

Ikram Madani, Petr Pokorný, Yahia F. Tahir,
Hamad M. Hamdeen and Adéla Pokorná

Vegetation Mounds in El-Ga'ab Depression (Sudan): Their Significance in Archaeology and Archeobotany

Introduction

Vegetation mounds (or vegetation hillocks) are hilly formations of sand and organic litter that has been trapped and thus successively accumulated within growths of long-living phreatophytic shrubs (mostly *Tamrix sp. div.*, namely *Tamarix aphylla*). This phenomenon was described and first thoroughly studied in Baharyia oasis in the Western Desert of Egypt (Pokorný and Pokorná 2013). In Sudan, Kababeesh settlers have encountered them when they first arrived at El-Ga'ab area and they gave them a local name – *tarbools*. In the same area, many tarbools are recorded near the old settlement remains, such as graves, churches and other buildings assigned to the Christian and Early Islamic periods. Madani *et al.* (2015) in their description of the vegetation cover of El-Ga'ab area considered tarbools as the most interesting features of local vegetation that are mostly the relics related to irrigated agricultural schemes of rather distant past. Tarbools occur in aggregations mainly in the bottoms of the depressions (Fig. 1). They extend along the whole length of El-Ga'ab in two chains. The eastern chain lies 25-40 km west of the Nile starting from north of Al Hasha through El-Ga'ab, Al Mweilih in

Um Hilal , Al Thawani, and Al Hamra. The western chain lies 60-70 km west of the Nile starting from Al Yanboo' Al Mirebeet through Al Yanboo' southwards until 90 km west of Dongola in Al Kwaib area (Fig. 2). Aggregations of tarbools increase in Um Hilal and some still support living plants on their tops. Um Hilal area, which is the lowest part of El-Ga'ab Depression (214-218 m a.s.l.), used to be flooded by the Nile during Early and Middle Holocene (Williams *et al.* 2010), but now all the cultivated farms are irrigated from wells. Nevertheless, underground water level of the local aquifer is close to the desert surface – not more than few meters.

A field survey was conducted in El-Ga'ab area in May 2013, September 2014, and November 2015. Its main task was to record the presence, location and morphometrics of the tarbools. The plants that formed them were identified as *Tamarix aphylla* (Fig. 3). The structures of these mounds or hillocks were also analyzed. More than 80 individual hillocks were encountered and documented in El-Ga'ab area. The height of some mounds may reach 10 m with a maximum basal circum-



Fig. 1. Vegetation mound (tarbool) landscape of El-Ga'ab Depression (Um Hilal area). Most tarbools are dead and partly eroded ones (photo: P. Pokorný)

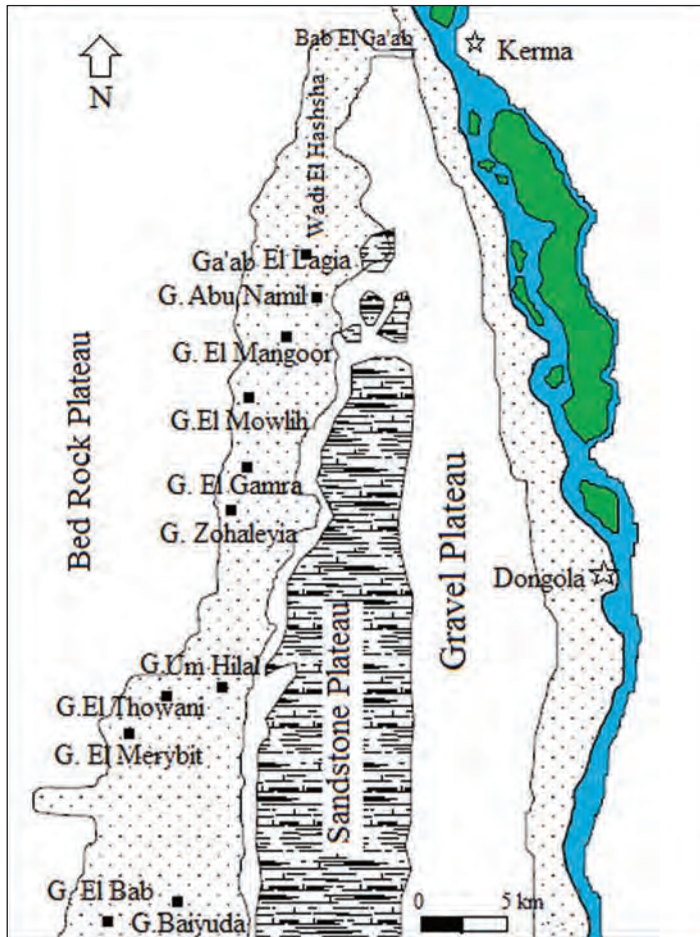


Fig. 2. Map of El-Ga'ab Depression

ference of 120 m. Most of them are exposed to wind erosion following the death of the *Tamarix aphylla* shrubs on their tops, resulting in a gradual decrease of height and volume of the remaining mound bodies. Some mounds are almost completely eroded (Fig. 4). In an attempt to uncover their stratigraphy and internal contents, six eroded tarbools were selected for excavation, five of which were in Um Hilal area and one in Al Hamra, near a Christian archaeological complex.



Fig. 3. Large tarbool with *Tamarix aphylla* shrub still growing on the top, supporting gradual accumulation of wind-transported sand and litter (photo: P. Pokorný)



Fig. 4. Almost completely eroded tarbool displaying its internal structure full of organic remains (photo: P. Pokorný)

Results

Site 1: Um Hilal

This site is located in a distance of about 36 km from the Nile. The coordinates, circumference and heights of the vegetation mounds were recorded. Five eroded mounds were selected for excavation. A vertical trench was made in the middle of one (heavily eroded) mound that is about 37 meters in diameter and three meters in high. Different remains were collected from different strata, such as animal droppings (presumably of camel), bones, pieces of pottery, and charcoal accumulations of herds (fire places). Some archaeologically important remains were encountered within the tarbool stratigraphies in Um Hilal area, such as pottery belonging to the Early Islamic period (Fig. 5). Numerous Christian and Early Islamic pottery was found and identified in the same area close to vegetation mounds. Fireplaces designed for accidental cooking which were noticeably located opposite to the wind direction (southern sides of the mounds, thus protected from northern winds). Samples for radiocarbon dating were collected from the interior of the mounds, where fireplaces with charcoal were encountered.



Fig. 5. Find of Early Islamic pottery (complete vessel) preserved in the interior of the tarbool (photo: P. Pokorný)

Site 2: El Hamra

This site is located in a distance of about 33 km from the Nile in El Hamra area near archaeological site reported as a Christian complex formed of 7 visible buildings and unknown number of invisible buried ones. The nearest to them, completely eroded tarbool was selected and the exposed plant remains (dry stems of *Tamarix*), as well as some carbonized seeds which were recovered during the Christian building excavation were taken for dating.

Conclusions

The discovery of *Tamarix* hillocks in El-Ga'ab Depression and what they hide underneath and in their internal stratigraphy qualifies them to be considered important archaeological and palaeoecological phenomenon. Inside the hillocks there are remains from old periods (Christian and Early Islamic in this particular case), indicating presence of irrigated lands in the past that supported germination of seeds and growth of plants. After the settlement and irrigation ceased, the phreatophytic shrubs were able to survive for a long time, even during and after desert encroachment, while other plants died off. As the dry climate is not suitable for the growth and establishment of seeds of such plants, it is believed that seedlings of these plants established in wet environment of irrigated agricultural land. They gradually accumulated wind-transported sand during the period of dry conditions, gradually forming the conical structure of vegetation mound (tarbool). Studying the internal structure of these mounds should recover archaeological materials and remains of plants and animals that reveal the ancient settlement, vegetation and fauna of the area, hence enabling to investigate environmental changes over centuries and even millennia.

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