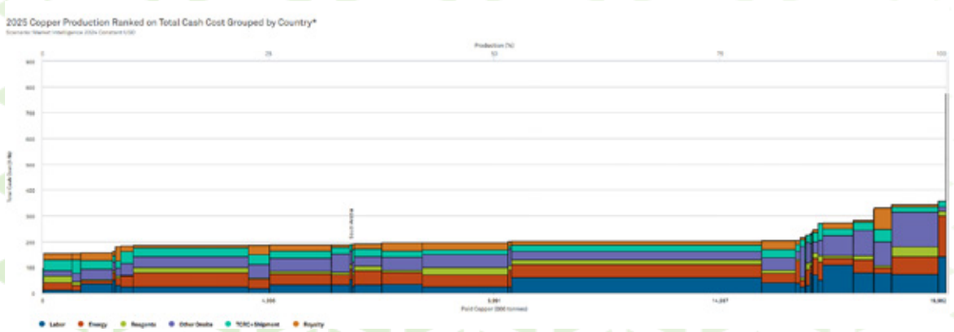
To incentivize downstream development, the Kingdom offers a five-year royalty holiday for existing mines, plus 30% reductions per value-add stage (up to 90% total), making it economically attractive to retain processing locally. Al-Belushi noted that taxing refined products (e.g., aluminum sheets at $3,500/ton value) generates far more revenue than raw ore ($50/ton).

The panel discussion highlighted complementary needs: predictable institutions and de-risking from development banks like the IDB (led by Karolina), infrastructure and clustering from industry leaders like Ian (Teck Resources), and public-private partnerships. Al-Belushi cited Manara Minerals' investments and the Future Minerals Forum as models of global collaboration.

On refining concentration, speakers agreed extreme diversification risks inflation, while over-reliance on one country threatens resilience.

The solution: strategic regional hubs with offtakes, infrastructure, and cross-border ties.

Al-Belushi's intervention reframes mining strategy from downstream hype to upstream reality, positioning Saudi Arabia as a pivotal player in balancing supply security with economic value creation.



@Image from our coverage in PDAC2026

Saudi Arabia Achieves Global Top-10
Ranking in Mining Investment Attractiveness

Saudi Arabia has attained a remarkable position in the 2025 Fraser Institute Annual Survey of Mining Companies. Saudi Arabia has advanced to 10th globally on the Investment Attractiveness Index with a score of **82.00—up significantly from 23rd in 2024.** The Kingdom also secured 4th place worldwide on the Policy Perception Index (94.99 score), surpassing many established mining jurisdictions.

Each year, the Fraser Institute surveys 256 mining executives and professionals across 68 jurisdictions to assess investment climates. Among 15 key areas covered are regulatory uncertainty, environmental regulations, legal system quality, taxation, land claims, protected areas, infrastructure, community development requirements, trade barriers, political stability, labor regulations, geological data quality, security, and labor/skill availability.

Historical context and recent progress

Prior to 2024, Saudi Arabia featured minimally in the survey, reflecting its nascent mining sector under Vision 2030's diversification strategy. As a result of reforms such as the Exploration Enablement Program, which offers cost reimbursements, and the Taadeen digital platform, exploration licenses increased 350% in 2024. As of 2025, respondents reported reduced concerns about regulatory enforcement (-26 points) and labor availability (-38 points), with strong mineral potential **(73.33 Best Practices score, 16th out of 41).** Saudi Arabia now outperforms its regional peers.

It is important to improve labor regulations (+24 points), security (+9 points), and trade barriers, despite Saudi Arabia's legal stability and taxation. To further improve its ranks, experts suggest implementing a full **Exploration Enablement Program** to incentivize early-stage exploration; expanding training programs through Ma'aden partnerships to address skills gaps; developing investor-ready geological databases for the Arabian Shield; improving infrastructure for remote sites, including power, water, and logistics; and further refining the Taadeen platform to minimize permitting time.

Comparative Analysis with Top Performers

Leading jurisdictions exemplify excellence in policy executionment Attractiveness

		IAI Score / Rank	PPI Score / Rank	Key Policy Strengths:
1	**Nevada** (USA)	1st / 90.87	1st / 100	Rapid permitting [6-12 months), no corporate income tax, digitized processes.
2	**Ontario** (Canada)	2nd / 89.98	5th / 93.70	Streamlined approvals via Mining Act reforms infrastructure investments.
3	**Saskatchewan** (Canada)	3rd / 89.66	8th / 92.90	Tax credits, fast-track permits, speclallzed labor training.
4	**Botswana**	7th / 85.99	2nd / 99.81	Secure tenure, low royaltles (5%], Investor data hubs
5	**Saudi Arabia**	10th / 82.00	4th / 94.99	Regulatory clarity, tax competitiveness, land access Improvements.

Saudi Gold Refinery Company
Accelerates Exploration, Mining, and Refining Ambitions Before 2030

Saudi Gold Refinery Company (SGR), a cornerstone of Saudi Arabia's gold sector, is further aggressively scaling its integrated operations across exploration, mine development, refining, and industry-wide services, driving Vision 2030's mining transformation with unmatched ambition and vertical integration.

According to Suliman Al-Othaim, Chairman of SGR, the company's core exploration program is targeting between 5 million and 10 million ounces of gold resources before 2030; the company is actively localizing mining sector needs, with details to be published soon . These targets reflect the company's confidence in the Kingdom's mineral potential and are informed by industry expertise.

Suliman Saleh Al-Othaim
Chairman and Chief Executive Officer

Mine Development Pipeline

SGR has also outlined a clear mine development roadmap. By 2028, the company aims to bring 2 to 4 mines online, increasing that number to 6 to 10 mines by 2030. Among the planned assets, Al-Dhakhri Mine is expected to be the second operational site in the portfolio.The company expects this growth to follow a steady annual pipeline of one to three mines, supporting its long-term expansion strategy across Saudi Arabia.

Refining Capacity and Market Positioning

The company is also preparing to strengthen Saudi Arabia's refining landscape through what it says will be the Kingdom's first internationally accredited gold refinery.

Salman noted that the Saudi market currently lacks an officially accredited refinery with international recognition, a gap the company aims to fill.

The refinery, to be based in Riyadh, will have an annual capacity of 60 tonnes and is intended to serve both local and international markets. Feedstock will come from SGR's own mines, African sources, including Sudan, and commercial supply contracts. This positions SGR not only as a mining company but also as a regional refining and trading hub.

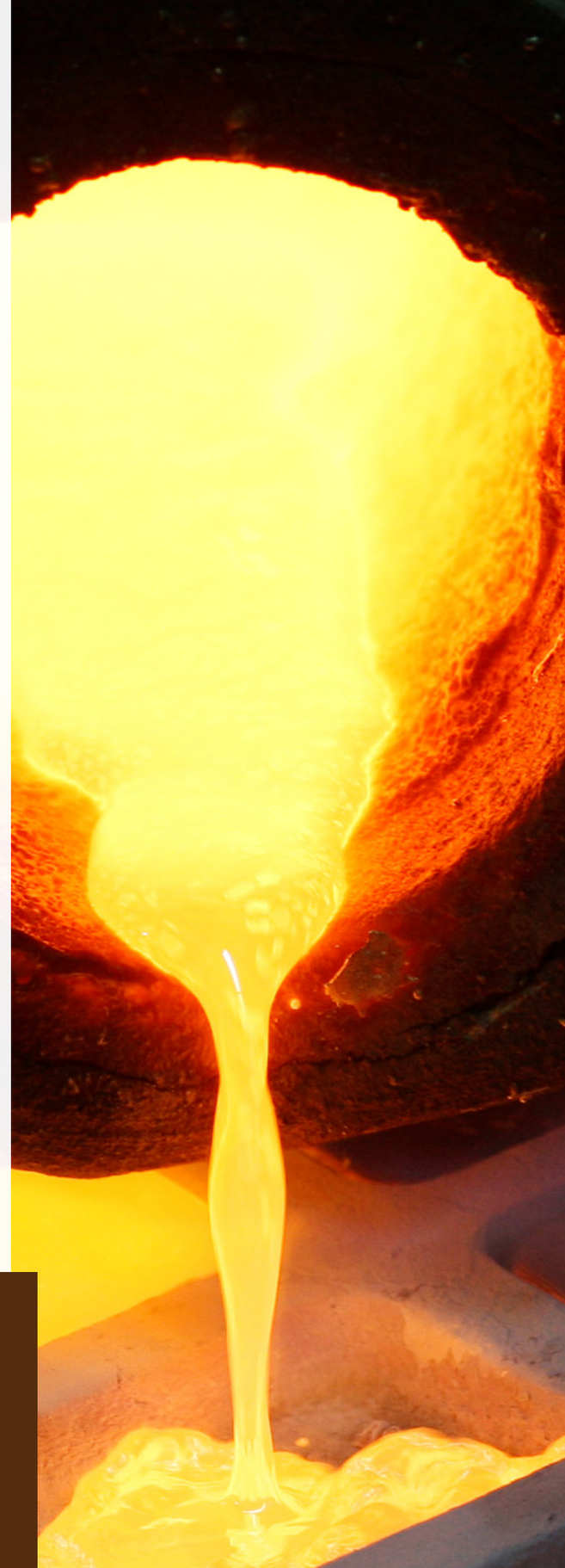
Supporting the Exploration Ecosystem

Beyond its own mining operations, SGR is building a broader ecosystem of technical and operational services to support the exploration sector in Saudi Arabia. These services are designed to help companies that face delays in their exploration programs maintain momentum and avoid disruption.

The company's offering includes geological sample laboratories, airborne and ground geophysics, drilling services such as DD and RC, logistics support, and core handling infrastructure, with additional services expected to be announced later.

International Expansion Strategy

According to Al-Othaim, they are also preparing for international expansion, with updates on planned activity in Ethiopia, Sudan, and Oman expected in January 2027. These developments are expected to strengthen upstream supply and expand the company's regional footprint. The partnership announcements will follow once mineralized belts are secured, reflecting an opportunistic approach to collaboration as assets are formalized.



Localization and Sector Impact

What distinguishes SGR is its long-standing vertically integrated model, supported by more than 40 years of experience across the gold value chain. The company operates across exploration, refining, jewelry manufacturing, and retail, giving it a broad platform to contribute to the Kingdom's mining ecosystem. The chairman has also emphasized its goal of achieving 100% localization of gold refining in Saudi Arabia, a target that will require continued government support and an enabling regulatory environment. By localizing capabilities and investing in domestic talent, the company aims to support both industrial development and broader economic diversification. Through this integrated strategy, SGR is positioning itself as a force in the kingdom's gold sector, not only by expanding resource potential and refining capacity but also by building services that support the wider industry. As Suliman Al-Othaim put it, "the company is consistently building a complete mining ecosystem that supports Saudi Arabia's ambitions and creates long-term value for the market."

@Image from interview done by Mining Saudi Arabia in FMF2026

Saudi Youth Fuel Vision 2030's Mining Talent Pipeline

RIYADH - Saudi Arabia harbors an untapped treasure trove of minerals worth $1.3 trillion. But mining that wealth requires more than drills and dynamite; it requires an emerging generation of data-savvy geologists, AI-trained engineers, and sustainability experts who see mining not as dusty drudgery but as the high-tech backbone of tomorrow's economy. This shift necessitates training programs that blend mining expertise with modern technologies like AI, machine learning, and data analytics. This aligns with the goals of economic diversification and technological advancement.

Ziyad Binmahfouhd

a mining geology student and co-founder of MNJM Community Arabic for Mine

Meet Ziyad Binmahfouhd, a mining geology student and co-founder of MNJM CommunityArabic for “Mine”whose passion is to educate and empower people through knowledge. Founded in 2025 and sponsored by the Engineering Localization Association (ELA), MNJM connects students, engineers, and industry leaders to reveal mining’s true potential.

From Global Crisis to Saudi Opportunity

A global mining talent shortage, documented in stark terms in the OECD's "Mining for Talent" report for 2025, cuts through Ziyad's message. Across developed economies, 72% of mining workers are over 35, women make up less than 17% of the workforce, and young people generally reject mining careers 70% say no, and 75% believe it harms society. In Queensland, Australia, there are two to three times the number of vacancies; in 2026, the state will need 24,000 skilled workers but only expects 16,000. Mining engineering enrollments have plummeted since 2014-down from 63% in Australia and 39% in the US. Similarly, McKinsey's survey in 2023 shows that talent shortages inhibit production targets for 71% of mining leaders; 86% say recruiting is getting more challenging, especially for mine planning, process engineering, and digital skills.Saudi Arabia isn't panicking. It's building solutions.

“Think about your smartphone,The heart of your daily connection starts with minerals from mining, often seen as ‘old’ and dusty. But mining is the hidden force behind modern life, powering energy, technology, infrastructure, and green solutions.”

Ziyad Binmahfouhd

a mining geology student and co-founder of MNJM Community Arabic for Mine

مجتمع منجم
MNJM COMMUNITY

+4000 Minutes of Mentorship	**+500** Applicants
+100 Mentorship Sessions	**+40** Students

MNJM Community : One Conversation Changes Trajectories

MNJM Community confronts mining’s image crisis head-on. Through awareness campaigns, professional mentorships, and market exposure, the nonprofit reveals a sector creating Vision 2030 jobs blending geology with machine learning.

For Ziyad, a mining geology student himself, the mission is personal. “Mining is ultimately about people,” he explains. “I build bridges between students and industry through mentorship, educational initiatives, and content that positions mining as future-oriented exactly what Vision 2030 demands.”

Its flagship Masar MNJM program paired 30 male and female students with sector leaders for over 5,000 minutes of targeted career guidance. Total impact: 500+ young Saudis now see mining as a path to national prosperity. “Ever wondered how a single connection sparks a career?” Ziyad asks. “We’re developing human capital for Saudi’s industrial future by showing mining its real economic and social value.”

Data Literacy: The Underrated Skill Saudi Youth Master

Saudi School of Mines: FMF 2026's Bold Launch

As part of the Future Minerals Forum in Riyadh in January 2026, King Abdulaziz University (KAU) and the Ministry of Industry and Mineral Resources (MIM) signed a cooperation agreement transforming the Faculty of Earth Sciences into the Saudi School of Mines. "This MOU creates a complete supply chain from classroom to industry," officials said. The focus is: advanced mining engineering, geology, digital skills, and sustainability to unlock Saudi's mineral wealth.

Ma'aden paved the way in 2023, sponsoring the first Bachelor of Science in Mining Science and Engineering at King Fahd University of Petroleum & Minerals. Now scaling to 30 scholarships annually (20 engineering, 10 geology) for a decade, the curriculum fuses AI, machine learning, data analytics, sustainability, and mineral economics.

Ma'aden CEO Robert Wilt didn't mince words: "By investing in our youth, we secure a sustainable pipeline of leaders to unlock $1.3 trillion in mineral wealth." Complementing elite degrees, the Saudi Mining Polytechnic (SMP) trains technical specialists through two-year diplomas plus six months of on-the-job training. Programs like Mineral Exploration produce exploration geologists, drilling operators, and GIS technicians grounded in sustainable practices directly localizing Vision 2030 jobs.

Human-centered digital transformation

Ziyad sees autonomous mining as an evolution rather than a replacement. "Digital tools provide insights beyond traditional methods," he notes. "But they require adaptability and continuous learning in addition to technology." When given a limited budget to digitize one manual process, he answers without hesitation, "operational data collection and reporting." "The improved accuracy and accessibility will enable faster, better decisions creating momentum for further innovation, " he concludes.

Wisdom meets digital fluency: bridging generations

"Keeping balance as a young professional begins with listening,"

Ziyad advises. "Experienced miners provide invaluable practical knowledge; younger professionals bring digital fluency.

"Introducing technology as a support tool rather than a replacement tool, change becomes collaborative and sustainable."

OECD research confirms this: diverse crews reduce injuries by 67%; cross-generational teams increase technology adoption.
Saudi mining graduates are paid SAR 9,000 (+/-) per month on standardized entry scales according to Ziyad, with advancement determined by performance and exposure, rather than titles.

Ma'aden's Professional Development Program (PDP), rotational assignments, structured mentorship, and hands-on skill building accelerate careers while advancing localization.

Mining Tomorrow, Saudi-Style

According to McKinsey, mining has lost some of its luster, and the OECD issues demographic warnings. Yet, in boardrooms from Perth to Antofagasta, executives struggle with the question: who will operate tomorrow's autonomous mining operations?

Saudi Arabia answers: its youth. Ziyad's vision crystallizes in. "One meaningful mentorship, one data-driven decision, one redefined perception," he reflects. "That's how we build an industry and a country ready for tomorrow."

From FMF 2026's Saudi School of Mines to MNJM mentees, Saudi Arabia's mining school is not just filling global gaps; it is redefining mining's future.

Reducing risk belowground:

How 3D modelling is changing mining decisions

In Saudi Arabia's rapidly evolving mining landscape, speed with confidence is paramount, and that can only be achieved by de-risking early. 3D geological modeling is no longer simply a technical discipline reserved for geologists; it is a strategic business tool that reduces uncertainty, accelerates decision-making, shortens project timelines, and strengthens investor confidence. Ultimately, Vision 2030 projects move faster because risk is minimized from the outset.

From uncertainty to clarity

Uncertainty is inherent in mining, and it has a direct impact on capital decisions. With complex geology, regulatory scrutiny, and aggressive development schedules, the need is not just for more data, but for better ways to interpret it.

Modern 3D geological modelling fundamentally reshapes how risk and opportunity are understood. It brings together geology, geophysics, geochemistry, and resource estimates into a single digital view of the orebody that updates in real time as new data is added. This integrated approach enables teams to build a defensible basis to test assumptions, compare scenarios, and refine strategies before capital is committed.

In Saudi Arabia, this matters under Vision 2030 and beyond. As exploration projects advance at an unprecedented scale and pace, 3D geological modeling is critical in unlocking the clarity needed to support better and faster decision-making.

Why the modelling approach matters

A major shift in recent years has been the move from manual, explicit modeling to dynamic, implicit geological modeling. Where geologists once spent time on manual interpretation, drawing surfaces and boundaries by hand, modern algorithms can define geological trends and build, and update, models from the data. This shortens interpretation cycles, reduces repetitive work, and allows teams to test several geological scenarios without rebuilding the model from scratch.

This is now being amplified by the power of open, cloud-based platforms, leveraging technologies such as AI and machine learning for greater subsurface intelligence.

Says **Mohamed Elbehairy, Customer Solution Specialist, Seequent:** "What excites me most about this is the openness it brings to geoscience and mining workflows. **"It opens the door for developing and extending tools tailored to Saudi Arabia's unique geology and ambitions."**

The combination of advanced modeling and modern technology creates a powerful and sustainable competitive advantage for the Saudi mining sector. It brings uncertainty into view and means stronger feasibility studies, smarter decisions, and faster discoveries.

Capital follows confidence

Investors do not back geology alone. They back confidence in the geology.

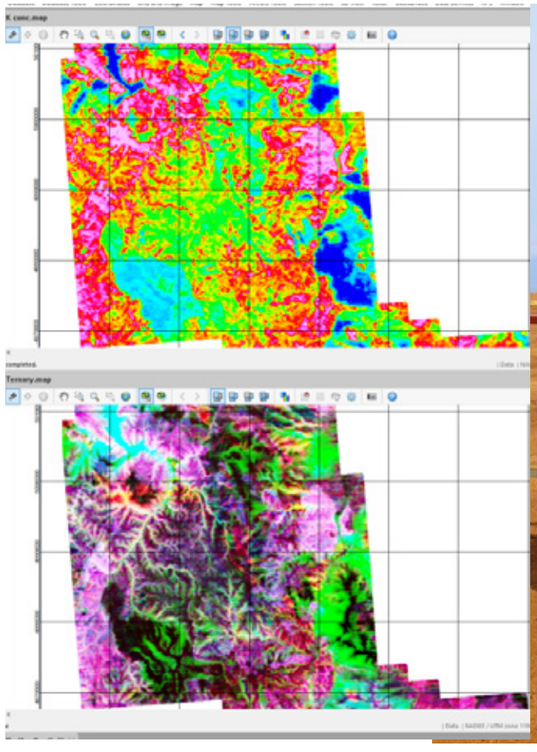
That is why strong 3D models matter so much in funding conversations. They allow operators to present risk, upside and uncertainty in a way that is easier to understand and harder to dismiss. They show continuity, variability and sensitivity more clearly than tables or 2D sections ever could.

A credible model helps support a more bankable feasibility study, especially in complex geological environments. In

South Africa's Bushveld Complex, the Council for Geoscience (CGS) used modern 3D modeling to re-evaluate a project and was able to **"clearly show the economic potential of the deposit for the first time."** This new, trustworthy model allowed them to confidently demonstrate the project's value and attract the capital needed to move the project forward.

At the PT Stargate nickel project in Indonesia,

integrated 3D geological modelling improved drill targeting and resource confidence, **contributing to an $8 million reduction in drilling costs**. By reducing unnecessary drilling and focusing capital where geological confidence was highest, the project was able to lower costs while also limiting environmental disturbance.



Stronger feasibility, better outcomes

Feasibility studies sit at the heart of every mining investment decision. They are also some of the most time-consuming and resource-intensive stages of the project lifecycle. A key challenge is the tension between moving quickly to meet ambitious timelines under Vision 2030 while maintaining rigor and accuracy. By linking geological models directly to resource estimation and mine design, modern methods can resolve this conflict, enabling both speed and confidence. The impact of this approach is already visible at operating mines.

At Anglo American's Barro Alto nickel mine in Brazil, digital integration of geotechnical data using dynamic 3D geological modelling reduced the time required to update geomechanical models by 75%. By working from a single, continuously updated model, teams were able to improve decision speed while strengthening safety and sustainability outcomes across the operation.

At Saudi Gold Refinery, Digital integration "has been the cornerstone of recent success in resource expansion".

> core objective is the intelligent and sustainable expansion of mineral resources. In today's competitive landscape, this requires not only geological expertise but also cutting-edge technology that enables speed, accuracy and collaboration

Ramadhani Ndonde
Group Mineral Resource Manager

ESG begins below ground

Environmental, social and governance expectations now influence major mining decisions including permitting, partner selection and financing. Many of the most important ESG outcomes - pit location, waste volumes, and geotechnical stability - are determined early in the planning process.

By integrating geoscience data, 3D modelling helps teams design mines with greater foresight and fewer avoidable impacts.

In Saudi Arabia, where new mining districts are emerging alongside communities and infrastructure, that foresight matters even more. It supports stronger regulatory confidence and a more durable social licence to operate.

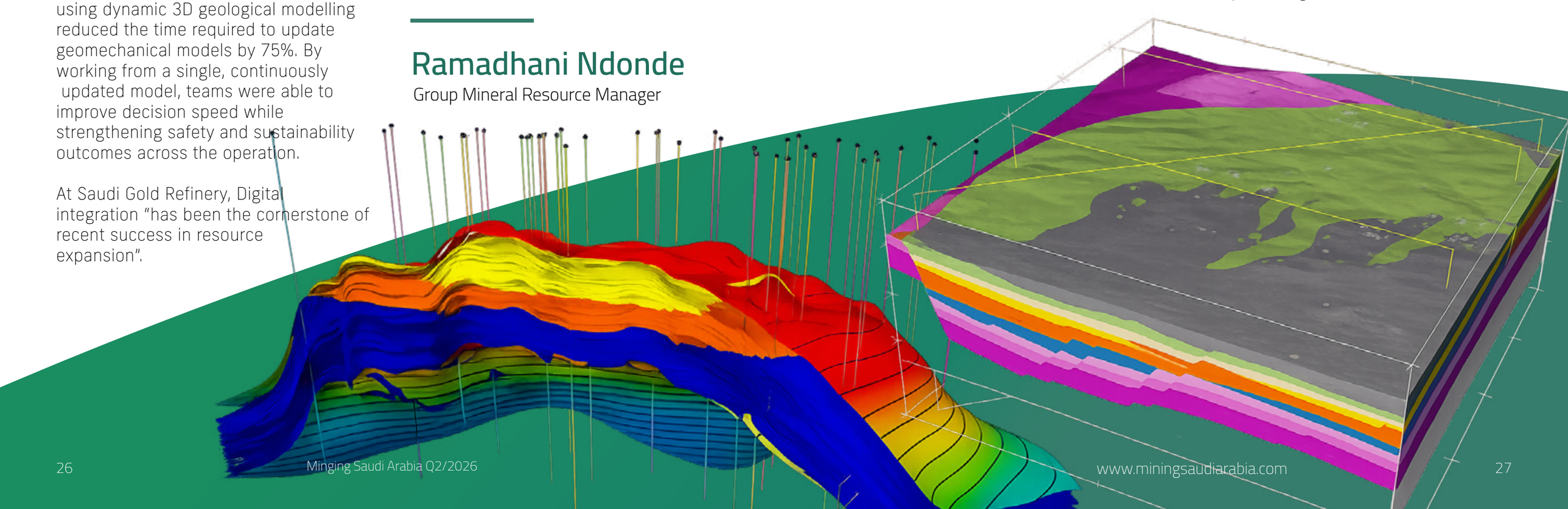
A strategic necessity

In a complex industry like mining, technology is not adopted for its own sake. It must deliver clear and measurable positive outcomes. This is where 3D geological modelling is different.

It reduces risk.
It builds confidence in feasibility.
It strengthens capital conversations.
And it supports more responsible mine design.

As Saudi Arabia positions mining as a core pillar of economic diversification, the organisations that succeed will be those that make better decisions faster and with greater confidence than their peers.

In that sense, 3D modelling is no longer just a way of understanding geology. It is a way of doing business.



Gold and Copper in Today's World

CPM Group

The current U.S.- Israel war against Iran has driven fossil fuel prices higher. Concerns around natural gas and crude oil supply disruptions linked to the Strait of Hormuzthrough which roughly 20% of global crude oil supply flow-shave been a key driver of higher prices.

The war also has caused material damage to regional oil infrastructure, which is expected to take months if not years to repair. As a result, the loss of natural gas and oil supply capacity would likely persist beyond the end of the shooting war, extending the inflationary pressures.

In addition to accounting for around 20% of global crude oil flows, the Strait of Hormuz also accounts for a third of global seaborne fertilizer trade, introducing an additional channel through which this international political trade disruption is projected to affect food input costs and broader inflation.

The freezing of air space over the Gulf region also disrupted the shipments of gold into Dubai for refining and refined gold out of Dubai to India, all of south and southeast Asia, and the Islamic markets from Morocco to Indonesia. Much of the gold trade has been re-routed through Istanbul, putting a strain on gold inventories in Turkey as well as foreign exchange markets there.

The war has also damaged major aluminum smelting capacity in the United Arab Emirates and Bahrain, which account for approximate-ly 10% of global aluminum supply. These disruptions could place upward pressure on industrial metals prices and downstream manufacturing costs. White sugar prices are up to six month highs as refineries in the Gulf region are unable to access raw sugar exports from Brazil and other countries. This development will contribute to higher food inflation.

Saudi Arabia has partially mitigated crude oil supply concerns associated with potential disruption in the Strait of Hormuz by operating its East-West pipeline at full capacity (seven million barrels per day), enabling approximately five million barrels per day of crude exports via the Red Sea. That said, the involvement of the Houthis in Yemen introduces additional risk to shipping routes in and around the Red Sea, potential-ly limiting the effectiveness of this alternative supply corridor.

Ultimately, the duration of the conflict and the scale of damage to commodity-producing infrastructure will be critical in determining the magnitude and persistence of the inflationary impact. While the whole world stands to suffer this inflationary impact, Europe and Asia are most exposed directly.

The war has three sets of effects. The first one is the immediate negative disruption of global economic conditions. Longer term, some of the reconstruction of oil, gas, aluminum, and other industries will take months or longer to repair. The third set of consequences are the even longer term negative consequences for the United States' economic, political, monetary, diplomatic, and social power globally.

Impact on Precious Metals

The current uncertainty about the inflation environment is supportive of higher precious metals prices, especially gold, which benefits from any sort of economic uncertainty.

Outside of the uncertainty factor, gold primarily is influenced by what happens to real interest rates. Higher real rates are a headwind to gold and other precious metals, just as lower real rates are positive for gold investor demand and prices. In other words, gold is less affected by what happens to inflation itself and is more affected by central banks' response to that inflation. If inflation rises faster than central banks' ability to maintain restrictive policies it would weigh on real rates and benefit gold. Such a scenario could arise if labor market conditions continue to weaken or economic growth slows, coupled with a supply side shock that is boosting inflation.

Monetary policy today increasingly carries an implicit responsibility for financing government debt sustainability. This constraint reduces the extent to which central banks can maintain restrictive policies for long periods, particularly if higher rates threaten fiscal stability.

This dynamic increases the probability of a regime in which real rates are capped either through explicit easing or by keeping nominal rates below inflation.

Such a set up would likely be structurally supportive for gold over the medium term.

Impact on Base Metals

The war in the Middle East is creating supply and demand dislocations, not only in energies, but across commodities. This conflict's fallout is pushing and pulling at base metals prices.

Many market participants have become increasingly aware of how interconnected the global economy is, in particular the Middle East and commodity flows in and out of the Strait of Hormuz. Rising and high energy prices are increasing market sentiment of a slowing global economy. Some countries and regions may fare better than others, but all economies will feel some adverse effects.

The base metals markets are entering a seasonally strong period for demand in the Northern Hemisphere as the construction season begins. However, higher energy prices and the uncertainty of the war in the Middle East are causing a softening in the demand outlook for base metals. Many markets participants built up inventories over the past year in light of tariffs placed by the United States, rising base metals prices, and concerns about supplies overall. It appears that these inventories may begin to be worked through. There are some markets that remain at low stock levels, however, such as aluminum.

LME three-month copper prices fell sharply in March, following record highs reached earlier this year, but have recovered since then. Supplies of copper continue to be a concern, but not as much as in previous months. There is a slow progression of rising copper output from mines that underwent troubles in 2025, such as the Grasberg mine. Inventories have been built up on the potential for increased tariffs on copper imports into the United States and combined exchange stocks are near record highs. There seem to be low treatment and refining charges in China, suggesting plenty of copper concentrate supplies, but market participants suggest this is an over capacity issue in China.

Demand meanwhile is reported to be mixed amid ongoing use of copper in the building of data centers and infrastructure. On the other hand, China continues to face property headwinds.

What Happens Next

The most likely scenario is that the Strait of Hormuz will remain closed for some time and the U.S. and Israel war with Iran continues in an on and off fashion. The longer the war, the more infrastructure destruction and bottlenecks via the Strait of Hormuz, the more likely all economies soften and so too base metals prices.

Gold meanwhile will probably keep holding on to its prices gains and potentially move higher overall as the year progresses. Even if the war were to end tomorrow, it will take time for the world to normalize to some form of post-war basis.

The trends toward deglobalization have gained momentum in recent years. Increased political tensions between various countries have led to an increased move toward onshoring. During this transition period, it will create supply chain constraints. Onshoring will also reduce efficiencies and increase costs at least initially, both of which are tailwinds to inflation.

CPM Group

This article was excerpted from CPM's monthly Base Metals Advisory and Precious Metals Advisory.

CPM Group is an independent commodities research, consulting, commodities and asset management, and investment banking firm that provides comprehensive research, analysis, and advisory services.

Voices from the Mining Value Chain:

Sun Peak's Journey in the Saudi Frontier

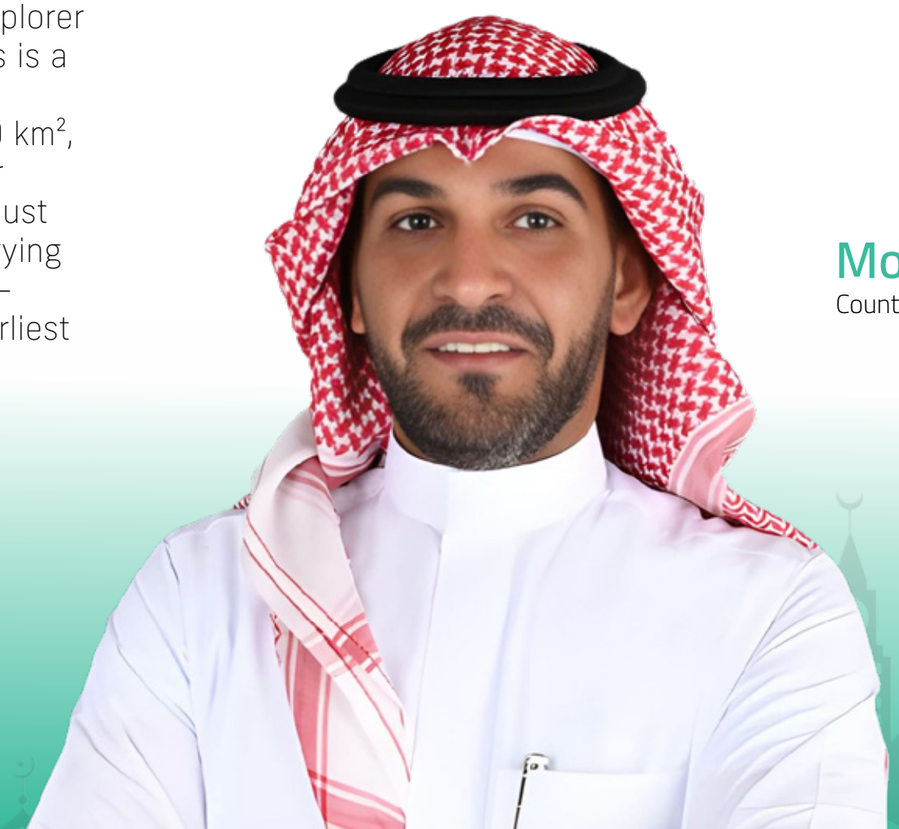
At the heart of Riyadh's emerging mining ecosystem, Mohammed AlMutairi, Country Manager for Sun Peak Metals, finds himself at a critical juncture: a global junior mining company is attempting to build one of the first foreign-owned exploration platforms inside the Kingdom, while Saudi Arabia is simultaneously attempting to prove it can be a serious, rules-based mining jurisdiction.

This isn't just a job to Mohammed; it's a test of patience, timing, and local-global integration. As head of Sun Peak's early-stage operations in Saudi Arabia, he is leading the company's efforts to leverage the region's geology, infrastructure, and policy framework to create long-term investments.

Mohammed is trying to bridge the gap between international exploration discipline and Saudi mining's young, fast-moving sector in this story about Sun Peak establishing its flag in the Kingdom. Sun Peak has responded by building what is effectively the first foreign-owned junior-explorer footprint in Saudi Arabia. This is a portfolio of 13 exploration licenses spanning over 1,000 km², with more applications under review. The company is not just reacting to the market; it is trying to anchor a long-term, Saudi-specific program from the earliest stages of exploration.

SUNPEAK METALS CORP

> Saudi Arabia is one of the finest places the company has worked in over the last 30 years. I'm not just referring to geology; I'm talking about the full package roads, airports, ease of access, government cooperation, and even digital infrastructure.



Mohammed Almutairi
Country Manager, Saudi Arabia

A hybrid model: international expertise, local execution

One of Sun Peak's distinctive features is its exploration-led hybrid model. While the company brings previous operating experience from mines development around the world, its strategy in Saudi Arabia is centered on mineral discovery rather than immediate in-house mine operations. Instead of attempting to build a fully integrated Saudi-based geophysics and drilling organization overnight, Sun Peak works closely with specialized exploration service providers for most field execution, while leveraging its technical experts in Canada to interpret geophysical and drilling data, identify priority targets to assess the long-term potential of the 13 exploration licenses already under its portfolio. At the same time, the company retains selected core capabilities in-house particularly gravity-based surveys and certain in-country interpretation work..

"We use international consultants and experienced contractors for the bulk of the advanced work, but we keep the oversight and coordination here," Mohammed explains. "This allows us to maintain tight control over the operational and regulatory process while still benefiting from the technical depth of the parent company and external partners."

At the same time, he is explicit about the current gap in very high-end technical services, especially around resource estimation and deep technical analysis. For now, those decisions are led from Canada, supported by external consultants. Sun Peak uses the Saudi-based team to execute, monitor, and feed the local context back into the decision-making process.

Mohammed sees this as a temporary phase. As the Kingdom's mining ecosystem matures, he expects to see more Saudi-based and internationally trained professionals capable of leading these advanced technical roles. This will gradually shift some technical decision-making closer to the ground level.

Local content, logistics, and the "Saudi-service gap"

The gap between advanced consulting services and highly specialized services still exists, according to Mohammed. There is still a dominance of international firms in advanced structural and technical risk consulting, for instance.

In the current situation, if you need a highly specialized contractor, you often bring them from abroad because there is simply no equivalent local option with the same scale and experience," he says. Despite this, there are still some big drilling and geophysics companies outside the Kingdom.

However, he also emphasizes that Saudi-based companies are catching up quickly. Due to Ma'aden and other large players' strict requirements for local content and technical quality, many Saudi firms have improved their safety, efficiency, and scale. The result is a growing tier of Saudi-owned contractors that can compete on technical and commercial grounds, not just on price.

The challenge for us isn't whether local companies exist, he says. "The challenge is that they are often undermarketed and difficult to vet. In many of their profiles, they don't clearly identify that they are from abroad because their technical pedigree is not clear.

In order to unlock local value addition, the government and industry must make supplier information more visible and transparent."

Community, remote sites, and the “human footprint”

As mining remains a business of remote areas, Sun Peak’s projects often need camps and mobile accommodations with all the necessary amenities since they are often inaccessible by daily commute.

Distances are manageable from abroad since they are 150 kilometers from the nearest town, an hour and a half drive. Although that is a long way from a city, it is not an insurmountable logistical challenge. One of the biggest challenges is the operation’s economic and social impact.

Mohammed stresses that the communities around the project areas have been respectful, cooperating with them from abroad because they source supplies, fuel, water, food, and basic services locally whenever possible, creating a small but visible economic cycle around each site.

“It’s not just a mine site we’re building,” he says. “Our goal is to build a relationship with local communities. Even simple things like using local catering services or importing them from abroad can save you money.”

Infrastructure, logistics, and the “Saudi advantage”

Mohammed’s assessment of the Kingdom’s infrastructure is strikingly positive. According to him, Saudi Arabia compares well with other jurisdictions he has worked in:

“Saudi Arabia is one of the finest places the company has worked in over the last 30 years. I’m not just referring to geology; I’m talking about the full packageroads, airports, ease of access, government cooperation, and even digital infrastructure.”

Red Sea ports and the Kingdom’s transport network provide investors and operators with flexibility when it comes to bringing equipment and materials into the project areas. Basic utilities such as power, water, and connectivity are reliable, and security is strong.

Still, he is candid about the external risk from global logistics: shipping schedules, customs bottlenecks, and third-party freight companies can introduce delays and cost volatility. That is why the local team is focused on maximizing the use of Saudi-based laboratories and services, where possible, instead of sending samples abroad.

“We do still send a small amount of work overseas when it is absolutely necessary. However, for the vast majority of our geochemistry and basic lab work, we use local labs,” he says. Shipping samples internationally is too complex and unpredictable right now.”

Leadership in a long-cycle business

Mohammed’s leadership style is shaped by his own experience and the sector in which he operates. Patience and discipline are more important than speed in mining, according to him.

Young Saudi professionals entering the field should follow his advice: “Do not rush the results.” In mining, meaningful achievements take years, if not decades. Remain on track, protect the data, maintain the flexibility to act when the opportunity arises, and avoid prematurely announcing milestones.

Moreover, he believes Saudi leaders are uniquely positioned to work with international companies. In addition to capital, foreign-owned juniors also bring established risk management frameworks, technical expertise, and global exposure. For a Saudi-based executive, that creates a chance to learn, grow, and then, in time, lead from a position of equal footing.

MINING©
Saudi Arabia

MENA Metals & Mining M&As in Q1 2026

The Deals Were Few - The Signal Was Structural

At first glance, the 1st quarter of 2026 looked unusually quiet for Metals and Mining M&A activities in the MENA region: there were no mega-deals, no aggressive bidding wars, and no transactions large enough to reset the global landscape. Compared to other regions, the flow of announced deals seemed modest.

However, that is precisely why the quarter deserves closer attention. Beneath the surface, something more important is happening. MENA is no longer just participating in global mining M&A - it is beginning to shape how it is structured, financed, and strategically deployed. And the signal is not in the number of deals. It is in their architecture.

Three Developments That Explain the Shift

Rather than a wave of transactions, Q1'26 produced a small number of moves that are far more revealing than their volume suggests:One of the most important is the emerging partnership between Ma'aden, MP Materials, and the U.S. Department of War, formalized in late 2025. At its core, this is not a conventional mining transaction but a strategic industrial project aimed at building rare earth (REEs) processing capacity in Saudi Arabia, aligned with long-term supply chain security goals.The structure itself is what matters. A Saudi majority-owned platform is combined with U.S. technical capability and policy-backed capital.

The objective is not simply to own an asset but to secure a position in a critical segment of the value chain.

In parallel, Ma'aden has outlined a long-term investment ambition exceeding $100B over the coming decade, spanning phosphates, aluminum, gold, and critical minerals. This scale of capital, combined with increasingly sophisticated partnerships, positions it as a potential global deal originator rather than just a domestic champion.

What this reflects is a broader shift: mining transactions are no longer purely commercial decisions. They are increasingly instruments of industrial policy.
A second development reinforces this point from a different angle: the planned critical minerals fund

VSSC LLC, USA

Vasily Storozhuk

Senior Advisor, Deal Advisory

by the U.S. Cove Capital and the Saudi industrial group AHQ, announced in March 2026, signals the arrival of a new layer of capital into the market. Until recently, MENA mining investment was largely associated with sovereign platforms. That is beginning to change.

Private and family-backed capital is now entering the sector with clear strategic intent, targeting assets in Africa across copper, lithium, cobalt, and REEs. Unlike sovereign funds, which tend to move deliberately and with a high degree of coordination, private capital operates with greater speed and flexibility. It can access mid-sized opportunities, structure deals more dynamically, and respond faster to market shifts.

The result is a more complex and capable capital base. MENA is no longer a single investor type: it is becoming a multi-layered investment ecosystem.

The third development highlights a different but equally important trend. In March 2026, SSR Mining agreed to sell its stake in the Çöpler gold mine in Türkiye to Cengiz Holding for approximately $1.5B. On the surface, it is a straightforward transaction but, in reality, it is a good example of how risk is reshaping ownership in MENA Metals & Mining. Following a major operational incident in February 2024, the asset faced regulatory pressure and a significantly altered risk profile. Despite strong gold prices, the international operator chose to exit and a domestic industrial player stepped in, acquiring the asset at a valuation reflecting that revised risk.

This pattern is becoming more common: when regulatory, political, or operational risks increase, ownership tends to shift from international operators to domestic or regional players who are better positioned to navigate the local environment. Jurisdictional risk, in other words, is no longer a background consideration. It is becoming a central driver of M&A outcomes.

From Ownership to Access

These developments point to a deeper shift in how mining investment is being approached.

For decades, the industry was built around control. Companies acquired assets, operated them, and consolidated their positions over time. That model still exists, but it is no longer the only one - and in MENA, it is increasingly not the dominant one.

The focus is shifting toward access: access to materials, access to supply chains, and access to long-term industrial inputs.

This is why deal structures are evolving. Investors are increasingly comfortable taking minority positions if those positions secure reliable supply. Offtake agreements are being embedded into transactions from the outset.

Financing structures are becoming more sophisticated, reducing upfront capital exposure while maintaining strategic alignment. Control is no longer the primary objective. Securing the flow of materials is.

Africa as an Integrated Supply Base

Much of this strategy is being executed beyond the region, particularly across Africa.

MENA capital continues to show strong interest in copper assets in Zambia and the Democratic Republic of Congo, as well as in uranium and base metals in Namibia and early-stage critical minerals across East Africa. Players such as Ma'aden, ADQ, and International Resources Holding are actively evaluating and structuring opportunities across the continent.

But describing this as outward expansion misses the point. This is not about geographic diversification. It is about integration.

Africa is increasingly being positioned as the upstream extension of MENA's industrial base, supplying the raw materials that feed into processing, manufacturing, and energy transition systems within the region.

The choice of commodities reflects this logic.Copper remains the central focus, driven by its critical role in electrification and infrastructure. Lithium and other battery materials are rising quickly in importance, although their development still requires partnerships for processing and technology. Gold continues to attract investment, but primarily for its cash flow and stability rather

than as a core strategic priority. At the same time, the market is notable for what it is not doing.

There is little evidence of a rush into high-risk greenfield megaprojects. There is no widespread overbidding for global assets. Capital deployment remains selective and disciplined, aligned with long-term objectives rather than short-term opportunities.

Saudi Arabia's Dual Strategy

At the center of this transformation is Saudi Arabia.

What is particularly notable is that the Kingdom is building 2 systems at the same time. One is outward-facing, securing upstream positions globally through partnerships and investments. The other is domestic, focused on accelerating exploration and resource development across the Arabian-Nubian Shield. Saudi Arabia has consistently communicated an estimated $2.5 trillion in mineral resource potential under its Vision 2030 framework, and exploration activity is increasing accordingly. As these programs mature, domestic assets will begin to move toward bankability, creating a pipeline for future transactions within the Kingdom itself.

This means that the next phase of MENA mining M&A may not only be outbound. It may increasingly be domestic as well.

A Model in Formation

Stepping back, a distinct regional model is beginning to take shape. MENA is not replicating the traditional Western approach of full control and consolidation, nor is it following the infrastructure-led, majority ownership strategies seen elsewhere. Instead, it is developing a hybrid model built around strategic participation, supply security, and alignment with industrial policy.

This model is still evolving, but its direction is clear.

The 1st quarter of 2026 was not defined by the number of deals announced.

It was defined by what those deals reveal. MENA is moving from being a source of capital to a designer of supply chains. From a participant in transactions to an architect of how they are structured.The deals themselves may have been limited.

But the shift behind them is not.

This article reflects the author's interpretation of publicly available information and ongoing market developments. It is intended for analytical discussion and does not constitute investment advice or a recommendation to participate in any specific transaction.

Storozhuk Vasily
VSSC LLC, USA

Mining Saudi Magazine sat down with Ken Ma, Co-Founder/ President of GeoX Tech, to discuss how the company's AI-and-hardware platform operates across radically different geographies, what the Gulf mining opportunity looks like through a technology lens, and where the frontier moves next. The conversation below has been edited for length and clarity.

Inside the Platform: Rebuilding Mineral Discovery from the Ground Up

The panel discussion highlighted complementary needs: predictable institutions and de-risking from development banks like the IDB (led by Karolina), infrastructure and clustering from industry leaders like Ian (Teck Resources), and public-private partnerships. Al-Belushi cited Manara Minerals' investments and the Future Minerals Forum as models of global collaboration.

On refining concentration, speakers agreed extreme diversification risks inflation, while over-reliance on one country threatens resilience.

The solution: strategic regional hubs with offtakes, infrastructure, and cross-border ties.

Al-Belushi's intervention reframes mining strategy from downstream hype to upstream reality, positioning Saudi Arabia as a pivotal player in balancing supply security with economic value creation.

> Most exploration companies own the ground and hire technology. We build the technology and earn the ground with it. That inversion changes everything downstream

Ken Ma

Co-Founder/President of GeoX Tech

“We built the technology and earned the ground with it.”

The company’s strategy is based on an inversion of a traditional model. To identify and secure mineral assets, the company built its platform instead of starting with licenses and layering borrowed technology on top.

Ma says most exploration companies own ground and hire technology. As a result of building the technology, we earned the ground. Inversion changes everything downstream, so geography doesn’t scare us like it used to.”

GeoX Tech runs six projects in five countries: Zimbabwe chromite in the Great Dyke, Pakistan placer gold in the Himalayan foothills, Namibia copper in the Damara orogenic belt, Kazakhstan porphyry systems, Cameroon gold, and active tin and monazite processing on the Jos Plateau in Nigeria.

All of this portfolio spans Precambrian cratons, active river valleys, orogenic belts, and tropical laterites. Not the sensors, but the “reasoning layer,” the AI that adapts how it interprets data based on the specific geology in front of it, is the company’s core strength.

“The last step is always human,” Ma emphasizes. “A JORC-qualified geologist signs off on every target package. AI handles pattern recognition at scale; geologists handle regional context. That combination travels well, and it’s taken us years to get it right.”

The next frontier: critical minerals, the ocean, and partnerships

The next phase is not incremental improvement but expansion. GeoX Tech’s next phase is not incremental improvement but expansion into the under-surveyed terrains. Ma identified three directions:

Critical minerals: lithium, copper, rare earths, and tantalum, where global supply gaps widen through 2035, and jurisdictions with the right geology remain under-explored. Nigeria’s 44 known mineral types and less than 30 percent of its prospective terrain surveyed and Saudi Arabia’s Vision 2030-driven mining push are ideal testing grounds.

The ocean : through the Abyssal system, a submersible platform for deep-water mineral surveys. The technology is at the EVT alpha stage, with real-water tethered testing completed. The long-term goal is to apply the same reasoning layer used on land to the seabed, where cobalt reserves may be five times higher than on land.

Partnership : The company already holds OEM and ODM rights to work-class ROV systems for global distribution and is in active discussions with Gulf energy majors about subsurface survey capability.

“What we are building is the infrastructure layer for mineral discovery globally, not just in our own book,” Ma says.

Operating in 50-degree realities

For mining leaders in the Gulf, one question inevitably rises above all others: How do you operate in extreme-heat environments without burning out your teams or blowing out your budget?

Ma argues that the real enemy of 50° temperatures is not the temperature itself, but rather the length of time spent in the field.

In traditional exploration, large ground crews are required to work long shifts under harsh conditions, which becomes a nightmare in terms of safety, cost, and scheduling. The pace of projects slows, rotations are shortened, premiums rise, and the best geologists leave the company.

"We designed the system so the drones and edge-computing units could already operate reliably at 40–45 degrees in Africa and southern China," Ma says. "Getting from there to full Gulf conditions is thermal engineering, not a platform rethink. We've planned for it."

Speed, scale, and savings

The company's internal metrics are striking: 50 times discovery probability, 10 times faster exploration cycles, and 75 percent lower validation costs across six pilot projects. Despite the fact that these are internal projections, not independently audited figures, the timeline compression reveals the underlying story.
In Namibia, three to six months of work became six hours. In Zimbabwe's SG6255 chromite project, the AI revealed that the operating plan had severely underestimated the value of the Main Sulfide Zone. This changed the economics of the planned concentrator build. In Pakistan's Gilgit area, the workflow uncovered ancient river channels and gold-bearing rock formations that conventional methods had missed. This pointed to a potential 20-plus-tonne hard-rock resource beyond the existing placer operation. "We are not replacing geologists," Ma stresses. "We are giving them a targeting layer that is 10 times faster and covers ground they could never cover manually, so their judgment gets applied to the right rocks."

From chaos to drill-ready: Namibia and Tangxi

GeoX Tech's Koaka copper project in Namibia's Damara belt is one of the cleanest demonstrations of its model.

The project was presented as a tangled mass of scattered reports, old field photographs, and a mining right that had been undervalued by its own operating plan.
There was a conventional belief that it would take a senior geological team three to six months to unpack it properly. Using GeoX Tech's AI-driven GeoMindra platform, it was completed within six hours. It surfaced thousands of concealed structural lines and geological features that human review had missed, then mapped alteration signatures across the tenure. Over the highest probability anomalies, drones added ground truth. As a result, a fully drill-ready, GPS-tagged, and ranked mineralization probability map indicated a roughly 4 million tonne copper-silver system with 6–8% copper as a byproduct. Even more telling is the Tangxiang case. Using historical data from a producing copper mine, it stripped out all references to the known orebody. After finding the existing tunnel, the system independently identified a secondary target that the mine's own geologists had never noticed. On-site experts confirmed that it warranted further exploration. "That's the double-blind test," Ma explains. "The AI discovered what humans had found, then found what humans had missed. We built this to end up on their screens, not in their recycling bins."

Ken Ma on Saudi mining partnerships:

In Saudi Arabia, where national champions, geological surveys, and sovereign capital align under Vision 2030, there's a rare five-year window to shape mining infrastructure. "The ideal partner has real assets, technical depth, and a long horizon, because discovery is infrastructure, not a six-month contract. The partners who move now will shape the next generation. If we're right, ten years from now mineral discovery won't look like an industry. It will look like infrastructure and early movers will own the supply chains."

From guessing games to data streams, a new AI mines the mining scene.

In an industry where a single misplaced drill can cost millions, a Saudi Arabian startup is betting that artificial intelligence can bring unprecedented precision to mineral exploration. TrueGrid AI, geologist Montasir abdelrahim, one of the co founder, is developing an AI-powered platform designed to solve some of mining's most persistent and expensive problems: inefficient exploration, inaccurate sampling, and the staggering costs of incorrect geological assessments.

Based on a recent in-depth interview, TrueGrid AI's mission is to transform a process often reliant on desktop studies, satellite imagery, and human estimation into a dynamic, data-driven science. The company is preparing to showcase its technology at the upcoming Future Minerals Pioneer competition.

The Problem: Billions Wasted on Guesswork

The inspiration for TrueGrid AI came directly from the field. Montasir and his team observed critical inefficiencies throughout the mining lifecycle.

"The issues start from the very first stages in exploration," Montasir explained. "Incomplete data, wrong targets, and wrong planning take a lot of cost." These early errors cascade, leading to misallocated resources. Later, during the grade control phase where miners decide which material is valuable ore and which is waste decisions are often made "by eye," a subjective process that can leave valuable ore behind or send worthless waste to processing plants, diluting profits.

"These issues reflect the entire mining sector around the world," Montasir stated, estimating that such inefficiencies cost the industry "billions of dollars."

Core Technology & Key Differentiators: Beyond Traditional Software

While other exploration software exists, TrueGrid AI claims a distinct advantage through its unique synthesis of real-time analysis, multi-model integration, and field-level accessibility.

"The application estimates the area that the user is located in, in real time, " Montasir emphasized. This is a departure from legacy tools that often require lengthy post-processing. A geologist can input text-based field observations, and the system "will convert this description into a weighted grid" almost instantly.

Furthermore, the platform's 90% validated accuracy stems from a sophisticated backend. "The result is not coming just from one method... it's a combination between different models," Montasir noted. The AI synthesizes geological data, user input, and estimations, assigning a confidence level to each prediction based on statistical variance. This hybrid approach aims to provide a more robust and reliable output than single-algorithm solutions.

Finally, the output is designed for direct field use. The final "estimated certificate" includes grade classification, variance diagrams, and geological recommendations, giving field geologists a comprehensive, actionable report on-site. "It won't save a lot of time of processing. This job work before the site visit, " Montasir added, positioning TrueGrid AI as a predictive tool that de-risks exploration before a single drill rig is mobilized.

Montasir Abdelrahim
Exploration & Mining Geologist

The Saudi IP Journey: Securing a “Unique AI Model”

Protecting this novel technology is a priority for the startup. When asked about intellectual property, Montasir confirmed that **TrueGrid AI has already applied for IP protection in Saudi Arabia.**

The basis for their IP claim rests on the uniqueness of their integrated system. “We are different from other software... in the real-time [analysis] and the accuracy level,” he stated. The proprietary combination of converting descriptive text into quantifiable geological weights, running concurrent multi-model analyses, and delivering a consolidated confidence-based certificate forms the core of their IP application.

While the exact timeline for final IP approval is not specified, the act of filing underscores the team’s commitment to building a defensible, technology-led company within the Kingdom’s framework, aligning with national goals to foster homegrown innovation.

Seeking Partnerships and Funding for the Next Phase

Currently, TrueGrid AI is a bootstrapped venture, developed by a small team in their spare time. Three of six planned AI models are complete. While the immediate focus is the Future Minerals Pioneer competition, the team is now actively laying the groundwork for growth and is **open to strategic conversations.**

“We did receive about two offers from two companies here to collaborate,” Montasir shared, indicating early market interest. **The startup is now formally exploring potential partnerships with both investors and incubators to accelerate its path.**

Looking ahead, the company anticipates significant funding needs to scale. “We will surely need a lot of money to train the AI models, [for hardware], and costs for marketing,” Montasir explained.

Funding will also support an expansion of the core team, as the current two developers are insufficient for the “huge idea.” The team is conducting a feasibility study to determine precise figures for development and marketing costs, with plans to have clearer financing targets by early next year.

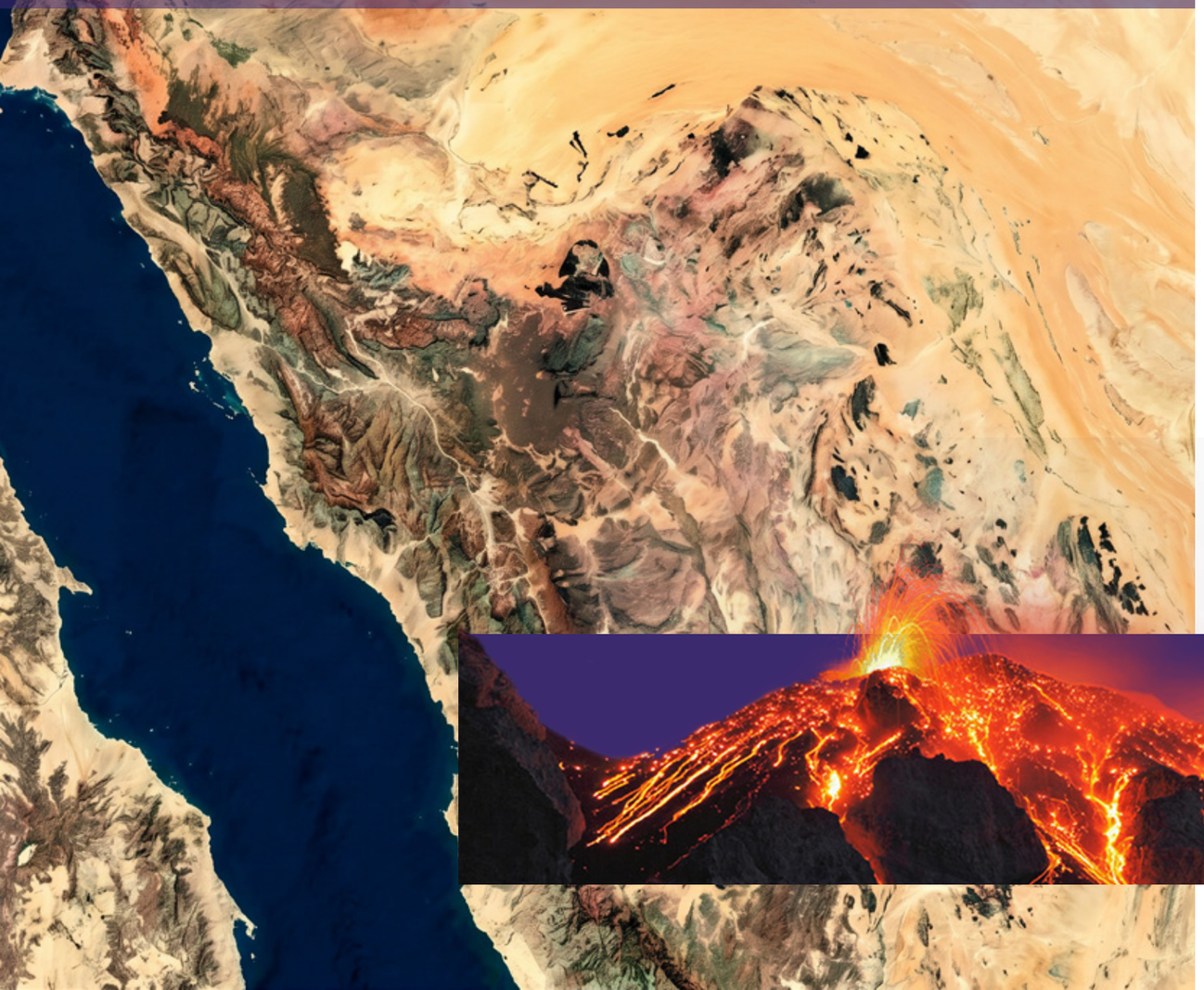
A New Era for Exploration

TrueGrid AI stands at the intersection of geology and cutting-edge AI, promising to mitigate the traditional risks and costs of mineral exploration. By turning real-time geological observations into high-confidence estimates, the startup aims not just to sell software, but to fundamentally change how mines are found and managed starting in Saudi Arabia and potentially expanding across the globe.

With a unique technological approach now under formal IP review within the Kingdom, TrueGrid AI is positioning itself as a serious contender in the mining tech space. The company’s current search for the right partners and investors marks a critical step in bringing this protected vision from a validated prototype to an industry-standard tool.

Base Metal Belts in the Arabian Shield: A Geoscience Study on Copper and Zinc

In Saudi Arabia's rapidly evolving mining landscape, speed with confidence is paramount, and that can only be achieved by de-risking early. 3D geological modeling is no longer simply a technical discipline reserved for geologists; it is a strategic business tool that reduces uncertainty, accelerates decision-making, shortens project timelines, and strengthens investor confidence. Ultimately, Vision 2030 projects move faster because risk is minimized from the outset.



What is the Geological Genesis of Volcanogenic Massive Sulfide (VMS) Belts?

Genesis of Volcanogenic Massive Sulfide Belts

These belts originate according to a precise scientific model linked to submarine volcanic activity. The process begins when seawater infiltrates through crustal faults, becomes heated by underlying magma, and leaches metals from the surrounding rocks. These mineral-rich fluids are then discharged back onto the seafloor, precipitating as metallic sulfides.

Volcanic Arc Tectonics: Most of these belts are located within ancient "island arc" environments that characterized the formation of the Arabian Shield.

Thermal Source: Hydrothermal fluids loaded with Cu and Zn precipitate upon contact with cold seawater, forming massive metallic "lenses."

Petrographic and Mineralogical Characteristics of Copper-Zinc Belts

Petrographic and Mineralogical Characteristics

Studying a mineral belt requires a rigorous understanding of the host rock components, typically categorized into three distinct levels

Massive Ore Zone: Contains dense sulfide accumulations where the mineral concentration exceeds 60%. The primary minerals include Sphalerite (for Zinc) and Chalcopyrite (for Copper).

Stockwork Zone (Feeder Pipe): Consists of a network of branching veins representing the ancient feeder channels, rich in quartz and disseminated sulfides.

Alteration Halos: Surrounding rocks that have been chemically modified, characterized by the presence of Chlorite (in the core) and Sericite (at the periphery).

Geophysical Exploration Techniques for Base Metal Belts

Since base metal belts are characterized by high density and high electrical conductivity, exploration relies on identifying “Physical Anomalies”:

Scientific Objective	Geophysical Technique
Detecting conductive massive sulfide bodies beneath the surface	Electromagnetics (EM)
Identifying density contrasts between the ore mass and the surrounding volcanic rocks	Gravity Survey
Pinpointing “disseminated ore” zones that traditional methods might overlook	Induced Polarization (IP)
Structural mapping and identifying faults that control belt placement	Aeromagnetics

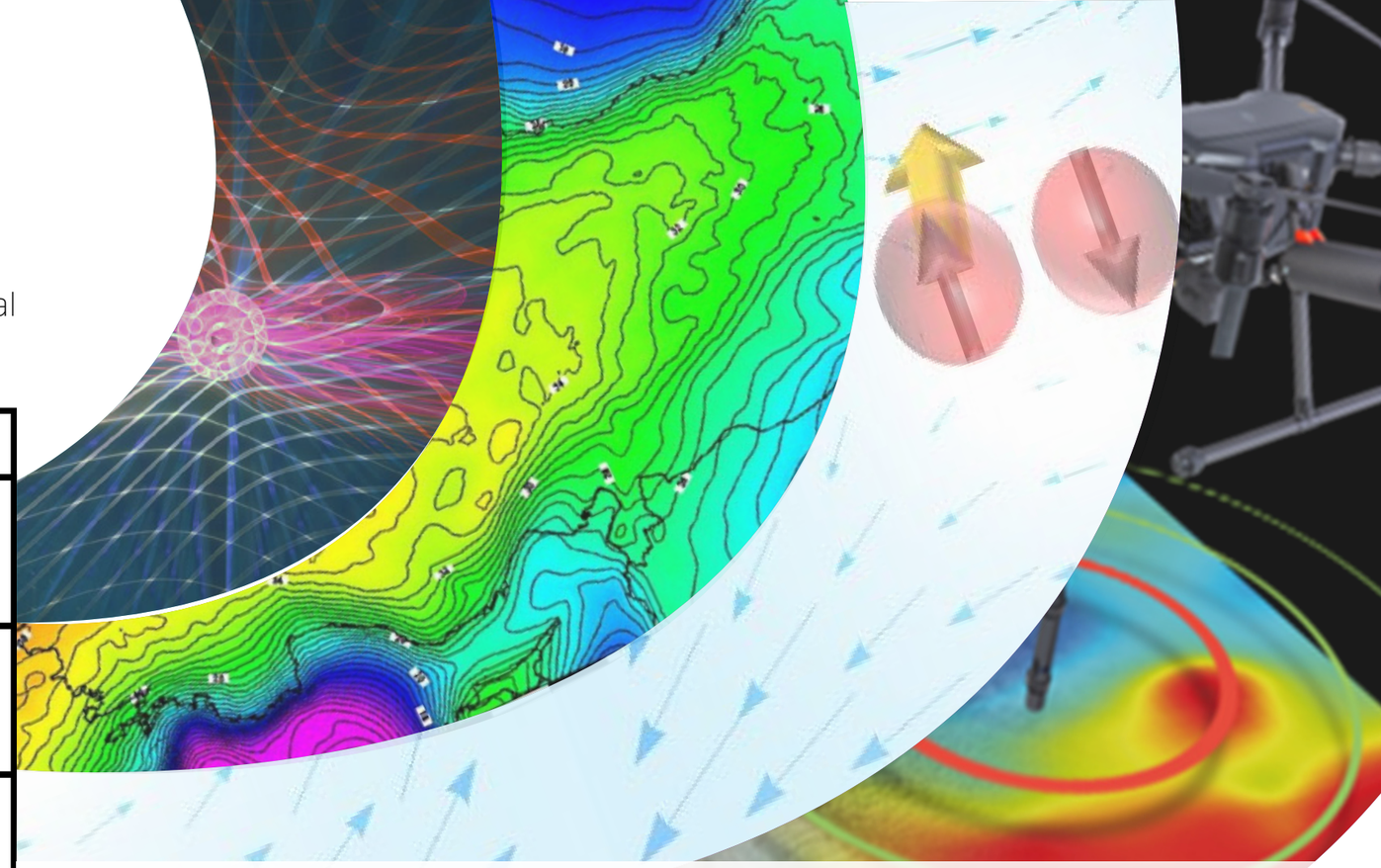
Mineral Zoning and Thermal Gradients within the Belt

Copper and zinc belts follow the law of “Thermal Zoning,” where minerals are distributed based on the temperature of the fluids at the moment of precipitation:

Belt Core: Rich in Copper (Cu) due to its precipitation at high temperatures exceeding 300°C.

Distal Margins: Rich in Zinc (Zn) and Lead (Pb), as these elements precipitate as fluid temperatures drop further from the thermal source.

Gossan (Iron Cap): The oxidized upper portion of the belt visible on the surface in red or brown hues, serving as the primary visual indicator for geologists.



Metallurgical Processing of Base Metal Ores

Mineral separation from base metal belts is a significant engineering challenge due to mineral intergrowth (Complex Ores). Processing follows this scientific pathway:

Liberation: Grinding rocks to micron sizes to liberate Sphalerite and Chalcopyrite grains from the gangue.

Differential Flotation: Using selective chemical reagents to separate copper concentrates from zinc concentrates in distinct flotation cells.

Laboratory Chemical Analysis: Utilizing (XRF) and (ICP-MS) techniques to verify purity levels and minimize impurities such as Arsenic or Cadmium. Base Metal Belts in the Arabian Shield are complex hydrothermal systems providing rich data for Earth Science researchers. An integrated understanding of the relationship between ancient tectonics, chemical alteration zones, and geophysical anomalies is the only way to identify the deep extensions of these belts and estimate their reserves accurately and sustainably.

HEXAGON

How does **Hexagon's** vision for the autonomous mine intersect with the need to cultivate human talent and creative problem-solving skills?

Technology doesn't replace people, it raises the bar for what people do. The autonomous mine isn't about removing humans; it's about removing constraints so humans can focus on higher-value decisions. Hexagon has always said it doesn't impose a vision of the mine of the future, instead we arrive there by listening, building trust, and solving real problems alongside our customers. Autonomy and AI shift the role of the workforce from manual execution to optimisation, management of variables, and continuous improvement. That requires critical thinking, creativity, and systems-level understanding. So, investing in talent isn't separate from automation, it's what makes it viable.

What inspired Hexagon to prioritize workforce and skills development as a strategic pillar rather than a support function?

Mining is facing structural challenges: talent shortages, ESG expectations, and increasing operational complexity. You simply can't solve those with technology alone. We've seen firsthand that the success of any digital or autonomous deployment depends on the capability and confidence of the people using it. That's why workforce development has to be a strategic priority. It's also personal. Mentorship and education shaped my own career, and as an industry, we have a responsibility to invest in the next generation, not just to sustain mining, but to improve it.

What makes Saudi Arabia a compelling hub for mining innovation and talent development within the Middle East?

Saudi Arabia has a unique combination of ambition, investment, and intent. The Vision 2030 agenda is creating a platform where mining is being developed not just as an industry, but as a strategic pillar of economic diversification. There's strong government backing, a focus on localisation, and a willingness to adopt advanced technologies from the outset. That creates the conditions to accelerate, building digitally enabled operations and a highly skilled workforce in parallel.

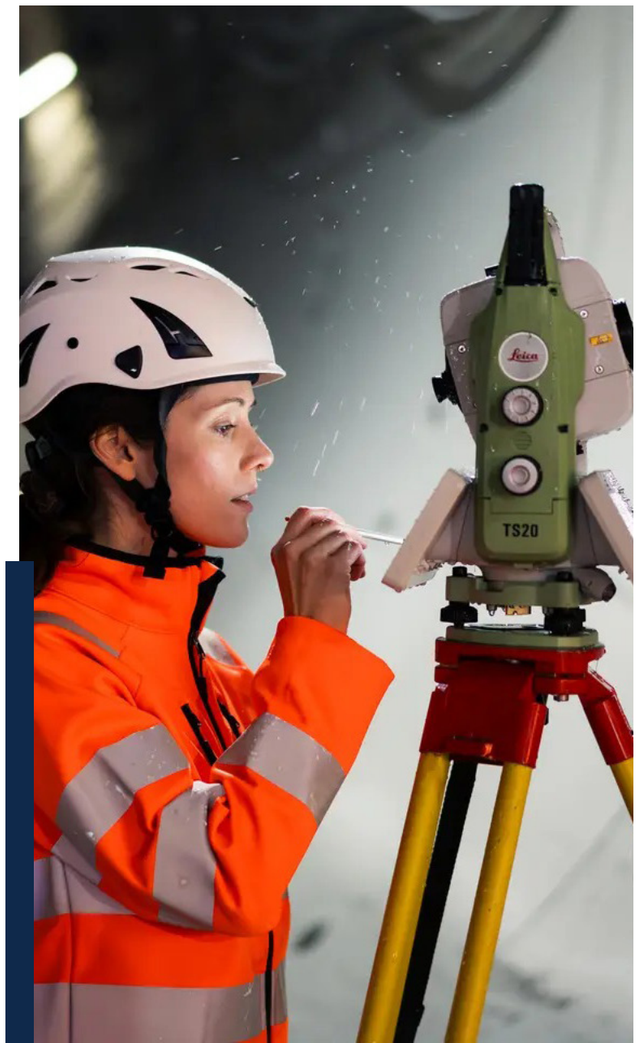
How can technology companies influence cultural and generational perceptions of mining careers, especially among young?

Perception changes when people see relevance and opportunity. Technology companies can help reposition mining as a modern, high-tech, purpose-driven industry, one that uses AI, data, and advanced systems to solve real-world challenges like energy transition and resource efficiency. Equally important is visibility. Partnerships with universities, inclusion initiatives, and showcasing diverse career pathways - particularly for women and underrepresented groups - help shift the narrative from traditional mining to future-focused innovation.

What shared priorities shaped this joint initiative with Ma'aden?

At its core, the partnership is built on a shared belief: that technology and talent must advance together.

We're aligned on three things: developing local capability, accelerating digital adoption, and building a long-term, sustainable mining ecosystem in the Kingdom. That means not just deploying solutions, but co-developing skills, knowledge, and operating models that can scale.



What lessons has Hexagon learned from global operations that could support inclusive and sustainable workforce growth in mining?

One of the biggest lessons is that trust determines adoption.

You can have the best technology in the world, but if the workforce doesn't trust it - or doesn't understand it - it won't deliver value. Successful deployments are the ones where operators are engaged early, trained effectively, and see tangible benefits. We've also learned that inclusion matters, not just socially, but operationally.

Diverse teams bring different perspectives, which improves problem-solving and innovation.

We bring lessons, not templates. Regions like Western Australia and the Canadian oil sands have shown how constraints, particularly labour, accelerate automation. But every region has its own context. In Saudi Arabia, there's a strong emphasis on localisation and workforce development, so our approach adapts to that, combining global experience with local priorities.

Looking ahead, what key outcomes would signal to you that this partnership has achieved its desired impact in technology adoption and human capital growth?

Success isn't just measured by technology deployed, it's measured by value realised. I'd look for three things: First, measurable improvements in safety, productivity, and efficiency. Second, a skilled local workforce confidently operating and optimising those systems. And third, a sustainable model, where capability continues to grow beyond the initial partnership. Ultimately, if we've helped create an environment where technology and people are advancing together, then we've done our job.

How do you see this partnership serving as a model for other regions seeking to integrate advanced technology with national training agendas?

What makes this model effective is that it's not transactional, it's a long-term partnership. We're not just deploying technology and walking away. We're working alongside our partners to embed capability, align with national priorities, and create pathways from education through to operations.

That integrated approach - linking technology, training, and local context - is something that can be replicated globally.

What new roles or job profiles do you foresee emerging within digital mining operations over the next decade?

You'll see a shift toward roles that sit at the intersection of mining and technology. Think data scientists embedded in operations, autonomy supervisors, remote operations controllers, AI optimisation specialists, and workflow engineers. The focus moves from operating equipment to managing systems and improving outcomes. Importantly, these roles require both domain expertise and digital fluency.

How is Hexagon balancing the introduction of AI and robotics with upskilling initiatives that prepare workers for more analytical and supervisory functions?

We focus less on automating machines and more on automating workflows. That distinction matters, because when you automate a workflow effectively, you're also redefining the human role within it. Our approach is to introduce technology in a way that builds capability, giving operators tools that augment decision-making, not bypass it. Upskilling is embedded in that process. As systems become more advanced, the workforce evolves alongside them.

Dave Goddard

President, Hexagon's Mining Division

Dave Goddard is a recognised leader with 30 years in the mining industry across a variety of mining companies, suppliers, and consultancies, including six years as a senior industry expert for McKinsey & Company. He serves on several mining industry organizations, including SME (Society for Mining, Metallurgy & Exploration) Foundation Board of Trustees.

Saudi Arabia's Mining Workforce of the Future: The Skills, Roles, and Talent the Sector Will Need

As Saudi Arabia accelerates its ambitions to position mining as the third pillar of its economy under Vision 2030, the conversation is no longer limited to mineral resources or i nvestment flows. Instead, a more critical question is emerging: **Does the Kingdom have the talent required to sustain this transformation?**

The Scale of Opportunity: What is the workforce demand?

Recent data highlights the accelerating pace of Saudi Arabia's mining sector. By February 2026, the total number of active mining licenses reached 2,963, following the issuance of 29 new licenses in January and 38 additional licenses in February. This steady expansion reflects sustained growth across exploration and production activities. However, industry identifies the availability of skilled labor as a key constraint on the sector's development, highlighting the growing pressure on the mining workforce pipeline

In parallel, sector reforms are expected to create substantial employment opportunities, with regulatory restructuring projected to generate 47,000 new jobs, reinforcing the scale of workforce demand across the sector.

Beyond job creation, the increasing complexity of the sector is also evident. The Saudi government has introduced a national occupational framework covering more than 500 mining-related roles. This reflects a shift from traditional roles to more diversified and specialized workforce structure.

In its "2025 Mining for Talent" report, the OECD argues that the real bottleneck is not geology or capital, but people and skills. Mining still anchors regional economies, but in some countries aging workers, weak talent pipelines, and unattractive remote locations are shaping the sector's future as much as commodity prices. With young and growing workforce, the scale of opportunity is significant. The mining sector in Saudi is expected **to generate up to 200,000 jobs by 2030.** At the same time, structural challenges within the labor market suggest that workforce readiness may not be advancing at the same pace. This creates a defining tension for the sector: **rapid industrial expansion versus the availability of specialized talent.**

Globally, This workforce stress is linked to booming demand for critical minerals, according to the report. Over the next decade, rare earth demand could increase **by 400 to 600%** due to the expansion of electric vehicles, solar panels, batteries, and other green technologies. As new digital and AI-related jobs grow, nearly half of North American mining jobs may be at risk of automation by 2030. Therefore, mining does not shrink; it changes shape. There is an increasing dependence on specialized talent as the value chain becomes more technical, more automated, and more automated. Therefore, recruitment is not the only problem. In other words, it is local development. It argues that housing, transportation, well being, family support, and local diversification all influence worker retention.

What is currently working globally?

This report's most important message is practical: governments, education systems, and companies must work together to reduce mining talent shortages. Several policy recommendations are put forward, including expanding the talent pool, filling skills gaps, improving the sector's image, and making mining regions more attractive.

There are also several models that are based on real-world experiences. **Australia uses apprenticeships and recruitment programs that target women, youth, Canada's Mining Essentials program fosters Indigenous participation; Sweden's Bergsskolan builds a regional mining education hub; Finland's KOE project maps future skills needs; Chile's Corporación Alta Ley links industry and education through forecasting and micro-credentials.**

Mining Jobs, Reimagined: Saudi Arabia's Talent Shift

The nature of mining jobs in Saudi Arabia is evolving alongside the sector's technological and operational transformation.

Historically, mining operations relied heavily on manual processes and traditional engineering roles. Today, however, the industry is increasingly shaped by **digital tools, data-driven decision-making, and integrated operational systems.**

This transformation is aligned with broader economic shifts highlighted in Vision 2030 policy frameworks, which emphasize the development of advanced industries supported by technology and innovation.

As a result, mining roles are no longer confined to extraction and site operations. They now **extend to areas such as:** digital geological modeling, data analysis and interpretation, automated and remote operations, environmental and sustainability management.

The expansion to over 500 defined roles within the sector is a direct reflection of this transformation, signaling that mining in Saudi Arabia is transitioning into a **multi-disciplinary, technology-integrated industry.**

The Talent Gap: A Structural Challenge

At a national level, labor market dynamics point to a structural talent gap as Saudi Arabia transitions toward a knowledge-based economy.

This challenge is particularly evident in the mining sector, which is expected to **generate up to 200,000 jobs by 2030,** while currently employing approximately **250,000 workers across its value chain.**

At the same time, **workforce composition reveals that expatriates account for around 77% of the total workforce,**

indicating a continued reliance on international expertise to meet specialized skill demands.

The Skills That Will Define the Future Mining Workforce

An increasingly complex mining industry requires qualified professionals to possess a mix of technical, digital, and operational skills. Saudi Arabia is expanding licensing, exploration, and localization, but its real competitive edge will come from talent development, data capabilities, and making mining an attractive career for young people.

Investing in training, AI-enabled workforces, and school-to-site talent pipelines will be key to long-term success.

How Saudi Arabia Is Building Its Mining Talent Pipeline

With targeted government initiatives, including occupational frameworks, specialized training, and partnerships with global mining companies, Saudi Arabia is advancing workforce development in mining. Developed by the Ministry of Industry and Mineral Resources, these programs align talent development with sector needs. The Exploration Enablement Program (EEP) further supports technical capability building and knowledge transfer through international collaboration, signaling a shift toward a sustainable, locally driven talent ecosystem.

The Strategic Gold Belts of Saudi Arabia: A Historical and Geological Perspective

Mining as the Third Pillar of the Saudi Economy

For the global investment community, professional geologists, and economists, the Saudi gold belts represent a rare opportunity: a Tier-1 mining jurisdiction with a stable government and world-class infrastructure. Unlike many established mining provinces in Africa or South Africa, the Arabian Shield offers a geological setting that remains significantly underexplored, providing a "first-mover advantage" to those utilizing modern geophysical technologies.

From Ancient Workings to the 2030 Renaissance

The history of gold in the Arabian Peninsula is a chronicle of intermittent brilliance spanning over 3,000 years.

The Paleo-Mining Legacy: Archaeological surveys conducted by the Saudi Geological Survey (SGS) have identified over 800 ancient mining sites. Radiocarbon dating of charcoal from slag heaps at sites like Mahd adh Dhahab (Cradle of Gold) indicates peak activity during the reign of King Solomon and again during the Abbasid Caliphate (8th–10th centuries). These ancient miners were remarkably adept at identifying high-grade outcropping quartz veins, which modern exploration companies still use as primary "proximity markers."

The Modern Institutional Era: The creation of Ma'aden (Saudi Arabian Mining Company) in 1997 shifted the focus toward large-scale, capital-intensive operations. Today, the "Renaissance" is fueled by modernized regulations that have streamlined licensing and attracted global giants to form strategic joint ventures.

Can the Arabian Shield's Geological "Belt" System Rival Global Provinces?

To a geologist, the Arabian Shield is a classic example of Late Proterozoic crustal evolution (900–550 Ma). It was formed through the accretion of multiple intra-oceanic island arcs against the African craton. Understanding the distribution of gold requires a focus on these specific tectonic belts.

A. The Nabita Fault Complex (The Golden Suture)

The most critical belt in Saudi Arabia is the Nabita Fault System, a 1,200 km-long north-south trending suture zone. It represents the collision boundary between major terranes.

Mineralization Style: This belt acted as a crustal-scale plumbing system for hydrothermal fluids. During the Pan-African Orogeny, gold-bearing fluids were expelled from the lower crust and deposited in brittle-ductile shear zones.
Economic Potential: The world-class Mansourah-Massarah project is located along this trend, proving that these suture zones host multi-million-ounce deposits.

B. The Al Amar Belt (The Eastern VMS Frontier)

Located on the easternmost edge of the Shield, the Al Amar Belt is distinct due to its high concentration of Volcanogenic Massive Sulfides (VMS) and epithermal systems.
Geology: Characterized by felsic volcanic rocks, the gold here is often polymetallic, associated with Zinc (Zn), Copper (Cu), and Silver (Ag).

Advanced Geophysical Technologies: Breaking the “Sand Cover” Barrier

One of the primary challenges in the Arabian Shield is that vast areas of promising belts are obscured by recent sediments and sands (Quaternary Cover).

Airborne Magnetic and Radiometric Surveys: KSA is currently utilizing high resolution surveys to “see” beneath the sands, identifying deep-seated tectonic structures and lithological contacts that host mineralization.

AI-Driven Remote Sensing: Satellite imagery (such as ASTER and Sentinel) is being integrated with machine learning algorithms to identify Alteration Halos. These chemical signatures in the rocks indicate the presence of gold-bearing systems beneath the surface, significantly reducing the “discovery risk” for exploration companies.

Metallurgy: Extracting Value from Complex Ores

The gold found across Saudi belts varies in its chemical “refractivity,” necessitating tailored processing solutions:

Free-Milling Gold: Found predominantly in the central belts (e.g., Ad Duwayhi). This gold is easily recovered using standard Carbon-in-Leach (CIL) circuits.

Refractory Gold: Found in certain suture zones where gold is “locked” within sulfide minerals like pyrite. Saudi Arabia has pioneered the use of Pressure Oxidation (POX) technology at the Mansourah-Massarah complex. This world-class facility uses high pressure and temperature to liberate gold from complex ores that were historically impossible to process.

Geological Challenges and Engineering Solutions in Arid Environments

Operating in the Saudi gold belts requires specialized engineering due to the hyper-arid climate:

Sustainable Water Management: Water is the most critical resource for gold processing. Saudi Arabia has implemented a global benchmark by using Treated Sewage Effluent (TSE), transported hundreds of kilometers via pipeline to remote mines, preserving the nation’s fossil groundwater.

Geotechnical Stability: As mines move to greater depths in the rugged Arabian Shield, advanced radar-based wall monitoring and 3D geological modeling are used to manage rock mass stability and ensure the safety of large-scale open pits.

The Strategic Horizon

The strategic gold belts of Saudi Arabia are no longer a speculative frontier; they are a proven, high-growth industrial sector. The convergence of Proterozoic geology, unprecedented state support, and cutting-edge exploration technology has created a “perfect storm” for value creation.

As the world seeks stable, competitive jurisdictions to secure precious metal supplies, the Arabian Shield stands ready. The transition from “Ancient Workings” to “Modern Industrial Hubs” is well underway, positioning the Kingdom to rival legendary gold provinces such as Canada’s Abitibi Greenstone Belt and Australia’s Yilgarn Craton.

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2. **Ma’aden (Saudi Arabian Mining Company):** Annual Operational and Technical Performance Reports.

3. **Johnson, P. R., et al.: Gold Deposits of the Arabian-Nubian Shield:** A Comprehensive Tectonic and Mineralogical Review.

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The Peru-Saudi Copper Corridor Could Redefine How Gulf Secures Critical Minerals

In an interview with Mining Saudi Arabia, Augusto Cauti, former Vice Minister of Mines in Peru, said the Saudi-Peruvian relationship could extend far beyond a simple buyer-seller arrangement in mining. “Peru would be a great partner since it combines a high quantity of reserves, constant production, and market diversification for Saudi Arabia,” Cauti said.

He noted that Peru’s strength is not only geological but also industrial and logistical. “The country exported more than 60,000 million dollars in mining products during 2025,” he said, adding that mining represented “66% of total Peruvian sales.” Cauti pointed to Peru’s position as a top global producer of copper, gold, silver, zinc, tin and molybdenum. In copper alone, he said, Peru is now the third largest producer in the world, with around 12% of global reserves.”

Saudi Arabia’s Peru offers scale, diversification and a path to faster supply growth through brownfield expansion. Cauti said nearly 70% of Peru’s current mining project backlog is copper-oriented, creating a strong opportunity for long-term offtake partnerships. “Besides, Saudi Arabia and Peru are part of the WTO and, from Callao port, Saudi Arabia is easily accessible through the Pacific Ocean and the Suez channel,” he said. “It is a more direct route than others from this part of the world.”

He added that Peru also offers a lower geopolitical risk profile than some alternative sourcing regions. Also, its location poses fewer geopolitical risks than others, he said. Cauti said global supply conditions would also improve Peru’s attractiveness. “With the current export ban on sulfuric acid from China, producers from countries like Peru become more attractive ,” he said.

How Saudi capital should enter?

Asked how Gulf sovereign funds or companies should structure investments, Cauti emphasized that the most effective deals are those that combine supply security with capital protection.

“Developers in Peru looking to attract Saudi Arabia investment would typically structure deals to solve two core concerns: capital protection or risk mitigation for the investor; and, a guaranteed long-term copper supply for Saudi Arabia’s industrial strategy,” he said.

He added that the most successful projects are usually built around multiple alignments rather than a single instrument. “The most compelling proposals tend to do so by combining equity, offtake, and operational alignment rather than relying on just one mechanism,” he said.

For him, that means the relationship should be designed as a long-term industrial partnership. “Peru monetizes future production at lower risk while Saudi Arabia internalizes the entire copper value chain.”

> Peru offers clean export logistics, and Saudi Arabia offers controlled import plus processing logistics

Augusto Cauti
former Vice Minister of Mines in Peru

A strategic corridor

Cauti argued that Peru's value to Saudi Arabia is not just as a producer but as a partner with institutional depth, engineering capacity, and a tested social license framework.

"Peru's advantage isn't just that it has copper," he said, "but also that it has spent two decades quietly building a solid, highly adaptive EPC/EPCM capacity."

He said Peru also offers a difficult-to-replicate institutional advantage under pressure. "Peru's edge isn't just its engineering capacity but institutional know-how under constraint," he said.

In his view, the Peru-Saudi axis can outperform competing supply routes because it connects upstream reliability with downstream certainty.

"The real advantage isn't just that Peru is 'closer' than Central Asia," he said. "It is that Peru offers clean export logistics, and Saudi Arabia offers controlled import plus processing logistics."

That, he said, is where real value is created. "It should not be just Peru selling and Saudi Arabia buying," Cauti said. "More than that, it shall be Peru monetizing future production at low risk at the same time that Saudi internalizes the entire copper value chain."

Brownfield lessons for Saudi Arabia

According to Cauti, Saudi Arabia can learn a lot from Peru's brownfield mining model. Infrastructure, permits, and technical capacity already exist, so existing operations move faster.
"Peru is an ideal location because brownfield expansions can come online in a few years using existing permits and infrastructure," he said.

But he warned that even mature mining districts face serious constraints. "Operating mines hit their limits, not from geology, but from surface rights, tailings capacity, and community acceptance," he said.

That is why he believes greenfield projects in Saudi Arabia should be designed differently from the start. "Greenfields should be designed with modular expansion pathways, flexible processing systems, and digital optimization from day one," he said. He also urged Saudi Arabia to think beyond individual projects.

"Another lesson would be to plan mining regions, not just mines," he said. "Be prepared for workforce mobility, enhanced regional infrastructure, and diversification of the economy."

ESG and social license

Cauti said Peru's experience of social conflict management offers an excellent model for new licensing areas. The key, he said, is to move from reactive conflict management to proactive trust-building.

Peru's model used to be based on "resolving conflict through structured dialogue," while that innovative approach to dealing with mining matters was based on preventing conflict through pre-negotiated, enforceable, and transparent agreements. A reactive framework can be turned into a proactive one by identifying key factors that need to be changed or improved.

"Peru has effectively "stress-tested" social license through repeated boom–bust cycles and conflict episodes. What's emerged isn't a single framework but a portfolio of institutionalized practices that together reduce disruption risk. For Saudi Arabia, the most transferable value lies in how these mechanisms are embedded into governance," he added.

Noting "Peru's community partnership model can be adapted by making social license a licensing condition, adding regular community trust audits, linking expansion approvals to trust metrics, and requiring localized benefits such as community dividends, equity stakes, and local supplier development. It should also include community participation in water governance, real-time water transparency, and locally based social-performance teams."

WOMEN in Mining

Sara Fakhry
Egyptian Geologist

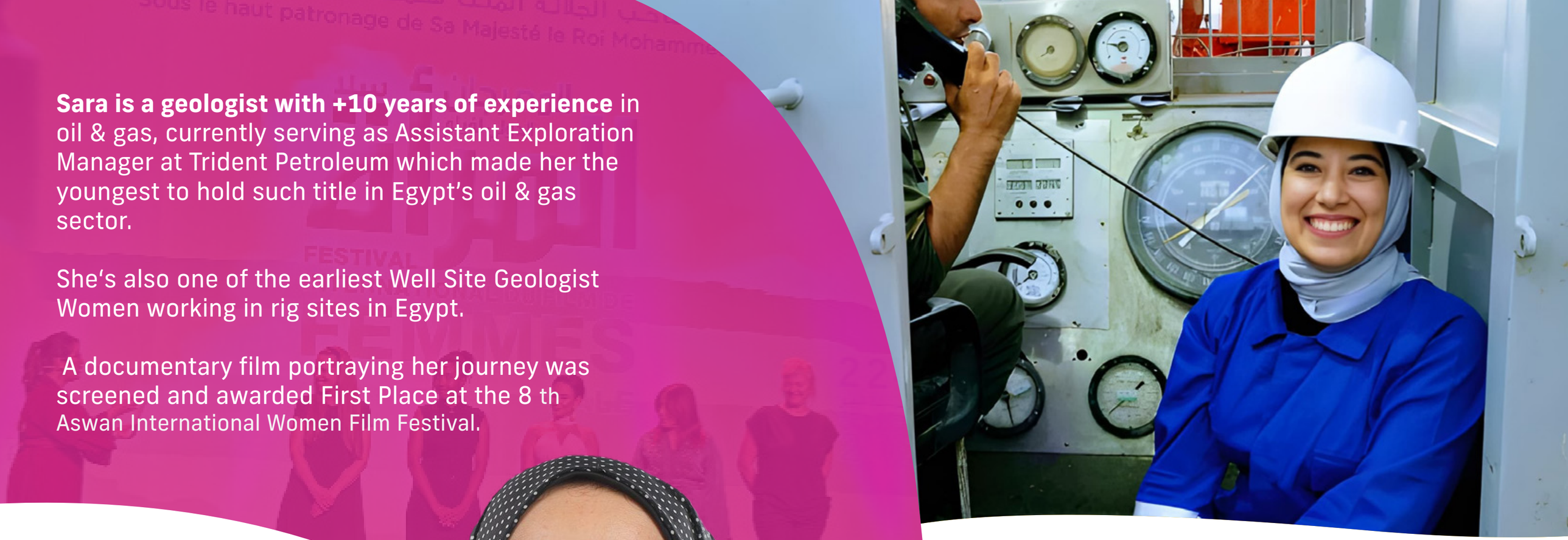
Women in Mining section shines a spotlight on the pioneers and rising talents across Saudi Arabia and abroad who are redefining what a career in mining can look like. Each profile highlights a woman's professional journey, the challenges she has overcome, and the impact she is making on projects, teams, and local communities. By sharing their experiences, we aim to inspire more women to consider roles across the mining value chainfrom fieldwork and operations to research, innovation, and leadership. Through interviews, case studies, and on-the-ground stories,

Mining Saudi Arabia Team

Sara is a geologist with +10 years of experience in oil & gas, currently serving as Assistant Exploration Manager at Trident Petroleum which made her the youngest to hold such title in Egypt's oil & gas sector.

She's also one of the earliest Well Site Geologist Women working in rig sites in Egypt.

A documentary film portraying her journey was screened and awarded First Place at the 8 th Aswan International Women Film Festival.



Q&A

You wear multiple hats: assistant exploration manager, wellsite geologist, science communicator, and mentor. How do these roles feed into each other in your day to day work?

don't really see them as separate roles; they are extensions of the same mission, and that is to translate complex geology into human impact.

As a geologist, I often describe myself as the detective of the subsurface. I collect evidence, piecing it together to understand what lies beneath. As an assistant exploration manager, I step back and build the bigger picture, turning subsurface uncertainty into decisions on where to drill the well and why. What makes my work more interesting is that I don't stop here; I go and drill that same well as a well-site geologist, where theory meets reality in real time. Mentoring and science communication extend this impact beyond the rig and the office. I multiply that impact by helping others in society.

Each role strengthens and completes the other. Together, they give my work value and meaning.

Can you share a story where the data told you one thing, but what you saw at the wellsite forced you to rethink the model?

This happens more often than people think, and it's where real experience is built.
In one case, we were drilling a multi-target well, based on a proposal that suggested certain formations' thickness and lithology. However, as drilling progressed, the cuttings and logs told a very different story. Several expected reservoirs were absent, and the remaining one was much thinner than expected. I remember that we had already considered alternative scenarios, which allowed us to adapt immediately, and we could quickly adjust decisions accordingly.

As a wellsite geologist, you're making real-time calls about suspending or continuing drilling. How do you handle that pressure when millions of dollars are literally on the line?

Pressure is, of course, part of the job, and I've learned to be flexible and adapt to whatever is happening on the rig floor. You don't eliminate pressure completely; you just learn how to think clearly inside it.

A good well-site geologist can't work in isolation; that's why I always collaborate with drilling and operations teams. The best decisions can come from shared understanding rather than individual judgment. Teamwork is key to reducing pressure.

I trust structured processes, where I break my decisions into smaller steps. I validate the data first, and then double-check interpretations while communicating clearly with the team.

How do you balance the ideal geological plan with the realities of operations, time, and safety on the rig floor?

One important thing every well-site geologist should understand is that a well plan is a guideline, not a fixed path.

For instance, formation depths may differ than proposed, coming earlier or later than expected. It's totally okay. We have this "range" that this formation might fall within. Also, logging can sometimes be skipped entirely because hole conditions would not allow safe tool deployment. Running logging tools in such conditions can put the drilling crew at risk. Once drilling begins, reality introduces many constraints, whether it's time, cost, equipment limitations, or safety. Decisions must be made quickly about what data is critical for decision-making and what can be compromised. With experience, you learn to prioritize.

Do you think geoscientists in oil and gas are being used enough in emerging areas like CCUS and geothermal, or is there still a big gap between potential and reality?

Unfortunately, not yet, and that is a missed opportunity. Geoscientists already have the core skills needed for these emerging fields. The potential is huge, but the transition is still slower than it should be. The gap isn't in their capability; it's in the application.

How do you keep exploration teams aligned with corporate strategy while still leaving room for curiosity and “risky but promising” ideas?

Exploration by nature involves risk. If you eliminate risk entirely, you eliminate discovery. I remember hearing our CEO say, “It’s a lot cheaper to drill a dry hole than to leave a whole oil field behind.” So, yes, we can align our exploration efforts with the company strategy while still leaving space for innovation. We know that not every idea will succeed, and that some of the most valuable discoveries come from unconventional thinking. It’s all about managing risk, not avoiding it.

If you were redesigning how geoscience is communicated in Egyptwhether to the public, investors, or policymakers what would you change first?

There’s a common perception in Egypt that geology is “**Useless knowledge**”, a field that doesn’t lead to real impact. I believe this perception comes from a gap in communication, not a lack of value. If I were to change one thing, it would be how we present geoscience to the public. We need to connect geology to everyday life, how it affects the environment, powers industries, and supports economies.

What practical steps can companies in Egypt take to move from “supporting women in STEM” as a slogan to something that’s visible in exploration and operations teams?

Supporting women is not just a slogan; it is an investment in stronger teams. Diverse teams can bring creative solutions that our sector currently needs. A very good practical step for companies to take is to establish structured long-term mentorship programs. Mentorship is essential for women’s career development. Overall, women are not asking for special treatment; they are asking for fair access.

Women in Mining Canada and recruitment specialist Lisa Thiess highlight how tech advancements are boosting safety: “As a woman in mining, I have seen how technology and AI have come together and evolved to help women in the industry feel more safe. Having automated trucks means there are fewer fatalities. It reduces the overall fatality and increases safety and awareness. For example, with automated trucks and fleets. I really see AI transforming in the future to encompass women in mining and women in mining excelling in that area.”

Lisa Thiess
Mining Engineering Co-op Manager

Kirsten Ketilson, ESG Director at Foran Mining, reflects on progress and sustainability: “As a woman in the mining industry, I just want to talk about the progress women have made in mining. In my career, certainly over the last 25 years in mining, we’ve seen more women coming to positions underground, positions in processing, positions in communities, and positions in the environment and safety. Women play a role in mining. And I think we’re really coming into an opportunity to take more of a leadership role in mining.”

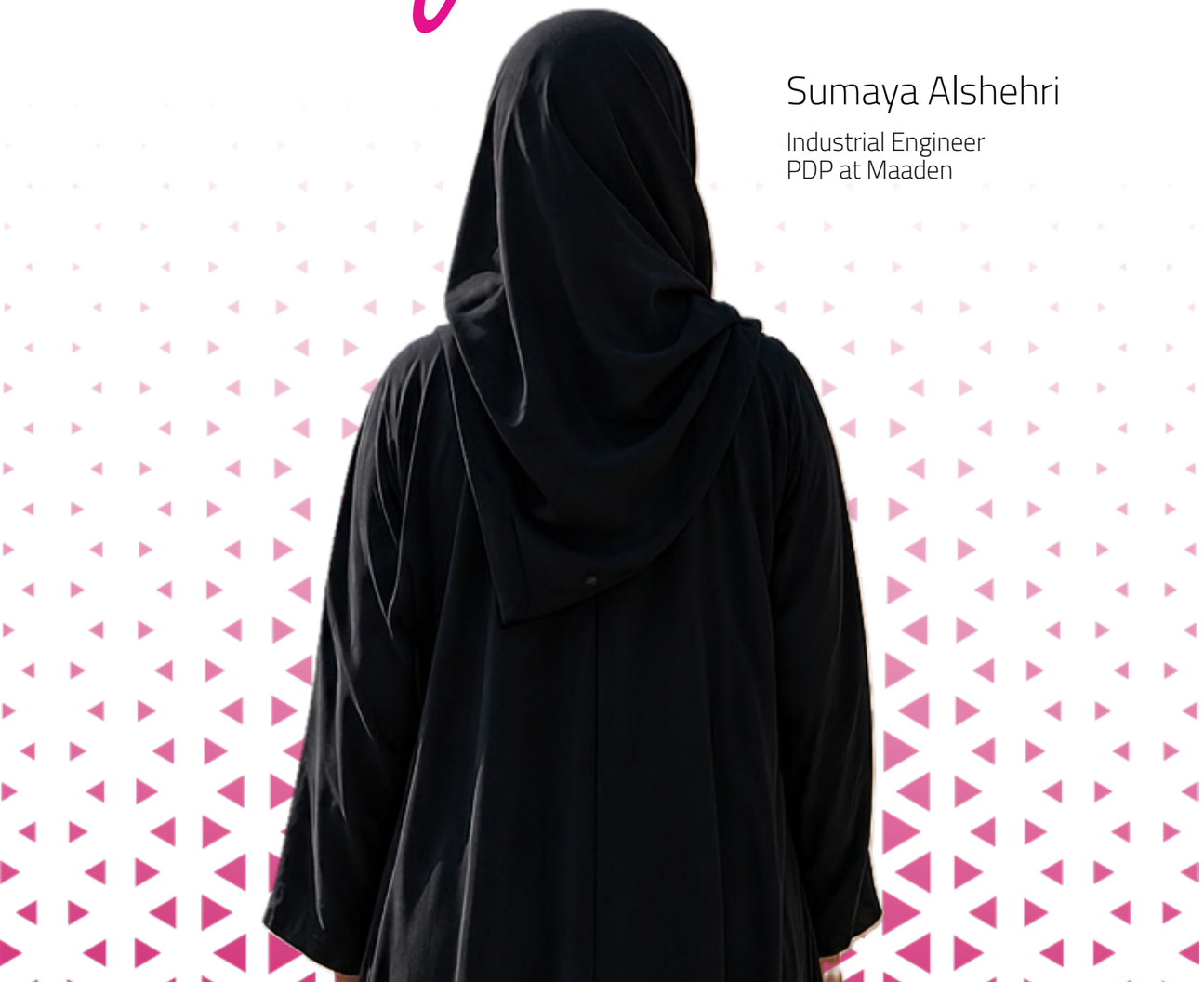
Kirsten Ketilson
Director at Foran Mining

Kate Milberg of Women Mining in Denver stresses growth and support needs: “Women’s mining is improving. The number of women in the industry, especially in mining, has seen massive growth. The first female miner was in 1972. Since then, we’ve grown by a considerable amount, but it is still a very small amount. We have about 8 to 17% of women in the industry in the US, a little less internationally, but we’re trying to change that number. We do a lot of different things for the women’s mining organization.

Kate Melberg
Channel Account Manager

WOMEN in Mining

Young Professionals



Sumaya Alshehri

Industrial Engineer
PDP at Maaden

What first attracted you to industrial engineering?

What first attracted me to industrial engineering was the diversity of its career paths. It offers vast opportunities to grow and make an impact across multiple industries and corporate environments. At the same time, its broad nature requires you to take ownership of your career and develop essential skills like data analytics. For me, that balance is what makes it both challenging and rewarding.

Was mining always your goal, or did it become an interest later?

While mining was always in the picture, it wasn't initially my primary goal. My interest deepened after graduation, when I saw the vast opportunities and rapid growth within the sector.

What moment made you feel that this sector is where you wanted to build your future?

During the onboarding program, we were introduced to the sector's journey how it started, how it has evolved, and its ambitious vision for growth and increased capacity. That moment stood out to me; it made me feel proud and inspired me to be part of something bigger and contribute to its future.

Why should more young Saudis consider mining as a career path?

Young Saudis should consider mining as a career path because the sector is undergoing a major transformation and rapid growth. This creates a rare opportunity to not only join an evolving industry, but to actively contribute to shaping its future.

What does your role as an industrial engineer in the PDP program involve on a daily basis?

As an industrial engineer in the PDP program within production planning, my role gives me the opportunity to balance the bigger picture with operational detail. I work on building production plans aligned with plant capacity while continuously identifying opportunities to reduce waste and improve efficiency across the value chain. I particularly enjoy the cross-functional nature of the role, as it allows me to collaborate closely with different departments and support overall operations. The PDP program has transformed my understanding of the mining sector by giving me direct exposure to real operations. It has helped me move beyond theory and develop a deeper appreciation of how complex processes and business flows are integrated to support a large-scale industry like mining.

Why do you believe mining is becoming such an important sector in Saudi Arabia?

Mining is becoming a highly important sector in Saudi Arabia because it is a key pillar of Vision 2030 and the country's economic diversification strategy. The Kingdom is leveraging its vast untapped mineral resources to reduce reliance on oil and develop a strong, sustainable industrial base.

What barriers or challenges exist for young professionals in the sector? And how would you improve it if you were a decision maker

The main challenge is the complexity of the sector and the learning curve at the early stage. I would improve this by increasing structured training, mentorship, and cross-functional exposure.

How does industrial engineering contribute to mining operations?

There is no single way industrial engineering contributes to mining operations, as its impact spans multiple areas of optimization. It plays a key role in reducing cycle times between operational activities to improve overall production efficiency. It also helps in managing inventory levels, including safety stock, to ensure consistent and reliable production output. Beyond that, industrial engineering focuses on identifying inefficiencies across the value chain and improving end-to-end performance through data-driven analysis, process optimization, and cross-functional collaboration.

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