

The Polymetallic Fantasy

written by Jack Lifton | October 5, 2026

A familiar promotional announcement has become fashionable in the critical minerals business. A company examines an existing deposit, or reexamines old samples, and announces that it has discovered gallium, germanium, vanadium, tungsten, or some other element appearing on a government's critical minerals list. Suddenly, a project previously promoted for one commodity acquires several additional sources of supposed value.

I call this the polymetallic fantasy.

The fantasy begins when the presence of an element is presented as evidence of an economically recoverable product. The analytical result may be entirely correct. The implication that investors are encouraged to draw from it may be entirely unjustified. This is an especially effective form of promotion because it exploits the investing public's limited knowledge of chemistry, metallurgy, and industrial engineering.

Modern analytical chemistry can detect many elements at parts-per-billion concentrations and, under suitable conditions, below those levels. Detection limits vary by element, sample size and type, and analytical method. Nevertheless, today's laboratory can produce an impressive list of constituents from an ordinary rock or soil sample. A longer list of detected elements does not necessarily mean that a more valuable deposit has been discovered.

The laboratory has answered a chemical question: What is present, and in what concentration? It has not answered the industrial question: Can anything present be converted into a product that a customer will buy, at a cost that leaves the producer a profit?

That distinction is where the polymetallic fantasy lives.

Consider the arithmetic. One part per million represents one gram per metric tonne. A deposit containing ten parts per million of a metal therefore contains ten grams of that metal in each tonne of material. Before losses, producing one tonne of the metal would require processing 100,000 tonnes of that material. At 50 percent overall recovery, the requirement doubles.

This calculation does not, by itself, establish whether a project is economic. Gold reminds us that low concentrations can support profitable mining under the right circumstances. But the arithmetic establishes the burden that metallurgy and economics must overcome. A promoter who quotes the selling price of a high-purity metal while omitting the cost of obtaining it from thousands of tonnes of rock has supplied the attractive half of the calculation.

Investors need to understand companion metals.

In 2015, Yale researchers N. T. Nassar, T. E. Graedel, and E. M. Harper [published](#) an important study of what they called metal “companionality.” Its wheel of metal companionality illustrated how numerous metals depend on the production of other, economically dominant host metals. The diagram depicted industrial relationships, not a catalog of independently developable mines.

A companion metal is recovered largely or entirely because another metal provides the economic justification for mining and processing the material that contains it. The host metal supports the movement of rock, the concentration plant, and much of the subsequent processing. The companion becomes a potential product when it reaches a stream where additional recovery is justified.

The crucial word is *additional*. A companion metal is not free. Recovering it may require a separate plant, additional reagents, energy, personnel, waste treatment, and further refining. Its contribution to profit must exceed those additional costs. Its presence in the original ore is only the beginning of the inquiry.

Selenium and tellurium provide clear examples. They are commonly recovered from the anode slimes generated during electrolytic copper refining. The copper industry has already performed much of the work of collecting and concentrating them. Their economic starting point is consequently very different from that of the same elements scattered through an undeveloped deposit.

Platinum group metals can likewise be recovered alongside nickel and copper. But investors should understand that some deposits are developed principally for platinum group metals. The economic relationship must be established for the particular operation. It cannot be inferred merely from a list of elements in an assay.

Gallium is perhaps the most instructive example of the distinction between geological presence and industrial availability. Primary gallium is recovered predominantly as a byproduct of processing bauxite, the principal ore of aluminum. The USGS has [reported](#) an average gallium content in bauxite of approximately 50 parts per million.

That concentration is tiny. Its value comes from the enormous scale of the aluminum industry and how gallium behaves in the processing circuit. Bauxite is mined and treated to produce alumina because aluminum has a vast established market. Gallium can accumulate in the circulating alkaline liquor used in that process, creating an opportunity for a dedicated recovery operation.

The relevant feedstock for gallium recovery is therefore the process liquor, with its particular concentration and chemistry. An investor cannot transfer the economics of that liquor to an unrelated rock merely because the rock contains an equal or greater gallium concentration.

Nor should anyone multiply annual aluminum production by a gallium assay and call the result available supply. The gallium concentration belongs to the bauxite feed. Its passage through the process, its accumulation, the installation of recovery equipment, and that equipment's efficiency determine how much becomes a product.

A rare mineral can contain substantially more gallium than ordinary bauxite. That fact may be scientifically interesting. To support a mine principally for gallium, however, the deposit must contain enough accessible material, with suitable mineralogy, to pay for the entire sequence from mining through refining. A concentrated mineral grain is not necessarily a concentrated orebody. Neither establishes a profitable business.

The same discipline applies to germanium, vanadium, tungsten, and every other fashionable addition to a company's promotional inventory. These elements do not all have the same production routes or economics. Tungsten has established primary ores and mines. Vanadium may be a principal product, a coproduct, or a byproduct. Calling all of them "critical" does not make their recovery equally feasible.

A genuinely polymetallic deposit can be commercially valuable. Several saleable products can help support one operation. But each proposed product adds a metallurgical obligation. A process optimized for one metal may lose another to tailings or place it in a stream from which recovery is expensive. Additional separation can introduce impurities, reduce throughput,

complicate waste treatment, or impair the recovery of the principal product.

Every additional element in the revenue forecast must therefore earn its place.

Investors should ask where that element reports during processing, what proportion can be recovered, what equipment is required, and what the resulting product actually is. They should ask whether a buyer will pay for it, what refining charges or impurity penalties apply, and whether the proposed recovery has been demonstrated on representative material.

Above all, they should ask whether the added revenue exceeds the added cost.

Multiplying contained metal by a quoted market price establishes none of these things. It assumes that material dispersed in rock can somehow become a fully payable product without losses, delays, capital expenditure, or conversion costs. Add that calculation across enough elements and almost any large deposit can be made to look like a national treasure.

I am interested in companies that demonstrate reproducible recovery, credible throughput, controlled costs, and products that customers can use. A new assay can justify further investigation. It cannot substitute for that work.

The investing public should welcome better analytical chemistry while refusing to confuse better detection with better economics. We can now measure traces that earlier generations would have missed. We still have to pay to recover them.

Governments and financial markets cannot suspend economic reality. Neither can a press release.

Follow where value is added. An assay tells you what is in the

rock. A business must demonstrate what it can profitably deliver from it.