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AMS 14C analyses of biospheroid granules for soil dating

Mihály Molnár, Gréta Titanilla Kertész, Virág Gergely, and Botond Buró
MTA ATOMKI, Debrecen, Hungary (molnar.mihaly@atomki.mta.hu)

Age determination of paleosoils is useful for the studies of archeology, soil development, climate change, paleoenvironment and landscape evolution research. C-14 dating of paleosoils is a challenging task as ordinary soil organic matter (SOM) does not give a realistic C-14 age of a soil layer as SOM is normally accumulated over hundreds or even thousands of years. If one could not find some macrofossil remains in the discovered soil horizon then the age determination is always a matter of debate. On the other hand secondary carbonates in soil could provide detailed information about the paleoenvironment and climate conditions in the past.
In this study we have investigated the eartworms produced biospheroids as a possible material for soil C-14 dating. Recent studies suggested that earthworms consume preferably fresh organic matter during their life in the soil, which means the products of their digestion would contain rather recent organic carbon instead of the aged carbon from the SOM fraction.
Although biospheroids are rather small (diameter < 2 mm and mass < 5 mg) pure calcite granules, accelerator mass spectrometry (AMS) technique gives the possibility of their radiocarbon dating at the AMS Laboratory of the Institute of Nuclear Research of HAS (Atomki).
We have investigated 8 different recent topsoil samples collected at 5 different localities in the Hajduság area (Hungary). Biospheroids were carefully collected form each soil samples and 2-3 granules were used for C-14 dating of the individual soil samples. Results confirmed that biospheroids mostly contain young (max age 30 years) organic carbon, which gives realistic (zero) C-14 age for the top soils.
We have already developed a method for sample preparation and reliable 14C analyses of biospheroids when more granules are prepared together and the obtained C mass was more than 0.1 mg. In this case one can use the graphitization method and normal AMS analyses, where graphite targets are measured. Now, we have an alternative technique to handle and measure even smaller samples, when C amount is between 0.01-0.1 mg using the AMS-GIS technique. Using the new method single biospheroid granules can be analysed. In the paper we present the test of the new method and their first applications on real biospheroid samples.
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