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BIOEXTRACTION AS AN ALTERNATIVE FOR TRADITIONAL MINERAL PROCESSING - AN ECONOMIC AND ENVIRONMENTAL GAME CHANGER

By

Renee Grogan,

Impossible Metals, Australia

Presenter and Corresponding Author

Renee Grogan

ABSTRACT

Impossible Mining is developing a novel, energy efficient, microbial bioextraction method for the processing of minerals critical to green energy production, that include nickel (Ni), cobalt (Co), copper (Cu) and rare earth elements (REEs). Bioextraction is different to traditional bio-leaching where the bacteria is used to generate acid to allow leaching of metals. By comparison, bioextraction occurs at neutral pH, in a process that is complete within 1-2 days.

The bioextraction methodology draws on knowledge gained from basic research on a group of bacteria that can rapidly dissolve various metal oxides, including insoluble iron (Fe) and manganese (Mn) oxides, under anaerobic conditions, thereby reducing the metal oxides to soluble metal salts. This technique will enable low-energy processing of minerals without traditional reagents like arsenic and cyanide, without generating toxic waste and without using freshwater. Furthermore, we will aim to achieve carbon neutrality, and eventually carbon negativity, by utilizing fossil fuel independent carbon and energy sources for the microbes.

Bioextraction has been tested at a small-scale laboratory level on polymetallic manganese nodules and shown to be extremely effective, achieving recovery rates of multiple target metals, commensurate with existing mineral processing methodologies, and without the generation of a waste stream. The process is currently also being tested on terrestrial ores, as well as terrestrial waste streams (in relation to recovery of metals such as cobalt and REEs, which may be present in tailings streams but not previously targeted or recovered).

Current work is focused on scaling the process from very small-scale laboratory tests, to a pilot-plant scale, over the next ~18 months – for both polymetallic nodules, and terrestrial targets. It is expected that, if scaling is successful, bioextraction will be extremely cost effective when compared to any other form of mineral processing, for both capex and opex, due to the low energy inputs, lack of reagent inputs and the lack of waste storage infrastructure required.

When proven at scale, we believe this technology will completely disrupt current mineral processing methods, delivering a pathway to carbon-neutral, waste free processing for the minerals industry.

Keywords: mineral processing, green energy, critical metals, bacteria, bioextraction