Contribution ID : **62** Type : **Oral**

Two birds with one stone: leaching of alkaline mineral wastes enhances CO2 sequestration and concentrates trace metals

Monday, 2 December 2019 16:00 (15)

The mineral wastes produced by ultramafic mines (i.e. Cu–Ni–PGE, podiform chromite, diamondiferous kimberlite and historical chrysotile) are ideal materials for sequestering CO2 via mineral carbonation. This natural process traps atmospheric CO2 in mineral form via weathering of Mg or Ca-rich silicate and hydroxide minerals to form Mg-carbonate. Due to a higher surface area, mineral carbonation of mine tailings typically occurs at rates 2-3 orders of magnitude above background rock weathering rates, and at the Mt Keith Ni Mine, WA, offsets 11% of the mine's annual CO2 emissions.(1) If geochemical treatments were applied to these materials, reaction rates could be further accelerated such that a mine could potentially achieve carbon neutrality. In order to encourage uptake of mineral carbonation technology at mine sites, treatments will ideally make use of relatively conventional technology and expertise within the minerals industry. As such, *in situ* heap leaching is proposed as a potential strategy to accelerate mineral carbonation. Here, we simulate this process in column experiments, by leaching ultramafic tailings from Woodsreef Chrysotile Mine (NSW, Australia) with dilute sulphuric acid (pH ≈ 1). An alkaline leachate rich in Mg is produced with the potential to sequester 21.4 kg CO2 m-2 of treated tailings per year, which is approximately 1-2 orders of magnitude higher than estimates of passive carbonation that has occurred within these tailings over the past three decades.(2)
Importantly, synchrotron X-ray fluorescence microscopy shows concentration of Ni, Co and Cr within Fe-(oxy)hydroxides at the neutralisation horizon, and geochemical modelling indicates that with continued acid leaching this horizon would become enriched in transition metals over time, concentrating metals of potential economic benefit in distinct zones within the vertical profile.
Acid heap-leaching technology could therefore not only be useful for accelerated mineral carbonation but also for ore processing and recovery of base metals from tailings, waste rock, or low-grade ores.

REFERENCES
1) Wilson S.A. et. al. (2014) International Journal of Greenhouse Gas Control 25, 121-140.
2) Turvey C.C. et. al. (2018) International Journal of Greenhouse Gas Control 79, 38-60.

Speakers Gender

Female

Travel Funding

Level of Expertise

Early Career <5 Years since PdD

Do yo wish to take part in the poster slam

Primary author(s) : Dr HAMILTON, Jessica (Australian Synchrotron (ANSTO))

Co-author(s) : Dr WILSON, Siobhan (University of Alberta); Dr MORGAN, Bree (University of Sydney); Dr HARRISON, Anna (Queen's University); Dr TURVEY, Connor (University of British Columbia); Dr PATERSON, David (Australian Synchrotron); Prof. DIPPLE, Greg (University of British Columbia); Prof. SOUTHAM, Gordon (The University of Queensland)

Presenter(s) : Dr HAMILTON, Jessica (Australian Synchrotron (ANSTO))

Session Classification : Session 11

Track Classification : Earth, interstellar and extreme environments