



New radiocarbon measurement methods in the Hertelendi Laboratory, Hungary

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In this paper we present two very different and novel methods for C-14 measurement from dissolved inorganic carbonate (DIC) of water samples. A new LSC sample preparation method for liquid scintillation C-14 measurements was implemented in the ATOMKI. The first method uses direct absorption into a special absorbent (Carbosorb E[®]) and a following liquid scintillation measurement. Typical sample size is 20-40 litre of water. The developed CO₂ absorption method is fast, and simple. The C-14 activities is measured by an ultra low background LSC (TRI-CARB 3170 TR/SL, Perkin Elmer) including quenching parameter (tSIE). The corresponding limit of C-14 dating is 31200 year. Several tests were executed with old borehole CO₂ gas without significant content of C-14 and also performed on samples of known C-14 activities between 29 and 7000 pMC, previously measured by GPC. The combined uncertainty of the described determination is about 2 % in the case of recent carbon. It is a very cost-effective and easy to use method based on a novel and simple static absorption process for the CO₂ extracted from groundwater. The other very sensitive method is based on accelerator mass spectrometry (AMS) using gas ion source. This method does not require graphite generation and a small volume of water sample (1-20mL) is enough for the radiocarbon measurement. The procedure is very similar to pre-treatment of carbonate contained sample preparation for stable isotope measurement with gasbench technique. We applied a MICADAS type accelerator mass spectrometry (AMS) with gas ion source for C-14 analysis. The radiocarbon content of water was sat free with phosphoric acid and then the headspace gas was rinsed vials. The whole measurement needs only 20 min of each sample. The precision of measurement is better than 1% for modern samples. The preparation is vastly reduced compared to the other AMS methods and principally allows fully automated measurements of groundwater samples with an auto-sampler. The presented two new methods can be suitable for C-14 measurements and dating of hydrological, and environmental samples as well. The new AMS facility in ATOMKI (Debrecen, Hungary) using an EnvironMICADAS AMS system with gas ion source has a great potential in groundwater C-14 analyses. The research was supported by the by TÁMOP-4.2.2.A-11/1/KONV and the Hungarian NSF (OTKA MB08-A 81515)