

Dissolution rates of crystalline basalt as a function of temperature and solution composition

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Reducing CO₂ emissions is one of most important environmental challenges of the 21st century [1]. The Carb-Fix project in Iceland (www.carbfix.is) aims to find a permanent storage solution for captured CO₂ in Hellisheiði. Hellisheiði is a basaltic formation, approx. 400.000 years old, with hyaloclastite and crystalline basalt. Injecting CO₂ charged waters into basaltic rock formations may be a viable solution to carbonate CO₂ given the high amount of Ca, Mg and Fe in basalt and the relatively fast dissolution of the host rock compared to silicic rocks [2].

To assess the potential of *in situ* mineral carbonation in basalts the dissolution rates of crystalline basalt were measured in Ti mixed flow reactors at pH 4 and 10, and temperatures from 25 to 75°C. The material used was obtained from a dyke on Stapafell Mountain on Reykjanes peninsula in Iceland because of its comparability with former experiments on dissolution rates on basaltic glass [3, 4]. Measured crystalline basalt dissolution rates based on Si release are systematically lower than corresponding rates reported for basaltic glass at both acidic and alkaline conditions. Mg and Fe are, however, found to be released preferentially from crystalline basalt dissolution at pH 4, likely reflecting the fast dissolution rates of divalent metal silicates (e.g. olivine and pyroxene). This observation suggests that *in situ* precipitation of magnesite and siderite may provide an important mineral storage host for CO₂ injected into basaltic rocks.

[1] Oelkers & Cole (2008) *Elements* **4**, 305-310. [2] Wolff-Boenisch *et al.* (2004), *GCA* **68**, 4843-4858. [3] Oelkers & Gislason (2001) *GCA* **65**, 3671-3681. [4] Gislason & Oelkers (2003) *GCA* **67**, 3817-3832.

Discrimination of sediment samples for forensic applications

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Colour is one of the many properties of sediments and soils that have been applied in forensic investigations. The existence of approximately 1100 distinguishable colour in soils together with their magnetic susceptibility characteristics make these properties powerful tools for sample discrimination.

Fifty six samples of sediments were collected in beaches of North (Entre-Douro e Minho) and South (Algarve) of Portugal. In the first region the source rocks are essentially from the crystalline basement and in the second from the sedimentary border. The samples were prepared for colour and magnetic susceptibility analysis. Colour measurements were performed on dry bulk, sieved (<150µm or <63µm) and ashed (850°C) samples, using a Konica Minolta CM-2600d spectrophotometer. Magnetic susceptibility (MS) was measured on 15g of dry bulk samples using a Kappabridge KLY4S equipment. All samples presented a colour closer to red and yellow continuums and a lightness close to the pale side of the L*a*b* system colour sphere. Samples collected in the north presented on average darker lightness than the samples collected in the south. The L* values measured varied between 77.30 (measured on ashed samples) and 30.11 (measured on <150µm size fraction); a* varied between 13.61 (for ashed samples) and 0.36 (for bulk samples); b* between 23.13 (measured on <63µm size fraction) and -0.08 (measured on <150µm size fraction). L*a*b* highest values were always observed for south samples. The magnetic susceptibility values range between 0.30x10⁻⁸m³/kg and 772.60x10⁻⁸m³/kg, with higher values obtained on north (mean value of 29.12 x 10⁻⁸ m³/kg compared with the mean value of 16.39 x 10⁻⁸ m³/kg obtained on south). After cluster analysis, bulk samples L*a*b* values allowed higher discrimination between samples than measures performed on sieved and ashed samples. As a conclusion we have found that Colour and MS results allowed a better discrimination between the north and south sediment beaches.

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