With the introduction of continuous flow applications in 1988 for compound specific isotope analysis (CSIA) using GC combustion a major breakthrough for smallest sample sizes was achieved. This was followed by bulk stable isotope analysis (BSIA) coupling an elemental analyzer via an open split interface to the IRMS. This boost in overall sensitivity had to be balanced by accepting a lower precision due to the transient GC peaks used in continuous flow analysis when compared to dual inlet applications.

Today all major isotopes in organic samples (CHNOS) are available in continuous flow IRMS heavily reducing the workload of sample preparation. Subsequently the focus of CF-IRMS research moves towards reading very small isotope signatures in nature within total ranges of a few ‰, like for CO_2 and other trace gases in air and in water currents, seasonality in tree rings and calcareous materials.

The research and monitoring of such minor isotope signals requires improved sensitivity, stability and linearity of the IRMS as well as of the continuous flow interfaces providing sample preparation, transfer and automation.
For all these applications the long term accuracy and precision is one of the most crucial parameters combining high performance with robustness.

The factors controlling the performance of continuous flow IRMS systems will be demonstrated on basic tests. Improved routine performance will be shown on specific applications.

Temperature effects on delta 13C of soil-respired CO2: an incubation study with arctic soils

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The delta 13C value of soils is mainly determined by the delta 13C value of the incoming litter and fractionation processes during organic matter decomposition. Thus, the C isotopic composition of soils and respired CO2 varies with composition of SOM, activity of heterotrophs and soil depth.
Arctic ecosystems store vast amounts of the earth`s soil carbon. In a global warming scenario this represents a ticking time bomb of potential increase of atmospheric CO2, one of the most important greenhouse gases. Although a loss of CO2 from arctic ecosystems to the atmosphere has been reported recently, it is as yet unclear whether microorganisms are able to utilze the large pool of more stable, recalcitrant C compounds.
In order to analyze the effect of temperature on the biological sources of heterotrophs in arctic soils we measured respiration rates and delta13C values of respired CO2 and soils incubated at 2, 12 and 24°C. We found a consistent increase in respiration rates across the entire temperature range in organic horizons. In mineral horizons, respiration rates increased between 2°C and 12°C, but were similar between 12°C and 24°C. The relationship between soil temperature and the stable C isotope ratio of CO2 produced by heterotrophs was linear, with depleted delta13C values of CO2 at higher temperatures relative to lower temperatures. Additionally, the delta13C values of CO2 were highly correlated to the delta13C value of bulk soil at 24°C but not at 2 and

12°C. The study clearly demonstrates that temperature has a major impact on the isotopic composition of soil-respired CO2 and, thus, on the substrate utilized by microorganisms. The results further suggest that, at higher temperatures, the SOM decomposed by microorganisms reflects the SOM pool of the soil. It seems that certain groups of soil microbes with preference for specific C compounds display characteristic temperature optima.
In summary, warming caused a shift in the carbon pool being mineralized and, thus, may play an important role in the ability of microorganisms to use different substrates.

Climatic record in the Maastrichtian continental deposits of Southern Carpathians

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The Hateg basin is an intra-mountainous depression situated in the central western part of the South Carpathians. From Maastrichtian to Early Paleogene two different formations are known: the Densus-Ciula and the Sinpetru Formation, both of them representing mollase type deposits (Grigorescu et al., 1990; Grigorescu & Csiki, 2002). Both Formations are critical for determining paleoenvironment conditions and tectonic processes of the area during Maastrichtian. Therefore, facies analyses, petrographic and geochemical data (stable isotope analysis on calcretes) have been carried out along representative profiles within these two formations.

Maastrichtian climate was not as warm and equable as the overall climate of the Cretaceous. Worldwide, the isotopic record from foraminifers and bulk sediments indicate temperature fluctuation during Maastrichtian time. These fluctuation are represented by: 1) progressive cooling during the Lower Maastrichtian; 2) accelerate cooling during Early to Late Maastrichtian transition (70 to 71 Ma); 3) abrupt warming at the end of Cretaceous (c. 65.4 to 65.1 Ma) and subsequently temperature decrease during the last 100 k.y. of Maastrichtian.
Continental climates in mid-latitude were still warm, despite cooling trends. Because ocean temperature do not always reflect land temperatures, additional data are in process in order to constrain continental paleoclimatic conditions from the Hateg basin at that time.
The Sanpetru formation consists of cyclic sedimentation of alluvial sequences deposited in a braided meandering river sequence. Within the overbank deposits numerous horizons of fossil soils with carbonate concretions develop. For the channel deposits, paleocurrent directions indicate an E-W flow, parallel to the strike of the detachment fault which border northward the Retezat metamorphic dome. The Retezat dome which rose at the end of the Cretaceous time (Bojar et al., 1998, Willingshofer, 2000) constituted most probably a natural barrier for the adjacent river systems. Paleomagnetic studies within the Sanpetru Formation (Sibisel Valley), show one site with normal polarity, while all the other sites distributed upstream for more than 4 km, have reverse polarity (Panaiotu & Panaiotu, 2002). The data suggest a lower Maastichtain age for the profile (Chron 31, 68.7-71.0). Oxygen stable isotope composition of calcretes from a