How to protect geochemists working on environmental issues from litigation?

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Four researchers working on environmental geochemistry at the Dept. of Env. Sciences of Siena University are involved in litigation. In December 2002, their institution was entrusted by the Italian Ministry of Defense to perform a geochemical-environmental study of two Sardinian firing ranges, due to their experience on the environmental impact of Depleted Uranium (DU) gained through previous investigations carried out in Kosovo. The geochemical-environmental study was focused on the distribution of U and other toxic heavy elements in soils, but active stream sediments, natural waters, and wild and cultivated plants were also investigated. Unfortunately, in contrast with the expectations of several inhabitants of the area, the Siena researchers did not find any evidence on the presence of DU in the surveyed area. The study of the Siena researchers was harshly criticized by the public prosecutor of Lanusei, technically advised by a full professor in physics of Brescia University, who is also member of the CERN of Genève. The crime of aggravated intentional omission of precautions against accidents and disasters was ascribed to the Siena researchers. In particular, they have been charged with: (a) not denouncing the danger of anomalous concentrations of Th present in the firing range; (b) using the knowledge gained in Kosovo to select methods that prevented to highlight the possible presence of DU. Actually, for what concerns point (a), there is no Th anomaly as Th contents in local soils are comparable with the values found in other areas of the Sardinia Region and elsewhere. For what concerns point (b), it is totally different, in terms of adopted investigation tactics, to study a small area, in which one knows that DU-shell were used and see the explosion craters (like in Kosovo), and to investigate a large area, in which one does not know if DU-shell were used or not (like in the Sardinian firing ranges). These facts demonstrate that technical advisors must be selected among experts in geochemistry to ensure a fair trial. The international geochemical community is urged to play an active role on this crucial point.

Radionuclides (^{10}Be, ^{210}Pb, ^{137}Cs and ^{7}Be) to Determine Anthropogenic Impact on Erosion Rates

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Short lived radiometric isotopes (^{210}Pb, ^{137}Cs and ^{7}Be) have been used widely for determining sediment sources and deposits [1-3]. However, little research has combined short and long term radiometric isotopes for this purpose. Here we combine short lived radionuclides with the long lived meteoric ^{10}Be to evaluate anthropogenic impacts on sediment erosion and redistribution during American colonial times (late 16th century) and longer timescales (within the Pleistocene). This research is based in the Christina River Basin, Pennsylvania (USA) within the Critical Zone Observatory (CRB-CZO). Anthropogenic impacts are being evaluated on soil redistribution and river channel development by using fallout radionuclides. Pre-colonial soil profiles and erosion rates are being quantified to gain information about natural erosion in the catchment. Sediment redistribution during colonial settlement is being evaluated to see the effects of land clearing and stream damming for mill use. Floodplain development within the last century is being investigated to identify changes in the source of sediment erosion due to afforestation and mill dam breaching. In addition, suspended loads in the streams from various storm events are being analysed to determine the present main source of erosion.

Initial results show changes in the concentration of the meteoric ^{10}Be tracer in river sediment of different ages. Millpond deposits that were in the streams at colonial times have a relatively high ^{10}Be concentration. Floodplain sediment that was deposited within the last century and present suspended loads have a lower ^{10}Be concentration. This clearly indicates a response of the erosional source in the streams to the environmental changes in the watershed. Deforestation and the increase in agricultural land-use enhances sediment surface erosion with high ^{10}Be and therefore lead to high ^{10}Be sediment deposits from that time. Afforestation and the increase in urbanisation in the catchment within the last 200 yrs in turn led to a decrease in upland erosion.

[1] Wallbrink & Murray (1996) *Water Res* **32** (2), 467-476. [2] Zapata (2003) *Soil Till Res* **69**, 3-13. [3] Aalto & Nittrouer (2012) *Phil. Trans.***370**, 2040-2074.

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