How basalt weathering rates vary with time and scale of measurement

M.P. BHATT[1]*, L.J. LIERMANN[1], P.B. SAK[2] AND S.L. BRANTLEY[1]

[1]Earth and Environmental Systems Institute, the Pennsylvania State University, University Park, State College, PA 16802, USA (*correspondence: mpb16@psu.edu) (ljl8@psu.edu, Brantley@essc.psu.edu)
[2]Department of Geology, Dickinson College, Carlisle, PA 17013, USA (sakp@dickinson.edu)

We synthesized the rates of basalt weathering reported in the literature for scales varying from laboratory experiments to watersheds following our previous approach [1]. As part of this compilation, we report new results from a column dissolution experiment that has been running for six years. Si release rates from that basalt study increase by a factor of 4.68 in the presence of citrate ligand. To compare basalt weathering at the soil profile scale, the mass transfer coefficient (τ) was calculated relative to bedrock chemistry using an immobile element approach. The τ profiles for major base cations and silicon documented that the depth and extent of depletion generally increased with mean annual precipitation (MAP), especially for MAP greater than 2500 mm. When rates are normalized by the geometric surface area at the scale of the study, weathering advance rates increase with mean annual temperature (MAT) and watershed rates > soil profile rates > weathering rind rates > laboratory rates. By assuming that all rates can be scaled together through an assumed 'true' surface area, an overall apparent activation energy can be calculated, 60-75 kJ/mol.

[1] Navarre-Sitchler & Brantley (2007) *EPSL* **261**, 321–334.

Geochemistry of fluvial sediments of Brahmaputra-Jamuna River, Bangladesh: Constraints on tectonic, provenance and weathering

MOHAMMAD A.H. BHUIYAN[1]*, M. JULLEH J. RAHMAN[2], SAMUEL B. DAMPARE[1] AND SHIGEYUKI SUZUKI[1]

[1]Dept. Earth Sci., Okayama Univ., 700-8530 Okayama, Japan (*correspondence: amirhb75@yahoo.com)
[2]Dept. Geologic. Sci. Jahangirnagar Univ., Bangladesh

This research evaluates the geochemical characteristics of sediments from Brahmaputra-Jamuna fluvial system in the context of provenance, tectonic and weathering history of upper and southeastern Himalayas. Samples were collected from bar-top and different facies units of the fluvial system and analyzed by lithium metaborate/tetraborate fusion ICP and ICP-MS. Petrographically, the sands which are rich in quartz (83%), followed by feldspars (10%) and lithic grains (7%) are predominantly quartzolithic and quartzose in composition with abundant low-grade metamorphic, sedimentary lithics, low feldspars and trace volcanic detritus, indicating a quartzose recycled orogen province. The geochemical analyses show no significant compositional variations among the different facies units. The low CIA values (mean: 53) suggest that these sediments are chemically immature and suffered low weathering effects. In the A-CN-K ternary diagram, most of the samples are plotted close to the plagioclase–K-feldspar join and UCC, and in the field of various lithologies of Higher Himalayan Crystalline Series (HHCS), suggesting that HHCS may have acted as the source rocks. Inference from tectonic setting and discriminant function diagrams together with Th/U vs. Th and Th/Sc vs. Zr/Sc plots suggest that the sediments may have been mostly deposited in an active continental margin and preserve the signature of a quartzose sedimentary provenance. Also, the chondrite-normalized REE patterns with flat HREE, LREE enrichment, and negative Eu anomalies indicate derivation of the sediments of Brahmaputra-Jamuna from felsic rock sources of upper continental crust.