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EDITOR'S NOTE

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- 1 **During the Holocene, that is, the last 11,500 years, the North African climate has undergone significant changes. While the Sahara is now the largest desert on Earth, there used to be a “Green Sahara” at the beginning of the Holocene. It resulted from significant precipitations that were linked to the northward shift of the inter-tropical convergence zone, which was caused by the increase in summer insolation in the northern hemisphere.**



Holocene lacustrine deposits from Hassi El Medjna, Grand Erg Occidental, Algeria



Édouard Bard and His Serene Highness Albert II of Monaco

- 2 Although insolation has very gradually decreased during the Holocene, the transition between this period and the current desert climate is studied in depth by scientists and debated within their community.
- 3 After dedicating the symposium to the memory of Françoise Gasse, CNRS Emeritus Senior Researcher at the CEREGE in Aix-en-Provence, who passed away prematurely in April 2014, Édouard Bard showed that the work of this pioneer and that of other

researchers in the field has revealed major variations in lake and paleolake water levels during the African Humid Period (AHP).

- 4 Yannick Garcin, from Potsdam University, Germany, then showed that the dating of the ancient shorelines of the Rift Valley lakes in Kenya supports the theory that the AHP ended rapidly, about 5,000 years ago. He also demonstrated that the intensity of precipitation can be reconstructed, by using the deuterium-hydrogen isotope ratio (D/H) of n-alkanes, that is, plant molecules carried by the wind and found in marine and lacustrine sediments.
- 5 Jessica Tierney, from the Woods-Hole Oceanographic Institution (USA), presented marine records of the D/H of n-alkanes in the Atlantic off the Mauritanian coast, and in the Indian Ocean around the Gulf of Aden. These series suggest that the beginning and end of the AHP were quick and that they lasted for much less than a millennium. Peter de Menocal from Columbia University, New York, then pointed out that Saharan dust, measured in marine sediments off the north-west coast of Africa, also bear the trace of a sudden variation in the hydrological system.
- 6 Research by Stefan Kröpelin from Cologne University, on pollens and grains in the sediments of Lake Yoa in northern Chad, however, clearly seems to support the theory of a gradual change in the ground cover, from a tropical forest to the Sahel savannahs. Likewise, Florence Sylvestre, from the CEREGE, revealed that the pollens found in the sediments of Lake Chad indicated a gradual change of vegetation at the end of the AHP. However other proxies measured in these same sediments, directly linked to the hydrological system, show sudden variations which are consistent with those observed in marine archives.
- 7 Several mechanisms were put forward to explain the transformation of a gradual climate forcing into an abrupt climate variation, for example, the positive feedbacks of vegetation on water vapour, the coupling of the ocean and the atmosphere, and the modification of albedo by the rapid increase of Saharan dust carried by the wind. These mechanisms are studied and quantified using numerical models that simulate the atmosphere's interactions with the ocean and continental vegetation, as Martin Claussen from the Max Planck Institute for Meteorology in Hamburg explained in detail.
- 8 The North African climate and vegetation changes strongly impacted on the populations of the Neolithic Period. Stefan Kröpelin showed that they scattered to the East of the Sahara 8,000 years ago. With the aridification of the region about 5,500 years ago, the populations gradually migrated south, or took refuge on the banks of the Nile or around the rare oases. Studying genetic mutations and their occurrences in current populations, Laura Botigué from Stony Brook University, Stony Brook, New York, analysed the chronology of the encounters between the different populations and retraced their migrations. Paulo Sereno, from the University of Chicago, showed that the Gobero Complex in central Niger constitutes the largest and oldest cemetery in the Sahara. For 5,000 years from the beginning of the Holocene, two hunter-gatherer populations succeeded one another on the banks of this paleolake, where they buried their dead according to different funeral rites.
- 9 The papers delivered at the symposium provided an overview of current knowledge on Holocene climate change in North Africa, and on its environmental and societal consequences. The speed of the transition from the AHP to the climate we currently know in North Africa was discussed extensively, as were the mechanisms responsible

for this change. In response to the gradual drop in summer insolation during the Holocene and to positive feedback mechanisms, migration of the monsoon area further south seems to have been quick, and to have changed the North African hydrological regime drastically in less than a millennium. The vegetation, fauna and human societies seem to have reacted more gradually to these events, due to their adaptability.

Videos of the symposium are available at www.college-de-france.fr, on the professor's page.

The Oceanographic Institute is a registered foundation established in 1906 by Prince Albert I of Monaco, an erudite explorer and member of the French Academy of Science. Prince Albert I was one of the pioneers of oceanographic research, to which he devoted close to thirty deep-sea biology expeditions from 1885 onwards. He also drew up the first bathymetric map. Today, the Oceanographic Institute supports the implementation of sustainable ocean management, with a view to reconciling the preservation of biodiversity with economic activities that are respectful of marine ecosystems. Through its two institutions, the Oceanographic Museum of Monaco and the Maison des Océans in Paris, it acts as a mediator between the scientific community, the actors of the maritime economy, political decision makers, and the general public.

Since 1949, the Oceanographic Institute has awarded the Grande Médaille Albert Ier annually to a highly qualified, internationally renowned scientist in the field of oceanography. This distinction is generally awarded alternately to a French scientist or a scientist from abroad. Recipients include oceanographers John Swallow, Christian Le Provost and Carl Wunsch, geologists and geophysicists Xavier Le Pichon, Wolfgang Berger and Anny Cazenave, as well as marine biologists André Morel, Victor Smetacek and Paul Falkowski.

The Grande médaille Albert Ier was awarded by His Serene Highness Prince Albert II of Monaco to Édouard Bard, during the 20 October 2014 ceremony at the Maison des Océans, in the presence of Ségolène Royal, French Minister of Ecology, Sustainable Development and Energy, and many academics, notably Bernard Meunier and Catherine Bréchnignac, President and Standing Secretary of the French Academy of Science respectively, and Pascale Delecluse, Director of the CNRS-INSU (Institut National des Sciences de l'Univers).