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The case for multi-metal mining

Multi-metal mining can help India extract more value from existing ores and strengthen critical-mineral supply chains.

Written by **Guest**

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By Neha Shukla

The global race for critical minerals is often described as a contest for [mines](#). Governments and companies are competing to secure lithium, rare earths, graphite, cobalt and other materials essential for electric vehicles, renewable power, semiconductors, data infrastructure, aerospace and defence.

But an important shift is taking place beneath this familiar narrative. The future of critical-mineral security may depend not only on how many mines are developed, but on how much value can be extracted from each mineral system. The International Energy Agency expects global demand for critical minerals to almost double by 2040 under current policy settings. Lithium demand could more than triple, while demand for nickel, graphite and rare earths is expected to increase by roughly 50-90 per cent.

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This rising demand is also blurring traditional commodity boundaries. [Lithium](#), graphite, tungsten, potash and rare earths can support dedicated mining operations. However, several strategically important minerals occur as associated or by-product elements within much larger commodity streams. Gallium, for example, is primarily recovered from aluminium and zinc processing; tellurium is associated with copper and lead processing; and germanium is commonly recovered from zinc and [coal](#)-related streams.

This changes the strategic question for the mining industry. The opportunity is not always to find another mine. It can also be to recover more metals from the mineral systems, concentrates and processing streams that companies already operate.

Teck Resources provides an instructive example. Its Trail Operations in British Columbia is one of the world's largest integrated zinc and lead smelting and

refining complexes. Yet the operation also produces germanium, indium and antimony metals that are important for semiconductors, advanced electronics and other high-technology applications. The economics are revealing. Trail generated gross profit of C\$281 million in 2025, compared with a C\$66 million loss the previous year even as refined zinc production declined to approximately 230,000 tonnes from 256,000 tonnes. Teck attributed part of the improvement to stronger prices for by-products including silver, germanium and indium.

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Sweden's Boliden offers another version of the model. Its Rönnskär smelter produced approximately 266,000 tonnes of copper in 2025, alongside 28,000 tonnes of zinc clinker, 27,000 tonnes of lead, 191 tonnes of silver and five tonnes of gold. Neither example suggests that zinc or copper has become secondary. Base metals remain fundamental to the economics of these operations. Rather, they demonstrate that sophisticated metallurgical facilities can transform a single mineral feed into a portfolio of saleable products.

This is more than commodity diversification. It is a different way of thinking about mining productivity.

Traditional measures tonnes mined, ore grades, recovery rates, operating costs and production volumes will remain essential. But another question is becoming increasingly important: How much economic value can be extracted from the mineral system as a whole?

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India has its own example of how an associated metal can become strategically and financially significant.

Hindustan Zinc was built primarily around zinc and lead. Silver, however, occurs naturally within the polymetallic systems associated with its operations. Over time, improvements in processing, recovery and commercialisation have transformed silver into a significant business in its own right.

The company says its silver production has increased more than 20-fold over two decades. It produced 627 tonnes in FY2026, while silver's contribution to overall profitability increased to approximately 45 per cent, compared with around 38 per cent a year earlier.

The broader lesson is that the economic value of an ore body is not necessarily fixed when a mine is developed.

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It shows that the economic value of an ore body is not necessarily fixed when a mine is discovered. Markets change, recovery technologies improve and processing expertise develops. A metal that once represented a relatively small part of the mineral system can become a meaningful source of value.

Hindalco's Birla Copper operation at Dahej provides another Indian example. Copper concentrate contains other metals, and the facility has a dedicated operation to recover and refine gold and silver from the concentrate.

The broader point is not that every associated mineral can or should be commercialised. Concentration, recovery costs, market size and product specifications determine whether an opportunity is economically viable. But critical

minerals are making the ability to answer those questions more valuable. This matters because the biggest vulnerability in many critical-mineral supply chains is no longer simply access to ore.

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Processing is highly concentrated. China accounts for more than 90 per cent of global refined supply for gallium, graphite, manganese and rare earths. Excluding rare earths, the average share of the leading refining country across key minerals rose to 72 per cent in 2025 from 70 per cent in 2023.

The gap between mining and downstream capability is also becoming apparent. The IEA estimates that diversified rare-earth refining capacity announced for 2035 represents about two-thirds of expected mined supply outside dominant suppliers, while planned magnet production represents only around one-third. A similar imbalance exists between projected lithium mining capacity and battery cathode production. Owning a deposit, therefore, is different from possessing the capability to turn it into a commercially usable material.

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Beneficiation, separation and refining require specialist equipment, experienced metallurgists, laboratories and process knowledge. For established miners, that creates an advantage. Mines are assets, but so are concentrators, smelters,

laboratories, technical teams and decades of metallurgical knowledge. The competitive advantage may increasingly lie in the capability around the resource, rather than the resource alone.

That distinction has particular relevance for India. The government has identified 30 critical minerals, reflecting their importance to energy security, high-technology industries, advanced manufacturing and defence. India is simultaneously trying to expand electric mobility, renewable energy and electronics manufacturing, whose supply chains depend on several of these materials.

The National Critical Mineral Mission, approved in 2025, envisages government expenditure of ₹16,300 crore, alongside an expected ₹18,000 crore of investment by public sector enterprises and other stakeholders. Significantly, its mandate extends beyond exploration and mining to beneficiation and processing. Domestic resource development has accelerated as well. By June 2026, the Centre had successfully auctioned 56 of the 88 critical and strategic mineral blocks taken up for auction. But India is also looking overseas.

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Khanij Bidesh India Limited, or KABIL, was established to pursue critical-mineral assets outside the country. It has secured exploration and development rights for five lithium-brine blocks covering 15,703 hectares in Argentina's Catamarca province, India's first overseas lithium exploration and mining project undertaken by a government company. The strategy reflects India's particular challenge. It needs to develop resources at home, secure access to minerals abroad and build the processing capability necessary to reduce dependence further down the supply chain.

Mining companies are responding to the same forces. Hindustan Zinc has secured a tungsten block in Andhra Pradesh, a rare-earth-elements block in Uttar Pradesh and a potash block in Rajasthan. Exploration at the tungsten block began during FY2026.

At the same time, its research programme with CSIR-National Metallurgical Laboratory includes analysis, mapping and extraction-process design for minor and critical minerals present in its existing value chain, alongside work to identify further opportunities across its mines and smelters.

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These represent two different paths towards the same strategic objective. One involves entering new mineral systems. The other involves developing deeper processing and metallurgical capabilities around an established mining base.

New technologies are also changing the economics of exploration.

Portable analytical tools such as handheld X-ray fluorescence (pXRF), hyperspectral imaging, drones, advanced geochemistry and artificial-intelligence-assisted geological interpretation allow exploration teams to collect and analyse large volumes of information faster than before.

More importantly, these technologies can shift exploration from a single-element mindset to a multi-element perspective.

A multi-metal miner, therefore, is not simply a company that owns several commodities. Large diversified miners have done that for decades. The more interesting model is a company able to apply geological, processing and metallurgical expertise across different mineral systems and translate that knowledge into commercial products. For India, the policy implication is significant.

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Critical-mineral strategy should not focus exclusively on discovering and acquiring new deposits. Equal attention must be given to developing the capabilities required to beneficiate, separate, refine and recover multiple valuable elements from both new deposits and existing industrial streams.

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