

Silicate dissolution kinetics under acid conditions: Applications to CO₂ sequestration

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We have studied the rates of interactions of mineral separates and reservoir rock samples with saline solutions acidified with HCl, using unstirred mineral suspensions with a dialysis membrane technique to maximize the proportion of mineral in the system. Starting materials were mineral separates of albite, labradorite, kaolinite, illite, and smectite, and disaggregated reservoir sandstones from the Huldra and Beryl fields, North Sea.

The rate of dissolution was tracked through analysis of both Al and Si and yielded mineral dissolution rates comparable to literature values.

Sandstone dissolution rates are faster by a factor of c.2 than the rates predicted from their modal mineralogy. For Huldra sandstone, dominated by quartz with albite, kaolinite and minor illite, Si and Al levels peak and decline, which is attributed to growth of secondary kaolinite. The Beryl sandstone has significant illite-smectite and both K-feldspar and albite, but only minor kaolinite, but again rates are reasonably close to those predicted. In particular, feldspar dissolution has not been inhibited by clay coatings.

We conclude that silicate minerals are effective at neutralising acidity introduced to pore waters, albeit more slowly than carbonates. Dissolution is enhanced by increased ionic strength. To a first approximation, dissolution rates of natural rocks can be modelled from the dissolution rates of their constituent phases, with little evidence of blanketing effects due to clay coatings.

Tracing weathering/erosion processes using colloidal iron from the rio Negro basin (Brazil)

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The suspended solids from representative toposequences and rivers of the rio Negro basin (Brazil) are studied using electron paramagnetic resonance spectroscopy and geochemistry to specify processes of weathering and erosion. Consistently with a previous study [1], two organic-rich size fractions are separated by tangential-flow ultrafiltration : particulate supernatant and colloidal fractions. Analyses of FeII and FeIII in solution are consistent with several endmembers including waterlogged podzols and drained laterites. Besides, all solid samples contain FeIII complexed to organic matter (FeOM) as well as iron oxides in the broad sense. [FeOM] is low in the toposequences whereas it is several times higher in the rivers. This is thought to originate from oxidation of FeII that is relatively abundant in porewaters and creeks from waterlogged podzol areas. Data mainly reveal the signature of podzolization, coupled to subsequent evolution of suspended matter. Effects of rain events, hydrological season as well as distance in the course of rio negro will also be discussed.

[1] Allard *et al.* (2004) *GCA* **68** (14), 3079-3094.