NATIONAL MUSEUMS OF SCOTLAND

SAQQARA PROJECT REPORT 1992-1993

National Museums of Scotland
Chambers Street Edinburgh EH1 1JF

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Ian Mathieson, Harry Smith, Ana Tavares

An interim report on the work carried out during the 1992-1993 season covering resistivity and proton-magnetometer sub-surface sensing, field-walking, topographic survey and research into previous records at the Saqqara Necropolis of Memphis, Egypt.

Project Directors
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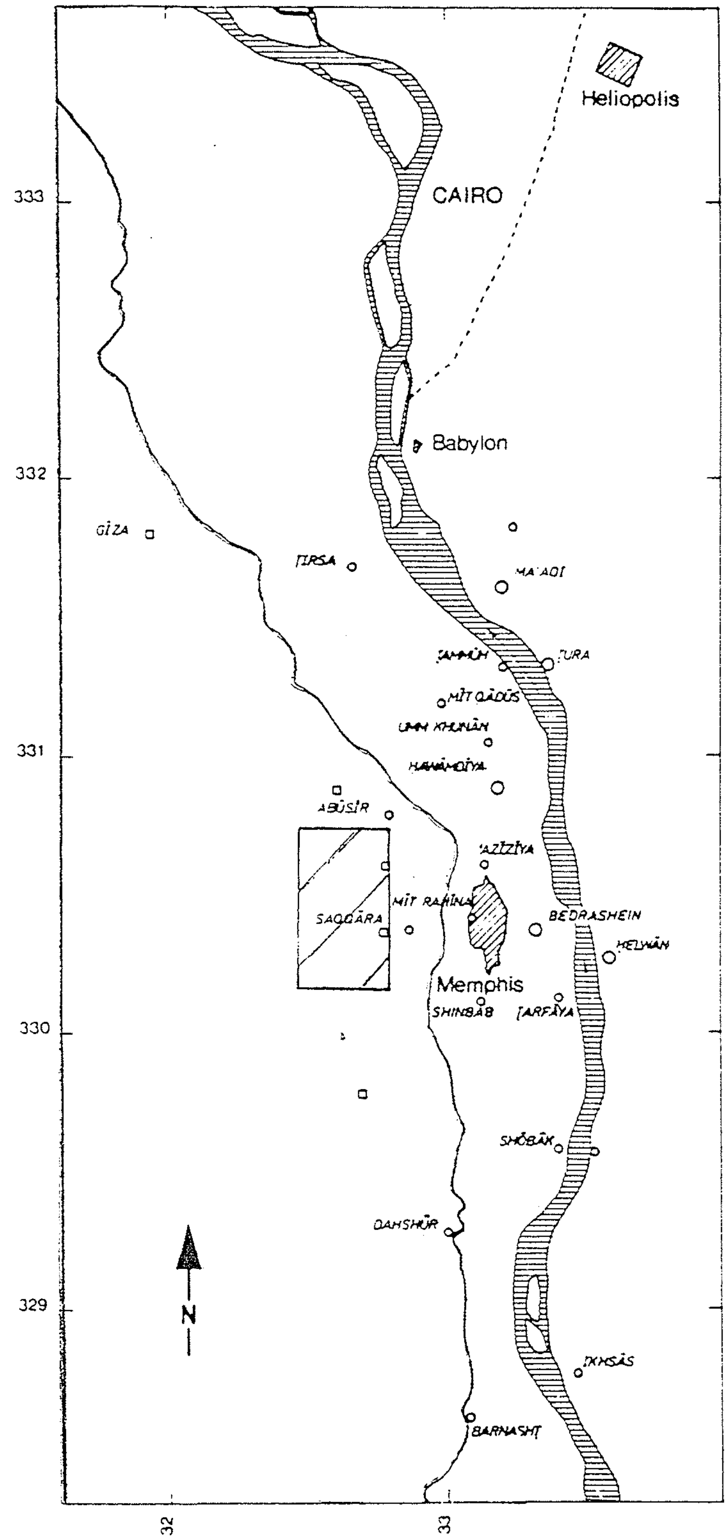
SAQQÂRA

Location map



extent of Nile flood plain

course of Nile

course of Bahr Libeiny

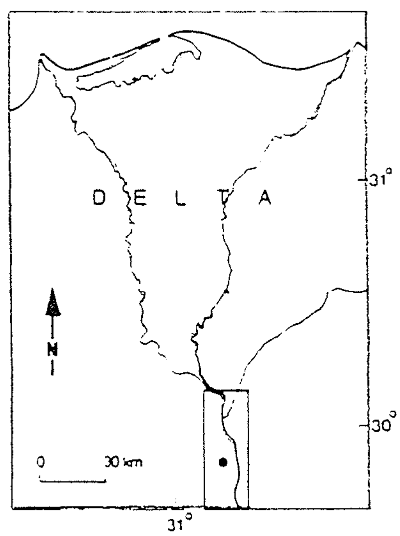
TURA — modern place name

pyramid field

Babylon — ancient place name

UTM GRID INTERVALS = 10 000 m

EES 1983



THE NATIONAL MUSEUMS OF SCOTLAND

PRELIMINARY REPORT OF THE SAQQARA SURVEY PROJECT, 1992

By IAN J. MATHIESON and ANA TAVARES

The findings of this project will enable the National Museums of Scotland to produce an up-to-date archaeological and sub-surface geophysical map of the described area known as the Abusir West-Saqqara Wadi. The work combines

- remote sensing investigation
- field inspection
- archival research into previous excavations and surveys
- selected excavation of anomalies that demand more detailed examination.

The National Museums of Scotland acknowledge with gratitude the help and co-operation of the Egyptian Antiquities Organisation with whose permission the Museum's work is carried out; especially the Officers at Abassiya, Chairman Prof Dr Mohammed Ibrahim Bakr, Dr Ali Hassan, the members of the Committee and the Secretariat, Mr Ahmed M. Moussa and Mme Samia; at Giza, Dr Zahie Hawass; at Saqqara, the Director of Antiquities Mr Yehia Eid and the EAO representative Mr Sabri Mohd El dein Farag, all of whom have been most willing to give assistance at all times.

Financial assistance from the British Academy and the Wainwright Fund and map reproduction by Survey and Development Services, Bo'ness, West Lothian are gratefully acknowledged.

The 1992 field season was delayed until the 7th of January 1993 and continued to the 25th of February, the staff being Co-directors Ian Mathieson (geo-archaeological surveys) and Prof. Harry Smith (Egyptological adviser), Ana Tavares (survey and archival research), David Wand (photographer). David Jeffreys (archaeological adviser) was consulted prior to the field season.

FIELDWORK

Location Surveys (Ian Mathieson, Ana Tavares)

The location of tombs, structures and survey lines are based on local triangulation schemes laid out by the Survey of Egypt, Cairo University Engineering Department and the Egyptian Exploration Society, all of which have been reduced to the UTM Grid (Universal Transverse Mercator Grid Projection-Hayford 1909 Int. Ellipsoid) which is the base for the topographic map sheets produced in 1978 for the Ministry of Housing and Reconstruction (MHR 1978) at a scale of 1/5000. It is from these map sheets

that the basic topographic features used by the authors are obtained. The main traverses and cross-sections of the completed resistivity profiles along with all shafts, tombs and structures surveyed are to be shown on the base map.

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. 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 began 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 which lies some 100m South of the Southern boundary of the Gisr-el-Mudir (the Great Enclosure).

RESISTIVITY SURVEY (Ian Mathieson, Ana Tavares)

Methodology

Sub-surface remote sensing for archaeological purposes can be carried out by:

- resistivity,
- proton-magnetometer
- sonic profiling,
- ground penetrating radar
- thermal imaging

For large-scale exploration survey the resistivity traverse method gives the fastest results and enables the concession area to be divided into a grid pattern for closer examination of any anomalies touched during the traverses. Resistance to an electrical current is a physical property that characterises a material almost as definitely as its density and magnetic susceptibility.

The electrical resistance method for sub-surface study was first developed by Schlumberger in France in 1912 as part of geophysical development in the pursuit of oil exploration. Since that time the method has proved itself to be among the most effective means for shallow sub-surface investigation. Resistivity surveys can distinguish types of sub-surface materials, determine the composition of an overburden and estimate the depth of the rock-head. Any intervening material or void gives an anomaly which can be plotted in depth and linear position.

The procedure relies on the principle that separate material deposits beneath the surface offer different resistances to the passage of an electric current, depending largely on the amount of moisture present in the material. A damp midden pit-fill will offer less resistance than the surrounding dryer soils and a brick or stone structure a much higher

resistance. The measuring device used consists of a source of electric current and a meter to measure the resistance. The particular instrument used for this survey project is a Strata-Scout analogue resistance meter connected to a linear array of 24 copper rods by a multi-core cable addressed by a multi-selection switching device. The copper rods are driven into the ground at two metre intervals and the current passed through the rods in paired sequences, the configuration being called the Wenner method, [1] which provides a measure of depth and position at which the resistance is being measured.

Each array or profile is overlapped to give a continuous depth recording down to 8 m depth. Readings can be taken at 10, 12, and 14 metres to gain further information when a structure is observed. The data is computerized for smoothing and removal of background 'noise' and then plotted in the form of crude cross-sections or pseudo-sections by software which gives maximum flexibility in scale and notation. As the resistivity data can range from zero to infinity within the space of a few metres the ability to plot natural scales as well as logarithmic ones is greatly appreciated for clarity of presentation in graphic form .[2]

The pseudo-sections for the main traverses and the cross-sections observed in 1990-1993 are shown on Figs. 1-22

PROTON-MAGNETOMETER SURVEY (Ian Mathieson, Harry Smith)

Methodology

Magnetometry has been used in the field of archaeology since early 1960 when the method was used to locate Etruscan Tombs in Italy. There are various types of instrument which lend themselves to archaeological field searching, (1) the flux-gate and gradient magnetometers, (2) the single-sensor proton-magnetometer and (3) the double-sensor differential proton-magnetometer.

All of them, by using the magnetic field of the earth as a base, attempt to measure modifications to the earth's surface static field caused by local ore bodies, metallic iron or the small but measurable anomalies caused by ancient foundations, graves, pottery, kilns or ovens, hearths, cavities or changes in sub-surface materials. The searcher is helped by the fact that the magnetic field of the earth changes in value during the passage of time and that the firing of clay or the destruction by fire of a site tends to freeze the magnetic field existing at the time of the event. The magnetic field of the earth, though very weak, is easily measured and averages about 50,000 gammas or nanoteslas (1 gamma = 1 nanotesla [nT] in international units for measuring the earth's magnetic intensity, SI System). Diurnal changes to the earth's field value can vary between very small amounts of 1 or 2 gammas to as much as 100 gammas during a solar magnetic storm which can last for several days.

For research work in Egypt where structures can be at depths of up to ten metres a double-sensor Liebhazet differential proton-magnetometer manufactured by M L Dalton Research of Dallas, Texas, USA was chosen. This instrument allows the calculated value of the earth's magnetic field intensity to be used as a calibration factor at the geographical position of the site.

By fine tuning the instrument, a difference of 0.5 of a gamma may be detected by using a beat frequency introduced into the decay sequence of the protons at the separate sensors. This enables the surveyor to field -walk to a grid pattern knowing that any anomaly will be indicated immediately by the audio beat, analogue meter or a strip recorder.

For the survey of the Serapeum area the instrument was calibrated at 42500 gammas and fine tuned to maximum response at the site. An addition to the recording side of the survey is the use of a Model 142, strip chart recorder, manufactured by Linear Inc., USA, which enables permanent records to be kept of all anomalies found during the survey.

The Serapeum (Map Sheet 1)

It was decided in 1992 to divide the Serapeum site into a grid pattern bounded by the access road on the North, South and West and the Tourist area to the East. Four resistivity cross-sections were surveyed North-South and four in a East-West direction, the actual positions being determined by topographic features. (Map Sheet 1)

A major difficulty was experienced in obtaining reliable data due to the excessive depth of fine wind-blown sand which has accumulated over the site . The high escarpment to the West causes the sand to fall over one third of the site to depths of three to five metres. The copper electrodes of the resistivity array had to be embedded into the sand some 40 cms before acceptable readings were obtained.

The ground in the Serapeum is fairly disturbed. Intensive sanding up of the area, large mounds of excavation debris as well as building work and tourist facilities now obscure the original topography and most surface traces of ancient buildings are completely obliterated.[3]

The Serapeum constitutes the nucleus of the Sacred Animal Necropolis at North Saqqara. It was approached from the East via an avenue of human headed sphinxes, which curved around a prominent rock knoll and lead to a semicycle adorned with Hellenistic statues. A series of temples and chapels were built in this area. The Serapeum itself was approached via a paved *dromos*[4]which had an Apis and a Carian shrine situated on its North side.[5] A gateway flanked by two lions (dated to Nectanebo II) led to the East pylon of the Serapeum enclosure wall.

The Apis galleries and isolated New Kingdom tombs were excavated by A Mariette in 1850-54.[6] Recent geophysical work has been carried out in the galleries[7] and the study of the extensive documentation from the Serapeum is a vast on-going project.[8]

The description below is based on Mariette's account of the excavation as well as his and De Morgan's maps.

The dromos runs for approximately 86m and enters the Serapeum enclosure at the East through a pylon gateway. Sections of the enclosure wall were excavated by Mariette[9] who discribes a limestone latticed construction ("bolcs espaces formant claire-voie ") for the North, South and East walls.[10] The West side probably had no actual built wall it being defined by the high desert plateau.[11]

East wall-North section
At a mid point in the latticed wall the bedrock was exposed showing a vertical deep cut (purpose unknown).[12] Further clearance showed it to be partly a man made partly a natural feature.

East wall-South section
This wall had two sections; an East wall on the same line as the pylon (60 to 80m long) at its South end a short wall runs East-West(50 m) then another wall runs North-South (100 to 150m) ie. the latter is set back 50m further West than the line of the East pylon. cf Map Sheet 1.

South wall
Parts of the limestone "claire-voie"were excavated but no pylon was found. At the mid point along the length, the wall was built over five tombs. These were approached via an open air sloping passage but were found empty.[13]

North wall
This was found along the entire length except at a mid point where it was interrupted. Here were found limestone colunm drums, remains of a pylon and bases for lions or sphinxes. The stone pavement had been removed.[14]

Inner structures
Mariette found no paving within the enclosure.[15] He reports brick walls to the South of the lion gateway (ie. South of the *dromos*) and within the enclosure. These had limestone revettment and unusual relief decoration.[16] Wall lines, mastabas and shafts are indicated, in the maps of Mariette, De Morgan and Rhone, at the South-East area within the enclosure.

Comments
As shown by Mariette the enclosure wall of the Serapeum[17] covers an area of approximatly 250x300 m. At present none of the enclosure walls are visible, there is no trace of the East pylon or any of the structures at the South-East within the enclosure wall. A quite different plan is published by Rhone which incorporates interesting information regarding the structures within the enclosure.[18] The West wall which is ommitted in all other maps, is indicated here. The topographic features indicated in the map seem to show that Rhone places the Western enclosure wall on the high desert plateau.[19] However when enlarged to scale the wall is actually positioned East just beneath the escarpment where one would expect a screen wall, chapels or shrines to have been built. The high readings recorded at various points along SRP 6 may indicate such structures.

Rhone also shows a regular celular building to the West on the high desert plateau. Field observation in the area revealed traces of a limestone paving (?). The construction was of roughly rectangular blocks forming a skin facing both sides of the core blocks which are layed perpendicularly. Coarse pink plaster was evident in both rising and bedding joins. Two of these features were evident, 15m apart, see Map Sheet 1, marked C. The anomaly recorded nearby at 4 m and high readings at 24, 49 and 64 m on XC13 correspond to surface indications.[20]

Rhone also shows a double inner enclosure wall at the centre of the Serapeum surrounding the actual entrance area to the underground galleries. Traces of two walls (North and South face of two East-West walls) were observed at the cross-ing of SRP9 and XS14. The anomalies recorded at 204 m on XS14 and at 149 m on SRP 8, as well as the anomalies at 215 m on SRP 9, 311 and 349 m on XS13, may correspond to the features recorded by

Rhone. The high reading on XS14 at 64 m may also relate to either the double wall or to the East enclosure wall or structures adjacent to it. A section of the outer Eastern enclosure wall may be indicated in the anomalies on XS12 at 103 m and on SRP10 at 171 m.

A large limestone mound to the West of the EAO resthouse and a West-East line of large stone slabs are likely to be part of the North enclosure wall and pylon. If Rhone's map is accepted as indicating a North pylon placed on the North side of the wall and an inner gate with an ante-chamber to the South of the entrance, the limestone features (one at the North-West and another at the South-West of the building) may be the few remaining traces of such a structure. This would place the North entrance of the Serapeum 40 to 50 m further North than shown in the maps of Mariette and De Morgan. Further evidence for placing the North gate 140 m North of the entrance to the Serapeum galleries, as shown in Map Sheet 1, is given by Macramalla's discription of a West-East wall on the North limit of his excavation. [21]

No coherent picture of the Late Period buildings within the enclosure wall has yet emerged although such structures have been found by various missions. [22]

Various bronze caches were found at the Serapeum by Mariette.[23] De Morgan indicates bronzes on the exterior and along the entire length of the enclosure walls. More recent excavations have also uncovered large numbers of bronzes. [24] The proton-magnetometer was run over the cross-sections and readings taken at 10m intervals using the audio beat count and the analogue meter deflections to indicate if anomalies existed. A total of thirteen spots of interest were located as shown on Map Sheet.1. These anomalies will have to be investigated in greater detail in a future season as many lie close to the rest-house building and may be due to buried metal or rubbish from the construction.

To the West of the derelict resthouse an early dynastic cemetery was excavated by R. Macramallah in the 1930's.[25] It consisted of small cist graves cut into a compact sand and gravel layer. This geological stratum was less than one meter thick above the friable bedrock. The majority of graves were unlined shallow cist burials cut into the gravel, with more elaborate tombs, usually bricklined or mud plastered, cut into the bedrock. The regular layout of group F has prompted N. Swelim to suggest that these may have been subsidiary burials surrounding a large mastaba to the East[26] It is however unlikely that such a large structure would have been missed by the excavator.[27] The large anomaly shown on cross-section SRP6 at this point may be caused by excessive sand cover over a minor disturbance.

The layout of the cemetery, the funerary goods and the sex and age of the burials have led W. Kaiser to propose this may have been a cult area of Den. He suggests that the cult buildings at the centre of the cemetery as well as an enclosure wall, may have been constructed of perishable materials. The entrance to the precint would have been between graves 146-147 of group G and the row of graves F.[28] Kaiser also argues for a slightly later use of the area being attested by the grave groups B/C, G and D.[29] The full extent of the cemetery has not been excavated.[30] The anomaly on cross-section 14A at 46m may be similar to that in SRP6 and be caused by deep sand cover over disturbed ground.

De Morgan's map shows three Greek shafts within the Serapeum enclosure.

and an West-East row of four Old Kingdom mastabas and one New Kingdom tomb. There are no surface indications of these features.
To the North-West of the L-shaped ridge and just South of the Serapeum enclosure wall (as shown in Mariette's map) De Morgan places the isolated Fifth Dynasty mastaba of Khyat-hotep-her. This may be equated with MT92. A roughly triangular area, with its apex at the crossing of XS 11 and T 3, and the base on XS 9, although showing some surface features is marked as empty in De Morgan's map.

Ptah-hotep Area (Map Sheet 2)

The Ptah-hotep area lies between the Serapeum access road to the North and the Gisr-el-Mudir to the South with the Ptah-hotep group of excavated tombs to the East and the rising ground forming the tailing out of the Serapeum escarpment to the West

Four major cross-sections were observed running East-West over the area. Two of these cross-sections XS8 and XS9 cover the L-shaped structure discussed in the 1990 and 1991 reports and confirm the presence of sub-surface anomalies and surface traces of large mud-brick structures in the North-Western section of the L-shape. Graphical representations of these anomalies bear similarities to each other. It is hoped that further work will allow for the creation of a recognizable *signature* to assist in the interpretation of like features.

The topographic features indicated in De Morgan's map can be roughly identified on the ground. The L-shaped feature is indicated and various clusters of tombs are positioned in an area of high ground which runs diagonally from the large crater(MT80) at the North-East, to the East end of the South arm of the L-shape. The ridge forming an L-shape limits the area at the West and South. This area is clearly separated from the mastaba field West of the Zoser enclosure (which includes the Ptahhotep tomb group and runs South to the Unas area) by a deep sandy wadi. These topographic features are clearly visible, the wadi running along the 45 m contour line. Within the high area he positions a large number of tombs, some of which (shafts) he dates to the Greek period while other structures (mastabas) are dated to the Old Kingdom. De Morgan places a Greek shaft at the centre of the large crater MT80; the ground surface showns a large excavation crater with two smaller ones to the North West and various small debris mounds within the overall 44-43 m contour which deliniates this mound. The resistivity results in XS 9 just south of MT80 (various high readings) are confirmed by extensive traces of mudbrick which stretch for 120m and run North under MT 82-83 and 81. The mastaba of Sem-nefer (Sixth Dynasty), to the South West of the large mound, shows no obvious surface traces but could be equated either with MT 82 or with the high readings noted in this area in XS 9.

Further to the South West a cluster of four Old Kingdom mastabas and a Greek shaft may correspond to the surface features MT 62 to 65 and 58.
The three Greek shafts just to the South of the large crater may tentatively be equated with MT 61, 59, 60. The remaining tomb clusters are more problematic. Further to the South West, near the internal angle of the L-shape, three Old Kingdom mastabas and one Greek shaft correspond to various high readings on XS 8 and to an area of shafts and excavation mounds near MT 45-46. Just North-East of these a row of two Old Kingdom mastabas and two Greek shafts, running West-East, may correspond to MT 57-56. Finally on the Eastern edge of this area two Old Kingdom mastabas on

a North-South line may be equated with MT 39, 40 or 34. MT 40 corresponds to a large stone mastaba, with the East and North face partially exposed. Two excavation pits on the East face indicate that the chapel and niche with false-door, have been removed or summarily excavated (see photo no.). Three New Kingdom tombs to the north of the Gisr el Mudir, as shown in De Morgan map, seem to correspond to MT 72, 71 and 70.

Much further work of a topographic and sensing nature is required before a definitive plan of the area can be published.

The Gisr-el-Mudir (Great Enclosure)

Resistivity work was concentrated on the Southern part of the concession where the Gisr-el-Mudir, the largest structure at Saqqara, covers the West and centre of the area. The Gisr-el-Mudir was first observed by Perring, who shows numerous 'tombs' within the enclosure, and is clearly indicated both by Lepsius and by De Morgan, who places three tombs within the perimeter.

Two main cross-sections, XS6 and XS7, were surveyed to complete the East-West grid started in 1990 and make a total of six sections cutting through the structure from the slopes of the Sekhemkhet pyramid enclosure to the West wall of the Gisr-el-Mudir A further 19 sections containing over 170 resistivity profiles were observed to clarify anomalies, geological features and assumed man-made structures.(see Map Sheets 2 & 3)

The Gisr-el-Mudir was a massive construction project, which still looks impressive even after thousands of years of use as a quarry. To put the size in context the enclosure is approximately twice the area of the Zoser Step pyramid complex and four times the area of the Sekhemkhet pyramid enclosure to name the two closest neighbours. The West, East and North walls contain some 3000 linear metres of semi-dressed local limestone. As yet the average height and the quantity of in-fill of these three walls is unknown but cannot be much less than 150,000 cu.m of rubble, gravel, sand and flint nodules. Whoever comissioned the building must have had considerable power and authority.

From the results of the resistivity survey it appears that the builder used as many of the natural features of the site as he could. By locating the Southern limit of the structure against a natural ridge running East-West bounded by small outcrops of local limestone at each end, the East and West walls were locked into the ridge and the South wall was formed by "bull-dozing" or scraping the natural desert surface of gravel, flint nodules and sand to the South of the ridge up and onto the crest to form the existing wall like feature which can be clearly seen to-day.

The builder also positioned the structure so as to include the other prominent natural feature, a large rounded, protruding bulge in the ridge, at the centre of the Southern area. If it was intended to build a funerary structure then this would be the most likely location. The resistivity lines taken on this feature do not show any man-made structures. However, if the design of the Sekhemkhet or Zoser complexes be taken into consideration then an undiscovered entrance could exist further North in the enclosure.[31]

In the search for the South wall two major anomalies have been located at the South-West corner of the ridge, both anomalies are surrounded by high resistivity values. The pseudo-sections shown on Figs. 2 & 3 show the anomalies and it is interesting to note that the Southern anomaly has an apparent fill of a different material at 6m & 8m. It is hoped that investigation of this finding by *sondage* will take place in the coming season. Fragments of a limestone stela are reported found in this area. .[32]

The resistivity survey also noted other interesting values which due to the very low resistance value of the bed-rock, clearly showed where the desert surface had been scraped off to create fill for the walls of the enclosure. Further North-East similar results suggest that the two long mounds to the East of the Gisr-el-Mudir and to the West of Sekhemkhet may consist of accumulations of this material.

The East-West cross-sections show that in many places high resistivity readings suggest structures built against the walls of the enclosure. Inside the enclosure on areas where the surface has been scraped off there are indications of surface burials with limestone and bone fragments scattered around.

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[1]F.Wenner, 'Method of Measuring Earth Resistivity', NBS Scientific Paper no 258, vol 12, no 3 (USA, 1915-1916), 469-478.

[2]Previous geophysical work at Saqqara has often not been part of an overall survey programme. Resistivity and magnetometer work was carried out in the area of the Sacred Anamal Necropolis, see A.H. Moussa and L.T. Dolphin, Applications of Modern Sensing Techniques to Egyptology, (California, 1977), and a magnetometer was used in the area immediatly west of the Zoser enclosure by a mission of the Polish Centre of Mediterranean Archaeology in Cairo, see J. Leclant, Or 57 (1988), 329 h; Or 58 (1989), 360 k. For details of geophysical work at south Saqqara and subsequent excavation,see Or 58, (1989), 363.

[3] eg. Late Period buildings excavated by Macramallah at the north-east of the site were obliterated by the construction of the E.A.O. resthouse (now itself abandoned as it is positioned over a fault or perhaps unexcavated galleries). No trace survives of the east temple of Nectanebo II or of the two chapels of the dromos. The large statue of an Apis bull from the Dromos Apis Chapel is now in the Louvre,N.390 [S.98].

[4]The avenue of shinxes dated to Nectanebo I and the east temples of Nectanebo II, were excavated by A. Mariette, Le Serapeum de Memphis, publie d'apres le manuscrit de l'auteur par G. Maspero, I (Paris, 1882), 36-7, 78-9, here refered to as Serapeum, Texte; A. Mariette, Choix de monuments, (Paris, 1856), 6-7. The dromos and semicycle have been subjected to more recent work by Macramallah in 1938 and Lauer and Picard in 1950-51, see J-P. Lauer and Ch. Picard, Les Statues Ptolomaiques du Serapieion de Memphis, (Paris, 1955), 1-3 and ff. The Greek statues of the dromos were further studied by R. Wunsche and M. Bergmann in 1987-8, see Or. 50 (1989), 361. For large scale animal cemeteries as a development of the time of Nectanebo II see A. Charron, RdE 41 (1990), 209-213.

[5]A. Mariette, Serapeum, Texte, 29.

[6]PM III 2, pt. 2, 780-784 (isolated tombs), 784-805 (galleries). For plans see, A. Mariette, op.cit., fig. 1 on 117. A Rhone, L'Egypte a petites journees , (Paris, 1877), facing 228; M. Malinine, G. Posener and J. Vercoutter, Catalogue des steles du Serapeum de Memphis , I (Paris, 1968), facing xvi.

[7] For details of sonic research at the Serapeum see OR 58 (1989), 361 and J.P. Piquet, H. Helaland, F. Iman, La geologie de l'ingenieur I (1988), 154, 157-8, fig. 1. Work has also been carried out at the Serapeum under the direction of Dr. M. Ibrahim, see Or 57 (1988), 331; OR 61 (1992), 246-7.

[8]For a discussion of monuments from the Serapeum see; M. Malinine, G. Posener and J. Vercoutter, op.cit.; H. de Meulenaere, CdEt. 35 no. 69-70 (1960), 104; M. Guilmot, CdE76 no. 37 (1962), 359-381; J. Vercoutter, Textes biographiques du Serapeum de Memphis , (Paris, 1962); J. Vercoutter, MDAIK, 16 (1958), 333-345. On stele found recently at the Serapeum see A. M. Ibrahim Sixth Congress , 220-221, BSFE 106 (1986), 31-44.

[9]A. Mariette, op.cit., 28, 36-7, 78-9.

[10]id.ib., 33-38

[11]id.ib., 78.but cf. below and note 19.

[12] id.ib., 36.

[13]id.ib., 37, Interestingly very similar to Mariette's description of the individual Apis tombs cf id.ib., 79.

[14]id.ib., 36.

[15]id.ib., 37.

[16]id.ib., 37. The walls were lined with limestone slabs with relief decoration. A scene of the king before a bull headed Apis is now in the Louvre N. 423 [S.119]. Similar buildings were found inside the enclosure wall. For comparative examples suggesting cultic use cf, D. G. Jeffeys and H. S. Smith, The Anubieion at Saqqara I (London, 1988), 54-58.

[17]Mariette, op.cit., planche E p.35; De Morgan, Carte de la necropole menphite , (le Caire, 1897).

[18]Rhone, op.cit., pl.I p.216 with legend on p.217.

[19]Field observation revealed no traces of such a feature or any indications that excavations had ever taken place this far west.

[20]Here there are two large excavation craters with fragments of limestone, bone, pottery and glazed composition.

[21] Macramallah, op.cit. introduction.

[22]See note 17 above. A. el-Khouli directed excavations in the area of the Serapeum carpark not under the house of A. Mariette, cf. OR.41, 225b; OR.42, 401b. For results see JEA 59 (1973), 151-5, pl. xl-xli. The structures found were described as part of a temple or administrative building. Rhone's map shows structures within the enclosure wall to the south of the approach to the galleries. At the north of the site small houses, with doorways to the south and a central communal room, were excavated by Macramallah. They are built of local limestone and seems to show various phases of use as doorways have been blocked. This may also suggest use as storage. These buildings were cleared on the north-east and west , and as they extended southwards into an area considered to be outside the main focus of the excavation they were not fully excavated. R. Macramallah, Un cimitière archaïque de la classe moyenne du peuple à Saqqarah , (Cairo, 1940), introduction and p.77, pl.II and LII.

[23]Mariette found various bronze caches under the dromos paving, as well as under the north pylon and in the vicinity both inside and outside of the enclosure wall, Mariette, op.cit., 36. A most interesting description is given

of the discovery of bronze caches lining a 'serpentine' way leading from the north gate of the Serapeum to the north-east ie. the Sacred Animal Necropolis at North Saqqara. The way had no paving or walls its direction being only indicated by the bronze caches, id.ib., 79.

[24]Macramallah, op.cit., 79-83 , pl. III.

[25]id.ib. See also J.J. Castillos, A reappraisal of the published evidence of Egyptian Predynastic and Early Dynastic cemeteries , (Toronto, 1982). For an interesting discussion of this cemetery, W. Kaiser, MDAIK 41, (1985), 47-60.

[26]Swelim, MDAIK 47 (1991), 389.

[27]Kaiserpoints out that a large central grave in the open area to the south would not have been missed by the excavator, Kaiser, MDAIK 41 (1985), 52.

[28]id.ib. pl.1-3.

[29]id.ib. 48, 54.

[30]Macramallah op.cit. intro.n. 3. According to the excavator more tombs are likely to be found to the north of the area worked, which covers 300 m north to south and 120 m east to west (see map 1). The undisturbed topography/ground to the north of the modern Serapeum road seems to confirm this observation, see pl. cf. Macramallah, op.cit. pl.IV.

[31]cf. J-P. Lauer, Pyramide à degrees , I (Cairo, 1936), fig. 218, III pl.xxi [4]; id. Histoire monumentale des Pyramides, I (Cairo,1962), 121-126, plan 26; id. Observations sur les pyramides ,(Cairo, 1960) fig. 18, 76-80; Z. Goneim, Horus Sekhem-khet I (Cairo, 1957) pl. II; V. Maragioglio and C. Rinaldi, L'architettura delle Piramidi Menfite II, (Turin, 1963) tav. 2-5.

[32] For stelae marking desert road from Dashur to Saqqara see H. Goedicke MDAIK 18(1962), 26-29.

SAQQARA NATIONAL MUSEUMS OF SCOTLAND

Pseudo-section of profiles 91/115-143

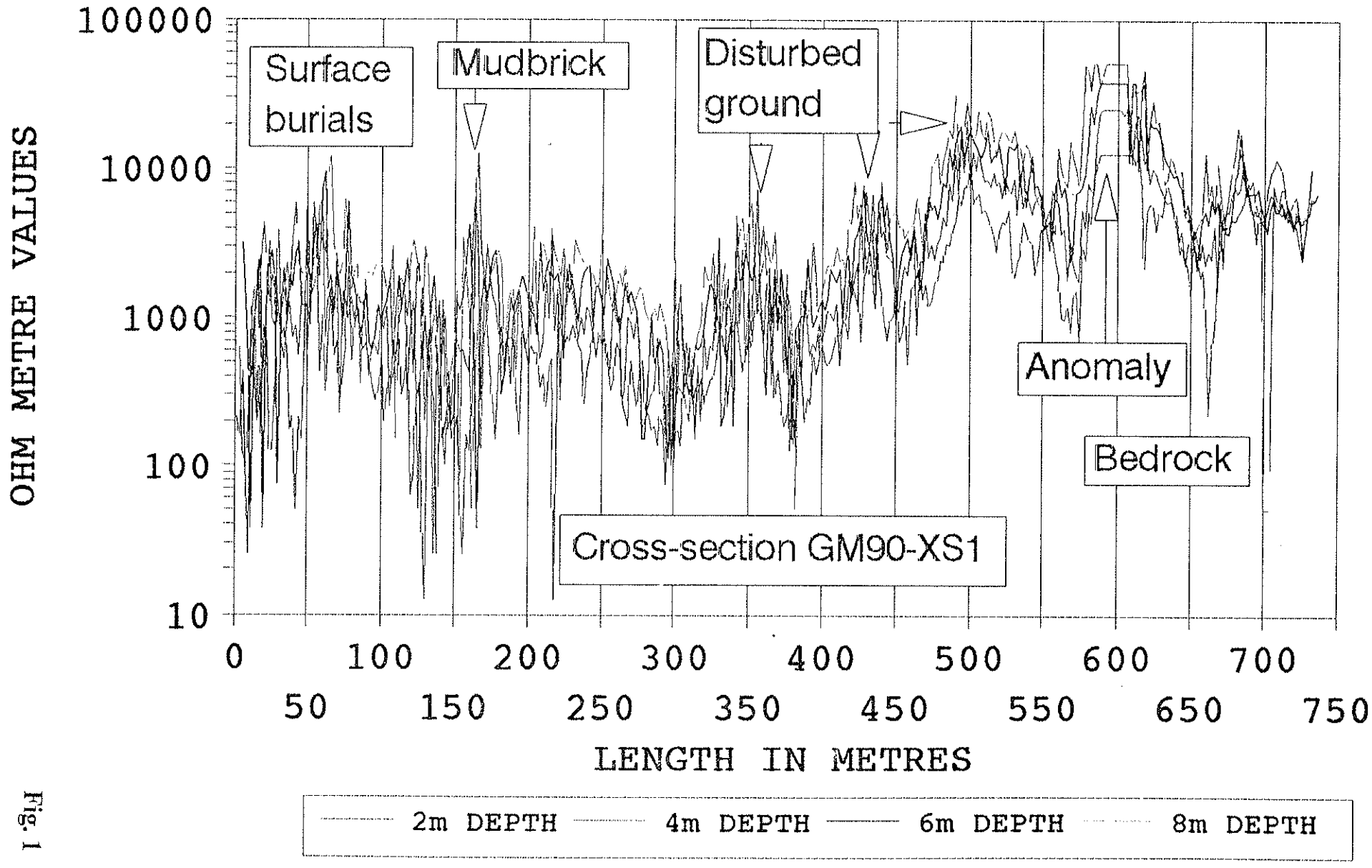


Fig. 1

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/483-485

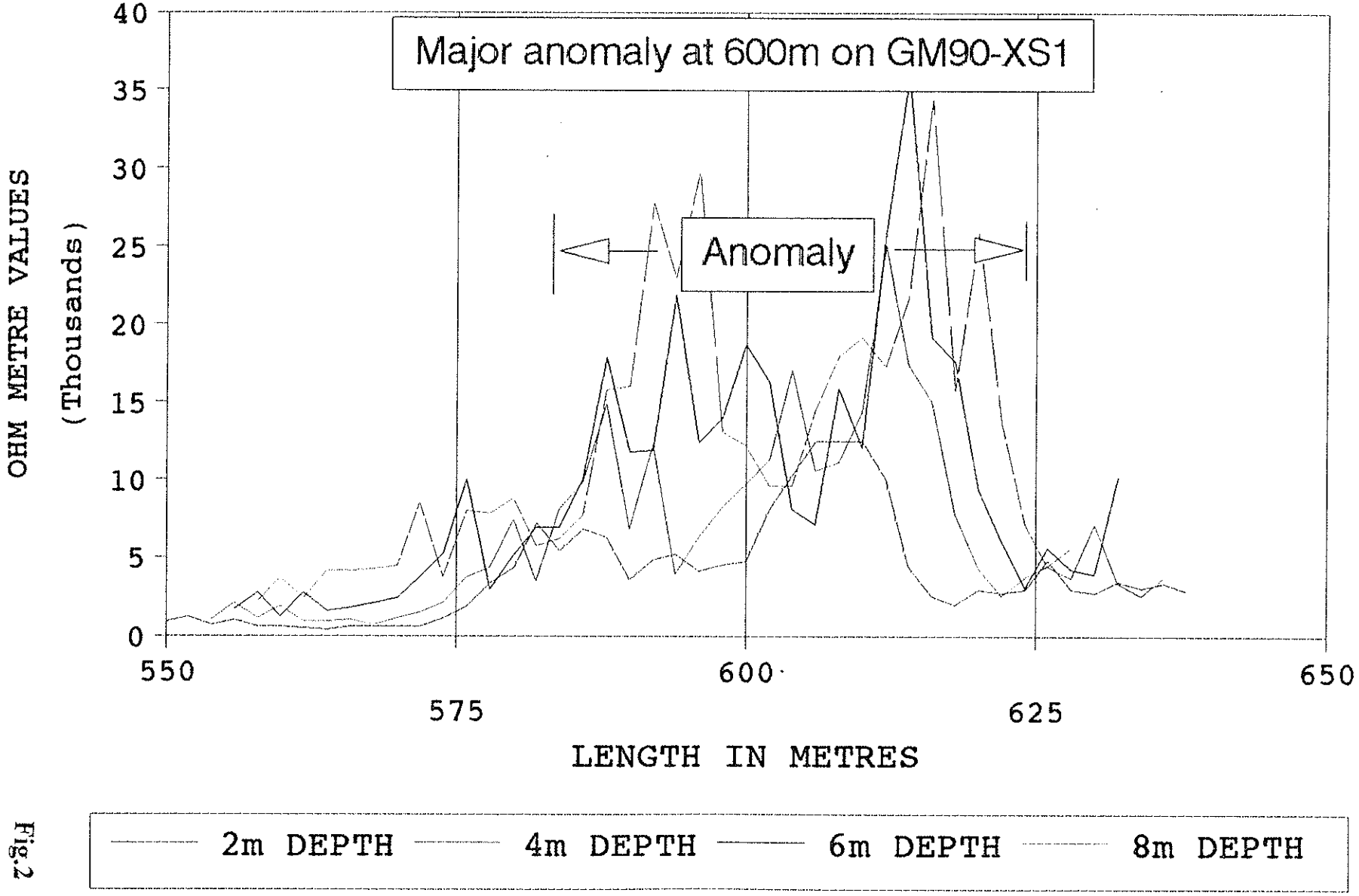


Fig.2

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/486-488

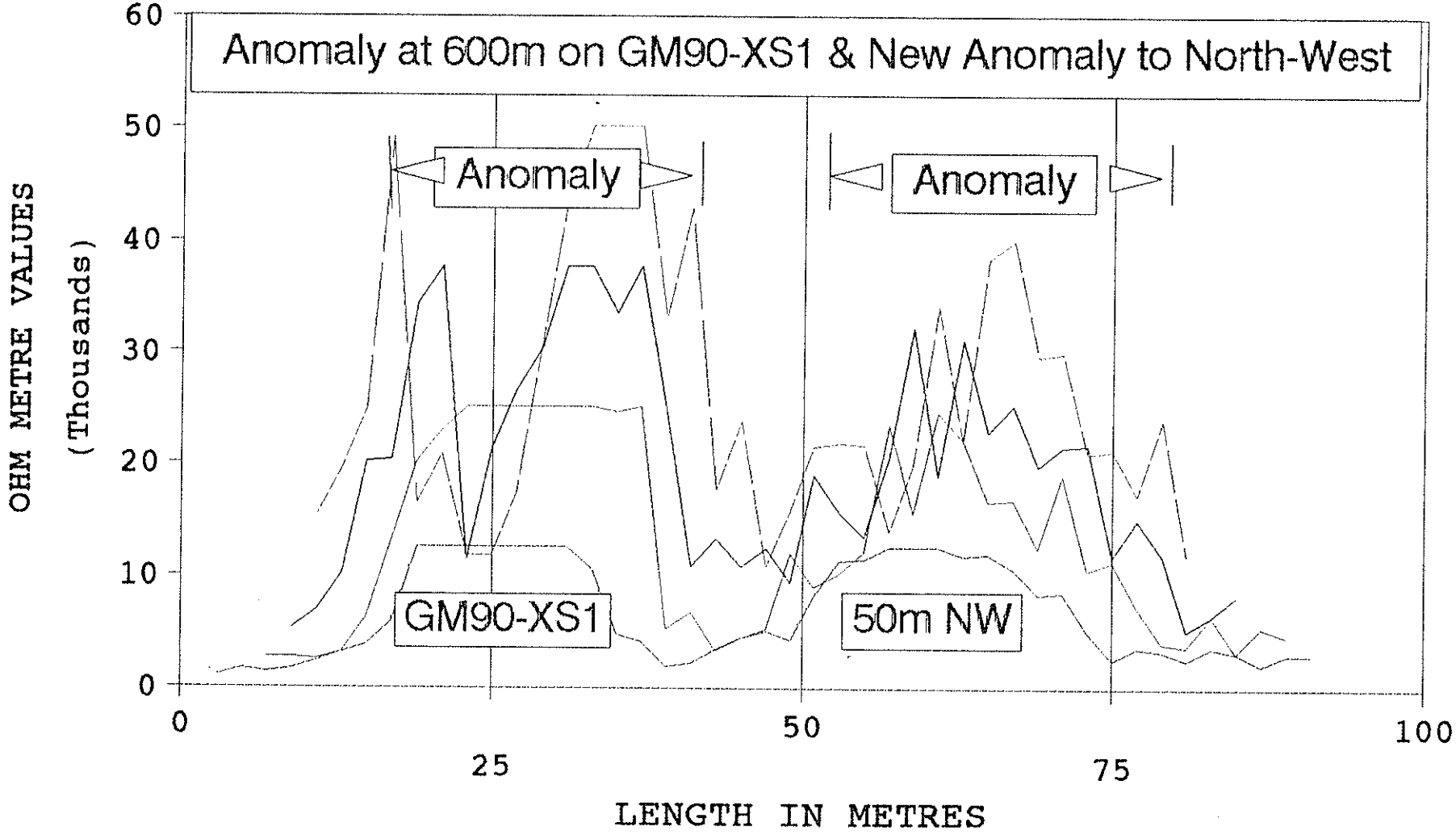


Fig.3

SAQQARA NATIONAL MUSEUMS OF SCOTLAND

Pseudo-section of profiles 90/144-174

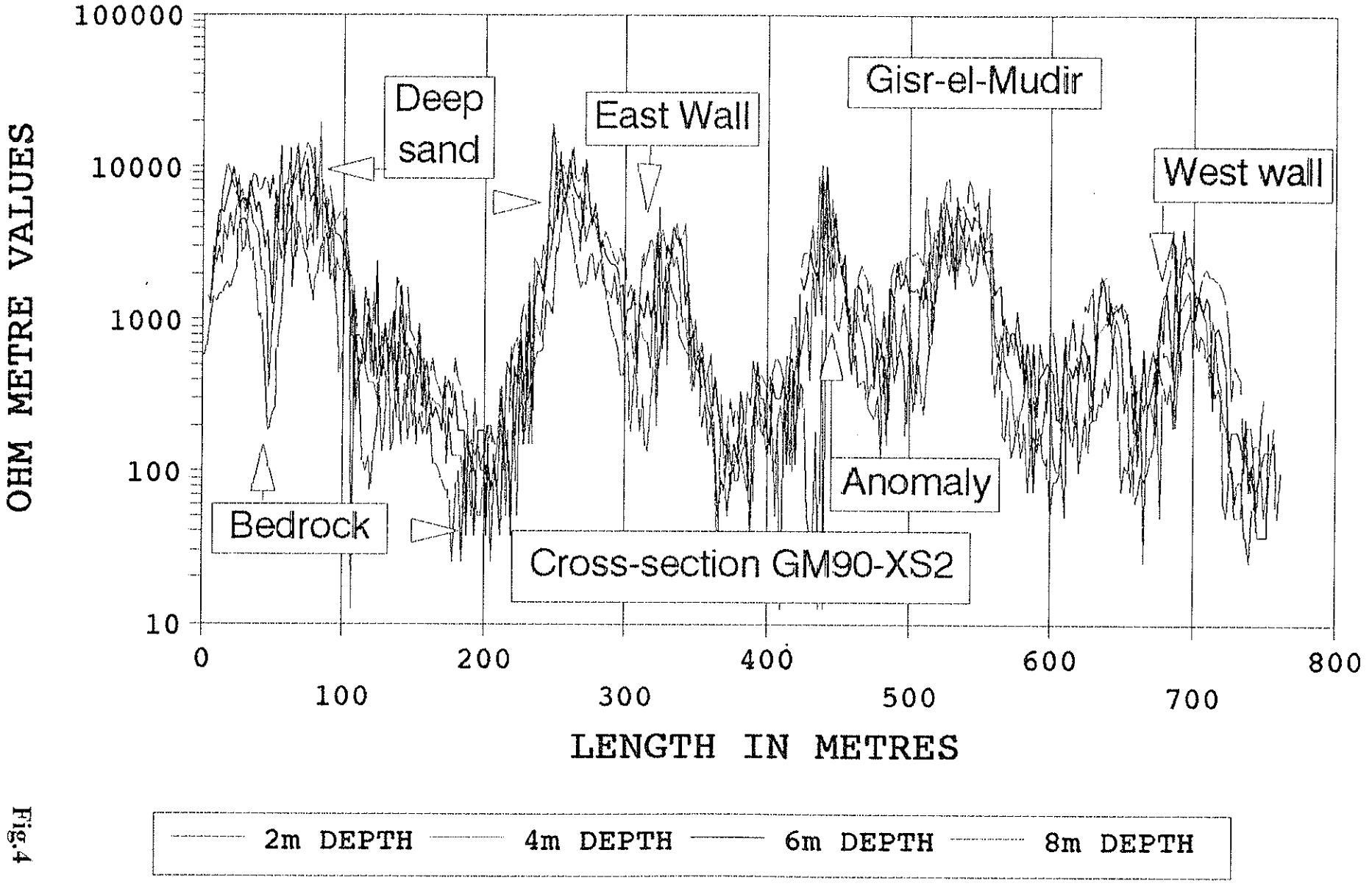


Fig.4

SAQQARA NATIONAL MUSEUMS OF SCOTLAND

Pseudo-section of profiles 90/175-206

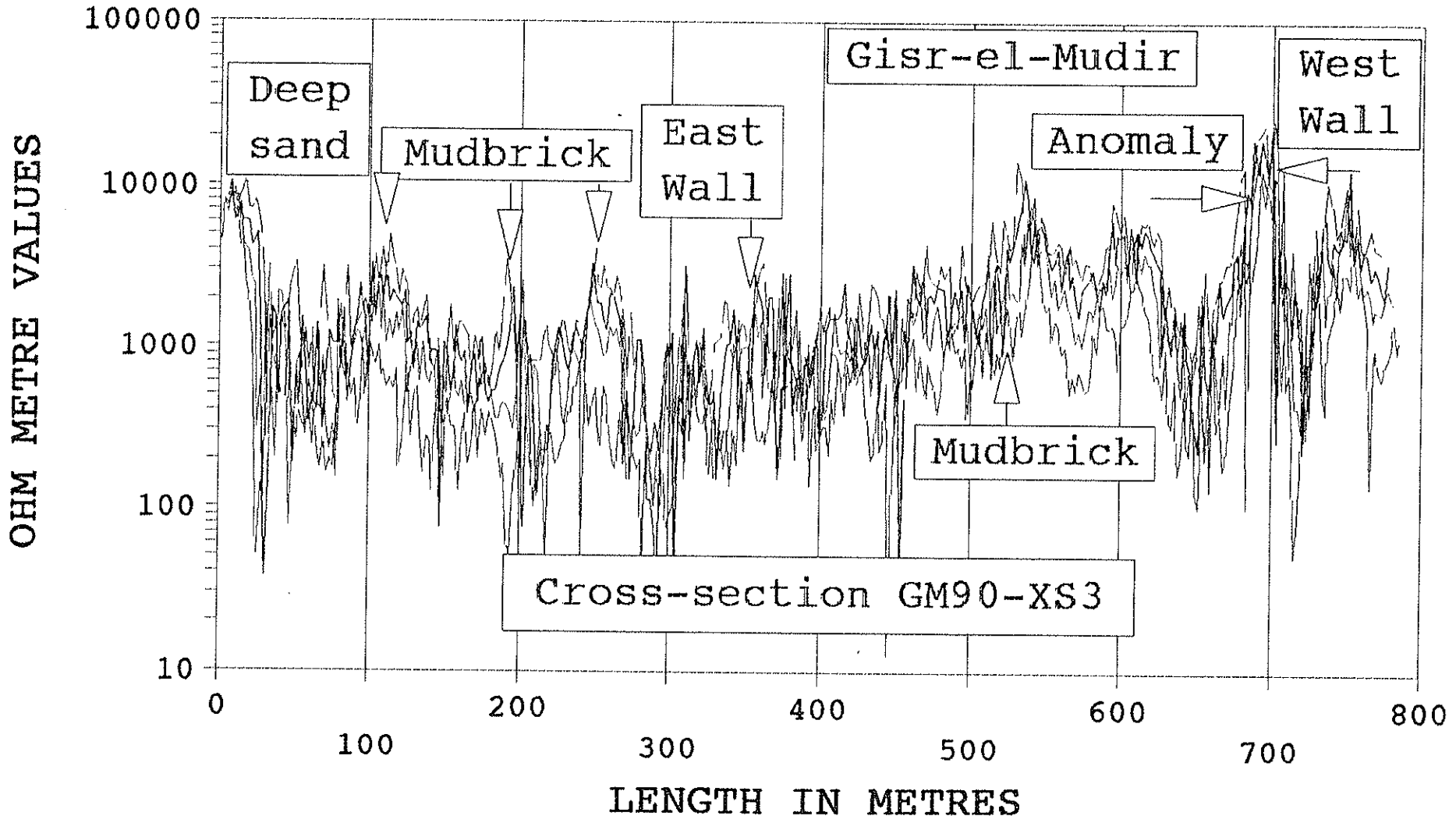


Fig.5

SAQQARA NATIONAL MUSEUMS OF SCOTLAND

Pseudo-section of profiles 90/213-244

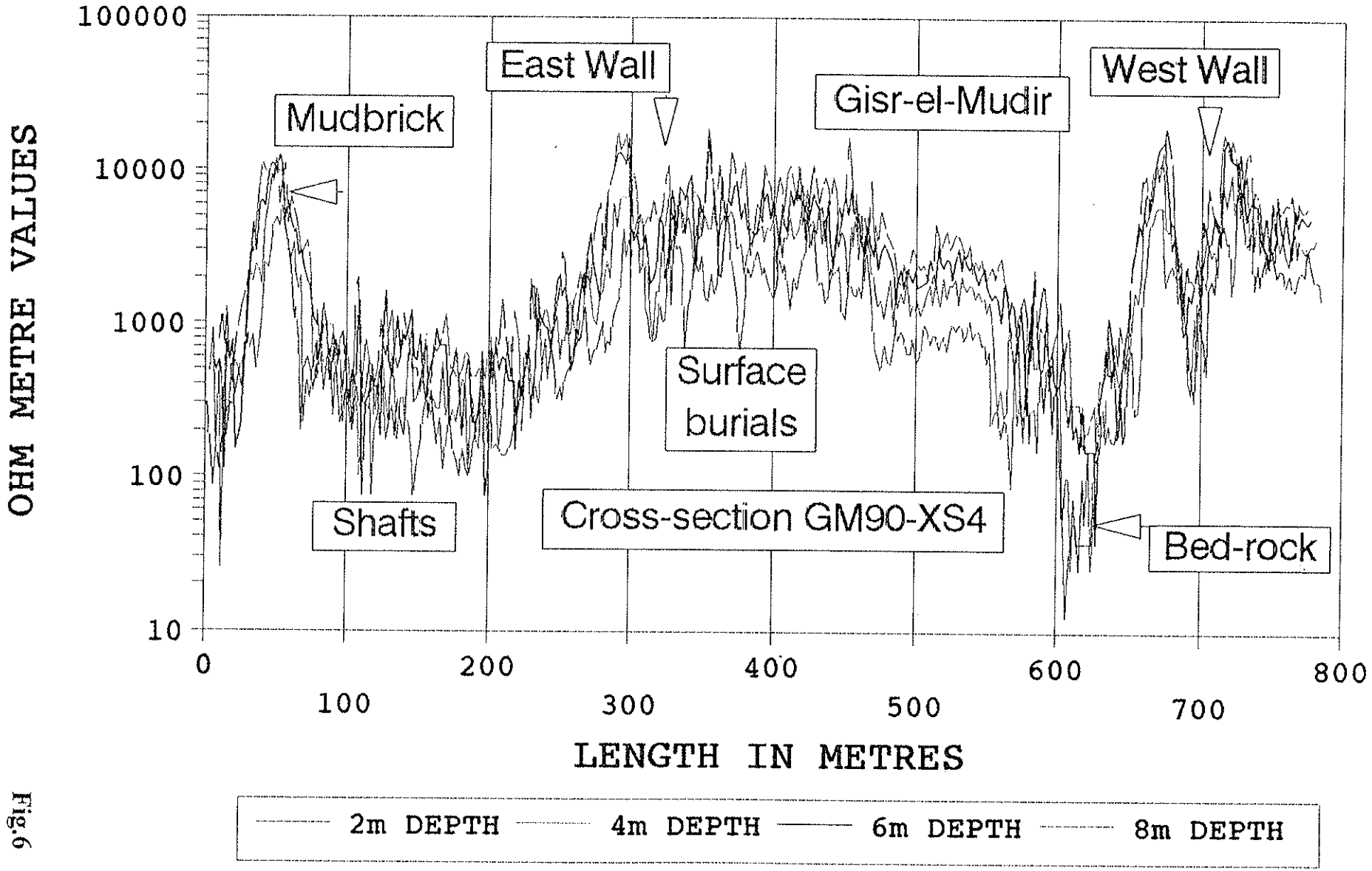


Fig.6

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/393-425

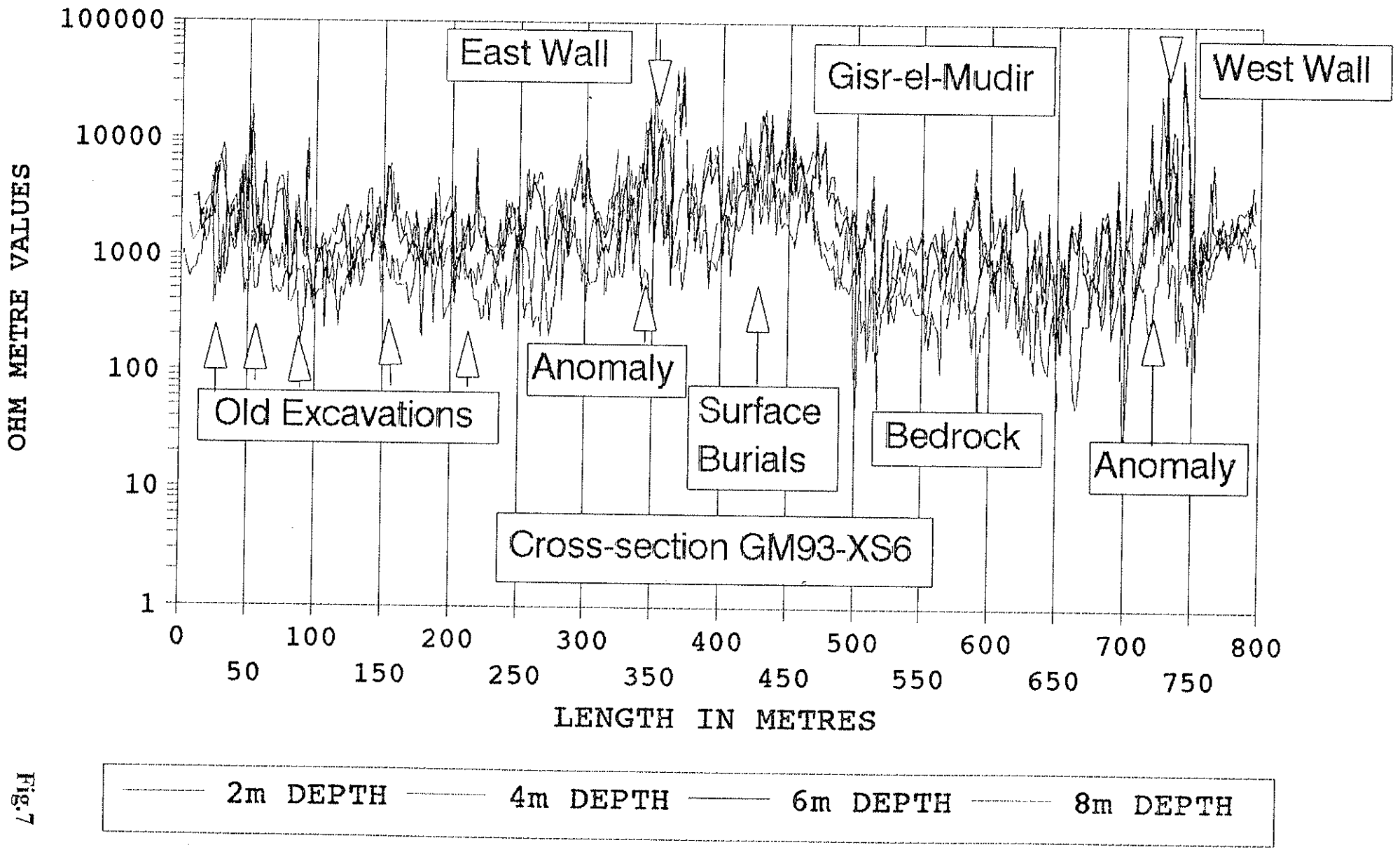


Fig.7

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/422-423

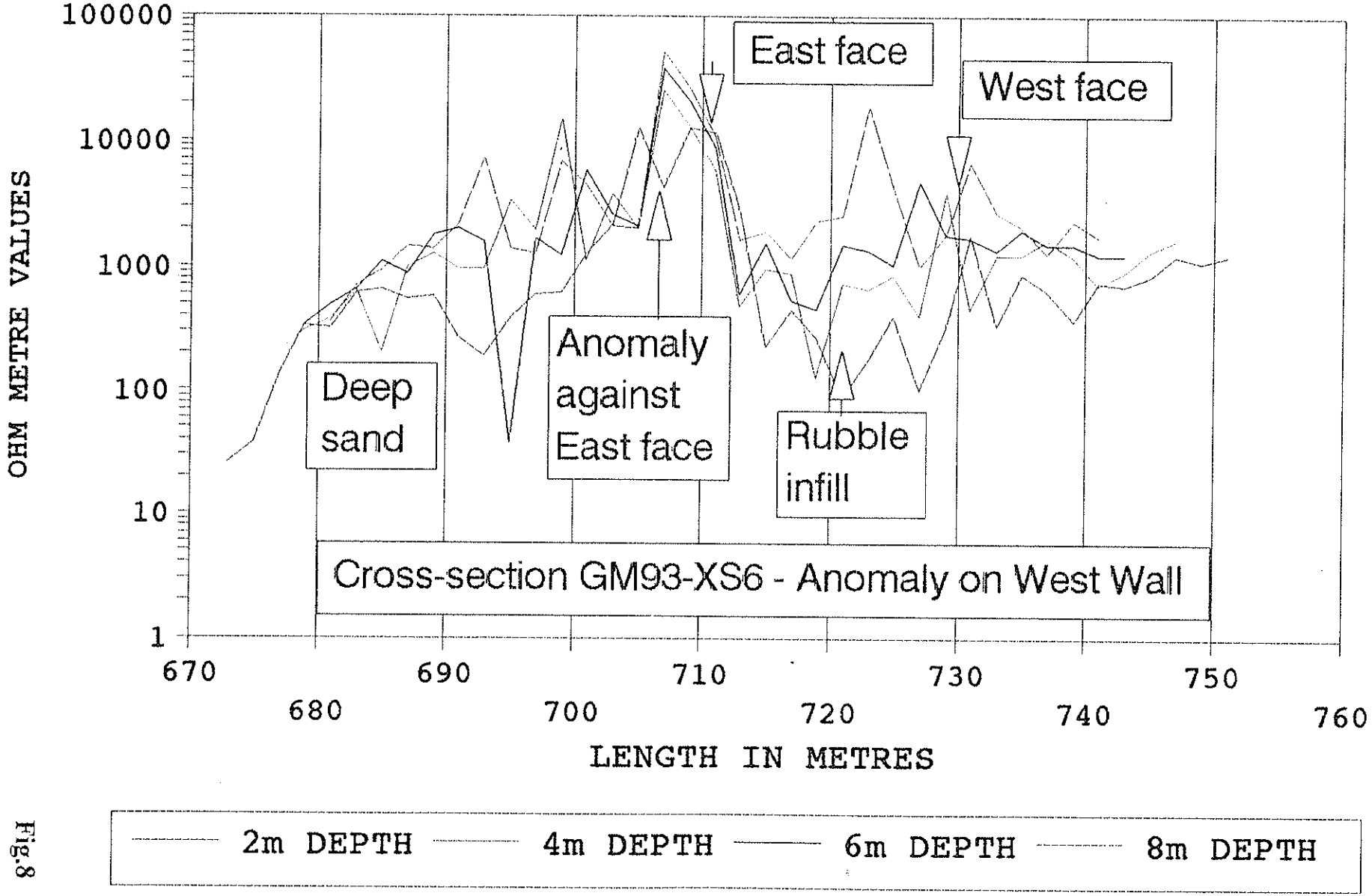


Fig.8

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/422-423

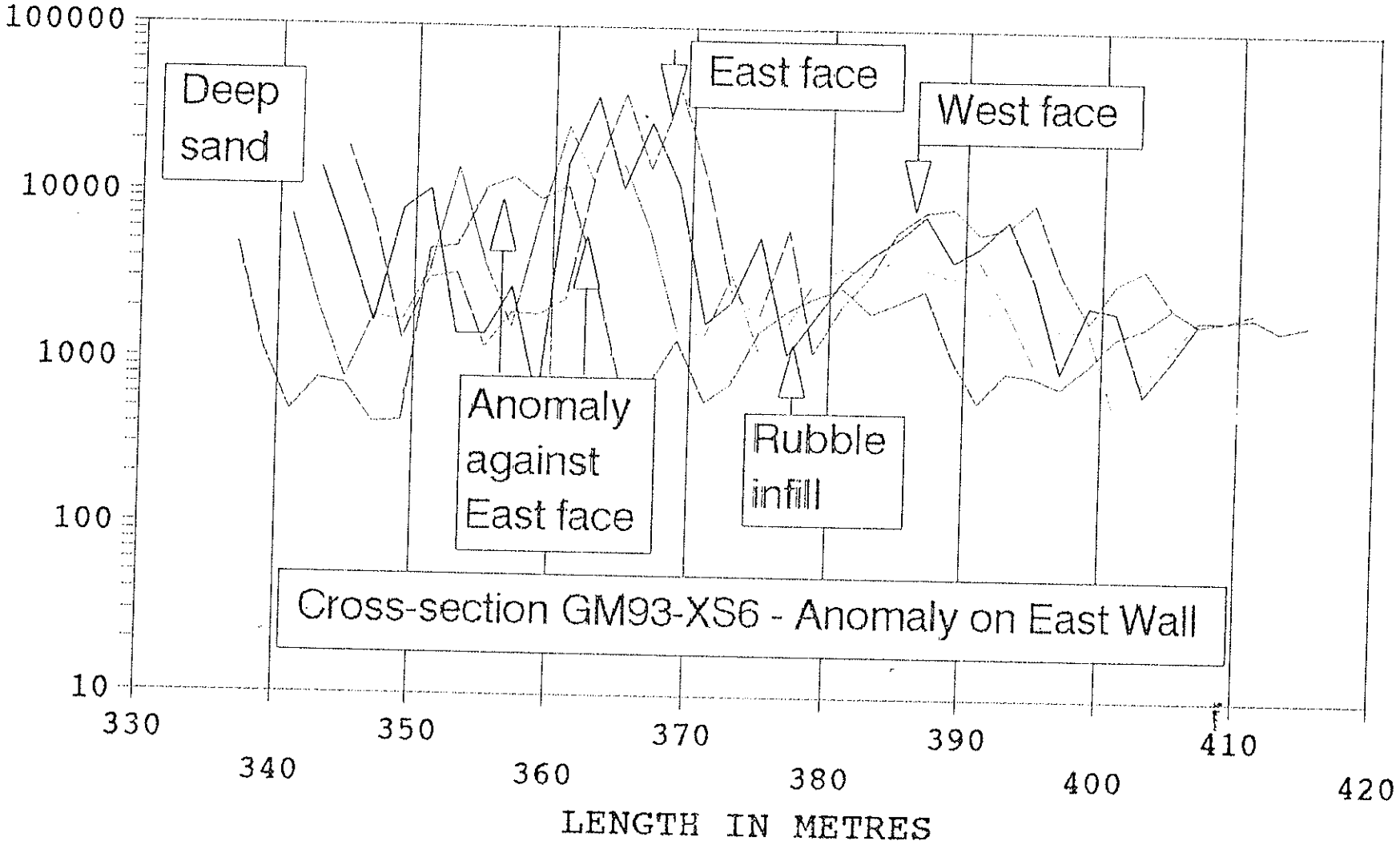


Fig.9

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/361-392

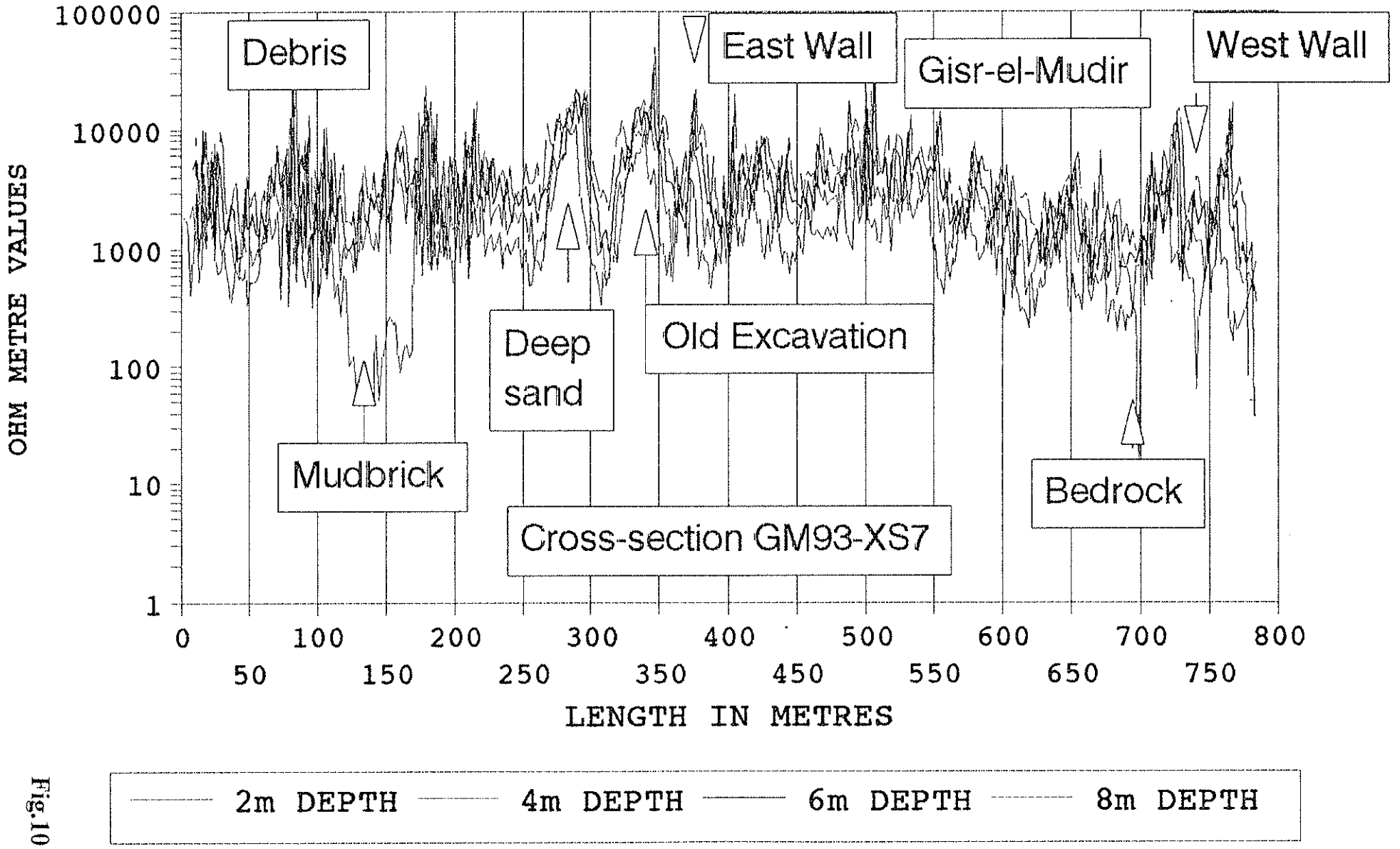


Fig.10

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/321-360

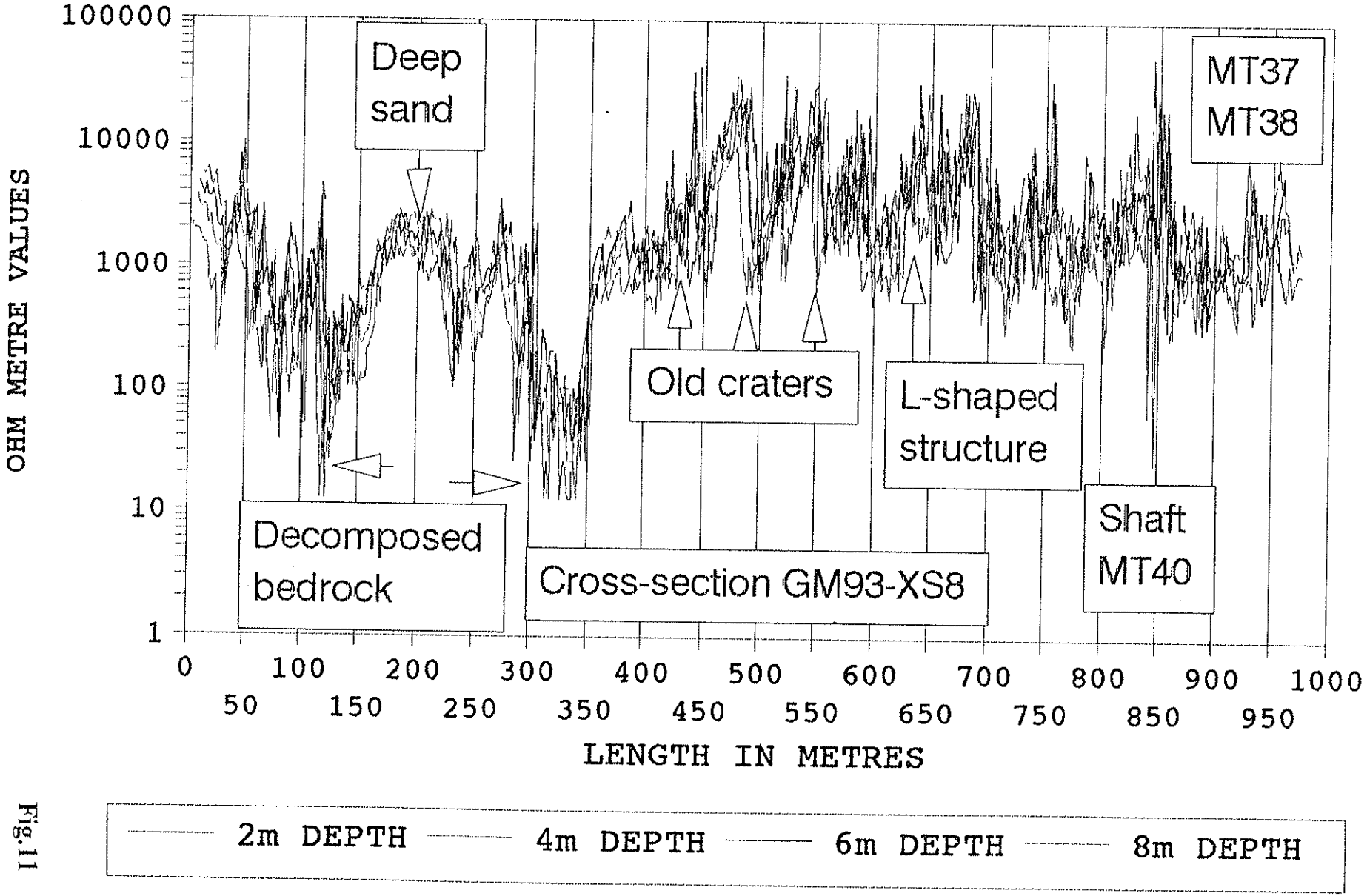


Fig.11

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/279-320

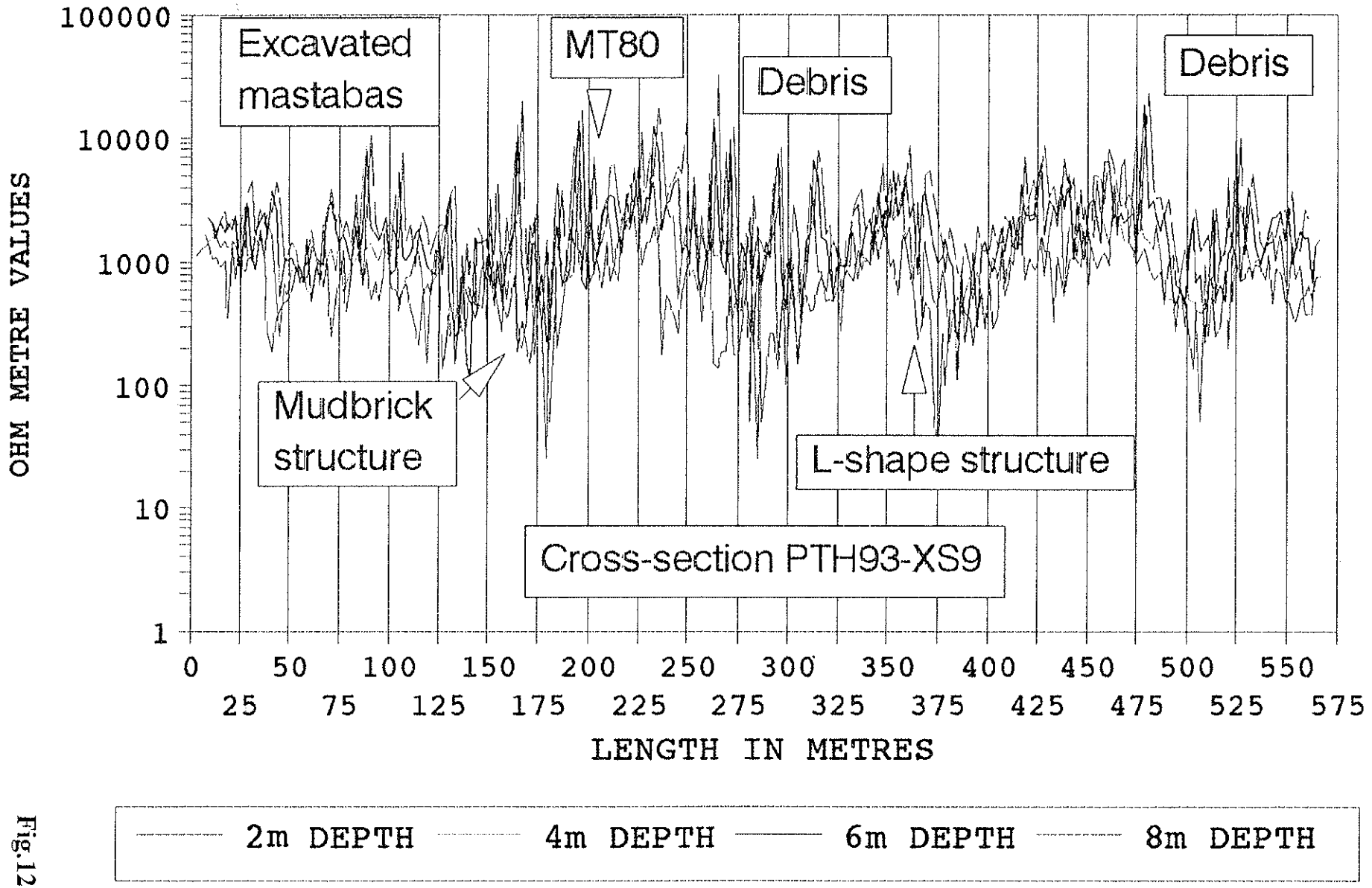


Fig.12

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/277-298

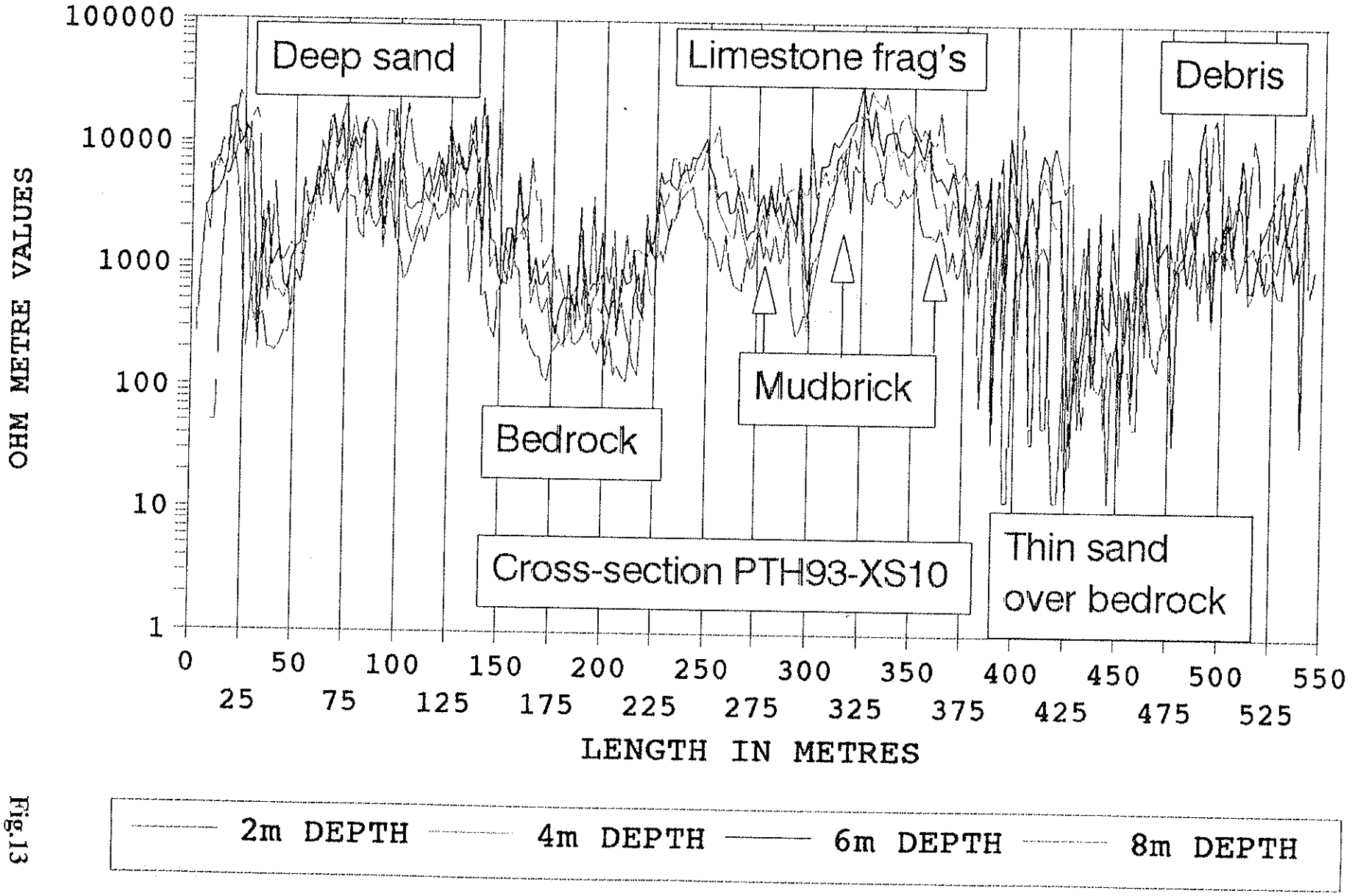


Fig.13

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/256-276

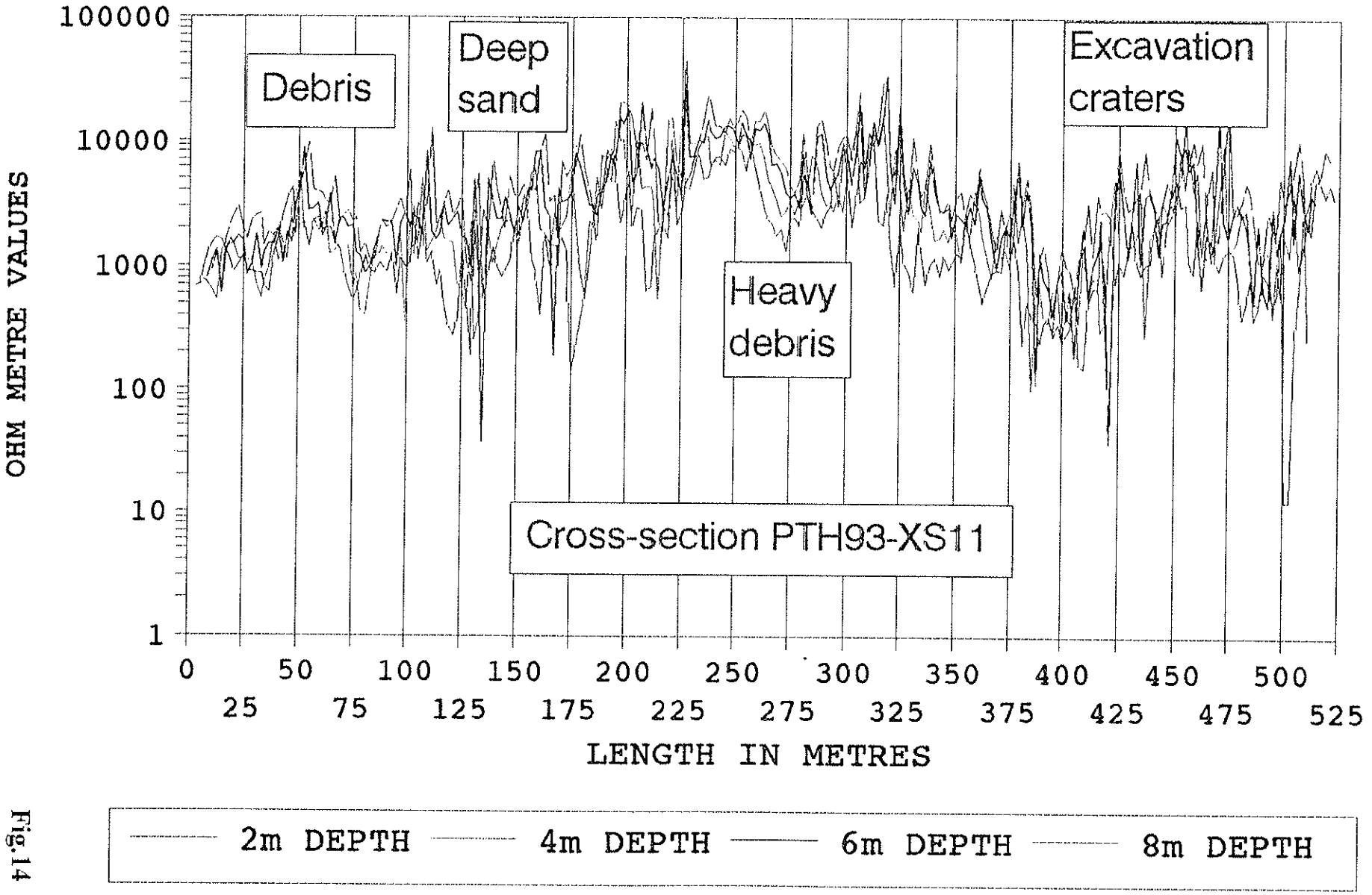


Fig.14

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/157-176

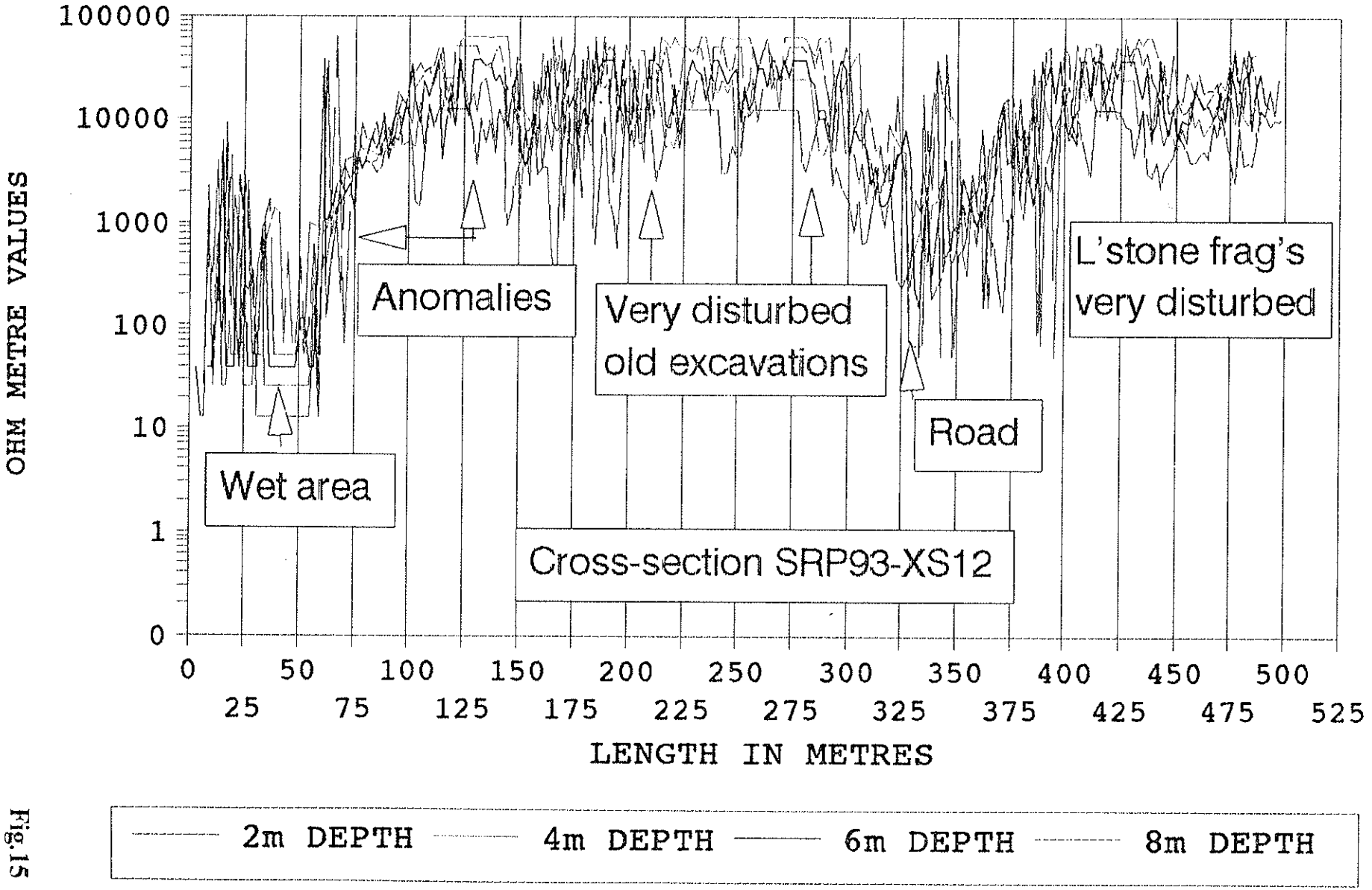


Fig.15

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/136-156

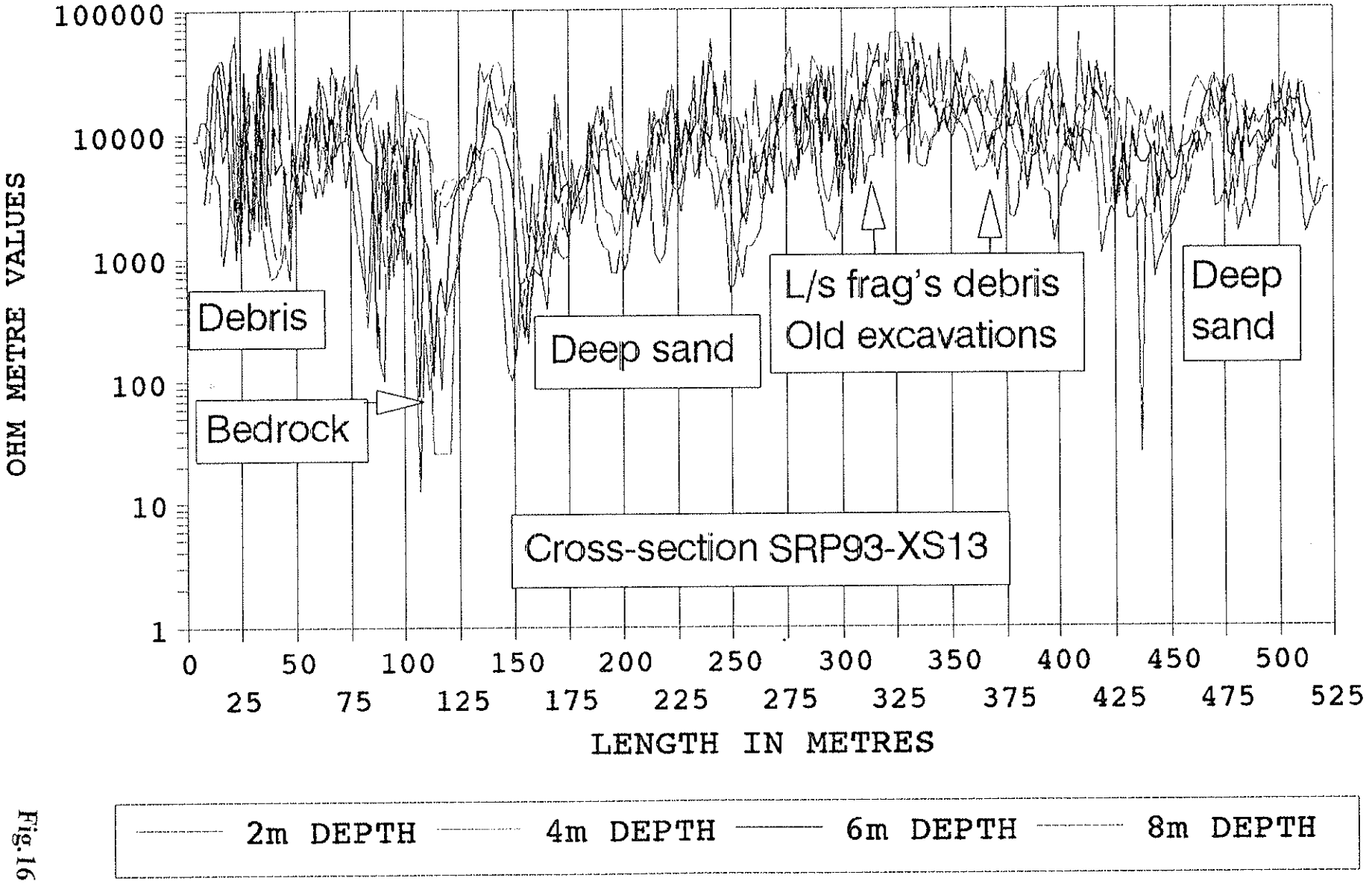


Fig.16

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/117-135

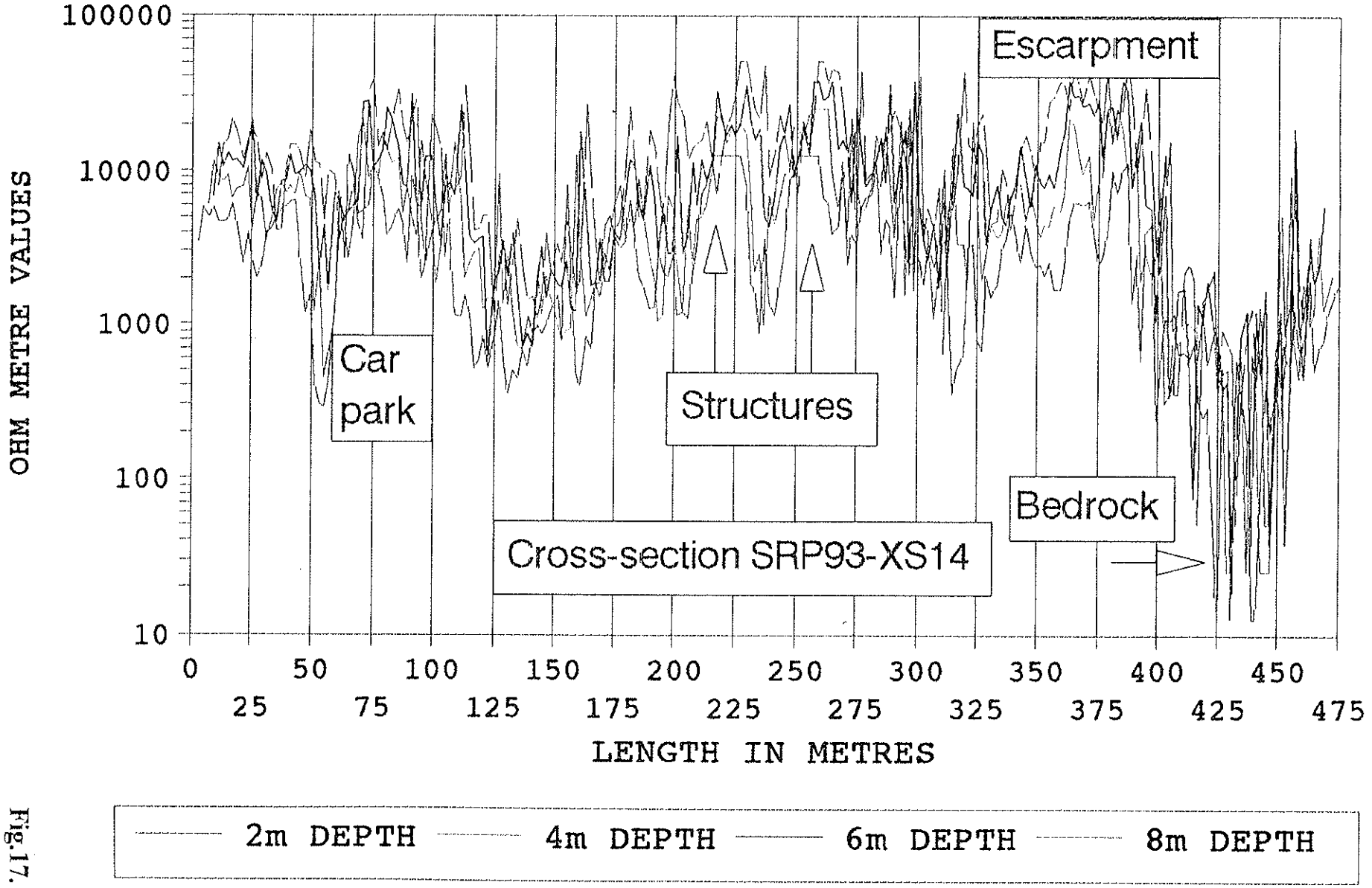


Fig.17.

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/107-116

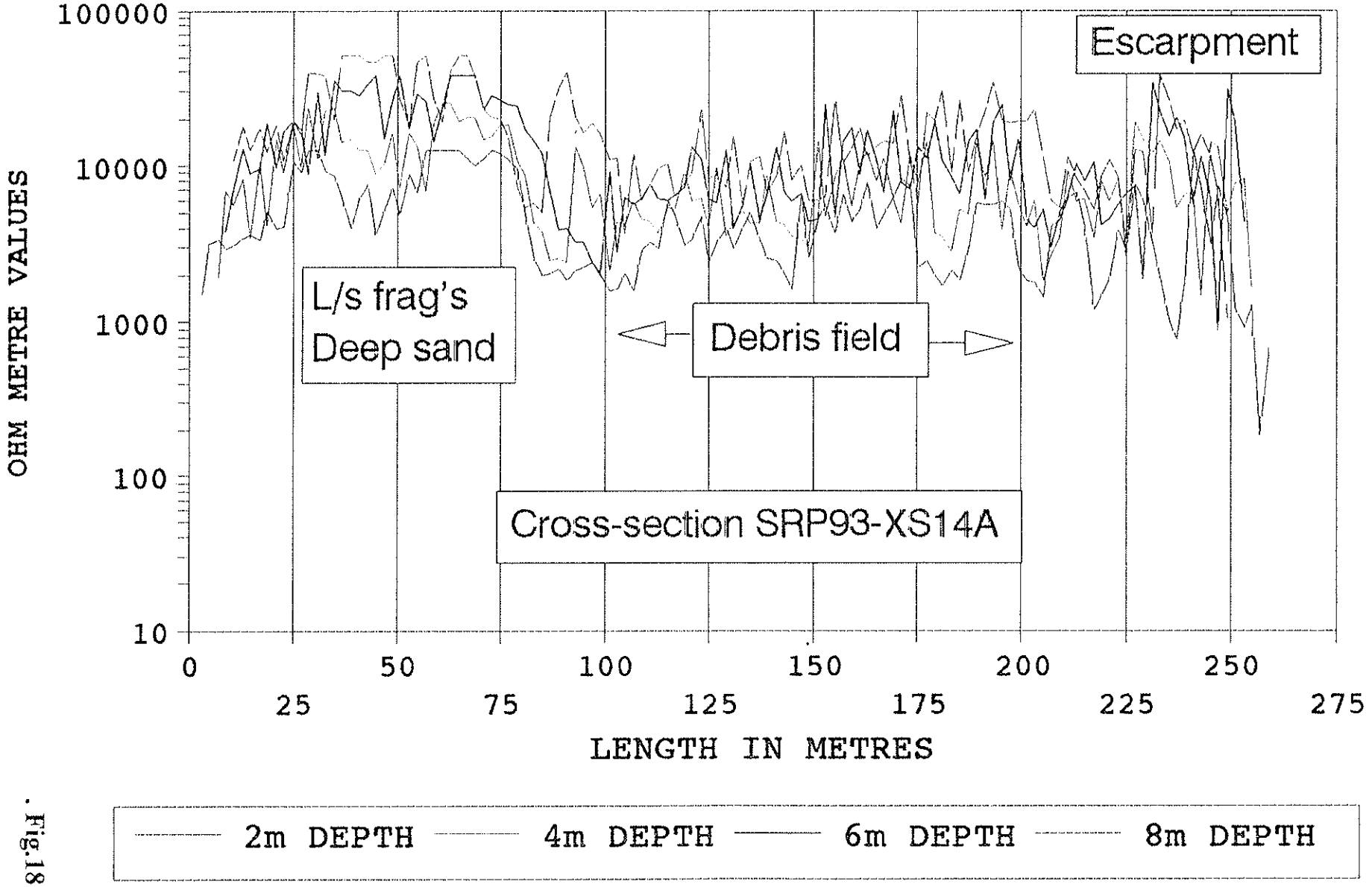


Fig.18

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/177-191

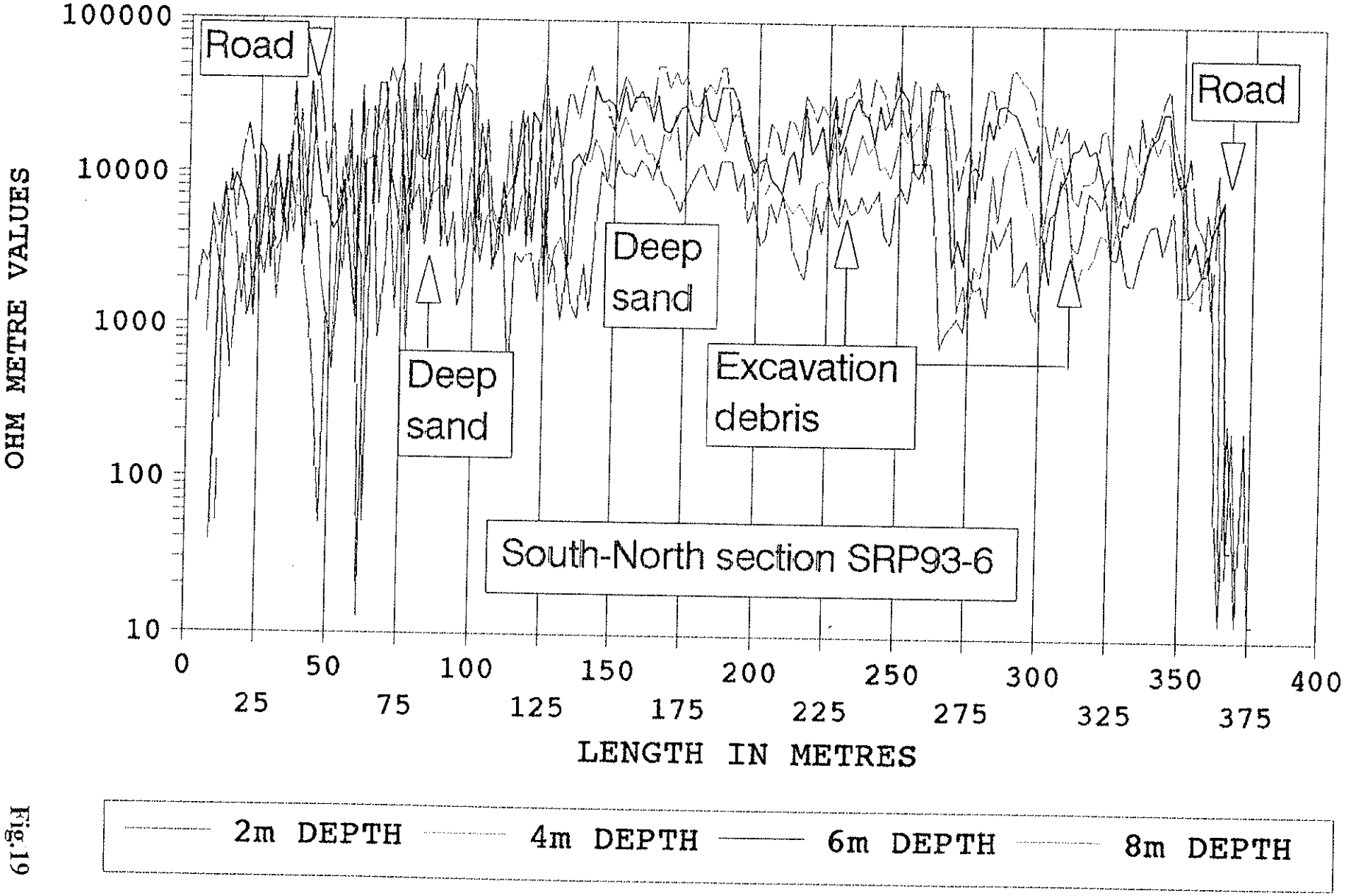


Fig.19

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/192-213

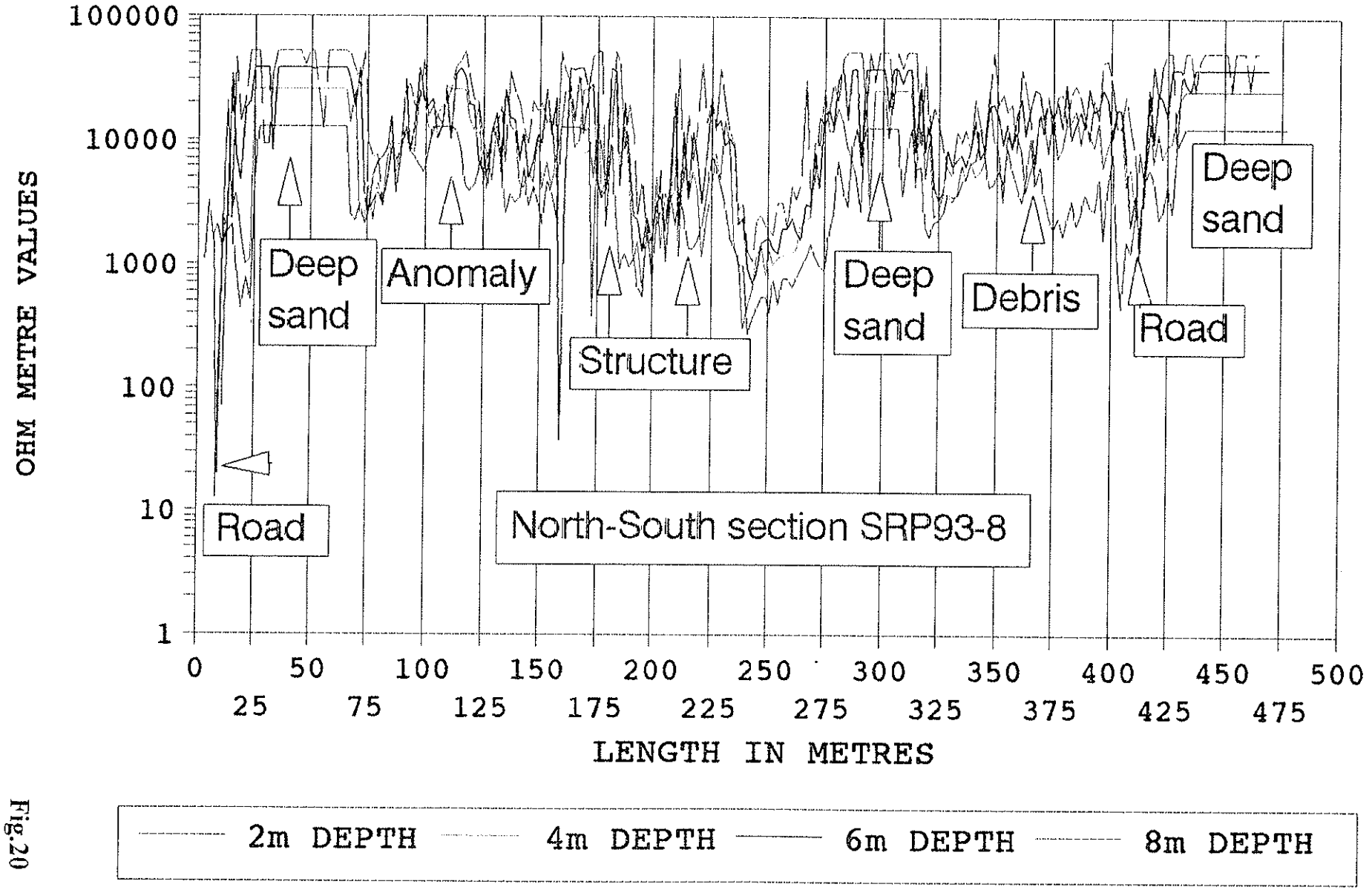


Fig.20

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/214-223

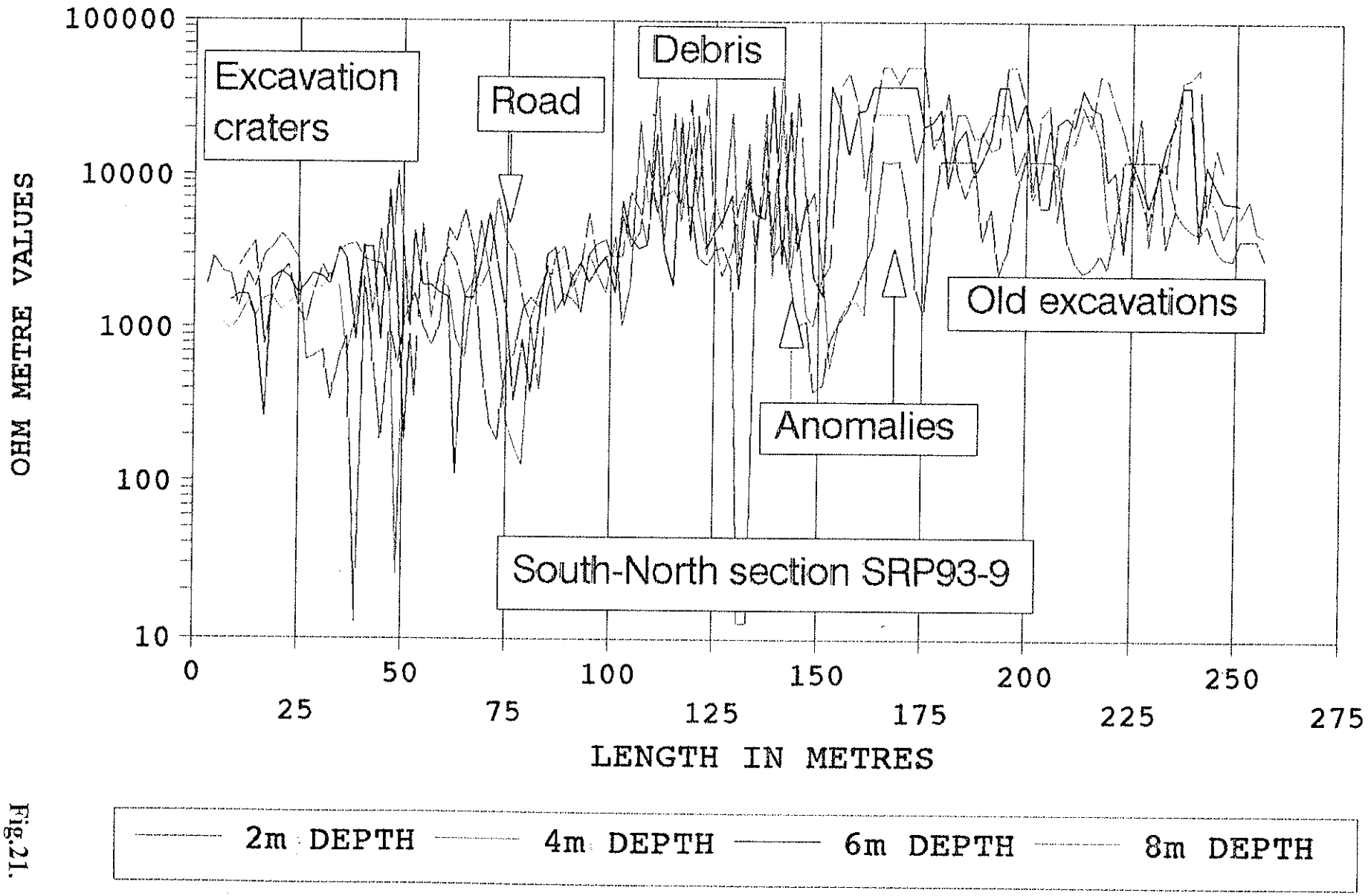


Fig.21.

SAQQARA NATIONAL MUSEUMS OF SCOTLAND
Pseudo-section of profiles 93/224-235

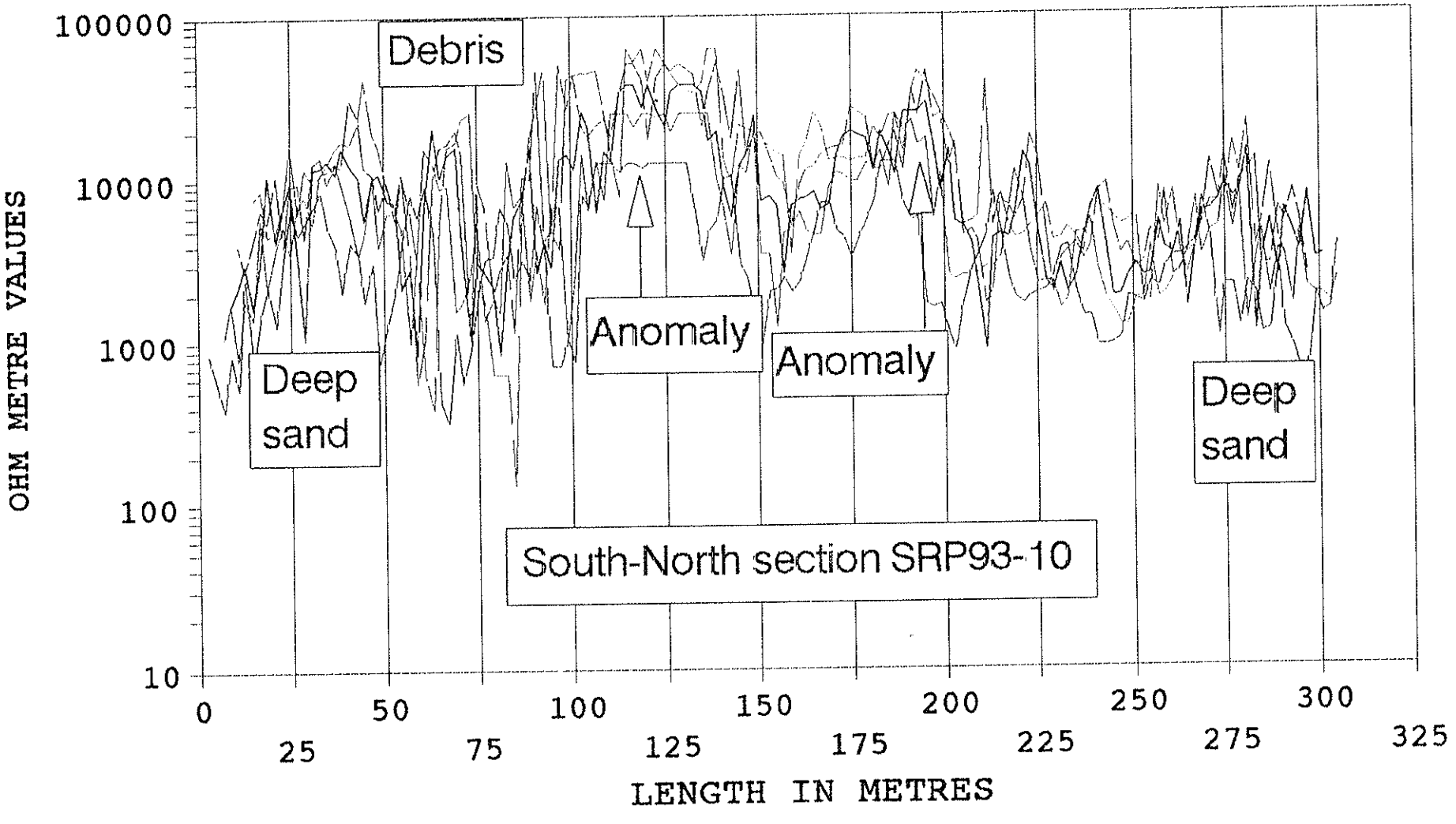
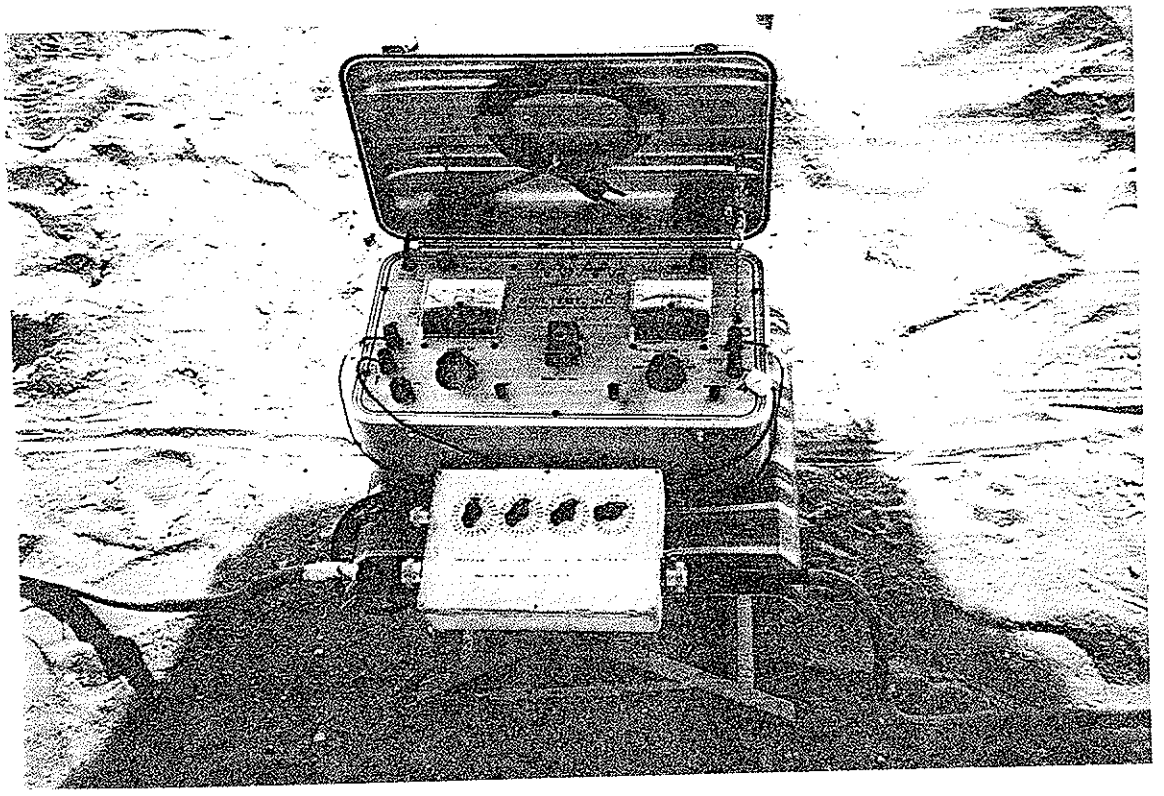
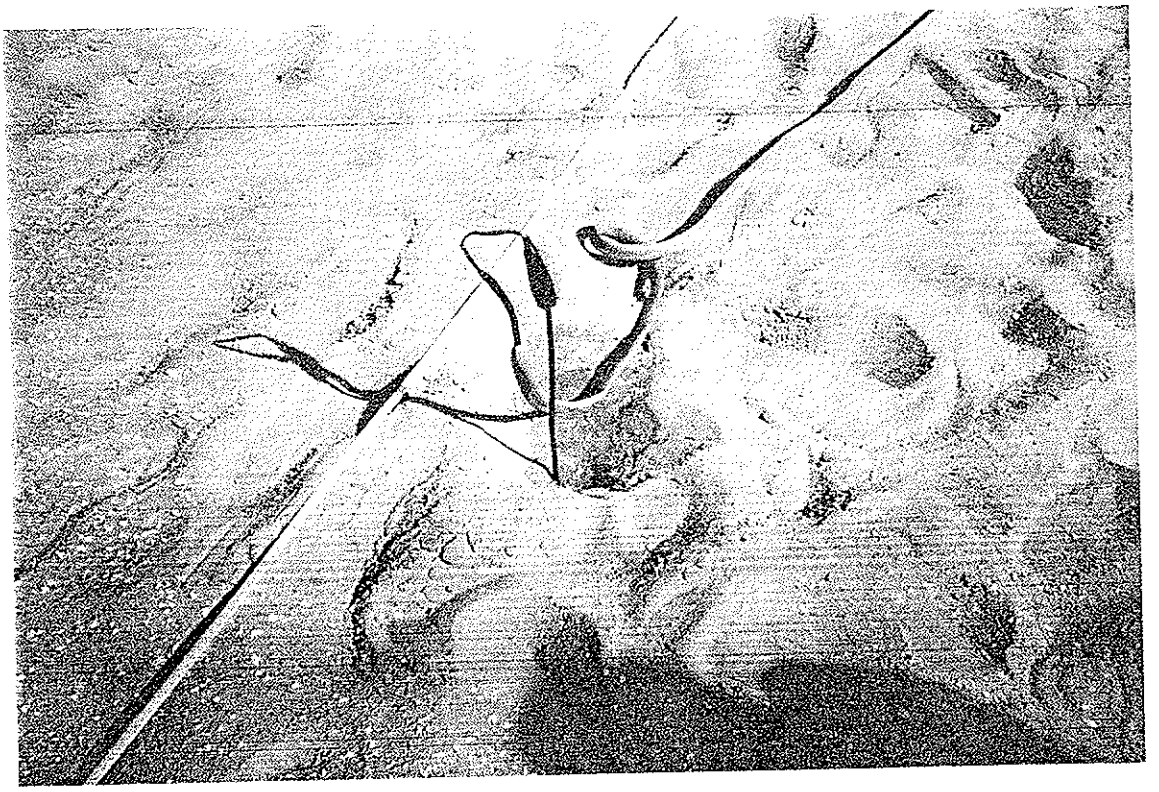


Fig.22

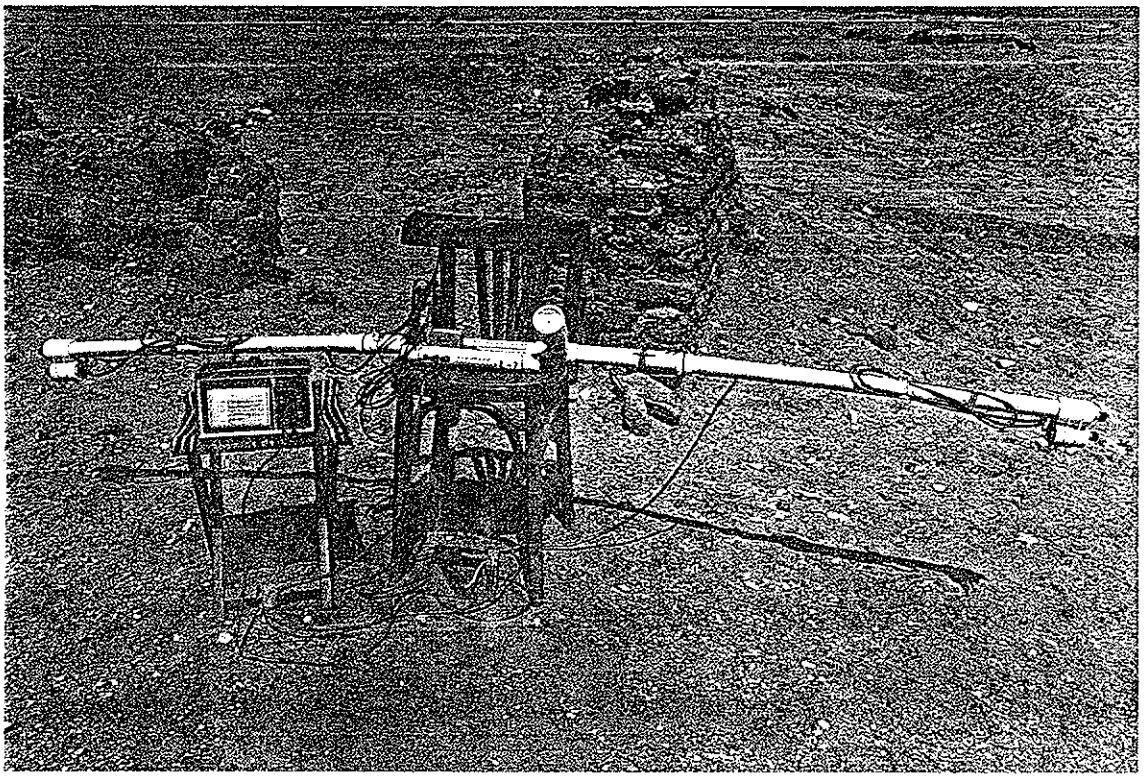


The Soiltest Stratascout Resistivity Meter

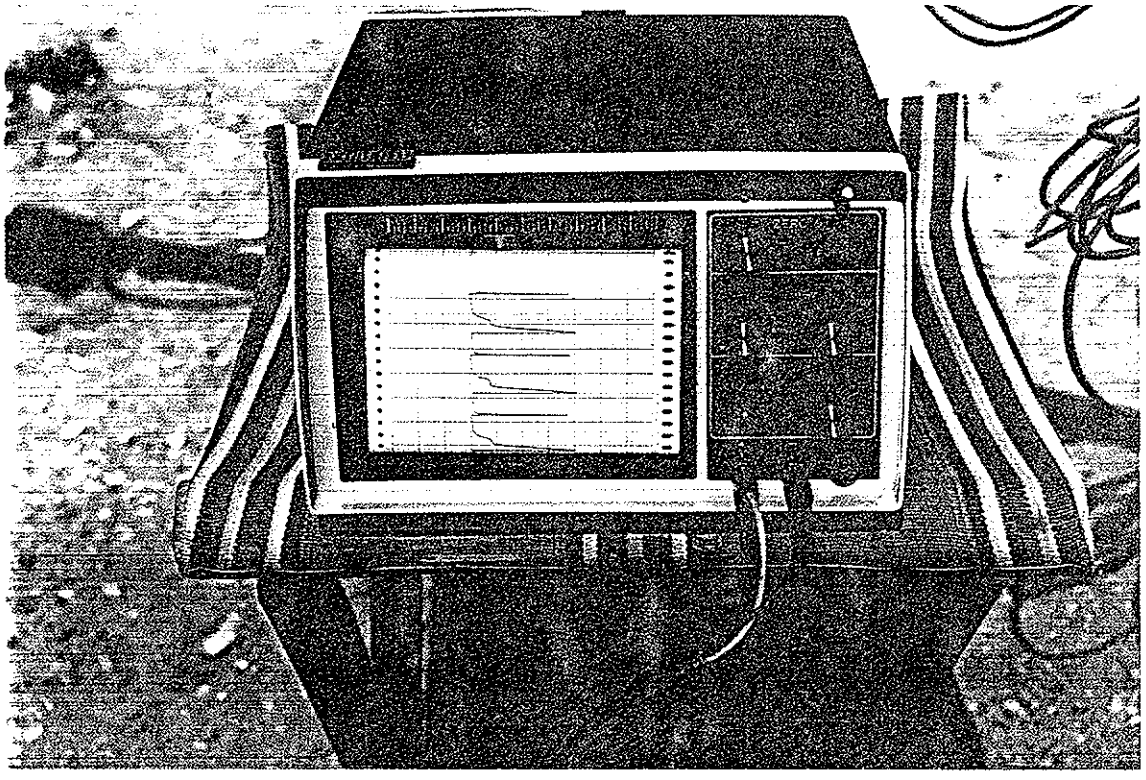


Copper Electrode in Position

Fig.23



Liebhazet double-sensor differential proton-magnetometer



Linear, Inc. Model 142 strip chart recorder

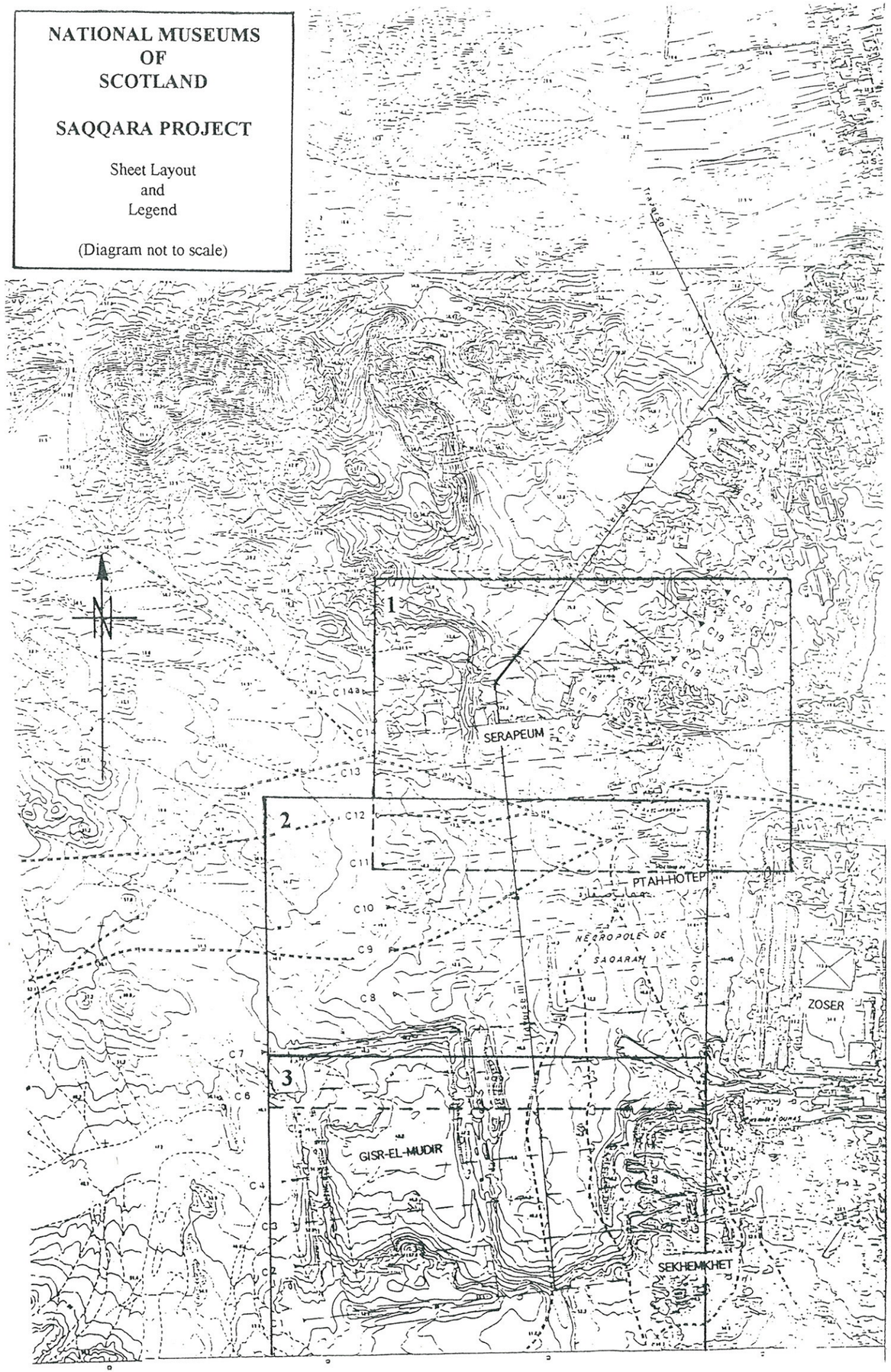
Fig.24

NATIONAL MUSEUMS OF SCOTLAND

SAQQARA PROJECT

Sheet Layout and Legend

(Diagram not to scale)



LEGEND

Topographic

Contour — 35

Spot Height — .29

Triangulation Point — T9

Building (modern)

Track

Geophysical Sensing

Resistivity Line (& direction) — GM / SRP 12

High Readings

Cross-section & Profile

Anomaly

Proton-magnetometer sites

Archaeological

Mariette's numbered tombs — 39

Surface features-surveyed & numbered (Mathieson & Tavares) — 46

Serapeum Enclosure (as shown by De Morgan) — A

Serapeum Enclosure (as shown by Rhone) — B

Early Dynastic Cemetery

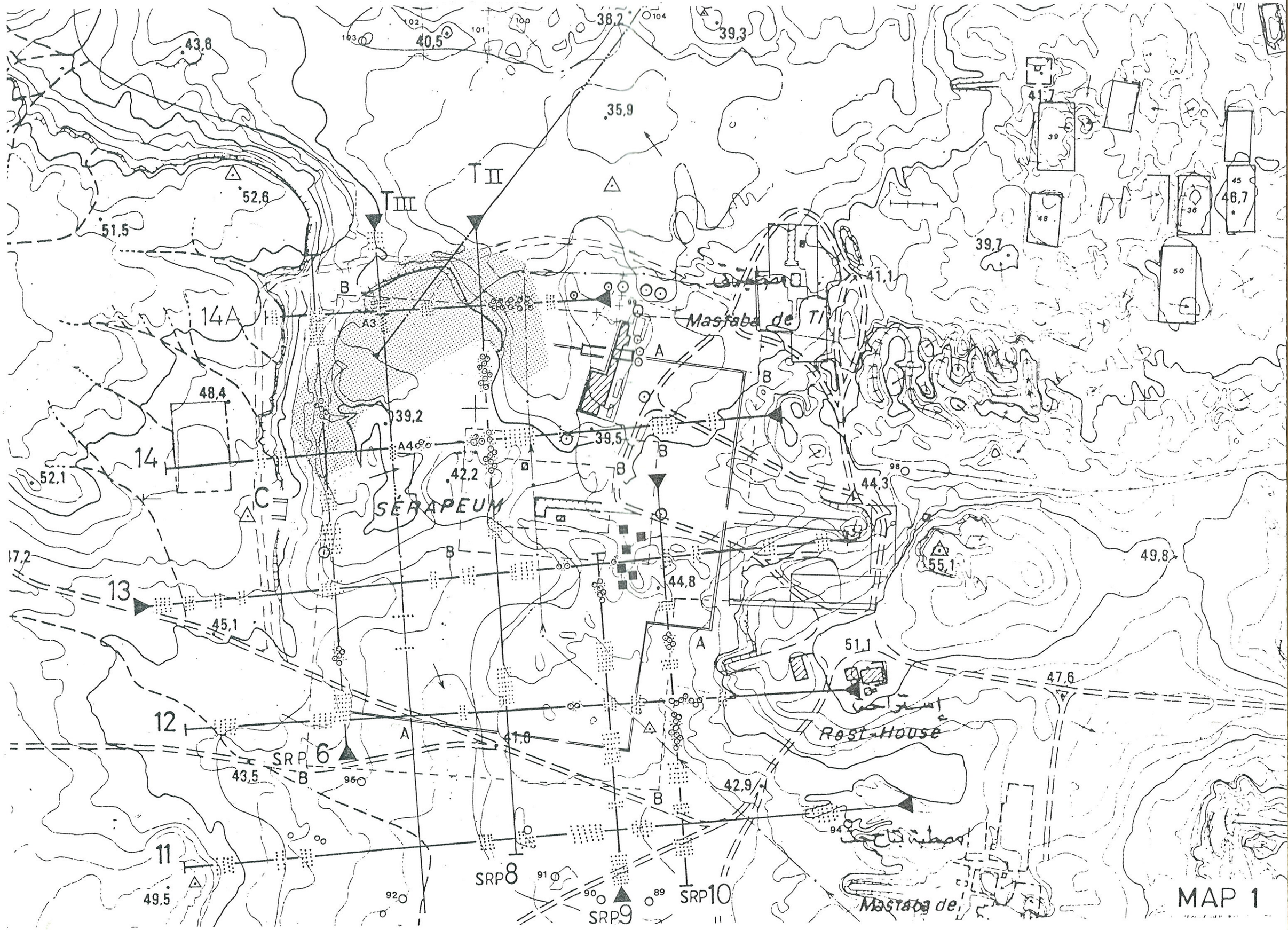
Probable shallow burials

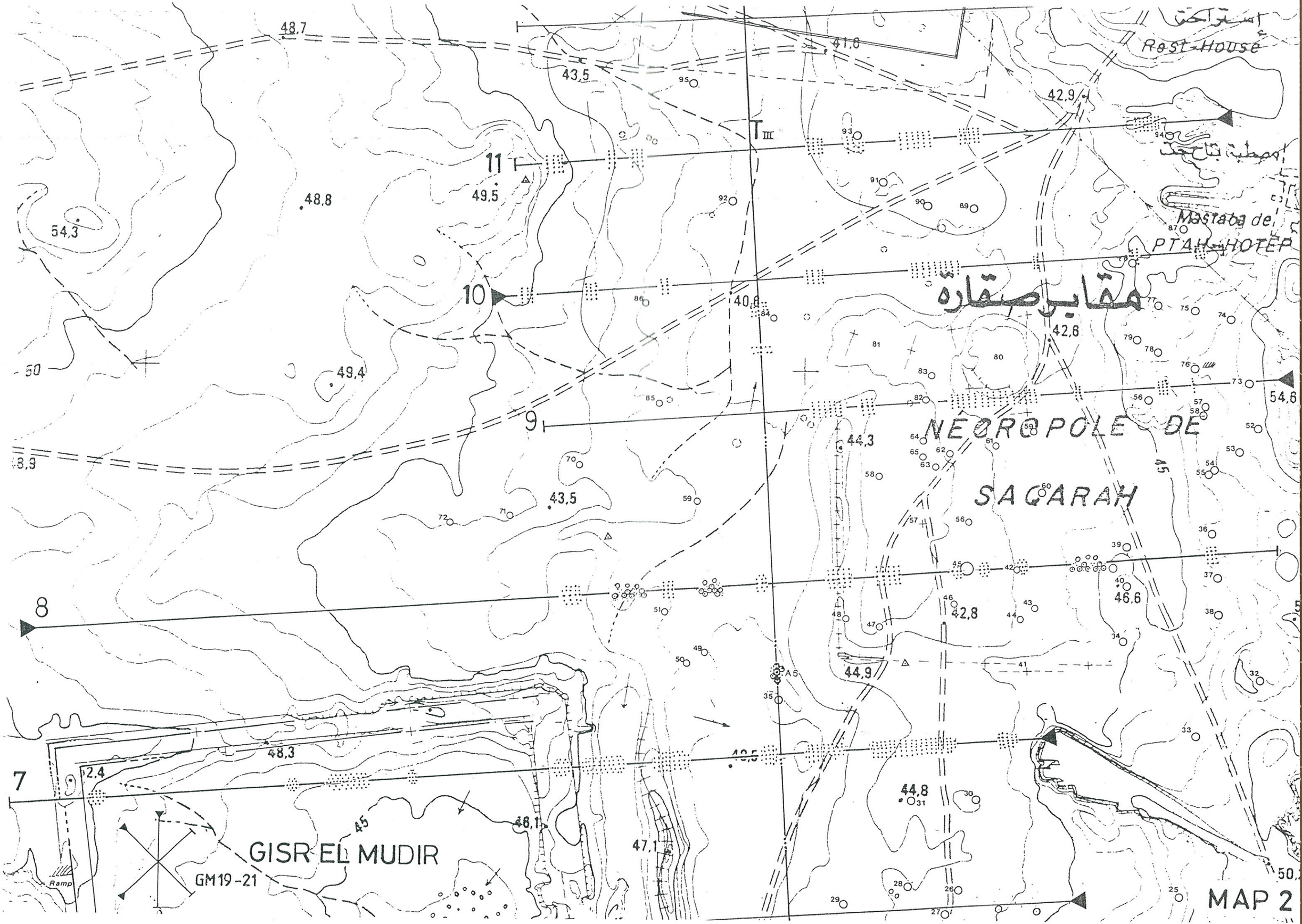
Scale

1/2500 — 0 100 200

Elevations in metres above Mean Sea Level

Topographic information from 1978 Map Sheets for the Ministry of Housing and Reconstruction
UTM Projection - Hayford 1909 Int.Ellipsoid


43,8
40,5
38,2
39,3
35,9
52,6
51,5
T III
T II
14A
B
A3
Mastaba de TI
41,1
39,7
48,4
14
39,2
A4
39,5
52,1
42,2
C
SERAPEUM
44,3
55,1
49,8
13
45,1
44,8
51,1
47,6
12
41,6
SRP 6
43,5
Rest-House
42,9
11
49,5
SRP8
SRP9
SRP10
Mastaba de
MAP 1


Rest-House
Mastaba de
PTAH-HOTEP
مقابر صقارة
NECROPOLE DE
SAQARAH
GISR EL MUDIR
GM19-21
Ramp
MAP 2
48,7
48,8
49,5
54,3
49,4
43,5
41,6
42,9
40,6
42,6
44,3
46,6
42,8
44,9
48,3
48,1
47,1
44,8
54,6
11
10
9
8
7

GISR EL MUDIR

GM19-21

GM 15-18

GM 11-14

GM 3

GM 9

GM 10

GM 8

GM 7

GM 6

GM 5

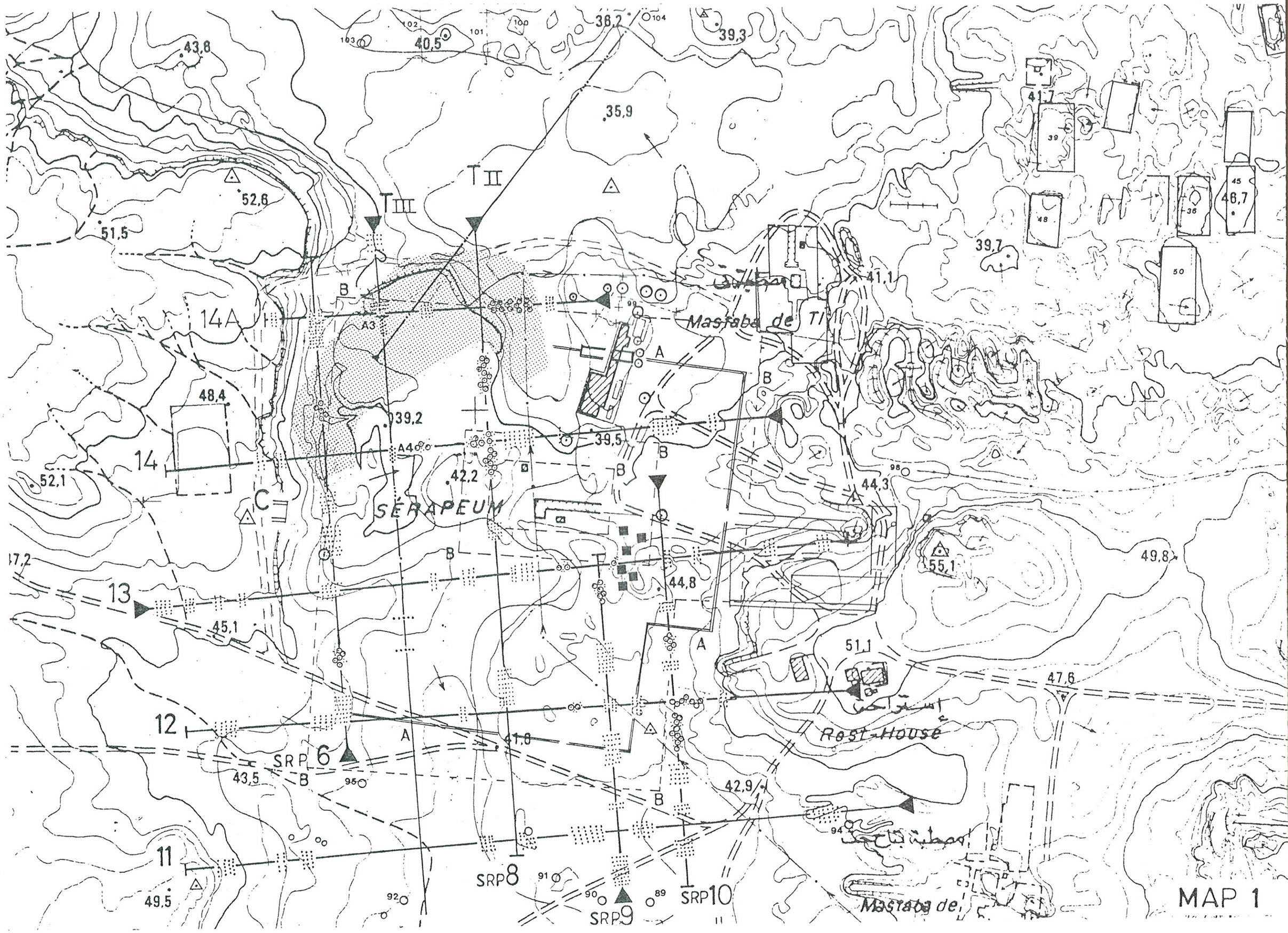
GM 4

Ramp

Sekhemkhet enclosure

Pyramide d'H
SEKHEM-

MAP 3


43,8
40,5
38,2
39,3
35,9
T II
T III
52,6
51,5
14A
B
A3
Mastaba de TI
41,1
39,7
48,4
14
39,2
A4
39,5
52,1
C
SÉRAPEUM
42,2
44,3
55,1
49,8
13
45,1
44,8
51,1
47,6
12
SRP 6
43,5
41,8
Rest-House
42,9
11
49,5
SRP8
SRP9
SRP10
Mastaba de
MAP 1