# Ca fluxes linked to particles exchange with seawater during Himalayan erosion

CHRISTIAN FRANCE-LANORD[1], MAARTEN LUPKER[1],
BRUNO LARTIGES[2] AND JÉRÔME GAILLARDET[3]

[1]CRPG-CNRS, Université de Lorraine, Vandoeuvre Nancy, France
[2]GET-OMP, Université Paul Sabatier, Toulouse, France
[3]Institut de physique du Globe de Paris (IPGP), France

Silicate weathering as a long term sink for atmospheric $CO_2$ must be coupled to carbonate precitation and burial. At the global scale, this process is hampered if the alkalinity exported by rivers is derived from alkaline silicates as no Ca (or Mg) is then supplied to the ocean to precipitated carbonates. One process to compensate for alkaline cation flux is the adsorbed cation exchange at the Contient-Ocean transition. In the river system, the dominant dissolved species, $Ca^{++}$ is also the main adsorbed cation on the sediment load. Upon transfer in seawater, $Ca^{++}$ is potentially exchanged for seawater $Na^+$, leading to a yet unacounted Ca flux [ref].

We atempt to evaluate this process on the Ganga-Brahmaputra rivers (G-B) which generate ca. 10% of the global river particles flux to the oceans. In addition, the Himalayan crust mostly delivers alkaline silicates to weathering. We measured Cation Exchange Capacity (CEC) on modern river sediments sampled in the Bangladesh delta. Measured CEC are strongly dependant on the grain size and mineralogical composition of the sediments. It varies between 15 meq/100g for clay rich sediment and 1 for coarse quartz rich sediment. This CEC is primarly bounded to $Ca^{++}$ (85%) and $Mg^{++}$ (12%) with minor proportions of $K^+$ and $Na^+$.

Assuming conservatively a G-B sediment flux of $1\times10^9$ t/yr and an average composition for the sediment with Al/Si = 0.23; this leads to a maximum of $\approx 2.5\times10^{10}$ moles of exchangeable Ca. Assuming a complete efficiency of Ca-Na exchange in seawater, this corresponds to ca. 20% of the present dissolved flux of silicate derived Na. CEC of Himalayan sediments is therefore largely insufficient to strenghthen the long term $CO_2$ uptake through alkaline silicate weathering in the Himalayan basin. The fate of Himalayan silicate alkalinity is therefore more likely to be involved in reverse weathering reactions with no net effect as sink for atmospheric $CO_2$.

This conclusion is likely generalisable to other large Asian rivers. On the contrary, rivers draining volcanic terranes may generate higher CEC given their sedimentological characteristics.

[1] Sayles & Mangelsdorf (1977) *GCA,* **41**: 951-960

---

# Molecular fossils and organic proxies evidencing the facial evolution of the Lower Miocene Sokolov basin, Eger Graben

J. FRANCU[1]*, D. MÁCOVÁ[1], I. SÝKOROVÁ[2],
M. HAVELCOVÁ[2], B. KŘÍBEK[3], K. MARTÍNEK[4] AND
P. ROJÍK[5]

[1]Czech Geological Survey, Leitnerova 22, CZ-65869 Brno (*correspondence: juraj.francu@geology.cz, daniela.macova@geology.cz)
[2]Inst. of Rock Structure and Mechanics, CAS, Praha (sykorova@irsm.cas.cz, havelcova@irsm.cas.cz)
[3]Czech Geological Survey, Geologická 6, 152 00 Prague 5, Czech Republic (bohdan.kribek@geology.cz)
[4]Institute of Geology and palaeontology, Charles University, Prague, Czech Republic (karel@natur.cuni.cz)
[5]Sokolovská uhelná JSC, Staré náměstí 69, 356 01 Sokolov, Czech Republic (rojik@suas.cz)

The Eger Graben deposits provide a geochemical archive covering Early to Middle Miocene fluvial to lacustrine environments. Proxy data based on bulk rock pyrolysis and molecular fossils provide evidence of a series of sedimentary events and climatic perturbations.

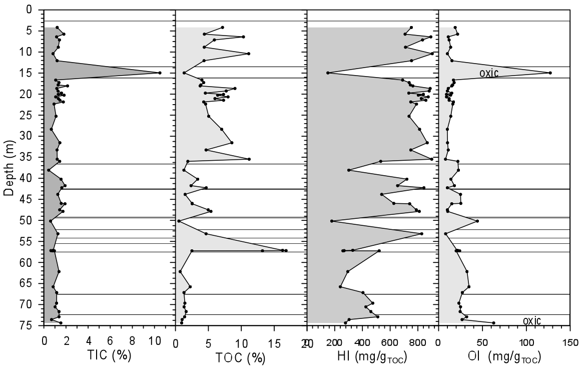

**Figure 1.** Total inorganic and organic carbon (TIC, TOC), hydrogen index (HI), and oxygen index (OI) in the DP-333 profile – clay interval starting above the coal seams.

Sudden flooding terminated the coal deposition. Aquatic plants and later algae became the major biological producer of organic matter. 6 epizodic drops of lake level were associated with drying, partial oxidation and formation of semifusinite. Analogical phases of palaeo-environmental evolution manifested by proxy data were identified in Sokolov and other Miocene basins.

This study was supported by the Czech Ggrant Agency (GAČR 205/08/1087).