



ARCHAEOLOGICAL AND ENVIRONMENTAL CHANGES BETWEEN 9500 BP AND 4500 BP: A CONTRIBUTION FROM THE SAHARA TO UNDERSTAND EXPANDING DROUGHTS IN THE “GREAT MEDITERRANEAN”

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ABSTRACT – The Sahara is more connected to the Mediterranean than often assumed and palynology, in particular, has provided evidence of past interrelations between the Mediterranean and the Sahara with pollen spectra from prehistoric Saharan deposits including Mediterranean taxa. In order to show human-environment relationships and populations’ strategies in response to changing environments, this paper presents a case study from the southern Sahara. This region offered a natural laboratory for the study of human/climate interaction as the range of environmental change extended from flood to drought, forcing people to cope with periodic environmental instability. When the tropical rainfall belt migrated northward, watertable outcropped in interdunal depressions and formed permanent lakes, which alternated with severe arid spells. As a case study, this paper presents the results of interdisciplinary investigations on climate changes, human adaptations and subsistence strategies at Gobero, in the southern Sahara of Niger. Gobero is a restricted archaeological area comprising 8 sites that surround the shores of a palaeolake. It was intermittently occupied between about 9500 cal years BP and 4500 BP. Due to alternating environmental conditions it could only be occupied at the beginning and at the end of the most humid periods.

KEYWORDS: ARCHAEOLOGY, GOBERO, POLLEN, PALAEOCLIMATE, SOUTHERN SAHARA

INTRODUCTION

The geographic focus of this paper is the Sahara desert, which is only apparently unrelated to the Mediterranean as its northern boundary reaches the Mediterranean coastal lowlands of Africa. The archaeological and environmental evidence from this area can effectively complement interpretations on global change and anthropic adaptation in the Mediterranean basin (e.g. Mercuri et al., 2011; Giraudi et al., 2013). Palynology, in particular, provided numerous instances of past interrelations between the Mediterranean and the Sahara with pollen spectra from prehistoric Saharan deposits showing that several Mediterranean taxa spread into the Sahara (Mercuri, 1999, 2008). Thus, comprehensive palaeoecological perspectives cannot be limited to present

environmental regions, but should be broadened to the primary extent of ancient landscapes, such as the “Great Mediterranean,” which notably includes North Africa (cf., e.g., Bar-Yosef & Pilbeam, 2000).

Furthermore, the Sahara can provide interesting contributions to those concerned with present climatic changes in Mediterranean environments. Observing surrounding climatic zones can offer relevant learning opportunities to understand – and possibly even prevent – some of the effects of global change. It can also provide insights into human-environment relationships and populations’ strategies in response to changing environments.

HUMAN/CLIMATE INTERACTION

Climate changes in the Sahara have been major factors that profoundly affected the recurring spreads and contractions of past human populations (Kuper & Kröpelin, 2006). The southern Sahara in particular may be considered as a natural laboratory for the study of human/climate interaction, possibly even more than the drier areas of the central and eastern Sahara as the range of climate change had a wider amplitude extending from flood to drought. In the early Holocene, the tropical rainfall belt migrated northward as far as 20°N–24°N and the isohyet moved approximately to 21°N (Gasse & Roberts, 2004). Consequently, watertable outcropped in several interdunal depressions and formed permanent lakes. On the other hand, during arid spells, this region was severely affected by multiple stresses driven by land degradation and fragile ecosystems. Because the border between the Sahara and the Sahelian savanna moved latitudinally, people had to cope with periodic environmental instability.

As a case study, this paper presents the results of interdisciplinary investigations on climate changes, human adaptations and subsistence strategies at Gobero, in the southern Sahara of Niger (Fig. 1).

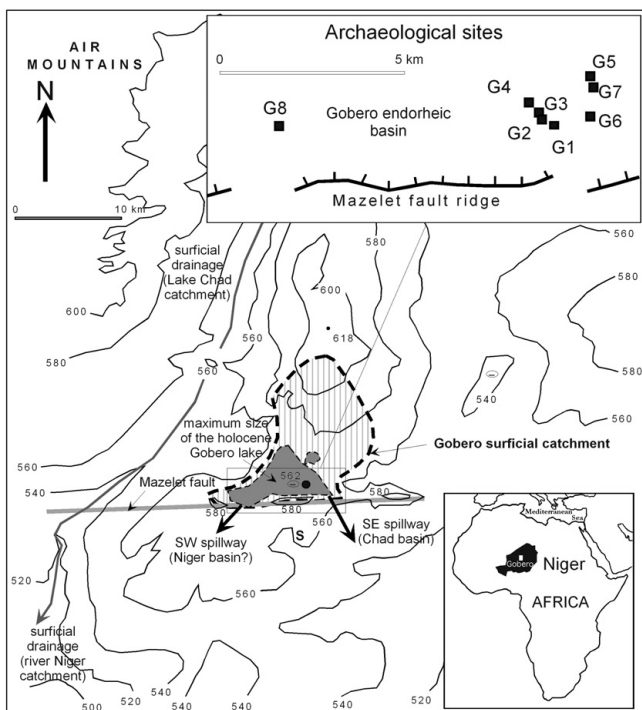


Fig. 1. Map of the Gobero basin with the archaeological sites and the Mazelet fault ridge.

THE CASE STUDY

Gobero is a restricted archaeological area comprising 8 sites, five of which (G1, G2, G3, G5 and G8) contain both funerary and habitation vestiges (Sereno et al., 2008; Garcea, 2013). The sites are presently located in the Sahara (Fig. 2), but surround the shores of a small palaeolake and were intensively occupied between about 9500 cal years BP and 4500 BP. This time period was profoundly affected by environmental changes, involving alternated phases of increase and decrease of the lake level, which had a strong impact on the local human population as well as on the faunal and plant life (Giraudi, 2013; Giraudi & Mercuri, 2013).



Fig. 2. View of the present landscape at Gobero.

The palaeolake is located in a small endorheic basin that, due to repeated climatic variations, alternately expanded and shrank, attaining a maximum surface of about 30 km² and maximum depth of 9 m. It was mainly fed by monsoonal rainfall with consequent groundwater outcrop and surface runoff of ephemeral streams flowing from the north and northeast of the Gobero basin. Thanks to this variety of water supplies, the lake continued to exist for some time after the onset of arid phases. A near-by fault scarp named Mazelet, located to south, regulated the filling and discharge of the lake. When the lake level increased beyond the top of the scarp, water outpoured south of the Gobero basin.

The archaeological area was not always habitable: as the main sites G1 and G3 lay about above the bottom of the lake, they were flooded when the lake level became higher and had to be abandoned by their settlers. Considering these constraints, the sites could only be occupied at the beginning and at the end of the most humid periods (Giraudi, 2013; Giraudi & Mercuri, 2013).

Several radiocarbon dates were obtained from human skeletal remains in the burials, vegetal tempers in the ceramics, bone harpoons, and ostrich eggshells beads (Sereni et al., 2008). In order to determine a differential use of the sites as either habitations or cemeteries, the dates of the burials were distinguished from those of the archaeological artefacts (pottery, harpoons and beads). The ages of the burials indicated that the area was first used as a cemetery at G3 from around 9500 cal BP. Then, during most of the 9th millennium BP, from around 9000 to 8300 cal BP, the site shifted to living activities, even though this occupational phase ended with a burial (G3B28) dated to 8330-8160 cal BP. A long hiatus with neither burials nor settlements followed for almost two millennia, until around 6380-5990 cal BP at G3, due to an alternation of dry-wet-dry periods (Giraudi, 2013).

The other major site, G1, was not occupied in any way until the end of the 8th millennium BP (around 7170-6950 cal BP), corresponding to the end of a wet period. Interestingly, a radiocarbon date from another site in Niger, Fachi, indicated that around 7000 years ago the frontier between the Sahara and the Sahelian savanna was at about 18°N (Neumann, 1991), which implies that Gobero, lying at 16°55'N, was within the Sahelian belt at this time.

From the mid-7th millennium BP, the two sites G1 and G3 were synchronously occupied for the first time until around 5750-5600 cal BP (the habitation) or 5580-5310 cal BP (the cemetery) at G3, while G1 was basically continually used as both a cemetery and a habitation until 5310-5040 BP, and then only as a cemetery until the end of the occupation of the main Gobero area at 4810-4440 BP.

ANTHROPOLOGY AND ARCHAEOLOGY

Since the Upper Pleistocene, the physical anthropological features of North African and Saharan populations displayed tall and robust bodies. These same traits characterised the early Holocene people buried at Gobero (Sereni et al., 2008; Stojanowski, 2013). The long chronological hiatus described above also reflected a population change. In the middle Holocene, the inhabitants of Gobero were shorter, more gracile and were also biologically more heterogeneous, probably due to a combination of local and external peoples.

These new groups, which either resulted from a population replacement (Dutour, 1989), or descended from earlier groups (Clark et al., 1973), introduced a new subsistence pattern into their previous hunting-fishing-gathering economy, involving a shift from consumption of wild foods to food production with herding of domesticated livestock without agriculture. This different subsistence economy provided means to reduce the direct dependence on the seasonal availability of wild food resources and enabled a more efficient adaptation to increasingly drier environmental conditions (Garcea, 2013).

From an archaeological point of view, these two groups were assigned to the Pre-Pastoral and Pastoral cultural complexes, in consideration of the radical changes in the economic system, which is typical of most of North Africa and the Sahara (Garcea, 2013). Their material culture included very high quantities of artefacts with over 16,000 stone pieces and 4,600 potsherds, suggesting an intensive frequentation of the sites for living purposes in addition to burial grounds. The stone tools were microlithic and mostly made of quartz and quartzite that were locally available in the gravels, and fossil wood (Fig. 3a-d), which also existed in the area as remains of a petrified forest (Sacchi, 2013). The pottery, which was predominantly decorated with impressions on the surface, was mostly tempered with vegetal material (Garcea, 2013). Plant tempers were obtained from dried grasses (straw) that appeared to have been intentionally collected for potting in the dry seasons after grain shedding (Fuller, 2013). Evidence of food material in ceramics pastes was observed in the form of a Panicoid grass caryopsis, probably *Panicum* sp. and possibly a wild *Eleusine* grain (Fuller, 2013).

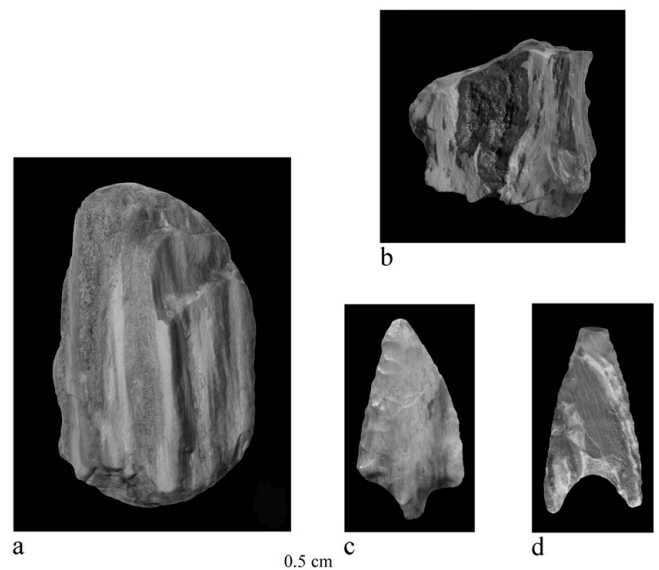


Fig. 3. a-b. Fossil wood used as raw material for stone tools; c-d. Arrowheads of fossil wood.

Furthermore, biogeochemical analysis of radiogenic strontium isotopic ratios showed that Pre-Pastoral young and adult individuals had different diets. While the young appeared to have very limited mobility, the adults lived in different environments before becoming sedentary at Gobero due to changed mobility patterns (Stojanowski & Knudson, 2011). With regard to the Pastoral period, even though herders often shift to a nomadic settlement system in order to pasture their grazing livestock, the Gobero pastoralists kept a low mobility system. Gobero seemingly functioned as a base camp and only a few individuals moved in search for the resources that were not locally available (Garcea, 2013).

THE ENVIRONMENTAL CONSTRAINTS AND OPPORTUNITIES FOR HUMANS

Pollen analysis was conducted on samples from the burials and the surrounding lake sediments, resulting in the identification of about 100 pollen taxa. Plants suggested climate changes from the early to the middle Holocene. In the early Holocene, the environment was more humid and became progressively drier with a climatic warming in the middle Holocene (Fig. 4). At this time, some humid episodes

still occurred, but seasonality was enhanced. The landscape was covered by grassland of Sahelian-type in the rainy seasons, although xerophilous plants spread in the dry seasons. Towards the final phase of human occupation from about 5000-4000 years BP, psammophilous shrubs spread in sandy places with the encroaching of the Sahara, leading to the abandonment of the sites (Giraudi & Mercuri, 2013; Mercuri et al., 2013).

Generally, a low degree of mobility is a successful settlement strategy among foragers (cf., Kelly, 1995; Garcea, 2006, 2013). In addition to that, the inhabitants of Gobero could benefit from the advantage of living in ecological and social conditions that are typical of edge zones. These areas are able to offer higher biodiversity and social interactions with different groups, providing opportunities to incorporate a wider suite of adaptive responses (Turner et al., 2003).

During the Pre-Pastoral period (9500-8000 cal years BP), the settlement system of the Gobero foragers corresponded to a ‘tethered logistical mobility’ (Kelly, 1995; Smith et al., 2005). This pattern is typical of settings where there are only restricted locations, such as a body of water, that are able to offer critical resources. Once foragers have chosen the (relatively) richest available patch of land and body of water, they are forced into sedentism by subsistence stress. In order to cope with decreasing resources, they develop a subsistence economy based on the consumption of a wider range of foods and specialize in elaborate techniques of harvesting and food processing. It is well-known that intensification of resource exploitation can provide for a more reliable schedule of the availability and predictability of food supplies (Marshall & Hildebrand, 2002). However, when humans become aware of the high risks of mobility and opt for a sedentary lifestyle, animals may not make the same choices and therefore humans’ potential prey can diminish. On the other hand, giving fairly stable environmental conditions, plants are more constantly available resources, particularly if a wider range of them is exploited through more efficient techniques.

During the Pastoral period (7000-4500 cal years BP), when the climate deteriorated, the Gobero palaeolake offered a very favourable, and exceptional, location for a base camp. In fact, when water supplies are limited, as was the case in the southern Sahara, lakes play a determining role in reducing the mobility of herders. Furthermore, when water availability continues to decrease, a marked behaviour expressing ownership of lands can be developed and appear with visible actions (Betts, 2008). Thus, settling at Gobero was not only an efficient logistical choice, but a social indication of ownership of the land and of the rights of its inhabitants to exploit its resources.

Ultimately, even though sedentism appeared as an effective strategy for the Gobero pastoralists, it could have involved some contrary effects which may have become fatal in the long-run. Among them, over-grazing may have been a

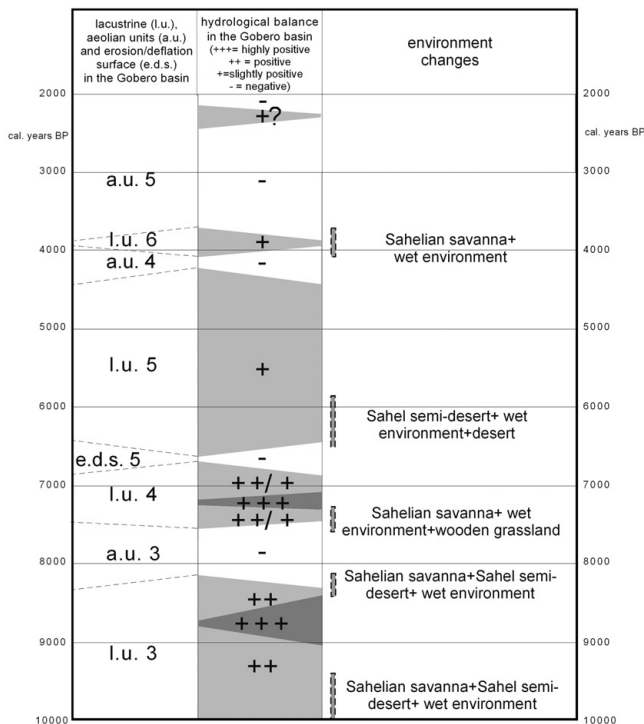


Fig. 4. Sketch of Lacustrine and Aeolian Units, hydrological balance of the Gobero basin, environment and pollen associations.

serious consequence and could have contributed to accelerating the desertification of such an ecologically sensitive area (see also, Mercuri, 2008; Gautier & Van Neer, 2011). Caught in a vicious circle, the pastoralists settled at Gobero continued to decrease their available resources and accelerated the process of progressive desertification of the environment until they were forced to leave the area.

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