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Nicolas C.M. Marty, Sylvain Grangeon

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Dissolution kinetics of AFm-Cl as a function of pH at room temperature.

N.C.M. Marty & S. Grangeon¹

¹*BRGM, 3 avenue Claude Guillemin, 45060 Orléans cedex 2, France*

E-mail: n.marty@brgm.fr

Estimation of reliable weathering/dissolution rates of cement phases is of fundamental importance for modelling the temporal evolution of radioactive waste repositories and well for CO₂ geological storage. In this context dissolution kinetics of AFm (hydrated calcium aluminates) have been studied with flow-through experiments at pH ranging from 9.2 to 13. Dissolution kinetics of a pure AFm-Cl, i.e. a mix between the Friedel's salt and its naturally-occurring form, hydrocalumite, have been investigated. Mineralogical (XRD) and chemical (EPMA, TEM/EDX) analyses have been performed to characterize the reacting minerals prior and after dissolution experiments.

For pH values ranging from 10 to 13, flow-through experiments indicate congruent dissolutions of AFm-Cl (i.e. Ca/Al ratios close to 2 both for solids and outlet concentrations). In contrast a precipitation of Al-phases and mixed Al/Ca phases are expected at pH 9.2 leading to high Ca/Al ratios of outlet solutions. However, estimated rate in such condition appears to be weakly affected by these secondary-phase formations. Accordingly, far-from-equilibrium dissolution rates were normalized to the final specific surface areas (ranging from 6.1 to 35.4 m² g⁻¹). None significant effect of pH on dissolution kinetics can be draw and therefore the far-from-equilibrium dissolution kinetics at pH ranging from 9.2 to 13 and room temperature is expressed as:

$$\log R(\text{mol m}^{-2} \text{ s}^{-1}) = -9.23 \pm 0.18$$