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Dissolution of alkaline materials in high pH solutions at 22 ^{o}C and 50 ^{o}C.

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The CO_2 levels in Earth's atmosphere have risen dramatically through the last decades and the need of a response has become more essential than ever. The application of basalt carbonation for *in situ*, subsurface CO_2 disposal has been demonstrated over the past 20 years (*e.g.* CarbFix). This study aims to assess the potential for applying this and similar technologies to carbon disposal by *ex situ* mineralisation, using other alkaline materials. For example, stone wool is a common insulation material, and its composition is quite similar to that of basalt. Waste stone wool, from demolition sites, needs to be recycled so we are investigating its potential as an *ex situ* carbonation method that contributes to a circular economy.

The dissolution of basaltic glass, stone wool and concrete, and the formation of secondary phases, at alkaline pH has been investigated, to quantify their ability to capture and mineralise CO_2 emitted from industry chimneys. Experiments were performed for 70 days, at 22 $^{\circ}$C and 50 $^{\circ}$C. Reactors were kept closed except for daily sampling (about 2 minutes), to minimise air entry, thus minimising the CO_2 content in the reactive fluids. Fluid pH remained near 12. The reacted solids were characterised by SEM, XRD, BET and XPS, before and after the experiments. Solution concentrations of Si, Al, Ca, Mg, Fe were determined on the once-a-day samples, using spectrophotometry.

Solution concentrations approached constant values after 5 days, likely a consequence of secondary phase formation. Molar solution concentrations of Ca/Si and Al/Si were <1; this, and the very low concentrations of Mg indicated the preferential precipitation of Ca, Mg, Al rich phases. Although the experiments were designed to minimise CO_2, $CaCO_3$ precipitation was observed in the SEM images of the reacted solids. XPS showed that surface cation concentrations (normalised to Si) increased after reaction. The clear formation of calcite, even when CO_2 was minimal, demonstrates that stone wool, as basalt, has good potential for *ex situ* CO_2 trapping.