Assessing the carbon dioxide sequestration potential of ultramafic rocks in British Columbia as a climate change mitigation strategy

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1 - INTRODUCTION

Ultramafic rocks and their serpentinite products are commonly associated with NaFe-Ca-Cr-PGE mineralization and can be used to permanently sequester carbon dioxide (CO2) as newly-formed minerals. Given the abundance of ultramafic rocks in British Columbia and the CO2 emissions related to resource extraction, the current government carbon offset schemes provide companies mining ultramafic rocks with an economic incentive for carbonating mine tailings. Serpentinization is a net volume-increasing reaction and involves the production of magnetite.

2 - STUDY SITES

Ultramafic rocks in British Columbia occur mainly as ophiolite massifs (e.g., Zagorevski et al., 2017) and as mineralization and can be used to permanently sequester carbon dioxide (CO2) as newly-formed minerals. Ultramafic rocks and their serpentinite products are commonly associated with Ni±Fe-Cu-Co-PGE mineralization and can be used to permanently sequester carbon dioxide (CO2) as newly-formed minerals. Given the abundance of ultramafic rocks in British Columbia and the CO2 emissions related to resource extraction, the current government carbon offset schemes provide companies mining ultramafic rocks with an economic incentive for carbonating mine tailings. Serpentinization is a net volume-increasing reaction and involves the production of magnetite.

3 - PHYSICAL PROPERTIES OF ALTERED ULTRAMAFIC ROCKS

Serpentinization is a net volume-increasing reaction and involves the production of magnetite. Serpentinites should be denser and less magnetic than their un-carbonated equivalents. Carbonated serpentinites should be denser and less magnetic than their un-carbonated equivalents. R1: olivine + orthopyroxene + H2O → serpentine + brucite + magnetite ± awaruite Carbonation fills any pore space and consumes magnetite, brucite, and olivine. Carbonated serpentinites should be denser and less magnetic than their un-carbonated equivalents.

4 - IMPLICATIONS AND NEXT STEPS

Carbonate alteration of ultramafic rocks can be clearly mapped in detail at the outcrop-scale using magnetic susceptibility.

REFERENCES

We gratefully acknowledge FPX Nickel Corp., and Giga Metals Corp. for access to samples from the Decar ophiolite and Turnagain intrusion and A. Zagorevski from the Geological Survey of Canada for access to sampling data.

5 - KEY TAKEAWAY POINTS

1. Serpentinites have low value as feedstock for carbon capture and storage, whereas fresh and carbonated ultramafic rocks do not.

2. Serpentinites are less dense and have higher magnetic susceptibility than their ultramafic protoliths, whereas carbonated rocks are more dense and have lower magnetic susceptibility than their serpentinite pre-cursors.

3. The relationships between alteration and physical properties will be used to formulate a carbon sequestration potential index to be used both on a regional-scale to characterize prospective sequestration targets AND at the mine-scale to identify and classify inclusions.

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