# The climatic control of weathering in the Himalayan river system

CHRISTIAN FRANCE-LANORD[1,] ALBERT GALY[2] AND SUNIL SINGH[1]

[1] CRPG-CNRS, BP 20 F-54501 Vandœuvre les Nancy (cfl@crpg.cnrs-nancy.fr)
[2] Earth Science Dep. Cambridge University. UK.

Physical erosion tends to favour weathering because it increases reaction surfaces in river basin. For most rivers, a rough positive correlation can be observed between chemical and physical erosions which suggests that physical erosion may exert a first order control on global weathering. Nevertheless, the Himalayan rivers, which have the highest rate of physical erosion among the major river systems, are not characterised by a remarkably high rate of chemical erosion. Depending on numbers accepted for the annual flux of sediment load, chemical erosion for the Brahmaputra and Ganga is between 3 and 7% in mass of the total erosion. Several factors explain this relatively low proportion including precipitation and transport dynamic. The comparison between the Brahmaputra and the Ganga drainages which have quite contrasted runoff (1.1 and 0.6 m/yr respectively) allow to test the importance of precipitation or runoff and transport on the efficiency of weathering in such basin undergoing very intense physical erosion.

Carbonates represent the major source of dissolved ions representing 80 to 90 % in mass of the dissolved load of the rivers. The Ganga and most of its tributaries are over-saturated with respect to carbonates and the rivers transport up to 10% of carbonate particles in their suspended load. On the contrary, the Brahmaputra carries no particulate carbonates and is under-saturated in the Assam floodplain. Carbonate particles are however carried by the tributaries including 5 % in the Tsangpo-Brahmaputra but they disappear from the sediment load of the Brahmaputra over few tenth of km in the plain. It is likely the high precipitation over Eastern Assam (5 m/yr) which allow this very efficient carbonate dissolution. Precipitation therefore acts as the controlling factor for carbonate dissolution. They are insufficient in the Ganga basin to dissolve all the particles released by erosion.

Chemical erosion of silicates is low when compared to physical erosion as it represents less than 1 % of the total erosion for both Ganga and Brahmaputra. Taking into account only Na, K and Si which are unambiguously released by silicate weathering, the specific chemical erosion of silicate is double for the Brahmaputra than for the Ganga basin. This difference is even higher if we do remove the Tibetan area of the Brahmaputra where erosion is minor. Examined in detail, chemical erosion of silicate is strongly correlated to local runoff and suggests that it is strongly controlled by precipitation rather than by physical erosion.

# The Role Of Metasomatising Fluids In The Genesis Of Orogenic Magmas. A Case Study From Sardinia, Italy

L. FRANCIOSI[1], M. LUSTRINO[2], L. MELLUSO[1], V. MORRA[1] AND M. D'ANTONIO[1]

[1] Dip. Sci. Terra, Univ. di Napoli Federico II, Naples, Italy (lufranci@unina.it)
[2] Dip. Sci. Terra, Univ di Roma La Sapienza, Rome, Italy

Miocene High MgO Basalts (HMB) from Montresta (N Sardinia) and Mt. Arcuentu (S Sardinia) have been analyzed with the aim of identifying the physical state of the metasomatizing agents in the mantle wedge. These rocks represent near-primary mantle melts likely not interested by crustal contamination. They show typical subduction-related trace element features: LILE (Large-Ion Lithophile Elements) enrichment relatively to LREE (Light Rare Earth Elements), with Ba/La ranging from 10 to 23. LILE and LREE are both enriched relative to NMORB-like HFSE (High Field Strength Elements).

$^{87}Sr/^{86}Sr$ ratios range from 0.70399 to 0.70631; $^{143}Nd/^{144}Nd$ ratios ranges from 0.51260 to 0.51274 and $^{206}Pb/^{204}Pb$ from 18.609 to 18.707, $^{207}Pb/^{204}Pb$ from 15.619 to 15.661 and $^{208}Pb/^{204}Pb$ from 38.408 to 38.747.

Sr, Nd and Pb isotopic data of Sardinia orogenic basalts indicate that, in addition to the input of fluids from altered subducted oceanic crust in mantle wedge, a further component from subducted oceanic sediments is to be considered. In order to constrain if subduction components are mainly fluid or melt phases, ratios among trace elements with strongly different solid/fluid and solid/melt partition coefficients (i.e. Th/Pb, Th/Nd and Sr/Nd) have been taken in consideration. Models based on elemental (Nd/Pb) and isotopic ratios ($^{87}Sr/^{86}Sr$ and $^{206}Pb/^{204}Pb$) indicate that small amounts of subduction fluid components in mantle wedge can account for the geochemical and isotopic features of Sardinia basalts.

In fact, mantle source of Mt. Arcuentu magmas can be modeled considering an enrichment of a DMM source by about 0.45% MORB fluid (derived from subducted oceanic crust) and 0.05-0.08% sediment fluid; for Montresta mantle wedge the amount of subduction components is about 0.1% MORB fluid and 0.03-0.04% sediment fluid. Such low values are consistent with the lack of negative Eu anomalies. It is noteworthy that, on the basis of Sr and O isotopic modeling, other authors proposed a much larger contribution of oceanic sediments (the same utilized in this work) (2-10%) for the Mt. Arcuentu basalts.