

Experimental and theoretical dissolution rates of a silicate rock: a case study with andesite at acidic pH values and 20°C

C.F. ARAGÓN-TOBAR¹*, P. DELMELLE¹, J. SCHOTT²

¹Environmental Sciences, Earth & Life Insitute, Université catholique Louvain, Belgium (*correspondance: carlos.aragon@student.uclouvain.be, pierre.delmelle@uclouvain.be)

²Géoscience Environnement Toulouse, CNRS- Université de Toulouse, 14 av. Edourd Belin, 31400 Toulouse, France (jacques.schott@get.omp.eu)

Dissolution rate equations for minerals are necessary for assessing and predicting the temporal evolution of fluids during water-rock interaction, both in natural systems and industrial processes. Despite the large number of dissolution experiments on individual minerals and silicate glasses, less is know regarding the dissolution rates of polycrystalline silicate rocks.

The objective of our study is to test if the dissolution rate of an andesitic rock (37% dacitic glass, 49% plagioclase, 7% clinopyroxene and 5% orthopyroxene) determined experimentally can be inferred from the dissolution rate of the main silicate constituents (minerals and glass) presented in this rock.

A dissolution rate equation for the andesite was obtained from dissolution experiments conducted at pH 2, 3 and 5 (20°C) and using a fluidized bed reactor: $\log r_{\text{Si}} = 0.238 \log (a_{\text{H}^+}/a_{\text{Al}^{3+}}) - 10.197$. Theoretical dissolution rates were estimated by assuming that (i) mineral dissolution is stoichiometric with respect to Al and Si release and (ii) dissolution of glass and plagioclase represents the bulk of element releases.

Our results indicate that the calculated dissolution rates [1,2] for the andesite in the pH range 2-5 are 5.5-9.6 times higher than the experimental dissolution rates. A satisfactory match between experimental and theoretical dissolution rates is achieved by reducing the ratio between the surface area of the glass and the plagioclase constituents and the surface area of the rock that contains them.

[1]Declercq et al. (2013) *Geochim Cosmochim Acta* 100. 251-263 [2] Gudbrandsson et al. (2014) *Geochim Cosmochim Acta* 139. 154-172.