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Judith M. Bunbury, Angus Graham and Kristian D. Strutt

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A small mound, known locally as Kom el-Farahy, stands *c.* 1.5m above the surrounding cultivation approximately 800m south-east of the necropolis of Hagr Edfu (figs. 1–3). Manfred Bietak (1979) had previously suggested, on the basis of his cartographic studies, that the course of the river once ran between Kom el-Farahy and Edfu town. Vivian Davies, director of the British Museum Expedition to Hagr Edfu, recognised the need to investigate the floodplain and this isolated kom as important to understanding the past land- and waterscapes of the floodplain between Edfu town and temple and the Hagr Edfu necropolis. Understanding the past movements of the river is essential to the broader geographical context of the necropolis and the journey between it and the town.

Experience of interpreting satellite data and maps and an understanding of the movements of the Nile at Karnak (Bunbury *et al.* 2008a; Graham *in press* [a]), Memphis (Jeffreys 1985; 2008; Jeffreys and Bunbury 2005; Jeffreys and Tavares 1994) and Giza (Bunbury *et al.* 2009; Lutley and Bunbury 2008) suggested to us that the kom formed as an island in the river. Our two short seasons during February 2008 and 2009 have proved the robustness of the interpretation of satellite images using the methods of Hillier *et al.* (2007) and Lutley and Bunbury (Lutley 2007; Lutley and Bunbury 2008).

Historical and geographical background

Edfu was the capital of the second nome of Upper Egypt and became an important regional centre from the Old Kingdom, with routes leading to Kharga Oasis to the west and the resources of the Eastern Desert and Red Sea to the east (Kurth 1999, 269; Vernus 1986, 324–5). Hagr Edfu, located 3.5km west-south-west of Edfu temple on the desert escarpment, has burials dating from the Middle Kingdom to the Ptolemaic and Roman Periods (Davies 2006, 134; 2009, 25, 27; Davies and O’Connell 2009; Effland *et al.* 1999, 41; Effland 1999, 25, 28; Fakhry 1947, 47–8). These include the tomb of an important official of the early New Kingdom, Sataimau, which along with other tombs and built structures have been documented, mapped and conserved by the British Museum Expedition since 2001 (Davies 2006; 2008; 2009; Davies and O’Connell 2009).

According to Sauneron (1983, 28–9 n. 3), a ‘temple-haut’ mentioned in the Edfu texts can be found either in the desert area to the south west or on the western gebel to the south. Sauneron (1983, 28–9 n. 3) suggests that the site of the monastery at Hagr Edfu, described by Weigall (1910, 347–8) as Mari Girgis, may be the location of this sanctuary (Davies 2009, 25). In a visit to the site in 1951, Sauneron noted inscribed blocks dating to the New Kingdom and Late Period included in the construction of the monastery. According to Meinardus (1999, 245), the abandoned monastery was rebuilt by Bishop Hadr of Aswan in 1975 and

consecrated in 1980. The Monastery of Saint Pachomius, Deir el-Amba Bakhum, is today a thriving community and place of worship and pilgrimage.

Kom el-Farahy does not appear on either the 1991 E.G.S.A. 1:50000 or the 1943 Survey of Egypt 1:25000 maps. The former gives a height of 83m for the floodplain in the general area of Kom el-Farahy and the latter shows a contour height of 81.9m in the area close to the kom. A dilapidated farmstead occupies the kom and the site appears to be a focal point for the local farmers. Brief observations of ceramic fragments in the field immediately to the south of the kom by Don Bailey in February 2007 suggest activity on the kom during the Roman Period (Vivian Davies *pers. comm.* February 2007). However, Arthur Weigall (1910, 346) noted that a low mound, known as Kom el-Hedid, lying between Edfu and Hagr Edfu, appeared to be the location of the remains of a small temple and town from the Ramesside to Ptolemaic Period based upon fragments of pottery from the site. Whether or not they are one and the same place remains to be established (Effland 1999, 22 n. 3). A fragment of a column base was noted on the side of the major E-W canal in 2009 approximately 1km east-northeast of Kom el-Farahy (24° 58' 20.43" N, 32° 51' 28.87" E). However, its recovery during the dredging of the canal provides no context of its past location.

The survey methodology

The initial aim of the survey was to test the hypothesis that Kom el-Farahy was a former island in the Nile. Our methodology comprised an integration of geoarchaeological and geophysical fieldwork, conducted in 2008 and 2009. The geoarchaeological work was based on a methodology developed at Karnak (Bunbury *et al.* 2008a), using an Eijkelkamp hand auger to extract sediment. A sedimentological description and interpretation of the sediments in terms of the past landscape were made and are recorded in the logs AL02 and AL03 (figs. 4–6). To date the sedimentary deposits, samples were sieved and all of the material was retrieved from each core to a diameter of 2mm and larger (each core typically representing 10–20cm of depth) (see Bunbury *et al.* 2008a, 352, 359–60, 365; Graham and Bunbury 2005, 18) and the anthropogenic content was studied in the hope that we could assign chronological parameters to the deposits.

In 2008 an auger (AL02) was carried out in the floodplain in a field of bersim (fodder) plants (24° 58' 12.4" N, 032° 50' 50.1" E) just to the west of the visible mound of Kom el-Farahy (figs. 7–8). This initial location was chosen as the possible flank of the proposed island in the minor channel since this is where the best preservation of deposits occurs. It was also hoped that material culture from the site would be present which would enable dating of the sedimentary deposits. In 2009 a second auger (AL03) was conducted to the north of Kom el-Farahy along the geophysical survey profile (24° 58' 12.7" N, 032° 50' 53.2" E) to assess the nature of deposits revealed in the geophysical survey.

In 2009 a geophysical survey was also conducted to locate and map the remains of sub-surface archaeological and geomorphological deposits relating to Kom el-Farahy and clarify our interpretation of its formation as an island in the Nile (fig. 8). A further survey was conducted at Edfu. In contrast to Kom el-Farahy, the site of the temple of Edfu is situated on sandstone bedrock (Attia 1954, 15–16; Michalowski *et al.* 1950, 62; Vernus 1986, 324). It

was hoped that a geophysical survey carried out to the west of the temple (fig. 9) would locate the changing depth of the bedrock edge along the western flanks of the site and possibly pick up any evidence of a former channel on this side of the bedrock outcrop.

The technique of Electrical Resistivity Tomography (ERT) was applied. This technique relies on the passing of an electrical current through the earth, and the measuring of the resistivity to the current at intervals (Clark 1996, 37; Scollar 1990, 321) to build up a profile of the changing resistivity of material below the surface of the ground, enabling the archaeologist to detect localised anomalies and features. This technique has been used with considerable success in a number of environments (Gaffney 2008, 321–2; Keay *et al.* 2009; Maillet *et al.* 2005, 317–19; Strutt and Keay 2008) and has produced good results at Karnak (Bunbury *et al.* 2008b; Graham *et al.* forthcoming; Graham in press [b]).

The resistivity tomography data was collected using a Geoscan Research RM15 Resistance Meter with PA3 configuration (figs. 10 and 11). An expanding Wenner array was used at the site (Aspinall and Crummett 1997; Bates and Bates 2000) with measurements taken at 6 different levels, down to a depth of around 11m (fig. 12). The depth at which measurements are taken corresponds approximately to half the distance between the individual probes, for example if the probes are 6m apart they take readings 3m below the surface. In the Kom el-Farahy profile the second traverse was at 6m spacing with the subsequent traverses increasing the spacing by a further 4m. Thus the traverses recorded resistivity at depths of 1m, 3m, 5m, 7m and 9m down to 11m. The chosen resolution of data points reflected the questions posed.

In addition to the ERT survey, a topographic survey was conducted along each of the ERT profiles using a dumpy level and staff (fig. 13) to produce a model of the changing elevation across the profiles. These data were then incorporated into the ERT profile model.

The resistivity data were processed in Res2Dinv software. The data were inverted in the software using a least squares inversion (Loke and Dahlin 2002), with the topographic data being incorporated into the dataset. A series of two-dimensional profiles were then produced through the survey area.

Survey results

The results of the 2008 auger (AL02) shown in the log (fig. 4) revealed that a branch of the Nile was present on the west side of the kom. The ceramic fragments in these river sediments were dated to the New Kingdom (see table 1).

The coring at AL03 in 2009 was carried out to the north of Kom el-Farahy at the 224 m mark along the 386m-long ERT profile (figs. 6, 8). The first two metres of AL03 contained fragments of pottery and sandy silts. This then became finer between 2 and 4m, and then became coarse and sandier at greater depth. The sediment size is broadly reflected in the resistivity profile (see below), indicating the spread of archaeological material close to the surface and the finer then coarser sediments at greater depth. No high resistivity material appears below the thin scatter of measurements to suggest a more substantial near-surface response derived from in situ structural remains. The ceramic fragments from AL03 still need to be studied. They will hopefully shed light on the date of the deposits and further our chronological understanding of the site.

The results of the geophysical survey indicate a number of variations in the sediments of the Nile valley at Kom el-Farahy and Edfu (figs. 15, 16). The range of measurements at Kom el-Farahy (fig. 15) indicate the presence of the kom, with a spread of high resistivity material overlying the general area of the kom (A), reflecting the ploughing out of sediment and clast material across the fields to either side of the site between 160m and 244m along the profile. Beneath this the main body of the kom is apparent (B) stretching from 176m to 224m along the profile. Immediately to the west of the kom an asymmetrical change in the resistivity values of the profile suggests the presence of a channel (C) shown up in the varying resistivity values caused by the changing size of the sediment. Further to the west the resistivity values in the area of AL02 support our interpretation of the auger data that this is part of a former channel (figs. 4, 5 and 15).

A similar less well pronounced variation is visible to the east of the kom (D). Two larger variations (E) and (F) are visible to the east. The first, running from 270m to 314m in the profile, suggests the presence of an in-filled channel. The second running from 344m to 356m may well be associated with the existing drainage channel running between the fields to the east of the kom (fig. 17).

By contrast less material was evident in the traverse to the west of Edfu (fig. 16), but the bedrock of the outcrop is clearly visible in the eastern portion of the traverse at 134m along the profile (G). In addition a slight asymmetrical variation in the deposits to the west of the bedrock (H) is present, running from 114m to 120m in the profile. A second broader change (I) running from 72m to 106m in the profile is visible. A broader channel (K) is also present, running from 32m to 64m in the profile, with both divided by an area of high resistivity readings (J), and an area of high resistivity (L) to the west.

Discussion

At the time of the New Kingdom the river had a minor channel between Kom el-Farahy and Hagr Edfu, probably with a larger channel to the east of Kom el-Farahy. During the New Kingdom the river, still close at hand, deposited flood silts around the site. The history of occupation at the site is not at all clear from the studied ceramics retrieved from the augering. There may have been continuous activity on the kom or a hiatus after the New Kingdom. The fine grained sediment, mostly silt and clay at the top of the agricultural unit in auger AL02, suggests that little if any sebach has been applied to this part of the area, even though it is evident at other points around the site. The Roman Period sherds from this unit suggest activity on the site at that time. The distal floodplain silts found in auger AL02 between 0.6m and 2.0m below the surface suggest that since the New Kingdom the river had migrated eastwards away from Kom el-Farahy. The corollary of this migration of the Nile eastwards since the New Kingdom is that it was migrating westwards until the New Kingdom, which may have placed it back at the Edfu bedrock island in the Old Kingdom or earlier (fig. 18). Observations of satellite images and maps reveal that in recent times the river has started to migrate westwards back to the town of Edfu. The present-day stone block work and cement armouring of the river bank at Edfu is an attempt to prevent both natural and anthropogenic erosion of the riverbank (figs. 19, 20) as well as providing a quayside for the cruise ships.

The Electrical Resistivity Tomography (ERT) surveys at Kom el-Farahy and Edfu clearly illustrate the changing nature and form of deposits within the floodplain of the Nile, specifically relating to the presence of outcropping bedrock and the presence of koms derived from the build-up of river sediments and the deposition of archaeological materials.

Results of the survey from Kom el-Farahy indicate the presence of high resistivity sediment and clast material, showing the location of the kom in relation to surrounding finer river sediment. The main body of the Kom rises at 170m along the traverse and disappears in the profile at around 225m along the traverse. This main high resistivity anomaly measures some 55m across, suggesting a relatively small feature within the surrounding river sediment. The low depth higher resistivity readings that surround the main feature appear at a depth of 4–6m below the modern ground surface. These represent coarser grained sediments within the Nile channel. Along the western edge of the kom, a channel is visible some 6m below the ground surface, measuring some 28m across, and running from 152m to 180m in the profile. The full depth of the channel was not reached in the profile due to issues of access to the field to the west of the kom. The channel appears to be deep and narrow, running close to the edge of the kom.

The features to the east of the kom appear by contrast to be shallower, changing at a depth of 4m, but are much broader. The channel closest to the kom (D) measures 35m across, with the second change in the depth of high resistivity readings (E) measuring 50m across, running from 270m to 314m in the profile. A small channel appears at depth in the extreme eastern part of the profile. This is situated directly below a modern irrigation channel, and may result from the variation in readings caused by the modern channel (see fig. 17). A series of near-surface measurements are visible across the area of the kom, located up to 1m below the modern ground surface. These seem to represent the distribution of coarser-grained sediment and ceramic material that has been ploughed out from the edge of the kom into the surrounding fields. This is verified by the results of borehole AL03. The resistivity properties in the profile appear to correspond with the percentage of clast inclusions and sherds in the borehole data. It is interesting to note that there is less correlation between the sediment size and resistivity values, although the lower portion of the resistivity does seem to correlate with the coarser sediments and sands of the lower part of the borehole. Readings from the ERT for the channel to the west of the kom (C) suggest a slightly steeper profile for the deepest and highest resistivity values on the west side, corresponding to a lesser gradient in the values on the eastern side where the kom rises. The lower resistivity values at shallower depth indicate a more symmetrical profile. Although it is difficult to ascertain the exact nature of the deposits from the resistivity values alone, it is possible that the asymmetry for the deeper deposits is caused by a greater degree of erosion on the outer concave (western) side of the channel, which evens out as the sediments become shallower and finer.

The data would suggest that the island is only about 55m wide. Without carrying out further work we cannot be sure of length of the island. Differing geometries of the island seem possible. It could be a 'long thin' (low width to length ratio) or a 'short fat' (high width to length ratio) island (Graham in press [a], figs. 2–3). An island with 'horns' or 'bars' such as the one found today in the river immediately east of Edfu is a further possibility (see fig. 2; Graham in press [a], figs. 4–6). However, if this were the case, then the east 'horn' of the

island would have to be east of our ERT profile. Only further work will clarify the geometry and history of the island.

To the west of the temple complex at Edfu the profile, while much shorter than the Kom el-Farahy traverse, indicates the presence of changing sediments and two possible channels, (I) and (K), and the surfacing of the Edfu bedrock in the eastern portion of the profile (G).

Most of the higher resistivity material is located at a depth of at least 4.5m below the present ground surface, suggesting that there are no koms or other islands created by the Nile channel along the profile. The bedrock appears to rise into the range of the profile at 120m along the profile. It then levels out and rises to the surface from 134m along the profile. Due to the lack of any borehole data in this area, it is more difficult to assess both the true depth of the coarser sediments at this point in the Nile valley, and to differentiate between the bedrock and coarser river sediment. In general the sand of the valley appears to have a higher resistivity value than the bedrock as it rises to the surface. Interpretation of the results from both Edfu and Kom el Farahy is constrained by the limited depth to which the ERT reached, ultimately caused by our restricted access to the fields in question. A deeper profile that reaches 4–5m below the current level would enable us to confirm the presence of the Pleistocene sands underlying the river channel.

Conclusions

The Electrical Resistivity Tomography survey and the augering at the sites of Kom el-Farahy and Edfu were successful in locating the remains of the kom and associated channels and material, and at finding possible channels to the west of the Edfu bedrock island. The profile of the kom was recorded in the data, together with results linked to the distribution of archaeological material in the ploughsoil to either side of the site. A series of possible channels was also located. Similar features were also located immediately to the west of the bedrock outcrop at Edfu.

Further geophysical survey, e.g. magnetometry and ERT, around Kom el-Farahy would shed further light on the geometry of the former island and any evidence of structures. An intensive surface survey of the surrounding fields for ceramic fragments and other material culture would provide evidence of the chronology of activity at the site and together may clarify the possibility that this is Weigall's 'Kom el-Hedid'. The investigation of other focal points in the floodplain such as the farmstead east of Kom el-Farahy at 24° 58' 09.36" N, 32° 51' 29.06" E may also prove fruitful (see fig. 14). Further geophysical and geoarchaeological survey in the floodplain and around Edfu would enable us to better understand the movements of the river and the connection between Hagr Edfu and Edfu town and temple. It may even allow us to shed light on the ancient landscapes that are mentioned in the documentary sources (Grieshaber 2004).

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Depth (m)	Sediment / environment	Proposed date
0.0 – 0.6	Clay rich agricultural unit	Recent containing post-Pharaonic and Roman sherds
0.6 – 2.0	Distal floodplain silts	Post-Dynastic sherds
2.0 – 5.2	Heavily vegetated mixed units of poorly sorted sands and silts – possibly dumping	Post-Dynastic sherds
5.2 – 6.0	Two silt units, fining upwards probably proximal flood deposits	New Kingdom sherds
6.0 – 7.0	Vegetated fining upwards unit, possibly island flank material	Undated sherds
7.0 – 8.8	Marginal channel sands and silts	Undated sherds

Table 1: A summary of the main units encountered in AL02.

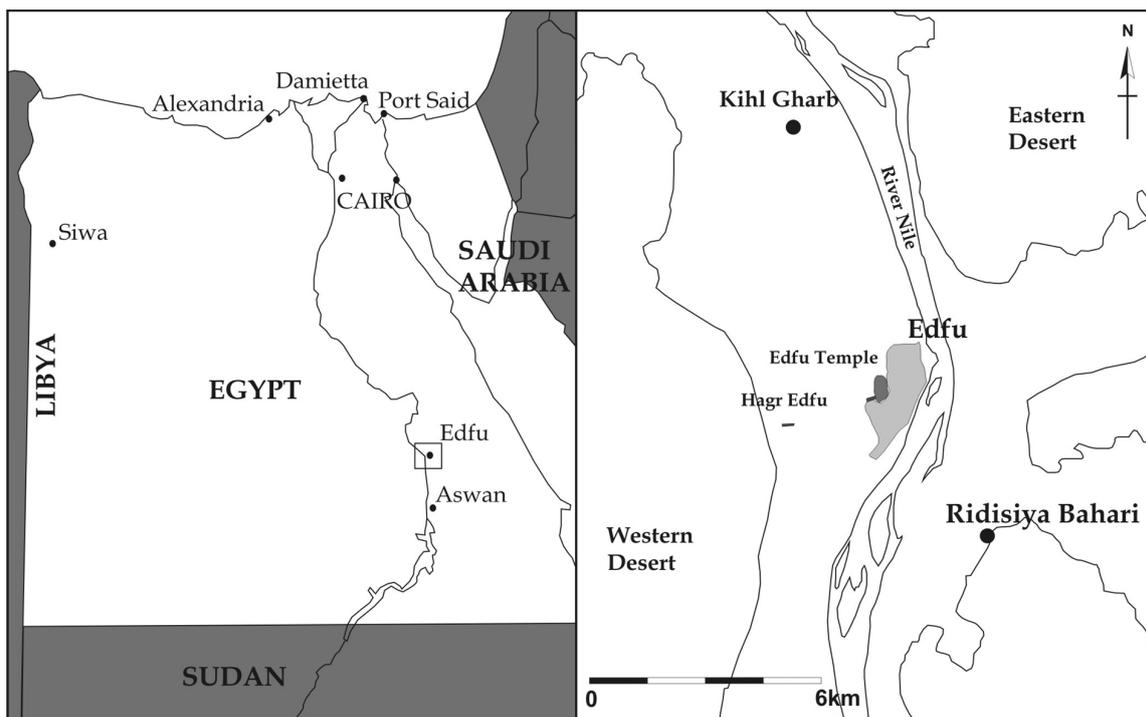


Fig. 1: Location map of Edfu.

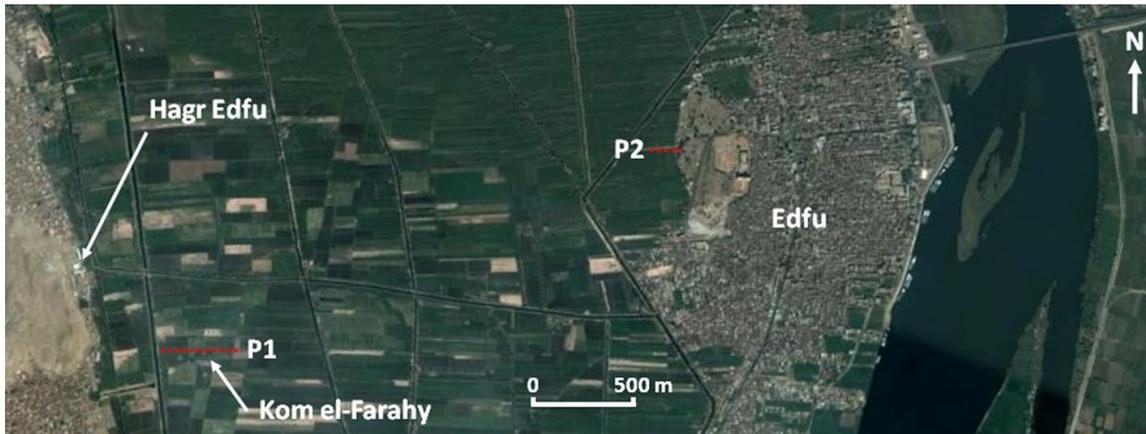


Fig. 2: Satellite image showing locations of Hagr Edfu, Kom el-Farahy, Edfu town and temple and the two ERT profiles (P1 and P2). An island with two 'horns' or 'bars' stretching downstream from the bar head can be seen in the river (Background image: © Google Earth).



Fig. 3: A view of the Edfu floodplain from Hagr Edfu showing the southern part of the Monastery of Saint Pachomius in the mid-ground and Kom el-Farahy and Edfu town in the background (photo: A. Graham).

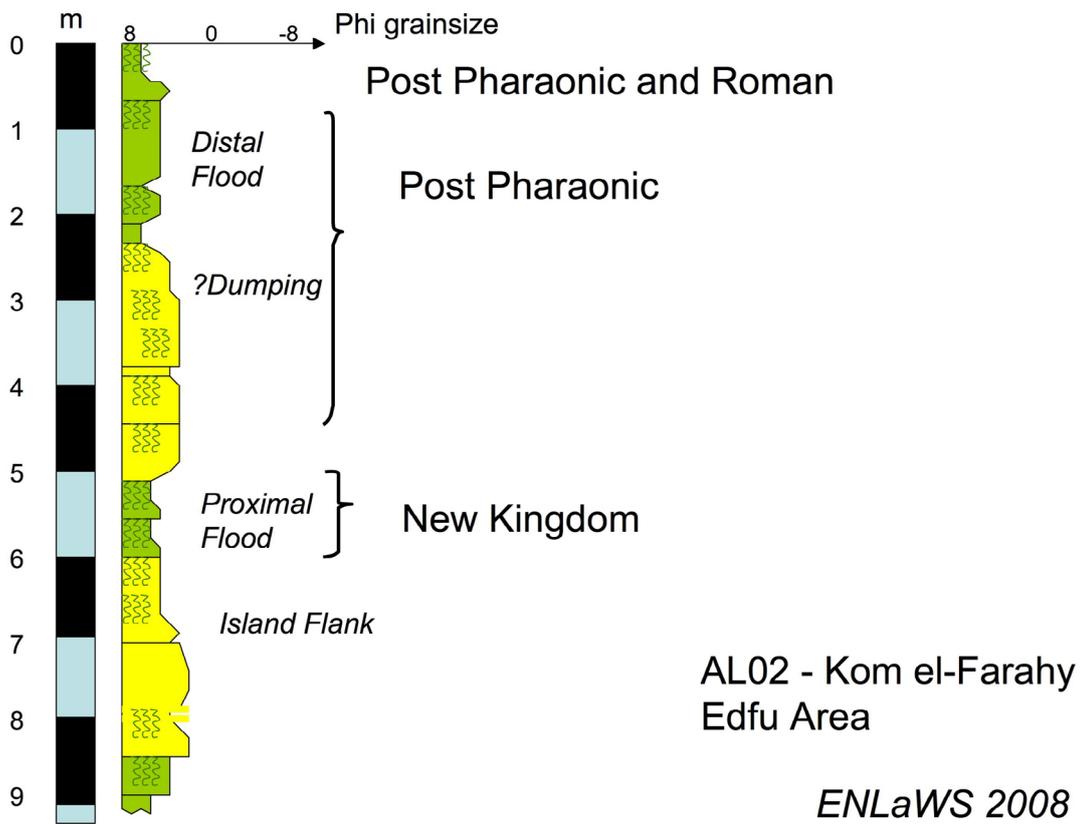


Fig. 4: Summary log of the deposits recovered from the auger AL02 at Kom el-Farahy in 2008.

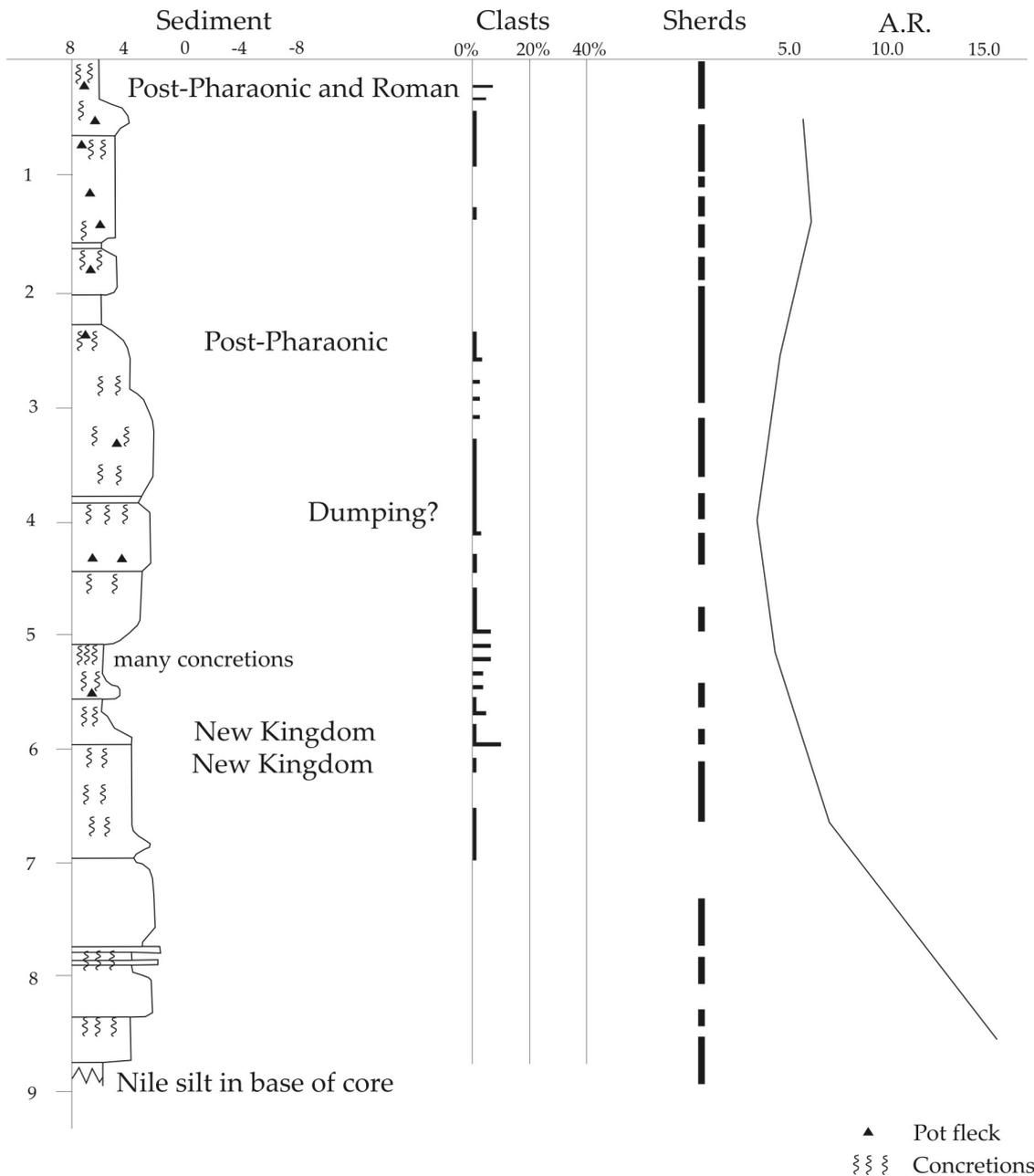


Fig. 5: Sediment diagram for AL02 showing the sediment size, percentage of clast inclusions and sherds for comparison with the changing apparent resistivity values from the 2009 ERT profile at Kom el-Farahy.

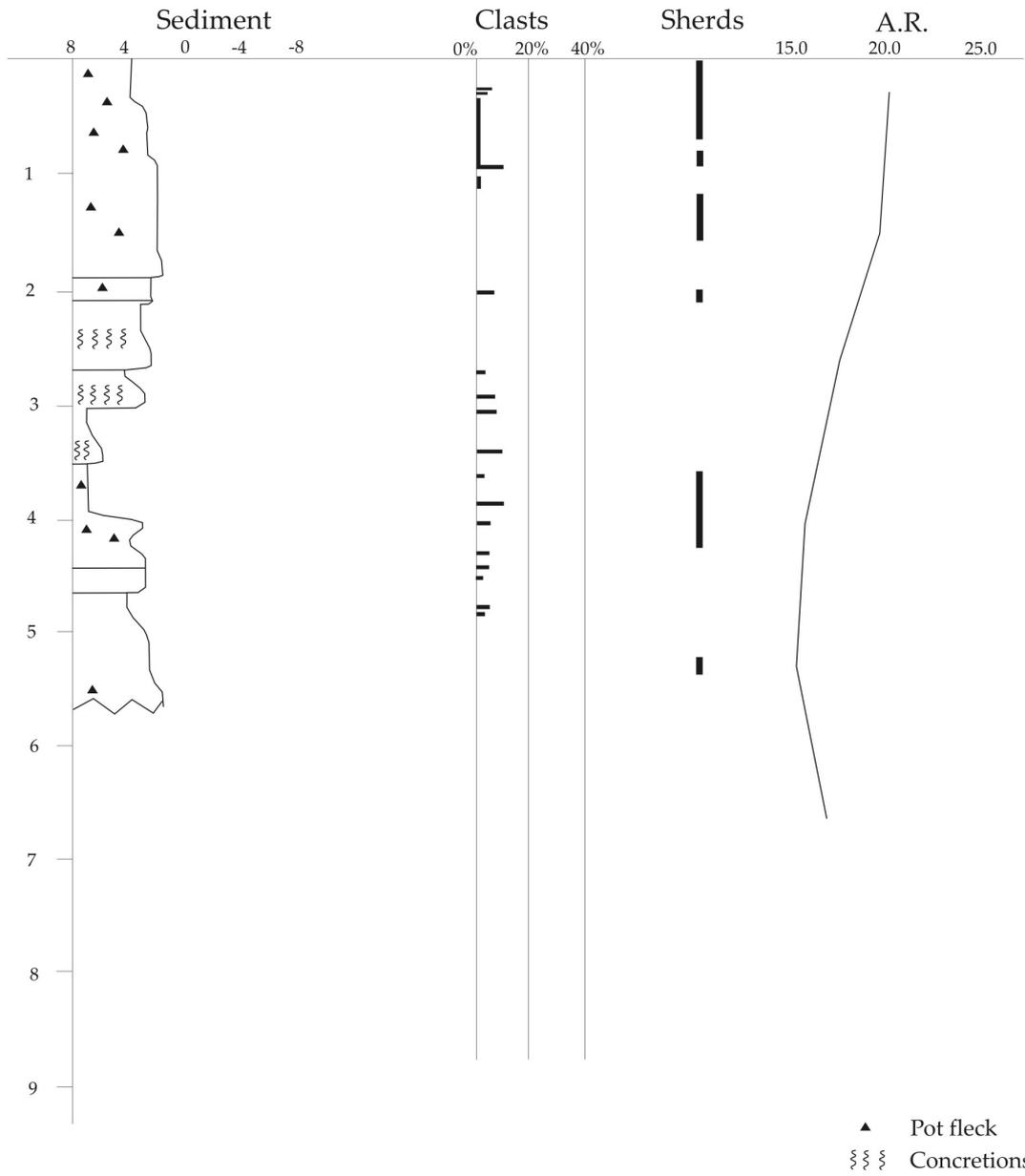


Fig. 6: Sediment diagram for AL03 showing the sediment size, percentage of clast inclusions and sherds for comparison with the changing apparent resistivity values from the 2009 ERT profile at Kom el-Farahy.



Fig. 7: Omar Farouk (left) checks order of the individual extractions ('cores') taken from AL02, which is being operated by the four men to the right. The palm grove of Kom el-Farahy is in the background to the right (photo: A. Graham).



Fig. 8: Satellite image of Kom el-Farahy showing the locations of AL02 and AL03 and the ERT profile (P1) (Background image: © Google Earth).



Fig. 9: Satellite image of Edfu showing the location of the survey profile (P2) (Background image: © Google Earth).



Fig. 10: Electrical Resistance Tomography (ERT) being carried out at Kom el Farahy. The workers are positioned at the current and potential probes of the Wenner configuration, with the probes in this photography set at 10m spacing (photo: Kristian Strutt).



Fig. 11: Kris Strutt carrying out the ERT survey using a Geoscan Research RM15. Readings from the probe array are being taken using the instrument pictured, and recorded for later importing and computer processing (photo: Judith Bunbury).



Fig. 12: Diagram showing the position of probes for the Wenner array resistance tomography, with the first traverse, to the left, probes are situated with 2m spacing. With the second traverse, to the right, probes are positioned with 6m spacing, increasing the depth of the measurement.



Fig. 13: Levels being taken along the profile at Kom el Farahy, allowing the topography of the site to be integrated with the ERT data (photo: Omar Farouk).



Fig. 14: Stand of palm trees in front of a farmstead 1km east of Kom el-Farahy (photo: Judith Bunbury).

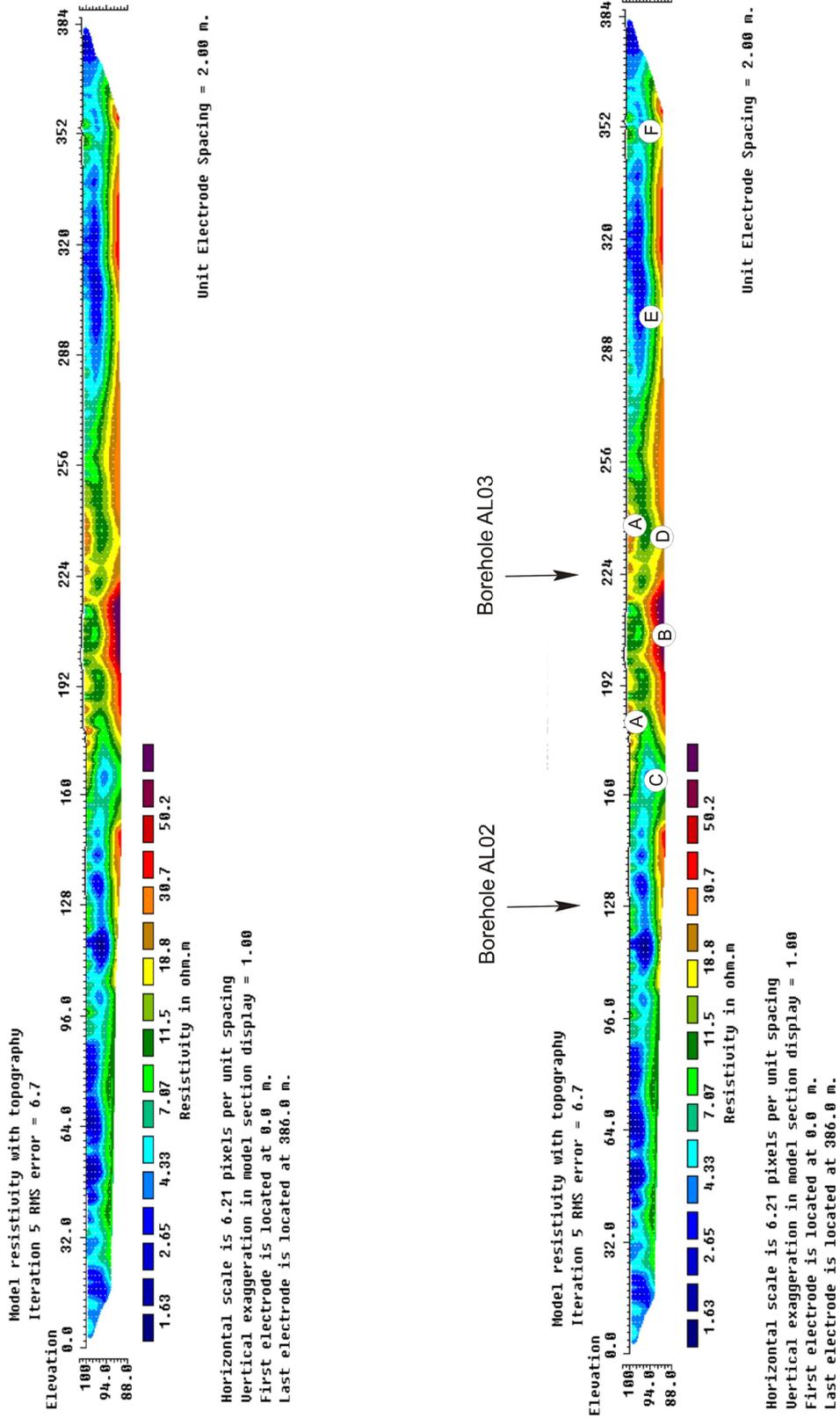


Fig. 15: The ERT profile from Kom el-Farahy showing the topography (upper image) with the location of the boreholes, and main variations in the resistivity added to the lower image. Elevation levels are based upon an arbitrary local datum; precise elevations have yet to be established.

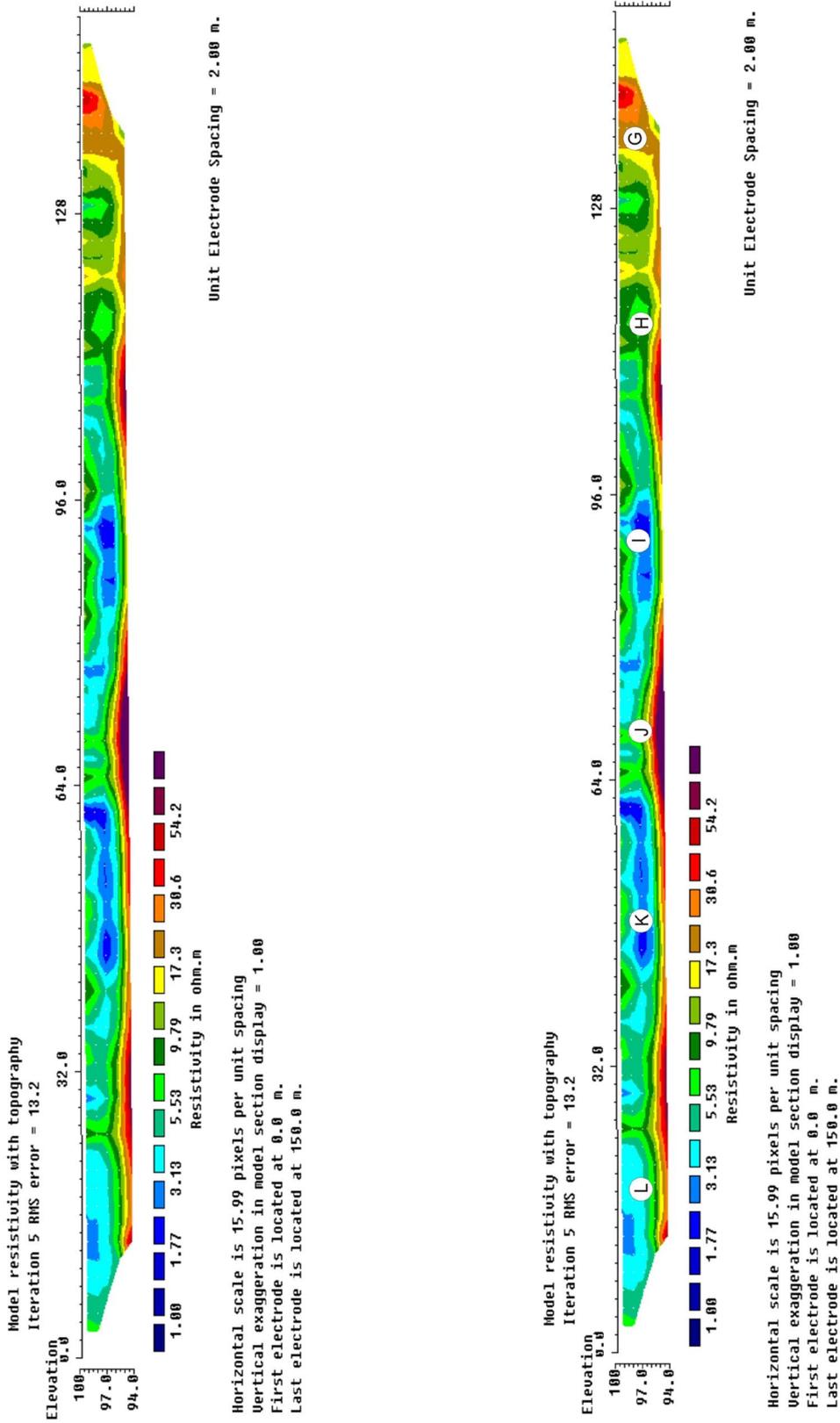


Fig. 16: The ERT profile from Edfu showing the topography (upper image) with main variations in the resistivity added to the lower image. Elevation levels are based upon an arbitrary local datum; precise elevations have yet to be established.

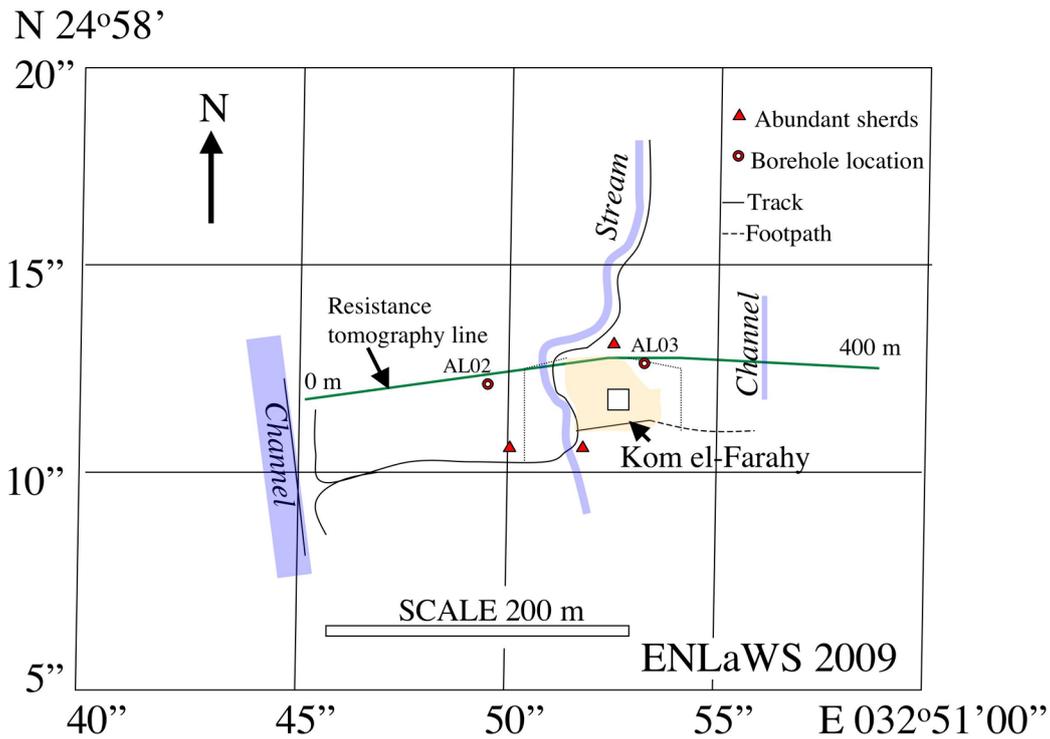


Fig. 17: Map showing the principal modern topographic features at Kom el-Farahy with the line of the ERT profile and auger locations AL02 and 03 (map from hand-held GPS data: Judith Bunbury).

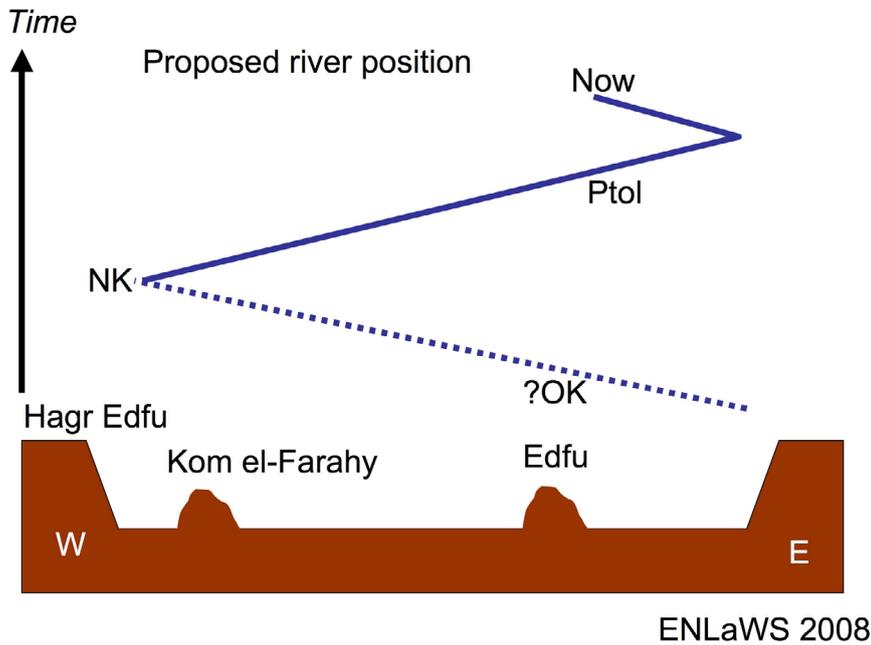


Fig. 18: Diagram (not to vertical or horizontal scale) to indicate the proposed location of the river relative to the Nile floodplain with time (t). The river location is shown in blue, splitting of the river around islands is not shown for the sake of increased clarity.



Fig. 19: The riverbank at Edfu in February 2008 with stone block work and cement (photo: A. Graham).



Fig. 20: The armoured riverbank of a former island to the east of Edfu. The upstream section (to the right) is in good condition where as the section in the foreground is badly eroded. Most likely due to a combination of human traffic on the bank and boat-generated wave erosion, as this is a ferry point (photo: A. Graham).