UV-Femtosecond Laser ablation MC-ICP-MS for *in situ* analyses of Si isotopes

JEROME CHMELEFF, INGO HORN, GRIT STEINHOEFEL AND FRIEDHELM VON BLANCKENBURG

Institut für Mineralogie, Leibniz Universität Hannover, Callinstr. 3, D30167 Hannover, Germany (j.chmeleff@mineralogie.uni-hannover.de)

Here we present results from the development of a novel in-situ approach to measure accurate and precise $^{30}Si/^{28}Si$ and $^{29}Si/^{28}Si$ ratios in minerals and glasses. We have developed an in situ-method for precise and rapid measurements of $^{29}Si/^{28}Si$ and $^{30}Si/^{28}Si$ ratios in silicates at a spatial resolution of 50 micrometers using our in-house built 196nm UV-femtosecond laser ablation system coupled to high-resolution MC-ICPMS. The use of medium resolution mode ($m/\Delta m$= 8000) permits to resolve spectral interferences on ^{28}Si, ^{29}Si and ^{30}Si as verified using a three isotope plot that shows an equilibrium mass dependent fractionation law which can be represented as $\delta^{30}Si=1.93*\delta^{29}Si$. Sample-standard bracketing is used to correct for the mass discrimination and the possible drift occurring between two measurements and thus $\delta^{29}Si$ and $\delta^{30}Si$ are calculated using NIST NBS28 (synthetic quartz sand) as bracketing standard. Different types of matrices have been analysed by laser ablation. Thus $\delta^{29}Si$ and $\delta^{30}Si$ have been determined for the silicon isotope standard IRMM-017 ($\delta^{30}Si$= -1.26 ‰ ±0.24 ‰ ; 2 s.d. n=89) and BigBatch ($\delta^{30}Si$= -10.55±0.42‰ ; 2 s.d., n=15), as well as San Carlos Olivine ($\delta^{30}Si$=-0.81±0.19‰ ; 2 s.d. n=14), Caltech Rose Quartz ($\delta^{30}Si$= 0.10±0.13‰ ; 2 s.d., n=14) and JER-diopside glass ($\delta^{30}Si$=0±0.09‰ ; 2 s.d., n=14) samples. Silicon isotope standard IRMM-018 has also been measured and confirmed to be heterogeneous.

Samples where Si is inially present in solution can also be measured. This approach has been verified by dissolving JER-diopside glass, separating the Si [Georg *et al*., 2006; Brzezinski *et al*., 2003] and measuring $\delta^{30}Si$ and $\delta^{29}Si$ by laser ablation from a film of precipitated Si-gel.

First results will be presented that show that sponge needles from a given specie and envirronment are homogeneous within and between individual needles. In contrast, hydrothermal quartz shows substancial internal isotope zonation.

References

Georg *et al*., (2006), *Chem. Geol.*, **235**(1), 95-104

Brzezinski *et al*., (2003), *Limnol. Oceanogr.*, **45**(5), 1846-1854

Using isotopes to track intercontinental dust transport: Building a bridge from Hefei, China to California, Spring 2002

JOHN N. CHRISTENSEN[1], STEVEN S. CLIFF[2], RICHARD A. VANCUREN[3], KEVIN D. PERRY[4] AND DONALD J. DEPAOLO[5]

[1]Lawrence Berkeley National Laboratory, MS70A4418, 1 Cyclotron Rd., Berkeley, CA 94720 (jnchristensen@lbl.gov)

[2]Dept. of Applied Science, UC Davis, One Shields Ave., Davis, CA 95616 (sscliff@ucdavis.edu)

[3]Research Div., Calif. Air Resources Board, 1001 I St., Sacremento, CA 95812 (rvancure@arb.ca.gov)

[4]Dept of Meteorology, Univ. of Utah, 135 S 1460 E, Salt Lake City, UT 84112 (perry@met.utah.edu)

[5]Dept of Earth & Planetary Sciences, UC Berkeley, Berkeley, CA 94720 (depaolo@eps.berkeley.edu)

Research over the past decade has highlighted the importance of intercontinental transport and exchange of atmospheric aerosols, including soil-derived dust and industrial pollutants. Principal component analysis of elemental data for aerosols collected over California has identified a persistent Asian soil dust component that peaks with Asian dust storm events [1]. Isotopic fingerprinting can provide an additional and potentially more discriminating tool for tracing sources of dust.

Sr and Nd isotopic data and chemical data have been collected for a time series of PM2.5 filter samples from Hefei, China taken in Spring, 2002; encompassing a series of dust storms. DRUM impactor samples collected on Jeju Island just south of the Korean peninsula were also analyzed. The sampling time frame overlapped with the 2002 ITCT-2K2 experiment along the Pacific coast of North America and inland California. Highs in $^{87}Sr/^{86}Sr$ in the Hefei time series coincide with peaks in Ca and Si representing peaks in mineral particulate loading resulting from passing dust storms. Mixing diagrams identify several components; a high $^{87}Sr/^{86}Sr$ component that we equate with mineral dust (loess), and two different low $^{87}Sr/^{86}Sr$ components (local sources and marine aerosol). Based on our Sr isotopic data, we calculate loess PM2.5 particulate concentrations in air that range up to 40 $\mu g/m^3$. Marine aerosol was a major component on several different days, consistent with back-trajectories that include coastal China and/or the China Sea, and at times is associated with rain events. Jeju stage 1 samples analyzed so far have $^{87}Sr/^{86}Sr$ consistent with a significant component of Loess Sr (up to 45%), with the remainder being marine aerosol Sr.

The results for the Hefei and Jeju samples provide a basis for our isotopic study of California mineral aerosols, including the identification and apportionment of local and far-traveled Asian dust components and their variation in time.

References

[1] VanCuren R.A., Cliff, S.S., Perry, K.D. and Jimenez-Cruz, M. (2005), *J. Geophys. Res.*, **110**, D09S90, doi: 10.1029/2004JD004973