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 ($W_{fPl}$, mol·m$^{-2}$·s$^{-1}$) were estimated in the field on the basis of drilled well water compositions using the formula:

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

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$^{-1}$), $\xi$ is the fracture surface wetting ($\xi = 8.5 \times 10^{-3}$ L·m$^{-2}$; [2]) and $\alpha_{Pl}$ is the proportion of plagioclase in the granite ($\alpha_{Pl} = 0.35$). The $W_{fPl}$ values were plotted against Gibbs energies of oligoclase $\text{An}_{20}$ 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.](image_url)

References