Accelerating carbon mineralisation of mine tailings at Woodsreef Mine, New South Wales, Australia

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Carbon mineralisation is being investigated as a potential climate change mitigation strategy. This technology utilises the natural process of silicate weathering to remove carbon dioxide (CO_2) from the atmosphere and store it in the structures of carbonate minerals.

Ultramafic mine tailings are an ideal place to promote carbon mineralisation because of the abundance of fine grained, reactive minerals [1]. The current challenge is to accelerate carbonation rates at these sites, while minimising economic and energy costs of treatment. The mining industry also produces large amounts of acid generating materials, which have been investigated as a potential source of acidity to accelerate ultramafic tailings dissolution and carbon mineralisation [2]. There are several environmental and economic benefits to this approach: acid mine drainage is neutralised, dissolved metals are immobilised, and silicate mineral dissolution is enhanced, thereby accelerating CO_2 sequestration. Our research thus far demonstrates that divalent/trivalent cations such as Mn, Ni, Cu, Cr and Co are readily incorporated into the structures of Mg-carbonate minerals, such that acid treatments are unlikely to generate metalliferous drainage.

In a world-first field demonstration, we have developed and deployed an automatic treatment system to accelerate CO_2 sequestration in mine tailings at Woodsreef Mine in New South Wales, Australia. Treatment options include using water or dilute sulfuric acid, with controls on tailings saturation in the vadose zone. Significantly, since these experiments make use of relatively inexpensive materials such as irrigation systems, the mining industry could incorporate these methods into existing tailings management practices.

[1] Wilson *et al*. (2014) *Int. J. Greenh. Gas Control,* **25,** 121-140. [2] Power *et al*. (2010) *Environ. Sci. Technol.,* **44**, 456-462.