Extreme silicate weathering rate in a tropical river, southwest coast of India

G.P. GURUMURTHY[1]*, K. BALAKRISHNA[1], JEAN RIOTTE[2,3], JEAN-JACQUES BRAUN[2,3], STEPHANE AUDRY[3] AND H.N. UDAYASHANKAR[1]

[1]Department of Civil Engineering, Manipal Institute of Technology, Manipal University, Manipal 576104 (*correspondence: gurumurthy.gp@manipal.edu)

[2]Indo-French Cell for Water Sciences, Indian Institute of Science, Bangalore 560 012

[3]Université de Toulouse, UPS (OMP), CNRS, IRD, LMTG, 14 Av Edouard Belin, F-31400 Toulouse, France

The rate of silicate weathering (SWR) and associated carbon dioxide consumption (CCR) of granite gneissic terrain of southwestern India is calculated, for the first time in a west flowing peninsular river, the Nethravati. Monthly samples (n=56) were collected from five fixed locations along the river Nethravati and its two tributaries over a period of twelve months. The total dissolved salts of the samples are in the range of 29 to 66 mg/l, with least values recorded during the months of peak discharge. Silicate weathering rate for the entire catchment is deduced by applying seawater correction using river chloride as a tracer. The SWR in the river Nethravati is estimated as 59.3 tons/km^2/yr. Such value is higher by 3.5 times than those reported for granitic rocks, at Rio Icocos, Puerto Rico [1] and comparable to Jalisco Highlands, Mexico [2]. The SWR in the river Nethravati is also comparable to the rivers draining Deccan basalts, located on the west coast of peninsular India [3]. Similarly, the CCR for river Nethravati is estimated as 11.6x10^5 mol/km^2/yr. The calculated molecular ratio (RE)[4] from the river water dissolved compositions suggests both seasonal and spatial variability in the intensity of silicate weathering; gibbsite precipitation during high flow and at upper catchments and kaolinite precipitation during base flow and at lower catchments. High SWR in the study area is likely due to the extreme precipitation and runoff induced by the Western Ghats. The annual fluxes of total dissolved salts discharged in to the Arabian Sea from the river Nethravati is estimated as 5.48 x 10^5 tons/yr, of which silicate derived cation flux amounts to 0.81x10^5 tons/yr.

[1] Millot *et al.* (2002) *EPSL* **196**, 83–98 [2] Riebe *et al.* (2004) *EPSL* **224**, 547–562. [3] Das *et al.* (2005) *GCA* **69**(8), 2067–2084. [4] Mortatti & Probst (2003) *Chem. Geo.* **197**, 177–196.

Calcium isotopes as tracers of high-pressure subduction-zone fluid-rock interaction

NIKOLAUS GUSSONE[1], TIMM JOHN[1], ANDREAS BEINLICH[2] AND GRAY BEBOUT[3]

[1]Institut für Mineralogie, Corrensstr. 24, 48149 Münster, Germany (Nikolaus.Gussone@uni-muenster.de)

[2]Physics of Geological Processes (PGP), University of Oslo, 0316 Oslo, Norway

[3]Lehigh University, Bethlehem, PA 18015, USA

The formation of eclogite in subducting slabs has great geodynamic importance, as it causes changes in rheology and could contribute fluids and slab geochemical signatures to arc magma source regions. Nevertheless, well-preserved field occurences that provide insights into the process of eclogite formation are rare. We investigated samples from the Tianshan mountains (China) that show a ‘frozen in’ example of eclogitization of upper oceanic crust. Our sample set consists of wall-rock blueschist cut by an eclogite vein (with a reaction envelope) representing a major fluid conduit of fluid release. Within the envelope, the degree of eclogitisation (and thus dehydration) increases towards the vein [1]. Calcium content increases also towards the vein, indicating that, during the fluid-mediated eclogitization, external Ca was introduced to the reacting wall-rock blueschist [1]. A Rb/Sr whole rock isochron reveals that the vein formed at the time of peak metamorphism and has since then remained undisturbed. Calcium isotope ratios of these rocks indicate mixing of two distinct Ca sources, the blueschist and an external fluid source, the latter of which is enriched in heavy Ca isotopes compared to the host rock. Also, a considerable, relatively constant offset was observed between the Ca isotope ratios of silicate and carbonate minerals. Together, these observations indicate a uniform Ca isotope fractionation between fluid and carbonate minerals at eclogite-facies conditions and large fluid-rock ratios. Based on the well-defined Rb/Sr whole-rock isochron and on textural evidence [1], a later formation of the carbonates is considered unlikely. The Ca isotope and Rb/Sr systematics indicate high fluid fluxes over a relatively short time period consistent with the vein having served as a conduit for high fluid fluxes from the subducting slap to the wedge. Our results demostrate a great potential of Ca isotopes as tracers of fluid-rock interaction in the deeper parts of the subduction zones and the shallower parts of accretionary wedges [2].

[1] Beinlich *et al.* (2010) *GCA* **74**, 1892–1922. [2] Teichert *et al.* (2009) *EPSL* **279**, 373–382.