ES SEMINAR SERIES
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Zoom/COB2 140

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Holocene palaeohydrological variations in the Eastern Mediterranean inferred from magnetic and isotopic properties of speleothems from Soreq Cave, Israel

Abstract: Soil-derived magnetic particles trapped in speleothems can retain valuable information on the physiochemical conditions of the overlying soil and changes in the hydrological system. However, a direct link between magnetic and isotopic properties of speleothems has been only qualitatively established and is known to vary regionally. Here, we demonstrate strong coupling between the inflow of magnetic particles (quantified using the magnetic flux index; IRM_{flux}) and stable isotope proxies in two Holocene speleothems from Soreq Cave (Israel). The stalagmites formed between ~9.7 and ~5.4 ky BP, with an overlap between ~7.0 and ~6.4 ky BP, capturing the pluvial Eastern Mediterranean conditions associated with Sapropel 1 (S1), which are followed by the transition to mid-Holocene wet-dry cycles. The Soreq Cave as a case study demonstrates two opposite responses of the magnetic flux parameter (IRM_{flux}) to precipitation rates. The wet early-Holocene is characterized with an apparent negative correlation to rainfall (low IRMflux – high rainfall), most likely due to soil degradation, removal or "shut-down" of soil formation. The mid-Holocene cycles identified in both isotopic proxies $\delta^{13}C$ and $\delta^{18}O$ and in IRM_{flux} covary suggesting rehabilitation of regional soil cover which in turn contributes pedogenic magnetic minerals to the karst water with increase in rainfall (high IRM_{flux} – high rainfall). The separate paleo-hydrological scenarios resolved from the two speleothems demonstrate how magnetic data can act as a powerful paleo-hydrology proxy, even in weakly-magnetized speleothems growing under semi-arid conditions.

Bio: Dr. Burstyn received a BSc in Environmental Sciences and Geology from the Hebrew University in 2009. He then started a MSc at the Geological Survey of Israel on the hydrology of the Soreq Cave. His PhD stemmed from his previous work at Soreq and explored the in-situ partitioning of conventional stable isotopes (O, C) and various trace elements during the deposition secondary cave calcite (speleothems) and their implications on high resolution paleoclimate interpretations, specifically when investigating change in seasonality. Dr. Burstyn is currently a postdoc at the Goldsmith lab at Hebrew University attempting to quantify precipitation and evaporation balance in closed basin lakes affected by the East Asian monsoon (shooting lasers on fossil snails). His focus is identifying and characterizing climate tipping points in the terrestrial geological records. He specializes in records from water limited environments where the signal to noise ratio is low but the effect of climatic shifts is amplified. He dabbles in karst hydrogeochemistry, speleothem multi-proxy climate records (conventional isotopes, trace elements, fluid inclusions, organic compounds, etc), high-resolution in-situ analysis of geological records, soil dynamics interpreted using environmental magnetism and conventional stable isotopes thermodynamics (mainly O and C). Member of the PAGES workgroup SISAL, certified SAR team member with INSARAG, assistant producer of inDnegev independent music and arts festival.