Ber. Inst. Erdwissenschaften K.-F.-Univ. Graz	Bd. 8	ISSN 1608-8166	Isotope Workshop Volume	Graz 2004

Memory Effects in Continuous Flow Hydrogen Stable Isotope Ratio Analysis on Water Samples

Jesper Olsen[1], Inger Seierstad[2], Jan Heinemeier[1]

[1]AMS ^{14}C Dating Centre, Department of Physics and Astronomy
Ny Munkegade, DK-8000 Aarhus C, e-mail: jespero@phys.au.dk
[2] Niels Bohr Institute for Astronomy, Physics and Geophysics
Blegdamsvej 17, DK-2100 Copenhagen Ø

In this study we focus on methodological refinements of $^{2}H/^{1}H$ analysis by isotope ratio mass spectrometry. Our experimental setup is a Micromass (now GV-Instruments) IsoPrime coupled to a EuroVector Elemental Analyser Pyrolysis system. We analyse 0.4μL pure water samples at a rate of 200 samples per day with standard deviations on 0.3 to 0.5‰. As described by Morrison *et al* 2001 this system is known to suffer from memory effects of approximately 1% of the intersample δD transition. Stable isotope ratios of deuterium have routinely been analysed at the Aarhus AMS ^{14}C Dating Centre since August 2002. Initially we found memory effects of ~6% which by now has been reduced to 1-2%. A systematic investigation of inlet parameters influencing the memory effect has been carried out in order to find the optimal setting for the smallest possible intersample memory effect. Also the long the term trends such as consumption of reactor chromium and the operational history of the system has been investigated.

The high precision enables improved ice layer counting in ice cores at greater depths. Corrections of raw isotopic data for memory effects are therefore decisive. By our investigation of the intersample memory effect we have designed an analytical model for corrections. We have found the intersample memory effect to be well described by a double exponential function, whereby we are able to split the effect in short and long terms. Longterm effects can reach back as far as 20 samples. This model has successfully been applied to stable hydrogen isotopic data from the GRIP ice core.

References

Morrison, J., T. Brockwell, et al., 2001. "Online High-Precision Stable Hydrogen Isotopic Analysis on Nanoliter Samples." Analytical Chemistry 73 (15), 3570-3575.