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Towards the limits: analysis of microscale ^{14}C samples using EA-AMS

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Radiocarbon (^{14}C) analysis of microscale samples is of increasing interest in a great variety of research fields, ranging from paleoclimate and biogeochemical research to the dating of artworks. A prominent example for the use of small sample sizes is the compound specific ^{14}C analysis of biomarkers, which allows not only to understand the diversity of the different carbon sources and the corresponding residence time of each, but ultimately to gain a deeper insight into the global carbon cycle. With the installation of the gas ion source interface at the MICADAS AMS (Accelerator Mass Spectrometry) system at ETH Zurich, Switzerland, the ^{14}C analyses of small and ultra-small samples ranging from 100 μg carbon (C) down to 10 μg C, are performed on a routine basis. In the case of combustible organic samples an elemental analyzer (EA) is used for sample introduction and directly coupled to the gas ion source of the AMS. Such small samples are extremely sensitive to extraneous C, which is inevitably introduced during sample preparation. Furthermore, the samples must be wrapped in vessels for the EA-combustion, which is an additional source of carbon. All of these contaminations will bias the results, hence a minimum number of pretreatment steps and a suitable data correction strategy are necessary. Complementary sets of processing standards are additionally required to precisely determine the mass and ^{14}C content of the contaminants. Optimized ^{14}C gas measurement procedures will be presented for EA-AMS analyses. The source of contaminations introduced over different pretreatment steps will be addressed and, finally, corrections applied during data reduction will be discussed.