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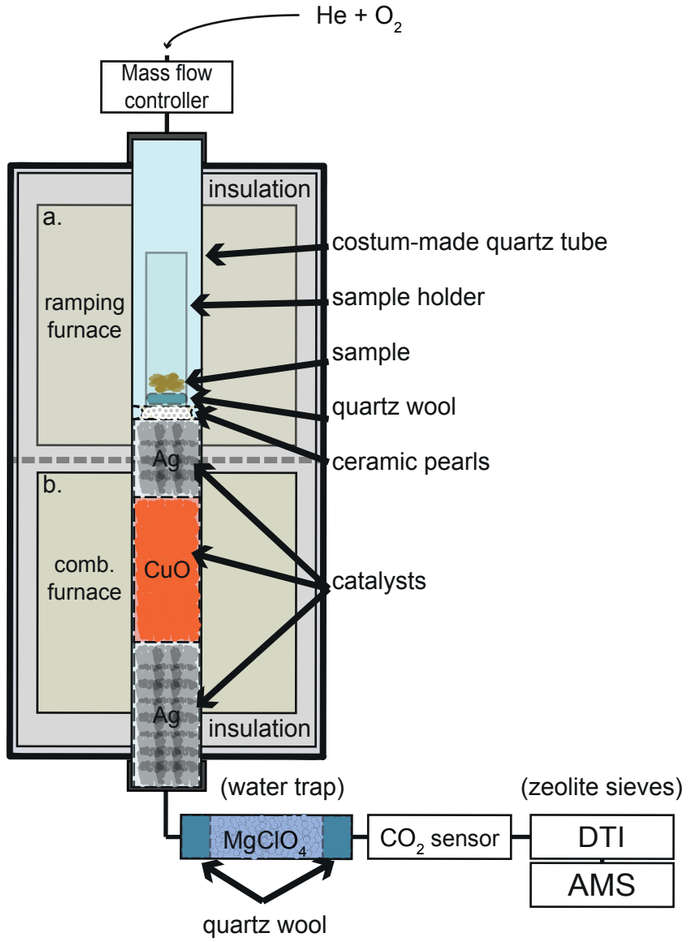
1 Motivation

- Radiocarbon (^{14}C) analyses are vital for studying the global carbon cycle, yet bulk measurements mask age variability in natural samples with complex organic carbon mixtures.
- Ramped oxidation unravels age distributions of organic carbon, fractionating based on thermal lability by oxidising at increasing temperatures and collecting the evolving CO_2 for ^{14}C measurement.

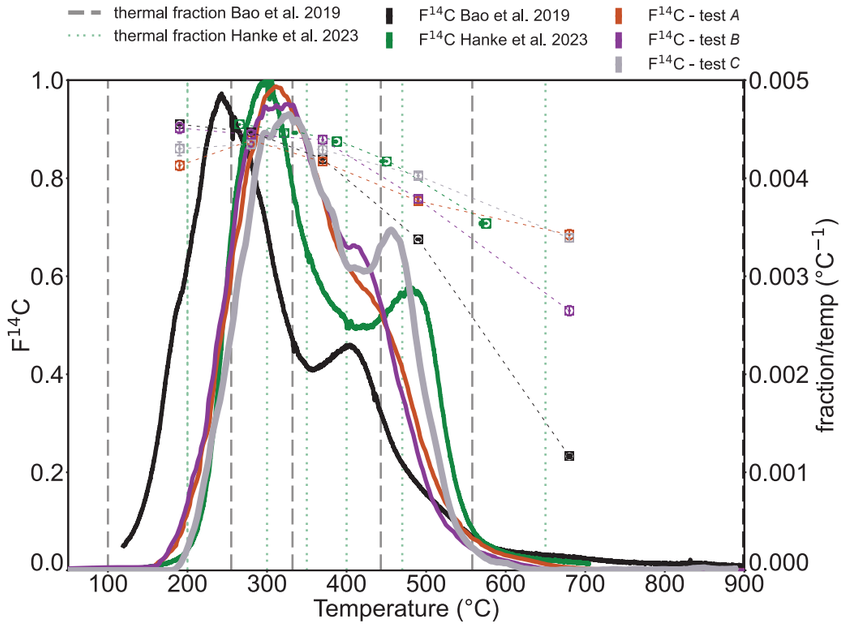
2 Setup



- Online ramped oxidation (ORO) setup comprises a furnace unit as shown on the left and a dual-trap interface (DTI) CO_2 collection unit, which is connected to an accelerator mass spectrometer (AMS).
- Soil and sediment samples are homogenized, and inorganic carbon is removed by acid treatment before being weighed into quartz tubes and loaded into the ramping furnace. Oxidized components are continuously transported by a gas flow (He + O_2) to a lower furnace maintained at a steady temperature (~900°C), where catalysts (CuO, Ag) ensure full combustion.
- Up to 8 CO_2 fractions are collected during ramped oxidation and directly measured for ^{14}C concentrations in the AMS, allowing for complete sample analysis within approximately 3.5 hours.

3 Sample thermal breakdown

- We compared the well-characterized Nantucket mud patch samples with results from Bao et al. (2019) and Hanke et al. (2023).
- Tests A and B used approximately 42 mg of material, while test C used about 20 mg. We consistently reproduced thermograms in our setup.
- Aiming for the same thermal fractions as reported by Bao et al. (2019), we found a primary outgassing around 300°C.
- To mimic Hanke et al. (2023), we adjusted gas flow and used thermal foil for heat distribution, resulting in minimal impact on thermograms. Minor adjustments were noted with changes in mass.
- $F^{14}C$ values of the earlier thermal fractions agree well with Hanke et al. (2023), while at higher temperatures, they are less consistent. We attributed this to high background.



The plot displays thermograms (CO_2 release over temperature), normalized to an area of 1 on the right, while on the left, it presents the respective $F^{14}C$ values for the different fractions per sample.

4 Conclusions

- The new ORO-DTI-AMS instrument for real-time ^{14}C analysis eliminates offline CO_2 processing of samples.
- Mass changes minimally affect ^{14}C values when sufficient carbon is present to offset background effects, while thermogram profiles can be sensitive to sample mass at higher temperatures.

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