BIZCOMMUNITY

SU student shows 'invisible' gold hosted in sulphide minerals in tailings dumps

Steve Chingwaru, a PhD-student in geometallurgy at Stellenbosch University's Department of Earth Sciences, has shown that there is still a significant fraction of "invisible" gold hosted in sulphide minerals in mine tailings dumps in the Witwatersrand region.

Source: Lynn Bendickson © 123RF.com

The mining of the Witwatersrand conglomerates, dating to 1885, has resulted in a massive accumulation of six billion tons of tailing materials. Due to historical processing inefficiencies, these tailings are currently being re-mined as a secondary gold source.

Chingwaru says his research delves into the complex interplay between geological and metallurgical factors: “The objective is to optimise the use of natural resources while minimising environmental impact. Through my work, I strive to develop innovative methods to extract valuable metals from mine tailings and turn waste into a valuable resource.”

Gold hosted in sulphides overlooked

Chingwaru says tailing dumps are not really a geological feature: “These dumps are man-made features and a historical artefact of our mining legacy. Historical mining of the Witwatersrand region focused almost uniquely on the free or native gold endowment. The gold hosted in the sulphides has largely been overlooked and is deemed ‘invisible’ as it is not recoverable by conventional methods.”

Working with samples from tailing dumps in Carletonville, Central Rand, Evander and Klerksdorp Goldfields, Chingwaru used extensive in-situ laser ablation and acid digestion analyses to determine which minerals hosted most of the gold. “Among a separate comprising the more dense mineral phases, we found that arsenian pyrite and pyrite accounted for 65% of gold in the Klerksdorp samples, 78% of the gold in the Carletonville samples, and 85% of gold in the Evander samples.”

Extracting the 'invisible' gold

Now that they understand where the gold is located, as well as its concentration and mode of occurrence, the next step is to design and develop an effective leaching method to extract the gold, and valuable by-products, from the pyrite.

Chingwaru explains: “By separating out these sulphide fractions during the reprocessing stage, it will also remove sulphide-associated heavy metals such as copper, cobalt and nickel. Not only are these economically valuable by-products, removal of sulphide minerals will also directly lessen the impact of acid mine drainage on the environment.”

Wits study investigates why Jagersfontein dam failed

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This unique intersection of paleo-geology and geometallurgy research emanates from the new African Rainbow Minerals research chair in geometallurgy, jointly held by Dr Bjorn von der Heyden from the Department of Earth Sciences and Dr Margreth Tadie from the Department of Process Engineering. They are both Chingwaru’s study leaders and co-authors on the recently published article “An underexploited invisible gold resource in the Archean sulphides of the Witwatersrand tailings dumps”, published in the journal *Nature Scientific Reports*.