



## Late Holocene Winter Temperatures in the Eastern Mediterranean and Their Relation to Cultural Changes: The Kocain Cave Record

Ozan Mert Gokturk (6,1,2), Dominik Fleitmann (3,1,2), Seraina Badertscher (1,2), Hai Cheng (4,5), R Lawrence Edwards (5), and Okan Tuysuz (6)

(1) Institute of Geological Sciences, University of Bern, Bern, Switzerland., (2) Oeschger Centre for Climate Change Research, University of Bern, Bern, Switzerland., (3) Department of Archaeology and Centre for Past Climate Change, University of Reading, Reading, UK., (4) Institute of Global Environmental Change, Xi'an Jiaotong University, Xi'an, Shaanxi, China., (5) Department of Geology and Geophysics, University of Minnesota-Twin Cities, Minneapolis, Minnesota, USA., (6) Eurasia Institute of Earth Sciences, Istanbul Technical University, Istanbul, Turkey.

Based on the  $\delta^{13}\text{C}$  profile of a stalagmite from the Kocain Cave in southern Turkey, we present a new proxy record of winter temperatures for the Eastern Mediterranean covering the last  $\sim 5500$  years. In this region precisely-dated and highly-resolved paleoclimate records for the cold season are almost non-existent. The comparison of the most recent part of the Kocain record with meteorological observations reveals that stalagmite  $\delta^{13}\text{C}$  values correlate on decadal scale with the amount of snowfall above the cave, which correlates well with average winter temperatures. More negative  $\delta^{13}\text{C}$  values indicate higher drip rates in the cave due to more efficient infiltration during snowmelt above Kocain Cave, during colder winters. Cold periods in the rest of the record coincide with widespread glacier advances, especially with the ones in the Alps during the Bronze Age – Iron Age transition (from  $\sim 1000$  BC on) and the late Little Ice Age ( $\sim 1600$  to 1850 AD). This further supports the interpretation of  $\delta^{13}\text{C}$  as a temperature proxy. Although winters during the Medieval Climate Anomaly were not continuously warm in the Eastern Mediterranean, winter warmth in the modern era was matched or exceeded several times in the last  $\sim 5700$  years, especially during the time of Minoan civilization in Crete ( $\sim 2700$  to 1200 BC). Moreover, we provide evidence for the important role of winter cold and drought in the events leading to the unrest in the 16th century Anatolia during the Ottoman rule. Kocain Cave record brings insights into several climatically-induced historical changes in the Eastern Mediterranean, and has the potential to be a key record in a region with a long and vibrant history.