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## Preparation of micro samples using AAA automat for AMS radiocarbon dating

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Radiocarbon dating is an exact dating method and its pioneer was the team of Professor F.W.Libby in the 1950s. This is the most significant and most commonly used  $^{14}\text{C}$  determination application. Within the carbon cycle in nature,  $^{14}\text{C}$  is generated in the upper part of the atmosphere by the interaction of  $^{14}\text{N}$  with cosmic radiation  $^{14}\text{N}(\text{n}, \text{p})^{14}\text{C}$ . Radiocarbon is relatively quickly oxidized to  $^{14}\text{CO}_2$ . Subsequently by photosynthesis  $^{14}\text{CO}_2$  is assimilated by plants and transmitted through the food chain.  $^{14}\text{C}$  activities in the atmosphere and the tissues of plants and animals are therefore almost identical. If the sample was isolated from the carbon cycle, the activity of  $^{14}\text{C}$  decreased due to radioactive conversion. Due to the half-life of  $^{14}\text{C}$  decay ( $T_{1/2} = 5730$  years), the range of the radiocarbon method is approximately 40 to 50 thousand years.

The AMS radiocarbon dating process is started by selecting the appropriate processing method. The process follows the isolation and purification of datable chemical forms of carbon. The Acido-Alkali-Acid (AAA) method is used for sample pre-treatment. After pre-treatment, the sample is dried. The sample with  $\text{CuO}$  is sealed under a vacuum in a quartz glass tube and burnt at  $900\text{ }^\circ\text{C}$ . The prepared  $\text{CO}_2$  is dried and dosed to graphitization. Reduction is carried out in a closed tube with  $\text{Zn}$  vapour after the catalytic action of  $\text{Fe}$ . Accelerator Mass Spectrometry (AMS) makes it possible to convert several percent of the  $^{14}\text{C}$  atoms from the sample to the detector during a short-term measurement. Carbon weights from the sample are about 1 mg. Samples for dating include foreign ingredients that need to be removed. Mobile chemical forms of carbon cause significant influence on the dating result. These include, in particular, humic and fulvo acids, which usually seem to reduce the age of the sample. Furthermore, the presence of a carbonate form of carbon significantly affects the result of dating, when it can be reduced or increased. The AAA method is based on alternate leaching in acid (removal of carbonate forms), neutral and alkaline media (removal of humic and fulvo acids). The AAA method can be used to pre-treatment of carbon, wood samples, and also to process collagen from bone samples.

For pre-treatment of micro samples using the AAA method, we have assembled an automated computer-controlled unit in our laboratory. The sample is placed in a 10 ml glass single-necked cuvette. The cuvette is sealed with a cap with capillaries for inlet and outlet of solutions. The machine consists of prepared solutions of  $\text{HCl}$ ,  $\text{NaOH}$  and distilled water, which are guided through the capillaries through the switching valve and the peristaltic pump into the cuvette with the sample according to the currently selected program. After the leaching of the sample is done in the cuvette, the solution is drained into the waste container. Depending on the sample type, the cuvette can be placed in a thermoblock heated to  $90\text{ }^\circ\text{C}$  or left freely in the rack. In the current layout, 6 samples of the same type can be processed on a machine during one cycle lasting approximately 17 to 30 hours.

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