CRONUS-EU Cosmic ray produced nuclide systematics – The European contribution

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The main objective of the CRONUS-EU is to advance Terrestrial cosmogenic nuclide (TCN) techniques into a robust tool for Earth surface and environmental sciences. CRONUS-EU aims to achieve this goal via:

(1) High quality calibration of TCN production rates at independently dated surfaces
(2) High quality calibration of TCN production rates using artificial targets
(3) Systematic cross calibration of production rates of different TCNs
(4) Refinement of scaling factors that describe the spatial and temporal variation of the cosmic ray flux relevant for TCN production using calibration measurements and numerical modeling from physical principles
(5) Reducing the uncertainty of decay constants
(6) Establishing the use of additional mineral phases in exposure age dating
(7) Improvement and standardization of chemical routines
(8) Laboratory cross calibrations
(9) Training of young researchers and the user community

The effort necessary to achieve above goal is significant even for the strong network teams in CRONUS-EU. To strengthen our effort and to achieve international evaluation and acceptance, we are seeking close collaboration with CRONUS-Earth, the parallel-running northern American sister initiative that obtained funding through NSF. Formal links between the two initiatives are established and each consortium will address complementary aspects to achieve the common goal.

The coordination of CRONUS-EU is at the VU Amsterdam, with network teams at SUERC, Scotland; CEREGE and CRPG, France; ETH-Zürich (2 teams), Switzerland; Univ. Bratislava, Slovakia; Univ. Hannover, TU-Munich and GFZ-Potsdam, Germany; and Utrecht University, The Netherlands (see also: *www.cronus-eu.net*).

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Interpreting cosmogenic nuclide concentrations in areas with complex exposure-burial histories under ice sheets: How sensitive are results to variations in the ice cover proxy curve?

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Phases of accumulation and decay of cosmogenic radionuclides in rock surfaces subject to episodes of exposure and burial by ice result in present-day nuclide concentrations that reflect the timing of initial exposure and the chronology of subsequent exposure, burial and erosion. Assuming no erosion, and using ice core or marine isotope records as proxies for the timing and duration of periods of ice cover, it is possible to constrain the timing of initial exposure and the number of phases of exposure and burial a rock surface has been subjected to using multiple cosmogenic radionuclide concentrations (typically ^{10}Be and ^{26}Al). However, in evaluating interpretations based on this approach, it is important to assess how sensitive the results are to the ice cover proxy curve. We have developed a program to evaluate variations in total exposure and burial duration as a function of different proxy curves and assumptions of cutoff values for ice free conditions. Initial results for northern Sweden and Antarctica indicate a highly variable pattern of sensitivity (step changes in results at critical ice cover / ice free cutoff values), and provide new insight into how to determine the level of reliability of calculated initial exposure dates.

Key words
cosmogenic nuclides; ice sheet; proxy climate curve; surface exposure dating