

# DISSOLUTION RATES OF TALC AS A FUNCTION OF SOLUTION COMPOSITION, PH AND TEMPERATURE

G.D. SALDI <sup>(1)</sup>, S.J. KÖHLER <sup>(2)</sup>, N. MARTY <sup>(3)</sup> y E.H. OELKERS <sup>(1)</sup>

<sup>(1)</sup> *Geochimie et Biogéochimie Experimentale, LMTG, CNRS/UMR 5563, Université Paul Sabatier, 14 ave Edouard Belin, 31400 Toulouse, France*

<sup>(2)</sup> *Institute of Applied Geosciences, Graz University of Technology, Rechbauerstraße 12, A-8010 Graz, AUSTRIA*

<sup>(3)</sup> *CGS / EOST UMR 7517, 1 rue Blessig, 67084 STRASBOURG Cedex, FRANCE*

Steady-state talc dissolution rates, at far-from-equilibrium conditions, were measured as a function of aqueous silica and magnesium activity, pH from 1 to 10.6, and temperature from 25°C to 150°C. All rates were measured in mixed flow reactors and exhibited stoichiometric or close to stoichiometric dissolution. All measured rates at pH > 2 obtained at a fixed sodium concentration of 0.02 M can be described to within experimental uncertainty using

$$r = \bar{s}_{BET} A_A \exp(-E_A / RT) \left( \frac{a_{H^+}^2}{a_{Mg^{2+}}} \right)^{1/8}$$

where  $r$  signifies the BET surface area normalized talc steady-state dissolution rate,  $\bar{s}_{BET}$  denotes the specific BET surface area present in the reactor,  $A_A$  refers to a

pre-exponential factor equal to  $5.8 \times 10^{-10} \text{ mol cm}^{-2} \text{ s}^{-1}$ ,  $E_A$  designates an activation energy equal to  $38 \text{ kJ mol}^{-1}$ ,  $R$  represents the gas constant,  $T$  denotes absolute temperature, and  $a_i$  refers to the activity of the subscripted aqueous species. This relationship closely resembles that of enstatite ( $\text{MgSiO}_3$ ) and is consistent with talc dissolution rates being controlled by the detachment of partially liberated silica tetrahedral formed talc edge surfaces from the exchange of two protons for one Mg at the talc edge surfaces. Corresponding atomic force microscopic observations confirms that dissolution proceeds by the removal of T-O-T layers from the talc edge surfaces. At  $\text{pH} \leq 2$ , the  $\text{Mg}^{2+}$  for proton exchange is so extensive that talc T-O-T sheets break apart at the edge surfaces leading to increased surface area and accelerated rates.