# $^{40}K$-$^{40}Ca$ constraints on the source of dissolved Calcium in Himalayan rivers

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This study investigates the potential of the $^{40}K$-$^{40}Ca$ system for quantifying the contribution of silicate and carbonate lithologies to the Ca dissolved load of major Himalayan rivers. The $^{40}K$-$^{40}Ca$ decay scheme has geochemical properties similar to the $^{87}Rb$-$^{87}Sr$ system but its application as a tracer has been hampered by the analytical precision required to measure small variations on the large $^{40}Ca$ isotope (96.9%). This difficulty can now be overcome using the Finnigan Triton TIMS, which allows measurement of the $^{40}Ca/^{44}Ca$ ratio with external precision of 0.3-0.5 ε-unit [1]. Previous work showed that dissolved loads from the Ganga (in Patna) and Brahmaputra (in Guwahati) carry radiogenic $^{40}Ca$ excesses of +1.4±0.3 and +0.9±0.3 ε-units, respectively [1]. Since the $^{40}Ca$ composition of seawater remained constant and indistinguishable from the mantle value ($\varepsilon^{40}Ca=0$) for the past 3.5 Ga [1], radiogenic Calcium must originate from the weathering of felsic rocks, or, alternatively, from metamorphosed carbonates having experienced isotopic exchange with surrounding silicates, as previously documented for $^{87}Sr$. In order to test these hypotheses, we performed high-precision $^{40}Ca$ analyses in bedload carbonates from rivers draining the major Himalayan rock units, and in whole-rock dolostones with highly radiogenic $^{87}Sr/^{86}Sr$ from the Lesser Himalaya. Our results show that whole-rock and bedload carbonates are characterized by an $\varepsilon^{40}Ca=0$ despite having highly variable $^{87}Sr/^{86}Sr$ ratios (0.71-0.86). A small excess (<1 ε-unit) was found in one dolomitic sample with $^{87}Sr/^{86}Sr\approx0.86$ but given its extreme $^{87}Sr/^{86}Sr$ signature, this marginal lithology is bound to have a negligible influence on the Himalayan riverine $^{40}Ca$ budget. Overall, it appears that the major carbonate units of the Himalaya were not significantly affected by metamorphic redistribution of $^{40}Ca$. These preliminary results suggest that radiogenic signatures measured in the Ganga and Brahmaputra are derived from the weathering of silicate lithologies, and highlight the potential of the $^{40}K$-$^{40}Ca$ scheme as a tracer of silicate weathering in the Himalayan system.

[1] Caro *et al*. (2010) *EPSL* **296**, 124-132

# Detoxification of milk contaminated by aflatoxin M1 using clay minerals and effects on milk quality

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Mycotoxines are widespread toxic substances produced by moulds in human and animal foodstuffs. Some of them, such as aflatoxin B1 (AFB1), are very toxic even in small amounts. The modern approach to the problem (and the link with public health) started in the 60s. After decades of studies, it appears that variations in nutritional habits and climatic conditions during the human history have emphasized epidemics and acute mycotoxin toxicity [1]. A main problem is the presence of AFM1 in milk and dairy products. The maximum amount in the European Union is 50ng/L (25ng/L for lactants). AFM1 is resistant to thermal and chemical treatments, so mineral sorbents are highly advisable. Clay minerals are suitable, but only a few data are available, as most studies deal with AFB1 which is absent in milk. To test the role of clay minerals in detoxifying milk, some bentonites and a kaolin were selected for the experimental work. The clay was added to milk and left to settle. Kaolin was less effective than bentonites, but was still able to detoxify contaminated milk, even using a little amount of kaolin (2.4% of the milk suspension). Among bentonites (beidellite-montmorillonite, ferruginous and saponite types), a saponite clay showed the highest sorbent capacity, in agreement with general theoretical consideration about its higher cell surface (available for AFM1) and less surface hydrophobicity. Fat, protein and lactose are slightly affected by clay treatments of milk; protein adsorption increases with the bentonite-milk ratio.

The climatic changes observed and predictably point to a wider diffusion of mycotoxines and health effects [1], and push toward the search for safe, cheap and accessible food treatments.

[1] Piva *et al*., 2006. Accademia dei Georgofili, Quaderni **2005**-III, 1-18.


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