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Late Pleistocene and Holocene Climatic Variability in the Carpathian-Balkan Region

ABSTRACTS VOLUME

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Assessing the suitability of Scarisoara cave ice for glaciochemical research: a coupled chemical and water isotopic approach

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Rationale

Ice deposits from Polar Regions typically contain detailed records of snow accumulation that in turn archive information about past atmospheric circulation and origin of air masses, including water vapor sources. Such proxies, particularly the concentration and isotopic composition of atmospheric gases and chemical impurities trapped in ice form the basis for reconstructing past global climates at unprecedented resolution. Here we report on one of the first geochemical investigation of an atypical ice deposit, that is the stratified ice block found within the Scarisoara Ice cave, Romania. Although one of the largest cave ice deposits in the world, with an estimated 100.000 m3 ice volume, the Scarisoara ice block has been undergoing significant mass changes over the last few decades, likely driven by current climate forcing. As such, it is of paramount importance that more research is carried out in exploring its potential as a paleoclimate archive and in understanding its state of preservation.

Methods and results

In this contribution we discuss a selected range of chemical proxies routinely employed in ice core research, including both inorganic (Na+, Ca2+, K+, F-, Cl-, NH4+, Cl−, NO2-, NO3-, and SO42-) and organic proxies such as carboxylates (i.e., formate (HCO2−) and oxalate (C2O42−)). The core length is 5 m and each measured sample encompasses 2 cm of ice. The chronological control relies on several radiocarbon age estimates measured on bat guano, that allow for establishing a preliminary chronology for assessing the rate of change observed in the concentration of the chemical components, discussing the meanings of their presence into the subterranean environment, and their variability over the past 900 years. Water isotopic data measured on the

same samples provide information on past climate conditions and the means in linking the chemical stratigraphy to other better established records of water-soluble gases and aerosols from typical ice/firn deposits in the Alps and the polar regions.

Apart from investigating such chemical proxies, we also recorded the detailed visual stratigraphy and measured several pilot samples consisting of fresh snow, as well as the perennial snow deposit at the foot of the entrance shaft. Several drip water samples that feed the seasonal lake water from which the ice forms were also investigated for the same parameters. We observed a systematic enrichment in most chemical species between fresh snow (taken as base-line conditions) and drip-water samples, which might indicate that some chemical species undergo enrichment by their passing through the cave rocks prior to the encasing within the ice body. However a pattern is observable in most proxies that indicate that the influence of past climate conditions (Little Ice Age, Medieval Warming Period) can be taken into account when reconstructing the subterranean depositional environment in terms of palaeoclimate forcing.

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