EGU24-18609, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-18609
EGU General Assembly 2024

Central Europe paleotemperature estimates over the last 300,000 years inferred from speleothem fluid inclusion water isotopes from Milandre Cave (Switzerland)

Elisa Hofmeister[1], Dominik Fleitmann[1], Hai Cheng[2], Timon Kipfer[1], Anamaria Häuselmann[1], and Stéphane Affolter[1]

[1]University of Basel, Quaternary Geology, Departement of Environmental Sciences, (e.hofmeister@unibas.ch)
[2]Institute of Global Environmental Change, Xi'an Jiatong University, Xi'an, China

Speleothems are continental archive used to reconstruct paleoclimate and paleoenvironmental settings at a high resolution of time. One advantage is that they can be precisely dated using Uranium-Thorium dating methods. Speleothems usually contain small amounts of paleowater trapped in micrometer voids named fluid inclusions, which are sealed in the calcite fabric. This water constitutes a witness of past precipitation falling above the cave at the time the inclusion was sealed. To extract and analyze this water, we use a crushing and extraction line available at the Quaternary Geology group of the University of Basel, that allows the simultaneous analyses of fluid inclusion oxygen ($\delta^{18}O_{fi}$) and hydrogen (δD_{fi}) water isotopes. In this study, we analyzed several stalagmites from Milandre Cave (Jura Mountains, Switzerland). Previous studies from this cave have already shown that $\delta^{18}O_{fi}$ and δD_{fi} can serve as key-proxies for paleotemperature reconstruction in central Europe (Affolter et al., 2019). For the temperature reconstruction, we use either the oxygen isotope fractionation between calcite and water as a paleothermometer or a transfer function based on the regional modern relationship between the water isotopes in precipitation and temperature. The resulting temperature estimates provide absolute mean annual cave and surface air temperatures, which, however, may be slightly biased towards the cold season. Stalagmites investigated in this study cover several glacial and interglacial periods, allowing us to reconstruct temperatures for the Holocene, Younger Dryas as well as for Marine Isotope Stages 5, 7, 8 and 9. Our preliminary results show absolute mean annual temperature in a plausible range with values ranging between 0°C and 9.6°C. To gain more information about glacial temperature change, we will use stalagmites coming from additional caves located in the western part of the Jura Mountains.

These quantitative paleotemperature snapshots obtained from Milandre Cave, together with those obtained from speleothems from neighboring caves in the Jura Mountains, will allow to document and enhance the comprehension of the temperature evolution of central Europe over the last 300,000 years before present.

Affolter et al. (2019), Sci. Adv. 5 eaav3809, doi.org/10.1126/sciadv.aav3809