

**NATIONAL MUSEUMS OF
SCOTLAND**

SAQQARA PROJECT

**PRELIMINARY
REPORT**

2001

**NATIONAL MUSEUMS OF SCOTLAND
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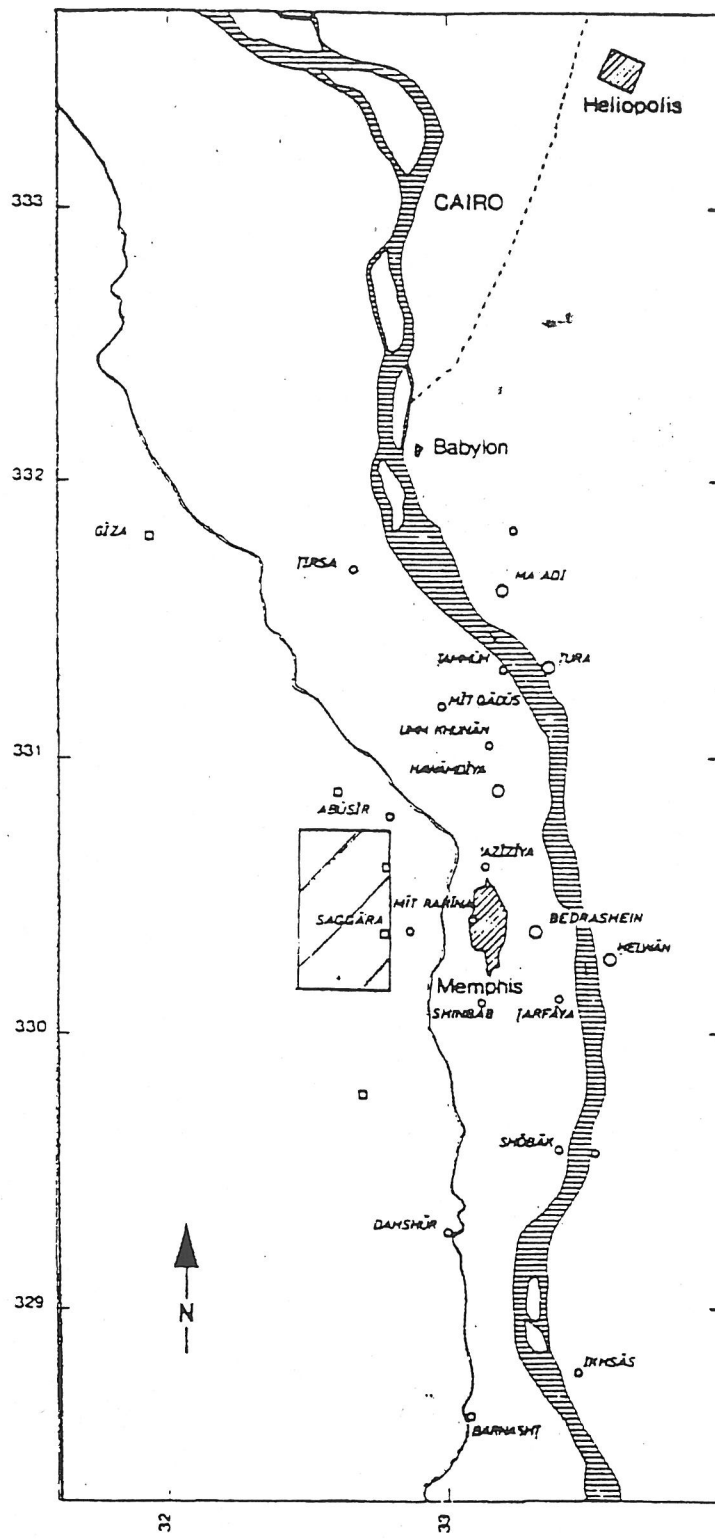
SAQQARA PROJECT 2001

**Elizabeth Bettles, Jon Dittmer, Fiona Haughey, Salima Ikram, Anthony
Leahy, Dan Lines, Ian Mathieson, Colin Reader, Robert Simpson,
Philip Vautier**

An interim report on the work carried out during the 2001 season covering the use of the
model 18 Geoscan Gradiometer equipment to test previous geophysical results and
record archaeological features in the Gisir el-Mudir, L-shaped enclosure area and the
valley on the north side of the Serapeum leading to Abu Sir.

**Project Director
Ian J Mathieson**

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SAQQARA

Location map

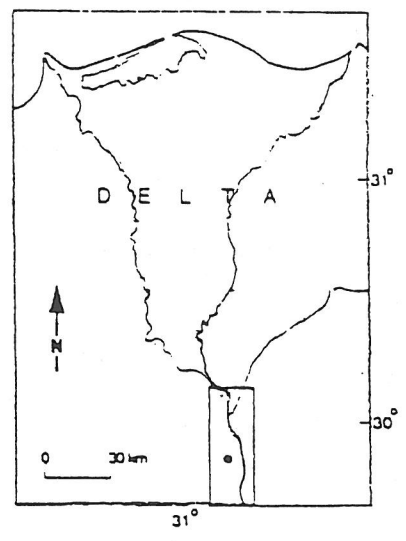
- extent of Nile flood plain
- course of Nile
- course of Bahr Libeiny
- course of Red Sea canal
- TURA modern place name
- pyramid field

Babylon ancient place name

UTM GRID INTERVALS = 10 000 m

SOURCE SOE 1930

EES 1983



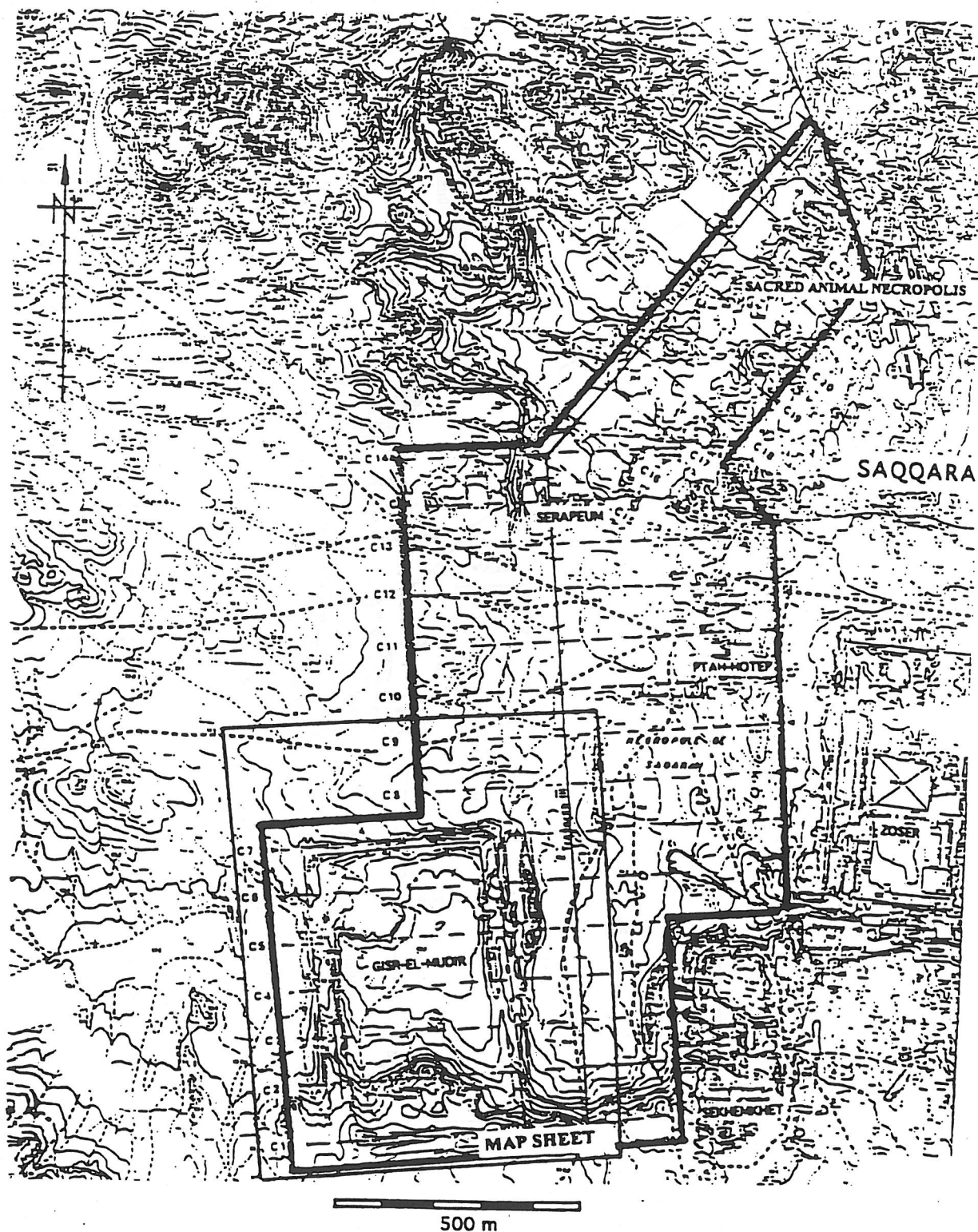


Fig. 1

National Museums of Scotland Concession Area

THE NATIONAL MUSEUMS OF SCOTLAND

PRELIMINARY REPORT OF THE SAQQARA SURVEY PROJECT 2001

By Elizabeth Bettles, Jon Dittmer, Fiona Haughey, Salima Ikram, Anthony Leahy, Dan Lines, Ian Mathieson, Colin Reader, Robert Simpson, Philip Vautier

The aims of the National Museums of Scotland 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, the major city of Egypt from c.3000 BC to Hellenistic times. The area concerned comprises the Gisir el-Mudir ('the Great Enclosure') in the south; an area of the structures lying to the west of the mastabas of Ptah-Hotep known as the L-shaped enclosure; the area of 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 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 National Museums of 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 Prof. Dr G A Gaballa, Mr Magdi abu el-Aala at the Secretariat, Dr Zahi Hawass at Giza, Mr Adel Hussein, Director of Saqqara, the Chief Inspectors Mr Sami Hoseini and Hasama el Shami, Mr Abdel Ghafar Abdel Meniam the inspector attached to the mission. The October - December 2001 season has been undertaken with the generous financial support of grants from the National Museums of Scotland, the Gerald Averay Wainwright Fund (Oxford University), the Russell Trust, the Egypt Exploration Society, Mr Robert Simpson and technical assistance in map reproduction by Survey and Development Services, Bo'ness, West Lothian.

The National Museums of Scotland field team comprised Ian Mathieson-field director, Elizabeth Bettles-archaeological site supervisor, Jon Dittmer-geophysicist, Fiona Haughey-archaeological site supervisor, Salima Ikram-faunal analyst, Anthony Leahy-Egyptologist, Dan Lines-archaeologist surveyor, Colin Reader-geologist, Robert Simpson-data recorder and Philip Vautier-archaeologist surveyor. Professor Harry Smith is archaeological advisor. The 2001 season opened on 1st October and continued until 15th November.

Previous Fieldwork

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 Gisir el-Mudir were

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

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 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 Gisir el-Mudir². In 1993 sondage trenches were opened on anomalies in the southwest corner of the Gisir-el-Mudir to check the resistivity data plotted 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 surveyed⁴. 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 Gisir el-Mudir and a portion of the L-shaped structure (Report 1997). In 1998 the conductivity survey of the Gisir 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 we were 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. We also found the position of the South Wall of the Gisir el-Mudir and located the southeast corner (Report 1999). In 2000 we used the Gradiometer 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 we found a line of rectangular anomalies and these formed the area for sondage excavation in 2001. The various excavation trenches from 1993 - 2001 are indicated on Fig. 2.

The Objectives of the 2001 season were:

1. To continue the electromagnetic survey of the Gisir el-Mudir, the L-Shaped enclosure and continuing across the Serapeum into the Sacred Animal Necropolis using the Geoscan Gradiometer instrument to measure the apparent anomalies in the sub-surface material to a depth of approximately 3 metres.
2. To re-observe certain areas previously surveyed by other electronic means to obtain comparative results.

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)

3. To test by small *sondage* trenches the results of the electronic surveys, which had indicated anomalies in the sub-surface materials.
4. To carry out a geological survey of the concession area to up-date the geological maps of the 1984 survey.

Fieldwork

Geoscan Gradiometer surveys. (Figs. 3, 4, & 5) geophysics team, Jon Dittmer, Robert Simpson, Dan Lines, Philip Vautier

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 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. Therefore, archaeological sites that have such features are suitable for surveying with a magnetometer. Due to the diversity of features on the site, the NMS concession area is eminently suitable for this instrument.

The Gisir el Mudir, Serapeum & SAN (Figs. 3,4, & 5) Jon Dittmer & Robert Simpson

A model 18 Geoscan gradiometer was hired to give comparative results over areas surveyed by resistivity, conductivity and Ground Penetrating Radar (GPR) and to extend our coverage of the concession in a northerly direction from the main base of the Gisir el-Mudir. The geophysical surveying work for 2001 was conducted over a three-week period, during October.

The work consisted of a gradiometer survey of a number of locations within the concession. The majority of the work, and that, which is reported at length here, was carried out over the area to the north of the Serapeum temple. This area covered approximately 270 metres north-south and 510 metres east-west. A total of 150 (30m) grid squares were observed giving 540,000 data points.

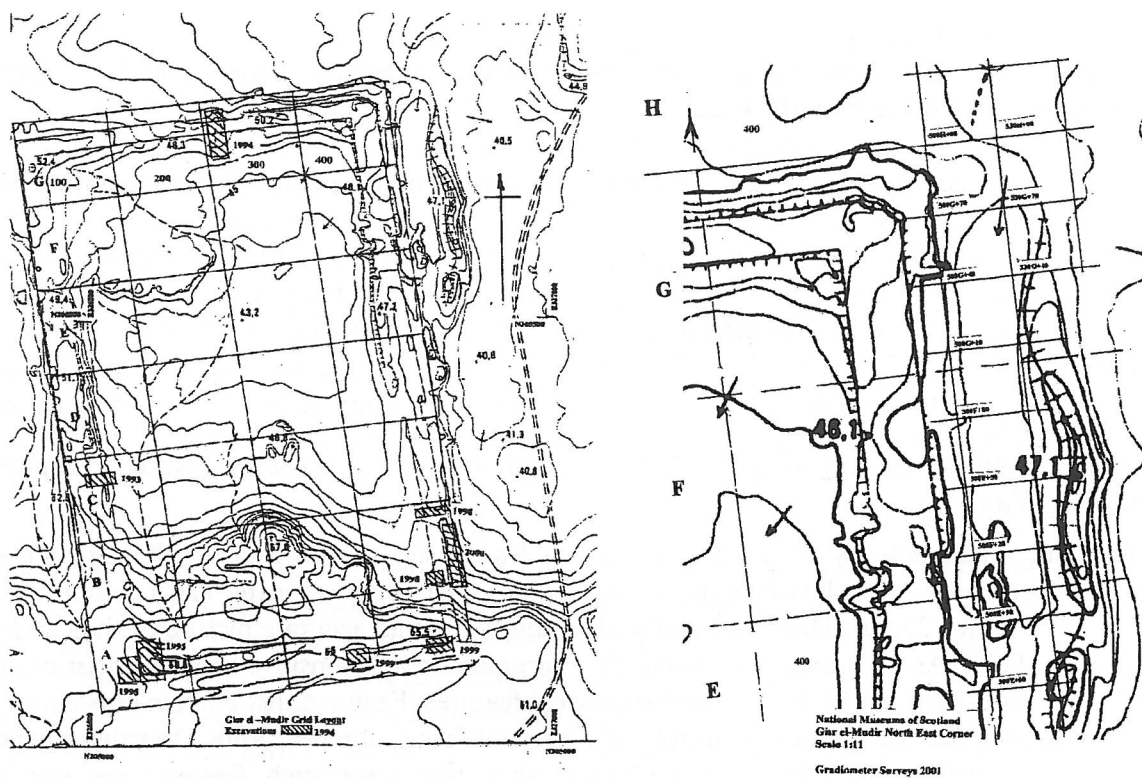
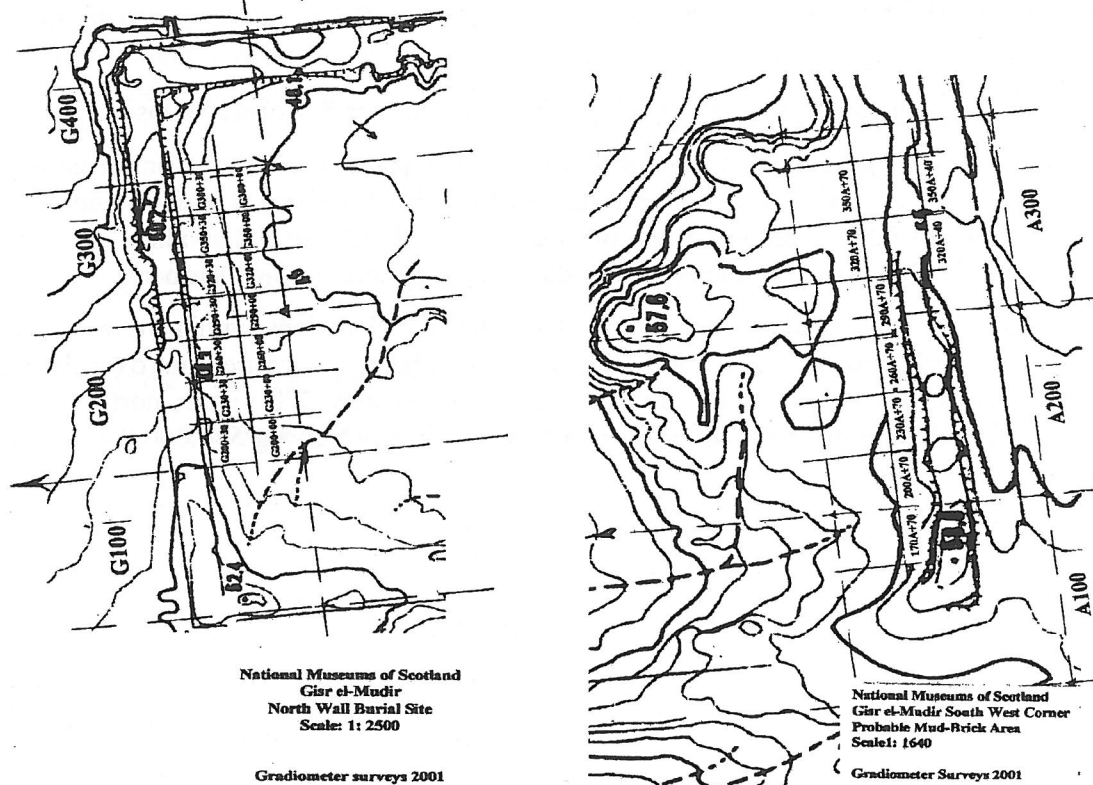


Fig. 2 Girs el-Mudir – Gradiometer surveys 2001



Gisir el-Mudir

A number of squares were surveyed on the Gisr el-Mudir. However, the gradiometer did not detect any meaningful features.

Serapeum Area.

A large area of ground was surveyed within the vicinity of the Serapeum. This can be conveniently subdivided into two regions. (Fig. 3)

The first region is best described as a strip 60 metres wide running north-south parallel to the road to the west of the Serapeum. Due to an excessive thickness of what appeared to be redistributed rubble, no major features were detected.

The second area covers the large predominantly flat area to the north of the Serapeum. The area surveyed also straddled the east-west trending band of mastabas and possibly temples, dug over by Mariette in the 19th century. (Fig.5)

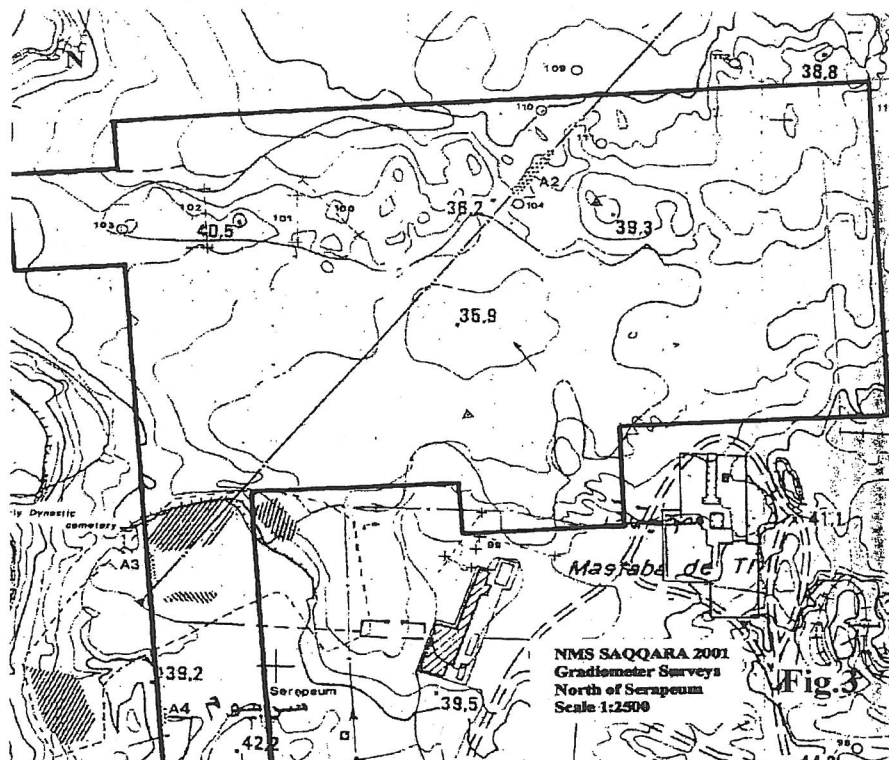


Fig. 3 Serapeum and Sacred Animal Necropolis Gradiometer surveys 2001

Figure 4 shows the results of the survey in a grey-scale plot. The level of grey reflects the level of the magnetic field gradient at that point. The results are very clear, showing a number of features of interest. These are tabulated below. The interpretations are purely subjective, and would need absolute verification by literature search and/or excavation.

Feature Number	Description
1	Building foundations at entrance to Serapeum
2	Building
3	Possible Mastaba
4	Mastaba*
5	Mastaba*
6	Mastaba*
7	Mastaba*
8	Mastaba/temple*
9	Mastaba/temple**
10	Mastaba*
11	Mastaba/temple*
12	Mastaba/temple*
13	?
14	?
15	Predynastic burials (excavated Macramalla (?))
16	Possible road

Table 1 Features detected in magnetometer survey

It is intended that the survey be extended towards the north in the direction of the Czech concession and to the north-east towards the village of AbuSir.

Figure 5 shows the interpretation of the old maps of De Morgan and Mariette with the gradiometer results of 2001.

NMS Saqqara 2001 Gradiometer Results
Scale 1/2000

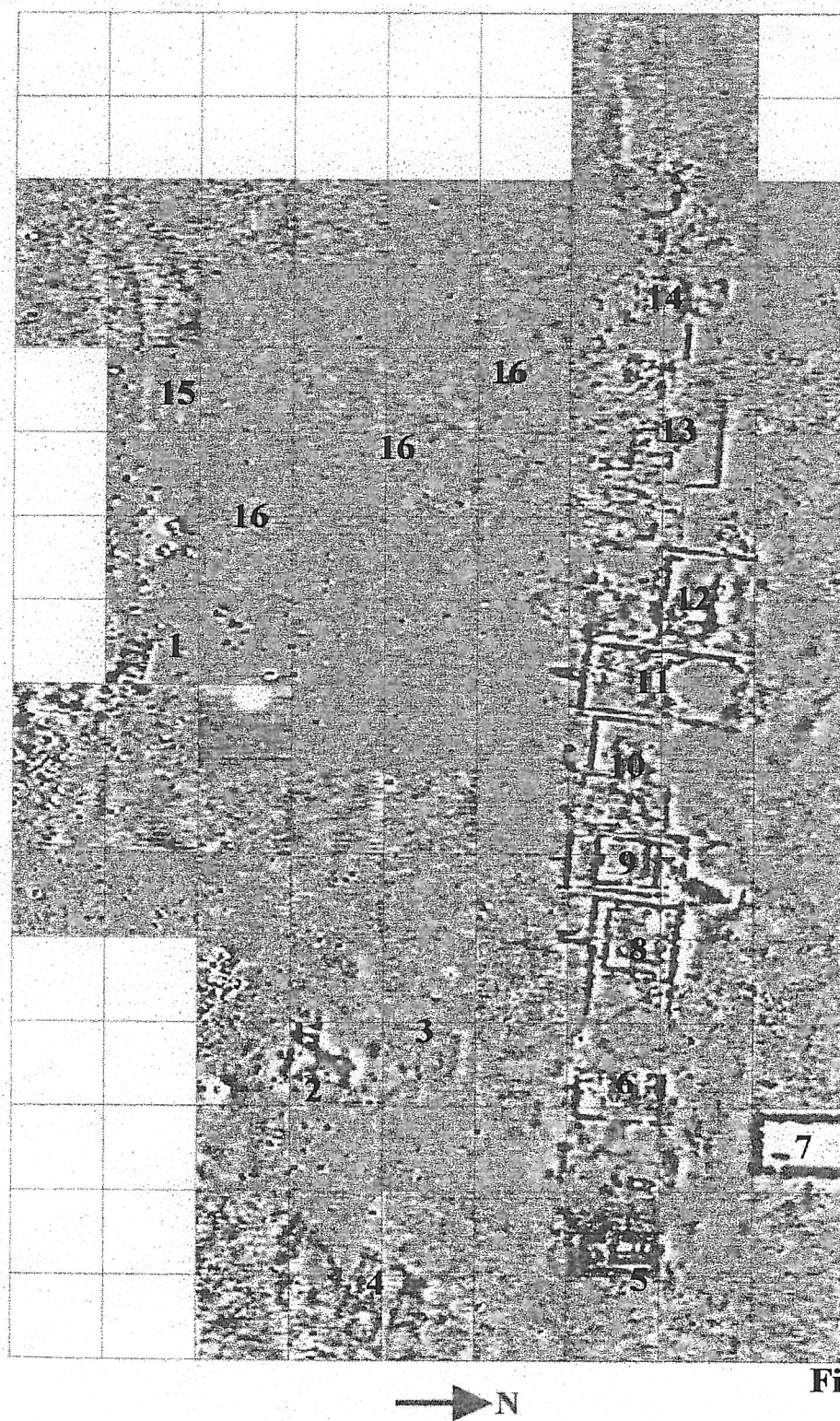
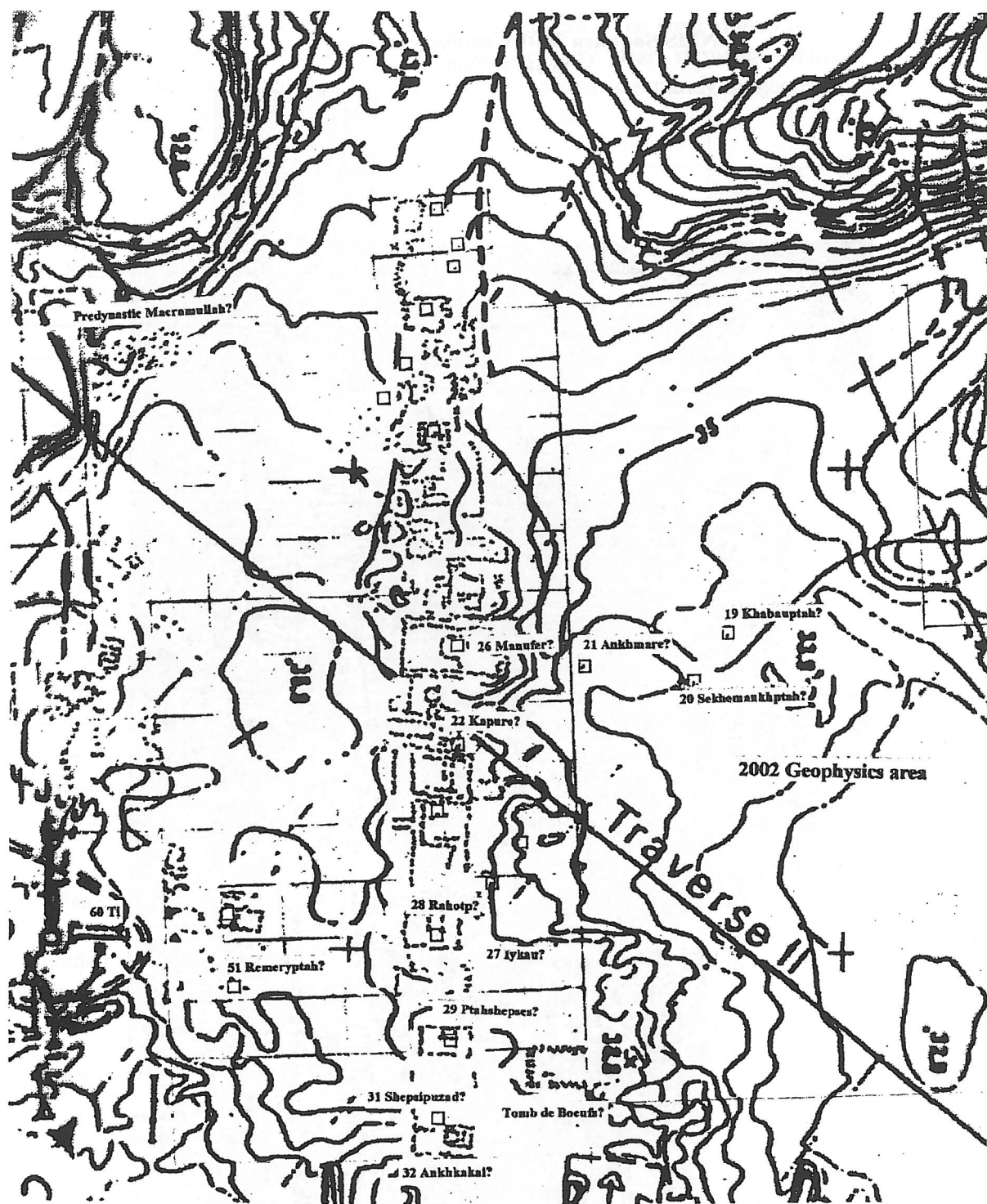


Fig.4



National Museums of Scotland Saqqara Project
Geophysical results 2001
Scale 1/2500

Fig. 5

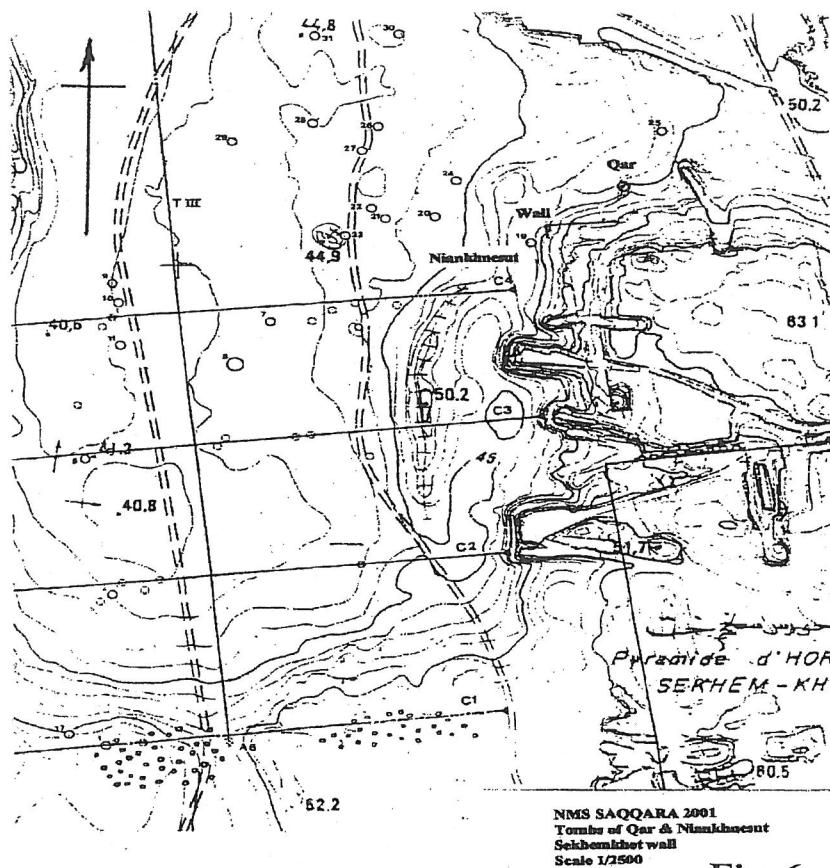
Mudbrick structures.....
A E Mariette & J de Morgan tomb plans..... □

Topographic survey of the geophysical prospection grid. (Fig. 3) Dan Lines, Philip Vautier

This was the first season using the new GPS co-ordinate structure to transform the information to fit the Ministry of Housing & Reconstruction 1/5000 topographic maps produced in 1977 which form the base maps of the Saqqara area. It was therefore decided to form a separate survey team to carry out check surveys and to locate the grid structure of the geophysical surveys.

A new Leica TCR 307 total station, on loan from the Egypt Exploration Society, was used to facilitate this survey work as the instrument has the capability of calculating co-ordinates in the field from data based on known points. Field instructions were developed to enable survey teams to locate and check intermediate stations quickly and to survey the position of the geophysical grid. Software was then adapted to enable the transformation to be made so that the new survey points could be plotted on the 1/5000 base maps.

The surveyors located the various geological outcrops and fossil finds made during the geological survey of the concession and fixed the position of the Tomb of Qar and the retaining wall at the north side of the Sekhemkhet enclosure. (Fig.6)



Geological field survey (Colin Reader, Geologist)

The Solid Geology of North Saqqara

Introduction

In a previous paper⁵, the geology of the area of the NMS Concession was discussed. This discussion was based on published literature, including a paper by Youssef et al⁶, which appears to be generally regarded as the most authoritative paper on the geology of North Saqqara. During the 2001 expedition, the opportunity was taken to undertake geological mapping of the NMS Concession, to build on the work of Youssef et al and, if appropriate to extend the understanding of the solid geology of the North Saqqara necropolis. The geological survey took place between the 20 and 26 October 2001. The heavy broken line on Figure 7 shows the limit of the NMS concession, however, this is a largely artificial boundary, which does not necessarily reflect the geology of the area. Permission was, therefore, obtained from the Director of the Antiquities Service at Saqqara to extend the geological survey across the full extent of the North Saqqara area, from the dry lake of Abu Sir in the north to the southern limit of the NMS Concession in the south. The extent of the geological survey is shown on Figure 8. Particular thanks must be offered to Mr Adel, Director of Antiquities at Saqqara, to Dr Miroslav Barta of the Czech expedition and Professor Karol Mysliwiec of the joint Polish-Egyptian mission to Saqqara for allowing access to their respective concessions to examine the geology.

The term *solid geology* refers to the rocks of a target area whilst *drift* is used to describe the overlying soils. However, inevitably, the gravels and more recent aeolian (wind blown) sand deposits at Saqqara influenced the mapping and interpretation that was to be undertaken. Not the least of these influences was that, across most of the site, drift deposits obscured the underlying bedrock. It was not within the remit of the geological survey to undertake any excavation within this important archaeological site and, therefore, the mapping exercise was based on existing exposures - sites where drift is absent and the strata are visible at the surface (Figure 8 gives the location of the principal exposures mapped during the geological survey. Note: not all the numbers in the sequence have been used to identify these exposures). The constraint imposed by the extensive drift deposits inevitably limited the data that could be gathered and also limited the extent to which fossils could be extracted from the rocks. Any macrofossils contained in loose scree or other readily available hand-specimens were, however, recorded and retained on site.

(Figures 7 & 8.)

⁵ I. Mathieson, E. Bettles, J. Dittmer and C. Reader, The National Museums of Scotland Saqqara Survey Project, Earth Sciences, 1990- 1998, Journal of Egyptian Archaeology, Vol 85, 1999.

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

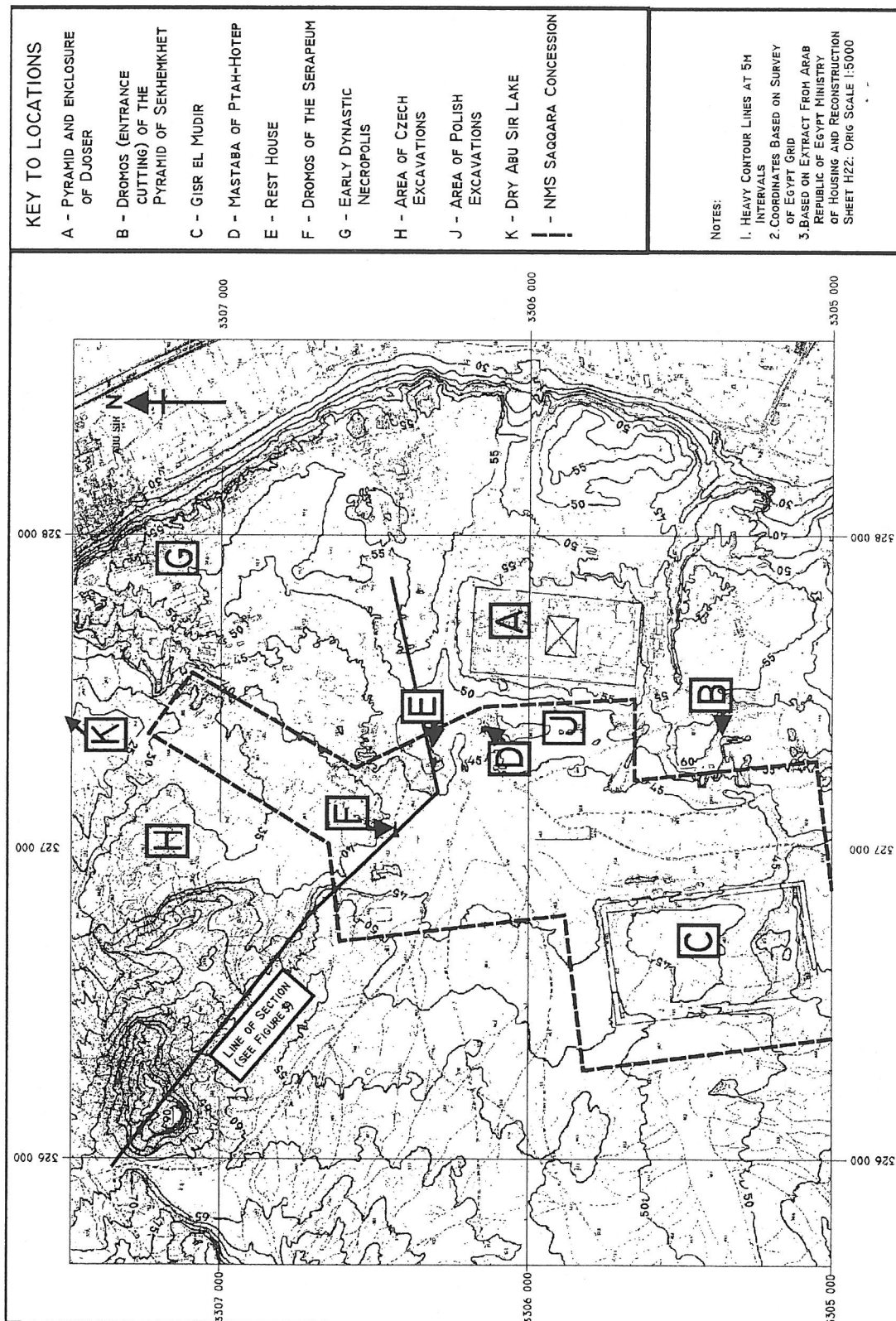


Figure 7 Topography of North Saqqara and Key Features

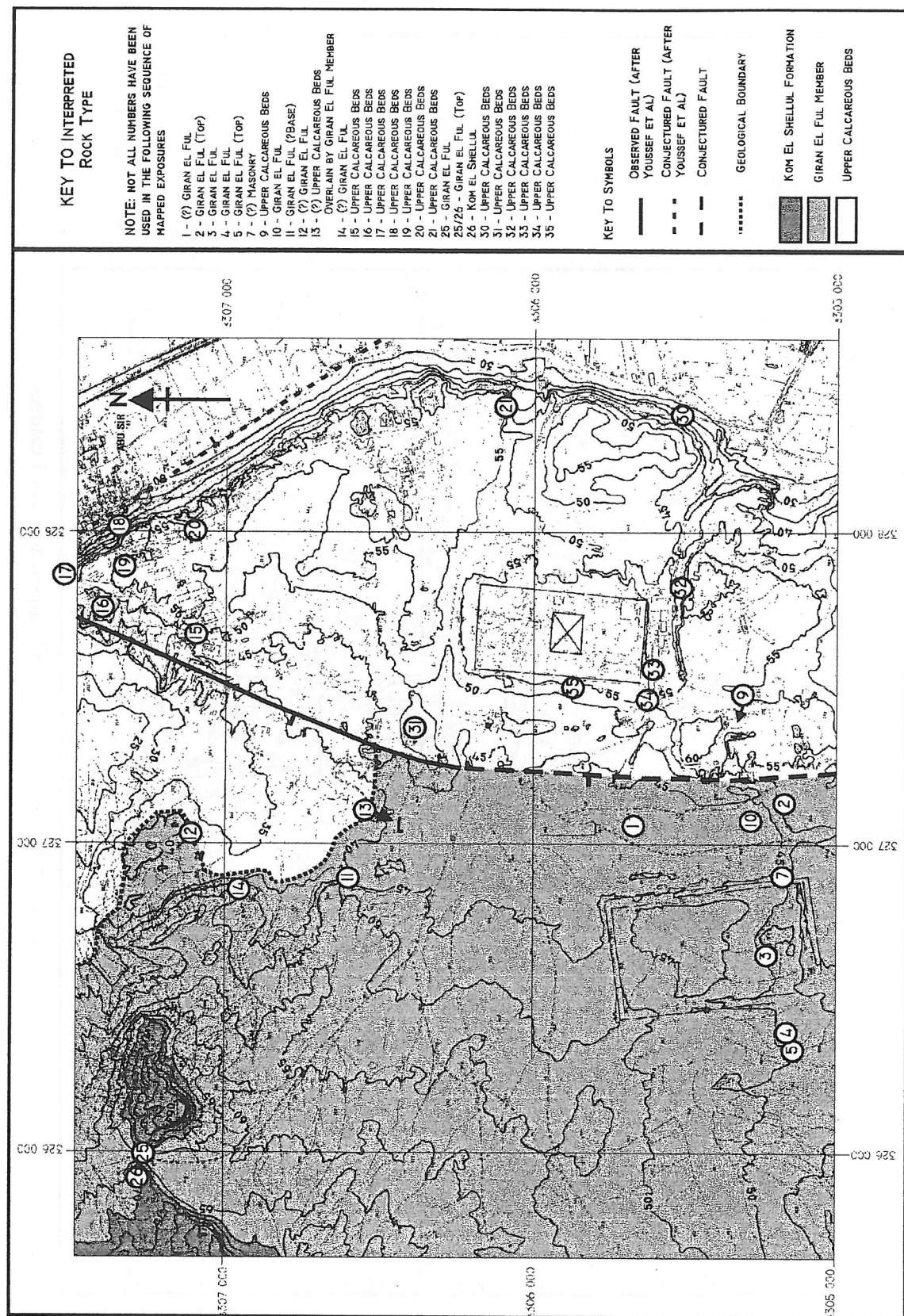


Figure 8 - Location of Mapped Exposures and Interpreted Geology

The Stratigraphy of North Saqqara

The stratigraphy of North Saqqara was discussed by Youssef et al and is summarised in Table 1, below:

Rock Unit			Characteristic Macrofossils	Age*	Approx. (Million Years BP)
Drift – (Idfu Gravels)			Not Applicable	Early Pleistocene	1.8 -
Kom El Shellul Formation			Pecten benedictus <i>Ostrea cucullata</i>	Early Pliocene	5.5 - 1.8
Maadi Formation	Giran El Ful Member		Carolia placunoides	Late Eocene	53.5 - 36
	Saqqara Member	Upper Calcareous Beds Basal Shale Beds	Generally devoid of Macrofossils		

Table 1 – Statigraphy of North Saqqara (after Youssef et al²)

*Note: strata from the Oligocene (36 to 25 Myrs BP) and the Miocene (25 to 5.5 Myrs BP) are not represented at North Saqqara.

Except for the Idfu Gravels (which, for convenience, are loosely considered in this report as drift deposits), these strata are all sedimentary rocks laid down under marine conditions. The characteristics of the different units, as identified during the NMS geological survey, and the palaeoenvironments in which they were laid down are discussed below.

Basal Shale Beds (exposed at Position 18 – Figure 8). The oldest and, therefore, lowest lying unit present at Saqqara, the basal shales are exposed only at the base of the eastern escarpment, adjacent to the modern village of Abu Sir. These are grey green marls (calcareous shales), probably laid down under relatively uniform low energy conditions such as within a shallow bay or estuary.

Upper Calcareous Beds (Position 9, 13, 15 to 17, 19 to 21 and 30 to 35 – Figure 8). Conformably overlying the Basal Shale Beds, the Upper Calcareous Beds are an alternating sequence of moderately strong yellow/grey sandy limestones with interbedded weak yellow/orange marls. This interbedded nature suggests deposition under shallow probably lagoon or coastal marine conditions in a climate characterised by alternating wet and dry periods.

The Upper Calcareous Beds dip to the west and are the dominant beds in the east of the North Saqqara area, reaching up to 60m above sea level (asl) and forming the steep sided plateau on which the Early Dynastic Necropolis (Item G on Figure 7) and the pyramids of Saqqara (including Items A

and B on Figure 7) were built. In the following text this area will be referred to as the Pyramid Plateau.

Unlike their stratigraphic equivalents at Giza, the Upper Calcareous Beds are generally devoid of any macrofossils, suggesting that palaeoenvironmental conditions were unfavourable for life.

Giran El Ful Member (Positions 1 to 5, 10 to 14, 13, 25 and 25/26 – Figure 8). This is the main rock unit exposed in the western areas of North Saqqara, and is typically a moderately strong to strong grey sandy limestone with interbedded grey shales and occasional weak orange brown sandy beds. The rocks contain frequent fossils, with the upper beds in the formation readily identified in the field by a layer of abundant bivalves (*Carolia placunoides*). In addition to the *Carolia*, however, other faunal types, principally bivalves, were encountered. These included a single specimen of what is possibly *Plicatula* (*P. polymorpha* ?⁷ – see (‘a’ Plate 1 –top left), a number of *Ostrea* species and a single specimen resembling *Pecten* or *Chlamys* (at Position 11). The poor preservation of this latter specimen, however, renders this identification uncertain. Also encountered at Position 2 was an *insitu* example of a brachiopod (‘b’ Plate 1), almost certainly a *Terebratulid*. In the specimen observed in the field, however, the commissure appears more pronounced than is typically the case. A number of trace fossils were also observed, the most frequent of which appeared to be infilled burrows.

The Giran El Ful member unconformably overlies the Upper Calcareous Beds and is considered to have been deposited under higher-energy (less sheltered) coastal- or shallow sea conditions than the earlier rocks. The presence of brachiopods, such as *Terebratula*, indicates that, for some periods at least, fully marine conditions prevailed. The dip of the Giran El Ful Member is difficult to measure in the field; however, observations at Position 2 and 3 suggest a dominant southerly component to the dip. This is contrary to the conclusions reached by Youssef et al, who advocated a northerly dip for the strata in the west of North Saqqara, however, as the authors stated, this was based on measurements of the Kom El Shellul formation which unconformably overlies the Giran El Ful. A southerly dip is also supported by the outcrop at Position 11, which was shown by topographic survey undertaken as part of the NMS work, to slope gently (less than 1°) to the south.

Kom El Shellul Formation (Position 26). Strata representing a significant period of time (the late Eocene, the Oligocene and the Miocene) are absent from the geological record at Saqqara. This is because, some unknown time after the end of the Eocene, the depositional palaeoenvironment that had prevailed gave way to one in which there was a probable combination of non-depositional- and erosive conditions. That some erosion has occurred is indicated by Youssef et al who undertook microscopic analysis of rock samples recovered from the site and identified frequent fragments of Eocene rocks in the younger Kom El Shellul Formation. The unconformity between the Giran El Ful rocks and the younger overlying Kom El Shellul formation, is also characterised by a change in dip (an angular unconformity), from a southerly dip recorded in the Giran El Ful Member during the NMS geological survey, to a northern dip in the Kom El Shellul formation, reported by Youssef et al and confirmed by observation in the field, during the NMS survey.

Where examined at Saqqara (Position 26) the Kom El Shellul formation consists of a grey and grey brown moderately strong sandy detrital limestone with abundant whole and fragmentary *Pecten benedictus*. Other macrofossils included an as yet unidentified loosely wound helical specimen,

⁷ R. Said, The Geology of Egypt, p136, Cairo, 1962

possibly a Gastropod or Cephalopod ('c' Plate 1 – this fossil has also been identified at Giza by the author). *Ostrea* remains were not identified at the studied exposure. The Kom El Shellul Formation is considered to have been deposited in similar higher-energy conditions to the Giran El Ful Member of the Maadi Formation.

The Structural Relationship of the Exposed Strata

As shown on Figure 8 and observed by Youssef et al, in the north of Saqqara the western escarpment of the pyramid plateau is defined by a NE-SW trending fault, extending from north of Position 16 to the Rest House (Position 31). As will be discussed in more detail later, Youssef et al identified strata of the Upper Calcareous Beds of the Maadi Formation both to the east and west of this fault line.

On the basis of the NMS geological survey, it is evident that this fault continues further south, passing somewhere between Points 2 and 9. This southward continuation of the fault was not observed in the field, however, its presence can be determined from the rock types exposed in the south of the survey-area. The strata exposed in the dromos (or entrance cutting) of the pyramid of Sekhemkhet (Position 9), clearly belong to the Upper Calcareous Beds. The top of this exposure is at a level of approximately 47m asl. The *Carolia placunoides* band identified at approximately 49m asl at Position 2 clearly indicates that only some 300m west of the dromos of Sekhemkhet, the top of the Giran El Ful Member is exposed. This suggests that between these two exposures, the younger Giran El Ful Member has been downthrown against the underlying Upper Calcareous Beds.

Carolia placunoides were also exposed (at a level of 52m asl) at Position 5 to the west of the Gisir el Mudir. Position 5 is, however, understood to be an old mortar-bomb crater and a degree of disturbance can be expected at this location. Nevertheless, the topographic ridge along which the southern wall of the Gisir el Mudir was built can be interpreted as an outcropping bed of durable strata, part of the upper beds of the Giran El Ful Member.

The same *Carolia*-rich beds were also identified at Position 25/26 in the north west of the NMS survey area, at a level of approximately 67m asl. These exposures (Position 2, 25/26 and, to a lesser extent Position 5) confirm the southerly component of the dip discussed earlier in this paper.

As discussed above, Youssef et al identified Upper Calcareous Beds on both the east and west of the fault that they observed along the foot of the Pyramid Plateau. Intersecting this fault, they also conjectured a second fault, trending SE-NW, passing to the north of Position 12 (see Youssef et al Figure 4 - referred to in the following text as Fault B). Although Youssef et al do not fully explain the evidence for this fault, it may have been invoked to explain the change in rock types exposed in this low-lying area of North Saqqara, with Upper Calcareous Beds to the north east of Fault B and the Giran El Ful Member to the south west. Whilst the presence of Fault B is a valid interpretation, no evidence of a fault at this or any parallel location was observed during the NMS geological survey. As discussed below, however, there is an alternative explanation for the distribution in the exposed rock-types, which does not require the presence of Fault B.

The upper beds of the Giran El Ful member (denoted by the *Carolia* bank) are exposed at a level of approximately 67m asl at Position 25/26. The exposure of the Giran El Ful Member at Position 11, with its rare fossils, is at approximately 49m asl – a difference of some 18m between the two

exposures. Although a small proportion of this difference in elevation can be attributed to the gentle southerly dip of the Giran El Ful Member, the difference in elevation at the two exposures (Position 25/26 and 11) is considered to be largely due to their different stratigraphic positions, with Position 11 lying *towards* the base of the Giran El Ful beds.

Published data indicates a thickness of up to 40m⁸ for the Giran El Ful Member (although other sources⁷ state that the beds become thinner in the south towards, it is assumed, Saqqara). Youssef et al indicate that, at Saqqara, the Giran El Ful Member is only some of 17.4m thick. As discussed below, however, the data obtained during the NMS geological survey indicates a moderate increase in the thickness of the Giran El Ful from that suggested by Youssef et al.

Of the four beds exposed within the dromos of the Serapeum (Position 13), the uppermost bed appears to be from the Giran El Ful Member (the base of this upper bed was surveyed at a level of approximately 38m asl). This upper bed is a moderately strong to strong grey/yellow brown shaley limestone with rare poorly preserved fossils. In many ways it resembled the rocks exposed at Position 11 and among the rare fossils were burrow-like trace fossils also found at Position 11. The upper bed at the Serapeum also exhibited cross bedding and other related features typical of the higher-energy conditions associated with the Giran El Ful Member, but generally considered to be absent from the Upper Calcareous Beds. It is considered possible that the upper bed, exposed in the dromos of the Serapeum (Position 13), may represent the base of the Giran El Ful Member. Grey laminated limestones and shales at Positions 12 and 14, above the 35m. contour line in the area of the Czech excavations, are also tentatively identified as belonging to the Giran El Ful Member.

When the level of the *Carolia* bank at Position 25/26 is considered, which marks the strata near the top of the Giran el Ful Member, together with the evidence from Position 13 for the base of the Member, it is considered that the Giran El Ful Member is somewhat thicker (in the order of approximately 25m) than stated by Youssef et al. This, combined with the gentle southerly dip indicated by the fieldwork, suggests that the base of the Giran El Ful beds subcrops beneath the drift to the east of the Czech excavations and in the area of the Serapeum, as shown on the fence diagram on Figure 9 and in plan on Figure 8. To the north and east of this subcrop, erosion along the wadi leading down to the Abu Sir lake (item K, Figure 7) has exposed the underlying Upper Calcareous Beds. Under this model, the geological boundary between the Upper Calcareous Beds and the Giran El Ful Member is topographically controlled and there is no need for the second fault (Fault B) conjectured by Youssef et al.

(Fig. 9 Fence Diagram)

⁸ Anon, Geological Map of the Greater Cairo Area, Egyptian Geological Survey and Mining Authority, 1983.

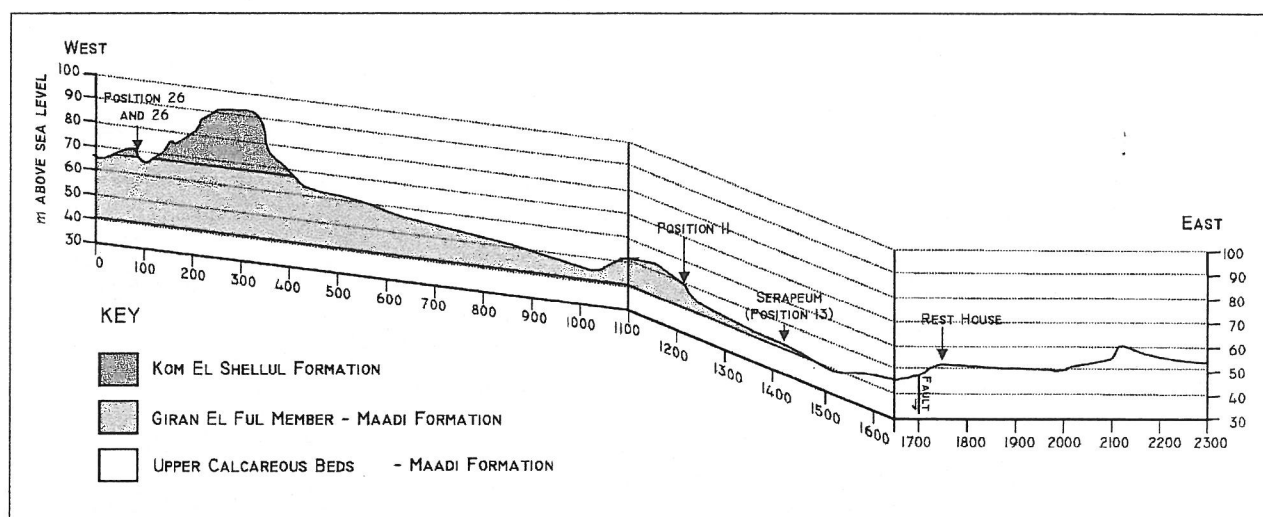


Figure 9 - Fence Diagram From West to East (see Figure 7 for line of section)

Conclusions

Taking all the available evidence together, the interpretation of the geology of North Saqqara, as determined by the NMS geological survey of October 2001 is presented on Figure 8. There is considered to be only a single fault zone running from north to south along the foot of the western escarpment of the Pyramids Plateau, which downthrows the younger Giran El Ful and overlying Kom El Shellul Formations to the west. In the north, the downthrow of this fault is given by Youssef et al as 20m, whilst in the south of the NMS concession, the data obtained by the 2001 fieldwork, suggests the downthrow to be in the order of 35m. Still to the west of this fault, in the north of the survey area, erosion along the wadi leading down to the former Abu Sir lake, led to down-cutting through the Giran El Ful Member, to expose the underlying Upper Calcareous Beds.

To the east of the fault zone, the high ground which the Ancient Egyptians chose for the earliest Memphite necropolis, consists of the Upper Calcareous Beds overlying the basal shale beds, both units belonging to the Maadi Formation.

Sondage excavations L-shaped enclosure area.

The Gradiometer survey of the L-shape enclosure and surrounding area in 2000 had produced several interesting anomalies, which are shown on Figs.10a & 10b. These anomalies had the appearance of large rectangular structures with indications of entrances in the north-facing walls. The structures were given the indicators LS1 to LS9 and it was decided to *sondage* the entrances to LS1 and LS5 being two large squares and the narrow rectangular LS4.

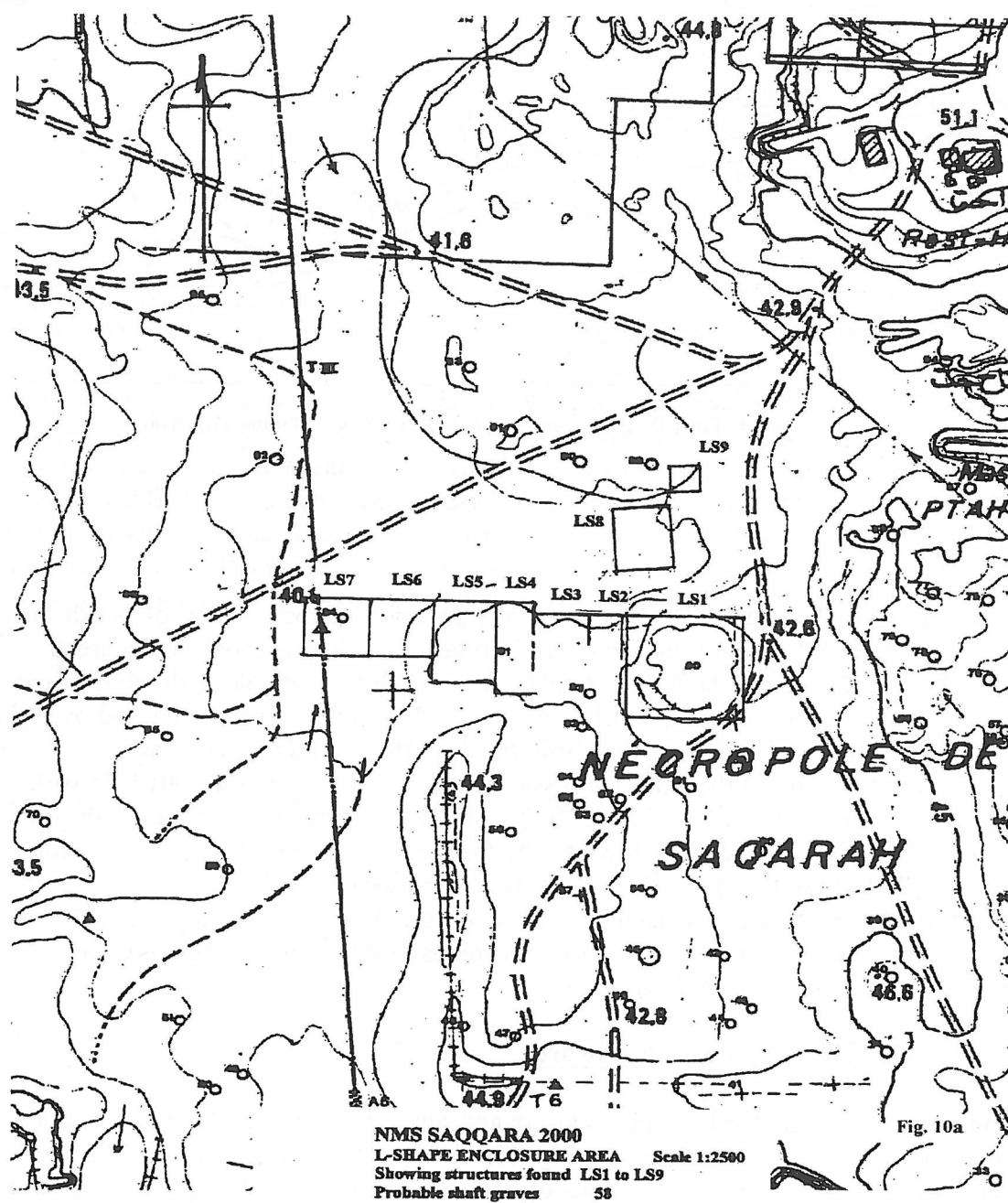


Fig. 10a L-Shaped enclosure

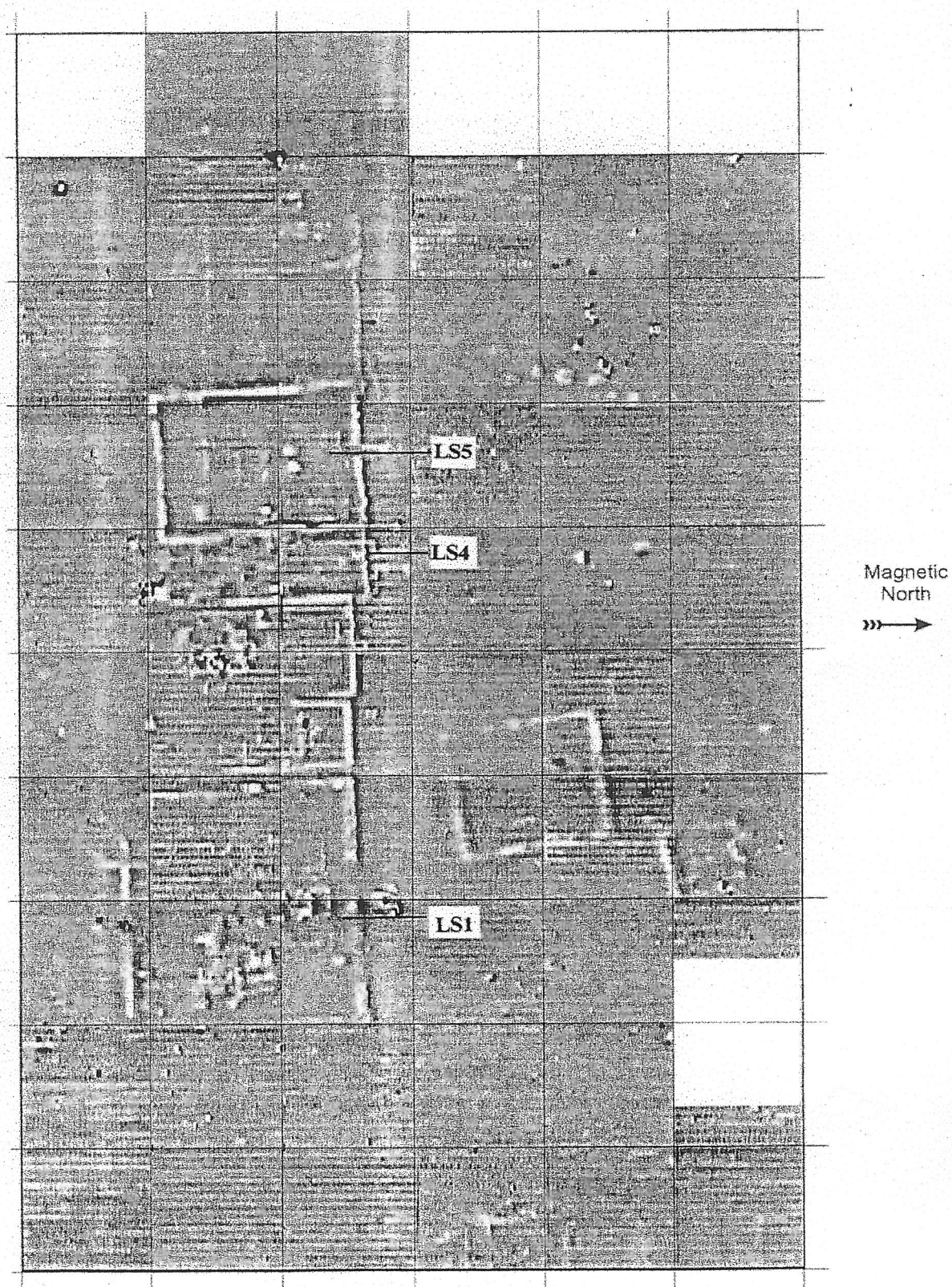


Fig. 10b
NMS Saqqara 2000 Gradiometer Survey Results

LS1 Sondage (Fiona Haughey, Site supervisor)

LS1 is the largest structure detected during the 2000 survey of the L-shaped enclosure. It is situated at the most easterly end of a row of what appear to be similar, smaller buildings, all facing northwards towards the Serapeum. It measures 60m x 60m with many internal features and a probable entrance on the north side. During 2001 this latter feature was investigated by means of a sondage. Four 5m x 5m squares were laid out with sections of eight others over the site of the entrance. A geophysical anomaly had been noted on the northeast portion of the structure. On site, this now lay in square 185+25 and during excavation a piece of corroded metal (probably from an old pail) was uncovered at a depth of 20cms below surface level.

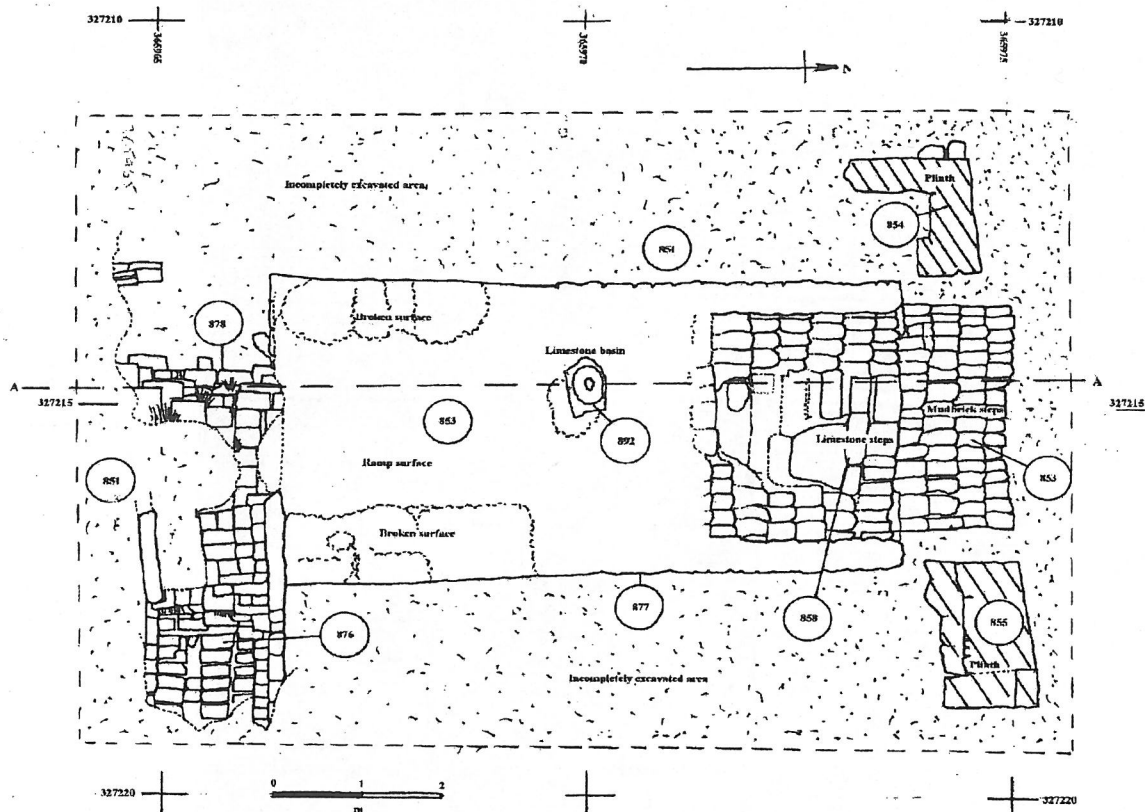


Fig. 11 Plan of LS1 sondage (Plates 3 & 4)

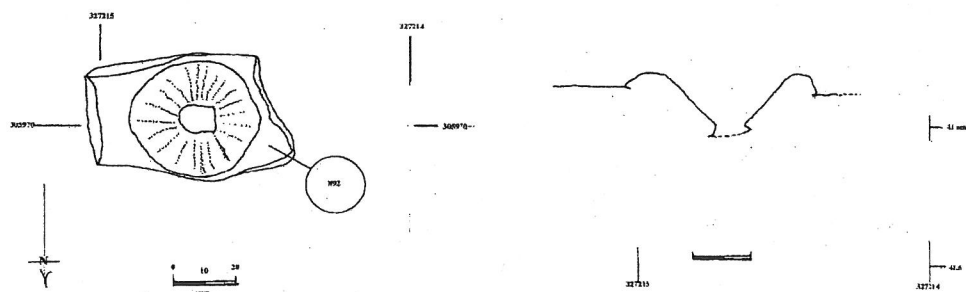
The aim of the excavation was to clarify and date the findings recorded during the geophysical survey. The former intention was successfully undertaken with the latter being less accurate than might have been hoped. The geophysical survey, undertaken using a gradiometer, had revealed the presence of a platform with two side arms and two smaller outlying features. To the south of the platform there appeared to be a gap and then part of the wall surrounding the main structure LS1. All the constructions were probably of mud brick.

Before clearance began, the southern squares could be observed as being situated on the north face of a rise, heavily strewn with fine/medium decomposed limestone debris. The northern squares, in

contrast, were sited at the base of the rise on loose sand with only a small amount of inclusions that included limestone fragments, gravel and pottery. When the site had been examined a few years previously only deep sand had been observed, underlining the mobile nature of desert sands, a factor that had much bearing on the stratigraphy of the excavation later exposed. Clearance began in square 180+20, working from the SW corner across to the SE at a depth of only 10cms and it quickly became apparent that the surviving archaeology was lying, for the most part, very close to the current surface. The top of the main structure (853) with its two north facing arms, and the tops of the two outliers (W - 854; E - 855) were uncovered and delineated within a depth of 15cms below surface level. This was also the case some days later when work moved into the square to the south, (180+15), where a clearance of only 5cm was needed to delineate the rear portion of the main structure (877).

The first period of excavation concentrated on (853), (854) and (855) and involved working within 6 squares both in part and, in the case of 180+20, in its entirety. Numbering of contexts for structures, features and sand matrices was, therefore, complicated by constant changes from square to square and this was rationalised by referring to the aeolian sand as (851) (although the square of retrieval of pottery and finds was always noted), the W outlier as (854) and the E outlier as (855). An area of firm sand with fine limestone inclusions (858/859) was noted at a depth of 20cm below surface level, straddling the boundary between 180+20 and 180+25, adjacent to the end of a limestone block. This, when further investigated, appeared to be a floor or surface roughly ovoid in shape (c.1.20m x 1m) and up to c.40cm in depth. It had large fragments of both limestone and *tafl* embedded in it with pottery and gravel and when sectioned showed no internal stratigraphy. It seemed to relate to none of the other exposed features and was recorded by drawing and photography prior to removal. The limestone block while partially degraded, still had sharp corners in those parts facing downwards and had a slight curve inwards on the underside. It measured 74 x 25 x 17cm. Upon removal, it disintegrated.

The geophysical survey had recorded the underlying mud brick structures subsequently numbered as contexts (853), (854) and (855). When exposed (853) was shown to include the two arms and revealed a mud brick surface, with evidence, in some cases ephemeral in nature, of stone flooring. 854 and 855 were similarly mud brick constructions.



Uncovered within the surface of (853) and offset to the western side was an oval limestone basin (892). The ground surface continued to be removed in a series of 10cm spits enabling a flight of steps built of mud brick and limestone blocks to be recorded leading downwards to the north between the two arms of 853. A total of 6 steps were uncovered although it is possible one more had existed originally at the top to the south but was now heavily eroded. The construction of the steps entailed the use of 3/4 mud bricks at each side and 2/3 limestone blocks (roughly 24 x 24 cms in cross section) in the centre. The lower two steps were complete but the top four rows had either totally or in part been robbed of the stone portions. Traces of the siting of the missing stones can be seen with impressions in the clay 'cement' particularly on the west side but there is a substantial hole remaining in the east/central part of the middle of the steps where the underlying sand base has been exposed. Steps 2 and 3, in addition, have stone 'packing' at the extremities.

The walls that form the arms of (853) are made entirely of mud brick but as the surface was lowered on either side of the structure, limestone blocks were uncovered within the outer faces. These were noted as sloping down from the southern edge of 180+20 (the then extent of excavation) to the level of the lower ramp. The deficiency in height was made up with mud brick. There is no remaining evidence that any part of (853) had been covered in plaster at any stage in the past.

While a more detailed discussion of (854) and (855) is included below, it is worth noting at this point, that the base of the two outliers was reached as the bottom of the lowest mud brick/limestone step was uncovered. Also that thus far the sand context (851) had remained unchanged to a depth of c.1m below surface level. In three areas, however, this latter state underwent a change. To the south of both 855 and 854 mud brick debris became evident with associated fine dust and mud wash (see below). To the north of the lowest mud brick/limestone step and contained within an area bounded on the west by (854) and on the east by (855), the sand became more gravely with occasional flecks of charcoal for a depth of 24cm (870) when it changed again and became firm with gravel and a noticeable increase in pottery (872). This latter included small saucer-shaped vessel fragments on some of which were remains of burning and ashes. (872) continued in depth for c.50cm.

During the excavation of these last two layers, a steeply sloping ramp emerged from below the lowest step of 853. Made from mud brick in four tiers, its foundation was a layer of *tafl* (886). (887) (the foundation layer to the east of the main structure) and (886) are probably the same basal layer but the area to the northwest of (853) (under 855) was not excavated and so it is not possible to confirm this. The ramp is 75cm at its highest point and drops at an angle of almost 45 degrees for a distance of approximately 1.40m. The width of the ramp across 853 does not cover the entire expanse. The east side commences 10cms inside the outer edge of the lowest step and the west side extends 10cms into the mud brick 'arm' that contains the steps.

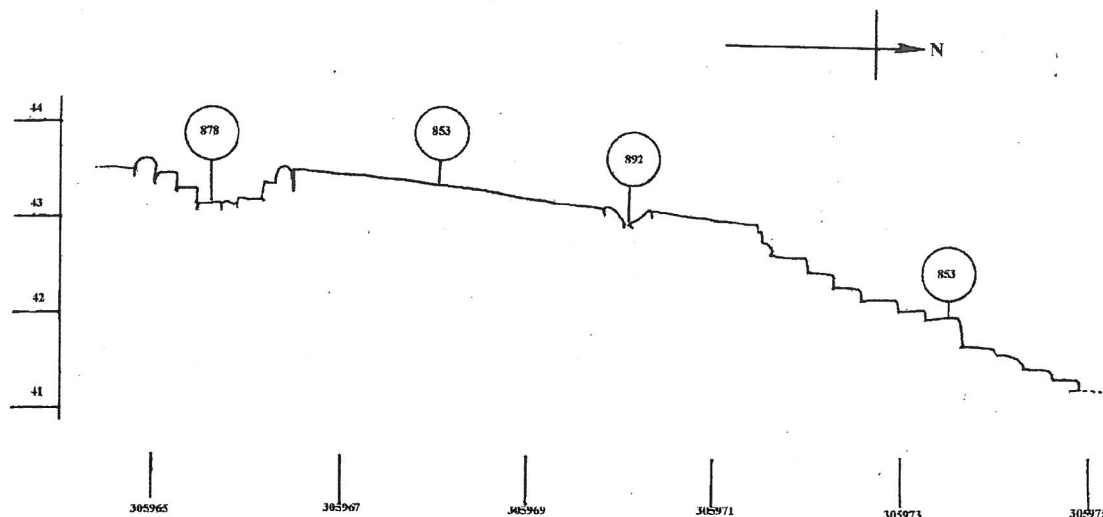


Fig. 13 LS 1 Section A-A (Fig. 11)

Attention now moved to the square south of 180+20, where it was expected that a gap would be uncovered (probably filled with debris) before being able to trace the wall of LS1. What came to light was a continuation of (853) but this time completely constructed of limestone, continuing southwards from that exposed at the junction of the two squares (877). Many semi-dressed stones had been utilised in the building work with smaller pieces used to fill the gaps. At the base of the structure, which lay on (887), an undulating layer of *tafl* as noted above, evidence of clay filling (by hand) used in the outer cracks was noticed and may be the foundation for a 'skirt' of clay along the bottom of the stone. The remains of such a 'skirt' was observed at the northern-most end of the east side of (853).

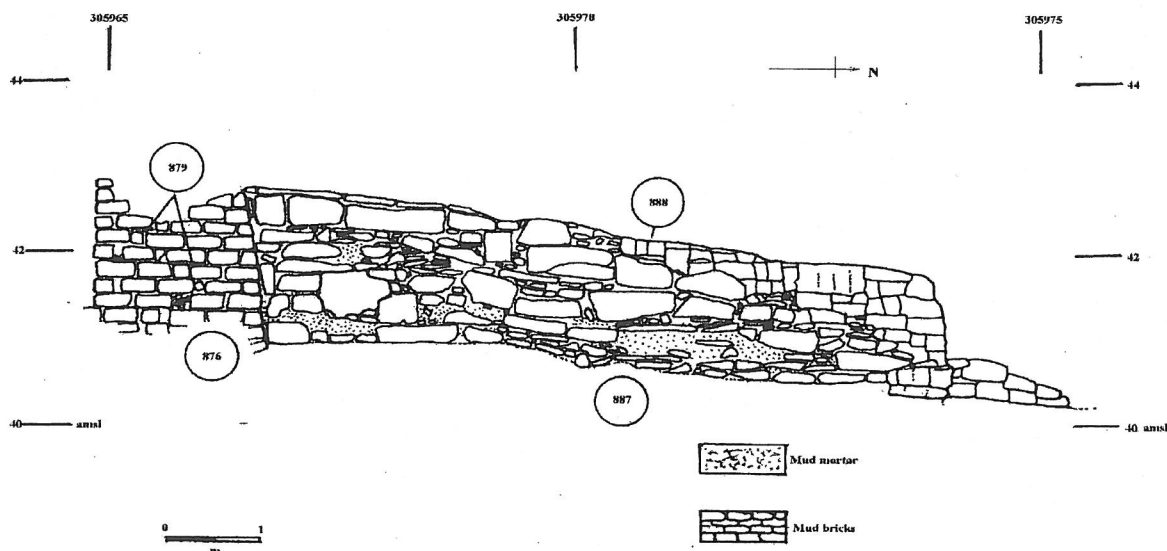


Fig. 14 LS1 East face of ramp showing limestone block construction

As stated above, the surface of (877), (888) lay only a few centimetres below current ground level and the limestone on the top had become heavily degraded. What remained was sufficient to note that the areas to the sides of the platform had previously been higher than the 'floor' and that the limestone flooring had obviously formerly covered the entire structure, as evidenced with that around the stone basin (892). In the east side of (877) and towards the rear, a hole in the wall (889) was observed which contained sand, pottery and charcoal but it was not possible to date the contents to any particular time of usage. The surface layer in square 180+15 (873) consisting of aeolian sand with a large component of limestone debris was taken down to only 1m below the top of the west side of (877). Notable finds include a number of shallow straight-sided flat-bottom dishes recovered near the junction of 853 and 877 at the lowest level excavated. In the area between the southern edge of (877) and that of the square, only a depth of 10cm was removed before a tumble of mud brick and sand was uncovered (875). Only the east side of (877/853) was taken down to foundation level.

The surface layer in square 185+15 (874) is similar to context (873), with the limestone debris 'leaking' from the top of 877. A number of almost complete vessels were found in this context. A wide strip running along the western side of the square was opened and at a depth of 1.25 the context alongside (877) was changed to (883) as there was an addition of mud brick fragments and a greater concentration of stones than that in (874). The basal *tafl* (887) was reached at a further 80cm below the commencement of (883).

In the southeast corner of square 185+15 a number of mud bricks were observed with some running in a line along the southern boundary (876). At the southern end of (874) where it abutted the south-east corner of (877), a small wall of mud brick was recorded extending along the limestone structure for 70cms in an east-west direction (878). Subsequent work established that (876) and (878) were two sides of the same structure, that is, part of the wall surrounding the main structure LS1 to the south. As (874) were removed within this area, further parts of the wall began to emerge. At the point at which 7 courses of brick had been exposed between (876) and (878), a change in context was observed in the area to the east of the wall, extending across the trench with the introduction of much mud brick debris amidst the darker loose sand, small stones, a significant increase in pottery and a number of objects (882). The wall was uncovered with the lower 4 courses stretching completely across the trench and a total height of 9 courses was recorded before the foundation was reached, cut into *tafl*, (887). (882) continued to a depth of 50cm where a mud brick floor was reached covering the whole of the exposed area. This latter comprised several rows of brick laid at right-angles to the wall with a central gap, through which the underlying formation could be observed. Finds from (882) included a complete circular faience bead (object 82) and 13 carbonised beans (sample 31). During excavation of (875), it became clear that this context was merely mud brick tumble mixed with a large amount of aeolian sand. At the eastern end of the context the west side of what transpired to be (876/878) was uncovered and further work clarified that this was indeed the case. The edge of the mud brick wall was traced opposite the southwest corner of (877), although neither the base of the wall nor that of (877) were uncovered in this area due to time constraints. The surface of (875) was fairly thin across the area and would not have supported a great deal of human traffic across it. The mud brick/sand mix was not formally laid out (as had been the floor inside the wall to the east). A base of a very small faience figurine (possibly of Isis) was recovered during the removal of (875).

(object 79). Observed emerging from both sides of the wall were a large number of desiccated reeds which were laid between several of the rows of bricks. It has been suggested that they would have been included to help the drying process if the bricks were not fully dry before using. No order in their placement or attempt at weaving could be seen.

The removal of part of (875) enabled the internal construction of (877) to be recorded. The limestone blocks were placed on the outside with observable thicknesses of up to 20cm. Two 'piles' of limestone pieces of approximately 20/25cm in length and 10/15cm in thickness were laid next and the central core comprised sand with small limestone debris. The robbed area within the steps of (853) has enabled an examination of the construction of this part. Sand again seemed to be the foundation but only a depth of 20cm was uncovered here leaving room for other unobserved methods having been used further inside.

Two 1m-wide strips were removed from the northern ends of the squares to the south (180+10, 185+10) to clarify the extent of the wall. A 10cm spit was removed from the 5m width of 180+10 (881), while that in 185+10 (880) was only 2m long, reflecting the size of the trench in 185+15. The material removed was extremely hard with many bricks of *tafl*, limestone debris and the sand a yellow/brown in colour. Some pottery was also recorded. A sondage within (880) was undertaken to a depth of 60cm and the contents exhibited no internal stratigraphy but were homogenous in distribution. A fragment of papyrus was recovered (sample 27) from the sondage. Other than small fragments, no mud brick was recorded from either (880) or (881).

The two outliers, (854) and (855), while similar in construction, were neither identical nor set symmetrically to (853). (854), built in an 'L' shape, is only one brick-length in width and extends along the west side of (853). (855) is rectangular in shape, was placed further northwards than (854) and has a section cut out of the northeast corner which was plastered on all surfaces. Both structures were built directly onto sand and were plastered on their west, north and east sides. Parts of both structures went deeper than others. (855), for example, while fairly uniformly level across the top, extends down 53cms on one side and 60cms on the other. The height of (854) is more variable with the northwest corner having a course entirely below the rest of the structure. Both have mud brick debris to the south, along either side of (853). That associated with (854), (869) comprised a small number of eroded mud brick fragments and mud wash which were drawn, photographed and then removed. These appear to be the result of erosion and subsequent collapse of the upper parts of (854). (855) seems to have been a much more substantial structure although the eastern end may have been added later at a slightly higher level. The debris recorded to the south was considerable, comprising a large number of uneroded bricks, some of which retain their plaster *in situ* and/or are still cemented to their fellows (868). Between the mud brick was a substantial layer of fine brick rubble and mud wash dark brown in colour (871). Together this stratum extended for 80cm alongside (853) for a depth of c.60cm. The trench at this point was 1.10m wide and the debris continued into the unexcavated area. Unlike that associated with (854), the size, condition and depth of the material suggests that this structure was demolished whilst still in a reasonable condition. Below (868/871), the matrix changed back to the light colour of (851) and while there was still some mud brick inclusions in the loose sand, pottery fragments were also retrieved (884). This stratum lay directly over the basal context (887). One find of note is the figurine pendant of the Goddess Taweret in blue

faience (object 77) recovered from within (851) adjacent to the west side of (855) at a depth of 20cms. While there has been some damage to the figurine (the face and lower left arm are missing), the piece is in otherwise good condition.

Conclusions:

1 The mud brick wall surrounding the main structures of LS1 was built first and then the platform was placed in front of it. The angle of the south side of the structure and the packing placed between it and the wall leaves no doubt as to the order of construction, although the timing between the two phases is unknown.

2 The platform seems to have been built in two phases. It is possible to relate the line of the lower ramp with the sloping angle of the limestone within (853). This would suggest a possible first phase of use where (877) would have been the platform area and the stone of (853) plus the lower ramp provided the means of access. The second phase would have included the addition of the mud brick floor and arms to (853) as well as the mud brick/stone stairs set at a slightly different angle to the earlier construction. (854) and (855) would have been added at this point and the lower ramp would have not been visible. The limestone flooring would have been extended to the new surface of (853) and the limestone bowl added.

3 A further corroboration of the possible 2-phase scenario can be seen in a comparison between the mud bricks of the wall (876/878) and those of the two outliers and the front of the platform (854, 855, 853). Those from the wall are highly organic in nature. Much reed/grass/straw has been used in their construction but no evidence of pottery was observed. Those from the outliers and (853) had very little or no evidence of the use of organic material but a heavy use of small sherds of pottery as a temper. Both types used Nile silt as a basic substance (Colin Reader pers. comm.)

4 Although the platform would seem to be the entrance to the structure LS1, no evidence was noted on site as to the actual passageway into the main edifice. It is probable that this had either eroded or been removed at a date after LS1 fell out of use.

5 Dating of the site may be possible through the pottery retrieved (which proved to be diagnostic but of long duration). It would however be possible to obtain a radiocarbon date from the reed matting lying *in situ* in the main wall (867/878). Accurate readings of the location of this material were taken prior to backfilling the site.

6 Stratigraphically, the site was very simple as the majority of the overburden comprised aeolian sands with inclusions of pottery, limestone debris and mud brick to varying degrees. It was only at the lowest levels near the basal *tafl* that changes in context could be observed and even these were localised in distribution.

LS5 Sondage (Elizabeth Bettles, Site supervisor)

The first task was to investigate the feature projecting from the north side of anomaly LS5, a comparatively large rectangular structure near the western end of these rectangular structures (Fig.10b). The gradiometer survey indicated strongly a gap in the north side of this structure and a linear feature projecting northwards in this locality. There were faint indications of a second linear feature parallel to the first, located to the east of it.

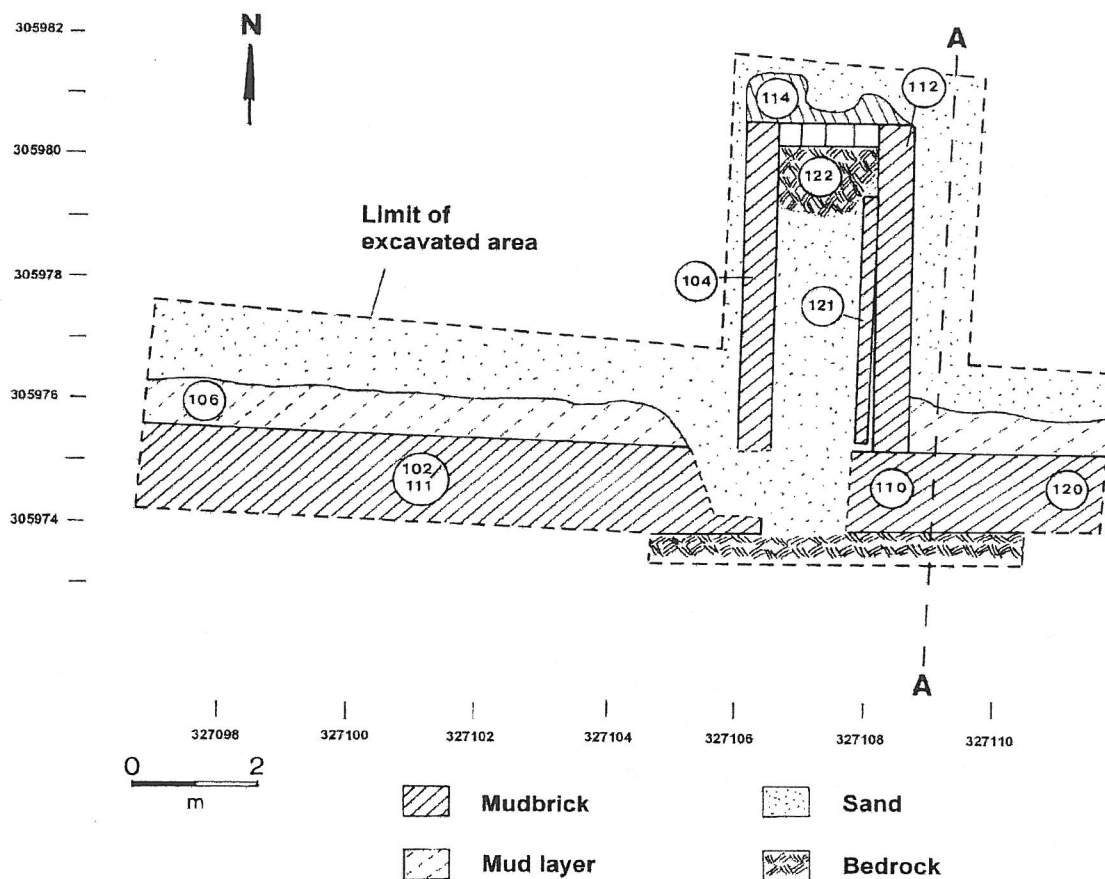


Fig. 15 Plan of LS5 (Plate 6)

Initially, four 5m x 5m squares were laid out on the surface over the area where the north side of LS5 and the projection feature faced each other at right angles. Starting with the SW square 65+15, the top surface layer of sand and gravel was cleared, followed by c.10 cms of fine, aeolian sand. During this process, a solid mudbrick wall was revealed, measuring about c.1½ m. wide and running in an E-W direction. The upper courses of this wall (102) were somewhat damaged, not surprisingly as it lay so near the current desert surface. Below this, the wall's construction appeared sound (111) (Fig. 16). As excavation continued eastwards along the north face of this wall, the mudbricks ceased, and the area was filled with fine sand down to bedrock level.

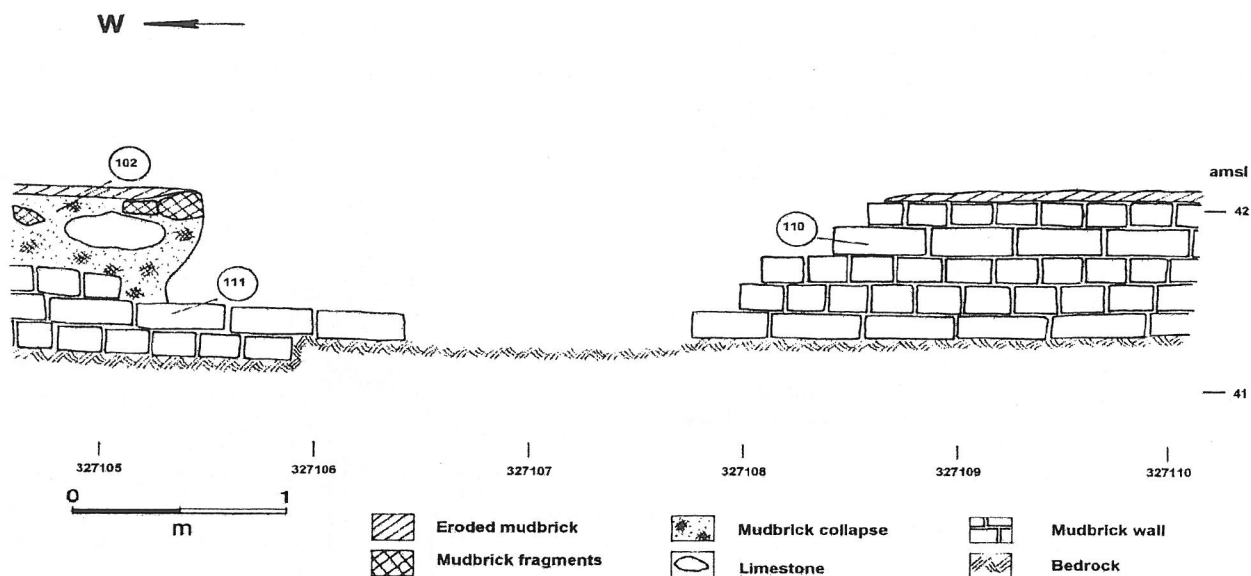


Fig.16 LS5 Elevation of walls (102/111) and (110/120) viewed from the south

After excavating a further c.1.4 m. eastwards, the remains of another mudbrick wall (110) were revealed, of the same thickness as (102/111) and continuing in the same E-W direction. Its preservation was better than that of wall (102/111). This wall (110) was cleared to bedrock level for a further 2½ m. eastwards.

Clearing its south face one could see the wall comprised 5 well-defined courses, with the possibility of at least one other at the top, now mostly eroded away. The bottom course consisted of stretchers, above which were two courses laid as headers, followed by a course of stretchers, with presumably two more courses as headers on the top. The wall was solidly constructed of mudbrick, though the builders had occasionally infilled small areas with pieces of brick and mud mortar (Fig. 17). The two lowest courses of the wall projected c.12 cms from the rest of the south face and were inset into *tafl* bedrock. Presumably this inseting of the walls was to ensure a secure foundation.

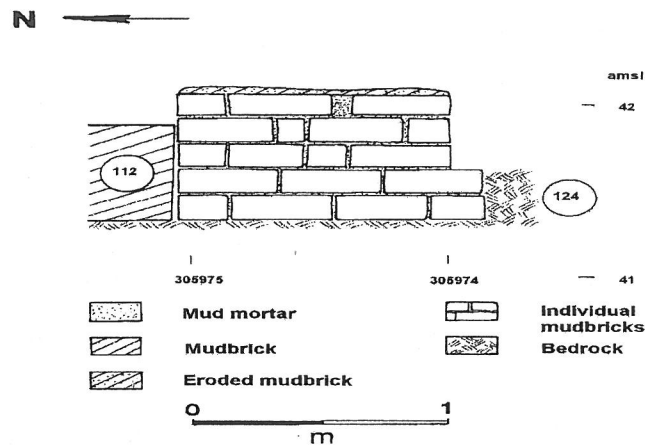


Fig. 17 LS5 Cross-section of wall (110)

As the sand was removed from the area to the north of wall (102/111) a mudbrick wall (104) was uncovered, lying at 90° to the east end of (102/111) (Fig.15). This wall was 5.15 m. in length, and narrower than the previously excavated wall, being c.35 cms wide. Presumably this wall had originally abutted the (102/111) wall, though these bricks were no longer extant. The (104) wall had two distinctive features. Firstly, the bricks had been laid at a sloping angle towards the north. Secondly, the number of courses decreased the further north it progressed, probably due to the rise in the bedrock (Fig.18).

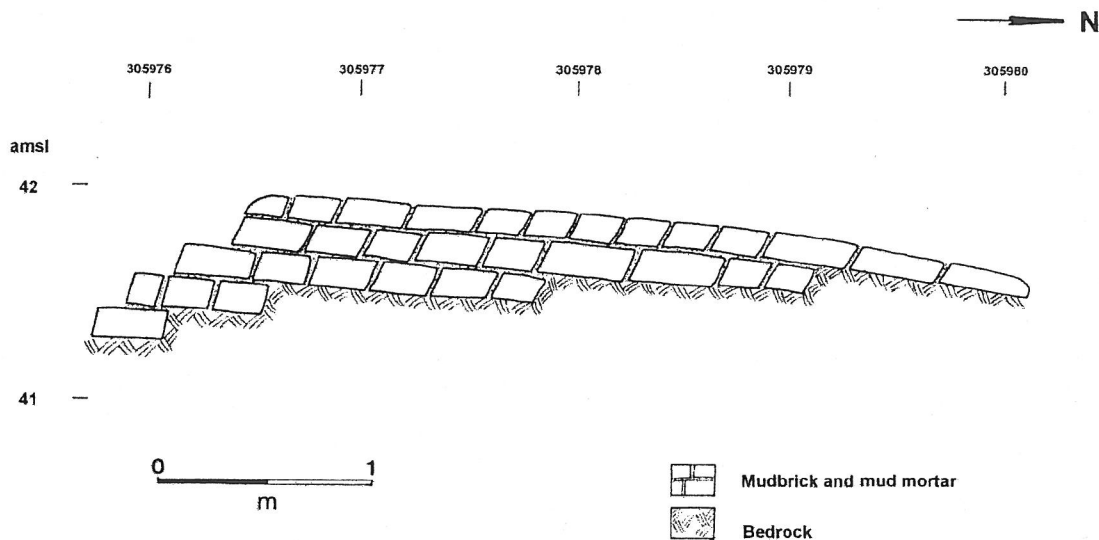


Fig. 18 LS 5 Elevation of wall (104) viewed from the east (Plate 6)

Another wall, (112), was uncovered c.1.3 m. to the east of, and parallel with, wall (104) (Fig.15). It also ran N-S, and was of the same length as the (104) wall. Between these walls was fine sand covering bedrock, the latter being exposed at the northern end, reflecting a rise in bedrock at this point. The southern end of the (112) wall abutted the north face of wall (110) without any use of mortar (Fig.17). As with wall (104), this wall was characterised by the number of bricks decreasing towards the north, to adapt to the rise in bedrock. A thin layer of white gypsum plaster, partially preserved, had been applied to the eastern face of the (112) wall.

Adjacent to the west face of this wall was a line of bricks, laid as stretchers, which stood a few centimetres from the (112) wall at its southern end, this narrow gap being filled with sand (Fig.15). This line of bricks, which apparently functioned as a width-wise extension of the (112) wall, did not extend north as far as the (112) wall, ceasing after 3.35 m., at which point it abutted the (112) wall. The two walls were joined together by a layer of single mudbricks which lay across the gap between them, so that from above, the wall looked solid.

Between the north end of the walls (104) and (112/120) were four mudbricks aligned N-S (Fig.15). To the north of these, at the limit of the excavated area, was a small area of tamped mudbrick flooring (114), which was poorly preserved as it lay just a few centimetres from the current desert surface.

A layer of hardened liquid mud (106) and (116) projected for over a metre from the north face of the walls (102/111) and (110/120) (Fig.15 and Fig.19). Below this was sand down to bedrock. Presumably this mud layer had been caused by severe rainfall when the surface of the bricks had melted and run-off onto the then current desert surface. A narrow area south of the walls (102/111) and (110/120) was excavated. The upper c.30 cms consisted of fine sand under the desert surface sand. Under this was a mixture of sand with a high proportion of gravel and finely crushed *tafl* (123), which continued for c.45 cms until bedrock (Fig.19).

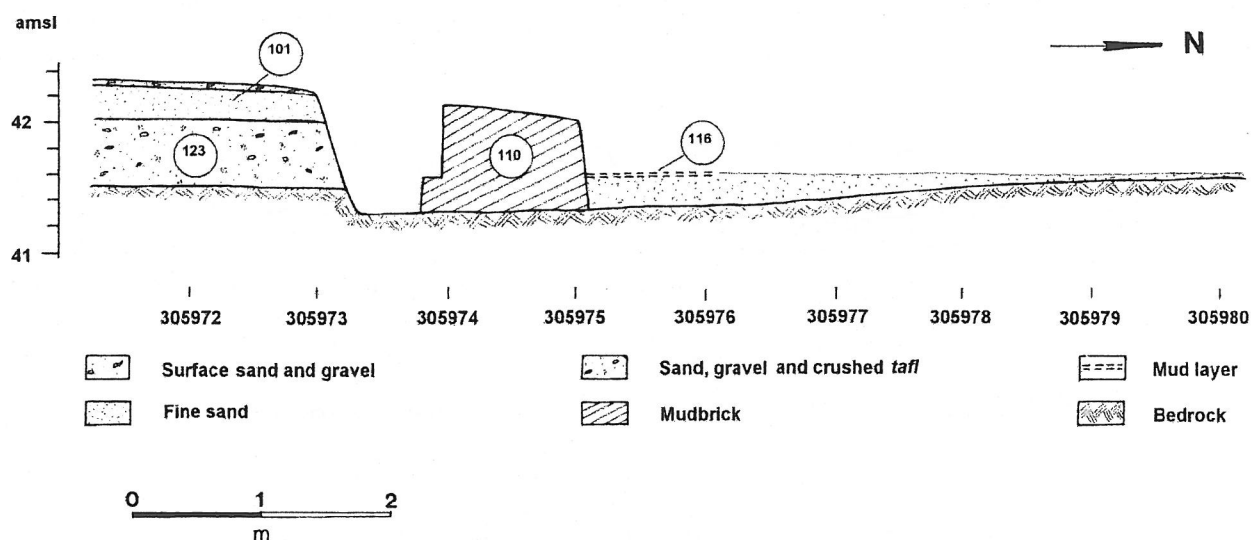


Fig.19 LS5 Cross-section A-A (Fig.15)

The mudbricks observed in the wall of LS5 were uniform in their dimensions and composition. The bricks usually measured c.40 x 20 x 14 cms. They were made of Nile silt mixed with abundant fine strands of organic inclusions, c.2-3 cms long, and some small pottery sherds. It seems the organic inclusions may have been chopped-up palm-tree wood. Part of a palm-tree branch, over 40 cms long and c.8 cms wide, projected from the north face of the (110/120) mudbrick wall. It was securely stuck between the mudbricks, suggesting it had been incorporated between the bricks during the construction process.

Interpretation of the architectural findings

- 1) The mudbrick walls (102/111) and (110/120) are likely to be the outer foundation walls on the north side of LS5. Within these foundation walls, a layer of sand, pebbles and crushed tafl had been laid on top of the bedrock. This may have been in turn filled with sand, or it could be that the sand has been blown in since the demolition of the building above. No remains of any flooring were discovered within the area to the south of the north walls of LS5.
- 2) The walls running N-S to the north of LS5 are interpreted as the robbed-out remains of supports for a stairway which had led up to the posited floor of structure LS5. No remains of the steps are extant. The extra brick wall (121) which was laid adjacent to wall (112) is seen as providing additional strength to support the stairway above. The gap in the wall in the north side of LS5 is considered to be a further result of the robbing process.

Dating this structure will depend on the pottery analysis. Very few objects were recovered from this sondage. These included a cylindrical copper bead (Object 26), small fragments of a blue glazed faience bowl and a limestone dice, a cube of c. 1cm², which had been apparently hand-made as the black spots are located off-centre (modern or ancient in date?) (Object 33). One small, round copper object could be a coin, but its surfaces are highly corroded (Object 32). None of these objects derived from a sealed context.

LS4 Sondage (Elizabeth Bettles, Site supervisor)

According to the 2000 gradiometer survey, the rectangular structure labelled LS4 is situated directly to the east of, and aligned with the north side of, LS5 (Fig.10b). LS4 appears to be narrower than LS5, and possibly longer, though its southern side appears indistinct on the survey results. The projection from its northern side also differed from that of LS5 as it had two linear features which apparently met the north side of the main rectangular structure after making two right-angle turns. Unlike the survey results concerning LS5, no gap was evident in the centre of the northern side of LS4.

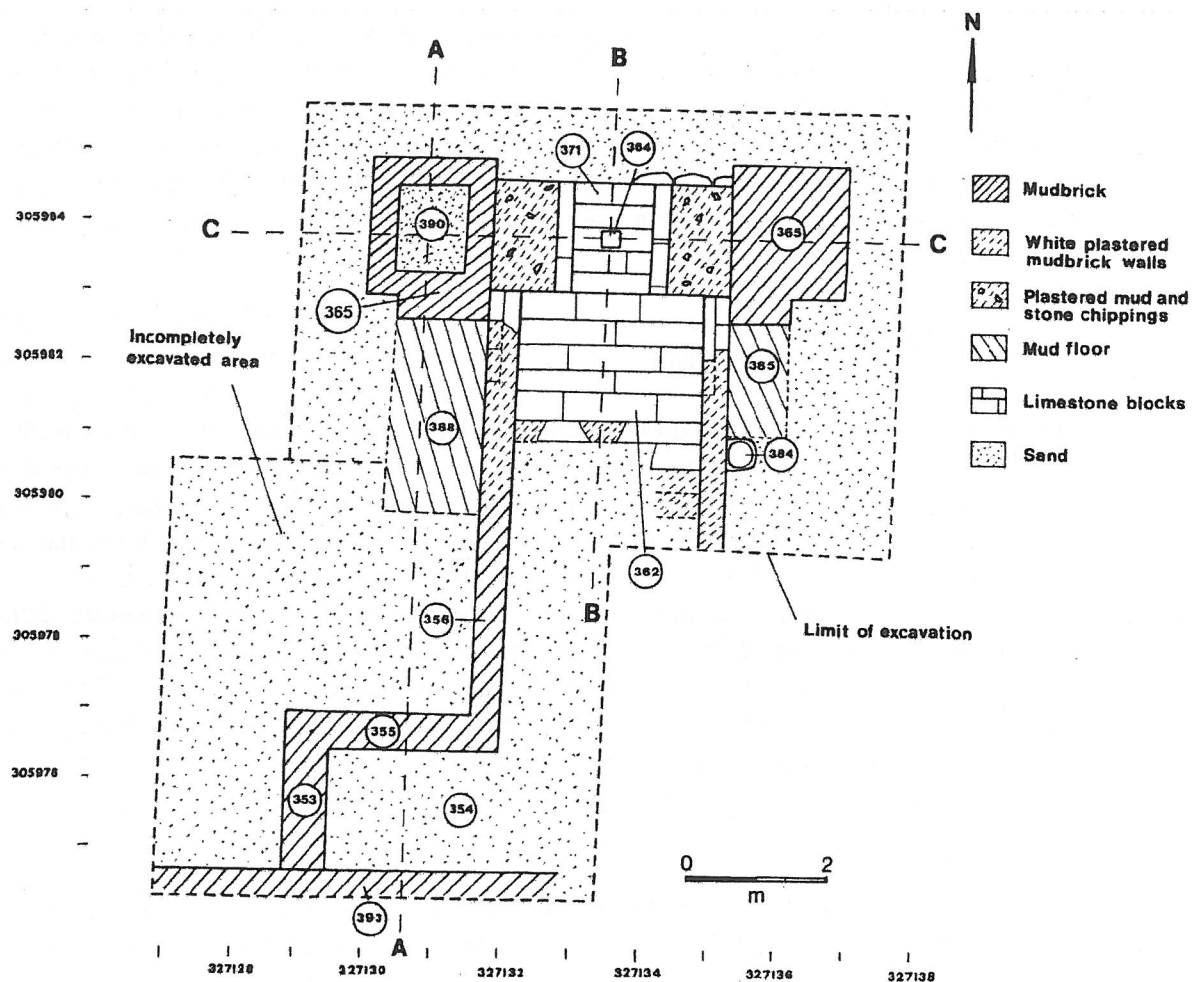


Fig. 20 LS4 Plan of sondage (Plate 5)

Excavation began by removing the top 10cms of surface sand from four 5m x 5m squares above those linear features which made two right-angle turns (the SE square being 95+20). Immediately, a mudbrick wall (353), c.50cms wide, was encountered which ran in a N-S direction. This wall extended northwards for 1.70 m., after which it turned eastwards at a 90° angle for 3.10 m. (355), and then made another 90° turn northwards (356) (Fig.20). The southern end of the (353) wall, which was uncovered in Square 95+15, abutted a solid mudbrick wall (393) which ran E-W, and which was apparently the main north wall of LS4. The outer faces of all these walls had received a mud wash, followed by a layer of white gypsum plaster, c.2-3mm thick. This plaster could be seen covering the corner where the west face of (353) wall abutted the north face of (393) wall, indicating that both walls had been standing when the plaster was applied.

As clearance of the sand continued northwards in the Square 95+25, the top of wall (356) began to slope steeply downwards, with thick areas of white plaster on its upper surface being revealed. In this plaster were rectangular impressions which suggested that some blocks had been inset in the plaster,

but which were no longer extant. At the northern end of this slope was a block of fine limestone, with a horizontal surface, measuring 36 x 21 cms (376). As the sand was cleared away towards the east of this slope, more blocks were uncovered revealing a stairway of fine quality Tura limestone (362), c.2.69 m. wide (Plate 5). The bottom-most five steps of this stairway were complete; the 6th and 7th steps near the top had been partly robbed of their stone blocks. Originally, there were probably at least two more steps above these seven steps, though these had been completely robbed out, leaving only the remains of their plaster emplacements. A hump of sand up to 30 cms thick in the area above the top of this staircase comprised a large quantity of limestone chippings. This probably had been caused by these robbing activities. The area to the south of the top of the stairs, as far as the main wall (393) running E-W, was apparently sand-filled, though this area was cleared only to a depth of c.20 cms. (Fig.20). No remains of flooring were found in this area. The top of the walls lay just a few centimetres from the current desert surface.

On the east side of the stairs another mudbrick wall (369), equivalent to wall (356), was observed, acting as a support for the staircase. A few rectangular limestone blocks (e.g. 20 cms x 90 cms) still remained in the emplacements of thick plaster on the top of its sloping surface. This indicates that the plaster emplacements on (356), now empty, had once been filled by limestone blocks.

As the sand was cleared from the northern end of this staircase, a narrower, and completely preserved, set of limestone stairs (371) was discovered. It comprised 5 steps, c.1.15 m. wide. In the centre of the third step a small limestone monolith stood erect (Plate 5; Fig.21 and 22). This block, 63 cms high, 19 cms wide and 23 cms deep, had been placed directly on the step, apparently without the aid of mortar. Its top appeared to be rounded, though it was in a poor state of preservation. Careful examination of the surfaces of this monolith revealed no inscription nor carved marks. To either side of this narrow staircase areas of mud mixed with stone fragments had been laid which extended to the width of the wider staircase, sloping downwards to the north, and at a lower level than the steps. A pink-coloured plaster had been applied to its smoothed surface. Abutting the base of this staircase were a few small undressed, flat stones. No further remains of flooring leading to the staircase, other than sand, were found.

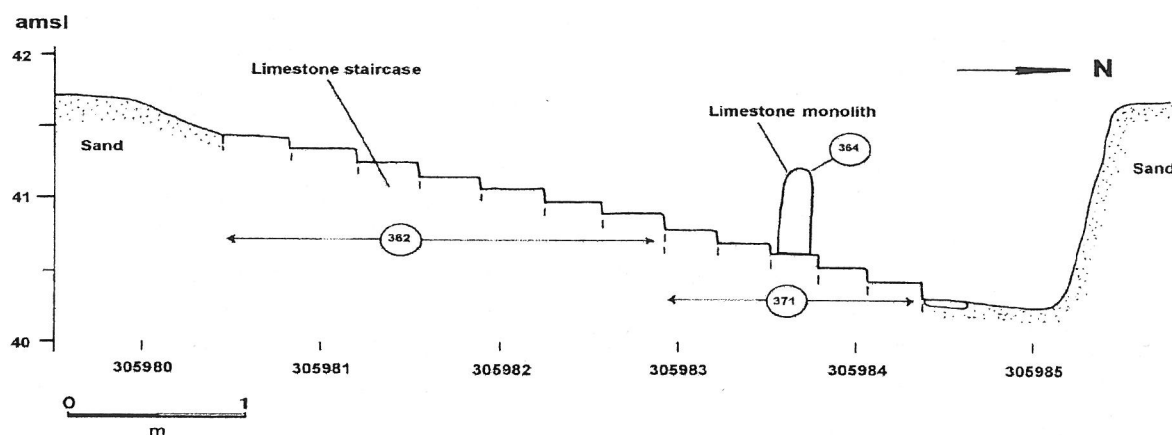


Fig. 21 LS4 Cross-section B-B (Fig. 20)

These two adjoining sets of stairs had been formed from blocks of the finest white Tura limestone which had been exceedingly well-carved. The blocks were uniform in dimensions and fitted together with little plaster. In the wider staircase the blocks had been laid according to a regular, alternating pattern (Fig.20). The rise of each step was uniformly 9-10 cms. (Fig.21 and Fig.24) The surface of the steps was well preserved and showed little sign of wear.

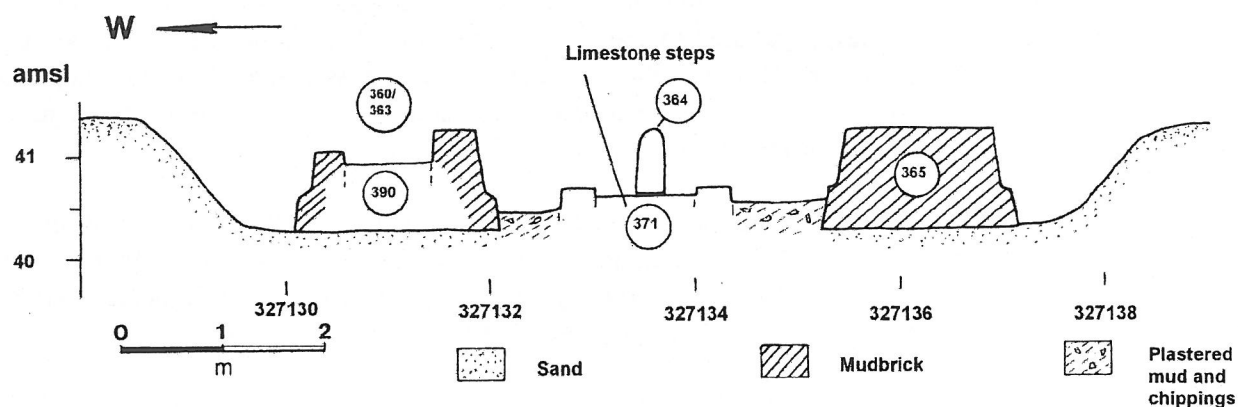


Fig. 22 LS4 Cross-section C-C (Fig.20)

On either side of the base of the staircase two substantial structures (360/363 and 365) had been erected (Fig.20). Predominantly of mudbrick, these structures are roughly rectangular in plan, with a small rectangular niche at one outer corner. The walls of the niche at the SW corner of (360/363), and the wall at the NW corner, were partly lined by undressed limestone fragments up to 30 cms square. These structures rose to a height of slightly more than one metre. Their sides are battered at the northern, eastern and western sides, with the bottom *c.*40cms projecting *c.*12 cms, from the upper 63 cms (Fig.22). The structure on the eastern side (365) was complete, displaying a flat, upper surface. The top layer of mudbricks on the structure on the west, (360/363), had become detached and had fallen over into the sand towards the west. This revealed that this mudbrick structure was hollow, with a core measuring *c.*1m². The upper 30 cms excavated of this core was excavated was found to consist of fine sand.

Once the aeolian sand to the west and east of the walls supporting the staircase and these two mudbrick rectangular structures was cleared, one could see that an application of mud wash had been applied to the outer faces of these walls. A layer of white gypsum plaster, *c.*2-3 mm thick, with a high proportion of quartz grains in the matrix, had been applied over this wash. This plaster was now partially preserved, though remains of finger impressions were sometimes observed on its surface where pressure had been applied to the plaster to aid its adhesion to the mud wash. On the east face of the mudbrick structure (360-363), at the base of the staircase, plaster could be seen underneath the mud and stone context which extended from the small staircase (371). This suggested that the mudbrick structure was already standing when this context (and the small stairway?) was constructed.

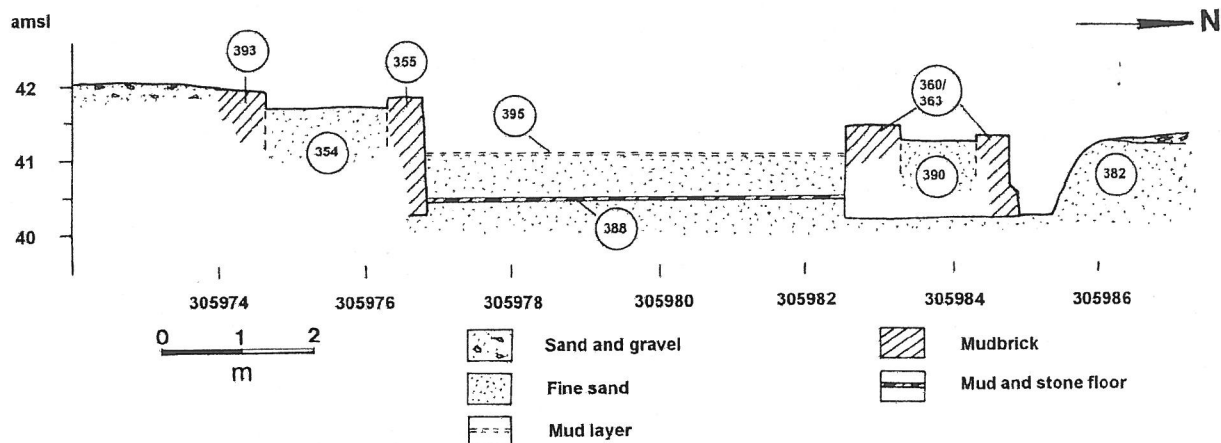


Fig.23 LS4 Cross-section A-A (Fig.20)

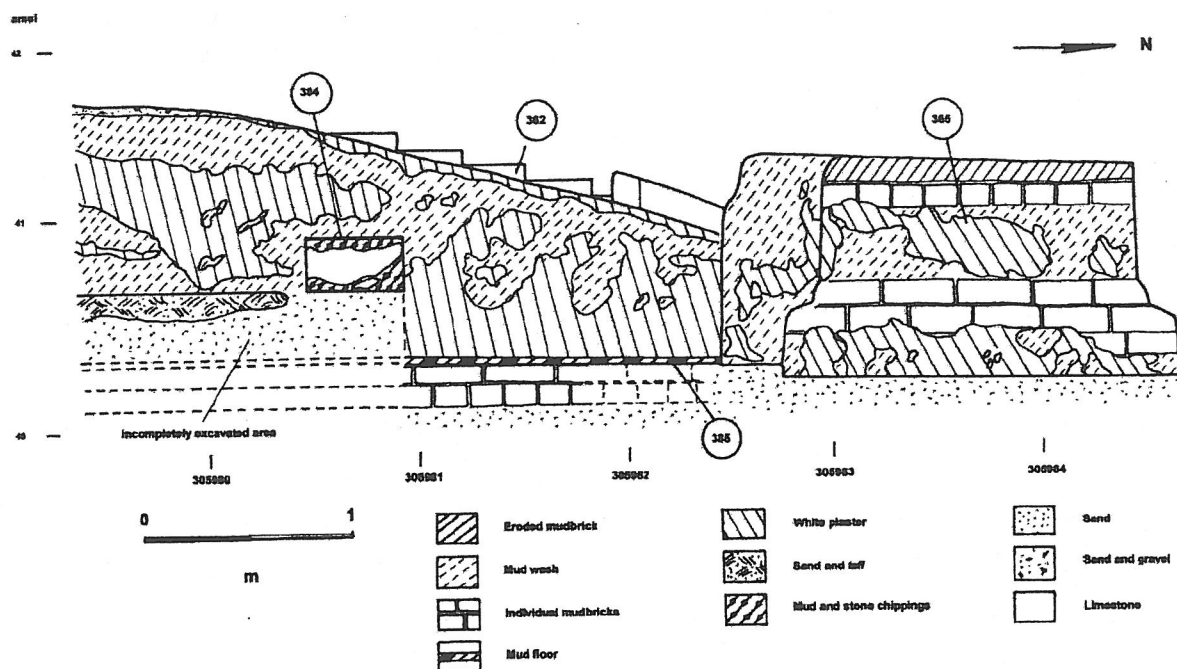


Fig. 24 LS4 Elevation of wall (369) and plinth (365) viewed from the east

On the west side of the wide staircase and the walls to the south of the steps, a layer of hardened liquid mud, c.1-2 cms thick, spread out c.30 cms from the walls. This feature had presumably been caused heavy rainfall melting the mudbrick surface, causing it to run down and cover the sand surface of that time (*cf.* contexts (106) and 116) in LS5). Underneath this layer was aeolian sand, c.43 cms deep, down to the mud flooring at the base of the walls. The white plaster wash continued on the wall

face below the level of the hardened liquid mud, suggesting this heavy rainfall had occurred some time after the stairway construction, when sand had built up against the face of the wall. The flooring at the base of the walls, and thus outside LS4, comprised tamped mud mixed with limestone flakes ((385) and (388)), c.3-4 cms thick (Fig.24). It extended to the southern faces of the mudbrick structures (360/363 and 365) at either side of the base of the staircase. An interesting feature projected from the east face of the staircase-supporting wall (369), c.24 cms above the mud flooring. This feature, (384), was made from a mixture of mud and limestone chippings, and measured c.47 cm² and 22 cms high (Fig.24, pl.5). A circular indentation, c.1½ cms deep, had been cut into its upper surface, as if the function of the feature was to act as a stand for some round object with a flat base. The relative narrowness of this feature suggests that this object cannot have been very heavy.

The builders of the walls found in this sondage had used mudbricks measuring 30 x 16 x 9 cms and 22 x 12 x 11 cms. The bricks comprised Nile silt, with some organic inclusions and a few small pottery sherds. The mud mortar between the bricks was comparatively thick (c.3-4 cms on the western face of wall (353)). On the north face of the main north wall of LS4 (393), where plaster had fallen off revealing the mudbrick courses beneath, one could see that the courses had been laid alternately as headers and stretchers. This was also noted in the foundation courses which lay underneath the staircase supporting walls. The foundation courses under the stairway support walls (356) and (369) comprised bricks laid as stretchers, above a course as headers (Fig.24). Underneath these mudbrick courses was sand. For the two mudbrick structures at either side of the stairway entrance (360/363) and (365), the foundations lay either directly on sand, or on a single course of bricks laid as stretchers.

Interpretation of the architectural findings

- 1) The main wall running E-W in LS4 is considered to be an enclosure wall for the foundations for this rectangular structure. The limestone steps led up to a floor of the entrance to this edifice, though no remains of this flooring were found in the excavation area. Presumably this had been robbed out. The northern foundation enclosure wall had been constructed first, then the walls of the entranceway built against it, and finally all outer surfaces had been mud washed and white plastered.
- 2) The two mudbricks structures at the base of the staircase, with their flat upper surface, are of uncertain function. Their flat upper surfaces suggest they could have acted as plinths. However, anything placed on top of them would have had to be relatively light, or be positioned with care, so as not to break through into the sand-filled core. These structures appear to have been constructed prior to the staircase, as the mud and stone context to either side of the narrower set of steps had been applied against their plastered surface.
- 3) The fine state of these limestone steps, with little sign of wear, could indicate that the building to which these steps led (of which there is no visible sign on the desert surface) may not have been in use for a comparatively long period.

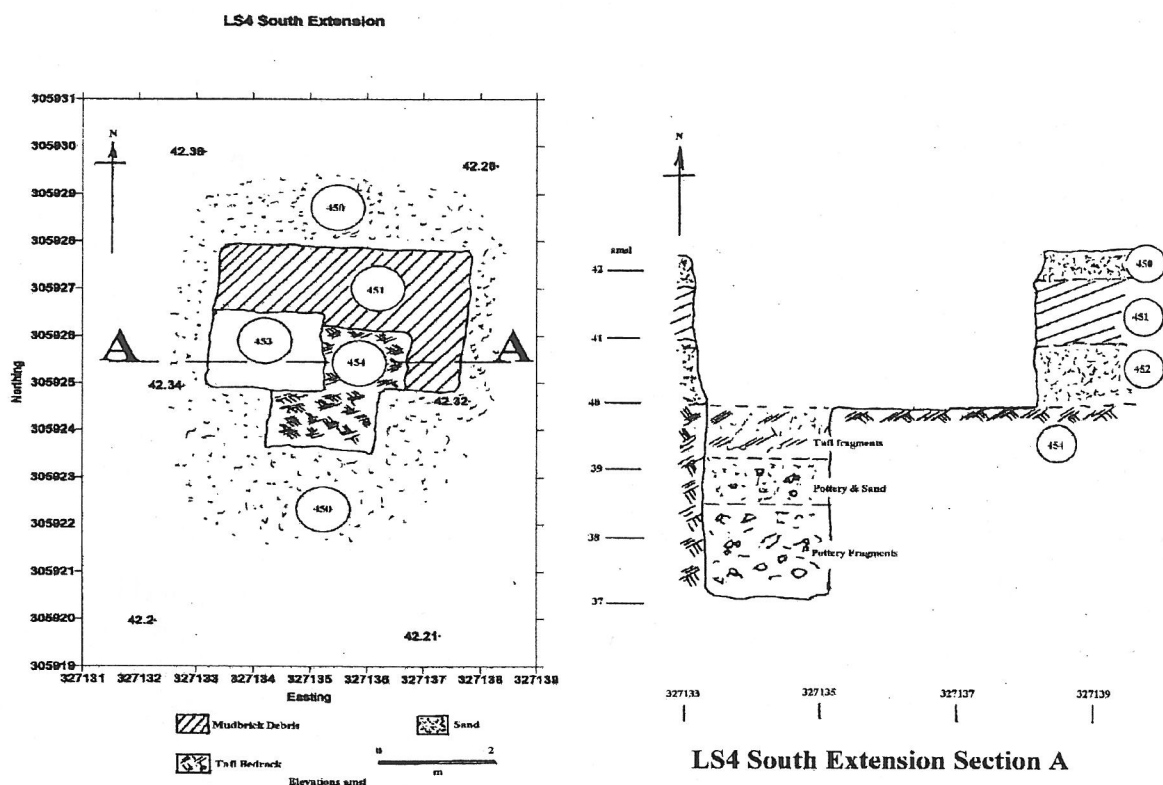
The artefacts recovered in the vicinity of these steps included a fragment of marble with a hieratic inscription painted black (Object 54), the lower portion of a tiny, but beautifully carved, faience

figurine of Isis sitting on a throne with Horus on her knees (Object 55, Plate 7); the upper portion of a small faience figurine of a cat goddess wearing the Double Crown with a hole through the lower part of the crown to allow the figurine to be hung from a thread (Object 56, Plate 7); a small round, incurving limestone bowl (Object 59); two small, thin copper round objects, highly corroded, which might be coins (Objects 53 and 60), fragments of small faience bowls and single beads of copper and faience. All except one copper object, which might be a coin, were found loose in sand, in a non-sealed context.

The dating of LS4 will require information from pottery and artefact analysis. However, one might hypothesise, from the gradiometer survey results, that the unusual narrowness of LS4 compared to the rectangular structures on its east and west, suggest that this building was inserted between LS5 and LS3 after they had been constructed. On this basis, LS4 could then be of later date than these structures.

LS4 South Extension sondage (LS4 s.ext.) Ian Mathieson, Site supervisor

On the geophysical plot of LS4 an anomaly appears in the southeast corner of the structure, this had also been plotted in 1998 using the proton-magnetometer instrument. It was decided to excavate a small sondage to discover the reason for this difference in data. Two 5m squares, 105-35 and 105-30 were excavated as shown on Fig. 6 and a small shaft (453) was found in the south-west corner of square 105-30 (Plate 2). On clearing the shaft was found to be 2.9m deep and contained a large amount of damaged pottery mixed with broken mudbricks and other debris.



The surface material (450) was typical of the sand, flint nodules, gravel and occasional mudbricks forming the upper infill of the casement blocks delineating the LS4 structure. Beneath this upper layer the amount of mudbrick debris increased towards the east (451) sealing the fine sand layer (452), that covered the whole area at this depth down to the *tafl* bedrock (454). It was into this bedrock that the shaft had been excavated.

After examination of the pottery and the removal of several diagnostic pieces (Plate 2), the remainder was collated, bagged and deposited again in the old shaft and the excavation back filled.

Egyptological conclusions – Anthony Leahy

The results of the survey season in the autumn of 2000 were spectacular. In a part of Saqqara near the L-shaped enclosure west of the Step Pyramid, where there is little to be seen on the surface, the gradiometer clearly identified a line of seven brick structures beneath the sand. It was apparent that they were individually large, that they were closely packed together and that they were all oriented in the same direction, facing north towards the Serapeum so as to form the south side of a 'street' running east-west. The purpose of the test excavations carried out in 2001 was to seek clarification of the nature and date of these structures. Three of the seven—LS 1, LS 4 and LS 5—were chosen for exploration and work began above what the images produced by the gradiometer readings suggested were the entrances. In each case, this proved to consist of a ramp or staircase. In LS4 a very fine limestone staircase set into a brick ramp was uncovered, whereas in LS1 the ramp was more crudely constructed of a mixture of mudbrick and large blocks of dressed limestone salvaged for reuse from some earlier structure. In both cases, one of a pair of roughly symmetrically disposed mudbrick 'pedestals' stood on either side of the foot of the stairway. The latter gave access to the top of a substantial platform created by the use of sand and rubble fill within mudbrick enclosure walls.

These structures are clearly not funerary, and it is probable that they served as bases for temples, built at least in part of stone which has long since disappeared into lime kilns or been reused in other ways. It has been recognised since Petrie's day that such platforms were used as a foundation for temples in the Delta, and similar complexes have more recently been found even closer at hand, in the Sacred Animal Necropolis at the north end of Saqqara. The platforms will have elevated the temples above ground level, impressing those who came to visit them, but also, perhaps, recalling the primeval mound on which the first Egyptian temple was believed to have been built. The pedestals may have supported statues of the deities worshipped in the particular temple. On the platforms may also have stood houses, shops and other buildings, since we know—both from Greek and demotic papyrological sources and from the excavations of the Egypt Exploration Society—that the landscape of Saqqara was transformed in the first millennium BC by the growth of the sacred animal cults there. At that time, the Serapeum became the heart of a complex of temples and dependent buildings extending over a considerable part of the plateau and far beyond the confines of the bull catacombs.

The tops of the platforms were not explored but it is apparent from the modern ground level that little can have survived there. We found no solid indication as to the deities to whom these temples were dedicated. Inscriptions were sadly lacking, and apart from tiny faience amulets of Taoueris, Sekhmet, and Isis suckling Horus, there were few objects. The only evidence for date as yet comes from the pottery, which predictably survived in abundance. Some of it was identifiably of a cultic nature but there was also much domestic pottery, thus reinforcing the view that these sites supported a variety of uses. Preliminary assessment on site (kindly confirmed by Mr Peter French, on the basis of a limited

sample of photographs) suggests that the overall assemblage covers the period from the sixth century BC into Ptolemaic times. The buildings themselves should therefore have been begun in the Twenty-sixth Dynasty and continued in use for four or five centuries. There was doubtless much modification over time and further study will be necessary to refine the dating of the individual structures. We cannot yet say anything about the order in which they were built or possible relationships between them.

However, what has been revealed so far provides a fascinating glimpse into an aspect of the late history of Saqqara that has hitherto been known largely from texts. The existence of a temple of Ptah and Isis in the vicinity of the Serapeum at least as early as the sixth century BC is proven by a stela which records the donation of a brewery to it by the pharaoh Amasis. The Greek and demotic papyri mentioned above refer to many others, including those of Imhotep and Astarte, and provide a vivid picture of the tensions of life in the communities which inhabited the area. Even so, the evidence of the papyri had not pointed to the existence of temple structures in this particular area, south of the Serapeum. A working hypothesis might be that this area constituted the southerly part of the great religious complex known to the ancients as the 'House of Osiris-Apis', and that the temple platforms were constructed to form a processional route towards it. This part of Saqqara is still largely unexplored archaeologically, however, and much further work will be needed to clarify these matters. The geophysical survey is providing a secure foundation for that work.

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 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.

In year 2000 we reported the finding of several large anomalies, referred to as LS1 to LS9 located in the L-shaped enclosure to the south of the Serapeum. This report covers the three *sondage* excavations carried out this year to identify the cause of these anomalies. We can now say that our work has identified at least seven previously unknown large rectangular structures which appear to be the casement type foundations for temples or chapels each apparently provided with an entrance ramp or stairway centrally situated on the north side.

The geophysical survey was extended on the north side of the Serapeum and 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 1882-1889.⁹ What is interesting is that there appears to be many more features in this area than those recorded by the two excavators. It is our intention to extend 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.

⁹ A. E. Mariette, *Les Mastabas de l'Ancien Empire*. G. Maspero Paris, 1889. J. de Morgan, *Carte de la Necropole Memphite*. Cairo 1897

NMS preliminary report

Also of benefit to all concerned was the geological survey work carried out this year to up-date the geological mapping of the Saqqara plateau.

With the permission of the Supreme Council for Antiquities the NMS plan to continue the work through 2003 to 2005 and complete the geophysical survey of the concession with particular reference to the Gisir el-Mudir, the proving of the L-shaped enclosure structures, the Serapeum and the valley between the Sacred Animal Necropolis and the Ka'aper tomb group.

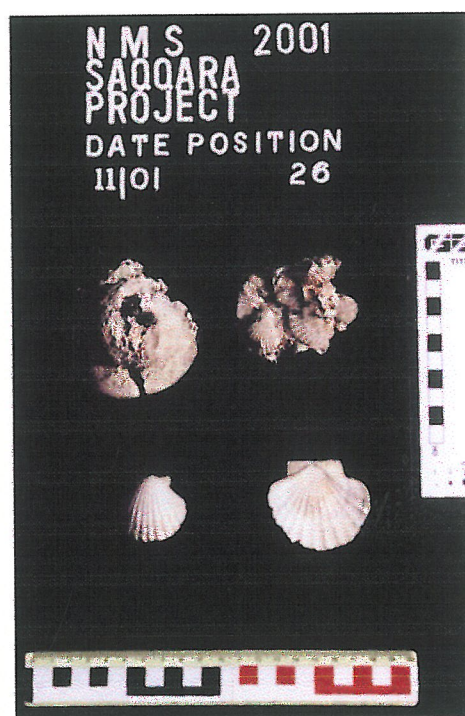
Ian J Mathieson

Project Director

March 2002



'a' Macrofossil Assemblage at Position 2
(Giran El Ful Member)



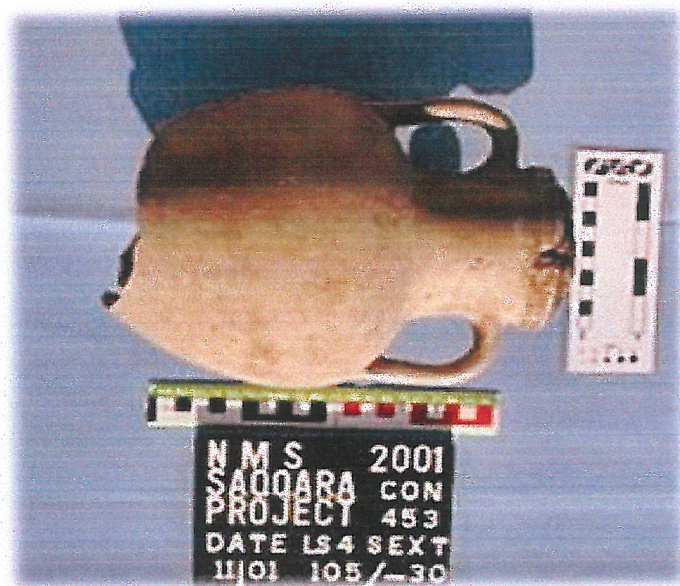
'c' Macrofossil Assemblage at Position 26
(Kom El Shellul Formation)



'b' In situ brachiopod (Terebratulid) at Position 2
(Giran El Ful Member)



LS4 S/Ext. Pottery from shaft



LS4 S/Ext. Pottery from shaft



LS4 S/Ext. Shaft



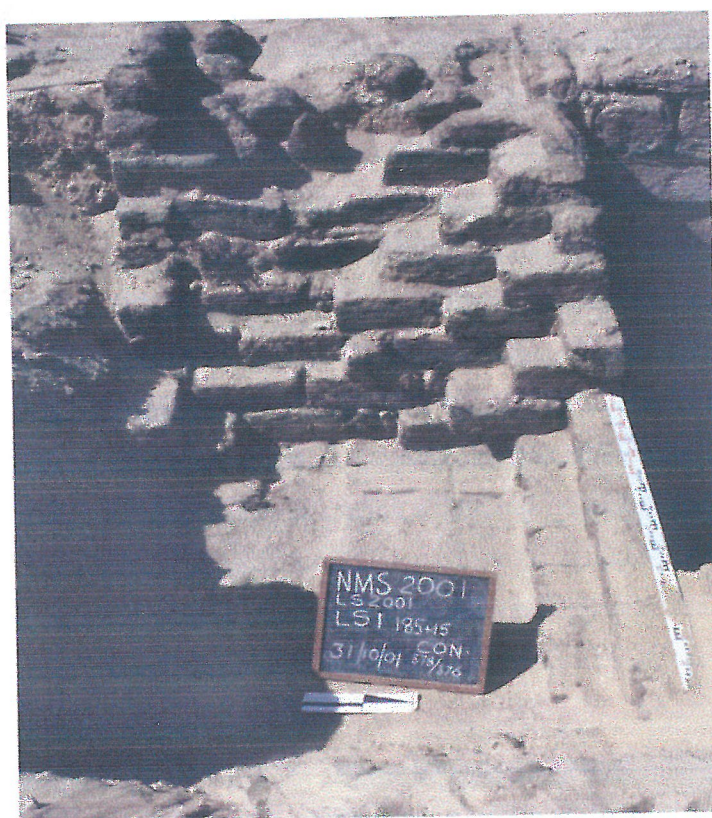
LS1 Robbed out steps and limestone basin on ramp



LS1 Showing construction of east wall of ramp



LS1 General view of ramp and plinths



LS1 Junction of ramp and construction of back wall



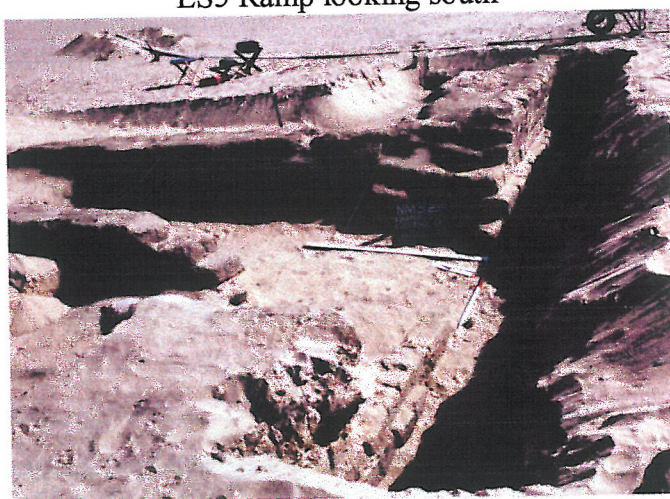
LS4 Limestone staircase



LS4 Monolith on staircase



LS5 Ramp looking south



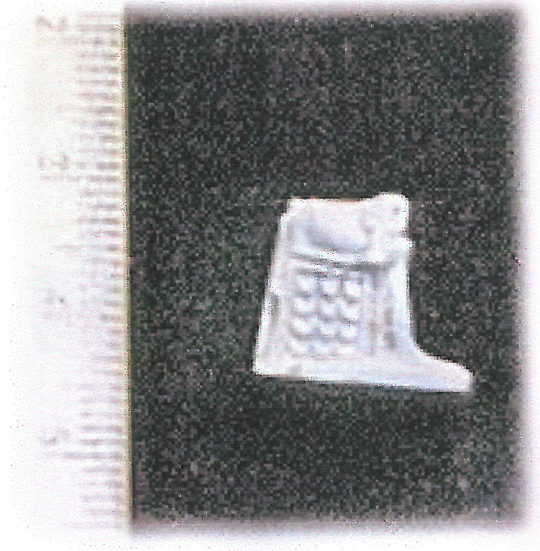
LS5 Junction of ramp and rear wall



LS5 West ramp wall showing original slope



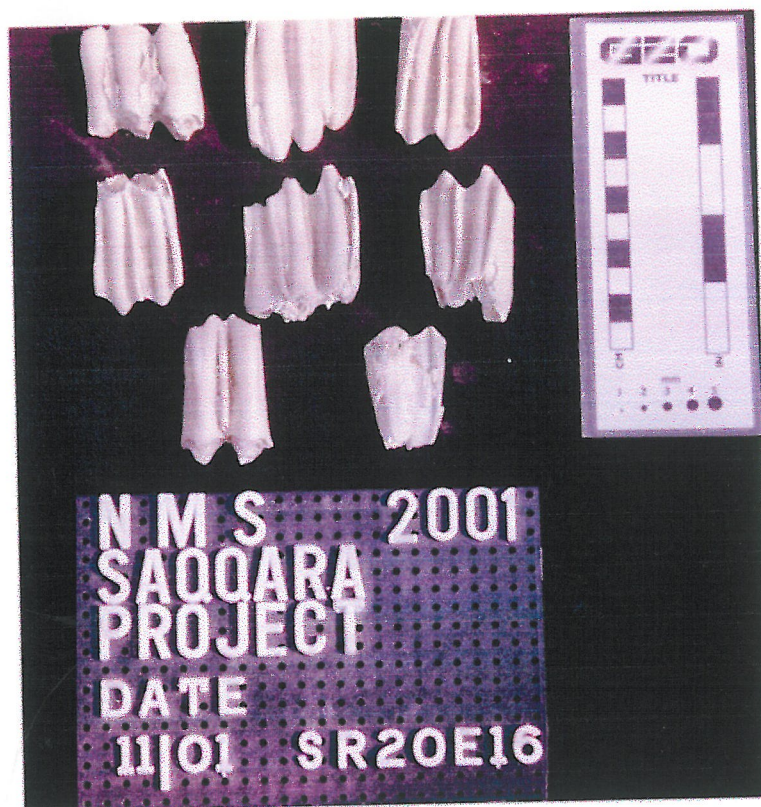
LS4 Object No.56 Cat Goddess



LS4 Object No.55 Isis on Throne



LS1 Object No.77 Goddess Taweret



Sacred Animal Necropolis Square SR20-E16
Bovine Teeth from area near Tomb des Boeufs
(De Morgan & Mariette maps)



Sacred Animal Necropolis Square SR20-E16
Site of Tomb des Boeufs & Tomb 29 Ptahshepses
(De Morgan & Mariette maps)