CHAPTER 7

REPORT ON THE 1987 FIELDWORK
A FURTHER RESISTIVITY SURVEY AT EL-AMARNA

by

Ian J. Mathieson

7.1 Introduction

At the request of Barry Kemp and the Egypt Exploration Society and with the help and co-operation of the Egyptian Antiquities Organization and their local Inspector, Ahmed Galal, I spent ten days in March, 1987 running resistivity profiles over two areas of interest as directed. The areas to be investigated were: (a) the location of the probable centre of a well being excavated at the start of a track leading to the Workman's Village (site Q48.4); and (b) the westward continuation of the Great Palace in the Central City, to be done by running several resistivity profiles from the edge of the ruin field to the bank of the River Nile through the cultivation, seeking (i) indications of any extension of the ruin field under the cultivation; (ii) to plot the slope of the old desert topography; (iii) to search for signs of the former course of the river.

7.2 Methodology

As in a previous season at Amarna (see *AR* I: Chapter 8, where the theory is briefly outlined) and others at Memphis, the method used was to run overlapping traverses consisting of linear arrays of twenty-four copper electrodes forced into the ground at 2-m intervals, controlled by a multi-selection switching device. The ohm-metre values were read on a Strata-Scout analogue resistivity meter and the results computerized for smoothing and removal of background "noise". The information was then plotted through the computer using a software program which gives maximum flexibility in scale and notation. As the resistivity readings can range from zero to infinity in the space of 10 to 15 m, the ability to plot at normal vertical and horizontal scales, but also to switch to logarithmic when required, is most desirable. The graphed results were finally interpolated with the topographic surface contours and a plan drawn of the interpretation for further discussion.

7.3 Survey area 1: the well at Q48.4

The situation and record of partial excavation of the well at site Q48.4 are described in Chapter 1. It lies within the excavation grid of 5-m squares designated no. 1, the shaft occupying grid squares G–I/11–13 (Figure 2.1). By the time of the resistivity survey the excavation had already started, and from the pottery count and general site inspection it was evident that the well really did lie within the squares delineated. As this covered an area of at least 225 sq m it was desirable to locate the approximate centre to avoid extensive excavation, and — given the uncertainty and hazards which inevitably attend an attempt to excavate a possibly deep shaft filled with soft sediments — to contribute any other information about depth and shape which could be added to such results as the excavation itself managed to obtain. A total of five lines was set out, shown in Figure 7.1. All the horizontal distances are measured to base 500 m. Line 1 was used as a base and control line for the resistivity readings as it was assumed that the well did not lie under this line. Lines 2 and 3 were of a similar nature, forming a triangle round the probable centre. Lines 4 and 5 were sited to cross at the "best guess" position of the well centre.

From the readings obtained from lines 1, 2 and 3 and from inspection of the uncovered face of the excavation on the west side it appears that the site lies in the geological position of an ancient wadi bed. The strata consist of gravel and boulder lenses caused by flood run-offs scouring the bed of the wadi and depositing sand in graduated layers with fine mud separation as the heavier sand dropped near the gravel lenses. This situation is ideal for well excavation as

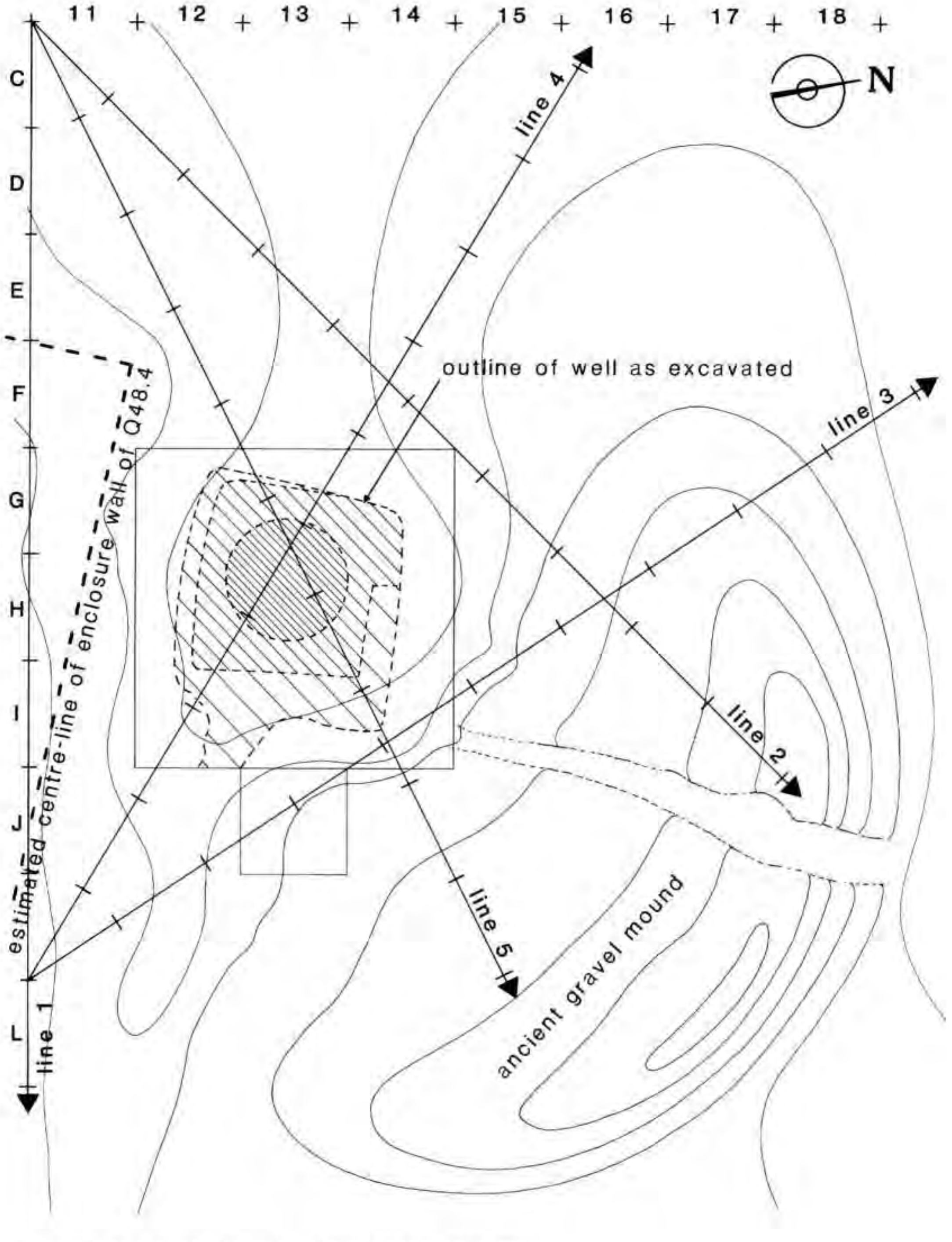


Figure 7.1. Outline plan of the well site at Q48.4 showing locations of the five resistivity lines (cf. Figure 2.1).

once the bed level has been obtained the moisture continues to run for many months after the wadi has dried out on the surface. If there should be spring-fed water in the limestone hills at the start of the wadi the seepage could provide a constant supply free from evaporation effects. However, the variation in consistency of the strata, both vertically and horizontally, makes interpretation of resistivity readings very difficult, for the fluctuations between adjacent natural deposits can be as great as between natural and man-made features and can have the effect of swamping the latter. The difficulty of interpreting this set of readings contrasts markedly with the second set, derived from the cultivation beside the Great Palace.

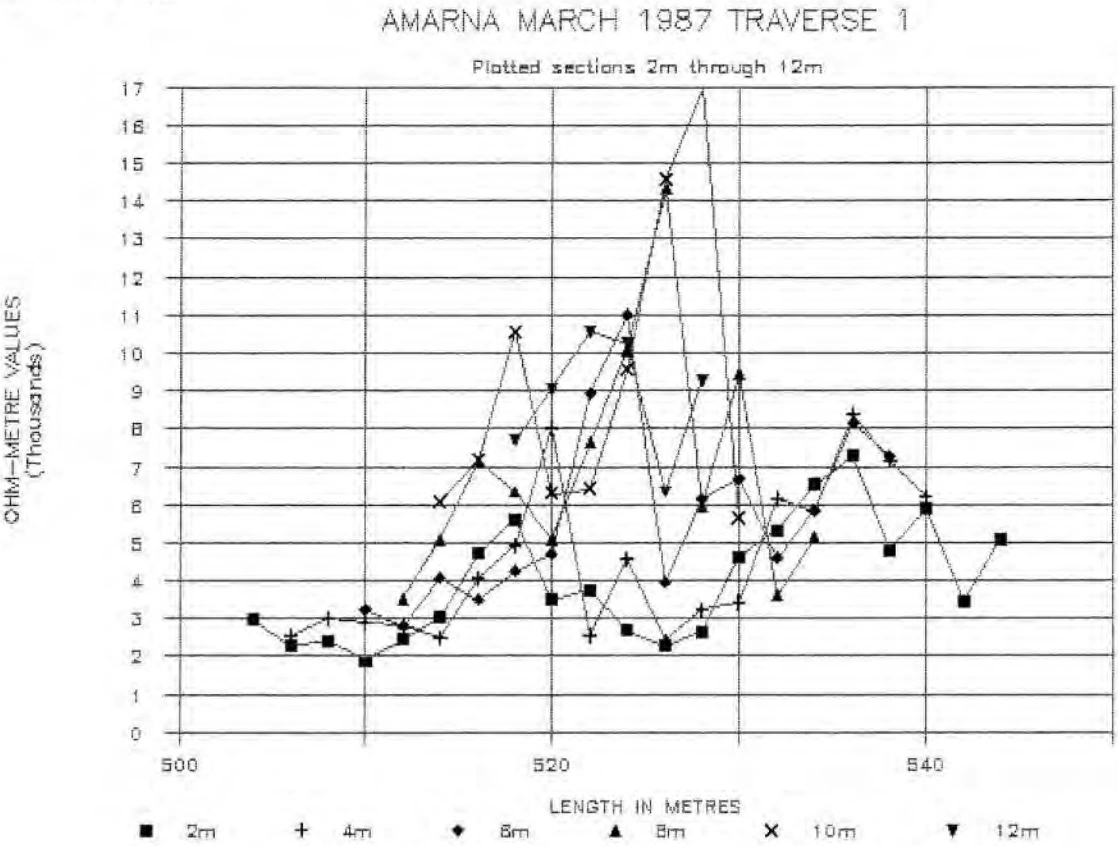
Traverse 1 (Figure 7.2). The readings along this line stand in sharp contrast to all of the other traverses at both sites in that most of the fluctuations occur within the 2–10 ohm-metre range, with the highest reading of all peaking at the 17 ohm-metre value. This implies a greater degree of sub-surface homogeneity on the low desert plateau on which the building of Q48.4 is situated than in the neighbouring area of the well, where the values can rise much higher and are generally scaled up to between 40 and 80 ohm-metres. At 0–2 m depth the ohm-metre values rise to form small peaks of resistance at 18 and 35 m. When transferred to the site contour map, these are places where one would anticipate that the mud-brick enclosure wall and its lateral spread of rubble would cross the line of traverse. Below this level the peaks and troughs of the 6, 8 and 10 m depths can be resolved into low-value sand layers at the 15 and 30 m positions, and a relatively high-value (still only 17 ohm-metres) gravel layer at the 28 m position.

Traverse 2 (Figure 7.2). With the remaining traverses the degree of variation is generally greater, presumably reflecting the greater sub-surface variation of an ancient wadi bed. Sand can probably be recognised at 6, 8 and 10 m depths at the 15 m position, gravel lenses at 10 and 12 m depths at position 25 m, and at 8 m depth at 30 m. The rise in ohm-metre values at 2 m depth in the last 15 m (from about the 30 m position onwards) is due to the mound of cast-out spoil from the digging of the well in antiquity. A secondary rise around the 22 m position must reflect the narrow erosion channel filled with gravel that runs into the well from the west in the middle of the west side.

Traverse 3 (Figure 7.3). This traverse, beside the location of the well but not actually across it, brings out dramatically the degree of local variation in the natural wadi deposits. The saw-tooth appearance of the graph is due to the line being, after about 12 m, roughly along the edge of the old existing bank of the wadi which is a conglomeration of gravel and sand with a large lens of highly resistant material at 10–12 m depth at the 25 m position. There is also a general increase in resistance with depth overriding the sudden variations. This degree of natural variation provides a poor background against which to detect disturbance from man-made features.

Traverse 4 (Figure 7.3). This is one of two lines which cross the middle of the well site. The subsequent continuation of the excavation revealed that the well shaft occupies the space between the 17 and 26 m positions. In contrast to the previous traverse a set of low readings (almost zero) obtains over this distance at the 2 and 4 m depths, reflecting the fill of the well with soft dry sediments, and remains low for much of the distance on either side, showing a local geology of sandy or marly deposits, offering only light resistance. Even the readings at the lower depths of 6, 8 and 10 m are generally low, broken principally by a sudden peak around the 25 m point, suggestive of gravel lenses. From their horizontal position they probably occur in the bedrock just behind the side of the well, thus outside the limits of the well shaft and its fill. The degree of the suddenness of the drop in resistance at 8 m depth could be an indication of the water level. Of particular interest is the shape of the curve at 12 m, which dips to low values exactly over the deepest part of the well shaft. This could be an indication that the shaft, which was excavated only to 9 m depth, really extends downwards for at least 3 more metres.

Traverse 5 (Figure 7.4). This line also crosses the well, which occupies the space between the 25 and 35 m points. The same low values at 2 and 4 m are seen over the desert to the south–west and over the well shaft, but both rise markedly immediately beyond, in the zone between the northern edge of the well and the mound of ancient spoil. By comparison with traverse no. 2 we can suggest that the tail of this spoil heap had slumped down to form part of the fill of the well shaft. At lower levels individual high readings occur over the shaft, presumably a result of detached lumps of bedrock present in the fill, and perhaps through catching the stones of the rough staircase that was subsequently shown to be probably present. A series of lows around the 25 m mark at 6, 8, and 10m, however, could mark penetration through the soft fill sediments of the shaft, although they are a little more to one side of the well than one would expect.



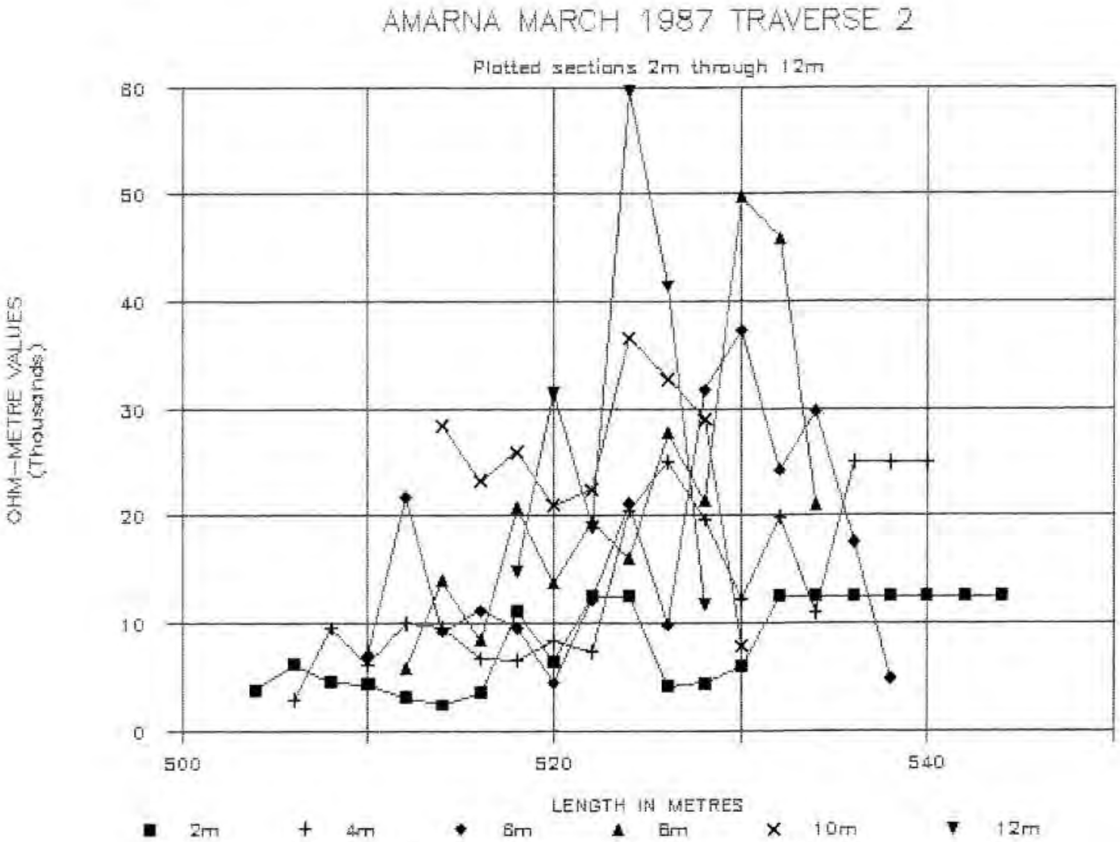
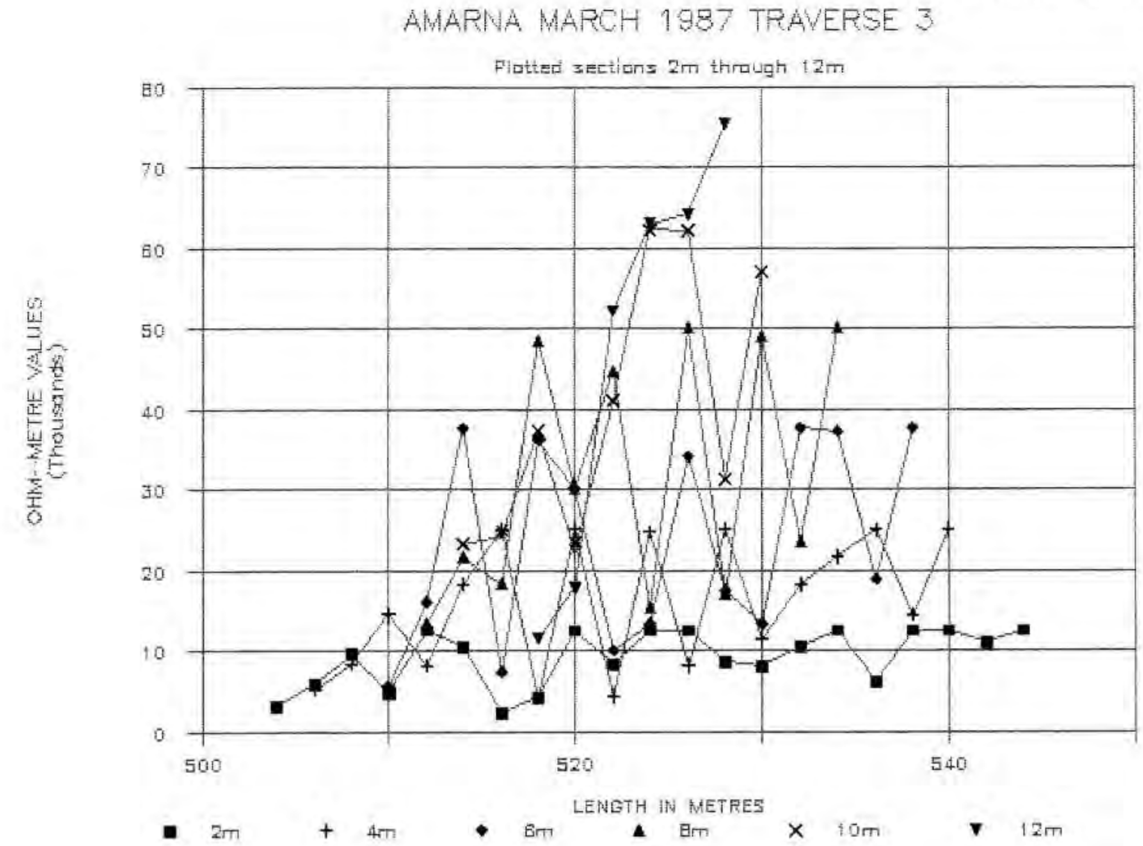


Figure 7.2. Resistivity profiles along lines 1 and 2.



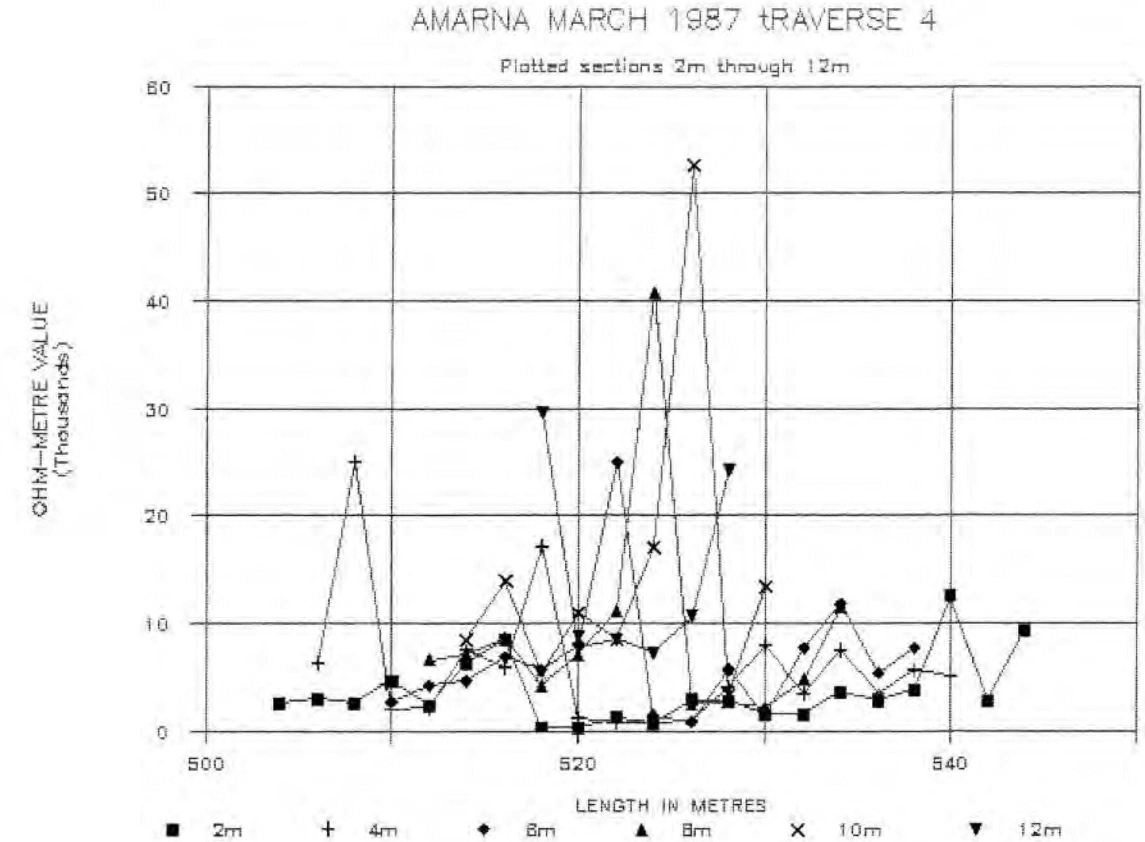


Figure 7.3. Resistivity profiles along lines 3 and 4.

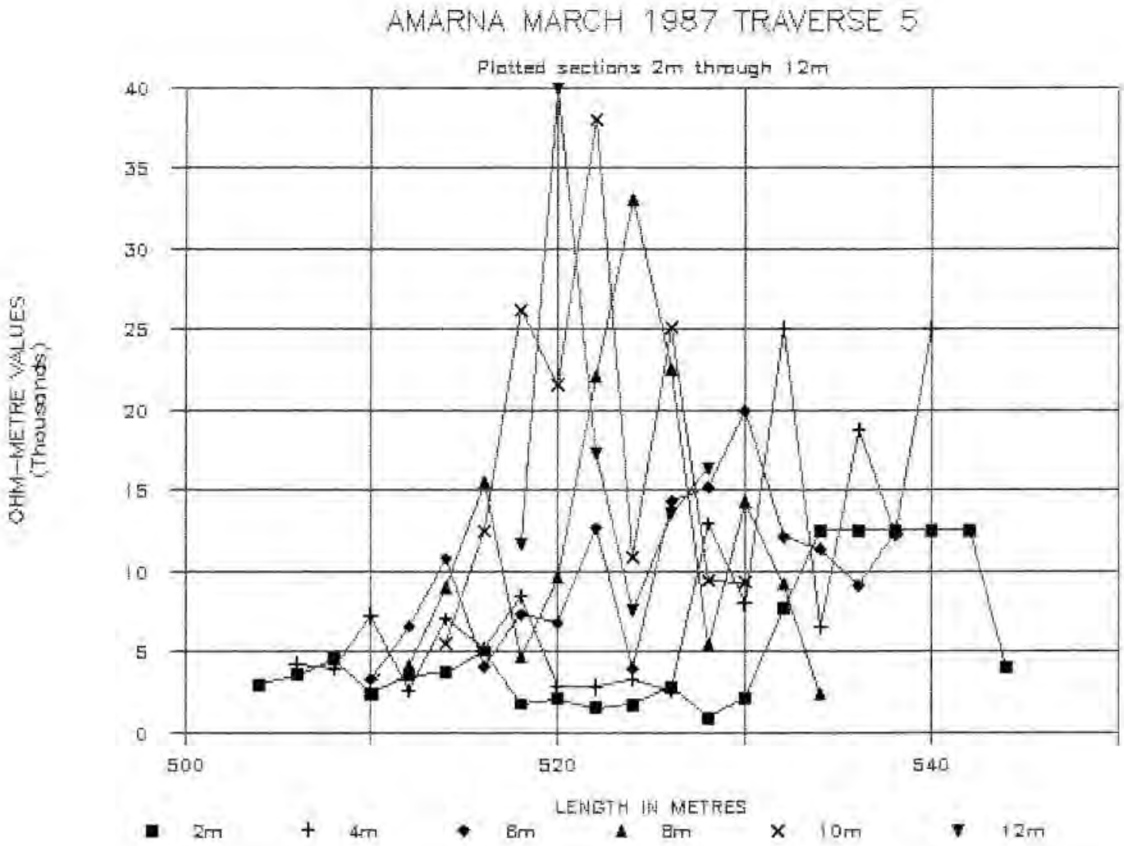


Figure 7.4. Resistivity profile along line 5.

The traverses were carried out at an early stage of excavation and quickly offered reassurance that the site did indeed contain a well shaft, located in square H13, with a predicted water table at 41–42 m local datum, i.e. a depth of 8–9 m from the surface. The resistivity results were, in detail, much affected by pockets of high resistance at different depths, probably localised gravel lenses, and do not, therefore, provide as clear a picture as one would like. They do, nonetheless, contain information which is not otherwise available. The contrast between traverse no. 1 and the others (apparent when allowance is made for the difference in scaling) can be interpreted as showing that the well occupies the line of a wadi whose weakly sorted deposits descend very deeply, implying that its capacity for greater underground water conductivity was appreciated anciently. Traverse no. 4 is the one which, after the excavation was completed, was found to have crossed the deeper part of the well shaft. But whereas the excavation was able to reach a maximum depth of only 9 m, and that over only a very small surface area, the traverse produced readings which suggest that the shaft descended for a considerably greater depth, to at least 12 m below the surface.

7.4 Survey area 2: the cultivation beside the Great Palace

The second area chosen for the investigation lay to the south of the village of El-Till between the edge of the ruin field west of the King's House and bridge over the Royal Road, extending through the cultivation to the east bank of the River Nile (Figures 7.5 and 7.6). The bridge leads into an extensive area first of brick walls and then of gypsum foundations for stone buildings that collectively are known as the Great Palace, excavated by Pendlebury between 1934 and 1936 (*COA* III: Chapter IV). As recorded by Pendlebury and as still visible today the natural ground level slopes away down towards the river more steeply than was convenient for the builders, who made up an artificial floor level by terracing (see *AR* III: 93–95), although the foundations of major walls rested on the natural surface. This is particularly apparent at the northern end of the Broad Hall, the part called *Weben-Aten*, where Pendlebury's photographs show wall foundations about 2 m below the level of the surrounding fields (*COA* III: Pl. XXXV.3 and .4, and p. 51). The main value of these observations is that they imply that whilst the modern cultivation might have encroached upon and therefore destroyed the raised floor level of the Great Palace, the original ground level should run well beneath the level of the modern fields, and might perhaps still preserve architectural remains of Akhenaten's time.

The land beside the Great Palace is intensively cultivated by private landowners in narrow strips running between the ruin field and the river bank at a marked angle to the latter. In order to avoid crop damage the survey lines were located along the routes of the narrow irrigation ditches which follow the alignments of the strips, and with prior agreement with the pump attendants we had no opening of ditches for irrigation when the cables and electrodes were in position. The method proved very satisfactory and as can be seen from the plan a considerable area was covered. In the diagrams which illustrate this part of the survey (Figures 7.7–7.10) each traverse is illustrated in two forms: the upper version includes the symbols to identify the depths of individual lines; in the lower these are omitted in order to increase the clarity of the overall effect.

Line 6–12 (overlapping traverses 6 through 12; Figure 7.7). This is the most northerly of the six lines and runs from the *Weben-Aten* as shown on Pendlebury's plan to the river bank. In detail we see that there is considerable ground disturbance down to the 6 m depth between the 515 m mark and the 550 m position, which suggests archaeological debris. At the 550 m distance there is a rise in resistivity of the underlying layers which could be interpretated as the old desert edge and start of the ancient flood plain; at 640 m we obtain a saturated reading of the lower layers.

Line 13–18 (overlapping traverses 13 through 18; Figure 7.7). The line was run at close proximity to line 6–12 to act as a check base for the ohm-meter readings. As can be seen, it is very similar to the previous line, only losing a portion of the disturbed ground as the start pin was some 30 m further west. There are no large variables and the water table appears at the 590–610 m position.

Line 19–28 (overlapping traverses 19 through 28; Figure 7.8). This line starts at the edge of the cultivation and for 130 m shows considerable disturbance when compared to the two previous lines, suggesting that the ruin field extends for a significant distance beneath the cultivation at this point. The similar rise in resistance of the lower layers appears to mark the old desert line, and the water table comes in at the 700 m position. Two auger holes at 560 m and 618 m would verify the extension of the ruin field.

Line 29–35 (overlapping traverses 29 through 35; Figure 7.8). Starting from the edge of the visible ruin field the resistivity observations confirm that this is more or less the actual limit, with the edge of the old desert at 540 m.

Line 36–45 (overlapping traverses 36 to 39, and 42 to 45; Figure 7.10). As a general check on the readings this line was run in the reverse direction from the others. The water table appears at the 80 m mark, with a high anomaly showing at 6 m depth at the 623 m position. This could be a large stone at 6 m, as there is no indication above or below of any unusual readings. At 660 m the line enters the ruin field with some quite high readings which were confirmed by a check line, 40–41.

Line 40–41 (traverses 40–41). A short line at right angles to the others along the edge of the ruin field and to check the high readings on line 36–45. The results are not illustrated.

Line 46–54 (overlapping traverses 46 through 54; Figure 7.9, in two parts). Starting at the edge of the cultivation there are signs of disturbance for 625 m until we reach the assumed edge of the old desert. However, the ohm-meter values have dropped compared to the northern lines showing a change in composition of the strata at the desert edge. The water table has moved much closer, showing at approximately the 600 m mark.

This has been a most interesting exercise in remote sensing and shows how useful the resistivity meter can be when given suitable strata conditions. The results are of almost textbook clarity, showing the rise of resistance with the passage through the finer more conductive soils at

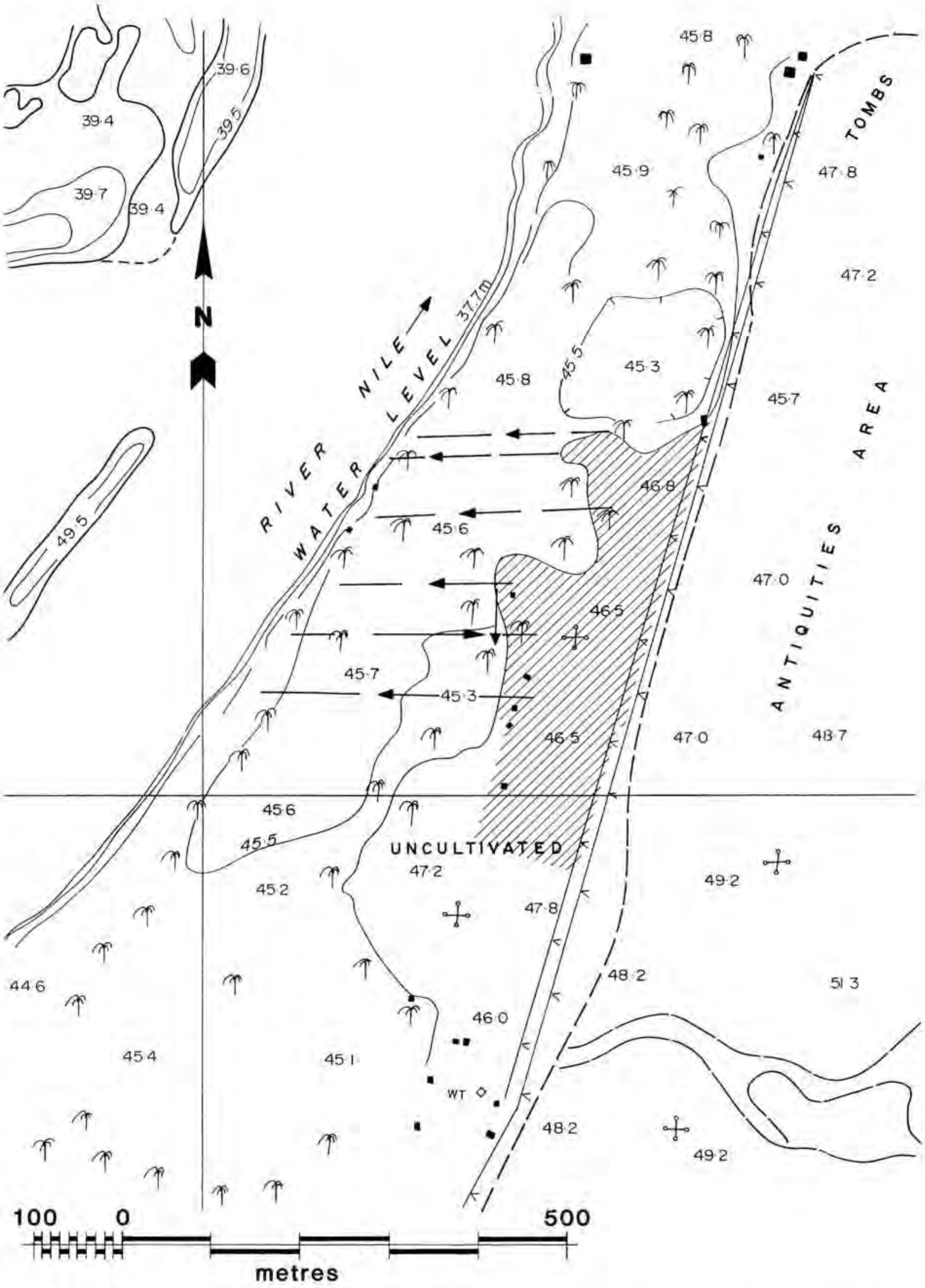


Figure 7.5. General map showing the location of the resisistivity profiles to the west of the Great Palace (which is shaded).

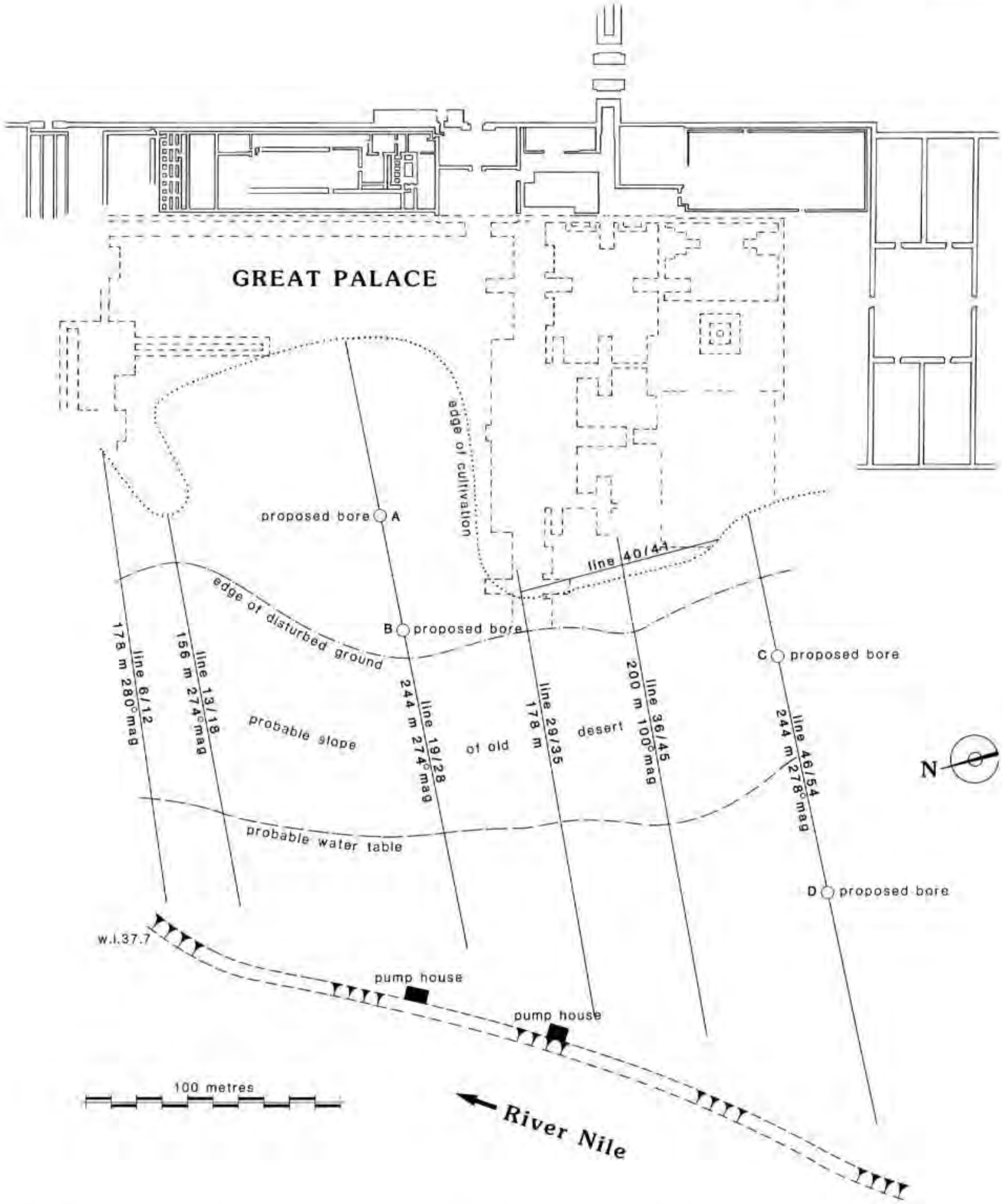


Figure 7.6. Locations of the resistivity profiles in the cultivation to the west of the Great Palace, with some notes on interpretations.

the surface to the consolidated debris, sands and rocks at deeper levels, then the reverse taking place as the water table makes the lower strata more conductive. It is difficult to realize that you are not looking at a topographic ground section, which would actually look like this as you approach the river, whereas the results shown are values of resistance to electric current.

If we study a particular graph, Line 46–54 at 510 m, the 2 m depth ohm-metre value is 105, and by 525 m this has dropped to 18 omv, a considerable change in the rather steady values of this area. From our empirical tests we know that this type of reading shows disturbed strata similar to a ruin field. If we continue to distance 600–620 at the same depth value, we find the ohm-metre value is greater than the reading at even 12 m depth. Unless there has been a drastic change in the structure of strata at 12 m depth the assumption must be that water has made the strata more conductive. A problem in this area could be that the surface soil has had most of the minerals leeched out by constant irrigation and has become more electrically resistant, but at this point there are several hundred meters of similar readings to base your assumptions on.

The general interpretive picture can be seem on Figure 7.6. It looks as if the town and palace area extends to the line marked "edge of disturbed ground". Between this line and the existing river there is a definite change in strata structure which could be interpreted as the old desert banking where the river used to run or where it used to flood.

If this work is to be extended I would suggest that auger bores be put down to a depth of 9–10 m at positions (A) and (B) to check the extension of the ruin field, and at (C) and (D) to check the resistivity changes in the strata and if possible prove the water table. A small trial sounding could be made at the crossing of lines 40–41 and 36–45 to investigate the high anomaly at that point.

Looking at the general direction of the assumed old desert edge it appears that the western end of buildings O42.2 and O42.1 must be close to where the river bank could have been, and also where the road between the Coronation Hall and building O43.1 joins at this point. It might therefore be productive to run a selection of lines across this area.

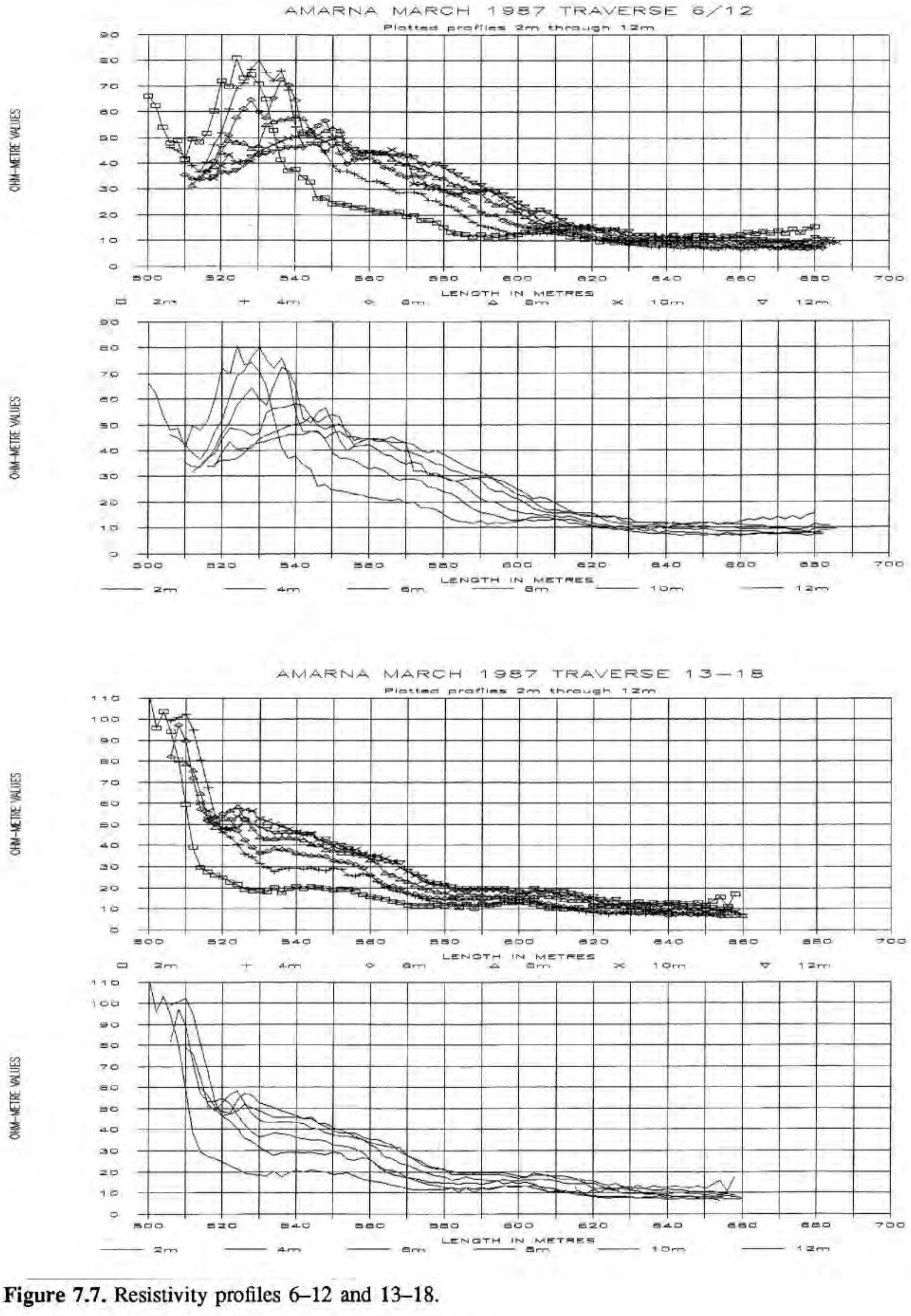


Figure 7.7. Resistivity profiles 6–12 and 13–18.

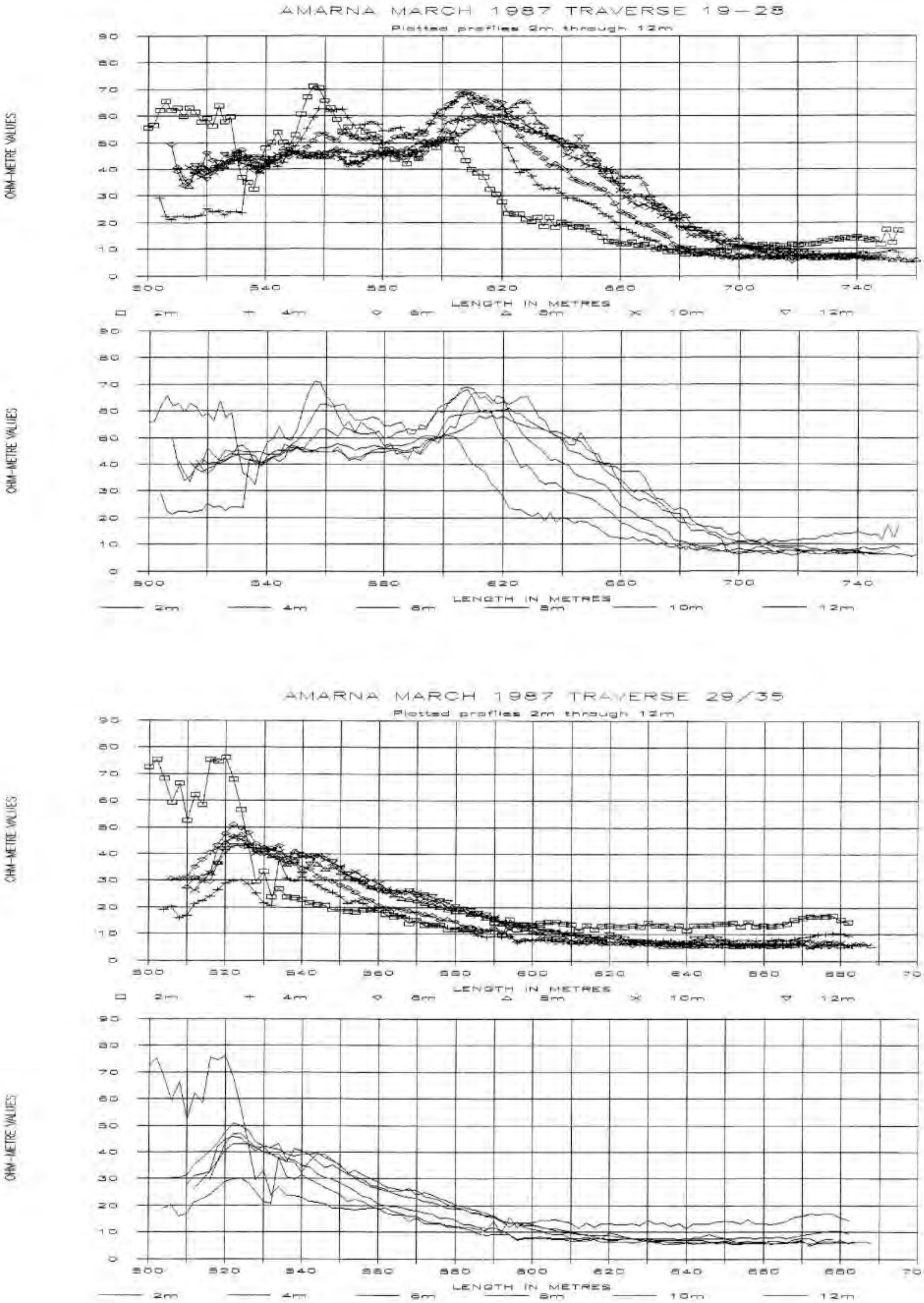


Figure 7.8. Resistivity profiles 19–28 and 29–35.

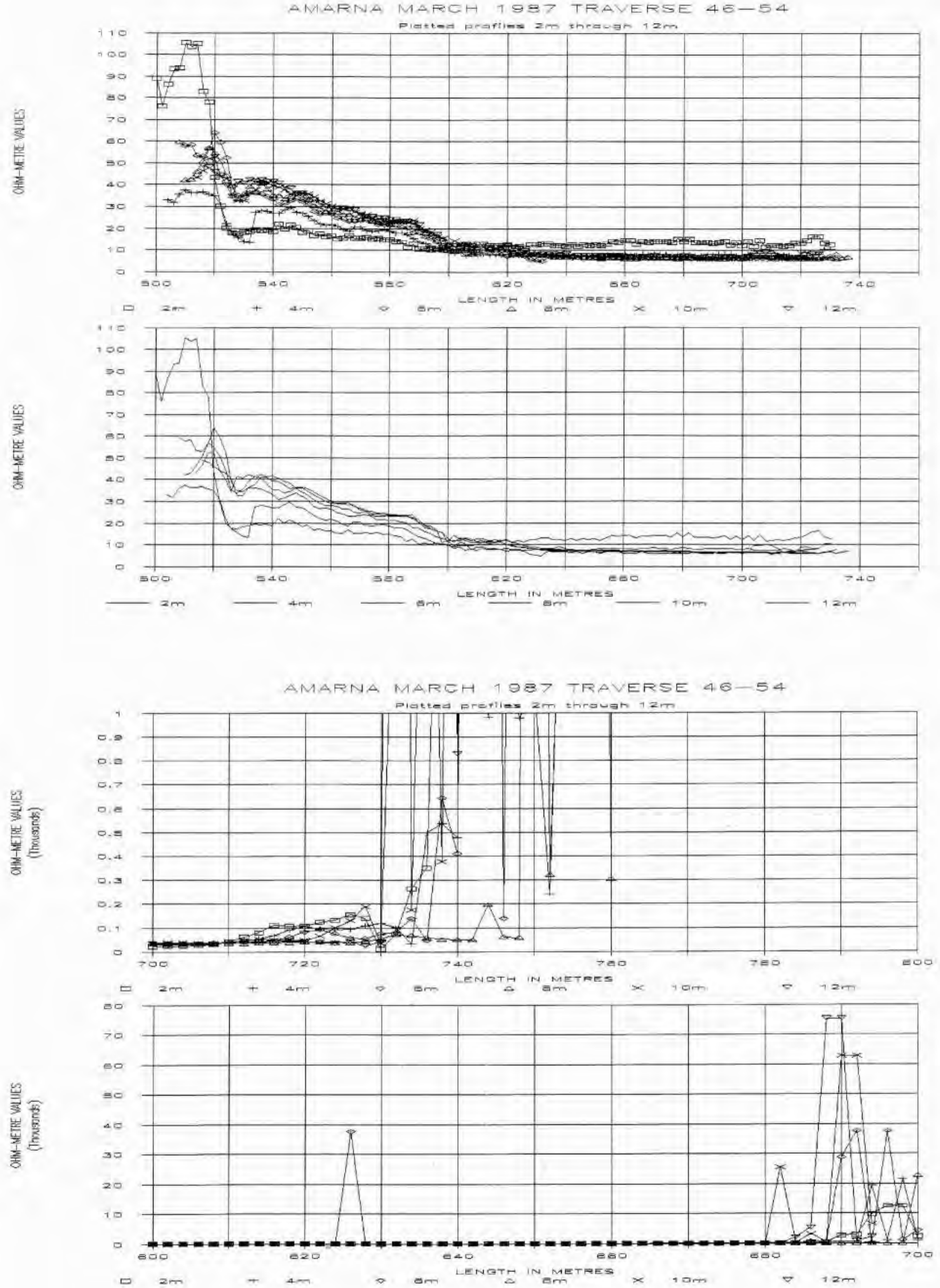


Figure 7.9. Resistivity profile 46–54, in two parts.

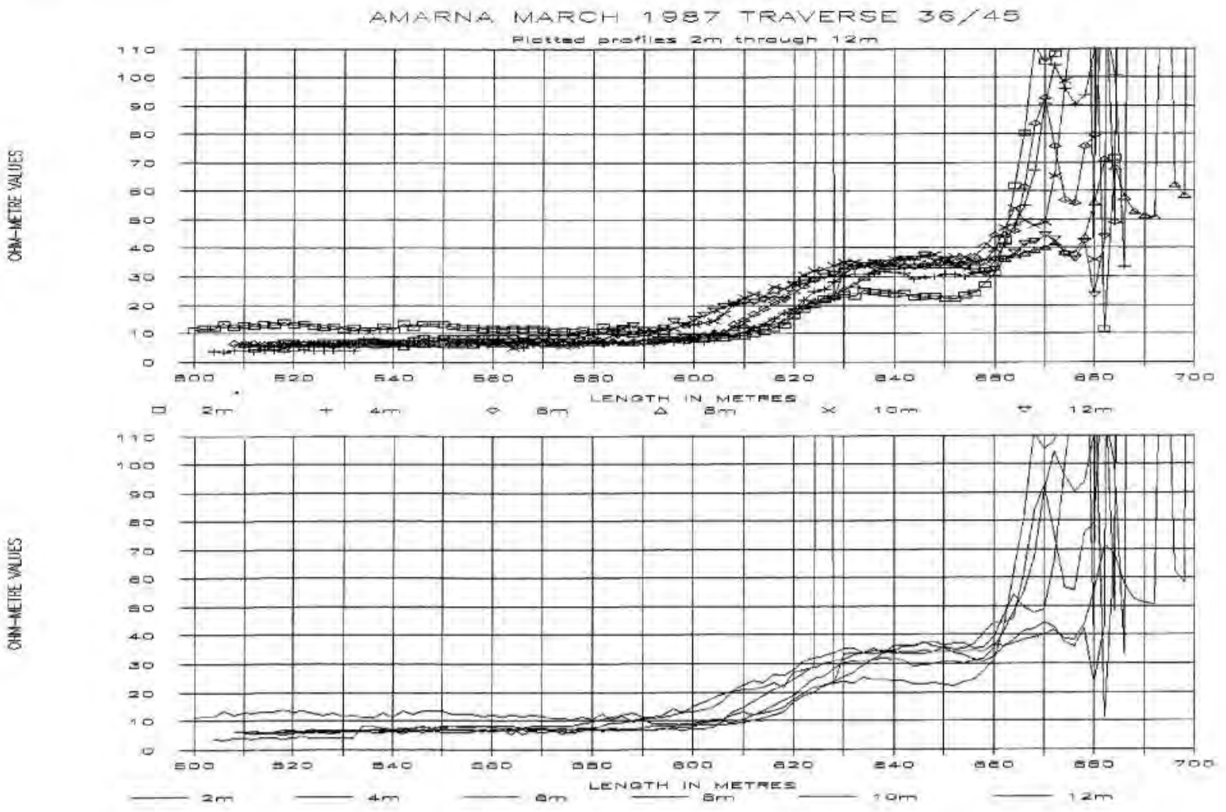


Figure 7.10. Resisitivity profile 36–45.

References for Chapters 1-7

Adams, W.Y. (1977). *Nubia: corridor to Africa.* London.

Amiran, R. and D. Shenhav (1984). "Experiments with an ancient potter's wheel." In P.M. Rice, ed., *Pots and Potters*: current approaches in ceramic archaeology. Monograph XXIV, Institute of Archaeology, UCLA: 107–112.

Arnold, D. (1976). "Wandbild und Scherbenbefund." *MDAIK* 32: 1–34.

Bakir, Abd el-Mohsen (1952). *Slavery in Pharaonic Egypt.* (Supplément aux Annales du Service des Antiquités de l'Egypte, Cahier n° 8). Cairo.

Borchardt, L. (1912). "Ausgrabungen in Tell el-Amarna 1911–12." *MDOG* 50, Oktober 1912.

Borchardt, L. (1932). "Ein Brot." *ZÄS* 68: 73–79.

Borchardt, L. and H. Ricke (1980). *Die Wohnhäuser in Tell el-Amarna.* (Wissenschaftliche Veröffentlichung der Deutschen Orient-Gesellschaft 91). Berlin.

Brissaud, P. (1982). *Les ateliers de potiers de la région de Louqsor.* Cairo.

Broneer, O. (1939). "A Mycenaean fountain on the Athenian Acropolis." *Hesperia* 8: 317–433.

Bruyère, B. (1939). *Rapport sur les fouilles de Deir el-Médineh (1934–1935).* Troisième partie. Cairo.

Bruyère, B. (1953). *Rapport sur les fouilles de Deir el-Médineh (années 1948 à 1951).* Cairo.

Davies, N. de G. (1929). "The town house in ancient Egypt." *Metropolitan Museum Studies* 1: 233–255.

Davies, N. de G. (1930). *The Tomb of Ḳen-Amūn at Thebes.* New York.

Davies, N. de G. (1933). *The tomb of Nefer-ḥotep at Thebes.* New York.

Drenkhahn, R. (1976). *Die Handwerker und ihre Tätigkeiten im Alten Ägypten.* (Ägyptologische Abhandlungen, 31). Wiesbaden.

Emery, W.B. (1963). "Preliminary report on the excavations at Buhen, 1962." *Kush* 11: 116–120.

Emery, W.B., H.S. Smith and A. Millard (1979). *The fortress of Buhen: the archaeological report.* London.

Eyre, C.J. (1987). "Work and the organisation of work in the New Kingdom." In M.A. Powell, ed., *Labor in the ancient Near East.* American Oriental Series, 68. New Haven: 167–221.

Faulkner, R.O. (1962). *A concise dictionary of Middle Egyptian.* Oxford.

Gardiner, A.H. (1947). *Ancient Egyptian onomastica.* 2 vols. London.

Griffith, F.Ll. (1924). "Excavations at El-ʿAmarnah, 1923–1924." *JEA* 10: 299–305.

Haeny, G. (1969). "Die Steinbruch- und Baumarken." In E. Edel, G. Haeny, W. Helck, W. Kaiser, P. Kaplony, H. Ricke and S. Schott, *Das Sonnenheiligtum des Königs Userkaf* II. Die Funde (Beiträge zur Ägyptischen Bauforschung und Altertumskunde, 8). Wiesbaden: 23–47.

Helck, W. (1961). *Urkunden der 18. Dynastie.* Übersetzung zu den Heften 17–22. Berlin.

Hoffman, M.A. (1982). "Excavations at locality 29." In M.A. Hoffman, ed. *The Predynastic of Hierakonpolis — an interim report.* (Egyptian Studies Association Publication, 1). Cairo: 7–14.

Hölscher, U. (1941). *The mortuary temple of Ramses III.* Part I. (The excavation of Medinet Habu, III). Chicago.

Hölscher, U. (1951). *The mortuary temple of Ramses III.* Part II. (The excavation of Medinet Habu, IV). Chicago.

Holthoer, R. (1977). *New Kingdom Pharaonic sites: the pottery.* (The Scandinavian Joint Expedition to Sudanese Nubia, 5:1). Stockholm.

Hope, C.A. (1981). "Two ancient Egyptian potter's wheels." *SSEA Journal* 11: 127–133.

Hope, C. (1982). "Concerning Egyptian potters' wheels." *SSEA Journal* 12: 13–14.

Hope, C. (1985). Review of Umm el-Qaʿab: pottery from the Nile Valley before the Arab Conquest. Catalogue. By Janine Bourriau (Cambridge 1981). *JEA* 71 (Reviews Supplement): 2–6.

Hope, C.A. (forthcoming). "Pottery kilns from Dakhleh Oasis." In J. Bourriau, ed., *Introduction to ancient Egyptian pottery.*

Hume, W.F. (1925). *The geology of Egypt.* Vol. I. Cairo.

Janssen, J. (1975). *Commodity prices from the Rammesid period.* Leiden .

Kelso, J.L. and J. Palin Thorley (1943). " The potter's technique at Tell Beit Mirsim, particularly in stratum A." In W.F. Albright, *The excavation of Tell Beit Mirsim* III. (AASOR XXI–XXII).

Kemp, B.J. (1978). "Preliminary report on the El-'Amarna survey, 1977." *JEA* 64: 22–34.

Kemp, B.J. (1979). "Preliminary report on the El-'Amarna survey, 1978." *JEA* 65: 5–12.

Kemp, B.J. (1981). "The character of the South Suburb at Tell el-'Amarna." *MDOG* 113: 81–97.

Kemp, B.J. (1981). "Preliminary report on the El-'Amarna expedition, 1980." *JEA* 67: 5–20.

Kemp, B.J. (1987). "The Amarna Workmen's Village in retrospect." *JEA* 73: 21–50.

Koenigsberger, O. (1936). *Die Konstruktion des ägyptischen Tür.* (Ägyptologische Forschungen, 2). Glückstadt and Hamburg.

Krauß, R. (1983). "Der Bildhauer Thutmose in Amarna." *Jahrbuch Preußischer Kulturbesitz* 20: 119–132.

Lacau, P. and H. Chevrier (1977). *Une chapelle d'Hatshepsout à Karnak*, I. Cairo.

Lesko, L.H. (1987). *A dictionary of Late Egyptian.* III. Providence.

Miller, R. (1980). "Water use in Syria and Palestine from the Neolithic to the Bronze Age." *World Archaeology* 11: 331–341.

Miller, R. (1988). [Tell es-Sa'idiyeh: preliminary report of renewed excavations.] "Appendix E. The water system." *Levant* 20: 84–88.

Newberry, P.E. (1893). *Beni Hasan* I. London.

Nicholson, P.T. and H.L. Patterson (1985). "Pottery making in Upper Egypt: an ethnoarchaeological study." *World Archaeology* 17 (2): 222–239.

Nicholson, P.T. and H.L. Patterson (1985). "Ethnoarchaeology in Egypt: the Ballas Pottery Project." *Archaeology* May/June, 1985: 52–59.

Oren, E.D. (1987). "The 'Ways of Horus' in North Sinai." In A.F. Rainey, ed., *Egypt, Israel, Sinai: archaeological and historical relationships in the Biblical Period.* Tel Aviv: 69–119.

Peacock, D.P.S. (1982). *Pottery in the Roman world.* Harlow.

Pendlebury, J.D.S. (1932). "Preliminary report of the excavations at Tell El-'Amarnah, 1931-2." *JEA* 18: 143–149.

Pendlebury, J.D.S. (1933). "Preliminary report of the excavations at Tell El-'Amarnah, 1932–1933." *JEA* 19: 113–118.

Petrie, W.M.F. (1894). *Tell El Amarna.* London.

Posener-Kriéger, P. (1986). "Les travaux de l'Institut français d'Archéologie orientale en 1985–1986." *BIFAO* 86: 367–397.

Pritchard, J.B. (1975). *Sarepta: a preliminary report on the Iron Age.* Philadelphia.

Redford, D.B. (1970). *A study of the Biblical Story of Joseph:* (Genesis 37–50). (Supplements to Vetus Testamentum, XX). Leiden.

SPSS Inc. (1986). *SPSS-X User's Guide* (2nd edition). New York: McGraw-Hill Book Co.

Sandman, M. (1938). *Texts from the time of Akhenaten.* (Bibliotheca Aegyptiaca VIII). Brussels.

Shinnie, P.L. (1951). "Preliminary report on the excavations at 'Amārah West, 1948–49 and 1949–50." *JEA* 37: 5–11.

Singer, C., E. Holmyard and A. Hall (1954). *A history of technology*, Vol. I. Oxford.

Soukiassian, G., P. Ballet, L. Pantalacci and M. Wuttmann (1984–1985). "Balat: rapport préliminaire des fouilles à 'Ayn-Asil, 1983 et 1984." *ASAE* 70: 151–161.

Stadelmann, R. (1983). "Die Pyramiden des Snofru in Dahschur. Zweiter Bericht über die Ausgrabungen an der nördlichen Steinpyramide." *MDAIK* 39: 225–241.

Steinmann, F. (1980). "Untersuchungen zu den in der handwerklich-künstlerischen Produktion beschäftigten Personen und Berufsgruppen des Neuen Reichs." *ZÄS* 107: 137–157.

Steinmann, F. (1982). "Untersuchungen zu den in der handwerklich-künstlerischen Produktion beschäftigten Personen und Berufsgruppen des Neuen Reichs. III. Bemerkungen zu den an Titel und Berufsbezeichnungen angeknüpften Angaben über Dienstverhältnisse etc." *ZÄS* 109: 149–156.

Steinmann, F. (1984). "Untersuchungen zu den in der handwerklich-künstlerischen Produktion beschäftigten Personen und Berufsgruppen des Neuen Reichs. IV. Bemerkungen zur Arbeitsorganisation." *ZÄS* 111: 30–40.

Tufnell, O. (1958). *Lachish* IV. The Bronze Age. London.

Ventura, R. (1987). "On the location of the administrative outpost of the community of workmen in western Thebes." *JEA* 73: 149–160.

Vercoutter, J. (1970). *Mirgissa* I. Paris.

Wishart, D. (1987). *CLUSTAN User Manual*. Edinburgh: Edinburgh University Program Library Unit.