Active CO$_2$ Mineralization in the Bay of Islands Ophiolite Complex, Newfoundland, Canada

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The thermodynamic instability and unique chemistry of ophiolites make them theoretically ideal sites for carbon mineralization. Within fracture networks, the circulation of meteoric waters generates basic and ultra-basic fluids capable of precipitating magnesium and calcium carbonates. Enhancing the rate at which these waters are generated, and form carbonates could be a significant sink for atmospheric CO$_2$. The goals of this study were to discover natural occurrences of carbonate precipitation in ophiolitic rocks of the Bay of Islands Complex (BOIC), NL, Canada, and to preform laboratory experiments enhancing the rate of carbon mineralization.

Partial exploration of BOIC revealed substantial calcium carbonate travertines and hydromagnesite mounds. Geochemical characterization and in-situ measurements indicate that CO$_2$ is actively being sequestered by the ophiolitic massif. Radiocarbon dating indicates that ultra-basic springs associated with calcium carbonates have been active for over 5000 years, while groundwater seepages at hydromagnesite deposits have been active for over 200 years. On going work includes estimating the amount, and rate, of CO$_2$ mineralization of the BIOC.

Laboratory experiments paired with a carbon mass balance model were used to determine the rate of CO$_2$ sequestration and the fate of atmospheric CO$_2$ in a closed system. In the closed batch chamber, crushed ultramafic rock from the BOIC site was combined with simulated basic and ultra-basic groundwaters. A CO$_2$ analyzer was connected to the chamber, which monitored headspace CO$_2$ concentrations. In simulated basic water experiments 30% of the headspace CO$_2$ was sequestered in 4-hours however the precipitation of carbonates was not detected. In simulated ultra-basic water experiments 70% of headspace CO$_2$ was removed from the headspace and 60% of the removed CO$_2$ precipitated as solid calcium carbonate during the four-hour period.