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Optimising geochemical treatments to enhance *in situ* carbon sequestration in ultramafic mine tailings

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Enhanced carbon mineralisation in ultramafic mine tailings has the potential to partially or even completely offset the CO_2 emissions produced during mining [1]. Ultramafic waste rock is ideal for carbonation because of its high Mg content and enhanced reactivity due to crushing [2]. While geochemical treatments have achieved increased rates of CO_2 uptake in laboratory experiments, accelerated carbonation has yet to be demonstrated to be economically viable and scalable for use in the field.

Acid mine drainage is costly to neutralise and remediate. However, using this waste acid to leach ultramafic materials has many advantages including acid neutralisation, immobilisation of potentially toxic metals, accelerated CO_2 sequestration [3], and formation of a durable cement crust on the tailings surface, which may help limit wind transport of hazardous fibres [4].

Here, we test novel geochemical treatments to accelerate carbon mineralisation of mine tailings, that have been optimised following field trials. Treatments are designed to be relatively inexpensive and compatible with current tailings management practices. Periodic addition of water or dilute sulfuric acid maintains optimum soil moisture levels, and a CO_2 flue gas stream is applied to overcome carbon limitation as observed in the field. We also investigate trace metal contents of leachates and carbonate precipitates to evaluate environmental risk, and the potential for recovery of valuable metals, which may add further incentive for implementation of this technology.

[1] Power *et al.* (2014) *Minerals,* **4**, 399-436. [2] Wilson *et al.* (2014) *Int. J. Greenh. Gas Control,* **25,** 121-140. [3] Power *et al.* (2010) *Environ. Sci. Technol.,* **44**, 456-462. [4] McCutcheon et al. (2017) *J. Haz. Mat. In review.*