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Landscape; survey; Egypt; agriculture; stone artefacts.

Introduction

The development of archaeological survey design is important, especially in environments that have undergone substantial modification since prehistoric times. Here we present a method for examining such landscapes and preliminary results of the implementation of this method. We hope to illustrate the value of these landscapes in contributing to our understanding of prehistoric human-environment interaction and the formation processes acting on the archaeological record. Subsistence practice is an important aspect of human-environment interrelationships, and in the context of the mid to late Holocene, this includes changing agricultural strategies. Ironically, modern agriculture and settlement pattern change presents one of the biggest challenges in carrying out this research. This is often seen as a destructive post-depositional process whereby the archaeological record becomes destroyed and visibility of any remnants obscured. The study of this subject is particularly appropriate in the context of prehistoric archaeological research in Egypt, especially in the Nile Delta, a region of where agriculture and settlement are rapidly expanding.

Agriculture in Egypt

Agriculture was the mainstay of Egyptian society from its introduction at around 7000 BP. Agricultural practice in Egypt has changed significantly from initial reliance on basin irrigation in the early Pharaonic period, through to more intricate local and regional water management schemes in the Ptolemaic period, and later national management schemes beginning in the 19th century. The cessation of the annual inundation in the 1960s, while now enabling perennial irrigation, prevents renewal of soil fertility. Fodder and animal manure help to add minerals and organic content to silt and sand soils, although mineral fertilizers are common.[1] Problems such as these in addition to salinization, may also result in crop rotation and fallow fields. These issues relating to soil fertility and access to water have prompted expansion of agricultural lands, although fields may frequently go unused if sufficient water is not available. This expansion potentially impacts the archaeological record, although archaeological investigation is still possible and productive.[2]

1 Mazoyer and Roudart 2006.
2 e.g., Phillipps 2006.

Survey Method in the Delta

Fieldwork on the desert edge on the western side of the Nile Delta by the "Khatatbah Prehistoric Survey" (Egypt Exploration Society) was aimed at documenting archaeological remains to further elucidate two key archaeological issues, the timing and geographical trajectory of modern human movement out of Africa during the Pleistocene, and the timing and development of early agriculture in Egypt. The survey area deliberately marks the distinct boundary between the cultivation of the Delta and the sudden transition to the desert edge, a boundary being forced further west by modern agricultural activities. Research by Junker confirmed the presence of Neolithic settlements at the sites of Merimde Beni Salama[3] and Abu Ghalib[4] (both south of the current survey concession area), the former further investigated by Eiwanger[5] for the DAI but it is likely these are not the only Neolithic occupations in the area. There is sparse published evidence for groups in this area during the Palaeolithic period,[6] and Fekri Hassan[7] noted Middle Palaeolithic surface finds at two of his survey sites in 1978.

The survey localities present environmental and geographical factors which have the potential for affecting

a) the preservation and weathering of artefacts due to differential elevation and exposure,

b) the integrity of the original context of occupation depending on modern agricultural disturbance, and

c) the elevation of the occupation, probably related to the position of shifting water sources and subsistence strategies.

After a preliminary survey, key objectives were identified and a survey strategy for the area proposed. The key objectives were to systematically survey selected, previously identified areas to map the distribution of Palaeolithic and Neolithic material across this region and to assess the condition of these archaeological remains. There are a number of criteria as to the selection of sites: their elevation and associated geomorphic features, the extent to which the scatters are in disturbed/undisturbed locations and their current accessibility. Satellite data was also used to help area selection and historic satellite data can provide information on patterns of modern land use, enabling archaeologists to identify areas that have undergone intensive use recently. The changing nature of modern landscape use can provide information about possible post-depositional disturbance. Fig. 1 shows satellite images from 2005, 2007 and 2010 revealing changes in the pattern of cultivated fields.

Two major survey techniques were proposed to complete this work. Firstly a pedestrian survey to record the general distribution of surface artefact scatters using hand-held GPS units and, secondly, an intensive survey to record the three-dimensional position of each artefact within general distribution, using a total station. Supplementary to this spatial data, some stone artefacts were analysed to record attribute data and likely chronological association. Geomorphological features were identified on existing topographic maps and modern agriculture (and recent past) disturbances were noted. Basic topography (elevation) was used to guide the pedestrian investigations based on previously recorded archaeological finds in this region.[8]

Pedestrian survey transects were placed approximately 1–2m apart, running north to south. No material was collected or recorded in detail, however general density and likely time period of artefacts was noted. Data were recorded with a Trimble GeoExplorer 2008

3 Junker 1928; Junker 1929; Junker 1930; Junker 1933a; Junker 1933b; Junker 1934; Junker 1940.
4 Junker 1928.
5 Eiwanger 1984; Eiwanger 1992; Eiwanger 1998.
6 Sandford and Arkell 1939, 110.
7 Hassan 1978, 39–56.
8 Rowland, Edinborough, and Phillipps 2009.

Fig. 1 | Satellite data showing changes in land use for agriculture between 2005 and 2010.

series hand-held GPS unit and consisted of area perimeters, spot finds, and infrastructural features deemed relevant for georeferencing maps and satellite images. Despite the heavily disturbed nature of the landscape, a large number of stone artefacts were observed. The majority of artefactual remains consisted of Palaeolithic material, mainly flakes and cores, and some tools, likely in secondary deposit due to fluvial action of the ancient Nile courses, or erosion due to modern agricultural activity. Some material may be more recent and datable to the early to mid-Holocene, likely both Epipalaeolithic and Neolithic artefacts are represented, although few typologically diagnostic artefacts were observed.

Results

After a brief initial pedestrian survey of the escarpments on the western edge of cultivation, the focus of investigation was relocated to the east, closer to the Nile, due to scarcity of archaeological material. Given the likely focus of prehistoric people on the Nile itself, particularly during the mid-Holocene, areas were targeted closer to the modern canal, which may represent the approximate position of the western most Nile branch, no

Artefact Type	Palaeolithic	Neolithic	Unknown
Complete Flake	86	15	13
Core	14	8	9
Broken Flake	10	1	8
Tool	6	1	2
Ceramic	N/A	0	2

Tab. 1 | Distribution of each artefact type for each time period.

longer present. This region is under cultivation today and field boundaries and irrigation ditches divide the landscape, and ploughing has likely disturbed most prehistoric features and artefacts. Fields currently not sown or in use provided a convenient sampling unit for the survey. These sampling units were selected from along a major road running north to south from the Khatatbah police station in the north to the boundary with Giza Province in the south. Each discrete field area was given a unique area designation and in addition to recording spatial data (position and extent), a detailed pedestrian survey was carried out (Fig. 2). A total of 18 areas were surveyed and recorded.

A detailed analysis of the artefact distribution was undertaken at Area 10. During this survey the position of 175 artefacts, stone (n = 173) and ceramic (n = 2) fragments were recorded in three dimensions using a total station. In addition to spatial data, a general chronological era, basic artefact class, and maximum dimension was recorded for each artefact, and every 20th artefact was photographed due to time restraints. While identification of artefact type was relatively simple, temporal designation was more problematic. Chronological eras were assigned based on technological features in some instance, and the degree of weathering in others.

Tab. 1 presents a breakdown of artefact type by time period. The high frequency of complete flakes suggests the assemblage is relatively undisturbed by post-depositional processes resulting in artefact breakage such as the movement of heavy vehicles across the surface. The high number of cores suggests very little reduction intensity or movement of artefacts away from their place of production. Spatial distribution did not reveal a patterning in terms of positioning or clustering of artefacts from a particular period. The majority of artefacts recorded are assigned to the Palaeolithic, although there are proportionately more Neolithic cores than Palaeolithic in comparison to flakes (Tab. 1). Given the complexity of post-depositional processes, it is not yet clear if this indicates any behavioural significance.

1 Discussion

Spatial analysis of the distribution of artefacts by maximum dimension suggests post depositional processes are a factor in the patterning of the archaeological record. Fluvial activity generally reveals distinctive patterning where smaller artefacts are 'winnowed' to lower elevations, although this was not observed.[9] Instead, Tab. 2 suggests a linear relationship between artefact size and elevation, where smaller artefacts occur at higher elevations and larger artefacts at lower elevations. The highest elevation contour pattern does not conform to this pattern, although it is closest to the bank disturbance. This is likely indicative of earthworks, particularly along the 'bank' between the field edge and the road, which may have created an environment where momentum of large artefacts has contributed significantly. Alternatively, the smaller artefacts closer to the bank may reflect the continued erosion of artefacts from the bank onto the surface of Area 10. This

9 e.g., Fanning and Holdaway 2001.

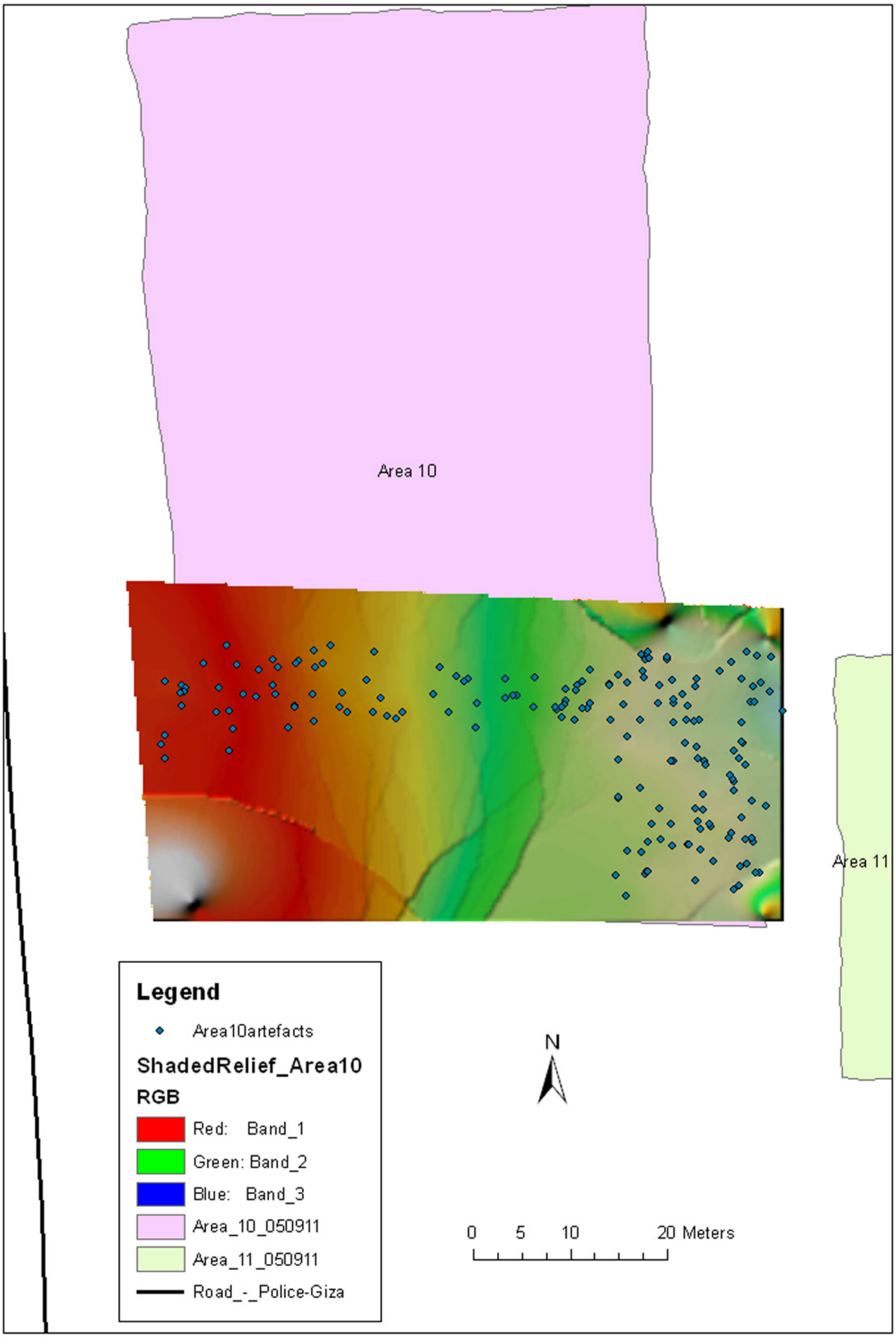

Fig. 2 | Detail of Area 10 with contour raster generated from point data.

provides us with empirical data on the effect of past and modern nature and cultural processes on the archaeological record, particularly surface visibility and fragmentation. This study confirms the archaeological potential for highly disturbed regions.

Contour Band (masl)	Mean Artefact Size (mm)
22,5–23	50.17
23–23,5	46.42
24–24,5	40.86
24,5–25	47.07

Tab. 2 | Mean artefact size for contour bands.

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