MS 9: Accelerator Mass Spectrometry and Applications 2

Time: Thursday 14:00–16:00 Location: DO24 1.205

Invited Talk MS 9.1 Thu 14:00 DO24 1.205

Progress at DREsden AMS — •Georg Rugel, Shavkat Akhmadaliev, Silke Merchel, Stefan Pavetich, Axel Renno, and René Ziegenrücker — Helmholtz-Zentrum Dresden-Rossendorf, Bautzner Landstr. 400, 01328 Dresden, Germany

The combination of a mass spectrometer with an accelerator allows very sensitive detection limits for many applications. At the Helmholtz-Zentrum Dresden-Rossendorf an AMS (accelerator mass spectrometry) facility, DREsden AMS (DREAMS), with a 6–MV tandem accelerator has been successfully installed [1]. DREAMS has its applications in many scientific fields by determining ^{10}Be, ^{26}Al, ^{36}Cl and ^{41}Ca. We made progress to develop a negative ion source for volatile elements like chlorine or iodine by reducing the memory effect [2]. The range of isotopes is broaden to higher masses by the first experiments with actinides. A time-of-flight beam line will enable the measurement at higher count rates and of additional isotopes. Another focus is the combination of a commercial SIMS (CAMECA 7f Auto) with the accelerator. For this so called Super–SIMS the CAMECA 7f is utilized as ion source and low energy mass spectrometer. By complete destruction of molecules in the stripping process at the terminal of the accelerator detection limits some orders of magnitude better than for traditional dynamic SIMS are expected, i.e. $\sim 10^{-9}$–10^{-12}, see e.g. [3]. The focus of applications will be geological samples in the framework of resource technology research. Ref.: [1] S. Akhmadaliev et al., *NIMB* 294 (2013) 5. [2] S. Pavetich et al., this conference. [3] C. Maden, *Dissertation* ETH Zürich 2003.

MS 9.2 Thu 14:30 DO24 1.205

Performance of the modified DREAMS ion source for ^{36}Cl applications — •Stefan Pavetich, Shavkat Akhmadaliev, Silke Merchel, Georg Rugel, and René Ziegenrücker — Helmholtz-Zentrum Dresden-Rossendorf

First analyses of real ^{36}Cl-AMS samples were performed with the newly developed low memory-effect ion source at the DREsden Accelerator Mass Spectrometry (DREAMS) facility [1, 2]. Considerable improvements have been reached with respect to the overall ion source performance. Especially, parameters like current output, ion source fractionation effects, normalization factors, blank values and sulphur suppression factors have been investigated to enhance accuracy of ^{36}Cl-data.

Applications cover a wide spectrum, which implies also highly variable ^{36}Cl/$^{35+37}$Cl-ratios ranging from nearly background level of $\sim 10^{-15}$ up to 10^{-10}. Samples from aquifers in arid regions for groundwater dating and modelling were analysed. Meteorite samples were measured to investigate the constancy of the galactic cosmic radiation, production rates from sulphur, and reconstruction of exposure histories of individual meteorites.

Acknowledgements: C. Wilske, B. Merkel (TUBAF), T. Müller (UFZ), U. Ott (MPI Mainz), T. Smith (U Bern), G. Domènech i Surinyach (U Barcelona), DREAMS-Operators.

[1] S. Pavetich et al., NIMB, submitted.
[2] Sh. Akhmadaliev et al., NIMB 294 (2013) 5.

MS 9.3 Thu 14:45 DO24 1.205

Search for supernova-produced ^{60}Fe in the microfossil record — •Peter Ludwig[1], Shawn Bishop[1], Ramon Egli[2], Valentyna Chernenko[1], Thomas Faestermann[1], Nicolai Famulok[1], Leticia Fimiani[1], Thomas Frederichs[3], Jose Gomez[1], Karin Hain[1], Marianne Hanzlik[4], Gunther Korschinek[1], Silke Merchel[5], and Georg Rugel[5] — [1]TU München, Physik Department — [2]ZAMG, Wien — [3]Universität Bremen, Geowissenschaften — [4]TU München, Fakultät für Chemie — [5]HZDR, Dresden

Material distributed into the interstellar medium by supernova explosions can be incorporated into terrestrial archives. After the discovery of live ^{60}Fe atoms in 2-3 Myr old layers of a Pacific Ocean ferromanganese crust (Knie et al., PRL 93, 171103 (2004)), a confirmation of this signal, as well as a mapping of the signal with high time-resolution is desireable. Another reservoir in which the ^{60}Fe signature should have been incorporated are the fossils of magnetotactic bacteria in ocean sediment. To this end, two sediment cores from the Eastern Equatorial Pacific were obtained, iron was chemically extracted with high selectivity towards biogenic magnetite, and the extraction procedure was characterized using novel magnetic measurements. The ^{60}Fe/Fe concentration in the samples was then measured with accelerator mass spectrometry at the GAMS setup in Garching. Preliminary results for both sediment cores will be reported.

MS 9.4 Thu 15:00 DO24 1.205

Production of $^{41}CaH_2$ samples for AMS measurements. Application to Interplanetary Dust Particles — •Jose Manuel Gomez Guzman, Shawn Bishop, Thomas Faestermann, Nicolai Famulok, Leticia Fimiani, Karin Hain, Stephan Jahn, Gunther Korschinek, and Peter Ludwig — TU Muenchen, Physik Department

Interplanetary Dust Particles (IDP) are small grains, generally less than a few hundred micrometers in size orbiting around the Sun. The most important source of IDP is the Asteroid Belt located at approximately 3 AU between Mars and Jupiter. During their flight from the Asteroid Belt to the Earth they are irradiated by SCR and GCR (solar and galactic cosmic rays) and ^{41}Ca is formed. ^{41}Ca ($T_{1/2}$=1.03× 10^5 y) can be used as a unique tracer to determine the accretion rate of IDP on Earth because there are no significant terrestrial sources for this radionuclide.

The chemical production of ^{41}Ca samples for AMS measurements can be made in two different ways: as fluoride or hydride, depending on the expected ^{41}Ca/^{40}Ca ratio in the samples. Since the very low expected ^{41}Ca/^{40}Ca ratios in IDP samples (in the order of 10^{-15}), the chemical procedure to get $^{41}CaH_2$ samples has been optimized at the Maier Leibnitz Laboratorium, presently the only AMS facility with sensitivity down to 10^{-16} for this radionuclide. First blank and standard measurements will be shown and the status of the AMS facility at MLL for the measurement of ^{41}Ca will be presented.

MS 9.5 Thu 15:15 DO24 1.205

Untersuchung des Laschamp-Events im Vansee mittels ^{10}Be — •Johannes Lachner[1,2], Jürg Beer[1], Marcus Christl[3] und Mona Stockhecke[1] — [1]EAWAG, Dübendorf — [2]Isotopenforschung und Kernphysik, Universität Wien — [3]Labor für Ionenstrahlphysik, ETH Zürich

Im Rahmen des PALEOVAN (ICDP) Projektes wurden Sedimentbohrkerne des Vansees in der Türkei entnommen. Mit einer teilweise jährlichen Auflösung bietet der Vansee ein hervorragendes Sedimentarchiv zur Rekonstruktion der quartären Klimageschichte, das bis zu 600.000 Jahre in die Vergangenheit zurückreicht. Die Eignung dieses terrestrischen Archivs für hochaufgelöste ^{10}Be-Untersuchungen wurde anhand einer Studie zur Laschamp-Exkursion des Erdmagnetfelds getestet. Die Messungen wurden an der kompakten AMS Anlage Tandy durchgeführt. Experimente zur chemischen Extraktion von ^{10}Be aus dem Sediment zeigen, dass zwar eine Berücksichtigung der verschiedenen Sedimentfraktionen nötig ist, unterschiedliche Lithologien das Signal jedoch nicht deutlich beeinflussen. Die hochaufgelösten ^{10}Be Werte werden verglichen mit bekannten Daten aus Eisbohrkernen.

MS 9.6 Thu 15:30 DO24 1.205

Quantifizierung glazialer Erosion mit kosmogenen Nukliden — •Christian Wirsig[1], Susan Ivy-Ochs[1], Marcus Christl[1], Christof Vockenhuber[1], Jürgen Reitner[2], Matthias Bichler[3], Martin Reindl[3], Christian Schlüchter[4] und Hans-Arno Synal[1] — [1]Labor für Ionenstrahlphysik, ETH Zürich, Schweiz — [2]Geologische Bundesanstalt, Wien, Österreich — [3]Department of Environmental Geosciences, Universität Wien, Österreich — [4]Institut für Geologie, Universität Bern, Schweiz

Kosmogene Nuklide bilden sich in situ in Gestein, das kosmischer Strahlung ausgesetzt ist. Durch Neutronen-induzierte Spallation gebildete Nuklide entstehen grösstenteils in den obersten 2-3 m der ausgesetzten Gesteinsoberfläche. Muonen hingegen dringen tiefer in Materie ein und bewirken auch dort die Entstehung von kosmogenen Nukliden.

Unter der Annahme, dass Nuklidbestände aus vorhergehenden Expositionsintervallen beseitigt wurden, ermöglichen AMS Messungen von Be-10 oder Cl-36 so die Datierung der Freilegung von Oberflächen, etwa seit dem Rückzug einer Eismasse, die das Gestein zuvor abgedeckt hatte. Ist das Expositionsalter der Gesteinsoberfläche hingegen bekannt, ermöglicht die Messung der Nuklidkonzentration eine Analyse der subglazialen Erosion während des letzten Gletschervorstosses. Wir

präsentieren erste Ergebnisse einer derartigen Studie am Goldbergkees im Nationalpark Hohe Tauern, Österreich.

MS 9.7 Thu 15:45 DO24 1.205

Deep-Sea Astronomy with Accelerator Mass Spectrometry — •Jenny Feige[1], Anton Wallner[2], L. Keith Fifield[2], Gunther Korschinek[3], Silke Merchel[4], Georg Rugel[4], Peter Steier[1], Steve Tims[2], Stephan R. Winkler[1], and Robin Golser[1] — [1]University of Vienna, Austria — [2]ANU Canberra, Australia — [3]TUM, Germany — [4]HZDR, Germany

Accelerator Mass Spectrometry (AMS) is a highly sensitive method to measure extremely low isotopic ratios of long-lived radionuclides relative to its stable isotope. Inspired by findings of an excess of ^{60}Fe in a ferromanganese crust approximately 2 Myr ago, which was interpreted to be of supernova-origin, we use this method to determine concentrations of a variety of radionuclides in deep-sea sediment samples covering a time range from 1.7 to 3.2 Myr.
An international collaboration of different AMS facilities is utilized to search for signatures of ^{26}Al, ^{53}Mn, and ^{60}Fe above terrestrial background production and extraterrestrial influx. In addition, the cosmogenic radionuclide ^{10}Be is measured to confirm existing magnetostratigraphic dating of the samples and for comparison with atmospheric production ratios of ^{26}Al/^{10}Be. All ^{10}Be and ^{26}Al measurements are finished, ^{53}Mn and ^{60}Fe is in progress. Measurement results and the influence of different background sources on a potential supernova signature will be presented and discussed.