Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.28256

# Evaluating Total Cation Accounting (TCA) as an MRV Approach for Enhanced Rock Weathering - Insights from a trial in Ontario, Canada

**AMANDA STUBBS**, ROSALIE TOSTEVIN, MATTHEW HEALEY, KIRSTINE SKOV, WILL TURNER, TZARA BIEROWIEC, LUCY JONES, ZOE COUILLARD, JOSH COUILLARD, LOGAN WISTEARD, GABRIELLE JANFIELD, DECLAN DEJORDY, DANIEL CHAPUT, TALAL ALBAHRI, GIULIA CAZZAGON AND XINRAN LIU

UNDO Carbon Ltd

Enhanced rock weathering is a promising carbon dioxide removal (CDR) technology involving the dissolution of silicate minerals. This process releases elements such as calcium, which can remain in solution, be charge balanced by bicarbonate, stored as pedogenic carbonate, or on soil exchange sites. To verify carbon removal credits, robust monitoring, reporting, and verification (MRV) approaches are essential. This study explores total cation accounting (TCA) as a novel MRV method. TCA involves a total digest of a soil-feedstock mixture in the near-field zone (NFZ; 15 cm) and analysis of major cations via Inductively Coupled Plasma Optical Emission Spectroscopy. The data include baseline cations (pre-spread), residual feedstock (post-spread), and weathered cations bound to exchange sites or forming carbonate minerals (post-spread). Major cations are summed to calculate total cations, and net cation loss from the NFZ determines CDR, with deductions for plant uptake.

This study uses data from a small plot monitoring site (4x10 m) in Ontario, Canada, where Canadian Wollastonite feedstock was applied to six replicates at four densities (0, 5, 50, 100 t/ha) in November 2023. Soil samples were collected using a 20:1 composite of 15 cm soil cores. Soils were processed to ensure homogeneity and a representative soil-to-feedstock ratio.

Prior to spreading, cation content in treatment and control groups clustered around a similar mean, representing baseline soil composition. Post-spread samples show increased cation content on treatment plots, demonstrating that feedstock addition is resolvable, even in soils with high background Ca. Subsequent samples show decreasing cation content, indicating cations have been exported into the far-field zone or lost via plant uptake or solid transport. Results align with other MRV approaches in the same field trial, though our findings suggest other methods may underestimate CDR. One advantage of TCA over competing MRV methods is its time-integrative nature, improving the signal-to-noise ratio with longer sampling intervals. The first field trials demonstrate its potential as a scalable, robust MRV methodology for ERW trials.