The CO_2 sequestration potential of the ultramafic portions of Large Igneous Provinces

SIMON M. JOWITT AND SIOBHAN A. WILSON[1]

[1] School of Earth, Atmosphere and Environment, Monash University, Melbourne, VIC 3800, Australia; simon.jowitt@monash.edu; sasha.wilson@monash.edu

Carbon mineralization, the storage of CO_2 within the crystal structures of carbonate minerals, is one of the safest and most effective methods for controlling the rising concentrations of atmospheric greenhouse gases that are associated with anthropogenic climate change. Although not typical metallogenesis, this form of sequestration will become more important over time as humankind increases efforts to alleviate the effects of climate change. Here, we discuss the potential for natural and enhanced CO_2 sequestration using the rocks formed during Large Igneous Province (LIP) events, focusing on the ultramafic portions of LIPs.

The magmatism that generates Large Igneous Provinces (LIPs) can produce significant amounts of ultramafic rocks, although the volumes of ultramafic rock within individual LIPs vary significantly. These rocks are also frequently associated with mineral deposits, generating ultramafic tailings and waste rock material with increased surface areas that are ideal feedstocks for CO_2 sequestration by carbon mineralization. Although the geochemical reactions that form carbonates in ultramafic rocks are becoming more clearly understood, the implementation of carbon mineralization technologies also requires an accurate determination of the volume of ultramafic rocks suitable for CO_2 sequestration within LIPs, including rocks associated with base and precious metal mineralization and rocks that are not.

The quantification of the abundance of ultramafic rocks within a given LIP ranges from good (e.g. in the case of the Bushveld LIP, which is dominated by a single, gigantic, well-studied and relatively uniform layered intrusion) to poor. This in turn means that the CO_2 sequestration potential of the ultramafic components of these LIP events frequently remains understudied. Archean LIPs, komatiite-dominated sections of LIPs (e.g. the Thompson Belt), and layered intrusion-dominated LIPs (e.g., the Bushveld LIP) all represent a relatively unexplored and untapped potential resource for CO_2 sequestration, especially as they also frequently host base and precious metal mineralization. Thus, increased efforts should be made to estimate the size of this resource and to take better advantage of the CO_2 sequestration potential of these and many other LIPs.