Modeling of Field Weathering Rates of Plagioclase in Vila Pouca de Aguiar (North of Portugal)

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In Vila Pouca de Aguiar (North Portugal), weathering rates of granite plagioclase (Wf_{Pl}, mol·m^{-2}·s^{-1}) were estimated in the field on the basis of drilled well water compositions using the formula:

$$Wf_{Pl} = (d[Pl]/dt) \times (\xi / \alpha_{Pl}),$$

where [*Pl*] is the mole fraction of plagioclase (mol L^{-1}), $d[Pl]/dt$ is the rate of change of [*Pl*] in time (mol·L^{-1}·s^{-1}), ξ is the fracture surface wetting (ξ = 8.5×10^{-3} L·m^{-2}; [2]) and α_{Pl} is the proportion of plagioclase in the granite (α_{Pl} = 0.35). The Wf_{Pl} values were plotted against Gibbs energies of oligoclase An_{20} dissolution (dots in Figure 1). The rates and Gibbs energies determined by [2] were also included in the figure for comparison (circles). Both sets of rates show a reasonable agreement with theoretically-derived and experimentally validated dissolution rates [1] (R_d, dashed lines). A major and important conclusion from this study is that field and laboratory rates may after all be reconciled.

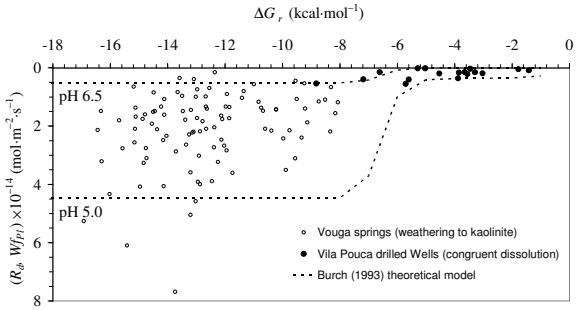

Figure 1.

References

[1] Burch, T.E., Nagy, K.L., Lasaga, A.C. (1993). Chem. Geol., 105: 137–162.

[2] Pacheco, F.A.L., Van der Weijden, C.H. (2006). Hydrologic and kinetic modeling of plagioclase weathering rates in the Vouga basin (Portugal): reconciling field and laboratory rates. Submitted to American Journal of Science.