UP 2: Bodenphysik und Ozeanographie

Zeit: Dienstag 11:45–12:45 Raum: 3B

UP 2.1 Di 11:45 3B

Detection of rare noble gas radioisotopes by atom trap trace analysis (ATTA) — •Joachim Welte[1], Anna Wonneberger[2], Markus Oberthaler[1], and Werner Aeschbach-Hertig[2] — [1]Kirchoff-Institut für Physik, Universität Heidelberg — [2]Institut für Umweltphysik, Universität Heidelberg

The noble gas radioisotopes ^{39}Ar, ^{81}Kr and ^{85}Kr have a great potential as dating tools in hydrology and oceanography, but are extremely rare and thus difficult to measure. Atom trap trace analysis (ATTA) provides a new way to detect these isotopes. The resonant scattering of many photons in laser cooling results in superb isotopic selectivity. Single atoms are trapped in a magneto-optical trap (MOT) and counted by detection of their fluorescence. The feasibility of ATTA for ^{81}Kr dating of groundwater has been demonstrated.

The aim of our project is to develop ATTA for the detection of ^{39}Ar, an isotope that opens an otherwise inaccessible time window for water dating. ^{39}Ar has successfully been used for the dating of groundwaters and oceanic deep waters, but its application has been severely limited by the excessive sample size required for ultra low-level counting. ATTA promises to overcome this limitation. We have realised a test setup based on an existing laser cooling system for metastable ^{40}Ar atoms and have successfully detected single atoms. We now plan to build a dedicated system optimised for the efficient trapping and detection of ^{39}Ar. Furthermore, new efficient methods for water degassing by membrane contactors as well as for the separation of Ar from the extracted gas are currently being developed.

UP 2.2 Di 12:00 3B

Wassergehalts- und Redox-Messungen im Oberboden — •Bernhard Ruth — GSF - Forschungszentrum für Umwelt und Gesundheit, Institut für Bodenökologie, 85764 Neuherberg

Mikrobielle Prozesse bestimmen die Umsatzraten im Boden und damit auch die Emission von klimarelevanten Gasen wie CO2, N2O und CH4. Grundvoraussetzung für die Prozesse ist ein ausreichender Wassergehalt. Bei Sauerstoffmangel treten die anaeroben Prozesse in den Vordergrund, die z.T. ganz geänderte Reaktionsabläufe zeigen. Das kommt u.A. auch bei der Mineralisierung toxischer Substanzen zum Tragen. Dieser Übergang zu anaeroben Prozessen kann mit Redox-Messungen verfolgt werden.

Obwohl Redox-Sonden üblicherweise in wässrigen Lösungen arbeiten, können auch bei relativ geringem Wassergehalt Redox-Potentiale gemessen werden. Die Messungen dienen zur Idendifizierung von Bedingungen, in denen klimarelevante Gase freigesetzt werden können.

Messungen im Freiland über mehrere Monate zeigen eine hohe Varianz, die durch die Heterogenität im Boden verursacht wird. Darüber hinaus wird der Einfluss von Bodentiefe, Niederschlägen und Temperatur und Vegetationsperiode deutlich.

UP 2.3 Di 12:15 3B

Noble gas measurements on fluid inclusions in speleothems — Tobias Kluge, •Thomas Marx, and Werner Aeschbach-Hertig — Institut für Umweltphysik, Universität Heidelberg

Measurements of dissolved atmospheric noble gases in groundwater enable paleotemperature reconstruction using their temperature dependent solubility. In contrast to groundwater, speleothems allow a more precise dating and offer high resolution records of stable oxygen and carbon isotopes. Unfortunately these data cannot be translated into paleotemperatures easily. By adopting the noble gas temperature (NGT) method to microscopic water-filled inclusions in speleothems it may be feasible to derive paleotemperatures.

Techniques for water and noble gas extraction from inclusions based on crushing and heating have been developed and are still improved continuously. In order to calculate NGTs by inverse modelling, NG concentrations are needed. Thus water amounts of about 0.1 to 1 μl have to be measured precisely, which can be achieved manometrically with a typical uncertainty of $\leq$ 2 %. The small gas amounts are measured using a sector field mass spectrometer and compared to a diluted standard. Additionally an extensive background control was performed. Most of the examined stalagmites contain too much air inclusions which mask the temperature signal. Methods to separate air from water filled inclusions are currently under development. However, calculation of NGTs was successful for a set of samples from one stalagmite and a soda straw.

UP 2.4 Di 12:30 3B

New Insights in Inverse Modelling of Noble Gases in Groundwater — •Amany von Oehsen and Werner Aeschbach-Hertig — Institut für Umweltphysik, Heidelberg

Inverse Modelling of noble gases in groundwater provides an independent tool for reconstructing past temperatures and has been used as such in a number of studies. The method is based on the temperature dependence of noble gas solubility in water. In many cases concentrations are found to be above the equilibrium for atmospheric conditions, a phenomenon referred to in the literature as excess air. A variety of models have been developed to account for this finding, some of which are very different as to what physical processes play the dominant role. Models are judged according to their performance in a chisquare test. The talk will give an overview over the models and present new insights speaking for and against them.