EGU24-21858, updated on 19 Jan 2025
https://doi.org/10.5194/egusphere-egu24-21858
EGU General Assembly 2024


# The geological potential of in-situ $CO_2$ mineral storage within onshore UK formations

**Angus W. Montgomery**, Chris Holdsworth, Emma Martin-Roberts, Ian Watt, and Stuart Gilfillan
School of Geosciences, University of Edinburgh, Grant Institute, Edinburgh, UK (angus.w.montgomery@gmail.com)

Carbon capture and storage (CCS) is essential for meeting the UK's legally binding net-zero targets by 2050. In-situ mineralisaton of $CO_2$ in mafic rock has been established as a rapid, secure, and affordable method of geological $CO_2$ storage by the Carbfix projects in Iceland.

In this study, we use geochemical, stratigraphic, and volumetric analyses to assess the suitability of UK onshore mafic and ultramafic formations for in-situ mineral storage of $CO_2$. We find that the total $Mg^{2+}$, $Ca^{2+}$, $Fe_{tot}$. oxide content of some UK formations is comparable to the geological reservoirs utilised by Carbfix in Iceland. We determine the volumes of the studied formations using a combination of boreholes, digitised cross sections and GIS calculated surface areas. We find that there are significant volumes of reactive rock available for $CO_2$ mineral storage in the UK.

Using a method developed by Callow et al. (2018) we determine the reactive surface area within connected pore volumes in the most suitable formations for in-situ $CO_2$ mineral storage. Our results indicate that onshore UK formations have the theoretical potential to store multiple gigatonnes (Gt) of $CO_2$. This is equivalent to the storage of decades' worth of annual UK industrial $CO_2$ emissions.

Our findings highlight that in the Antrim Lava Group alone, there is between 1.6 and 21.9 million $km^2$ of reactive surface area available for $CO_2$ mineral storage. This equates to a potential theoretical $CO_2$ storage capacity of between 8 and 110 $GtCO_2$. These results demonstrate that the theoretical $CO_2$ mineral storage capacity of onshore mafic and ultramafic rocks in the UK far exceeds the $CO_2$ storage requirement for the UK to achieve net-zero GHG emissions by 2050. Future research efforts should prioritise the investigation of connected porosity, reactive surface area, impact by alteration and mineralisation rates specific to the formations identified by this study.