The Pyrenees host a large number of ice caves with great potential for paleoenvironmental analyses, such as the Armeña A-294 Ice Cave (2238 m a.s.l; Spanish Central Pyrenees). This ice deposit contains several detrital layers with plenty of well-preserved plant macrofossils such as Pinus uncinata needles and Dryas octopetala leaves. The period recorded spans the mid to late Holocene, with ages ranging from 5700 to 2200 cal yr BP, making it the oldest known firn ice cave worldwide. The analyses of pollen and plant macrofossils carried out in a previous study revealed the impact of the Neoglacial cooling period (NGC; starting at ca. 4600 cal yr BP) on the vegetation, resulting in a progressive lowering of the treeline and the consequent establishment and expansion of alpine meadows dominated by D. octopetala in the surroundings of the cave.

In this study, we aim to evaluate the aDNA preservation of D. octopetala leaves in order to study the impact of the NGC on the genetic diversity of this species. Here we provide preliminary results of endogenous aDNA successfully isolated from D. octopetala leaves that date back to ca. 4800 to 2300 cal yr BP. Signs of chemical damage (cytosine deamination) indicate that the DNA we isolated is ancient. On the basis of our novel results we discuss the potential of ice caves for aDNA studies, providing valuable information about the preservation, extraction and amplification of aDNA from plant macrofossils.

M13: Lead isotopes distribution and variability in two ice accumulations from Montes de Valnera (Burgos, Spain)

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Torca La Grajera y Torca La Len, both located in Montes de Valnera, Cantabrian Range (NW Spain), are two potholes in which over time the snow precipitation events has become layered ice. Torca La Grajera is -185 m deep, and had around 15 m of accumulated ice, and Torca La Len is -55 m deep, and had around 28 m of accumulated ice; both are natural open spaces directly connected to the surface. Ice sample collection was made in three campaigns performed in September 2015, 2016 and 2017. The Grupo Espeleológico Edelweiss (GEE from its Spanish initials) was responsible for arranging all the equipment to descent into the hole and taking samples when possible from a quite narrow space left between the rock wall and the ice cone, which was the only accessible part to sample [1,2]. Unfortunately, there has been a dramatic loss of ice in recent years and currently the presence of ice is only testimonial.

Ice sample chronologies become difficult due to the impossibility of having a core and a clear picture for annual layer counting. However, enough organic remains could be recovered from some ice samples for radiocarbon dating. Lead isotope ratio measurements (Pb-IRM) have been used for tracing lead sources and environmental changes by using an HR-ICP-MS sector field ELEMENT™ 2 of ThermoFisher® mass spectrometer.

The data indicate that ice accumulation is 340 30 years old. The distribution of the ages allowed us to set the lead variability recorded in the ice samples. The results indicate that influence of industrial activity from the beginning of the industrial revolution can be observed, according the determined lead isotopes variations.

[1] Martín-Merino, M.A., 2017. Cubía, 21: 18-21. [2] Alegre Rincón, R. 2018. Cubía, 22: 16-19.

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M14: Winter precipitation records from ice caves of the Eastern Alps (Austria): stable-isotopic variability over the Common Era

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Stable isotopes of water are a famous proxy used ubiquitously in polar or glacier ice core studies to reconstruct past climate. Less known underground ice accumulations found in certain Alpine caves can reach millennial ages locally. Winter snow falling such single entrance descending caves (sag-type) undergoes firnification underground, with liquid water percolation and freezing contributing to the transformation of snow into ice. Stratified cave-ice deposits are thus archives with tangible links to past winter climate variability, but also to changes in the relative contribution of ice-forming processes: diagenesis and freezing.

Well-dated, replicated records from sag-type ice caves in the Alps are currently scarce, often lacking robust chronological control due to complex ice stratigraphy, discontinuous exposures or lack of datable material. The replicated analysis of several ice exposures spanning similar time periods, coupled with the monitoring of modern values in precipitation is thus needed to further develop the cave-ice stable-isotope proxy.

Using a 100 sample radiocarbon dataset to place the ice-accumulation in absolute chronological context, we present the stable isotopic record hosted in six well-dated underground ice records of the caves in the Austrian Alps spanning the last two millennia. We review the impact of fractionation processes which alter the original link to past precipitation by comparing modern drip