Modelling Carbon Sequestration Capacity of Ultramafic Rocks for Use as a Criteria for Critical Metal Exploration in British Columbia, Canada

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Significant quantities of battery metals need to be mined to help electrify the economy and reach net-zero carbon emissions targets by 2050. Some of these critical metals, like nickel and cobalt, are hosted in ultramafic rocks that have the capacity to naturally sequester CO_2. As such, certain mine sites could in fact operate with net zero or even net negative carbon emissions. Serpentinized ultramafic rocks are highly reactive with CO_2 - magnesium in minerals like brucite and serpentine react with CO_2 to form carbonate minerals that are stable over geologic time. This process, carbon mineralization, has been found to be occurring passively at several mines around the globe. The capability of serpentinized rocks to store CO_2 is starting to be considered as an exploration criteria by mineral exploration and mining companies who hope to eliminate mine emissions.

Serpentinization of ultramafic rocks generates magnetite, causing the rocks to become magnetically susceptible. Using magnetic susceptibility as a proxy for the extent of serpentinization of ultramafic rocks, we evaluated regional magnetic data to determine the volumes of serpentinized ultramafic rocks in British Columbia (BC), Canada. We identified ninety-nine sites in BC where mapped ultramafic units correlate with positive magnetic anomalies indicative of serpentinization. The anomalies were modelled in 3D to yield volumes from which carbon mineralization capacity per site was calculated. Considering only the near-surface bodies (<1km depth), we calculated that approximately 30 Gt CO_2 could be captured by ultramafic rocks in BC, if these rocks were crushed as tailings. This is the equivalent of >400 years of BC's CO_2 emissions. Exploration companies can use the 3D models and estimated carbon mineralization capacities alongside other exploration criteria to prioritize exploration sites based on their potential to reduce CO_2 emissions, and to plan for technology and infrastructure that could support or enhance carbon capture.