# Accessing $^{14}C$ profiles in carbonate records using laser ablation

C. WELTE[12]*, B. HATTENDORF[1], L. WACKER[2], M. CHRISTL[2], J. KOCH[1], J. FOHLMEISTER[3], S. F. M. BREITENBACH[4], L. ROBINSON[5], A. H. ANDREWS[6], H.-A. SYNAL[2] AND D. GÜNTHER[1]

[1]Laboratory for Inorganic Chemistry, ETH Zurich, Switzerland (*correspondence: cwelte@phys.ethz.ch)
[2]Laboratory of Ion Beam Physics, ETH Zurich, Switzerland
[3]Academy of Science, Heidelberg, Germany
[4]Department of Earth Sciences, University of Cambridge, UK
[5]School of Earth Sciences, University of Bristol, UK
[6]NOAA Fisheries, Pacific Islands Fisheries Science Center, USA

High resolution radiocarbon ($^{14}C$) profiles in carbonate records have been difficult to produce using the tedious and time consuming multi-step sample preparation required for conventional $^{14}C$ measurements using accelerator mass spectrometry (AMS). A novel setup [1, 2] combining the ease-to-use and high spatial resolution of laser ablation (LA) with gas ion source AMS [3] allows rapid in-situ determination of radiocarbon in carbonates. By focusing an ArF-excimer laser ($\lambda = 193$ nm) on carbonate samples carbon dioxide is generated and directly introduced into the gas ion source of an AMS. The applicability of this novel technique has been tested with pressed carbonate powder reference materials, marble and natural samples. Analytical aspects including sensitivity, accuracy, blanks and cross contamination were addressed. The carbon flow into the ion source was estimated to be 3 $\mu$g/min, resulting in negative ion currents up to 20 $\mu$A. The blank level showed a $Fd^{14}C$ of $0.011 \pm 0.002$ which allows to measure samples as old as 35,000 years. Nominal values of standard materials could be reproduced within two standard deviations. Due to continuous sampling the LA-AMS setup offers great flexibility with regard to analysis time, spatial resolution and measurement precision: several cm per hour can be scanned providing a rapid overview of the $^{14}C$ abundance in the sample. A spatial resolution down to 100 $\mu$m and a measurement precision of 1 % are presently achievable for modern samples. The novel setup is applied to different natural materials (stalagmites, corals, shells) that exhibit prominent $^{14}C$ features such as the bomb peak or growth stops.

[1] L. Wacker et al. (2013) *NIM* B **294**, 287-290. [2] C. Münsterer et al. (2014) *CHIMIA* **86**, 215-216. [3] M. Ruff et al. (2007) *RADIOCARBON* **49**, 307–314.