Goldschmidt 2000
September 3rd–8th, 2000
Oxford, UK.

Journal of Conference Abstracts
Volume 5(2), 629

Mineral Weathering Rates and Groundwater Recharge Rates

Fernando António Leal Pacheco (fpacheco@utad.pt)[1] & **Cornelis H. Van der Weijden** (chvdw@geo.uu.nl)[2]

[1] Trás-os-Montes e Alto Douro University, Department of Geology, Quinta de Prados, 5000 Vila Real, Portugal
[2] Utrecht University, Department of Geochemistry, P.O: Box 80.021, 3508 TA Utrecht, The Netherlands

Undoubtedly, the most important single factor controlling the rate of breakdown of parent minerals and the genesis of specific secondary products is the quantity of water leaching through the weathering environment (Loughnan, 1969). Mineral weathering rates may be quantitatively estimated from hydro-chemical studies by solution of mole balance models. To work, these models must be fed with information on the stoichiometries of interactions between water, minerals and biota, as well as with the element fluxes leaving the system within a fixed period of time. Drainage conditions are closely related and therefore of quantitative appraisal by the rates of groundwater recharge taking place during the yearly rainy periods. Using the available chemical and mineralogical information of rocks and soils and hydrological and chemical data of two tens of perennial springs, we were able to feed a particular mole balance algorithm (the SiB algorithm of Pacheco and Van der Weijden, 1996) with the necessary information and make it work in the Morais massif, an allochthonous thrust complex in NE Portugal, composed by serpentinites, flasergabbros, amphibolites gneisses and mica-schists. We obtained weathering rates for forsterite, calcite, clinozoisite, talc, sphene, chlorite, plagioclase, amphibole and serpentine. Values are shown in Table 1 for stagnant and fast flow conditions, represented by very low (5 mm/y) and considerably high (250 mm/y) recharge rates. Rates obtained for plagioclase by Cleaves et al. (1970) (14.0 moles/ha.y.%plagioclase), Paces (1983) (11.7) and Velbel (1985) (36.7,39.3) are within the results of this study (0.9-45). Results regarding the other minerals could not be checked, given the lack of information that most weathering studies reveal about spring discharges (so rates are calculated solely on the mol/L basis) and/or mineral abundances (impeding rates from being normalized by bulk percentages).

	Mineral Recharge Rate (mm/y)	Weathering Rate (mol/ha.y.%mineral)
Forsterite	9.7	485.0
Calcite	5.3	266.0
Clinozoisite	2.3	114.0
Talc	2.2	108.0
Sphene	2.0	98.0
Chlorite	1.0	49.0
Plagioclase	0.9	45.0
Amphibole	0.6	28.0
Serpentine	0.4	19.0

Table 1

Cleaves ET, Godfrey AE & Bricker OP, *Geol. Soc. Am. Bull.*, **81**, 3015-3032, (1970).
Loughnan FC, *Chemical weathering of the silicate minerals. American Elsevier Publishing Company, Inc., New York*, 149, (1969).
Paces T, *Geochim. Cosmochim. Acta*, **47**, 1855-1863, (1983).
Pacheco FAL & Van der Weijden CH, *Water Resources Research*, **32**, 3553-3570, (1996).
Velbel MA, *Am. J. Sci*, **285**, 904-930, (1985).