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Chlorine-36 data from CRONUS-EU calibration sites - Recent landslides in the Southern French Alps

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In-situ produced cosmogenic nuclides have proved to be valuable tools for environmental and Earth sciences. Progress in the field of accelerator mass spectrometry (AMS) allows the determination of radionuclide concentrations as low as of 10^4-10^5 atoms/(g rock) that makes quantifying Earth's surface processes possible. But accurate application of this method is only possible, if production rates in a certain environment over a certain time period are exactly known. Unfortunately, the necessary data found in the literature differs quite a lot.

One of the European project "CRONUS-EU", goals which shall be achieved is the high quality calibration of the ^{36}Cl production rate at independently dated surfaces. As part of fulfilling this task we took samples from two medieval landslide areas in the Southern French Alps: "Mont Granier" (N 44˚36', E 5˚27', 330-420 m, 1248 AD) and "Le Claps" (N 45˚30', E 5˚58', 800-900 m, 1442 AD). Calcite rich samples originate from bedrock and big boulders.

For the successful determination of ^{36}Cl by AMS, one needs to chemically separate Cl from the dissolved sample. The applied chemistry is a variation of Stone et al. (1996) with special care to remove atmospheric ^{36}Cl and to prevent Cl losses before total equilibration.

Accelerator mass spectrometry of ^{36}Cl was performed at the 10 MV accelerator at the Lawrence Livermore National Laboratory (LLNL) and the 6 MV accelerator of PSI/ETH Zurich. Due to the use of a ^{35}Cl-enriched spike, we were able to apply directly the isotope dilution technique giving us natural chlorine concentrations in the low μg/g region. With the exception of two calcite-poor samples, all measured

^{36}C/^{35}Cl ratios were found to be in the range of 4-9$\cdot 10^{-14}$ and, therefore, clearly distinguishable from the corresponding processing blanks (5-9$\cdot 10^{-15}$). Resulting ^{36}Cl concentrations were calculated to 20-192 kiloatoms/gram of rock dissolved.

Because we are still awaiting final results of target element and element concentrations influencing the production by the ^{35}Cl(n,γ)^{36}Cl reaction, we cannot yet determine precise production rates. But so far, they are in the same order as those from Phillips *et al. 2001*. Despite the fact that we have been able to measure ^{36}Cl from such very young surfaces for the first time, it still has to be discussed how valid production rates based on this short time scale will be for the application on longer time periods. A detailed discussion on the influence of the variation of the Earth magnetic field and the cosmic radiation itself has to follow.

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*References: J. O. Stone et al., GCA **60** (1996) 679. F. M. Phillips et al., Chem. Geology **175** (2001) 689-701.*