

Production rates of cosmogenic ^{36}Cl on Ca and K

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The verity of exposure ages and surface process rates measured using *in situ* produced cosmogenic nuclides depends on the accuracy of the production rates used. Cosmogenic ^{36}Cl within rocks may be produced by several reaction pathways on K, Ca, Cl and to a lesser extend on Fe and Ti. The relative contribution of these reaction pathways to ^{36}Cl production is currently a matter of methodological debate. Typically, ^{36}Cl production rates have been quantified using samples from independently dated geomorphological features. An alternative approach to measure production rates is to sample rocks undergoing negligible erosion which have been exposed long enough to become 'saturated' with respect to cosmogenic ^{36}Cl . We will present the first results of a study using saturated samples to derive ^{36}Cl production rates for Ca and K.

Samples were selected from ancient surfaces in the hyper-arid portion of the Atacama Desert, Chile. The antiquity of these surfaces has been established previously from high or near-saturation concentrations of cosmogenic nuclides (^{21}Ne , ^{10}Be) in quartz. We analysed the ^{36}Cl concentrations in duplicate feldspar separates extracted from each sample. Further, we measured the ^{36}Cl concentration in three calcite samples collected from an additional surface in the Chilean Coastal Cordillera. The range of Ca and K-concentrations within the samples analysed is used to resolve the relative contributions of the Ca, K and Cl reaction pathways to ^{36}Cl production. We will present and discuss the results within the framework of previous production rate determinations and cosmic ray scaling models.

Major element analysis of various glass reference materials by IR- and UV-fs Laser Ablation-Inductively Coupled Plasma Mass Spectrometry

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Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) is an established technique for trace element analysis of glass samples. Quantification is commonly carried out by external calibration using internal standardization. The internal standard is determined using complementary techniques, such as XRF or EPMA. Recently a 100% normalization approach has been successfully applied, which is based on determining all major element oxides for internal standardization [1, 2].

This study was focused on the determination of major elements (Na, Mg, Al, Si, K, Ca, Ti, Mn, Fe) in e.g. BCR-2G, BHVO-2G, BIR-1G, NKT-1G and the MPI-DING series using IR- and UV-fs laser ablation. The ablation parameters were similar to those typically applied for trace element determinations (185 μJ – 2 mJ, 10 Hz, 45 to 170 μm crater diameters, 60 s ablation). NIST 610 was used as external calibration material and Si was used as internal standard.

The results indicate that fs-LA-ICP-MS is not significantly improving precision and accuracy for major element analysis. The influence of fluence or wavelength on the quantitative results is negligible. Precision for major elements was always in the range of 0.3 to 2.1 % and independent of crater size used for ablation. Surprisingly, Na was consistently determined lower than the reference values (10 - 22 %). However, using a calibration standard with a matrix composition closer to that of the samples (e.g. BCR-2G) accuracy improved to 3 - 5 %. Significant deviations were also observed for K and can not be explained by formation of significant levels of $^{23}\text{Na}^{16}\text{O}^+$. All other major element concentrations agreed with the reference values within 1 to 10 % and indicate that matrix effects are most dominant for easy ionizable elements.

[1] Leach (2002) *J.Anal.Atom. Spectrom* **17**, 852-857.

[2] Guillong (2005) *Geostand Geoanalytical Research* **29**, 315-331.