Noble-gas temperature reconstructions on Swiss stalagmite during the last glacial – interglacial transition

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We present results of a first application of our "Combined Vacuum Crushing and Sieving (CVCS)" system (e.g., a device to crush the stalagmite samples to defined grain size under vacuum condition) to stalagmite samples grown under cool climatic conditions during the last glacial-interglacial transition.

Concentrations of dissolved atmospheric noble gases on stalagmite samples have been used to reconstruct and to determine past ambient temperatures and hydrological condi-tions in terrestrial environments as speleothems exist in all continental regions and grow over time intervals up to 10^5 a [1]. To reconstruct paleo-temperatures from noble gases ('noble gas thermometry') in water-filled inclusions, we processed samples from stalagmites M2 and M6 from Milandre cave (Switzerland) by the CVCS system.

Optical investigation of thin sections of stalagmite M6 show that most fluid inclusion seem to be of primary origin and to preserve the original drip water from which the stalagmite grew and which was trapped by precipitating calcite. As air-filled and water-filled inclusions are different in size, the CVCS allowed to separate the small water inclusion from the large air inclusion by selectively crushing the air inclusions. This separation is key, as only noble gas concentrations of water-filled inclusion can be interpreted in terms of paleoclimate information.

Noble gas analysis shows that the annual mean temperatures in Milandre Cave were 2.2 ± 2.0 °C during the late Allerød, and dropped to 0 ± 2 °C at the onset of the Younger Dryas. Such temperatures close 0°C indicate that drip water supply stopped due to the formation of permafrost condition around the cave which prevented further stalagmite growth. Our study makes an argument that noble gas thermo-metry is applicable also to stalagmites that grew under cool climatic conditions.

[1] Vogel N. et al. (2013) *Geochemistry, Geophysics, Geosystems*, **14**, 2432-2444.