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Online radiocarbon analysis of carbonates with laser ablation AMS

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The fastest way of analyzing carbonate samples for their radiocarbon content is using a novel laser ablation (LA)n accelerator mass spectrometer (AMS) technique (Welte et al. 2016). By focusing a pulsed laser beam (ArF excimer laser 193 nm, 200 – 250 Hz) on the sample's surface, CO and CO_2 is produced, which is directly and continuously introduced into the gas ion source of the AMS and analyzed online for radiocarbon. A positioning system allows precise movement of the sample relative to the laser beam. Hence, scanning along the growth axis of a naturally grown carbonate sample such as stalagmites, corals, shells etc. allows recording a continuous ^{14}C profile with high spatial resolution down to 75μm. Therefore, the LA-AMS setup installed at ETH Zurich combines the advantages of high sample throughput, high spatial resolution and minimal material consumption compared to standard ^{14}C sample preparation methods.

Here, we present the novel LA-AMS system and apply it for the analysis of marine shells (Arctica islandica). In less than one hour a ^{14}C profile along the growth axis of an individual specimen was established revealing the complete ^{14}C bomb peak. The LA-AMS results are in agreement with the ^{14}C-AMS analysis of micro-drilled samples that had been done previously (Witbaard et al. 1994). The new technique now can be applied in broader field studies e.g. to monitor the distribution of ^{14}C in many specimens and with large geographic coverage.