SAQQARA GEOPHYSICAL SURVEY PROJECT

PRELIMINARY REPORT

2003

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SCOTLAND

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Jon Dittmer, Carla Gallorini, Salima Ikram, Anthony Leahy, Dan Lines, Ian Mathieson, Colin Reader

Abstract: An interim report on the work carried out during the 2003 season covering the use of the model 18 Geoscan Gradiometer equipment to test previous geophysical results and record archaeological features in the valley on the north side of the Serapeum leading to the village of Abu Sir. Anomalies surveyed in 2002 were tested by sondage excavation and shown to be temple platforms ranging from the 5th century BC to the mid-Ptolemaic.

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THE SAQQARA GEOPHYSICAL SURVEY PROJECT

PRELIMINARY REPORT OF THE SAQQARA SURVEY PROJECT 2003

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The aims of the Saqqara Geophysical Survey Project have been:

a) To produce an up-to-date archaeological and subsurface geophysical map of an interesting and relatively little-studied area of Saqqara, the great necropolis of Memphis, which was the major city of Egypt from c.3000 BC to Hellenistic times. The area concerned comprises the Gisr el-Mudir 'the Great Enclosure' in the south; the structures lying to the west of the mastabas of Ptah-Hotep known as the L-shaped enclosure; the Serapeum and its dependencies; part of the Archaic necropolis; and the Sacred Animal Necropolis complex near the village of Abusir in the north (see plan of concession area).

b) To adapt and combine a series of well-known geophysical techniques to the special problems of plotting large monuments, cemeteries, catacombs and natural features in desert conditions where unexcavated and previously excavated monuments are buried either under drift-sand or under the dumps of former excavations. These techniques incorporate resistivity survey, electro-magnetic impulse profiling, ground conductivity, proton magnetometer survey, sonic profiling, field inspection, archival research and test-excavation (for descriptions see 1992/3 Report pp. 1-4).[1]

The Glasgow Museums, Scotland, acknowledge with gratitude the help and co-operation of the Supreme Council for Antiquities with whose permission the Museum's work is carried out; the Chairman Dr Zahi Hawass, Mr Magdy El Ghandour at the Secretariat, Mr Kamal Wahid Director of Saqqara, the Chief Inspector Hasama el Shami, Madam Samia Mohamad Mahmoud the inspector attached to the mission. The September - November 2003 season was undertaken with the generous financial support of grants from the Gerald Averay Wainwright Fund (Oxford University), the Russell Trust, Friends of the Glasgow Museums and private donors.

The Glasgow Museums of Scotland field team comprised Ian Mathieson-field director, Jon Dittmer-geophysicist, Carla Gallorini-ceramicist, Salima Ikram-faunal analyst, co-director Anthony Leahy-Egyptologist, Dan Lines-archaeologist surveyor and Colin Reader-geologist. The 2003 season opened on 1st September and continued until 1st November.

Previous Fieldwork - under the sponsorship of the National Museums of Scotland 1990-2001

During the 1990 season resistivity work was completed along the length of the concession area and four of the proposed cross-sections covering the large enclosure known as the Gisr el-Mudir were surveyed (fig. 1). In 1991 the complete concession area was field-walked and all visible surface indications of structures and old excavations were located for inclusion on the base maps. Work was completed in 1992 on the observation of the resistivity data covering the southern two-thirds of the

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[1] See I. J. Mathieson et al., *JEA* 85 (1999), 21-43.

original concession area, from the northern access road to the Serapeum to the southern limit of the concession, some 100m south of the southern boundary of the Gisr el-Mudir[2]. In 1993 sondage trenches were opened on anomalies in the southwest corner of the Gisr-el-Mudir to confirm the structures the resistivity data had shown at these points. A mud-brick platform was discovered inside the enclosure at the SW corner and the construction of the enclosure walls was investigated (1993 Report, Map Sheet 1, A7 & A8). In the 1994 season sondage trenches were opened to confirm the geophysical findings on profiles taken over the North Wall (1994 Report, Map Sheet 1, GMNWXS2). The construction of the wall was found to extend to the North with a buttress formation on the North face. Several graves were found on the South side of the wall, one of which had a stela of the Persian period deposited in the sub-structure (Reports 1990 - 1994)[3].

During 1995 further sondage trenches were opened (1995 Report, Map Sheet 1, A9-14), to inspect anomalies over the southwest corner of the monument where the inside corner was located and surveyed[4]. In 1996 electro-magnetic impulse equipment, kindly loaned by ERA Technology of Leatherhead, Surrey, was used for the first time in Saqqara. Many scanning profiles were taken over existing resistivity surveys and the results confirmed the previous findings and gave a much-enhanced interpretation of the sub-surface conditions (Report 1996). In 1997 conductivity surveys were carried out using the Geonics EM 31 covering half of the Gisr el-Mudir and a portion of the L-shaped structure (Report 1997). In 1998 the conductivity survey of the Gisr el-Mudir was completed and several auger holes were drilled to determine the elevation of the bedrock. Sondage excavations examined the structure of the East Wall (Report 1998). In 1999 the project was fortunate to obtain the loan of Global Positioning Satellite equipment from The Natural Environment Research Council and surveyed all the main triangulation stations in the Saqqara area. The position of the South Wall of the Gisr el-Mudir and the southeast corner were located (Report 1999). In 2000 the Gradiometer was used for the first time and the results obtained showed this to be an ideal instrument for tracing mud brick structures. On the northern boundary of the L-shaped enclosure a line of rectangular anomalies was found and these formed the area for sondage excavation in 2001. In 2001 small sondages at the north side of three of the anomalies showed that they were probably temple casement foundations with entrance stairways on the north sides. In 2002 the project was sponsored by the Glasgow Museums and further geophysical findings showed more temple type structures and many tombs on the North side of the Serapeum and a study of the pottery from the 2001 sondages.

The Objectives of the 2003 season under the sponsorship of Glasgow Museums were:

1. To continue the electromagnetic survey from the Serapeum down the valley to the Old Lake of AbuSir between the Sacred Animal Necropolis and the ridge on the north side, using the Geoscan Gradiometer instrument to measure the apparent influence of the surface material to a depth of approximately 3 metres.

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[2] See I. J. Mathieson and A. Tavares, *JEA* 79 (1993), 17-31.

[3] See I.J. Mathieson et al. *A Stela of the Persian period from Saqqara. JEA* 81 (1995), 23-41.

[4] See I.J. Mathieson et al. *The National Museums of Scotland Saqqara Survey Project 1993-1995. JEA* 83 (1997)

2. To re-observe certain areas previously surveyed by other electronic means to obtain comparative results.

3. To test by small sondage trenches the results of the electronic surveys of 2002 which had indicated several structural anomalies.

4. To continue the geological survey of the concession area to up-date the geological maps of the 1984 survey and to carry out auger drills within the Old Lake of AbuSir to delineate the boundaries of the ancient flooded area and investigate the sediments.

Fieldwork

Sondage on entrance to Temple site 1(Figs.2, 3 & 4, Plates 1, 2 & 3) Dr Tony Leahy & Dan Lines

In the area to the north of the Serapeum surveyed in autumn 2002, a line of mud brick structures apparently oriented south towards it was identified by magnetometer. The entrance ramp to the largest building in the row was selected for testing in September 2003. The aims were to assess the accuracy of the magnetometer readings and to explore anomalies, to clarify the nature of the structure and to attempt to date it. Only the minimum necessary to achieve these aims was exposed. It proved to be a mud brick enclosure, up to 1.6 metres in height, and filled with rubble to create a platform. The access ramp (Fig. 2 & Plate 1), part of the façade, including the south–east corner, and the entrance on top of the platform were investigated. No inscriptions and very few objects were discovered and the only evidence for dating comes from pottery finds. (Plates 2 & 3) Preliminary analysis suggests that the majority of this is Ptolemaic but some pieces date to the sixth or fifth centuries BC, so that the platform itself may have been constructed in the Twenty-sixth Dynasty and continued in use well into the Ptolemaic period. We believe that the platform served as a base for the construction of temples and associated buildings, and was part of a complex of similar structures associated with the Serapeum. These are known from Greek and demotic papyri, but their exact location was previously unknown. The architecture of the platform was carefully recorded (Fig. 2 shows provisional draft results) and an extensive photographic record was made before it was covered with sand again. The results of the sondage showed the magnetometer survey to be accurate to within less than a metre, and added substantially to our understanding of Saqqara as a major religious centre in the first millennium BC.

Bone Report: Dr Salima Ikram

The 17 bones found at Temple Site 1 of the Glasgow Museum Expedition to Saqqara were examined on September 21, 2003. The majority of the remains came from humans (see Table 1), and were clearly disarticulated fragments from Late to Graeco-Roman period mummies. The majority of remains were from hands and feet, although a few vertebral fragments were also recovered. These showed signs of lipping, perhaps caused by arthritis. All the human remains were very dark and looked as if they had been burned, presumably by the application of hot resins. The remaining bones

came from animals, with donkey (*Equus asinus*) being the only species that could be securely identified (see Table 1). All the donkey bones seem to have come from the same animal. The few remaining animal bones consisted primarily of rib fragments, with only one limb bone fragment and one vertebral fragment coming from a medium to large mammal. Clearly all the bones found here during the course of excavation were from disturbed contexts and none was related to the temple activity.

Ob.#	Taxa	Element	Side	Age
83a	E. asinus	tibia	Right	fused & old
83b	Medium mammal	rib fragment	unknown	mature
48	E. asinus	incisor	Right	very worn
85a	Medium mammal	rib fragment	unknown	mature
85b	Medium mammal	rib fragment	unknown	mature
51	Med-large mammal	Limb bone fragment	Unknown	Mature?
46	Medium mammal	Vertebra fragment	Irrelevant	unknown
16	Homo sapien sapiens	Carpal/tarsal	Unknown	mature
34	Homo sapien sapiens	Metatarsal	Unknown	mature
5	Homo sapien sapiens	Vertebra; centrum	Irrelevant	Old?
6	Homo sapien sapiens	Metatarsal	Right	mature
7	Homo sapien sapiens	Humerus fragment	Unknown	unknown
49a	Homo sapien sapiens	Calcaneum fragment	Right	mature
49b	Homo sapien sapiens	Bone fragment	Unknown	unknown
44	Homo sapien sapiens	Limb bone fragment	Unknown	unknown
52	Homo sapien sapiens	Vertebral fragment	Irrelevant	mature
17	Homo sapien sapiens	Tarsal fragment	Unknown	unknown

Table 1

Geoscan Gradiometer surveys.(Figs. 1, 3 & 4) Dr Jon Dittmer

The magnetic gradiometer is an instrument that enables the surveyor to measure the earth's magnetic field very accurately. The device is moved across the surface of the area being surveyed and readings are taken approximately every 25cm. This fine density of readings gives an accurate picture of the variations in the magnetic field. As two sensors are used, the instrument is very sensitive to local variations caused by shallow-buried (up to 4 - 5 metres) archaeological features. Features that contain concentrations of magnetic compounds (in particular iron) such as mud brick, ditches, kilns, hearths etc produce measurable anomalies. Due to the diversity of features on the site, the concession area is eminently suitable for this instrument. (Fig.1)

The Serapeum to AbuSir Area

This area covers the large predominantly flat sand-covered region to the north of the Serapeum and to the northeast down the valley to the village of AbuSir. Following our extensive geophysical coverage of 2002 and the discovery of many tomb structures and a complicated area of structures which could be large tombs subdivided by smaller burials, workshops or living quarters. It was decided to extend this survey to the edge of the cultivated area of Abusir and the scrub coverage of what is considered the Old Lake of AbuSir.

Fig. 3 shows the present extent of the survey which has again discovered many new tombs and it is obvious that many of the structures are similar to early dynastic finds made by Emery in the 1950's. (Fig. 4)

The extent of the geophysical coverage now gives a very accurate plan of the existing mudbrick structures located in the valley between the Serapeum and the high outcrops containing the tomb of Ka'Aper and the work of the Czech mission.

A total of 164 grid squares measuring 30m were observed giving 662,400 data points. Once again the equipment proved very successful in locating mud brick structures and as can be seen on Fig. 3, lines of very interesting anomalies appear to stretch in a northwest – southeast direction down the valley between the Sacred Animal Necropolis and the excavations of the Czech concession. (Fig. 3)

Items of particular interest are:

1. The appearance of a large mastaba tomb, measuring some 50 metres by 20 metres. See Fig.4. It clearly has two chapels in the eastern wall, the southern being larger than the northern. This style corresponds to mastaba tombs found by Emery on the higher ground to the east. These are of 2nd dynasty date and might give an indication of the date of this monument. The survey of 2002 also revealed a number of similarly sized monuments.
2. Unfortunately, due to the large spoil heaps left by Emery's excavations in the SAN, it is not possible to determine the eastern extent of this cemetery.
3. The major area surveyed in 2003 was the area to the north east of the 2002 survey, laying to the south of Abusir. The large white spots clearly evident in the data are due to large steel posts; Survey of Egypt steel markers and SCA lamp standards.

Within this area there are far fewer structures visible than are visible on the valley floor and on the western side of the wadi. However, a number of features are evident.

a. A long, curving linear feature running from the wadi floor, next to the large bluff, up to a series of mudbrick structures. Could this be a road?
b. The series of structures at the top of the 'road'. It should be noted that whilst conducting the survey, a large limestone wall was clearly visible to the west of these buildings.
c. A number of probable mastabas can be seen to the south of the road. These are of similar dimension to structures found on the western side of the wadi in the Czech mission concession..
d. A number of disjointed mudbrick structures are visible in the so-called lake. The deep and fairly thick grass prevented surveying in much of the lake area.

The third area surveyed during 2003 was a region to the west of the 2002 survey. The area straddled the slopes of the valley floor and the area on the top of the cliff. The cliff is clearly visible in the data, as a distinct change in the orientation of the mudbrick structures. Structures on the top of the cliff have a general north-south orientation. Those below the cliff tend to follow the contours of the slope.

There are a number of interesting building shapes and floor plans in the structures found beneath the cliff line. Of particular note is a courtyard containing distinctive rows of column bases.

Geological field survey (Colin Reader, Geologist)

Soils Investigation of the former Abusir lake area

Introduction

Geological studies undertaken in 2001 and 2002, as part of the Saqqara Geophysical Survey Project (SGSP) have addressed the solid geology of the site. For the 2003 field season, attention was focused on the superficial geology (the soils) of the northern-most part of the SGSP concession - the area generally referred to as the former Abusir Lake.

The supposed area of the Abusir lake, at the northern-most part of the Saqqara necropolis, is characterised by an area of sparse scrub vegetation which, from south to north, trends from a thin, low-lying cover of thorn bushes, through more abundant coarse grasses to stands of palms (Plate 4). The area of palms was outside the SGSP concession and did not, therefore, form part of the study area. Extending to the north and east from the study area, are the well-vegetated areas of the cultivated Nile Valley.

Objectives

The objectives of the 2003 geological component of the SGSP fieldwork were to examine the evidence for the presence, extent and nature of the area of the former Abusir lake and to determine, if possible, how this feature may have influenced the location of ancient built-development in the North Saqqara/ South Abusir area.

Site Description

The study site covers an area of approximately 220m from north to south by 190m from east to west at the widest point. Topographically this is one of the lowest-lying areas of the SGSP concession, generally lying below 22m (amsl (above mean sea level) at the northern end of the Abu Sir wadi.

Soil cover was predominantly recent wind-blown sand, however, it was noted that heavy cohesive soils were exposed along the eastern and western flanks of the vegetated area, between approximately 21m and 23m amsl.

Method

In order to investigate shallow soil conditions, a hand auger was used. This produced either 90mm or 60mm boreholes (depending on the auger attachment used) that could be cased through loose soils (using 90mm external diameter plastic casing) to ensure stability of the borehole. Both the auger and the casing could be extended to suit the depths being investigated, which were anticipated to be up to 4m below ground level (bgl).

200mm long auger attachments were used, with the boreholes advanced incrementally and the sampled soil brought to the surface for examination and logging after each 200mm increment. The soils extracted using the auger were described in general accordance with British Standard BS5930: 'Code of Practice for Site Investigations', however, the BS required modification to accommodate the non-UK archaeological setting of the investigation. Groundwater observations were also made during augering works.

Given the difficulty in removing cores augered through loose dry sand (even with the use of casing) at times it was found necessary to add water to the bores to assist with the investigation. The addition of water was minimised as far as possible.

No samples of soil were recovered during the investigation and, on completion; each borehole was backfilled using the soils removed from the bore. All boreholes were surveyed to give accurate data on position and elevation relative to mean sea level.

A total of thirty-five hand auger holes (HA 1 to 10, HA 11a, 11b, 11c, 11d and 11e and HA 12 to 31) were completed between 18th and 26th October 2003 to depths ranging from 0.6m (HA 16) to 4.3m (HA 10). The positions of all auger holes are given on the attached drawing (Figure 5) which also shows that, with a number of exceptions, the boreholes were positioned to produce a long-section (Section C-D, Fig. 7 running approximately north south) and a cross-section (Section A-B, Fig. 6 running approximately east-west) within the vegetated area. Detailed hand auger records for each borehole are recorded.

Ground Conditions

In general, ground conditions consisted of up to 2m of recent windblown sand overlying soils which were predominantly granular but contained varying proportions of dark humic material. Within the dark-coloured soils, mudbrick structures were encountered, together with fragments of red/black pot and occasional shell fragments. In limited areas of the study site, the dark soils encountered were more cohesive with occasional fine roots.

Underlying the dark soils, coarse gravelly sands were encountered in the majority of boreholes. Groundwater was generally encountered in these coarse sand deposits. Close to the limits of the vegetated area, where sand cover was thin or absent, stiff green grey silty clay was encountered.

The predominant soils types encountered are described below, and each has been given a generic name for ease of subsequent discussion.

Recent windblown sand

Typically: Loose yellow brown fine SAND with occasional fine to medium rounded gravel

Inundation Deposits

Typically: Medium dense brown or grey brown silty SAND with some rounded fine and medium gravel and rare shell fragments.

Still Water Deposits

Typically: Medium dense/firm brown/grey brown clayey sandy SILT/ CLAY with rare rounded fine gravel and occasional fine roots.

Mudbrick

Typically: Medium dense/firm brown sandy SILT with occasional roots and pot fragments

Ancient Wadi Floor Deposits

Typically: Medium dense (yellow) brown coarse SAND with fine to coarse rounded gravel.

Weathered Basal Shale

Typically: Firm grey/green brown silty CLAY with some evaporite veins.

Interpretation and Discussion

Data for each borehole, including position, ground level, groundwater conditions and the reduced level of all soil types encountered is given on the attached Table T- 'Summary Of Exploratory Holes'. In preparing this table, an interpretation has been made of the soils encountered, which has allowed each stratum recorded on the exploratory hole logs to be identified with one of the generic soil types described above. Using the data presented in the 'Summary Of Exploratory Holes' (Table T), illustrative Sections A-B and C-D (Figures 6 and 7) have been produced.

As the two sections show, the data obtained during the SGSP soils investigation of the former Abusir lake has established that, before the covering of recent windblown sand deposits, this area was subject to the deposition of fine dark-coloured organic-rich soils. As discussed below, this dark coloured soil suggests that the area was subject to a complex history of flooding and indicates that, rather than a true lake (i.e. a body of permanent standing water) the area more likely represents an inundation basin, affected by seasonal flooding associated with the Nile.

This conclusion is based on an assessment of the darker coloured deposits which generally were encountered underlying the Recent Windblown Sands. For the purposes of interpretation, these darker coloured deposits have been differentiated on the basis of a visual assessment of their sand, silt and clay content, as the 'Inundation Deposits' and the 'Still Water Deposits'.

The most extensive of these two soil types were the Inundation Deposits, which were found across most of the area south and east of HA 12. The inundation deposits were predominantly sands with a subordinate fines (i.e. silt and clay) fraction. These soils are considered to have been formed in a generally arid environment characterized by soils analogous to the underlying Ancient Wadi Floor Deposits (i.e. gravelly sands) into which Nile silts were deposited during the annual inundation. These soils showed little evidence of life, consistent with the supposed transient nature of the wet environment at these locations, with no significant root content and only fragmentary shell inclusions. The shell inclusions that were observed were probably deposited by the inundation rather than being derived from local fauna.

Of secondary importance, in terms of their distribution, are the Still Water Deposits, in which the relative proportions of silt and clay were visually assessed to be dominant, with the sand fraction being subordinate, though rarely absent. These soils were encountered in the northern section of the area investigated (HA 12 and 26 to 28) and in the west of Section A-B (HA 19 to 23). Within these soils, occasional roots suggest limited vegetation growth, indicative of more prolonged or even permanent habitats. As the generic name suggests, it is considered that these Still Water Deposits were laid down in areas of the inundation basin that were poorly drained and, therefore, able to retain water after the floods had receded. These areas, therefore, sustained bodies of low-energy water for

much if not all of the year, allowing fine sediments suspended in the floodwaters to settle out and to accumulate over the Ancient Wadi Floor Deposits.

The distribution of the Inundation and Still Water Deposits suggested on the attached Sections is somewhat interpretative, relying as it does on the identification of boundaries between the soils. In reality the distribution between the soil types is marked by gradations in the sand, silt and clay content of the soils rather than definite boundaries as suggested on the sections (Figures 6 and 7). Whilst the clayey soils encountered in HA 27, for example, are undoubtedly the result of deposition of fine soils under prolonged still-water conditions, the sandy silts encountered m HA 19 are associated with a somewhat different environment for which the likely duration of inundation is more difficult to establish. Therefore, whilst areas of largely permanent standing water can be identified from the available data, these appear to be limited in extent and, for the area available to the investigation, are not sufficiently extensive to indicate the presence of a true 'lake'.

It is possible, however, that areas beyond the northern limit of the concession, closer to the pyramids of Abusir were occupied by more extensive areas of standing water and it must be accepted that the presence of a 'lake' further to the north can not be ruled out. Indeed investigations undertaken within 1km of the northern limit of the SGSP concession by Dr David Jeffreys, as part of the Survey of Memphis[5], encountered significantly thicker deposits (up to 2m) of grey brown silt (Survey of Memphis HA 155) which may be analogous to the Still Water Deposits discussed in the present paper and, if so, suggest much more prolonged and extensive still water conditions to the north.

In addition to the complex variation in spatial distribution of Inundation Deposits and Still Water Deposits discussed above, it was evident from the findings of the 2003 SGSP soils investigation that the distribution of these water-lain deposits varied with time. A number of exploratory holes (HA 6, 11A, 14, 17, 18 and 20) encountered mudbrick which appeared to form structures (determined by the presence of regular bands within the mudbrick, which are considered to be the mortar beds between courses. As far as could be established from the hand auger work, the mudbricks generally encountered were in the order of 15cm high).

The mudbrick was generally found at the margins of the dark water-lam soils that were encountered during the soils investigation (see Section A-B, Figure 5), however, in a number of cases (HA 11A and HA 20) the mudbrick was located within the area of water-lain deposits. It is considered unlikely that mudbrick construction would have deliberately been placed in a position known to be subject to regular or sustained annual inundation and the presence of mudbrick in these exploratory holes suggests that the locations concerned where, for significant periods of time, above the limits of the inundation and, therefore, predominantly dry.

A further indication of the temporal variation within the former 'lake' of Abusir comes from HA 20 (see Figure 6) in which two layers of mudbrick were encountered separated by a thin (5cm) layer of yellow brown sandy soil. This sequence suggests an early phase of development (the lower mudbrick), which was abandoned due to inundation, and was subsequently denuded, before short-lived arid conditions re-established allowing a second phase of mudbrick construction to take place (the upper mudbrick), before the site was finally abandoned.

Whilst these temporal variations in conditions may provide clues to the changing climate in ancient Egypt, without excavation and dating of the mudbrick and any associated remains it will not be

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[5] Jeffreys, D. (Journal of Egyptian Archaeology, 87, 2001), 14-15

possible to establish whether this evidence fits the know climatic record and, therefore, truly represents variations m the climate or is simply the result of small-scale local factors.

Solid Geology in the Context of the Former Abu Sir Lake.

The objectives of the 2001 and 2002 field seasons were to map the solid geology of the SGSP concession and to develop the earlier work undertaken by Youssef et al[6]. In order to explain the distribution of solid strata across north Saqqara, Youssef et al discussed possible faulting that had taken place in remote geological time.

Youssef et al identified two faults in the area, the first, a north-south trending fault, which was observed in the field (to be referred to as Fault A), defined the eastern limit of the Abusir wadi, with the higher pyramids plateau rising to the immediate east of the fault. Youssef et al also conjectured a second fault (Fault B), with a north west-south east alignment, which ran through the area of the former Abusir Lake.

On the basis of the fieldwork undertaken as part of the 2001 and 2002 SGSP fieldwork, it was argued that there was no need for the conjectured Fault B and that the distribution of exposed strata identified by Youssef et al could be explained in terms of the topography of the site. As discussed below, this conclusion has been further confirmed by the 2003 SGPS fieldwork in the vicinity of the Abusir Lake.

A number of hand auger holes encountered firm to stiff grey and grey green silts and clays with fine gravel of evaporite along the eastern and western flanks of the former 'lake' area. These soils have been interpreted as weathered Basal Shales and represent an exposure of the lowest and, therefore, earliest solid strata exposed at Saqqara.

Previously the only other exposure of the Basal Shales exposed at the site was at the eastern foot of the pyramid plateau, at a reduced level in the order of 35m amsl. The presence of Basal Shales at levels below 23m amsl, in the vicinity of the former Abusir Lake, can not be explained by the regional dip, which is gentle and generally considered to be to the south. The lower lying exposures of Basal Shale in the vicinity of the former Abu Sir lake are, therefore, considered to be the result of down-throwing of strata to the west of Fault A, an interpretation which is consistent with the accepted geology of the site.

Overlying the Basal Shales are the Upper Calcareous Beds, which represent the exposed strata that forms both the main pyramid plateau at Saqqara and the higher ground leading up from the Abusir 'lake' towards the pyramids of Abusir to the west. These beds are generally considered to be in the order of 22m thick[ref 2]. On this basis, with the top of the Basal Shales encountered at levels in the order of 23m amsl in the vicinity of the Abusir lake, the top of an unfaulted sequence of the Upper Calcareous Beds (i.e. without disturbance from Fault B as conjectured by Youssef et al) would be expected to be at a level of approximately 45m amsl.

As discussed in previous reports on the findings of the 2001 and 2002 SGSP fieldwork, the top of the Upper Calcareous Beds to the west of the Abu Sir lake has been interpreted as being at a level in the

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[6] M. Youssef, 0. Cherif, M. Boukhary and A. Mohamed, Geological Studies on the Saqqara Area, Egypt (Neues Jahrbuch fur Geologie Palaontologie 186, 1984), 125-144.

order of 40m amsl, sufficiently in accordance with the estimated level of 45m amsl discussed above. This further confirms that, as previously suggested by the SGSP fieldwork, there is no need to invoke the presence of a fault (Fault B) at the location conjectured by Youssef et al.

Conclusions

Though clearly subject to inundation during the Pharaonic period, the area of the former Abusir Lake within the concession of the Saqqara Geophysical Survey Project appears generally to have been an inundation basin with only limited areas in which standing water was maintained for any significant period of time.

The evidence of built-development using mudbrick, within the former lake area, suggests that as conditions varied, the extent and height of the inundation also changed. Without excavation and dating of the various mudbrick elements encountered, however, it is not possible to state whether the varying conditions were due to local or regional influences.

Pottery Study (Dr Carla Gallorini, ceramicist) (Figs. 8, 9 &10, Plates 2 & 3)

The work on the ceramic material from the sondage at Temple Site 1 was carried out alongside the excavation. The amount recovered daily was manageable and by the end of the season all the excavated pottery had been sorted and recorded, the diagnostics were drawn and photographed and, with the exception of a few selected sherds, all the ceramic material was deposited back on site.

In all c.1600 sherds were unearthed, half of which was too small and eroded to be positively identified. Of the 274 diagnostics found, 131 were drawn and the rest typed to drawings already present in the corpus if a good match (that is same profile, same stance and similar diameter) was found. The body-sherds were sorted by fabric and surface treatment, possible relations to any of the diagnostics in the same context were recorded, and then they were counted and discarded.

The majority of pottery comes from the clean sand ubiquitous on site outside the platform (context 500) and from context 502, a highly contaminated surface stratum of sand mixed with decayed mud-brick. Overall the number of complete vessels recovered was minimal and the bulk of the material amounts to fragmented sherds. Moreover potentially interesting contexts, like the original fill of the temple platform, were remarkably uninformative, with few, very small diagnostics and many badly eroded sherds. It all contributes to a general feeling of residual debris rather than one of association with the architectural structure.

An exception is context 546, a pottery dump just east of the main cross wall of the temple platform. The pottery was damaged, possibly by the collapse of the nearby wall, but it was possible to reconstruct the complete profile of most vessels. The assemblage consists of at least 3 amphorae, all of the same type (fig. 8, 2055), with folded rim, tall cylindrical neck and a set of two opposite, vertical handles. Parallels from Buto and Naukratis suggest a date between the end of the 3rd and the middle of the 2nd century BC. In the same context we also find cups and bowls of various shapes (a selection is illustrated in fig. 8), a cooking pot and two jars, all datable to the same chronological phase.

The rest of the ceramic material from Temple Site 1 is mainly utilitarian in nature. Open forms are by far the most common, usually in a sandy Nile clay and with red slip. There are small plates with thickened rim and flat base, small and medium-size carinated dishes with round base, carinated bowls with flat base and incurved bowls with ring base. Most of these shapes have a very long life span, covering both the Late and the Ptolemaic Period, but the sandiness of the fabric and the use of red slip fit better a Ptolemaic date. Cooking pots and casseroles are also common, and so are torches. Small and medium-sized jars and jugs in marl clay are rare and the bulk of the closed shapes is constituted by amphorae, both Egyptian and imports (from South Palestine and the Aegean). A selection of the most complete types is illustrated in Figures 9 and 10. Although most of the open shapes also occur in burial sites overall the emphasis here seems to be on storing supplies, cooking and eating.

Bearing in mind what has been said above on the fragmentary nature of the pottery, and its lack of clear association with the structure, the datable, diagnostic ceramic material suggests a life span for the site ranging from the 5th century BC to the mid-Ptolemaic.

Conclusions – Ian Mathieson

Our work this year has once again proved the value and accuracy of the geophysical and topographic surveys. The use of the gradiometer to delineate sub-surface features has been amply proved by the small-scale *sondage* trenches excavated in 2001 and 2002 to test the anomalies. In all cases the accuracy of the topographic survey has enabled the *sondage* to be opened exactly over the anomaly shown by the geophysical data. The saving of labour time and the ability to keep the excavation to strict size limits, means the environmental damage is controlled and at the same time enhancing the archaeological interpretation of the site.

The geophysical survey was extended on the north side of the Serapeum and covering the valley down to the remnant Lake of Abusir we can now say that we have found or rediscovered the sub-surface signatures of the tombs and chapels reported by De Morgan and Mariette in 1882-1889.[7] What is interesting is that there appears to be many more features in this area than those recorded by the two excavators. We have now extended the geophysical survey to the north and east to join our work with the concession of the Czech Archaeological Mission, which should be of mutual benefit to the Saqqara office of the Supreme Council of Antiquities and future excavators.

Also of benefit to all concerned was the geological survey work carried out this year to investigate the area once covered by the Lake of Abusir with the discovery that sub-surface structures existed within the supposed lake area and that the probable permanent lake was much smaller than expected, the growth and depth being subject to the annual inundations of the river Nile.

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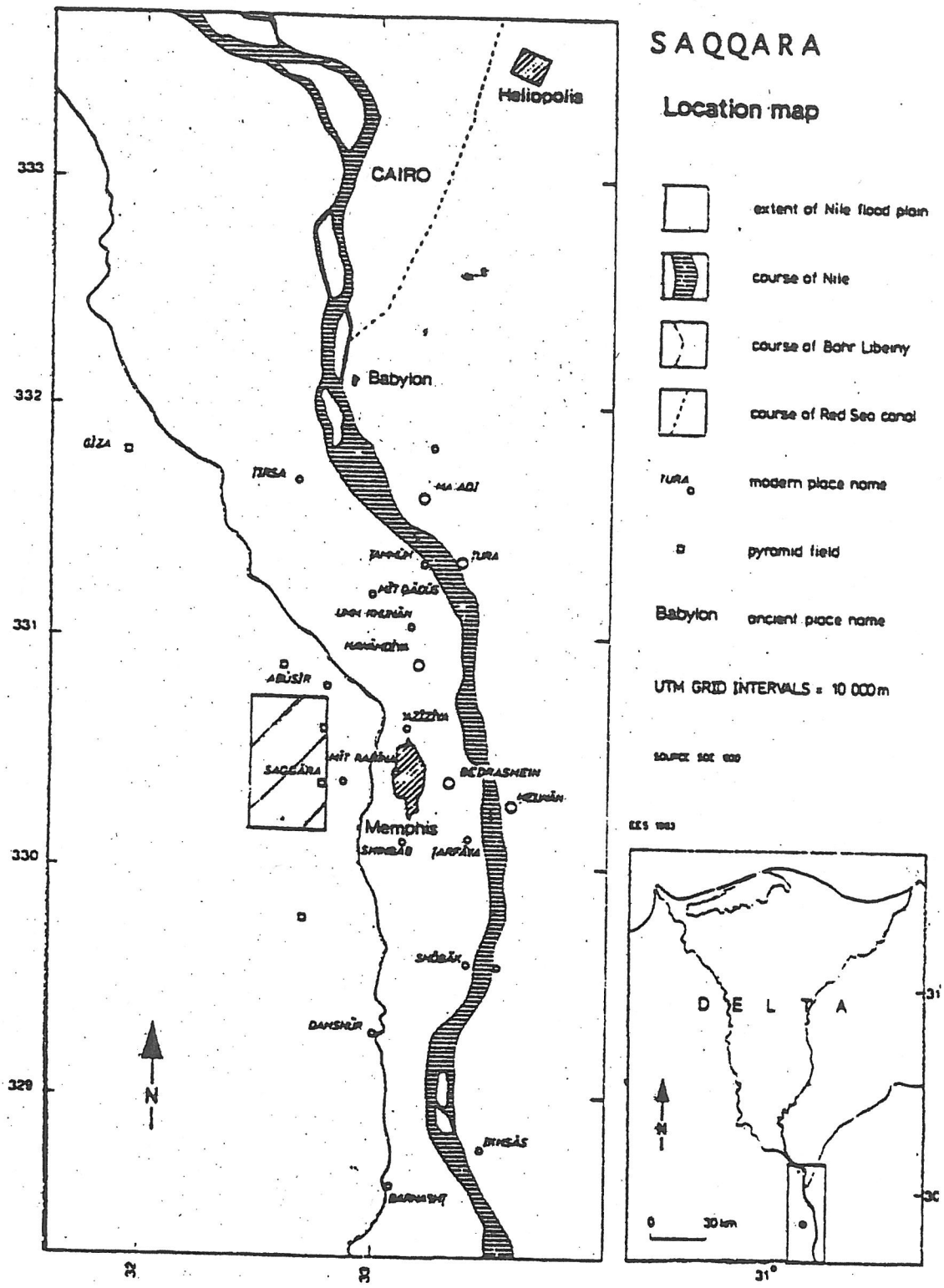
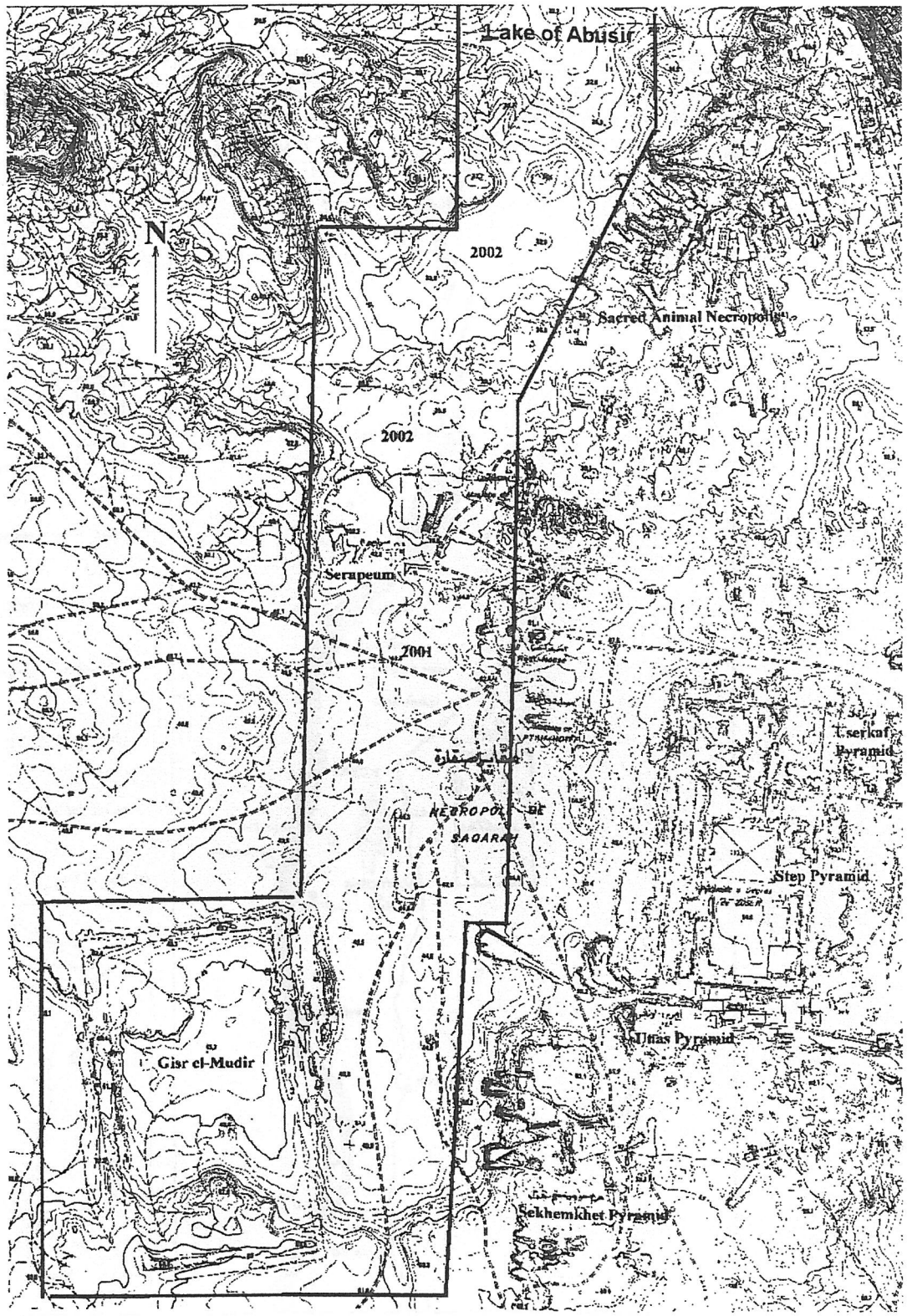
[7] A. E. Mariette, Les Mastabas de l'Ancien Empire. G. Maspero Paris, 1889. J. de Morgan , Carte de la Necropole Memphite . Cairo 1897

With the permission of the Supreme Council for Antiquities the Saqqara Geophysical Survey Project plan to continue the work through 2004 and 2005 and complete the geophysical survey of the concession with particular reference to the Gisr el-Mudir, the proving of the L-shaped enclosure structures and the area between the Serapeum and Sacred Animal Necropolis.

Ian J Mathieson

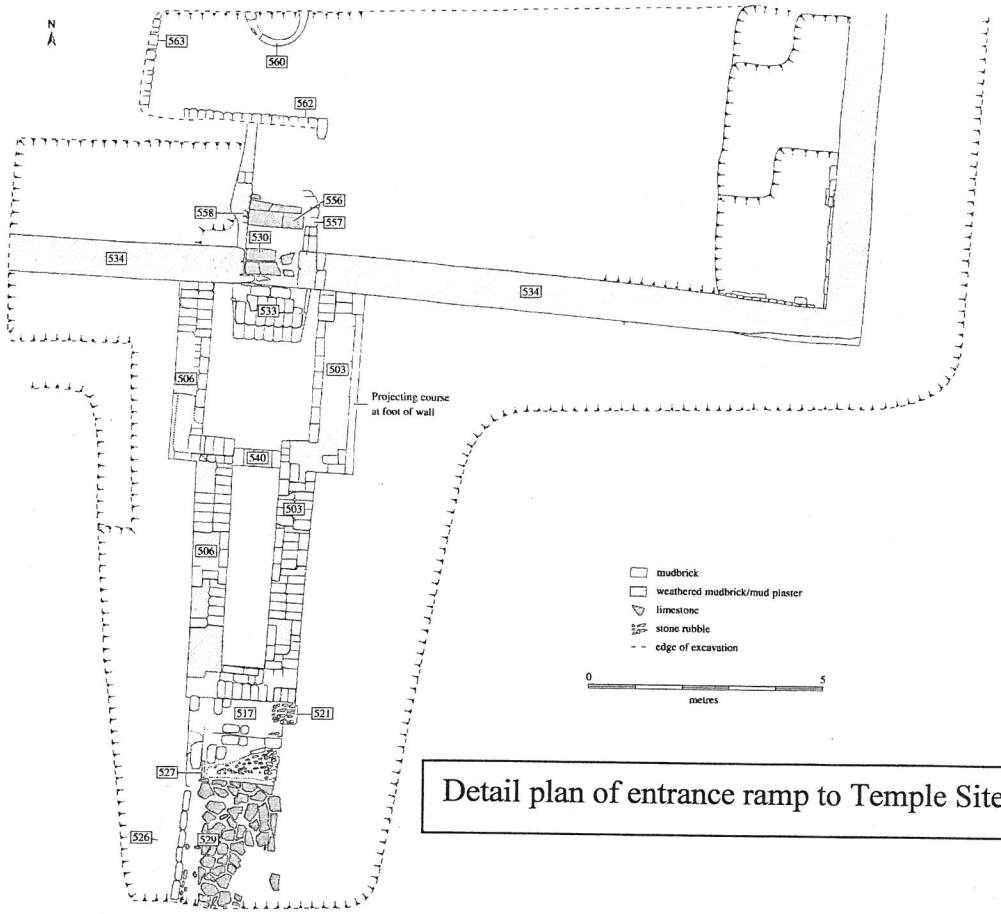
Project Director


SAQQARA
Location map
Heliopolis
CAIRO
Babylon
GIZA
TURA
extent of Nile flood plain
course of Nile
course of Bahr Libeny
course of Red Sea canal
modern place name
pyramid field
Babylon
ancient place name
UTM GRID INTERVALS = 10 000m
Memphis
SAQQARA
ABUSIR
DAHSHUR
D E L T A
N
0
30 km
333
332
331
330
329
31°

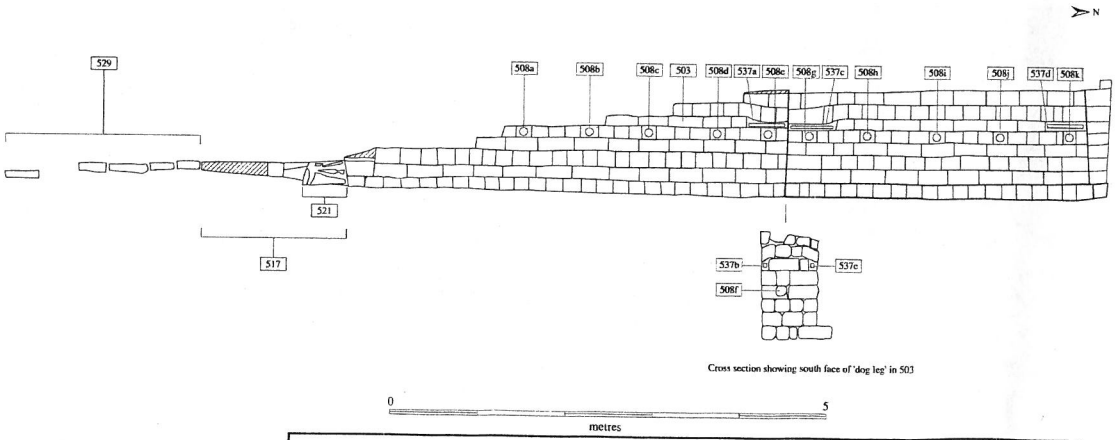


Saqqara Geophysical Survey Report
Survey Concession Area

Fig. 1



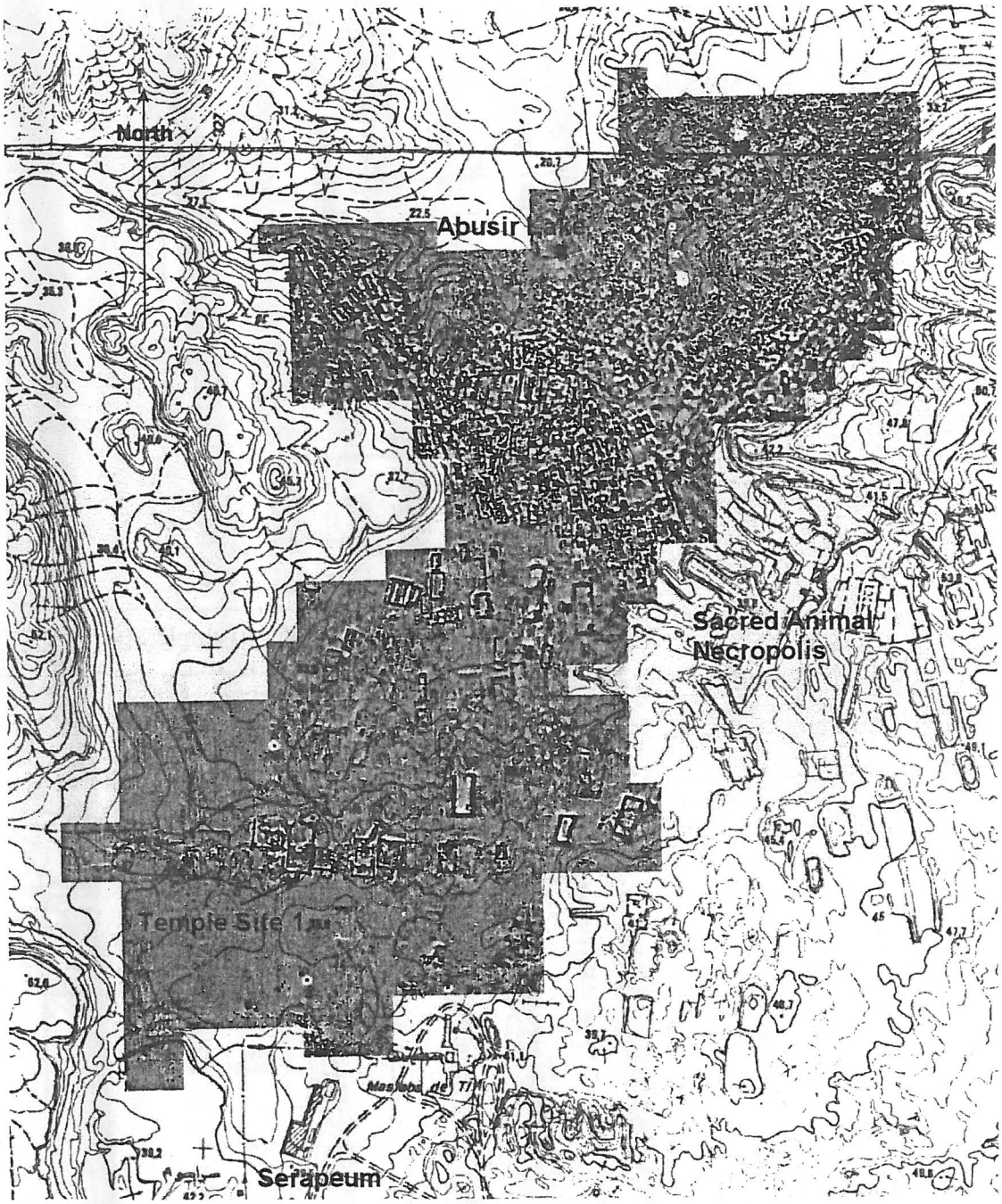
Detail plan of entrance ramp to Temple Site 1



Elevation of east face of entrance ramp to Temple Site 1

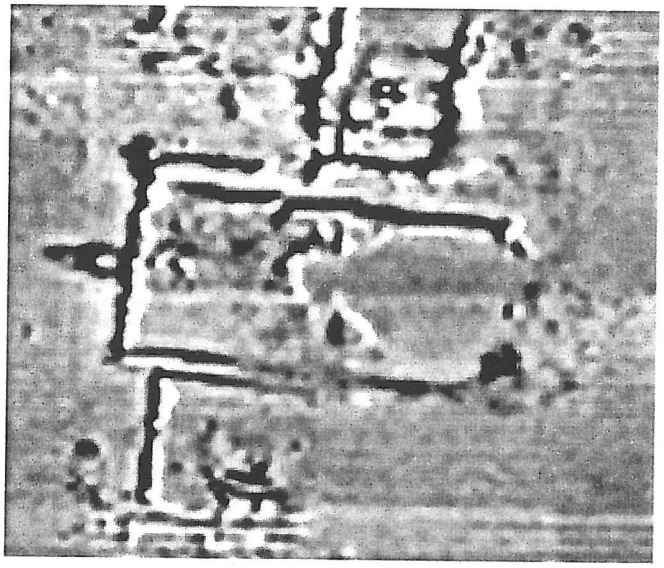
Saqqara Geophysical Survey Project
Temple Site No.1 Entrance Ramp

Fig. 2



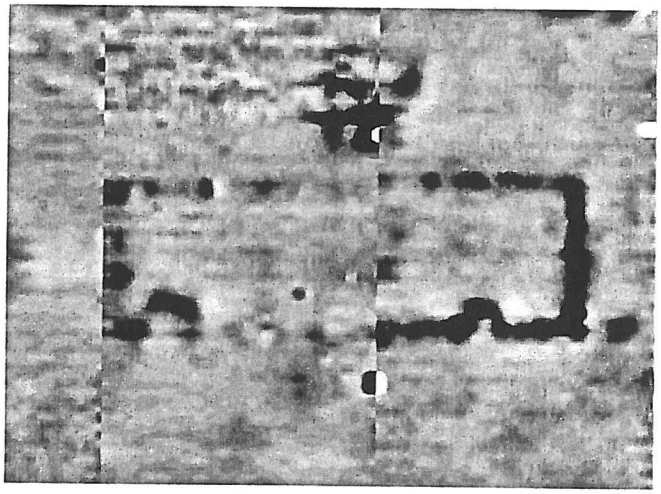
Saqqara Geophysical Survey Project
Composite Topographic and Geophysical Plan
of 2003 survey work

Fig. 3



Temple 1 Site

The geophysics plot clearly shows the entrance ramp and external retaining walls. See Fig.3 for the position of the temple in the line of similar structures to the north of the Serapeum and Fig. 2 for the excavation of the ramp.



A very large 50m x 30m structure shown by the geophysics to have a very similar layout and size to the 2nd Dynasty Tomb 2302 described by Emery, Archaic Egypt, p 94 (1961). See Fig. 3 to the west of the Sacred Animal Necropolis.

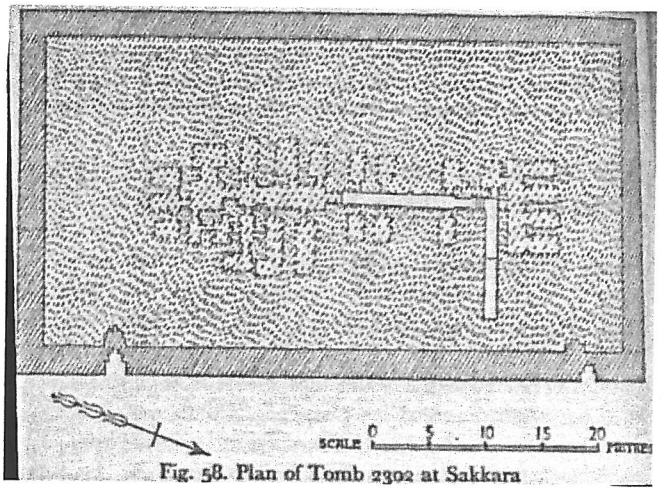
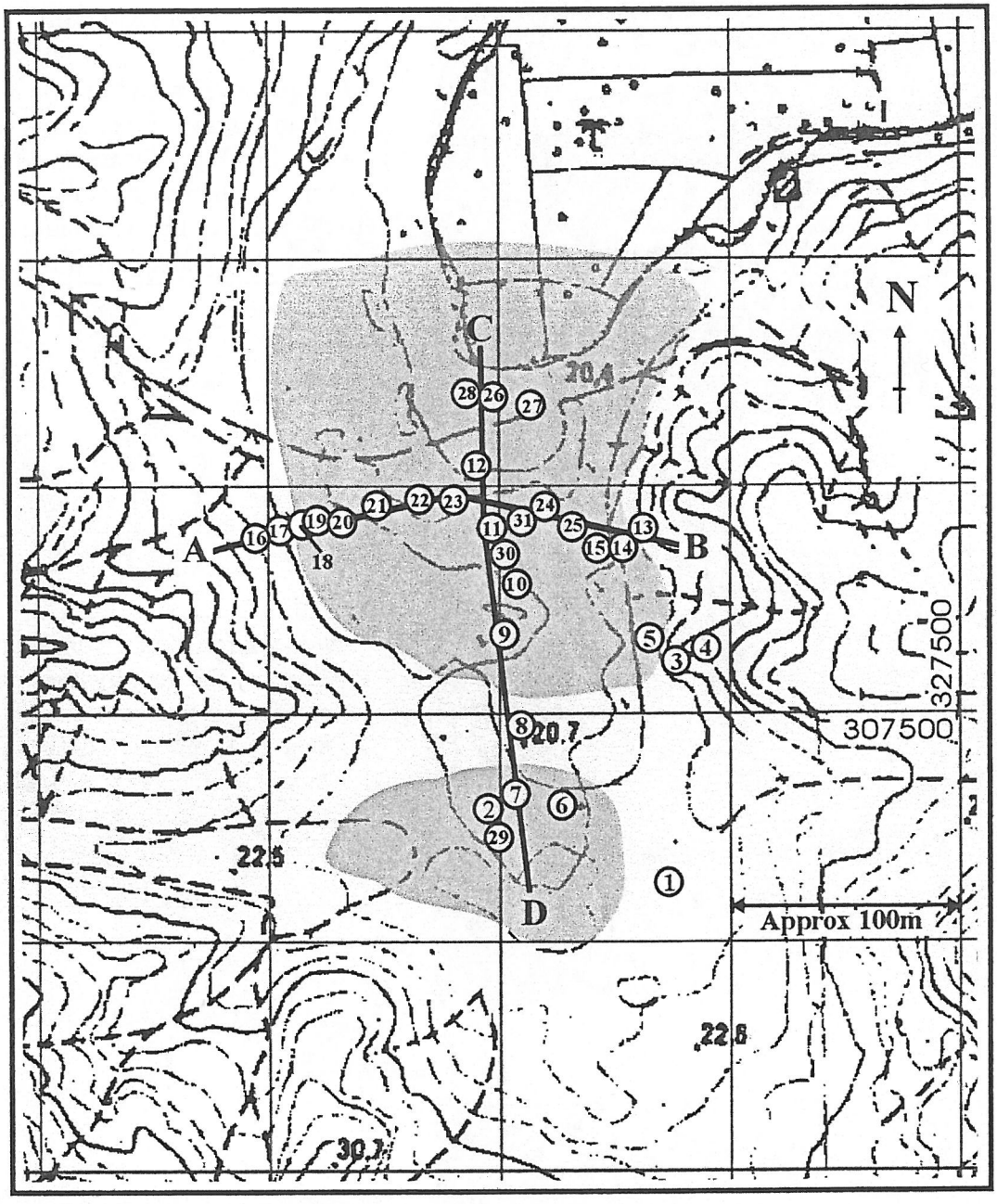


Fig. 58. Plan of Tomb 2302 at Sakkara

Plan of Tomb 2302 as shown in Emery, Archaic Egypt, p94 (1961)

Saqqara Geophysical Survey Project
Temple Site 1 and early Dynastic Tomb

Fig. 4

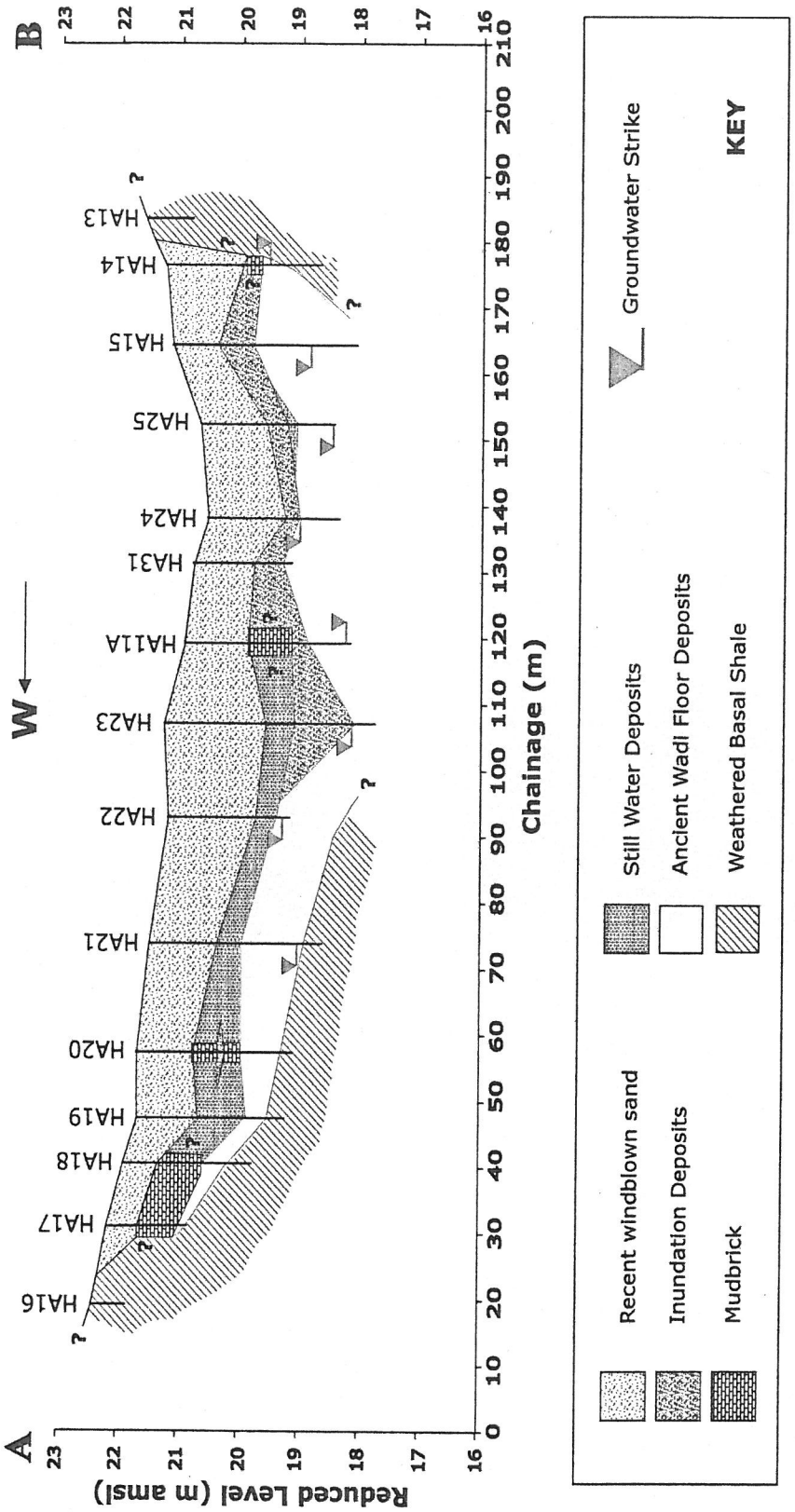


SAQQARA GEOPHYSICAL SURVEY PROJECT
SOILS INVESTIGATION OF THE FORMER ABUSIR LAKE

Hand Auger Locations and Lines of Section A-B and C-D

(Shaded areas represent the approximate extent of vegetation at the time of the survey - October 2003)

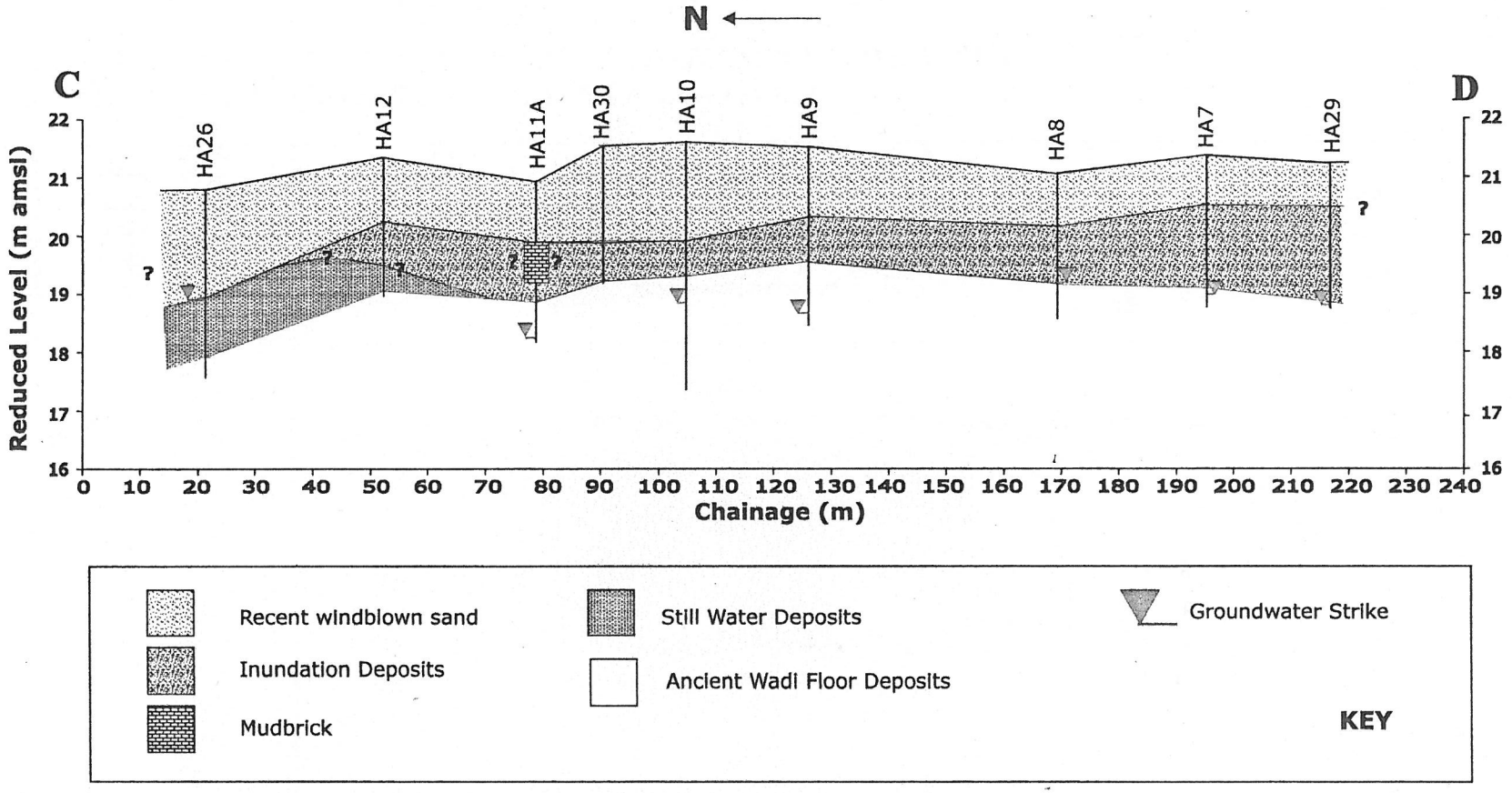
Fig. 5



SAQQARA GEOPHYSICAL SURVEY PROJECT
SOILS INVESTIGATION OF THE FORMER ABUSIR LAKE

Section A-B

Fig.6



SAQQARA GEOPHYSICAL SURVEY PROJECT
SOILS INVESTIGATION OF THE FORMER ABUSIR LAKE

Section C-D

Fig. 7

HA	DEPTH (m)	EASTING	NORTHING	GROUND LEVEL (m amsl)	BASE OF BOREHOLE (m amsl)	SOILS ENCOUNTERED	DEPTH TO BASE OF SOIL TYPE (m bgl)	RL AT BASE OF SOIL TYPE (m amsl)	DEPTH OF GROUNDWATER (m bgl)	REDUCED LEVEL OF GW (m amsl)
1	3.2	327367.5	307429.1	21.396	18.196	Recent windblown sand	2.5	18.896	2.9	18.496
						Ancient Wadi Floor Deposits/obstruction?	?			
2	3.2	327293.3	307459	21.43	18.23	Recent windblown sand	2.07	19.36	2.76	18.67
						Inundation deposits	2.67	18.76		
						Ancient Wadi Floor Deposits/obstruction?	?			
3	2.9	327370.9	307522	22.1	19.20	Weathered Basal Shales	?		None	
4	0.95	327382.8	307526.7	23.64	22.69	Weathered Basal Shales	?		None	
5	3.14	327359.8	307531.6	21.77	18.63	Recent windblown sand	0.36	21.41	None	
						Inundation deposits	1.05	20.72		
						Weathered Basal Shales	?			
6	3.1	327324.2	307461.3	21.22	18.12	Recent windblown sand	0.4	20.82	2.48	18.74
						Mudbrick	2.52	18.7		
						Ancient Wadi Floor Deposits	?			
7	2.6	327304.6	307466	21.38	18.78	Recent windblown sand	0.84	20.54	2.4	18.98
						Inundation deposits	2.29	19.09		
						Ancient Wadi Floor Deposits	?			
8	2.49	327306.4	307494.1	21.07	18.58	Recent windblown sand	0.9	20.17	1.88	19.19
						Inundation deposits	1.91	19.16		
						Ancient Wadi Floor Deposits	?			
9	3.1	327299.6	307533.6	21.54	18.44	Recent windblown sand	1.2	20.34	2.88	18.66
						Inundation deposits	2	19.54		
						Ancient Wadi Floor Deposits	?			
10	4.3	327304.9	307554.1	21.64	17.34	Recent windblown sand	1.74	19.9	2.8	18.84
						Inundation deposits	2.34	19.3		
						Ancient Wadi Floor Deposits	?			
11A	2.75	327295.2	307578.8	20.92	18.17	Recent windblown sand	1.04	19.88	2.67	18.25
						Mudbrick	1.73	19.19		
						Inundation deposits	2.05	18.87		
						Ancient Wadi Floor Deposits	?			
11B	2.6	327291.9	307576.6	21.09	18.49	Recent windblown sand	1.58	19.51	2.48	18.61
						Inundation deposits	1.72	19.37		
						Ancient Wadi Floor Deposits	?			
11C	2.1	327295.1	307581.3	21.09	18.99	Recent windblown sand	0.98	20.11	2.03	19.06
						Inundation deposits	1.7	19.39		
						Ancient Wadi Floor Deposits	?			
11D	2.1	NOT RECORDED				Recent windblown sand	1.28		1.9	
						Still Water Deposits	1.42			
						Ancient Wadi Floor Deposits	?			

Table T - Summary Of Exploratory Holes

HA	DEPTH (m)	EASTING	NORTHING	GROUND LEVEL (m amsl)	BASE OF BOREHOLE (m amsl)	SOILS ENCOUNTERED	DEPTH TO BASE OF SOIL TYPE (m bgl)	RL AT BASE OF SOIL TYPE (m amsl)	DEPTH OF GROUNDWATER (m bgl)	REDUCED LEVEL OF GW (m amsl)
11E	1.9	327297.2	307577.1	21.08	19.18	Recent windblown sand	1.12	19.96	DRY	
						Still Water Deposits	1.67	19.41		
						Ancient Wadi Floor Deposits	?			
12	2.39	327288.6	307603.5	21.34	18.95	Recent windblown sand	1.09	20.25	DRY	
						Inundation deposits	1.84	19.50		
						Still Water Deposits	2.29	19.05		
						Ancient Wadi Floor Deposits	?			
13	0.8	327356.9	307577.5	21.6	20.80	Weathered Basal Shales	?		DRY	
14	2.6	327346.3	307569.4	21.28	18.68	Recent windblown sand	1.37	19.91	1.7	19.58
						Mudbrick	1.6	19.68		
						Ancient Wadi Floor Deposits	2.27	19.01		
						Weathered Basal Shales	?			
15	3.09	327339.5	307569.3	21.17	18.08	Recent windblown sand	0.76	20.41	2.3	18.87
						Inundation deposits	1.37	19.8		
						Ancient Wadi Floor Deposits	?			
16	0.6	327200.9	307575.2	22.41	21.81	Weathered Basal Shales	?		DRY	
17	1.39	327208.7	307577.6	22.19	20.80	Recent windblown sand	0.52	21.67	DRY	
						Mudbrick	1.21	20.98		
						Ancient Wadi Floor Deposits	1.33	20.86		
						Weathered Basal Shales	?			
18	2.2	327215.7	307579.4	21.92	19.72	Recent windblown sand	0.6	21.32	DRY	
						Mudbrick	1.34	20.58		
						Ancient Wadi Floor Deposits	1.77	20.15		
						Weathered Basal Shales	?			
19	2.49	327222.1	307581.5	21.7	19.21	Recent windblown sand	1.02	20.68	DRY	
						Still Water Deposits	1.82	19.88		
						Ancient Wadi Floor Deposits	2.18	19.52		
						Weathered Basal Shales	?			
20	2.6	327231.2	307580.6	21.7	19.10	Recent windblown sand	0.98	20.72	DRY	
						Mudbrick	1.38	20.32		
						Windblown sand	1.43	20.27		
						Mudbrick	1.74	19.96		
						Ancient Wadi Floor Deposits	2.46	19.24		
						Weathered Basal Shales	?			
21	2.8	327247.7	307587.7	21.48	18.68	Recent windblown sand	1.1	20.38	2.46	19.02
						Still Water Deposits	1.52	19.96		
						Ancient Wadi Floor Deposits	2.55	18.93		
						Weathered Basal Shales	?			
22	2.08	327264.2	307590	21.2	19.12	Recent windblown sand	1.49	19.71	1.92	19.28
						Still Water Deposits	1.84	19.36		
						Ancient Wadi Floor Deposits	?			

Table T - Summary Of Exploratory Holes

HA	DEPTH (m)	EASTING	NORTHING	GROUND LEVEL (m amsl)	BASE OF BOREHOLE (m amsl)	SOILS ENCOUNTERED	DEPTH TO BASE OF SOIL TYPE (m bgl)	RL AT BASE OF SOIL TYPE (m amsl)	DEPTH OF GROUNDWATER (m bgl)	REDUCED LEVEL OF GW (m amsl)
23	3.6	327279.3	307589.4	21.25	17.65	Recent windblown sand	1.68	19.57	3.1	18.15
						Still Water Deposits	2.14	19.11		
						Inundation deposits	3.16	18.09		
						Ancient Wadi Floor Deposits	?			
24	2.21	327315	307585.4	20.55	18.34	Recent windblown sand	1.28	19.27	1.53	19.02
						Inundation deposits	1.49	19.06		
						Ancient Wadi Floor Deposits	?			
25	2.23	327327.8	307578.3	20.67	18.44	Recent windblown sand	1.08	19.59	2.18	18.49
						Inundation deposits	1.44	19.23		
						Still Water Deposits	1.62	19.05		
						Ancient Wadi Floor Deposits	?			
26	3.22	327295.4	307632.9	20.78	17.56	Recent windblown sand	1.84	18.94	1.92	18.86
						Still Water Deposits	2.87	17.91		
						Ancient Wadi Floor Deposits	?			
27	2.21	327284.7	307634.6	20.49	18.28	Recent windblown sand	1.38	19.11	1.95	18.54
						Inundation deposits	1.58	18.91		
						Still Water Deposits	1.88	18.61		
						Ancient Wadi Floor Deposits	?			
28	2.14	327310.9	307628.7	20.83	18.69	Recent windblown sand	0.93	19.9	DRY	
						Inundation deposits	1.62	19.21		
						Still Water Deposits	2.03	18.8		
						Ancient Wadi Floor Deposits	?			
29	2.48	327296.9	307450	21.24	18.76	Recent windblown sand	0.73	20.51	2.43	18.81
						Inundation deposits	2.38	18.86		
						Ancient Wadi Floor Deposits	?			
30	2.35	327300.3	307567.2	21.53	19.18	Recent windblown sand	1.62	19.91	DRY	
						Innundation deposits	2.29	19.24		
						Ancient Wadi Floor Deposits	?			
31	1.62	327307.8	307580.9	20.79	19.17	Recent windblown sand	1.02	19.77	DRY	
						Innundation deposits	1.51	19.28		
						Ancient Wadi Floor Deposits	?			

Table T - Summary Of Exploratory Holes

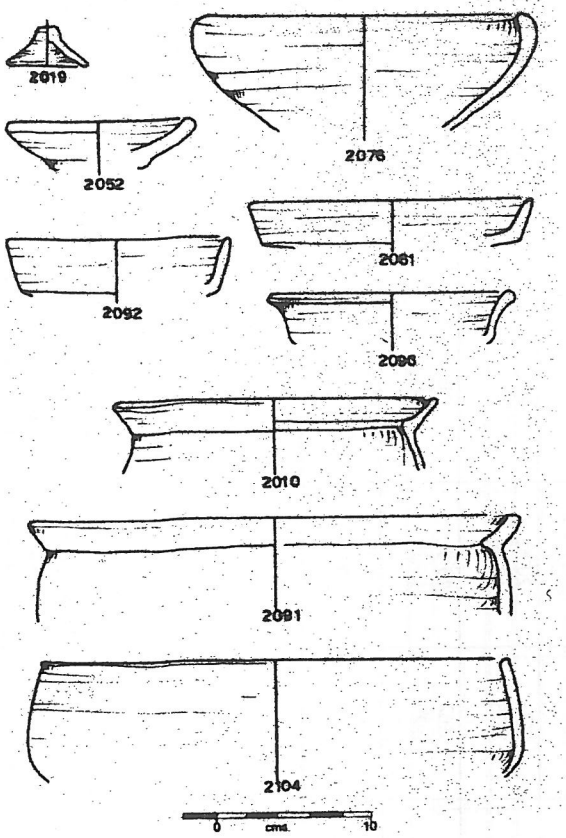


Fig.9

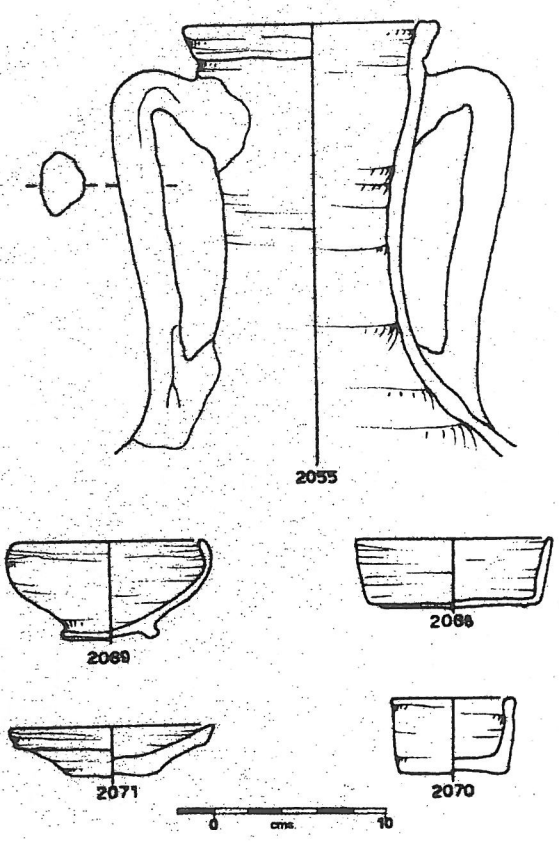


Fig. 8

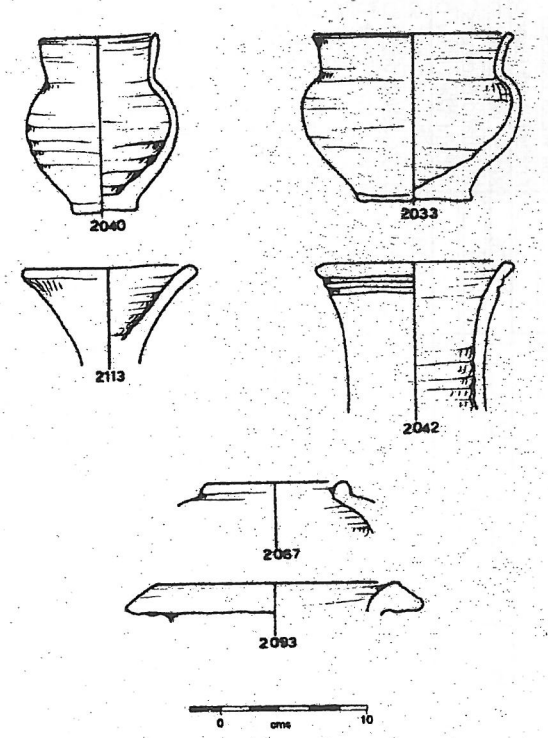


Fig. 10

Ceramic material from Temple Site 1

Saqqara Geophysical Survey Report

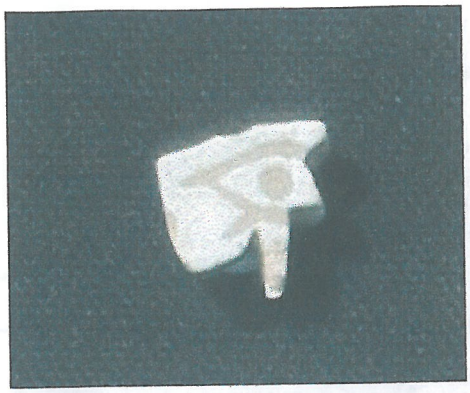
Ceramic Material from Temple Site 1

Figs. 8, 9, 10

Temple Site 1 View of main entrance ramp

Temple Site 1 View of East wall showing wood inserts

Plate 1



Fragment of Wadjet Eye (approx. 15mm square)

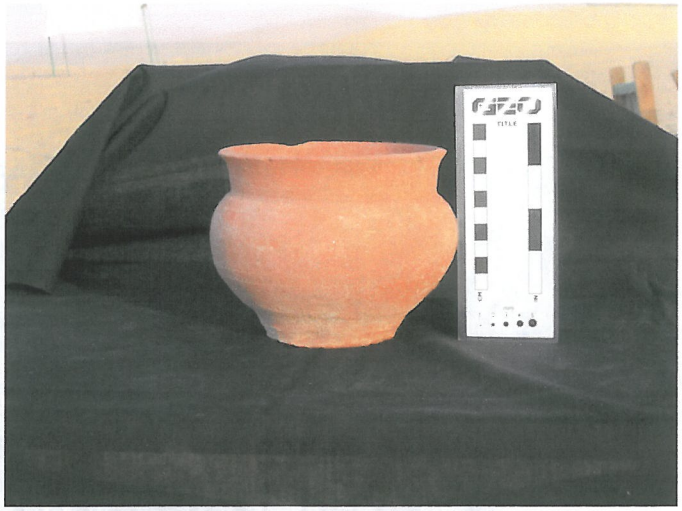
Votive charm of Isis suckling Horus (approx. 40mm high)

Small clenched fist or animal paw (60mm x 40mm)

Inverted pot buried below the east side of Temple Site1 ramp

Saqqara Geophysical Survey Project
Selected objects found on site

Plate 2



Pot Fig. 10 No. 2033

Amphorae Fig.8 No. 2055

Collection of Torch Holders

Saqqara Geophysical Survey Project
A selection of pottery finds from Temple Site 1

Plate 3

The area of the Former Lake of Abusir from the southeast, with scrub vegetation trending towards a grove of palm trees and Abusir village