# Altitude dependence of the production rates of terrestrial cosmogenic nuclides

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Terrestrial cosmogenic nuclides (TCN) are continuously produced in the uppermost layer of the Earth's surface due to nuclear interactions with cosmic rays. The application of TCN as chronometers has revolutionised research in the field of geomorphology in the last decade. For accurate appliction of this methodology the altitude and latitude dependence of TCN production rates needs to be known accurately [1-6]. We will present results of a study on the altitude dependence of $^{21}$Ne, $^{36}$Cl, (and $^{14}$C) production rates in sanidine.

Samples from three trachitic lava flows from the north western flank of the volcano Payun Matru in Argentina (36º25' S and 69º12'W) have been analysed. These flows overlap at an altitude of 2500 and cover a profile of about 1300 m, from 1878 to 3149 m above sea level. The overlap of the altitude range of the lava fows allows the determination of the relative altitude dependence of the production rates even if the ages of the flows are unknown. The lower flow has been dated with K-Ar to be 15±1 ka [7].

Preliminary data show that the relative $^{21}$Ne and $^{36}$Cl production rates increase with altitude, and for $^{36}$Cl an apparanet attenuation coefficient of about 140 g/cm$^2$ can be calculated. It is planned to analyze $^{14}$C in the sanidine as well, and it is expected that initial results will be presented at the conference.

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# Chromium isotope data for the Yorkshire 'Jet Rock': Transition metal isotope analysis of the Toarcian OAE from NE England

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A new approach for the investigation of palaeoclimatic and palaeoenvironmental changes from sedimentary records is now made possible by recent advances in mass spectrometry that permit the routine measurement of a very wide range of stable isotope ratios. Chromium has particular advantages as a tracer of past ocean-water oxygenation because its two principal stable oxidation states exhibit dissimilar chemical properties in the natural environment and responds to a changing redox state by a different degree than other elements. Consequently, Chromium-isotope stratigraphy may offer information on past seawater chemistry and global volumes of anoxic/euxinic waters on timescales of <10,000 years, its present day oceanic residence time. For comparison, Molybdenum, which has oceanic residence times ~800,000 years, shows an ~2 permille excursion in the $^{98}$Mo/$^{95}$Mo ratio across the Early Jurassic (Toarcian) Oceanic Anoxic Event (OAE) interpreted as a drawdown of marine Mo into a sediment sink as euxinic conditions envelop the water column [1].

Accurate and precise isotope ratio measurements demand a method for extracting chromium from rock samples that delivers a high yield to ensure that the natural signal is not masked by any isotope fractionation induced by the separation process. We have recently developed a method which consistently delivers chromium yields of >95% for sedimentary samples. Preliminary results for chromium abundance and $^{53}$Cr/$^{52}$Cr isotope ratios across the Jurassic, Toarcian OAE, from the 'Jet Rock' section at Hawsker Bottoms, Yorkshire, UK are presented.

[1] Pearce *et al*. (2008) *Geology* **36**, 231–234.