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Tracking humid-dry cycles in northeastern Sahara: The Negev Desert, Israel during the Pleistocene

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The Sahara Desert is the largest desert in the world, and is divided into several climatic zones. The existence of the East Africa Rift, makes the climatic characteristics of this region unique, and different from the climatic zones typical of western Africa. The Negev Desert, Israel, situated in the northern-eastern (NE) corner of the Sahara Desert and is an ideal region to study the paleoclimate of NE Sahara because of the sharp climatic gradient from about 300 to less than 50 mm isohyets.

More than 20 karstic caves were found in the Negev Desert, and found to contain large number of cave deposits (speleothems), clearly indicating that wetter conditions prevailed in the past. Their growth periods, thus, serve as direct evidence for the presence of water in the unsaturated zone and reflect the periodicity of wet and dry periods and the southward expansion of the Atlantic-Mediterranean low-pressure systems.

Dating speleothems growth periods in high-resolution using MC-ICP-MS U-Th method shows that in the part of the region that presently receives 300 to 150 mm annual rainfall, speleothems deposited during glacial and interglacial cycles. However, their growth was frequently terminated by short hiatuses, coinciding with the northward migration of the desert border. Since about 7 kyr there is a very strong aridity trend in this region.

South of the 150 mm isohyets the Negev Desert region was wet only during the Pliocene and early Pleistocene when large lakes and numerous speleothems with large calcite crystals were formed. This region was dry for the last 500 kyr and speleothems were deposited only during short time intervals lasting 100-200 years. Periods of deposition occurred during interglacial MIS 9, 7.3, 7.1, 5.5 and 5.3, and glacial MIS 6.5, and 6.4. There are no speleothems younger than 100 kyr.

These time periods are known to be very wet in the entire eastern Mediterranean region [1,2], and it is highly probable that migration of hominids "out of Africa" along the East African Rift was associated with these relatively "wet" intervals.

References

[1] Ayalon A., Bar-Matthews, M. and Kaufman A. (2002) *Geology* **30,** 303-306.

[2] Bar-Matthews, M., Ayalon, A., Gilmour, M., Matthews, A. and Hawkesworth, C.J. (2003) *GCA* **67,** 3181-3199.

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Investigating the causes of ^{14}C variation in speleothems using high-resolution stable-isotope and trace-element data

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Speleothems have a high potential to be used as accurately dated high resolution archives of climate and geochemical information. A multiproxy record of stable-isotope (^{13}C, ^{18}O), trace-element (Mg, Sr, Ba, P), ^{14}C and U/Th data was obtained at <1 mm resolution on a submerged stalagmite from Sagittarius Cave, Grand Bahama (GB89-25-3). The 25.6 cm long section grew continuously during the last deglacial period from 15 to 11 ka BP. Previous work on a stalagmite from the same location (GB89-24-1) showed 14C variation for the last glacial period [1].

A robust chronology for the stalagmite section is obtained using MC-ICPMS U and Th isotope measurements with precisions comparable to AMS ^{14}C measurements for similar sample sizes. The effect of initial ^{230}Th is investigated using isochron techniques. To constrain our age models, facilitate comparison between different speleothem samples and obtain climate information, we are also producing high-resolution laser-ablation stable-isotope and trace-element profiles. The profiles of ^{18}O, ^{13}C, Sr, Mg and U variations are likely to be indicative of the changing climate and/or recharge. This multiproxy evidence is also used to investigate the possible effect of changing climate or water-rock interaction on variations in ^{14}C. The new results will be compared to previous results on GB89-24-1 as well as other high-resolution climate archives.

References

[1] Beck, J.W. et al. (2001) *Science* **292**, 2453-2458.