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Geoarchaeological investigations on Holocene climate change in the Great Sand Sea, Western Desert



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# Geoarchaeological investigations on Holocene climate change in the Great Sand Sea, Western Desert

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## 1 INTRODUCTION

The central focus of ACACIA's research is the interaction between prehistoric occupation and environmental change during the last 10.000 years in the Eastern Sahara (Kuper and Kröpelin 2006; Kuper 2006). Archaeological sites and sediment profiles of old lakes (playas) are important archives to study the climatic and cultural development (Kindermann et al. 2006; Bubenzer & Riemer in press). Fine grained playa silts as an indicator for lake sedimentation can be observed at a number of basin locations that formed episodic water pools during the Holocene humid period. These shallow basins were attractive for prehistoric hunter-gatherers and herders, since no other water resource could be found in the desert outside the oases.

## 3 METHODS

The main focus during the recent campaign was on playa relicts especially where they were found in connection to prehistoric sites. The investigation stressed to synchronize the playa development and the chronology of the archaeological sites and their artefacts. Two key profiles of the playa have been studied sedimentologically, and the elevation of specific playa layers has been recorded. Additionally, prehistoric artefacts in the vicinity of the playas were individually measured to record the exact position and altitude of the artefacts and its relation to sediment layers. The chronological affiliation of the artefacts helps to date not only the prehistoric sites, but also the development of the lake.

## 2 LOCALITIES

Three study locations across the southern Great Sand Sea have been selected for detailed examinations of playa sediments of which two could be studied during this expedition. While the playa basin of "Willmann's Camp", listed as site 81/62 is situated at the western margins of the Great Sand Sea, site 02/14 has been discovered at the eastern margins. The third playa system namely the Regenfeld playa is situated in the central southern Great Sand Sea, however, it has not been studied because of the limited time frame and water scarcity during this expedition. All three locations were the focus of intensive archaeological investigations during former campaigns of the B.O.S. project (1980-1993) and ACACIA (since 1995).

## 4 PLAYA RELICTS AT "WILLMANN'S CAMP" (SITE 81/62)

Willmann's Camp was the home base of the Conoco oil prospecting group in the western Great Sand Sea during the 1970s. The playa terraces nearby were studied by V. Haynes in 1980 before R. Kuper investigated the prehistoric site 81/61 about 1 km to the north in 1981 and 1983. The nearby playa site was listed here as 81/62.

The recent investigations focussed on a detailed re-study of the playa relicts and a correlation of playa layers and archaeological horizons. Haynes had observed *Acheulian* artefacts at Willmann's Camp. In fact, on the basin's floor a

number of large flakes, cores and hand axes made out of quartzite were collected during our field survey, provisionally dated to more than 300,000 years ago. They represent the old bedrock level on which the younger playa silts were deposited.

The playa silts became visible within three test trenches dug along a 50 m east-west line from the recent dune towards the basin's centre. Within the 3 m high stratigraphy, three massive playa layers were identified intersected by fossilized aeolian sand agglomeration. Artefacts have not been found within the trench, but systematic surveys around the playa basin illustrates that the playa silts can be connected to the Holocene. Typical Early and Mid-Holocene stone tools and potsherds have been observed on the eastern shore line approximately dating between 8,000 and 5,000 BC (calibrated). They seem to correlate with the playa layers, however, the final analysis of the topography and contour lines will provide a deeper understanding of the playa development and chronology.

## **5 PLAYAS AT THE EASTERN GREAT SAND SEA (SITE 02/14)**

Prehistoric sites from Early and Mid-Holocene times (c. 8,000-5000 BC) have been discovered at the south-eastern margins of the Great Sand Sea during the ACACIA campaign in 2002. Many sites, in particular the very large sites, were connected to playa basins. At site 02/14 a playa stratigraphy about 4 m high was selected for further examination. The sedimentological analysis indicates a bi-sectioning of the deposits: The lower part consists of well stratified "sandy playa" layers while the upper part is formed by a hard and massive homogenous playa layer. The topographic comparison with artefact scatters around the basin underlines a Holocene age of the playa silts. Early Holocene artefacts such as backed bladelets, elongated triangles, backed points, and notched blades were recorded on the lower playa contour lines while the mid-Holocene material among them many upper and lower grinders have predominantly been found on the upper parts of the basin. Following this provisional results, the stratified sandy playa might be connected to the early Holocene while the upper playa was of mid-Holocene age.

Observations at a number of playa basins in the vicinity of 02/14 has revealed similar stratigraphic compositions consisting of the lower sandy playa and the homogenous top playa. This indicates that 02/14 can be seen as a key profile for the area that does not represent individual geomorphological conditions of the site, but a general climatic trend.

## **6 PRELIMINARY CONCLUSION**

The human occupation history of the last 10,000 years in the Western Desert of Egypt illustrates the timing and development of climatic conditions (Kuper and Kröpelin 2006). The start of the early Holocene increase of humidity is combined with earliest dates of human presence in the Western Desert after the hyper-arid Pleistocene. The beginning of a rapid increase of archaeological sites at 7,500 BC obviously followed the stabilisation of maximal humid conditions. The Holocene climatic optimum approximately lasted in the Eastern Sahara from 7,000 to 5,000 BC. The drying up started after 5,300 BC with the first signals of depopulation in the remotest areas of the desert, such as the Great Sand Sea. However, the desiccation process took about several thousand years to complete, a process that was unsteady, and in various intervals humid conditions returned. Moreover there are regional expressions as a result of topography and individual geomorphological factors.

As a preliminary result, the playa relicts investigated during the recent ACACIA campaign in the Great Sand Sea can be dated to the Holocene humid phase. The examination of the playa stratigraphies and the related archaeological sites will help to reconstruct the timing and change of climatic conditions during the Holocene more precisely.

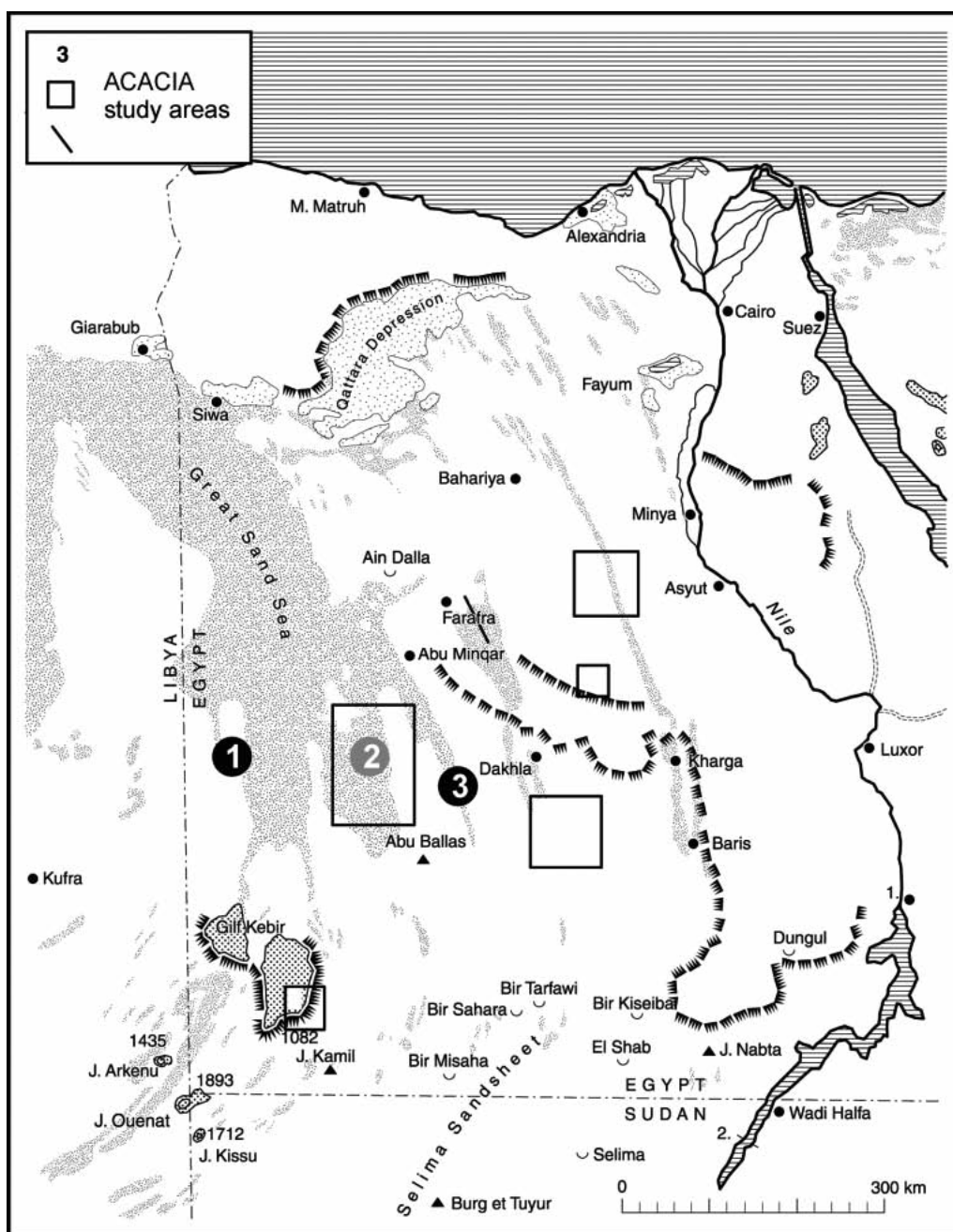
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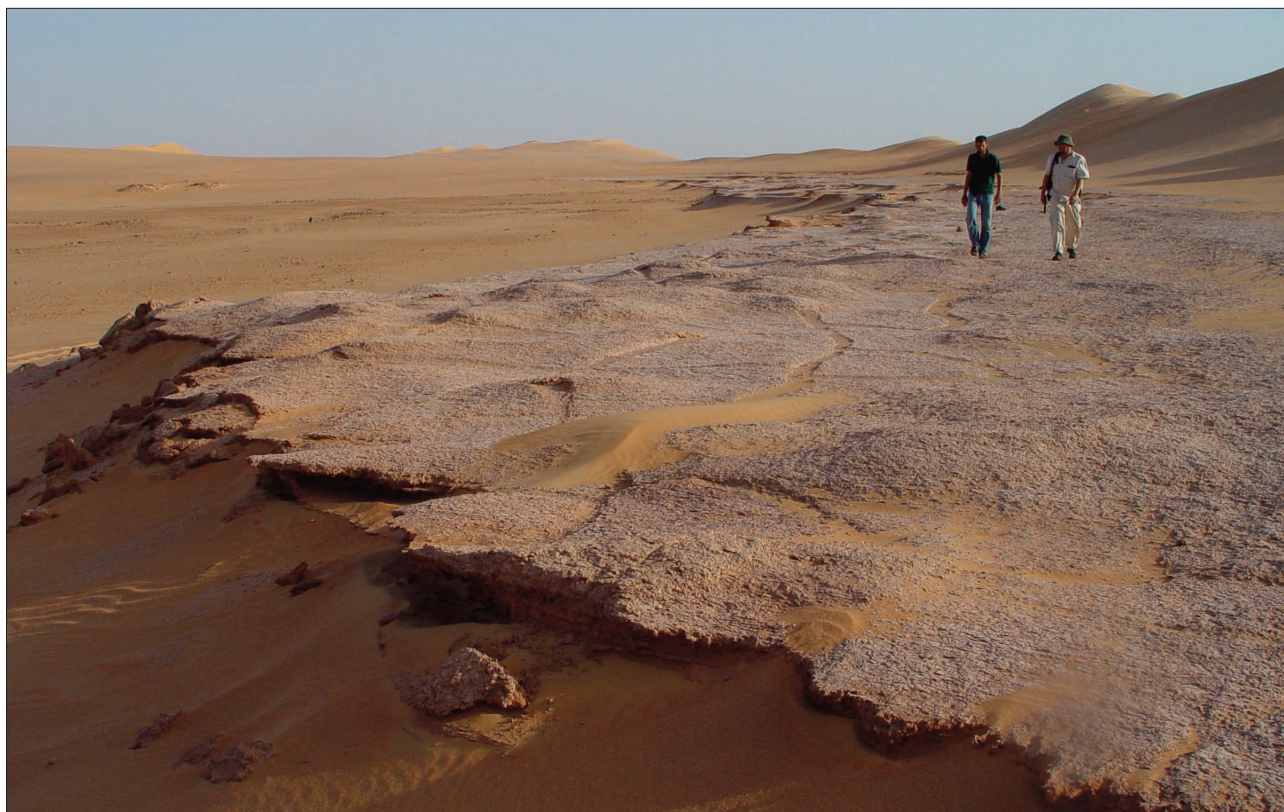
**Fig. 1** Map showing the three principle study areas in the Great Sand Sea:

1 site 81/62 "Willmann's Camp";

2 Regenfeld (not explored);

3 site 02/14.





**Fig. 2** Playa (lake) relicts at site 81/62 called “Willmann’s Camp”, western Great Sand Sea.



**Fig. 3** Digging a trench into the playa terraces to study the sedimentation history at 81/62.





**Fig. 4** Surveying the relative altitude between lake sediments and artefacts around the former shore line of the lake with a total station.

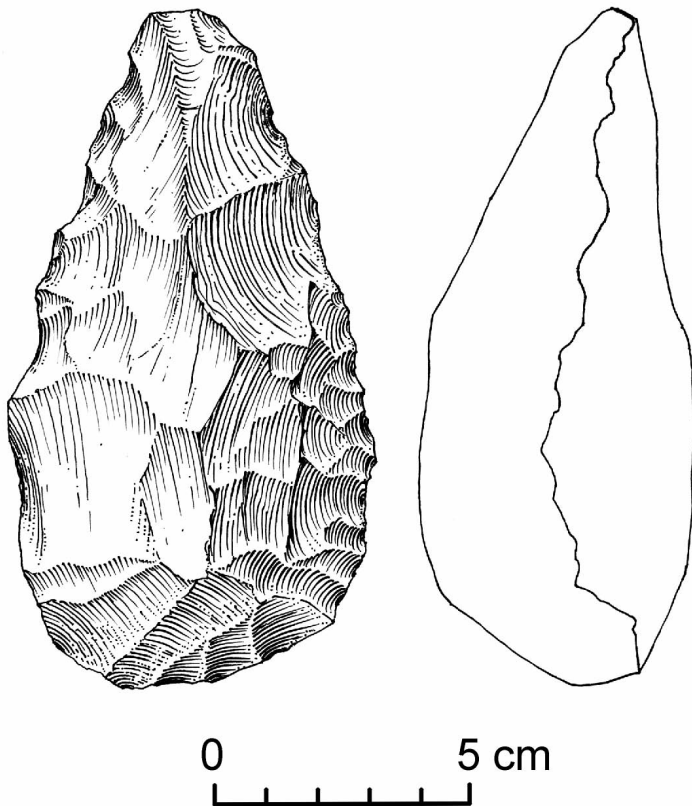


**Fig. 5** Grinders can be found on archaeological sites around the old lakes. They are a good chronological marker indicating a mid-Holocene age around 6,500-5,000 BC..





**Fig. 6** Playa remains at site 02/14 attached to a sandstone hill, eastern Great Sand Sea.



*Fig. 7 Hand axe found on the floor of the basin at 81/62*