The Nickel Sulfosalt Chronicles

Deep in the Limpopo Province of South Africa lies the Murchison Greenstone Belt, a rugged stretch of ancient rocks that has fascinated geologists for generations. It is a place where volcanoes once roared, where tectonic plates danced, and where mineral-rich fluids carved their way through the crust, leaving behind veins of treasure: gold! But recently, this geological story has revealed a long-kept secret that is changing how we think about gold extraction.

For years, scientists believed that a mineral called arsenopyrite was the main hiding place for “refractory gold”, that is, the gold that is locked so tightly inside minerals that it cannot be extracted using normal methods like cyanide leaching. Arsenopyrite was the usual suspect, the one blamed for making gold recovery expensive and complicated. If you wanted that gold, you had to roast the rock, pressure cook it or use bacteria to break it down. Not exactly easy or cheap.

But what if arsenopyrite is not the only player in this narrative? What if there are other stars? Picture this: you are deep in the Murchison Range, boots dusty, compass in hand, chasing the whispers of ancient hydrothermal systems. You sample a sulphide-rich vein, expecting the usual role player arsenopyrite, the classic gold star, to be loaded. But when you fire up the LA-ICP-MS [SW1] back in the lab, the results are scandalous. Arsenopyrite? Practically gold-starved. Meanwhile, other obscure minerals ullmannite (gold range = 0.008 ppm to 9.15 ppm) and gersdorffite (gold range = 0.07 ppm to 0.85 ppm) are glittering with hidden treasure, some grains clocking over 8 parts per million of gold. That is a a lot, especially when arsenopyrite barely registered a trace in these samples (gold range = 0.001 to 0.02 ppm).

If gold is hiding in ullmannite and gersdorffite, then mining companies need to rethink how they process gold-bearing ore from this region. These nickel-bearing sulpharsenides are not just side characters; they are the real stars. With their antimony and arsenic-rich structures, they offer prime real estate for gold atoms, whether through substitution, nano-inclusions, or some sneaky mechanism we are still decoding. And they are doing it quietly, tucked between other minerals, like smugglers in a mineralogical masquerade.

It is not just about processing. It is also about exploration. The presence of these nickel-rich minerals suggests that the fluids that formed the gold deposits were different, maybe hotter, deeper, or richer in certain elements compared to more typical gold deposits. That gives us new clues about where to look next. Ullmannite and gersdorffite could become the new signposts for hidden gold.

There is something thrilling about overturning a long-held assumption. About finding gold not only where it is supposed to be, but also where it wants to be. Ullmannite and gersdorffite are not flashy. They do not sparkle in hand samples or dominate the textbooks. But they are quietly rewriting the rules, showing us that gold behaviour is more rebellious, more complex, and more

fascinating than we thought. The Murchison Greenstone Belt has always been a geological treasure chest, but this discovery adds a new layer of intrigue. It challenges the orthodoxy, flips the script, and reminds us that gold does not care about our assumptions. It goes where the chemistry is right, where the lattice is welcoming, where the conditions whisper “come hide here.”

The above article was submitted to the DSTI-NRF CIMERA 2025 ‘Translate your research’ writing competition. The author is Thabo Kgarabjang, a DSTI-NRF CIMERA sponsored PhD candidate from the Department of Earth Sciences, University of Limpopo. This entry was placed tie-first.