## **Opportunities for Carbon Sequestration in Mined Materials**<sup>1</sup>

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**Abstract:** Current and legacy mining activities have exposed large quantities of mineral surfaces to weather in reaction with rainwater and atmospheric gases. While the resulting release of contaminants is well known, geochemical reactions in mine waste also represent an opportunity for sequestering  $CO_2$  from the atmosphere as geologically stable carbonate mineral. This process requires release of divalent cations from oxyhydroxide and/or aluminosilicate minerals and subsequent contact with  $CO_2$  dissolved in water. Because the former process is favored by low pH conditions and the latter by high pH, the overall rate of carbon sequestration can show complex dependencies on factors such as mineral composition, water:rock ratio, and gas flux. A geochemical model accounting for these factors was calibrated on kinetic test data for calcium-rich troctolite. Results indicate kinetic coupling of cation leach rates with protons liberated via sulfide oxidation and, therefore, the existence of an optimum sulfur content for stimulating carbonation. Predictive results for carbonation potential in a variety of representative mine wastes will be presented to demonstrate the potential magnitude of  $CO_2$  sequestration using mined materials.

Additional Key Words: Carbonation, Geochemical modeling.

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