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# Limnogeology: tales of an evolving Earth

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dent with diminished orbital eccentricity, and associated reduction in precession-dominated climatic extremes. The observed transition is interpreted as a major change in the mode of tropical climate forcing, from precession-dominated tropical climate, to one forced by high-latitude processes linked to the global thermohaline circulation.

### S9-03

#### Potential of a continuous and subannual Holocene record from Lake Yoa, Ounianga Kebir (central Sahara, Northeast Chad)

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We discuss here the potential of a finely laminated sediment record from Lake Yoa, a 25 m deep hypersaline lake at Ounianga Kebir in remote northeastern Chad (19°N; 20°30'E). Lake Yoa is one of the very few permanent waters in the hyperarid Sahara desert, where rainfall is negligible and annual evaporation exceeds 600 cm. Today it is maintained by subsurface inflow of fossil groundwater lastly recharged during the early-Holocene humid period.

The 7.7-m long sediment profile reveals continuous millimetre-thin lamination with sub-annual resolution. It represents the first, and most probably only, continuous record of climate and environmental change for the arid-subarid belt of North Africa from the mid-Holocene to the present-day. Preliminary multi-proxy data from the upper 3.7 m suggest that Lake Yoa has been poly- to hyper-saline during the past 2600 <sup>14</sup>C years, and that conditions of physical and chemical limnology have been similar to today for the past 1000 years.

Ongoing analyses and AMS dating are filling the gap in our knowledge of climate history of the Sahara due to lack of high-quality sedimentary archives since its desiccation about 3,000 years ago. The anticipated

results will significantly improve the existing data on the middle and late Holocene of the central and eastern Sahara and help to better understand the archaeological evidence.

### S9-04

#### A 2000-year lacustrine record of environmental change in the Middle-Atlas: the Lake Afourgagh (Morocco)

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Lake Afourgagh is a karstic groundwater fed lake located in the Liasic dolomites of the Middle-Atlas (Morocco). Closed today, it shows marks of a past lake stabilisation level (palæoshoreline) corresponding to an outflow through a wadi ("Afourgagh"). The severe drop in the lake level during the last two decades (maximum depth of 15 m in 1984, 6 m in 2005), induced by human activity (agriculture) and recurrent drought, has caused the exundation of the most recent deposits. A multi-proxy study (field correlations, biological remains, mineralogy, geochemistry, organic matter) allowed the reconstitution of the lacustrine system evolution through historical time. The geometry and facies of Lake Afourgagh deposits provide evidence for successive major lake level fluctuations during the last 2,300 years. Sedimentation is mainly biogenic with thick charophyte-rich tufas interbedded with silty layers in distal areas and palaeosols in proximal areas (lateral facies evolution). These alternations point to four major deposit sequences with lowstand phases dated at 2090, 1380, ca. 1200 and 660 cal BP. These events, interpreted as main episodes of aridity, seems not to be linked to human activity, as historical data show that the region was only peopled by nomads. Indeed, these phases are characterized by an ostracod association (*E. virens*, *C. bispinosa* and *H. salina*), pointing to lowstand phases with possible drying up. These data are corroborated by a diatom spectrum (*A. sphaerophora*, *H. amphioxys* and *D. ovalis*). Wet periods are characterized by a lot of encrusted stems and gyrogonites of *C. aspera* and *C. hispida*, and also by a typical association of ostracods (*C. vidua* and *C. neglecta*).