Inter-comparison in ^{10}Be analysis starting from pre-purified quartz

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As far as the authors are aware we present the first inter-comparison of ^{10}Be analysis in quartz at environmental levels. Due to a lack of geological standard reference materials for ^{10}Be, quality control of exposure age and erosion rate determinations based on ^{10}Be analysis from quartz is difficult. Until now inter-comparisons have neither included very low ^{10}Be concentrations nor complex sample preparation from quartz.

^{10}Be concentrations in six quartz samples from the Sierra Nevada, Spain, were analysed at ANU, Australia and at SUERC, Scotland. The samples were originally taken to determine erosion rates and these data will be published elsewhere. Pre-purified quartz prepared at ANU was divided into two aliquots and processed and analysed independently at ANU and SUERC. The table below summarizes the results for the first four samples. To compare two different chemical separation methods (addition of stable Be carrier before and after dissolution) two aliquots were prepared from sample B11 at SUERC (CF stands for carrier first and CL for carrier last addition). All results are normalised to NIST SRM 4325 using $3.00*10^{-11}$ as its Be isotope ratio. The uncertainties given are standard uncertainties that include uncertainties of the sample and the standard measurement as well as the uncertainty of the blank correction.

Sample	^{10}Be (at/g) ANU	^{10}Be(at/g)SUERC
B11(CL)	$(1.64\pm0.06)*10^6$	$(1.60\pm0.06)*10^6$
B11(CF)	-	$(1.71\pm0.08)*10^6$
Ger3	$(3.12\pm0.14)*10^6$	$(2.97\pm0.12)*10^6$
17	$(1.22\pm0.10)*10^4$	$(1.31\pm0.16)*10^4$
21C	$(2.04\pm0.14)*10^4$	$(0.70\pm0.08)*10^4$

The analyses of both laboratories agree, within their uncertainties, for all samples except 21C.

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iCRONUS meets CRONUS-Earth: Improved calculations for cosmogenic dating methods – From neutron intensity to previously ignored correction factors

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We report progress on two five-year projects whose common goal is to improve cosmogenic dating methods: CRONUS-Earth will improve calibration; iCRONUS will develop a software system based on an artificial intelligence core (thus, the ‘i’ in the name). Calibrated production rates and correction factors modifying production rates are two critical aspects of calculating cosmogenic ages. Calibration depends on the accurate computation of neutron fluxes at the air-ground interface. The currently-used diffusion equation under-estimates neutron fluxes at the surface. Two more accurate alternatives, the physically comprehensive Monte Carlo N-Particle transport code and a simpler analytical transport model, are implemented in iCRONUS. Correction factors are of two types: global (affect all samples) and local (affect only the samples from a specific landform). Global correction factors include those that modify the secondary cosmic ray intensities; the most important are air pressure and geomagnetic cutoff rigidity of the sample site. The size of the correction depends on the location, temporal variations of the geomagnetic intensity, position of the magnetic poles, eustatic changes of sea level, temporal and spatial changes of sea-level pressure, and temporal and spatial changes of temperature and lapse rate. Every landform also requires its own, unique set of local corrections, applied on top of the global corrections. Examples include erosion of landform’s surface and sampled surface, (neo)tectonic displacement, topographic shielding, cover, and variable chemistry. Our improved calibration and all correction factors form a framework implemented in the iCRONUS software. We will demonstrate a desktop version of iCRONUS at the meeting.

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