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Speleothems - marine - lake records in the Eastern Mediterranean widen our understanding of regional paleoclimate and global connections

M. Bar-Matthews (1), A. Almogi-Labin (1), A. Vaks (1,2), and A. Ayalon (1)

(1) Geological Survey, Geochemistry, Jerusalem, Israel (matthews@gsi.gov.il; almogi@gsi.gov.il), (2) Department of Earth Sciences, University of Oxford, Oxford, UK

This study compares high resolution speleothems records obtained from caves located in different climatic regions in Israel, representing Eastern Mediterranean type climate, semi-arid, and the hyper-arid climate of the north-eastern Saharan Desert. The comparison of these records enables us to understand the influences of the northern Atlantic and the tropical monsoonal systems on the climate variability in the region. The analysis of the terrestrial system is augmented by comparison with the marine high resolution oxygen and carbon isotopic records of the planktonic foraminifera *G. ruber*, sea surface temperatures and pollen in two cores located in the southern and northern Levantine basin. The southern core is located beneath the River Nile plume, whose sources are influenced by the monsoonal climate system. The northern core, located ∼380 km further north SE of Cyprus, represents the northern Levantine basin where climatic conditions are less arid and more typical of the Mediterranean-type climate. These marine and the speleothems records are also compared with lake levels of Lake Lisan, the precursor of the modern-day Dead Sea. The comparisons enable us to explore several key issues: the spatial differences in δ^{18}O in the Levantine basin; the sea-land temperature and δ^{18}O relationships and their implications on isotope hydrology and climatic controls of rainfall systems in the region.

The main findings are summarized by the following observations: (1) Average sea surface temperatures of the Eastern Mediterranean Sea during glacial and interglacial periods was similar to the average land temperatures, with the major vapor source being the central/northern Levantine basin. (2) During glacial periods there was greater oxygen isotopic depletion in rainfall reaching the caves, owing to Rayleigh effects associated with lower sea levels. (3) Sapropel formation in the Eastern Mediterranean was associated with heavy rainfall events throughout the region, which left a strongly defined imprint on the difference between the δ^{18}O of rainfall and that of the sea-surface. (4) An anomalous warming event occurred at 54-50 ka in the central and north eastern Mediterranean region that coincided with maximum insolation in the northern hemisphere. (5) The changes in hydrological conditions indicated by the very low δ^{18}O values of Eastern Mediterranean speleothems during termination II, MIS 6-MIS 5 transition, predate the maximum solar insolation in 65^{o}N, and occurred in 3 steps: at 140 ka, at 135 ka, and with the major drop in δ^{18}O occurring between 128 and 120 ka and coinciding with maximum insolation. The last episode of speleothem growth in the NE Sahara also commenced at ∼140 ka , with major speleothem growth occurring between 135 and 124 ka. The origin of the moisture during this extreme wet event was mixed f north and tropical Atlantic, with storm tracks passing over the Mediterranean Sea (6) The sharp post glacial change in the hydrological conditions in the Eastern Mediterranean started at ∼18.5 ka, ∼3000 years before the warming in the Northern Hemisphere. It is not clear if this sharp change in the speleothems δ^{18}O is associated with early warming in the Eastern Mediterranean region or is related to other affects. (7) High lake levels in the Lake Lisan during last glacial, when climate in the northern hemisphere and the vast Sahara Desert was cold and relatively dry, were associated with sharp drops in temperature resulting in less evaporation and higher water infiltration coefficients into the unsaturated zone.