

¹⁰Be production rate from 1717 AD rock avalanche in Val Ferret (Mont Blanc Massif, Italy)

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On September 12th 1717 AD, one of the largest rock avalanches of the Alps destroyed two small settlements with 7 casualties and loss of their cattle in the upper Ferret valley (Mont Blanc Massif, Italy). A rock volume larger than 10 million m³ and a huge volume of ice from Triolet glacier were mobilized by this avalanche [1]. Composed of ice and sediment, this mass moved more than 7.5 km downvalley and reached the lower part of the valley. Can this historically recorded natural hazard be a well suited site for the ¹⁰Be production rate calibration?

With the aim of answering this question, seven samples from the granite boulders within the rock avalanche deposit were collected in June 2008 and prepared for AMS analysis. In order to compute sea level – high latitude ($\geq 60^\circ$) ¹⁰Be production rates from the measured concentrations of these seven boulders, local scaling factors were first calculated after Stone [2]. The production rates are corrected for shielding of the surrounding topography, dip of rock surface and sample thickness, but not for snow cover and vegetation. Temporal changes in palaeomagnetic intensity and polar wander were taken into account [3]. Our results from Val Ferret reveal a sea level – high latitude ($\geq 60^\circ$) ¹⁰Be production rate of 5.82 ± 0.69 atoms per year per gram SiO₂ for an exposure time of 291 years (from 2008 back to 1717 AD). This production rate scales to 5.61 ± 0.66 for a integrated exposure age range comparable to the calibration samples used by Stone [2]. This is then in agreement with the sea level – high latitude production rate of Stone [2] although somewhat high. A pre-exposure of about 30 years only would bring it into perfect agreement. Such a small amount of pre-exposure most probably induced by deep muon production can never be ruled out completely.

[1] Deline & Kirkbride (2009) *Geomorphology* **103**, 80-92.

[2] Stone (2000) *JGR Solid Earth* **105**, 23753-23759.

[3] Pigatti & Lifton (2004) *EPSL* **226**, 193-205.

Identification of active microbial communities linked to bioremediation and natural attenuation of radionuclides and heavy metals in contaminated aquifers

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Groundwater contamination with radionuclides and heavy metals is a global problem resulting from nuclear weapons production during the Cold War Era. Microbial activity may limit the mobility of radionuclides and heavy metals through natural attenuation or bioremediation. The aim of this study was to identify the active microbial communities controlling metal mobility at two different subsurface locations heavily contaminated with uranium and heavy metals. Stable isotope probing (SIP) was applied to microcosms of subsurface sediments from the Oak Ridge Field Research Center (ORFRC), USA and surficial soils of the Gessenbach Creek within a former uranium-mining district in Germany. ORFRC sediments are characterized by pH 3.7-6.7, >20 mM NO₃⁻, and 70 µg g⁻¹ U, whereas Gessenbach soils are pH 4.9-5.9, 12 mM SO₄²⁻, 1000 µg g⁻¹ U, and contain high concentrations of heavy metals. Reduction of NO₃⁻, Fe(III), SO₄²⁻, and U(VI) was stimulated in ORFRC microcosms with ¹³C-ethanol addition. Addition of ¹³C-substrates stimulated activity in Gessenbach soils under Fe(III)- and SO₄²⁻-reducing conditions. Fe(III)-reduction was associated with immobilization of Cu and mobilization of Co, Ni, Zn, As, and U, whereas, SO₄²⁻-reduction was associated with immobilization of Ni and Co and mobilization of U. Members of the *Firmicutes*, δ - and β -*Proteobacteria* (*Geobacter* and *Dechloromonas*), and *Actinobacteria* (*Arthrobacter*) were the predominant active microbial populations in ORFRC and Gessenbach microcosms. Although some overlap was observed in the metabolically active microbial communities, subsurface microorganisms at the two metal contaminated sites greatly differed in their ability to mediate U bioimmobilization. Thus, the mechanism of uranium bioremediation is likely to be site-specific and dependent upon geochemical conditions.