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Summaries of Five Seasons of Research at Harappa (District Sahiwal, Punjab, Pakistan), 1986-1990

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A summary of five seasons of archaeological investigations at Harappa is presented in the form of excerpts taken from preliminary reports provided after each season to the Department of Archaeology and Museums, Government of Pakistan. Presented in this way, these reports give the reader some idea of how the work at Harappa progressed from year to year, with each season's work building on the results of the previous.

This chapter is a summary of the objectives and accomplishments of each season's work at Harappa (Figure 13.1). Excerpts have been taken from the preliminary reports submitted after the close of each season to the Department of Archaeology and Museums, Government of Pakistan. These will convey to the reader the character of the project as it developed over the five years from 1986 to 1990. Interpretive statements presented in the reports of individual seasons are of a preliminary nature and relevant to the particular season. More synthetic discussions can be found in the papers in this volume, while final evaluation must await completion of data analysis and stratigraphic correlations. Personnel for each season are generally not noted in the following text except in the case of specialists. Instead they are listed in Chapter 12 of this volume. Likewise, funding sources are acknowledged in Chapter 1.

First Season: January—Mid-April, 1986

Project Objectives

Our knowledge of the urban aspects of the Indus Civilization is conditioned primarily by the discoveries made in the 1920s and 1930s at Mohenjo-daro and, to a lesser extent, at Harappa. Both sites were excavated extensively and lengthy reports were published. The emphasis in those early days was on architecture and artifacts—the physical remains of the civilization that could be seen, touched, and displayed in museums. Without those initial discoveries and publications, this earliest urban civilization of South Asia would not be known to us today. But the objectives and standards of present-day archaeological research demand a different set of data recovered

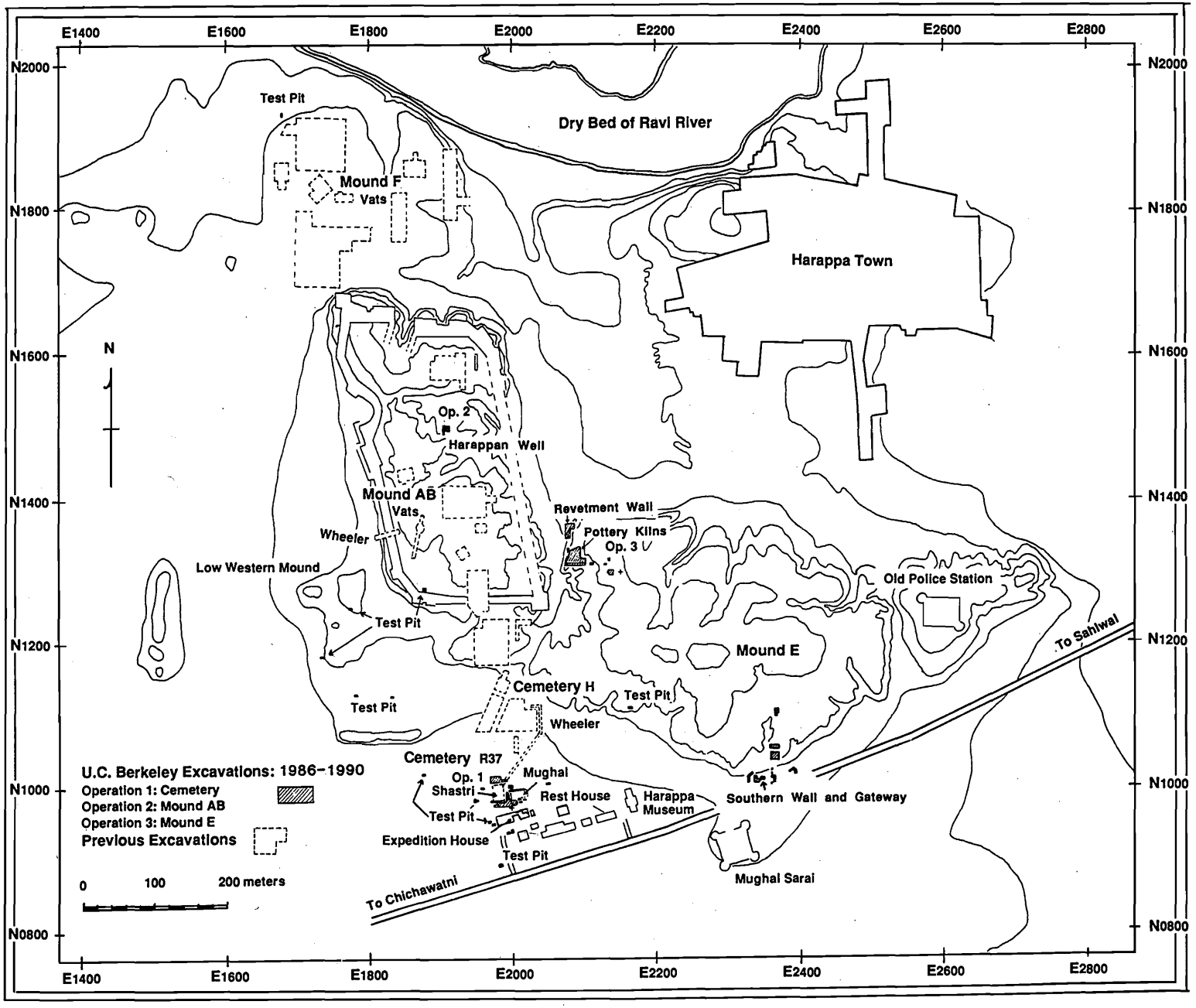


Figure 13.1: Harappa 1990 site plan showing extent of excavations.

through the use of modern techniques in order that quantitative and interpretative analyses can be made. The collection and analyses of floral, faunal, palaeo-ecological, settlement pattern, and other data are essential. The return to earlier excavated sites such as Harappa is important not only because they are so rich in basic data but because the stereotyped conceptions of the sites and of the civilization they represent are in need of drastic reevaluation based on modern research strategies and techniques.

Objectives for the First Season

A. *Excavation and Survey*
   1. Mapping and grid system
   2. Survey
   3. Exploratory trenches

B. *Conservation and Site/Museum Development*
   1. Establishment of conservation procedures.
   2. Construction of expedition house and field laboratory.

C. *Training program for Pakistani graduate students*

Description of Work Accomplished

A. *Excavation and Survey*

1. Mapping and grid system

In spite of our best efforts, none of the original bench marks used for the site plan published by M.S. Vats (1940) could be located. It was necessary, therefore, to utilize the Survey of Pakistan benchmark located at the bridge on the Lower Bari Doab canal (between Harappa and Harappa Station) and to traverse back to the site in order to install new permanent concrete benchmarks. These benchmarks were established in a new site grid that was laid out with metric measurements and oriented to sidereal rather than magnetic north (Figure 13.2).

2. Surface survey

Surface surveys of the entire site and the surrounding plain identified numerous surface features, pottery, and other artifacts that might indicate areas of specialized activities. Of primary concern were those areas of the site that were only briefly described by earlier excavators. These include the low western mounds and the adjacent flood plain, the southeastern mound that is covered with heavy growth (Mound E), and the northeastern mound that is covered by the present-day Harappa city. In addition to these unexcavated areas, eroded sections of previous excavations were examined as were all the dumps from previous excavations to give us an idea of the types of artifacts that might have been overlooked by earlier excavators. These preliminary surveys were conducted in units which correspond to major erosional patterns of the site. At plain level where no erosional features were evident, the survey unit was a 50 square meter grid. When concentrations of artifacts were detected, their coordinates within the grid unit were recorded and their locations plotted on the new site plan.

On Mound AB, all recognizable dumps from previous excavations were examined along with selected portions of the uppermost excavated surfaces. Because of the complicated erosion of the citadel edges—partly natural and partly exaggerated by the massive robbing of bricks in the 19th century—more detailed surveys must await the installation of grid markers for smaller units at one to five meter intervals.

A general survey of the cultivated and inhabited areas to the west and south of the site was made to determine the extent of debris scatter. The fields and habitations north of the site and beyond the dried bed of the river Ravi were examined to see if there were any remnants of ancient habitation in that direction. Many hamlets and two larger village mounds were examined, but only modern debris was noted. The same situation holds true for the modern town of Harappa where recent construction and debris build-up appears to have largely obliterated any original Harappan or Late Harappan occupational deposits. Modern drains, for example, dug to a depth of one meter reveal only modern debris. But the town is built on an obvious mound and further investigations are required. [*Harappan remains were noted in the excavation of a foundation for a house on the northwest side of Harappa city in 1989.*] Areas to the east of the town have yet to be surveyed.

Several important features of the site have been revealed by the surface surveys. The low mound to the west of Mound AB (called the "Low Western Mound"– Figure 13.1) is made up of Harappan phase debris—mostly pottery—with no evidence of structures at the surface level. Localized concentrations of chert debris, agate flakes, sandstone/quartzite flakes, and vitrified pottery and nodules suggest that the mound may have been an industrial part of the city. Two small test pits (numbers 11 and 12) on the mounds revealed only Harappan phase dump deposits with no indications of working floors or structures (see below for details).

On the plain just to the south of this low mound, two small test pits (numbers 9 and 10) revealed the presence of a Harappan brick structure occurring in between major debris layers. Several other long low mounds that are covered with Harappan phase sherds and artifacts are located even farther west of Mound

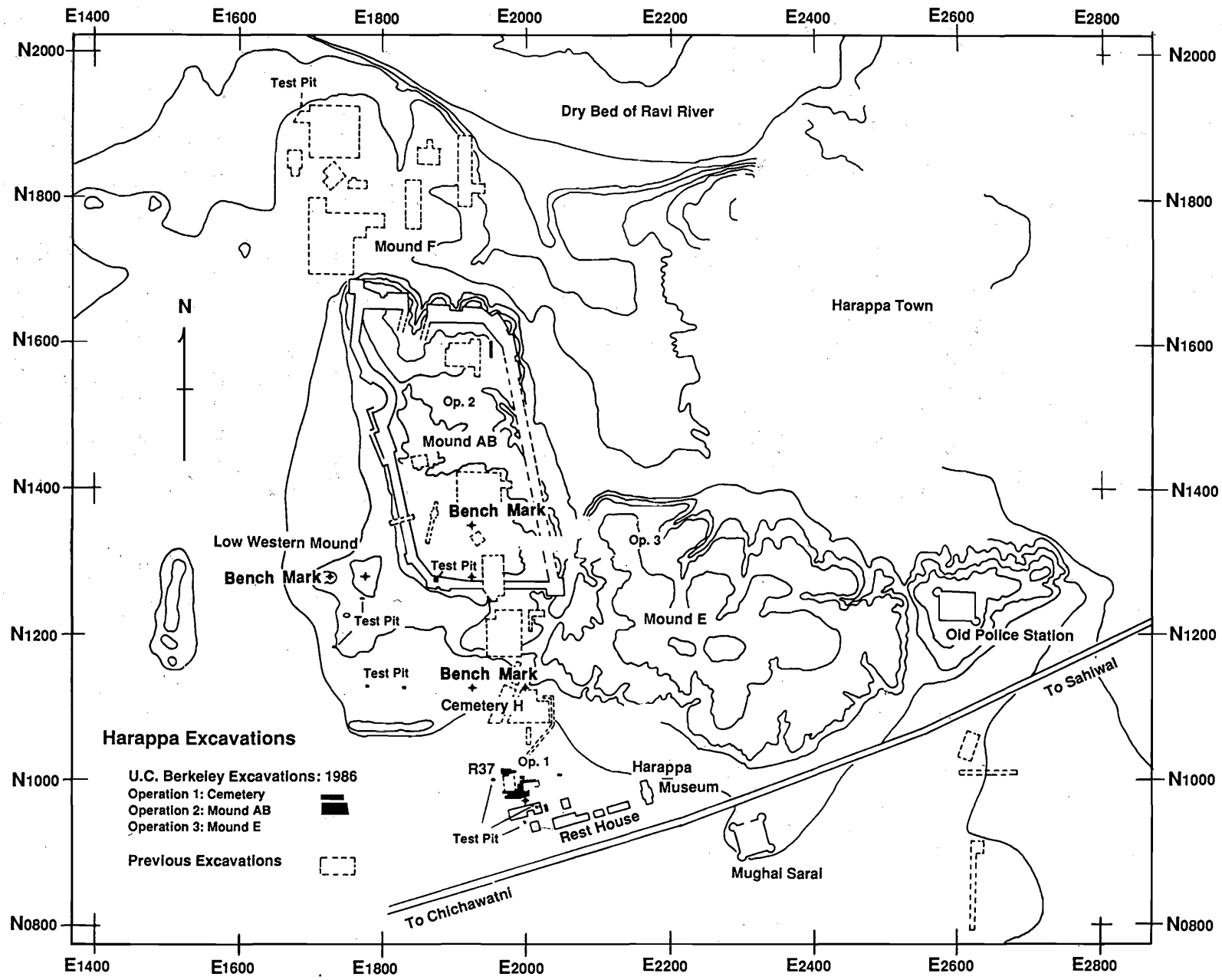


Figure 13.2: Harappa 1986 site plan showing location of test pits and benchmarks.

AB. Their east-west or north-south orientations at the edges of modern fields suggest that they may be the result of repeated scrapings or gradings of the adjacent fields to remove potsherds, nodules, and saline soil. Future excavations will be required to test this hypothesis.

The surface survey of Mound E turned up many interesting features. Along the southern slope of the mound are indications of *in situ* Harappan structures marked by brick walls, mud-brick platforms, sump pits, and habitation deposits. Evidence for production of agate beads, stone tools, ceramics, shell ornaments, and perhaps copper implements was located at the extreme eastern end of Mound E (Old Police Station mound). Important features identified at the northwestern corner of Mound E include an ancient kiln, *in situ* fired brick drains, and habitational debris. Fragments of Late Harappan (Cemetery H) pottery were found on the top of the mound in this area. Although the northern slope of Mound E has been affected by modern activities, occupational debris was noted in sections in the gullies, and numerous Harappan artifacts such as stone tools, beads, and terra-cotta objects were collected. The top of Mound E is covered by trees and vegetation and thick aeolian sediments. Square and rectangular shaped surface features are found scattered across the entire length of the mound, and they are oriented in many different directions. Some of these structures resemble mud-brick walls, but there is no distinctive pottery to determine if they are ancient or modern. They will be examined in more detail next season.

Along the entire western edge of the Mound AB are enormous dumps left by the 1946 excavations of Mortimer Wheeler (Wheeler 1947). "Early Harappan" sherds similar to those discovered by Wheeler beneath his so-called "defense wall" were recovered all along the tops of these dumps. This is an important discovery because it provides additional evidence that there was a substantial Early phase settlement at the site. An additional area of interest on Mound AB lies at the southeastern corner of Vats's principal excavations. Here there were found numerous pieces of sawn steatite and also vitreous slag from what might be faience production. The deposits visible in the section cut by the present walkway do not appear to be in primary context, and they may well be the result of workshop debris having been dumped as fill between or inside other structures during the ancient occupation of the area.

3. Exploratory Trenches

During this first season, 14 exploratory trenches were excavated (Figure 13.2). Nine of these trenches (numbers 1-8 and 13) focused on determining the extent of the Harappan phase cemetery (R37) in preparation for large-scale excavations planned for the second season. The evidence from these explorations indicates that little if any of the cemetery is preserved south of where the original R37 excavations were conducted.

Test Pit 1 (G.F. Dales, supervisor): A 1 × 2 m pit was excavated to a depth of 2.5 m (160.0 m AMSL). Five strata were recorded consisting of alluvial soil covered by Harappan pottery debris characteristic of the thick debris layer reported by Wheeler (1947) and Mughal (1968) to cover Cemetery R37. No structures or burials were encountered.

Test Pit 2 (Thomas Gensheimer, supervisor): A 1 × 2 m pit was excavated to a depth of 1.5 m (161.35 m AMSL). Five strata were recorded. In stratum 4, a disturbed and fragmentary Harappan burial was encountered consisting of a few complete pottery vessels, a few fragmentary human bones, and a fragment of a human skull.

Test Pit 3 (John Berg, supervisor): A 1 × 2 m pit was excavated to a depth of 2.0 m (161.13 m AMSL). The five strata were similar to those in pits 1 and 2. In the lowest level, hard packed clay may represent the remains of a disturbed burial lining, but no actual burial was found.

Test Pit 4 (G.F. Dales, supervisor): In a 1 × 2 m pit were encountered, 0.7 m below the surface, a Harappan pottery ring stand and a medium-sized globular pot that probably was originally placed in the stand. About a meter to the southwest, at a similar depth, was found a group of 17 Harappan pottery vessels. These 19 pieces may all have come from the same grave, but no bones or other burial evidence were found.

Test Pit 5 (G.F. Dales, supervisor): After clearing brush and other surface debris, a 1 × 2 m pit was dug along the southern edge of the depression left from Shastri's Cemetery R37 excavations in the early 1940s. The soil was all dark brown down to a depth of about 2 m (161.1 m AMSL) where a surface of calcium carbonate accretions was encountered. This being probably an original natural surface, excavation was stopped. Only one pottery item—a complete Harappan vertical handled cup—was found in this pit.

In clearing the surface just to the east of Pit 5, between it and the western edge of Mughal's 1966 cemetery excavations, well preserved mud-brick walls were found. They were probably the linings of Cemetery R37 burials excavated by Shastri.

Test Pit 6 (G.F. Dales, supervisor): To investigate the possible extension of Cemetery R37 to the west of Shastri's excavations, a test pit was dug at the bottom of the western side of Shastri's dump. This 2 × 2 m pit was located between the dump and the cultivated field

to the west. The upper levels consisted only of debris from the dump and silty deposits from a modern irrigation ditch at the base of the dump. Lower deposits appeared to be secondary in nature and contained very little pottery, a few fragmentary bones, and one animal figurine. No traces of intact cemetery materials were found. Excavations stopped at a depth of about 1.5 m below the surface (c. 161.68 AMSL).

Test Pit 7 (Thomas Gensheimer and G.F. Dales, supervisors): At a depth of about 1 m, this 1 × 2 m test pit turned up a few very fragmentary bones and a large group of Harappan pottery. More than 40 pottery vessels were found in what was probably an intact burial, but the closeness to the surface in this heavily watered garden area resulted in the deterioration of the burial itself and seriously altered the surfaces of much of the pottery. Excavation stopped at a depth of about 1.4 m when clean, presumably natural, sediment was encountered.

Test Pit 8 (G.F. Dales, supervisor): To test for the possible extension of the Harappan cemetery to the east of earlier excavated areas, a 1 × 2 m test pit was dug just to the east of the cement walk at the eastern edge of the known cemetery. The excavations was taken to a depth of 2.8 m (160.53 m AMSL), where natural sediment was reached. Most of the deposit in the pit consisted of a thick and dense deposit of Harappan pottery—broken and incomplete vessels and sherds, some fragmentary bones, charcoal, and occasional artifacts. The largest percentage of the pottery consisted of "pointed base" or "Indus" goblets. This debris deposit is identical to those described by Wheeler (1947) and Mughal (1968) in their reports on Cemetery R37 excavations.

Test Pit 13 (J.M. Kenoyer, supervisor): This 2 × 2.5 m pit was excavated to a depth of about 2 m (160.0 m AMSL) and yielded relatively clean layers of alluvial deposit with a few Harappan potsherds. No evidence of cemetery material was found.

Four trenches were excavated in the plain to the west of Mound AB: two in the plain itself and two into the low mounds mentioned above. Thick deposits of Harappan debris, fragmentary remains of Harappan walls, possible hearths, and dump areas were recorded.

Test Pit 9 (Thomas Gensheimer, supervisor): The plain to the southwest of Mound AB is covered with Harappan sherds and with what appear to be the remains of industrial activities. Test Pits 9 and 10 were dug to investigate the nature of two of the areas that looked most promising from the surface survey. Pit 9, 1 × 2 m in area, was dug to a depth of 2.5 m (161.5 m AMSL). Fourteen strata consisted mostly of different types of Harappan debris. Stratum 6 contained remains of what may have been a hearth or manufacturing workshop. Stratum 7 also had ash and may represent an earlier workshop or hearth. The lowest stratum was of clean sand and may represent the original ground surface.

Test Pit 10 (Thomas Gensheimer, supervisor): Located about 50 m west of Test Pit 9, this 1 × 2 m pit was excavated to a depth of 2.1 m (161.96 m AMSL). Eleven strata with Harappan materials were recorded. Strata 2-5 consisted of debris associated with the corner of a baked brick wall. The function of this structure was not determined. The lowest stratum appeared to be natural sediment.

Test Pit 11 (J.M. Kenoyer, supervisor): This pit and Test Pit 12 were excavated on the Low Western Mound (see above). This 1 × 2 m pit was dug to a depth of 2.8 m (161.8 m AMSL). Eight strata were recorded, the upper seven consisting of Harappan debris with no structural remains. The lowest stratum was of clean sediment and may represent the original land surface.

Test Pit 12 (J.M. Kenoyer, supervisor): This 1 × 2 m pit was excavated to a depth of about 3 m (164 m AMSL) on the highest point of the Low Western Mound. No structures were encountered. Three recorded strata consisted of massive deposits of Harappan debris comprising mostly sherds.

Test Pit 14 (G.F. Dales, supervisor): The largest test pit, starting with an area of 3 × 4 m that ended up as 1.5 × 1.7 m at a depth of 6.7 m (161.54 m AMSL), was sunk in the bottom of a deep erosion gully within the southwestern corner of Mound AB. The purpose of this excavation, located to the south of Wheeler's "great trench," was to examine the area for the presence of the Early Harappan settlement suggested by the discovery by Wheeler of Early Harappan pottery along the western edge of the mound. Making use of the erosion gully considerably reduced the amount of overburden that had to be removed. Also, the pit is located farther inside Mound AB than was reached by Wheeler's trench. We hoped that this location would offer a better opportunity for exposing an Early Harappan occupation level than farther toward the perimeter where only sherds had been found.

With the exception of a single stratum of intact Harappan occupational remains in the uppermost level, the remaining strata consisted of fill, debris, and wash, much of it sloping down from east to west. These debris layers were extremely rich in animal bones and botanical remains. Two distinctive Early Harappan sherds were found in the lowest stratum just above natural soil. This lowest stratum was sloping from east to west and appeared to be water-deposited wash. Thus, even though the trench was dug about 1.5 m deeper than Wheeler had gone, no

evidence for a substantial Early Harappan settlement was found. The steep slope of much of the debris suggests that it was deposited over the edge of a higher area, perhaps the massive wall published by Wheeler (1947) or an earlier stage of the same wall not yet defined.

Conclusions: The 9 test pits in and near the Harappan cemetery (R37) confirmed the presence of disturbed and water-destroyed burials in the area south of Mughal and Shastri's excavations. Pottery groups were encountered, but only fragmentary human skeletal remains were found in some of the test trenches. The constant water logging from gardening activities has had a destructive effect on much of the pottery, with surfaces deteriorated almost to a red powder. The two pits to the east of the earlier cemetery excavations confirmed the findings by Wheeler (1947) and Mughal (1968) of an enormously thick stratum of Harappan debris covering the cemetery.

The four test pits in the plain to the west of Mound AB revealed thick deposits of Harappan debris and manufacturing waste. With the exception of the brick wall in Test Pit 10, no traces of architecture were found.

The largest test pit (No. 14), sunk within the southwestern corner of Mound AB, provided further evidence that there is an Early Harappan occupation beneath the Harappan phase remains. A major effort will be made in future seasons to find and expose the actual occupation levels.

A total of 176 artifacts, comprising pottery, beads, figurines, inscribed objects, bangles, etc., was recorded, catalogued, and turned over to the Custodian of the Harappa Museum. Some 176 lots of excavated sherds were also recorded. Diagnostic and unusual examples were drawn, described in detail, and photographed. The best preserved of the remaining sherds were bagged for future study.

B. *Conservation and Site/Museum Development*

1. Establishment of conservation and preservation procedures

A temporary conservation laboratory was set up in one of the rooms of the old museum building by Donna Strahan of the Smithsonian's Conservation Analytic Laboratory. During this first season Ms. Strahan advised and assisted in acquiring the basic equipment and supplies and in designing a laboratory to be included in the newly built expedition house. One important task was to establish procedures for desalinating excavated artifacts. An electric water distillation unit was purchased and tests were made on a variety of artifact types to determine the best procedures for their cleaning and preservation.

2. Construction of Expedition House and Field Laboratory

A major achievement of this season was the construction of an expedition complex on museum property just south of Cemetery R37 (Figure 13.3). This complex includes sleeping quarters for up to 15 persons, an eating area, and laboratory facilities. The 23 × 30 foot laboratory is equipped with independent systems for running water and electricity and has adequate space for the treatment of the anticipated volume of excavated materials (Figure 13.4).

C. *Training Program for Pakistani Graduate Students*

Although full-scale excavations were not undertaken, a program of field training for a small group of Pakistani graduate students was begun. Dr. Javed Husain of Karachi University brought four of his students to Harappa for a three week field session. They assisted in surveying and mapping; helped in classifying, describing and drawing pottery and objects; received basic instruction in conservation techniques; and participated in methodological and theoretical discussions relating to the interpretation of archaeological data.

Second Season: January-April, 1987

Objectives for the Second Season

A. *Excavations and Analyses of Scientific Samples*
   1. Harappan Cemetery (R37)
   2. Mound AB
   3. Mound E

B. *Palaeoenvironmental Studies*
   1. Palaeozoological and Palaeobotanical Studies
   2. Pedological and Palaeoclimatic Studies

C. *Conservation and Site/Museum Development*

D. *Training Program*
   1. Pakistani Graduate Students
   2. Conservators

Description of Work Accomplished

A. *Excavations and Analyses of Scientific Samples*

1. Harappan Cemetery (R37)

The main focus during the second season was the further delimitation and excavation of the Harappan cemetery that had been excavated in part by Shastri in 1939 (unpublished), Wheeler in 1946 (1947), and Mughal in 1966 (1968) (Figure 13.5). Eleven additional test pits were excavated (Figure 13.6) and of these,

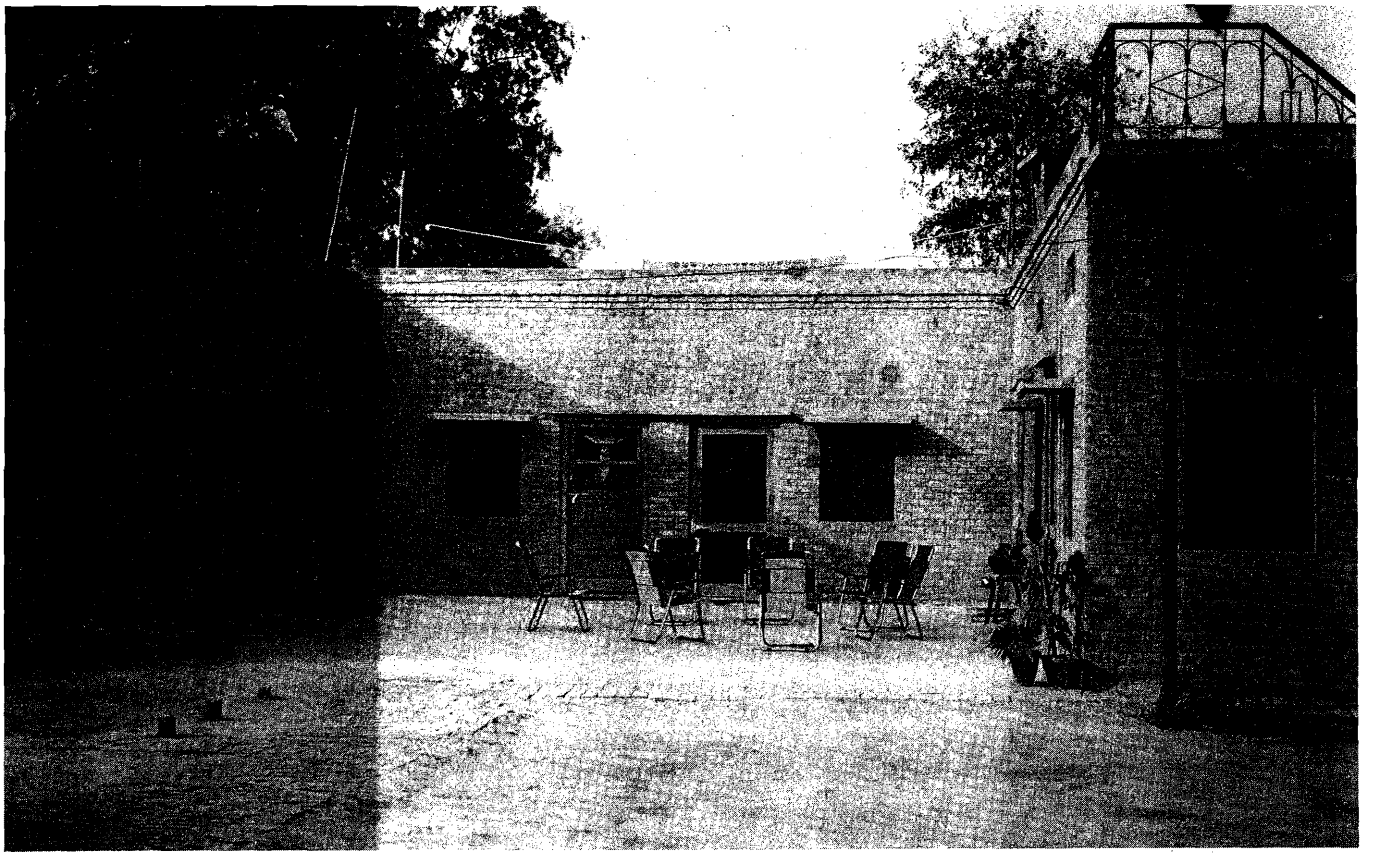


Figure 13.3: Harappa expedition house, constructed in 1986.

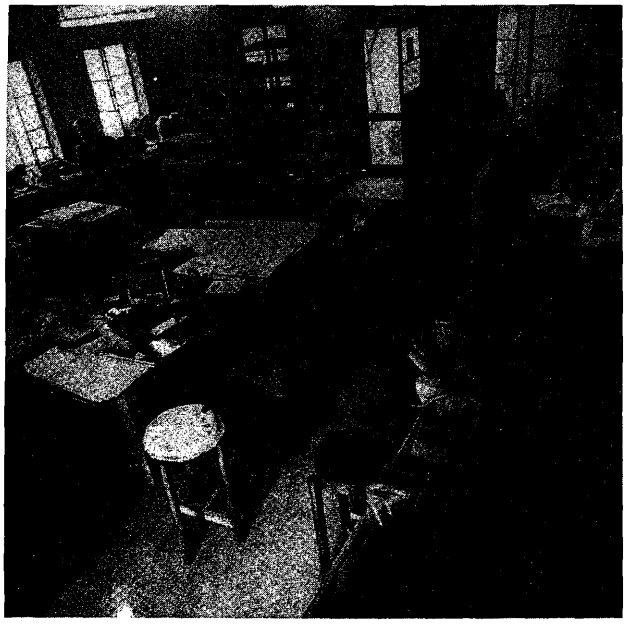


Figure 13.4: Conservation and research laboratory in Harappa expedition house.

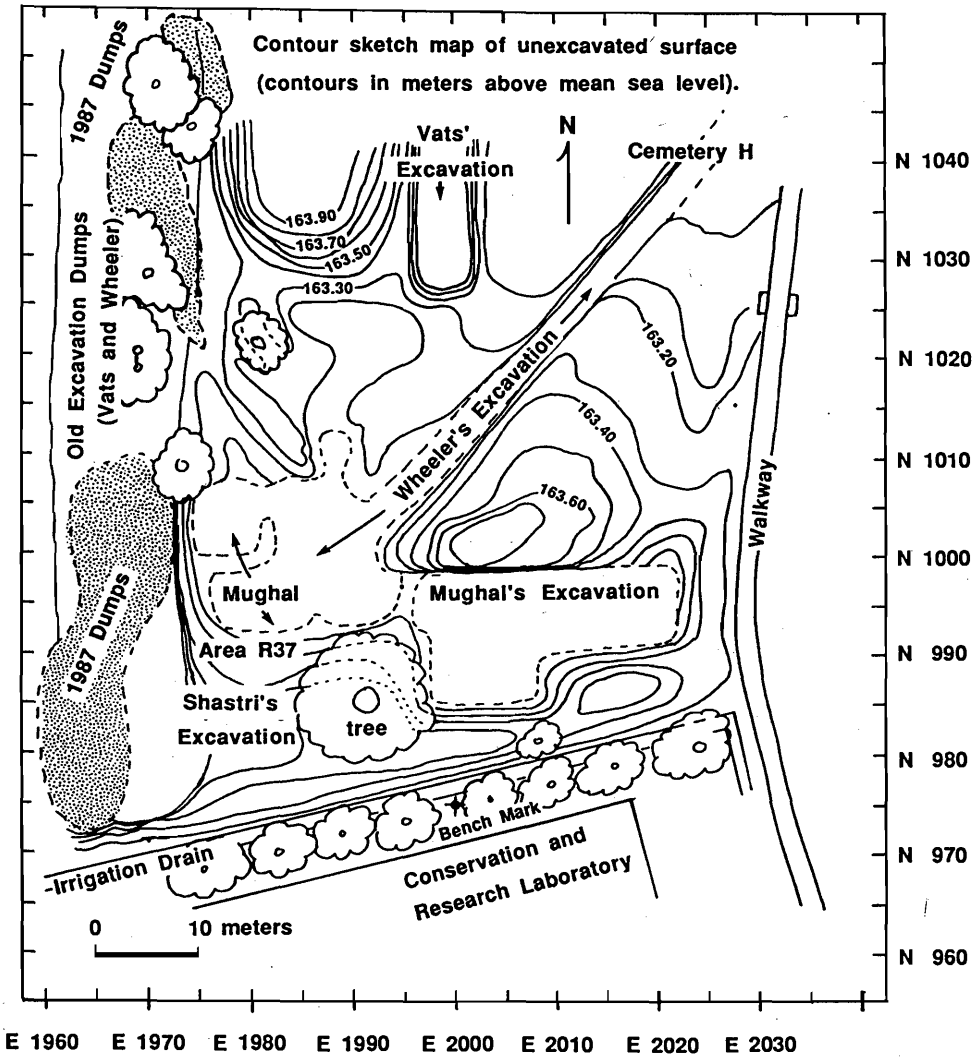


Figure 13.5: Harappa 1987 cemetery excavations: contour sketch map of unexcavated surface and temporary dump areas.

eight turned up primary context or eroded burials. These burials were then more fully exposed, and by the end of the season, 371 square meters within the cemetery area had been opened up, with some locations excavated to natural sediment and others to varying depths depending on the presence or absence of burials.

Although the cemetery excavations were carried out under the supervision of J. Mark Kenoyer and various graduate students, a team of four physical anthropologists was closely involved in the delicate excavation of the actual skeletons and their subsequent removal to the laboratory for further analysis. Each anthropologist had a different speciality: K.A.R. Kennedy, morphometrics; John R. Lukacs, dental anthropology; Nancy Lovell, palaeopathology and palaeodietary reconstruction; and Brian Hemphill, discrete traits analysis. The detailed report of the skeletal remains will be presented by the physical anthropologists when they have completed their analyses; however, tentative identifications of the primary context burials indicate that 8 were female and 3 were male.

In terms of excavation procedures, all of the sediment from the test pits and burial areas was screened and all artifacts, including tiny potsherds and bead fragments, were collected for further analyses. The vast amount of sediment from the thick debris layers was carefully examined by hand. All cultural materials, including pottery, minute fragments of beads, figurines, chipped stone, and fragments of human and animal bone were collected for tabulation and further analysis. The procedure for systematically recording and coding stratigraphic layers, archaeological features, and artifacts will be presented in the final report.

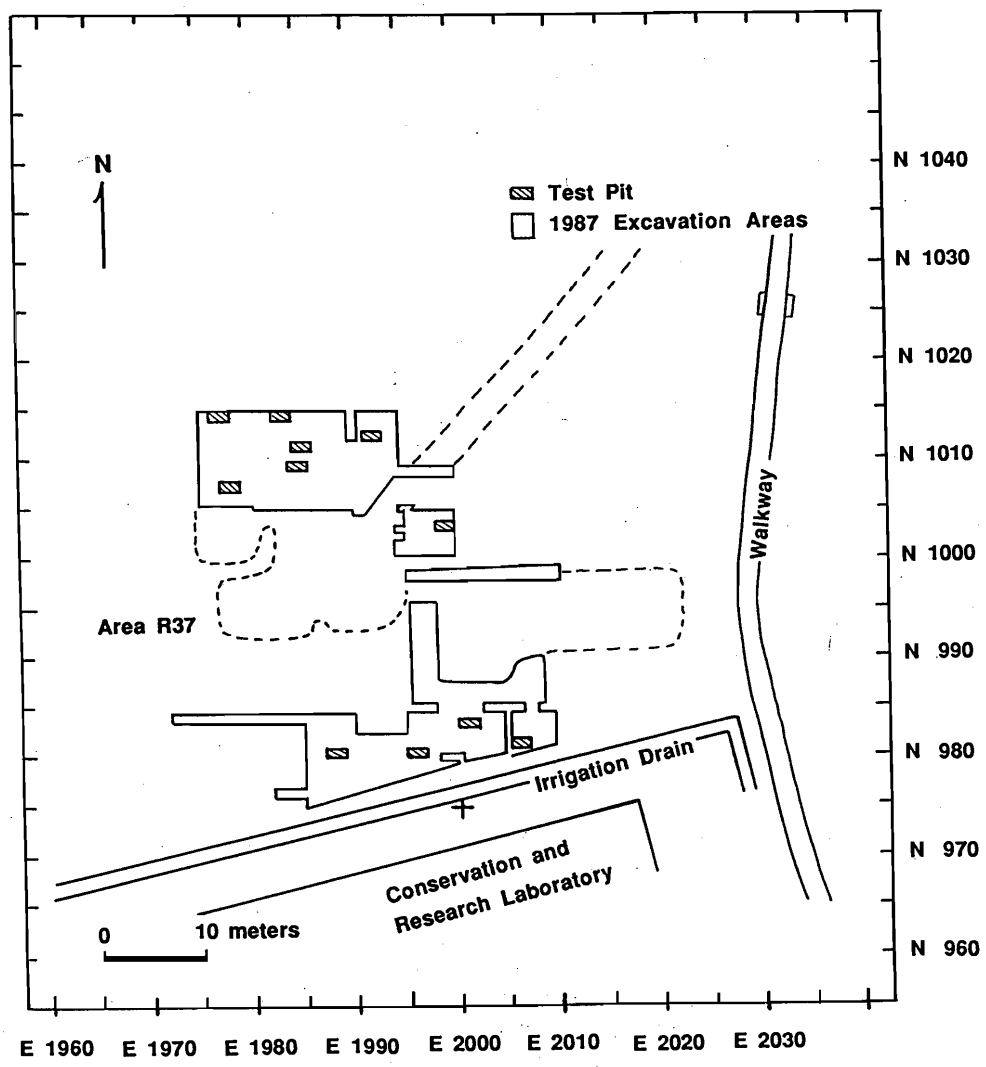


Figure 13.6: Harappa 1987 cemetery excavations: location of test pits and total excavated area.

Although the results of these excavations are not conclusive, they suggest that the main concentration of *in situ* burials is along an east-west axis just north of the modern irrigation ditch (Figures 13.7 and 13.8). To the south of the ditch are disturbed and eroded burials, to the east are eroded sediments with a thick overburden of debris, while in the west are similar eroded sediments and a thick debris deposit. The northern limit of the primary context burials needs to be better defined, after which it will be possible to estimate the size and total extent of the cemetery area. At this point it appears that this cemetery represents only a small segment of the population of the ancient city, and there may be more extensive cemetery areas in other parts of the site.

The primary context burials were all located in the area where the original land surface is still preserved at the level of the modern surface. All of the primary context burials are in distinct rectangular pits, but there are also collections of human bone that appear to have been removed from burials and dumped on the slope or in shallow depressions.

Most of the burials had been disturbed by the intensive use of this area by the Harappans themselves (Figure 13.9). They dug into previous burials to make room for later burials, disturbing or entirely removing the earlier skeletons and burial pottery (Figure 13.10). From the preliminary observations of the burials, it appears that there are several modes of burial represented with a wide variety of burial goods. All but one of the Harappan burials are extended and supine, with the head to the north and the feet to the south.

Three of the burials had traces of coffins which were indicated by dark staining in the sediment (Figure 13.11), but no microstructural traces could be identified. One coffin burial had what appears to have been a lid, and it was possible to collect samples of this for later identification.

The range of burial goods includes quantities of pottery vessels arranged at the head and foot of the grave shaft. In some burials the pottery was placed in the grave first and then partially covered with sediment. The body was then placed level with the top of the pottery, after which the grave was completely filled. The subsequent weight of the sediment often crushed the coffin and underlying pottery, resulting in a disturbed burial. Other burials had the pottery arranged at the same level as the body. Some of the later burials that cut into and disturbed the earlier burials were supplied with only a few vessels or no burial pottery at all.

Almost 40 percent of the 553 artifacts registered this season are complete or restorable pottery vessels recovered from the burials and the overlying debris. The preservation of the surfaces of the vessels varies considerably. Many vessels have reddish slips and/or black painted decoration in good condition whereas other vessels, sometimes from the same burials, have only fragile traces of surface color. The explanation for this seemingly differential preservation of vessel surfaces is under study. In one of the earliest burials, a large painted vessel had its design intentionally obscured by an outer coating or coatings of a clay-like material; this may have been applied by the Harappans to protect the elaborately decorated surface. [*See Figure 5.2 in Chapter 5 of this volume. Additional vessels with similar surface treatments were found in this burial in the following season.*] This is the first recorded example of such a practice at Harappa. At Mohenjo-daro, however, there is a sherd of a vessel that was first decorated with black, red, green, and yellow designs and subsequently covered with a thick white plaster-like coating (Dales and Kenoyer 1986: figure 88:8b and plate 17E). Such secondary surface treatment is a practice that may have been relatively common but has gone unrecognized until now.

Preliminary analysis of the ceramics suggests that the painted pottery is generally limited to the lowest and hence earliest burials, while in the later burials most of the pottery is unslipped and unpainted. There are, however, some exceptions to these patterns. [*See Dales, Chapter 5 of this volume.*]

Significant new aspects of Harappan ornamentation are seen in these burials, including shell bangles, a copper ring, steatite disc beads, carnelian and lapis lazuli beads, black stone amulets, and a unique ornament made of three shell rings, a jasper bead, and hundreds of steatite microbeads.

Four burials of what are probably adult females were found with shell bangles on their left arms (Figure 13.12). The bangles were arranged on both the lower and upper arm, with the characteristic Harappan chevron motif pointing counter clockwise. One burial had 14 shell bangles, another had seven, another had five, while the final had only two. Once we have relative dates on these burials, these bangles may provide an important clue to stylistic variation over time.

A distinctive form of black stone amulet has been discovered in three of the burials, all of which are probably females. One amulet was actually found *in situ* at the 3rd to 4th cervical vertebrae, suggesting that it was worn at the throat or possibly placed in the mouth at the time of burial. Two of the burials had carnelian beads—one on the right hand near the pelvis and one on the left pelvis, and one burial had a carnelian and a lapis bead under the edge of the left pelvis. In one burial a copper/bronze ring was found on the middle finger of the left hand. An anklet of approximately 300 steatite disc beads was found in

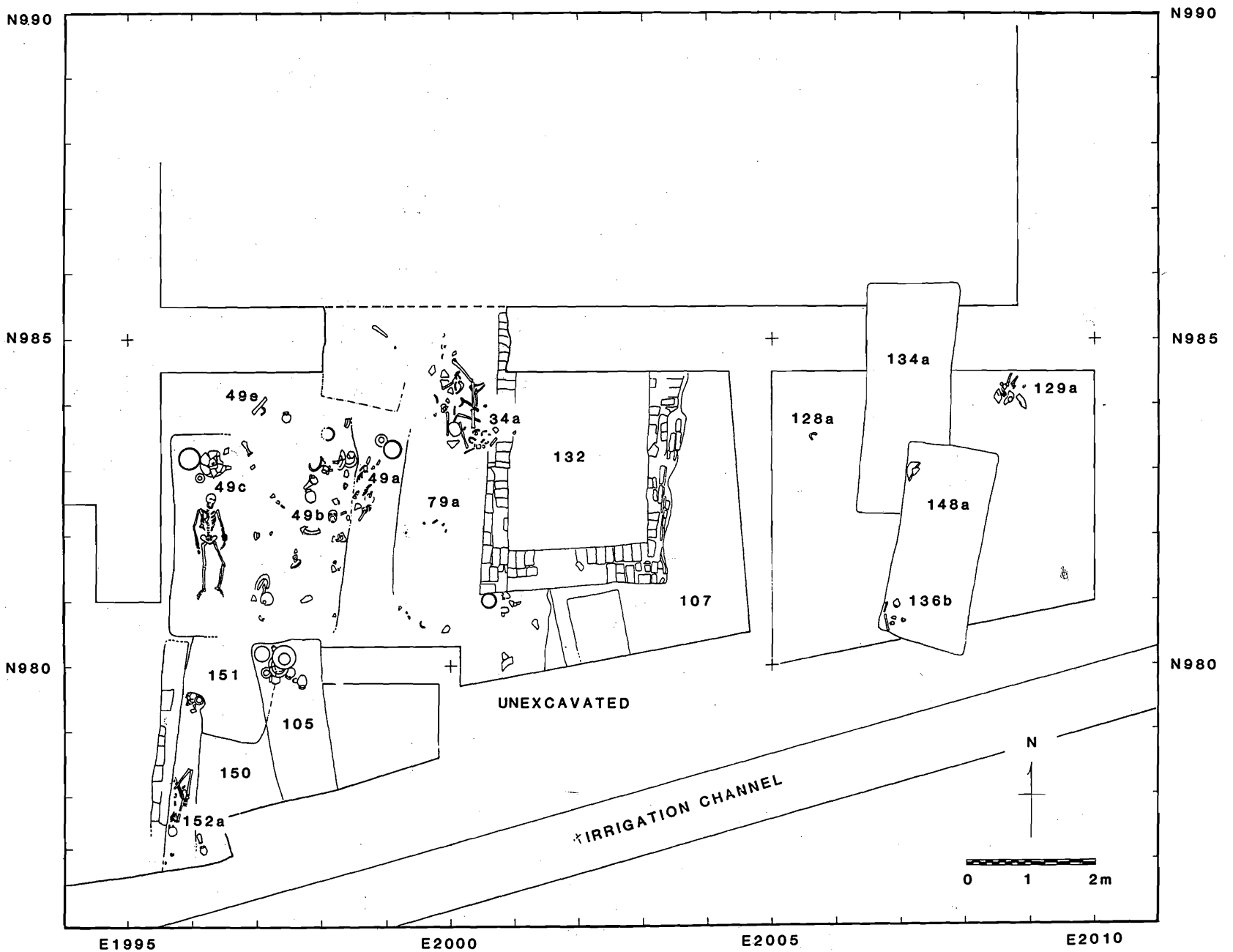


Figure 13.7: Harappa 1987 cemetery excavations: plan of upper levels with feature numbers.

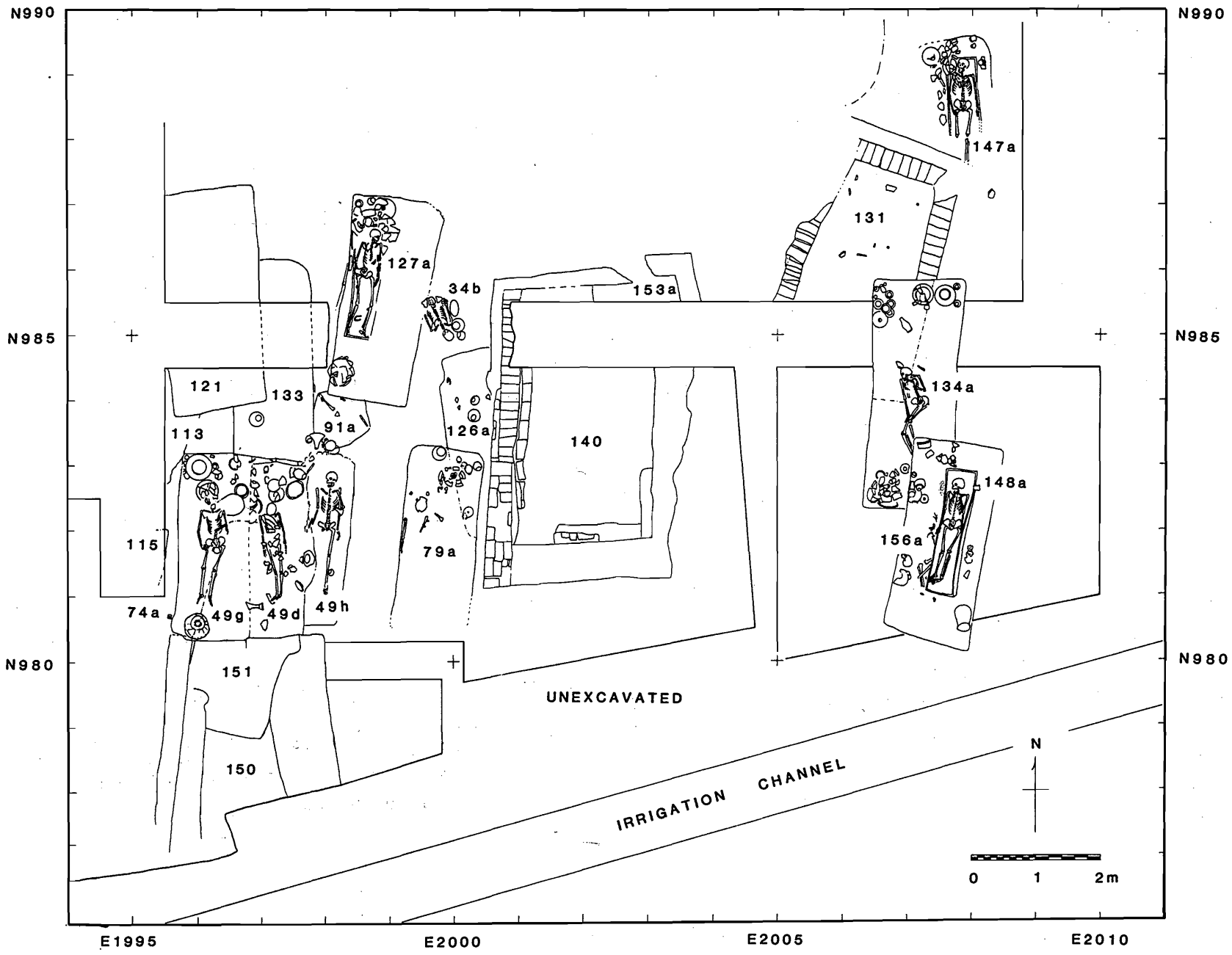


Figure 13.8: Harappa 1987 cemetery excavations: plan of lower levels with feature numbers.

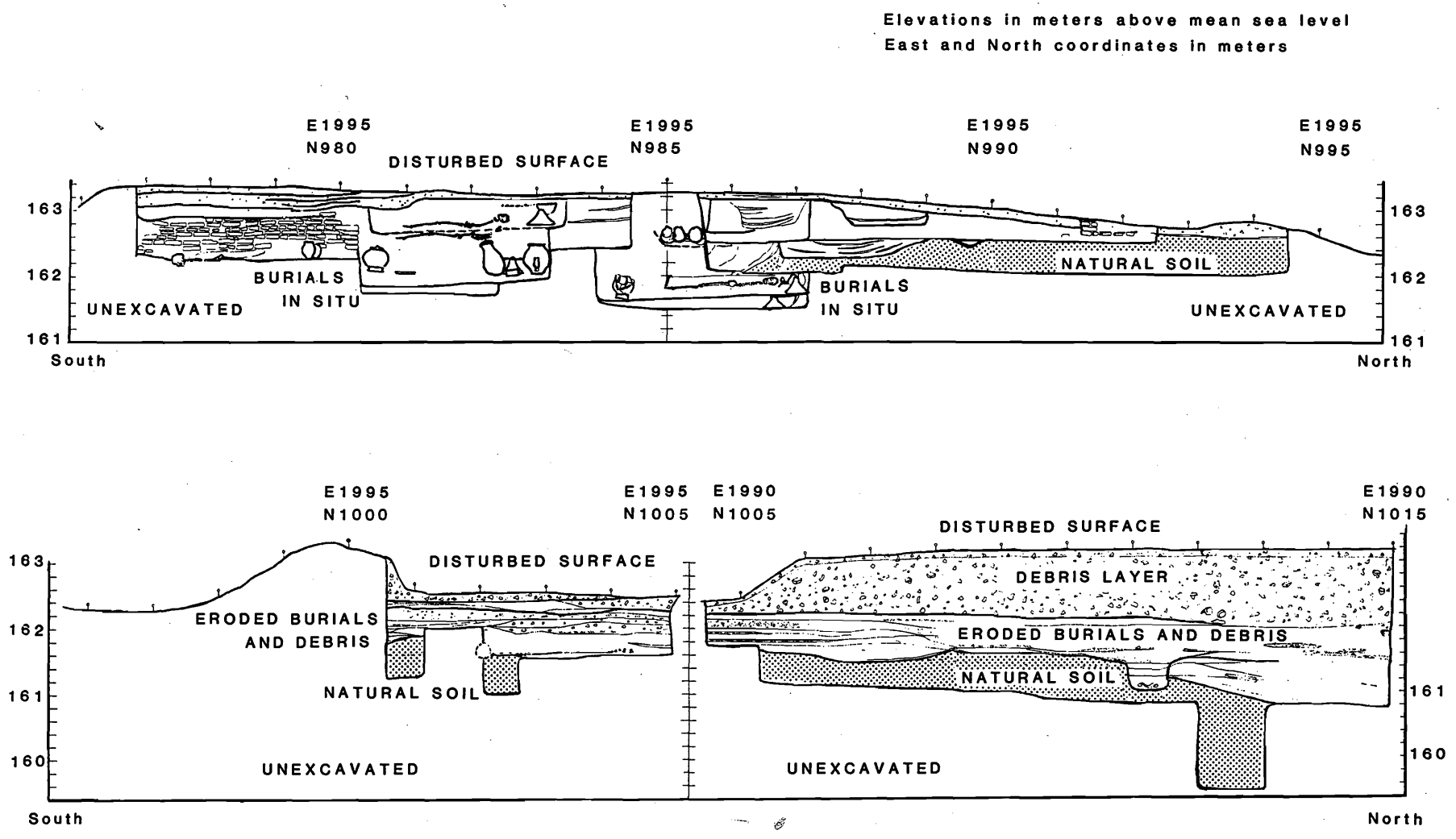


Figure 13.9: Harappa 1987 cemetery excavations: north-south sections.

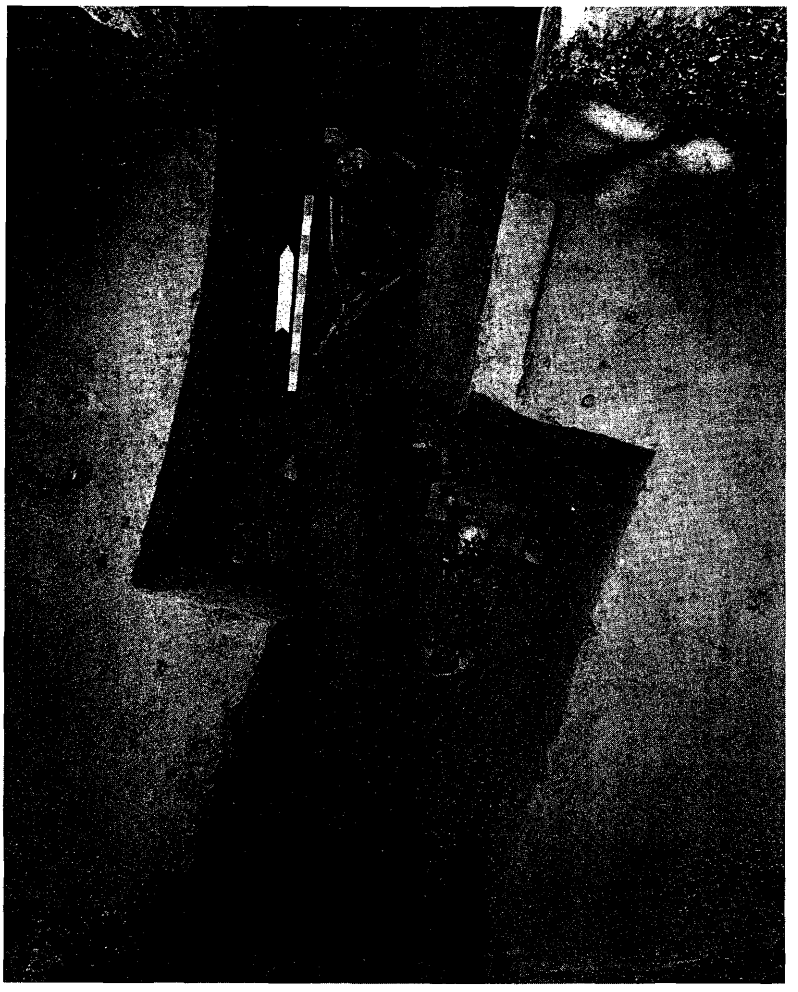


Figure 13.10: Harappa 1987 cemetery excavations: Burials 134a and 148a (see Figure 13.8).

one burial, while the most dramatic ornament consisted of three shell rings, a jasper bead and a collection of hundreds of tiny microbeads that were located to the right of the skull. This was found on what was probably an adult male (Lot 136, Feature #[147a]—Figure 13.11) who was buried in a coffin with over a dozen vessels arranged at the head of the pit and additional vessels along the side of the pit. On the left wrist was a shell bangle and near the right hand a carnelian bead.

2. Mound AB

The expedition began excavations in one of the large erosion gullies at the northeastern corner of Mound AB (the citadel mound) ("Op.2" in Figure 13.1). The objective was to obtain a sequence of occupational and structural remains going down to natural soil with the hope also that intact remains of the Early Harappan settlement would be located. A 10 meter square area straddling the central part of the gully was marked out for the excavation. Relatively well preserved remains of fired brick floors and drains as well as mud-brick walls with fired brick foundations were found just below the erosional debris of the gully. These structures on both sides of the gully appear to be related to broad floorings—or platforms?—of mud-brick that covered the entire center of the gully. Excavations will be continued in this area next season.

A considerable quantity of Late Harappan, Cemetery H, pottery was found in the uppermost levels on both sides of the Mound AB gully. Mud-brick structures seen in section have different sized bricks than the standard Harappan structures, and it is likely that they may be architectural remains related to the otherwise unknown Cemetery H period (Late Harappan phase) occupation of the site.

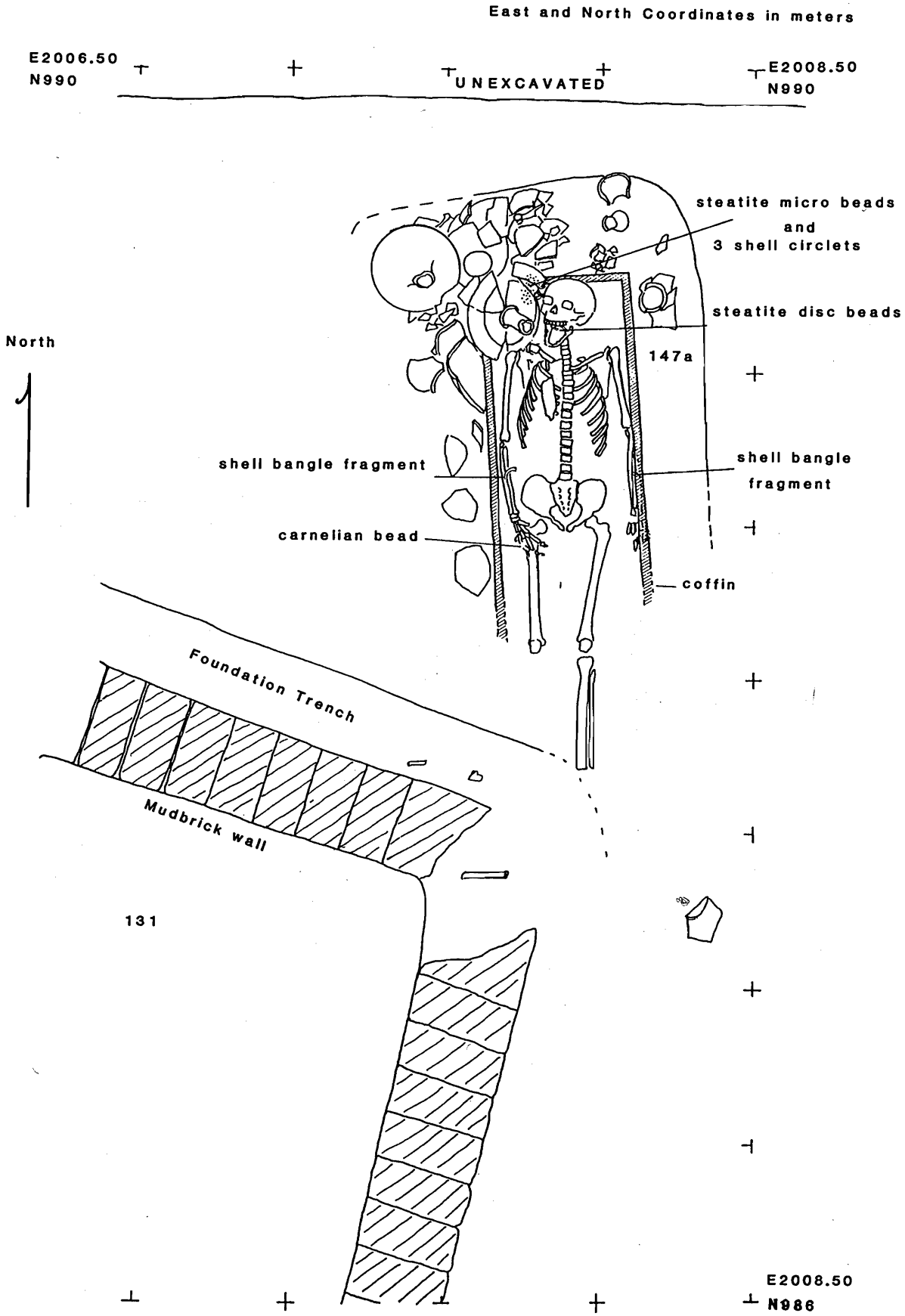


Figure 13.11: Harappa 1987 cemetery excavations: Burial 147a (see also Figure 13.8).

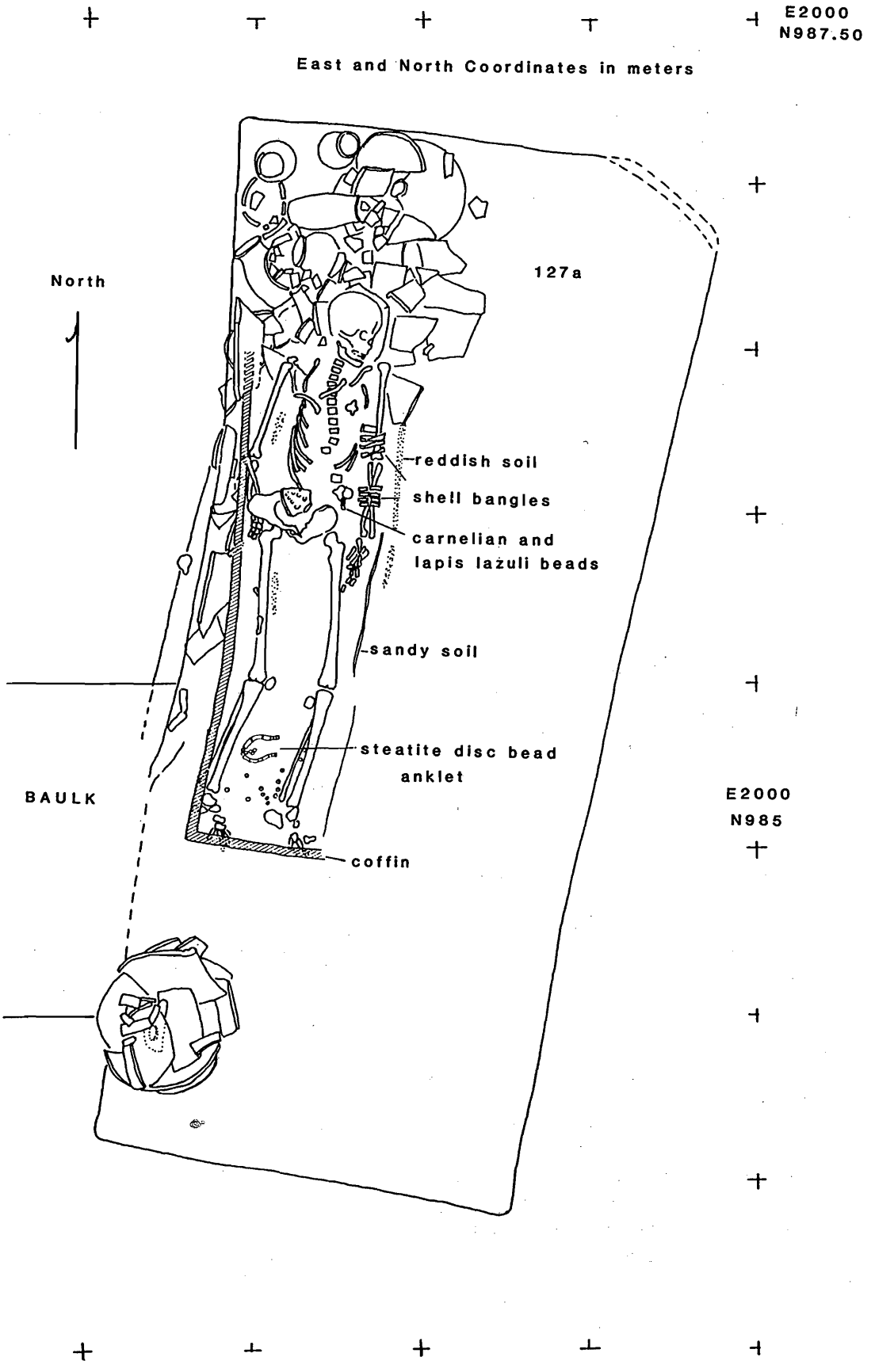


Figure 13.12: Harappa 1987 cemetery excavations: Burial 127a (see also Figure 13.8).

3. Mound E

Preliminary excavations were conducted at the top of Mound E on the northwestern corner ("Op.3" in Figure 13.1). The first objective was to examine the square and rectangular shaped structures noted during the initial surface surveys in 1986. Test excavations revealed that at least one group of these structures were the result of shallow rectangular excavations, where the dirt and brickbats from the pits were piled along the edges, giving the impression of walls. The pits themselves had been filled with aeolian sediments from which fragments of glass, a cowrie shell (*Cypraea monetas*), and 12 Islamic period coins were recovered. Directly beneath these pits were the remains of mud-brick and baked brick walls associated with Harappan pottery and artifacts.

B. *Palaeoenvironmental Studies*

1. Palaeozoological and Palaeobotanical Studies

Richard Meadow initiated palaeoenvironmental studies by beginning the identification and analysis of animal remains excavated during the 1986 and 1987 seasons. All the bones excavated in 1986 from Test Pit 14 (southwestern corner of Mound AB) were recorded. The remains of cattle and sheep dominate, with very few goats represented. Of particular interest is the fact that bones of wild mammals including gazelle, deer, blackbuck, nilgai, and wild boar make up almost one quarter of this assemblage. Cattle were relatively small animals, but the sheep were very large, this perhaps indicating the development of a special breed of large animals. [*See Chapter 7 in this volume.*]

Palaeobotanical studies will begin next season. Preliminary work this year involved collecting sediment samples for possible pollen analysis and recording impressions of grains and grasses found in clay materials.

2. Pedological and Palaeoclimatic Studies

Ronald Amundson and Elise Pendall launched pedological and palaeoclimatic studies this season. The long range objective of such work is to define the environment of the site in the past and to determine the extent to which climate and vegetation may have changed over the past 5,000 years. Soil chemistry; particle size analysis; micromorphology; stable carbon, oxygen, and possibly nitrogen isotope analyses; and palynology will be used to determine the climatic and vegetational history of the region.

The initial work this season was directed toward three objectives: (1) to locate the undisturbed natural soil beneath the mounds at Harappa and to describe and then sample them for stable isotope and pollen analyses; (2) to examine sections exposed by the archaeologists to look for evidence of soil development and sample such soils for chemical analysis; and (3) to work with the archaeologists in interpreting the stratigraphy and in reconstructing the original land surface. This work focused mainly in the cemetery area where vertical sections were exposed in the excavations, mostly down to natural soil.

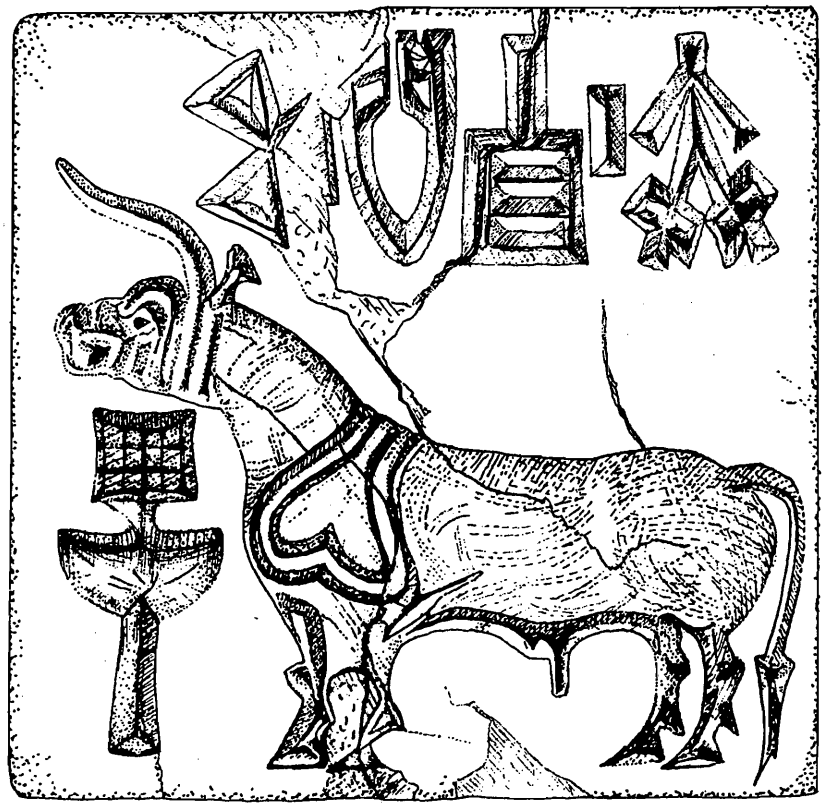
Amundson and Pendall also investigated other areas outside the cemetery. Most importantly, Test Pit 14, excavated the previous season within the southwestern corner of Mound AB, was cleaned out, and corings were made into the natural soil. It appears that erosion resulting from human activity removed a large portion of the soil profile prior to being covered by artifact-rich debris.

A small test trench was excavated at the northwest corner of Mound F, between the so-called "granary" and the former bed of the Ravi to facilitate the soil/sediment studies. Two soils, or strata exhibiting pedogenic development (organic matter accumulations and minimal *kankar* ($CaCO_3$) development), were observed in this trench and samples were taken for chemical and physical analyses. If, as expected, these are soils rather than other types of sediments, it would indicate several periods of relative landscape stability during human cultural periods. Although this section lacked charcoal or shell, *kankar* (caliche) was collected for dating. [*See Amundson and Pendall, Chapter 3 in this volume, as well as Pendall (1989) and Pendall and Amundson (1990a and 1990b).*]

C. *Conservation and Site/Museum Development*

Donna Strahan of the Smithsonian's Conservation Analytic Laboratory returned this season and was assisted by Margaret Leveque of the Museum of Fine Arts, Boston. The importance of having a well equipped, competently staffed field laboratory was clearly demonstrated as the staff treated considerable quantities of fragile skeletal materials and artifacts. The initial problem for many of the excavated items was to rid them of salts. The conservators established an effective routine of soaking artifacts in distilled water, after which they were cleaned, consolidated, and repaired. A selection of the inscribed material and figurines so treated is illustrated as Figures 13.13, 13.14, and 13.15.

The conservation staff also worked with the excavation team and the site curator on specific problems of site conservation. In the cemetery excavations, plastic sheeting covered by soil was used to protect the edges of the excavations from erosion. Some low areas left by the previous excavations in the cemetery were partially filled in both to protect them from further erosion and to also retain the outlines of the excavations for visitors to see.



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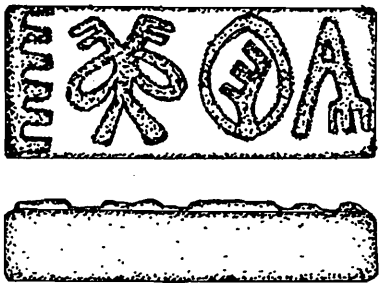
1



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2

Figure 13.13: Harappa 1987: (1) steatite stamp seal (H87-262/14-01 – height 26 mm, breadth 26.5 mm); (2) faience token (H87-214/37-02 – height 10 mm, breadth 24 mm).

The project also initiated measures to consolidate and protect some of the eroding areas associated with the earlier excavations on Mound AB. These areas include the southern edge of the mound where over-enthusiastic visitors climb the walls and destroy the edges of the excavations and around the top of the huge trench dug by Wheeler in 1946. Cement posts, metal railings, and barbed wire fencing were erected

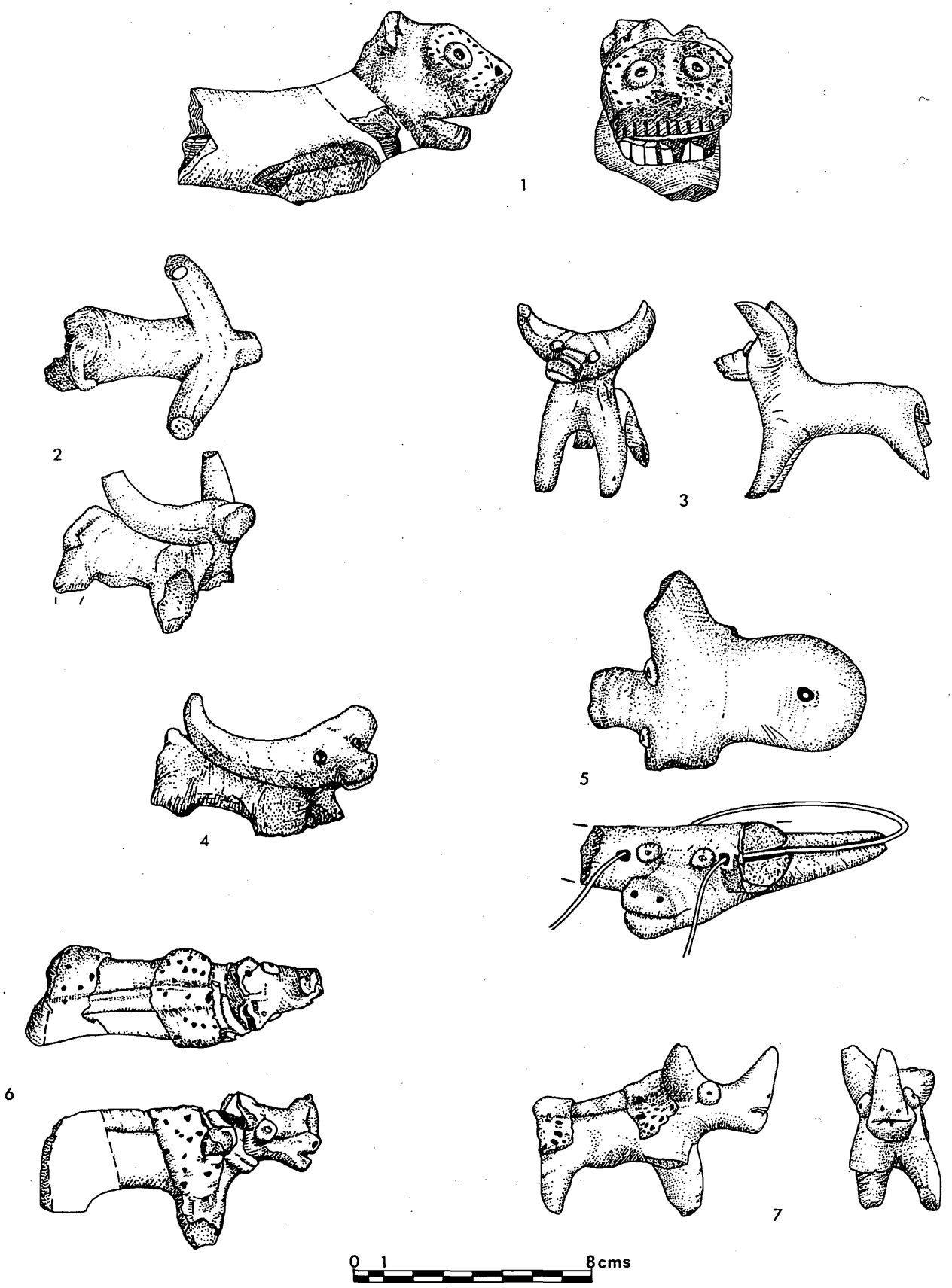

Figure 13.14: Harappa 1987 animal figurines: (1) feline (H87-339/59-17); (2) buffalo (H87-181/01-05); (3) bull (H87-194/04-01); (4) buffalo (H87-183/01-07); (5) bull? (H87-245/05-26); (6) rhinoceros (H87-243/11-49); (7) rhinoceros (H87-283/57-18).

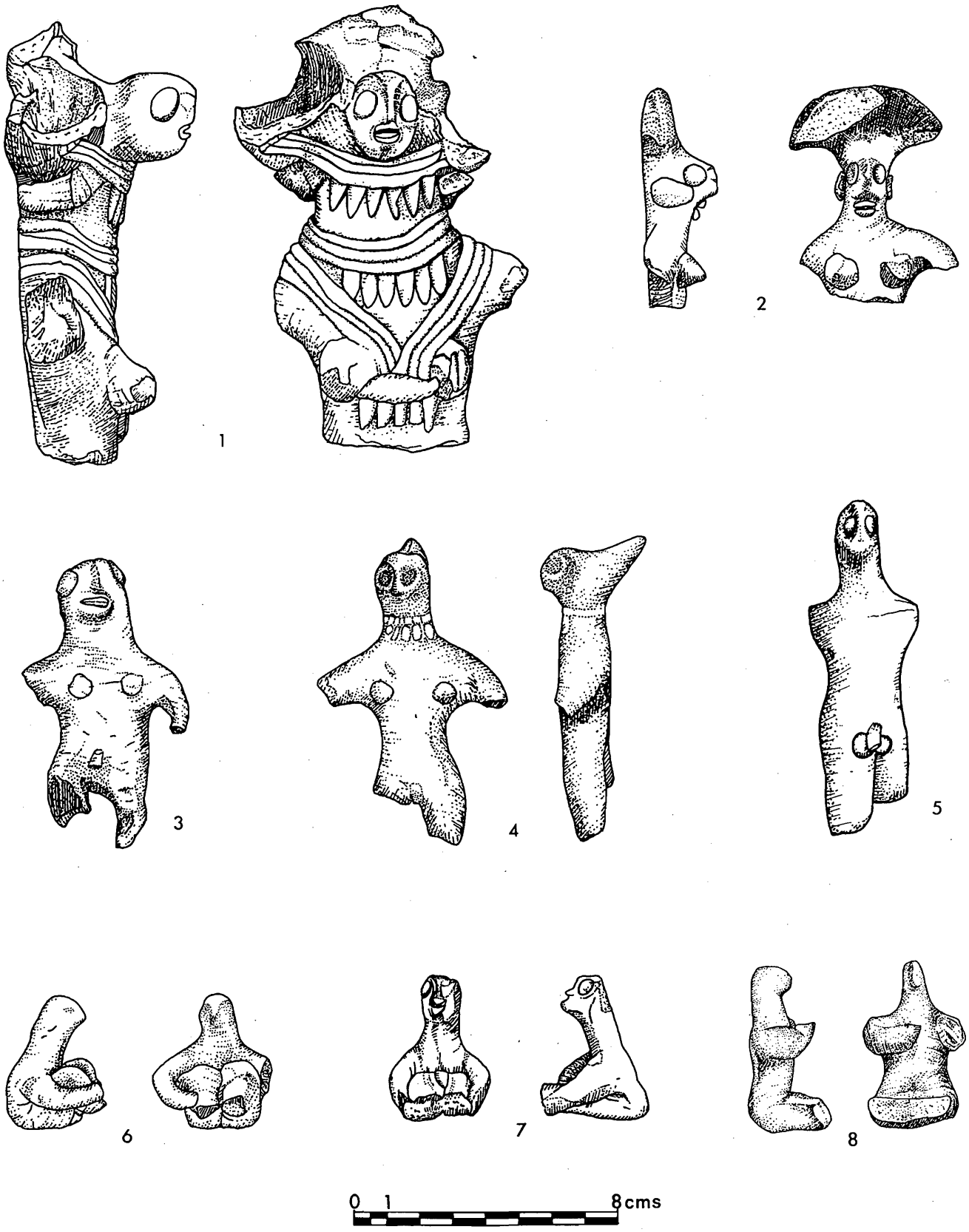

Figure 13.15: Harappa 1987 human figurines: (1) female (H87-189/01-13); (2) female (H87-260/12-55); (3) male (H87-185/01-09); (4) male (H87-248/05-29); (5) male (H87-209/12-48); (6) male (H87-259/12-54); (7) male (H87-196/04-03); (8) male (H87-428/62-20).

along with signs in Urdu and English to explain the exposed remains to visitors. Members of the project also worked with the museum curator in repairing several of the exhibits and in installing some new displays using objects recovered from the current excavations.

D. *Training Program*
1. Pakistani Graduate Students

The student training program was continued, and Julie Lowell served as coordinator of the lectures and field training. Two Pakistani universities participated in two three-week training programs. Karachi University sent four students, accompanied by their professor, Dr. Javed Husain, and Shah Abdul Latif University (Khairpur, Sindh) sent four students.

2. Conservators

Toseef-ul-Hassan, chemist from the Department of Archaeology's laboratory in Lahore Fort, spent five weeks at Harappa receiving training and practical experience in field conservation methods.

Third Season: January—Mid-April, 1988

Objectives for the Third Season

A. *Excavations and Analyses of Scientific Samples*
1. Harappan Cemetery (R37)
   a. Excavations and Burial Goods
   b. Morphometric Analysis
   c. Palaeopathology
   d. Palaeodietary Reconstruction
   e. Dental Anthropology
   f. Discrete Traits Analysis
   g. Conclusion
2. Mound AB, Deep Sounding
3. Mound E
   a. Exploratory Trenches
   b. Pottery Kiln
   c. Top of Mound
4. Collection of Samples for Radiocarbon Dating
5. Studies of Specific Artifact Categories
   a. Pottery
   b. Figurines
   c. Other Specialized Crafts

B. *Palaeoenvironmental Studies*
1. Palaeozoological Studies
2. Pedological and Palaeoclimatic Studies

C. *Conservation and Site/Museum Development*
1. Personnel
2. Conservation and Restoration of Excavated Materials
3. Assistance to Site Curator

D. *Training Program*
1. Pakistani Graduate Students
2. Conservators and Museum Personnel

Description of Work Accomplished

A. *Excavations and Analyses of Scientific Samples*
1. Harappan Cemetery (R37)
   a. Excavations and Burial Goods

Excavations in the Harappan phase cemetery continued under the supervision of J. Mark Kenoyer and with the same team of physical anthropologists as in the previous season. Excavations this season confirmed most of the basic observations about the cemetery noted last season. (See Figure 13.9.) The natural surface into which the cemetery was dug is a raised area of well-developed fine sandy to silt-clay loam with distinct horizons of calcium carbonate nodules (*kankar*). This ancient surface slopes away in all directions from its high point near the irrigation channel that forms the official southern limit of the site, but the dip is sharpest to the north and east. Eroded burials and debris form layers of varying thickness which lie on the natural soil. The eroding slopes of the cemetery are covered by a massive layer of Harappan debris, mostly pottery, about 40% of which consists of the pointed-base "Indus goblets."

Evidence from the Harappan cemetery suggests that burial customs at Harappa were relatively standardized (Figures 13.16 and 13.17). The vast majority are primary burials located along the east-west ridge that represents the undisturbed Harappan land surface. All of the primary burials consist of distinct rectangular pits oriented north-south.

Most of the burials have been disturbed by the intensive use of this area by the Harappans themselves. They dug into previous burials to make room for later burials (Figure 13.18), disturbing or entirely removing the earlier skeletons and burial pottery. The practice of digging into previous burials to make a new grave is suggested by the fact that the fill in every grave shaft contains broken pottery, isolated fragments of human bone, often complete bones, and in one case, a complete skull. These collections of remains are referred to as being in secondary context/fill in order to distinguish them from actual secondary burials.

Another context for the discovery of human bone is the eroded surface of the cemetery that was subsequently covered by the debris layer. These eroded burials are no longer *in situ* and are referred to as secondary context/wash or secondary context/debris. Secondary context/debris means that the human bone was found in the debris layer itself, but because all of the human bone in the debris layer occurs at the interface between the debris layer and the eroding cemetery

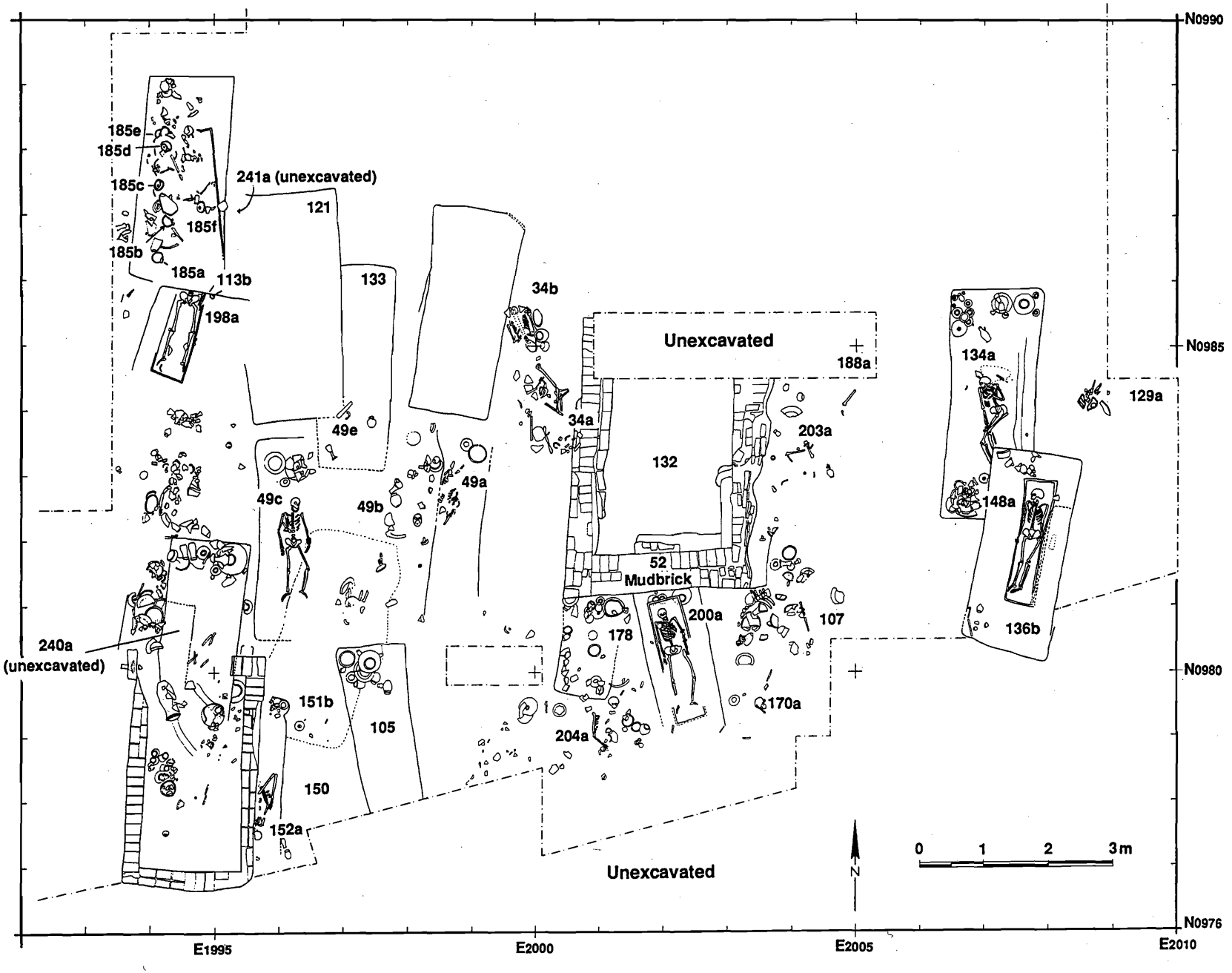

Figure 13.16: Harappa 1987-1988 cemetery excavations: plan of upper levels with feature numbers.

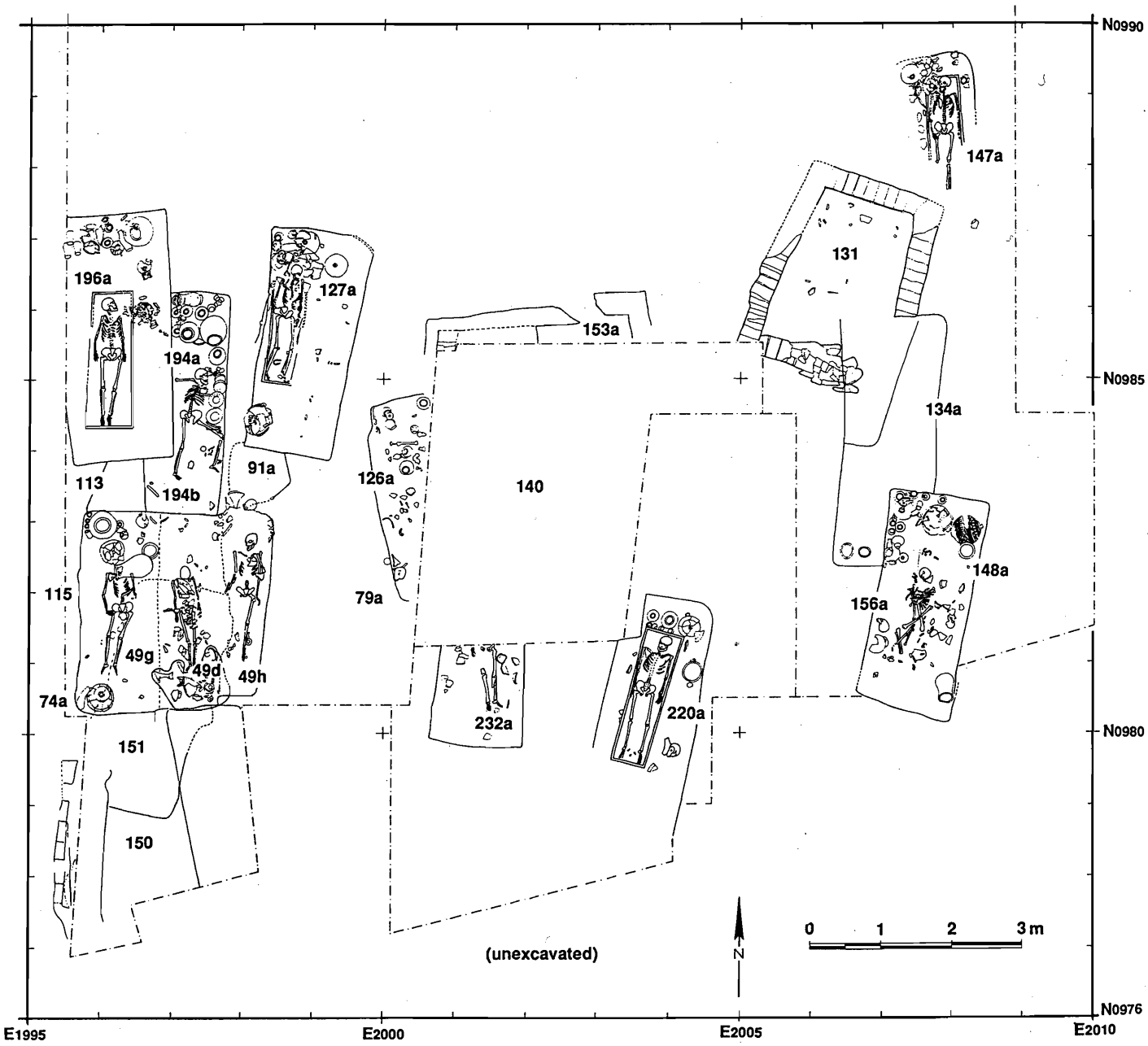

Figure 13.17: Harappa 1987-1988 cemetery excavations: plan of lower levels with feature numbers.

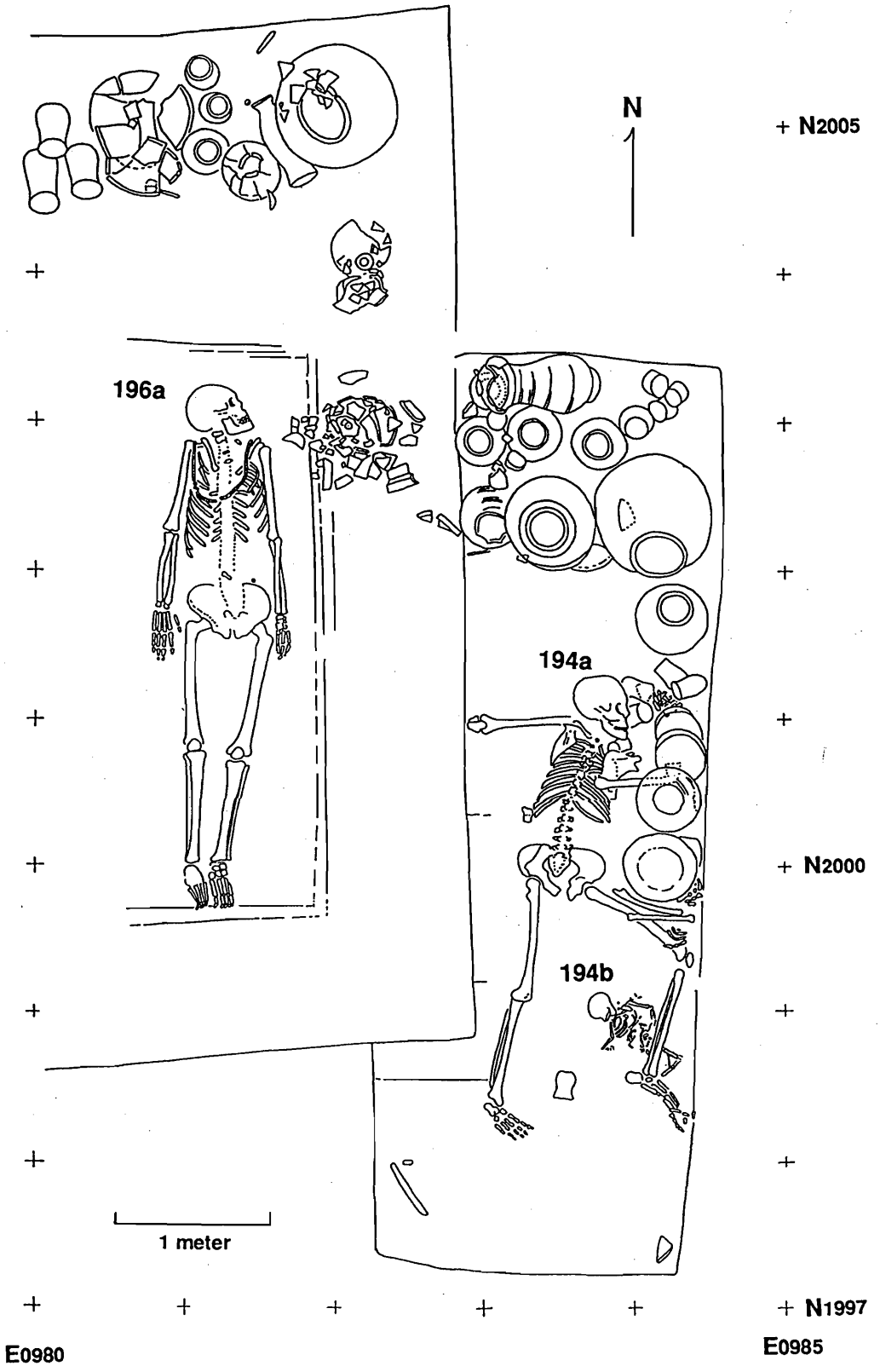

Figure 13.18: Harappa 1988 cemetery excavations: Burials 196a, 194a, and 194b (see also Figure 13.17).

surface, this bone is assumed to have been derived from the cemetery and is probably not a part of the debris that was brought to the cemetery for disposal.

Excavations also confirmed the presence of an extension of the cemetery under fields to the west of the protected site. These fields have been irrigated for at least the last 60 years, but distinct north/south oblong patches of lighter colored vegetation suggested the presence of subsurface features. Excavations revealed the presence of primary and secondary burials (Figure 13.19), as well as scattered human bone that appears in the fill of the grave shafts and therefore is the result of Harappan activity.

The uppermost levels of debris that protected this extension of the cemetery to the west have been removed by the farmers to get to the rich alluvium. This has exposed the uppermost burials to intensive plow zone disturbance with the result that they have been almost totally obliterated. However, the lower burials are in quite good condition, and even though the area exposed was quite small, it indicated the same type of intensive use of this part of the site for burial purposes. Due to limited time and the presence of standing crops, further excavations were not conducted in these fields. However, another test pit (E1968-1970, N951-952) directly south of the known cemetery revealed the presence of burial pottery, a copper mirror, and disturbed skeletal material.

At this stage of the analysis, it is difficult to discuss the presence or absence of significant status indicators. Some of the skeletons excavated this season had been buried in wooden coffins, two of which had some form of lid made of reeds or wood. In terms of burial goods, some individuals were buried with ornaments, and there was considerable variation in the quantities of pottery. The overall impression is that the persons buried in this cemetery were not from greatly diverse socioeconomic segments of the society. Given that the Harappa burials are quite similar to those known at other sites such as Kalibangan (Lal 1962; Lal and Thaper 1967; Thaper 1975; Sharma 1982) and Lothal (Rao 1979, 1985), the question arises as to whether only a special segment of the population was buried in cemeteries at all. Much more information is required before we can make positive statements concerning the burial practices of Harappan populations.

b. Morphometric Analysis

To date, 34 discrete individuals have been described by the physical anthropologists. K.A.R. Kennedy's preliminary analysis is as follows:

SEX		
Males		10
Females		17
Sex Uncertain		7
AGE		
Infant	(less than 3.5 yrs)	2
Child	(3.5 - 12 yrs)	1
Juvenile	(12.5-15 yrs)	0
Young Adult	(16-35 yrs)	18
Middle-aged Adult	(36-55 yrs)	11
Older Adult	(greater than 55 yrs)	0
Adults of uncertain age		2

[*These are preliminary determinations and have been modified since they were originally reported; see Chapter 11 in this volume.*]

c. Palaeopathology

Identification of pathological conditions of the skeletal remains was made in the field by Nancy Lovell through macroscopic and radiographic examination. The health of the new collection of Harappans can be tentatively characterized by a low incidence of traumatic injury, low incidence of chronic infectious disease, and no malignant neoplastic disease. One developmental abnormality, a scaphocephalic skull, was found. No cases of nutritional inadequacy, such as rickets, scurvy, or anemia were identified; however, there are three cases of arrested growth lines appearing on long bones (visible on radiographs), which suggest that growth during childhood was halted temporarily in these individuals. Growth arrest may be caused by malnutrition or other physiological stress such as an acute illness. Arthritis is the most common condition, and usually appears in the spine, and also in the joints of the knee, hands, and feet. Arthritic lesions in these locations are common among almost all people of the world and are usually associated with advancing age. There are several cases of severe arthritis in the neck, including fusion of adjacent elements. This could be associated with unusual stress on the neck vertebrae, such as would occur with carrying heavy loads on the head.

d. Palaeodietary Reconstruction

Nancy Lovell also designed and initiated procedures for reconstructing subsistence at Harappa using stable carbon and nitrogen analysis. The results of analysis in the 1987-88 academic year were spurious. The problem was identified as due to diagenetic effects. A study of diagenesis has been initiated, and new procedures for sample purification will be used in the coming year. The possibility of differential preservation in the cemetery as a factor in the isotope results will also be examined by comparing histological thin sections of bone from burials at different locations and depths within the cemetery. Most of the bone samples obtained in 1987 came from deposits that were closer

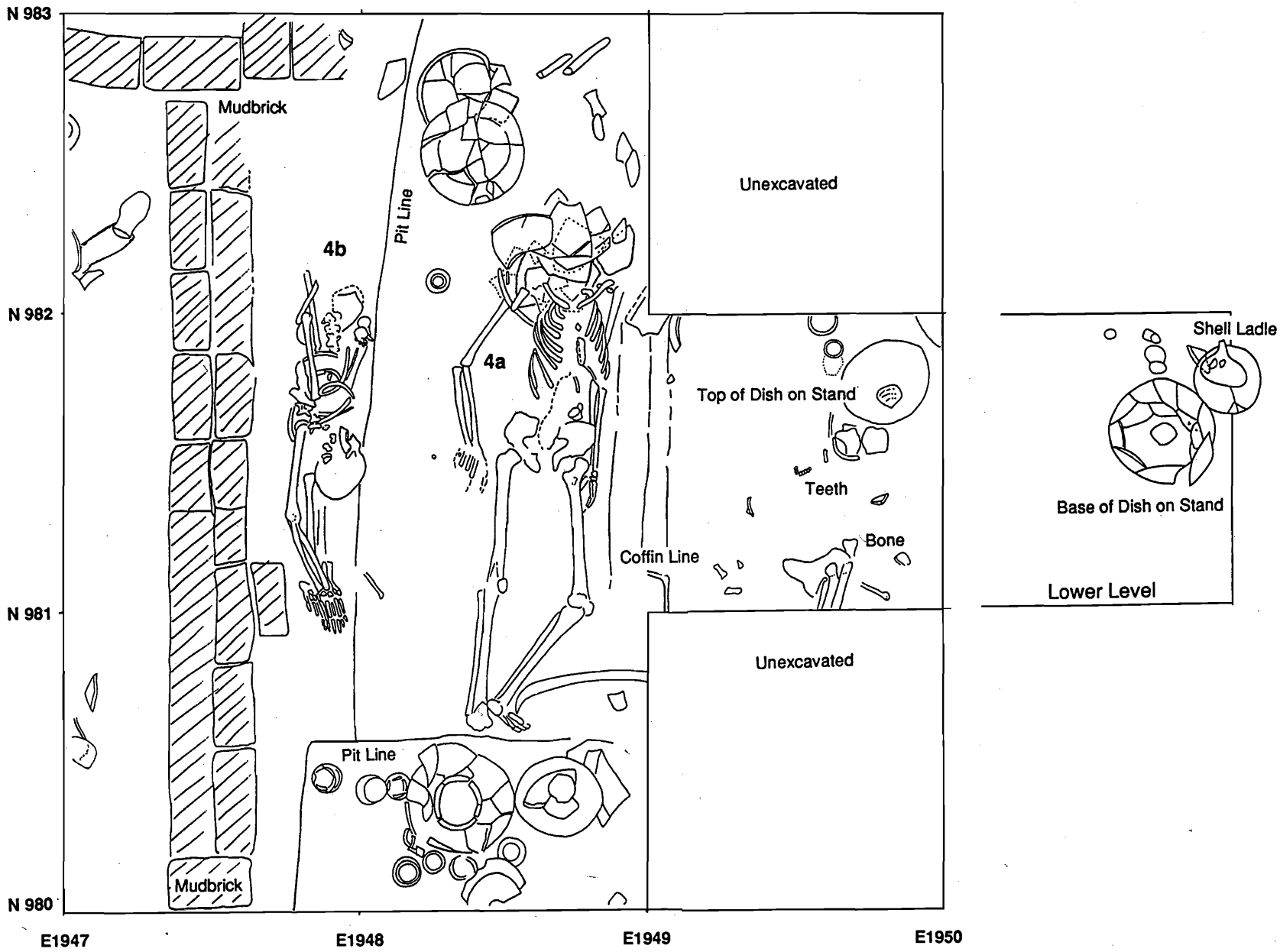

Figure 13.19: Harappa 1988 cemetery excavations: burials in fields west of area R37.

to the surface than those obtained in 1988 and therefore may be less well preserved.

e. Dental Anthropology

While human skeletal remains have been recovered from Harappan contexts for several decades, analysis of the dental remains have been sorely neglected, and valuable information regarding Harappan dental health conditions and dental morphology were routinely omitted from those earlier investigations. The current study of the Harappan dentition by John R. Lukacs serves to fill a crucial gap in the spatial and temporal database for South Asian dental anthropology.

The analysis of the new data to date shows that the dental pathology profile at Harappa is in agreement with an agricultural mode of subsistence. Prevalence of dental pathology when assessed by a tabulation of individuals reveals gross enamel hypoplasia as the most common and hypercementosis as the least common dental affliction. Dental caries was present in 43.6% of the individuals examined. Ante-mortem tooth loss (AMTL), calculus, and alveolar resorption occur in the skeletal sample with moderate frequency. Analysis of dental caries by tooth count method yields a 6.8% caries rate.

Sexual dimorphism in dental diseases at Harappa are most apparent for enamel hypoplasia and AMTL, although both caries and pulp exposure also show distinctly different rates between the sexes. Dental abscesses, calculus, and alveolar resorption are disorders for which males and females display similar rates.

A clearer picture of the dental health and odontometric status of the Harappans can only be derived through carefully controlled comparative analysis of these Harappan dental data with other prehistoric skeletal series from the Indo-Pakistan subcontinent. [*See Chapter 11 in this volume.*]

f. Discrete Traits Analysis

The analysis of discrete morphological non-metric trait variation has been utilized by many workers in recent years to assess both population affinities and microevolutionary trends within and between human populations. This method of analysis looks at the frequency of occurrence of specific features of the cranial and post-cranial skeleton. In the study, designed and conducted by Brian Hemphill, forty-eight non-metric features of the cranium are being assessed for presence or absence, and in the same manner, thirty non-metric traits for the post-cranial skeleton are being assessed. This study of the variation in discrete non-metrical traits among the human skeletal remains from Harappa is addressing the following seven questions:

1) To what other prehistoric populations from South Asia are the ancient Harappans most closely related?
2) What modern populations of South Asia bear the closest similarities to the ancient Harappans with respect to non-metric skeletal features?
3) What is the degree of genetic heterogeneity within the Harappan population as represented by the human skeletal remains recovered during the course of this expedition? Do males tend to be more genetically homogeneous one to another within the populations or do females appear to be more homogeneous? Such questions may give some insight into whether marriage customs among the ancient Harappans were based upon patrilocality, matrilocality, both, or neither.
4) Is there a correlation between the appearance of elaborate grave goods, i.e., social status, and specific genetic features which would suggest that wealth was amassed in certain lineages?
5) Is there a correlation between burial location within the cemetery and the occurrence of combinations of non-metric features which would suggest that families or lineages were buried together?
6) What is the relationship between the cranial and post-cranial non-metric features? Do these two sets of data provide the same information, or is one of them more heavily influenced by environmental factors?
7) Do non-metric features of the cranial and post-cranial skeleton tend to indicate the same populational affinities as those suggested by dental morphology and by traditional craniometric techniques utilized by the other physical anthropologists working at Harappa?

g. Conclusion

The above are examples of the kinds of information that are being provided by the physical anthropologists studying the skeletal remains from Harappa. Before definite conclusions can be reached about the ancient Harappan populations, more processing of data is required. It is essential that estimates of sex, for example, be checked by a battery of statistical measures that will support the morphological analyses or raise questions not perceived at this first stage of field laboratory research. Stature reconstructions, frequencies of pathological conditions, and other

features must be investigated using multivariate and regression statistics. [*See Chapter 11 in this volume.*] When these data are thoroughly analyzed, the physical anthropologists should be in a better position to define the biological affinities, diversities, and characteristics of at least that segment of the ancient Harappa population represented in the Harappan phase cemetery excavations.

2. Mound AB, Deep Sounding

During the third season, we resumed excavations in the large erosion gully on Mound AB. Because of the presence of well-preserved fired brick floors, drains, and walls discovered last season along both edges of the gully, the focus this season was in the large flat area in the center of the gully. Directly in the center of the mud-brick area, the top of a well constructed with fired brick was discovered (Figure 13.20). With the exception of a few bricks missing from the top rings of the well, the structure was found to be in excellent condition. It was constructed of wedge-shaped bricks, each marked with a pair of incised vertical lines on the outer surface. Since such markings are not known on other well bricks at Harappa, it is possible that the markings were used to identify bricks to be used for making this well alone. The interior diameter of the well is 1.20 meters and each ring consists of 36 bricks each 26 cm long.

The interior of the well was cleared to a depth of 5.9 meters from the existing top layer of bricks, i.e., from 168.78 to 162.87 AMSL (Figure 13.21). The upper half of the filling consisted mainly of Late Harappan (Cemetery H) pottery sherds, while the lower part contained Harappan brick fragments and sherds. The bottom of the well was not reached. The lower walls started to crack and bulge in as the interior filling was removed and a new pattern of stresses on the structure was created. Excavations in the well, therefore, were halted, and the top was sealed for purposes of safety.

Outside the well, a tall vertical section was cleared against its northern exterior to investigate its construction. The well, which can be dated sometime late in the Harappan phase, appears to have been constructed by first excavating a large pit in the center of the mound cutting through earlier habitation layers and domestic debris. This interpretation, however, requires further testing.

Our original goal of reaching natural soil in this area of excavation was thwarted by the discovery of intact and extensive Harappan architectural remains, which are important in themselves as they represent one of the few areas on Mound AB that has undisturbed Harappan architecture.

3. Mound E

a. Exploratory Trenches

Excavations on Mound E were begun during the second season, but major exposures were not started until the third season. The excavation areas were selected on the basis of surface indicators such as architectural features, surface topography, and artifact concentrations. Three distinct areas were excavated: the northwestern slope, the top of the northwestern corner of the mound, and the southwestern slope.

The excavations on the northwestern slope consisted of a major step trench oriented east-west and extending from the crest to the base of the mound (Figures 13.22, 13.23, 13.24, 13.25, 13.26). Additional areas were exposed to the north and south of the step trench to delimit architectural features and special activity areas. The total excavated area on the slope is 181.5 square meters, with the depths of the excavations ranging from 50 cm to 6 meters.

On the top of the mound, similar test trenches were begun and then expanded. Four distinct trenches were opened totaling 116.5 square meters, with an average depth of 2 meters.

The excavations on the southwestern slope were conducted in a 4 × 6 meter area (24 square meters) where baked brick walls were seen eroding from the mound.

The results of these different excavations revealed the presence of three major periods of occupation. In the lowest levels, the earliest occupation of the site is represented by hearths and possible mud-brick architecture of the Early Harappan phase (Figures 13.25 and 13.26). These levels are overlaid by deposits that contain artifacts and pottery that may reveal the nature of the transition from the Early Harappan to the subsequent Harappan occupation. Most of the trench reveals remains of the Harappan habitation of the mound (Figures 13.22, 13.23, and 13.24). These deposits comprise several phases of major architectural activity representing the construction of what appear to be massive mud-brick revetments and platforms at the edge of the mound. Some of the platforms are reinforced by baked brick revetment walls.

Although the detailed analysis of the stratigraphy is still underway, it seems that the edge of the mound was used for both craft activities (pottery manufacture) and habitation. The uppermost levels of Harappan occupation are followed by strata containing pottery of the Late Harappan (Cemetery H) phase. Again, the pottery styles suggest that there may be a transitional period between the Harappan and the Late Harappan phases. Future excavations in this area of the mound and the final analysis of the artifacts and pottery will

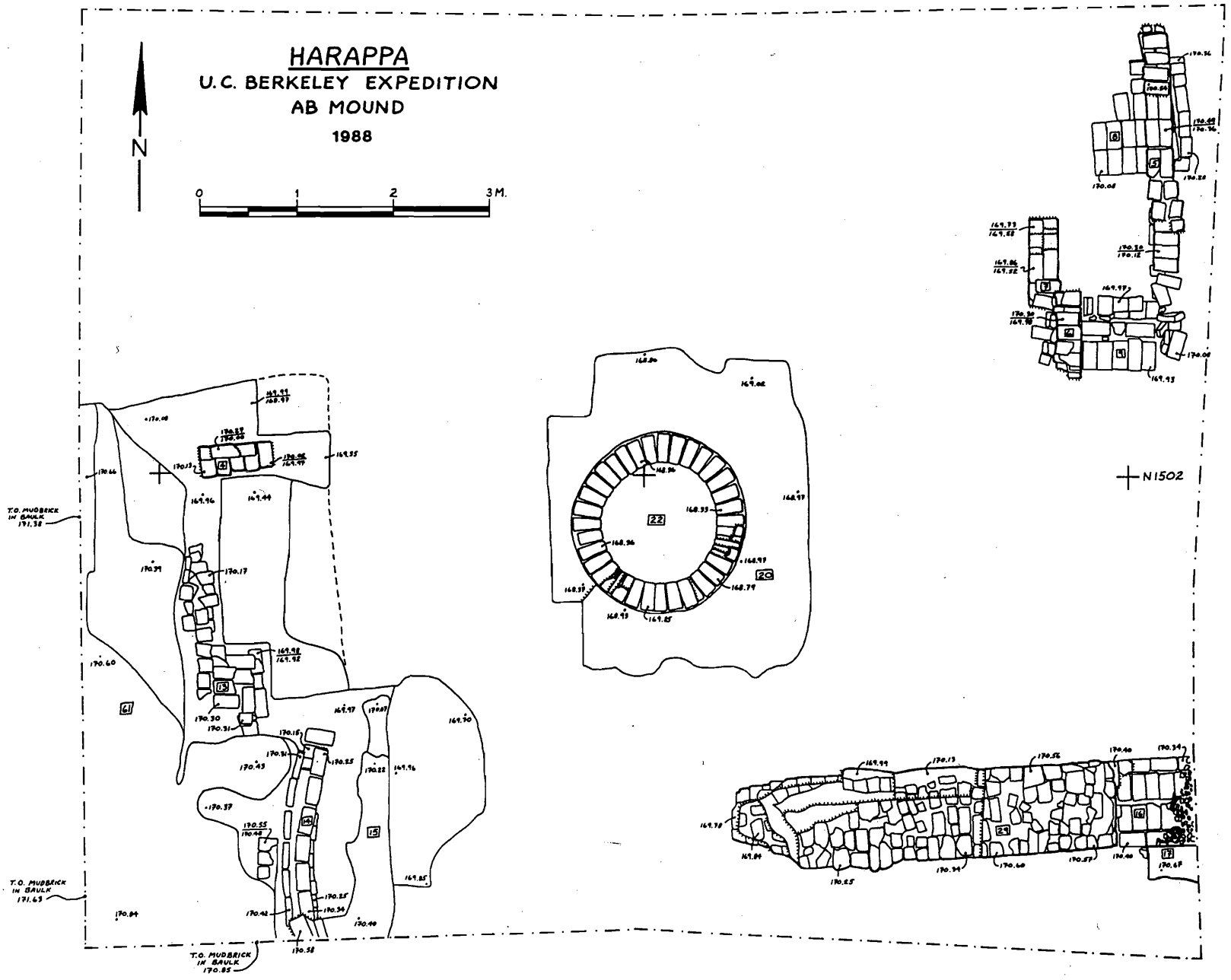

Figure 13.20: Harappa 1988: Mound AB, Operation 2: plan of excavations.

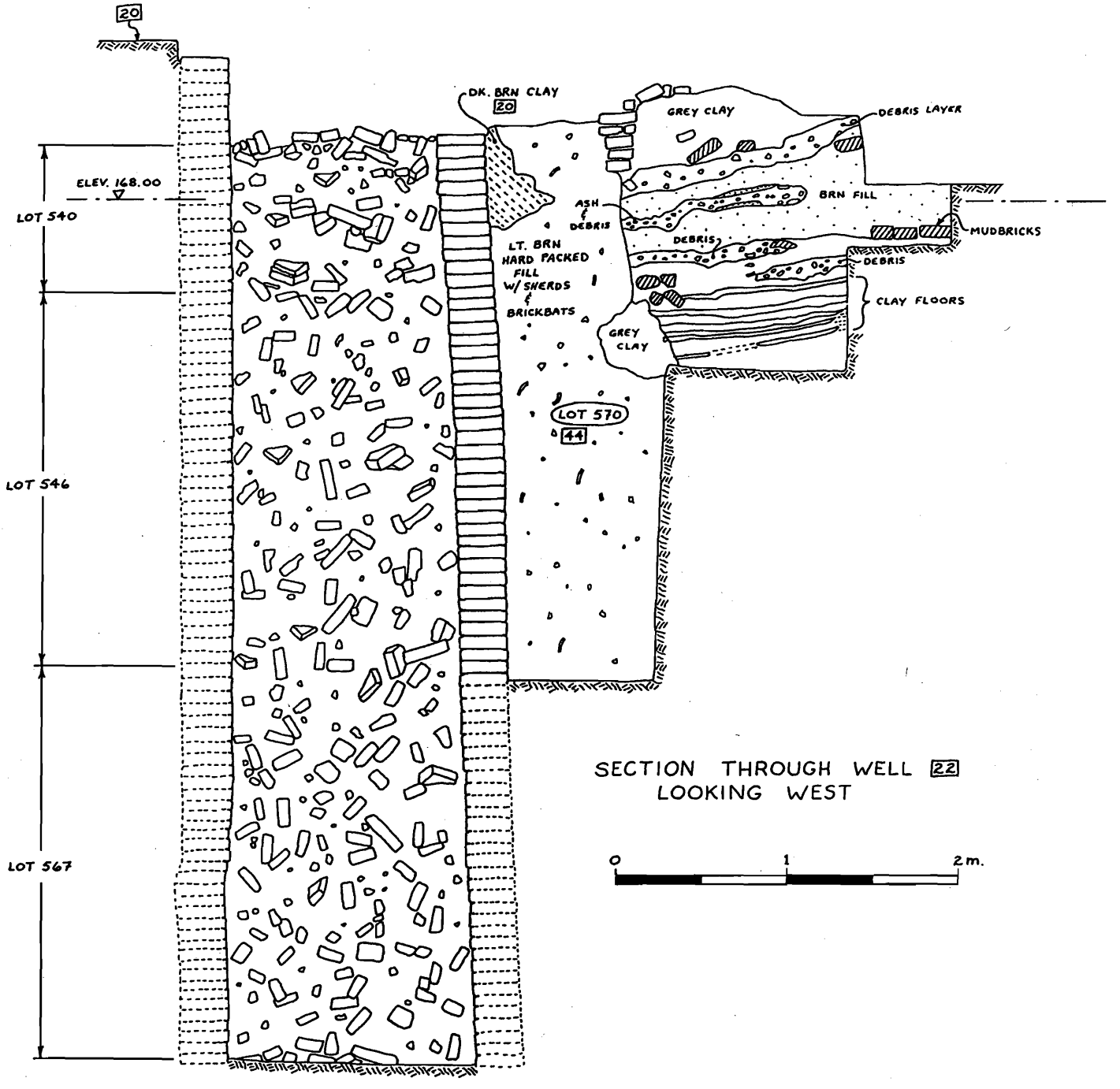

Figure 13.21: Harappa 1988: Mound AB, Operation 2: section through well #[22] facing west.

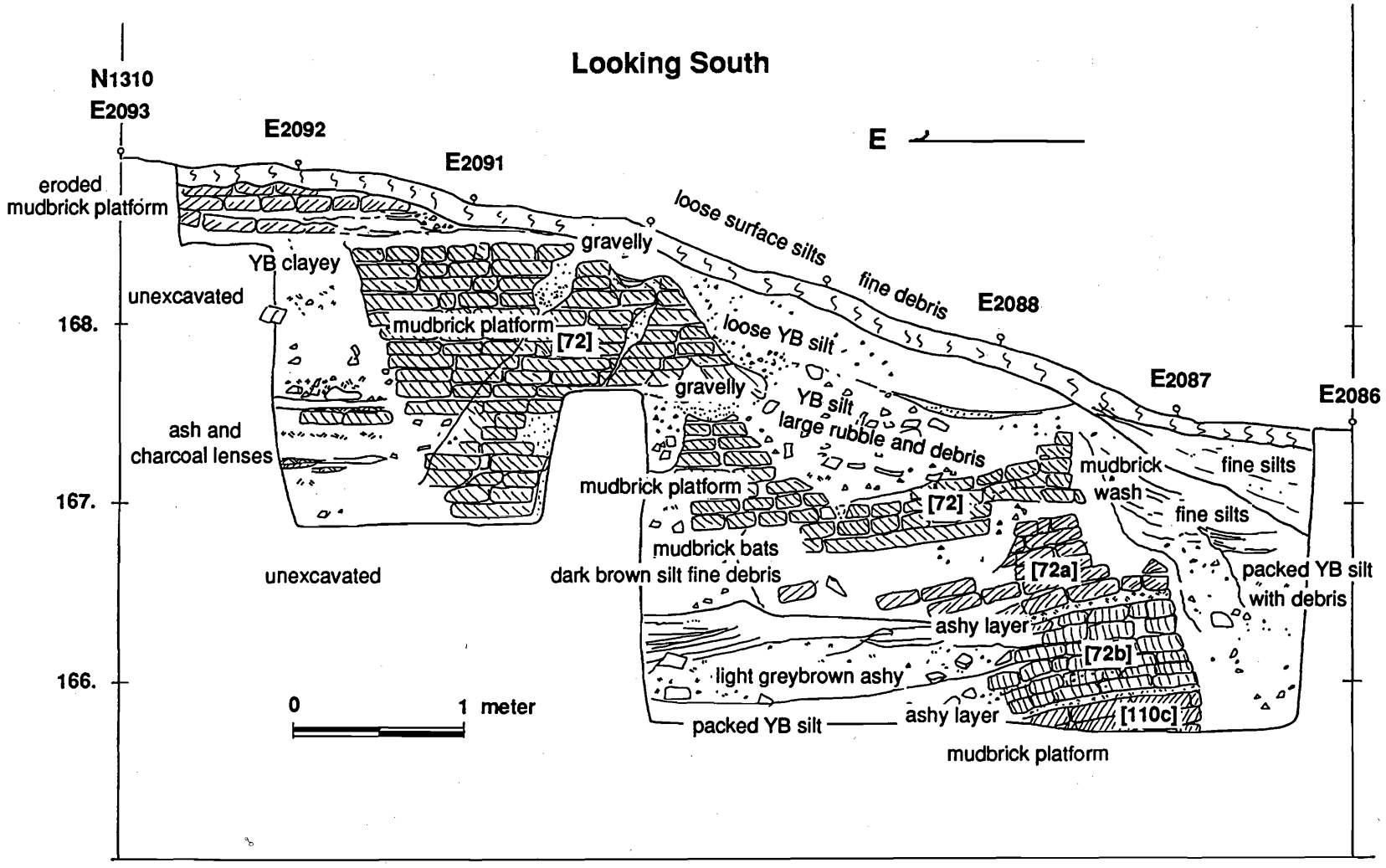

Figure 13.22: Harappa 1988: Mound E, northwestern slope: east-west section at edge of mound facing south.

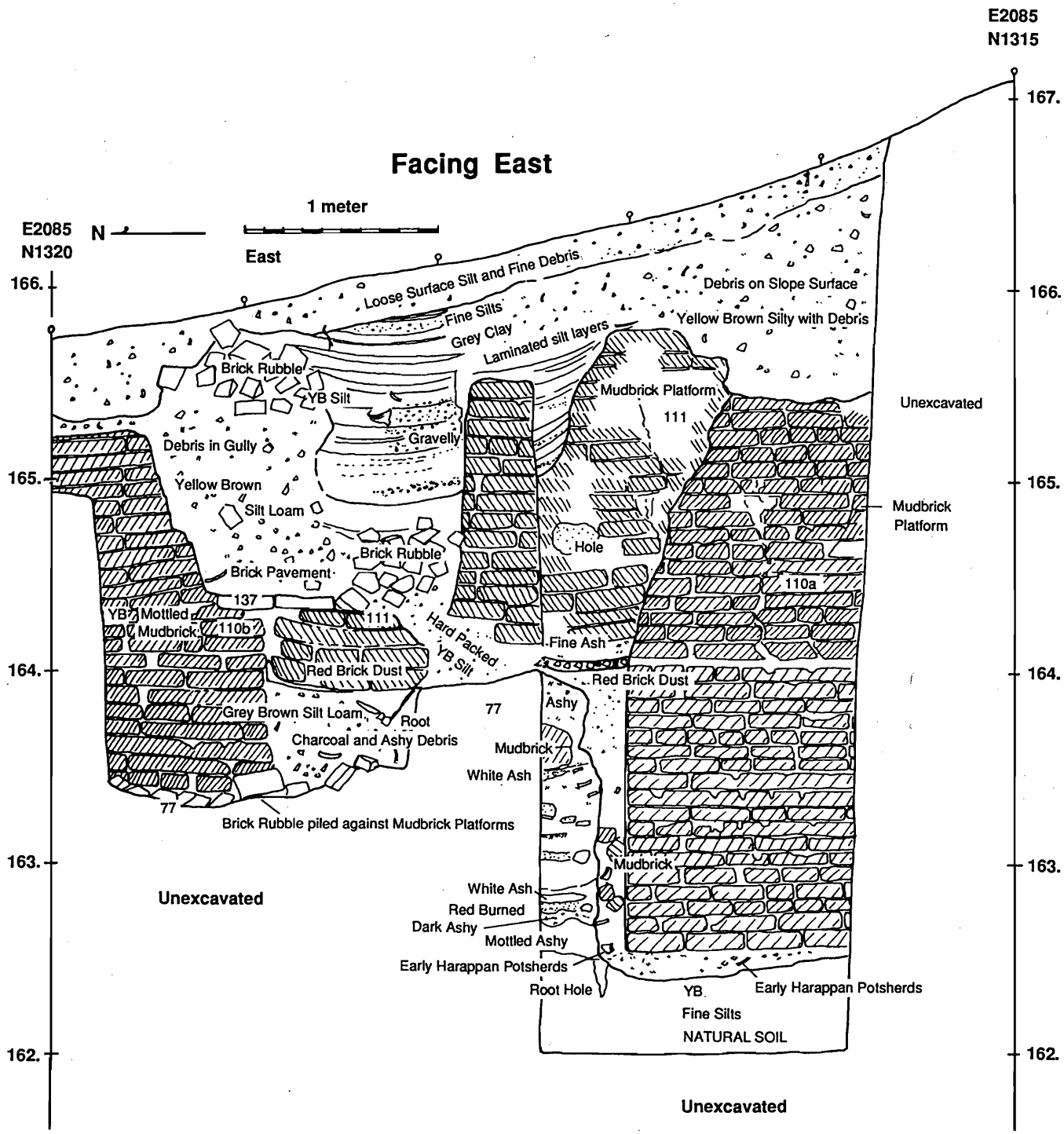

Figure 13.23: Harappa 1988: Mound E, northwestern slope: north-south section facing east showing platforms.

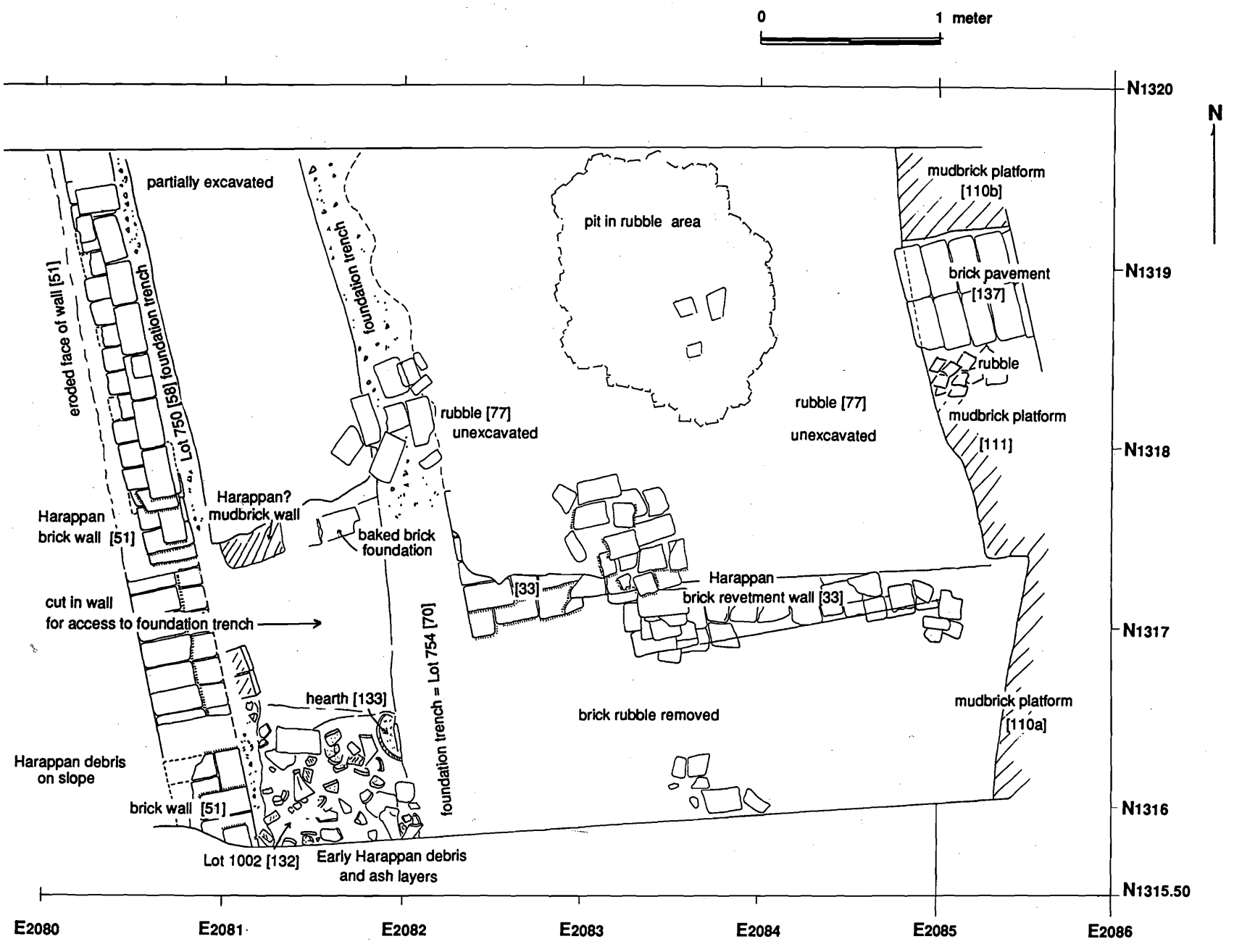

Figure 13.24: Harappa 1988: Mound E, northwestern slope: plan view of walls and revetment.

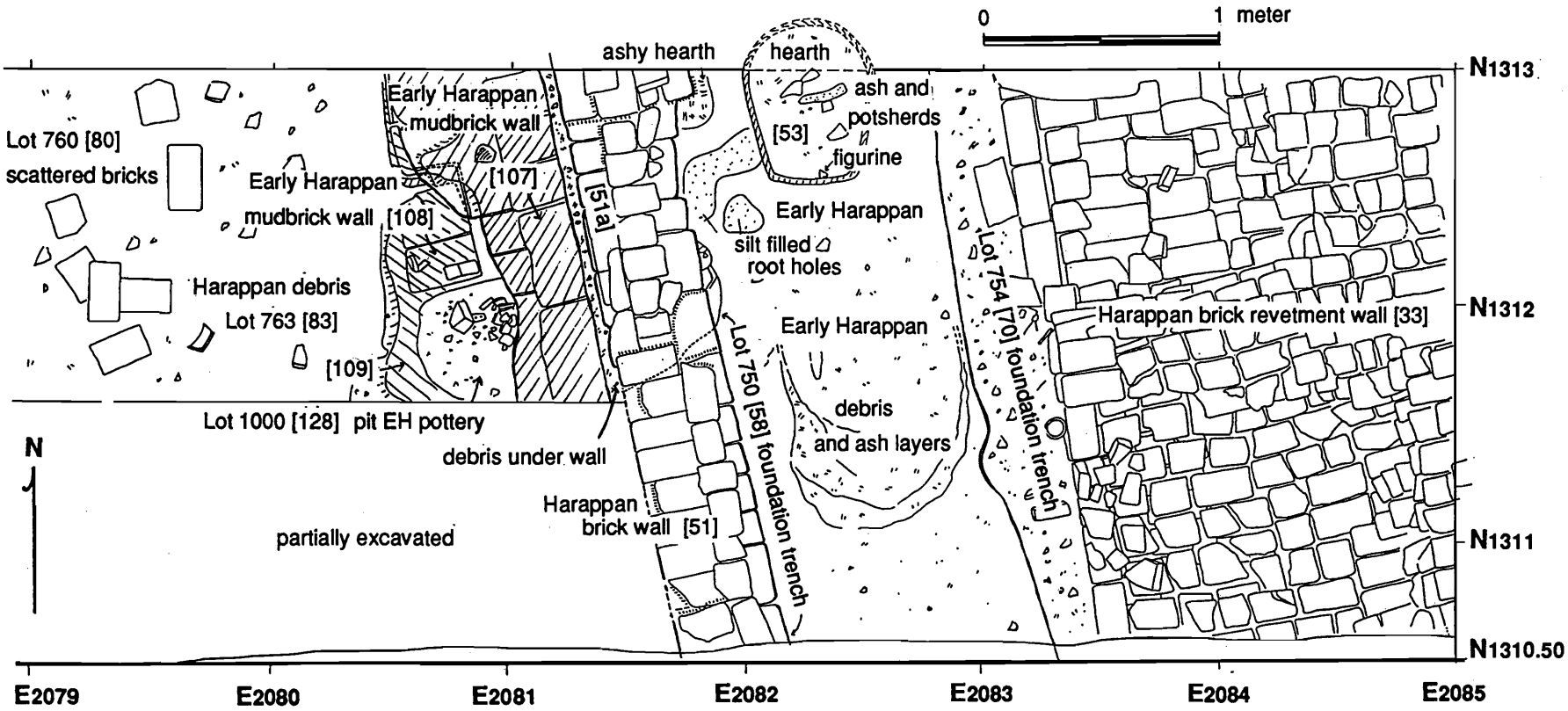

Figure 13.25: Harappa 1988: Mound E, northwestern slope: plan view of walls and revetment.

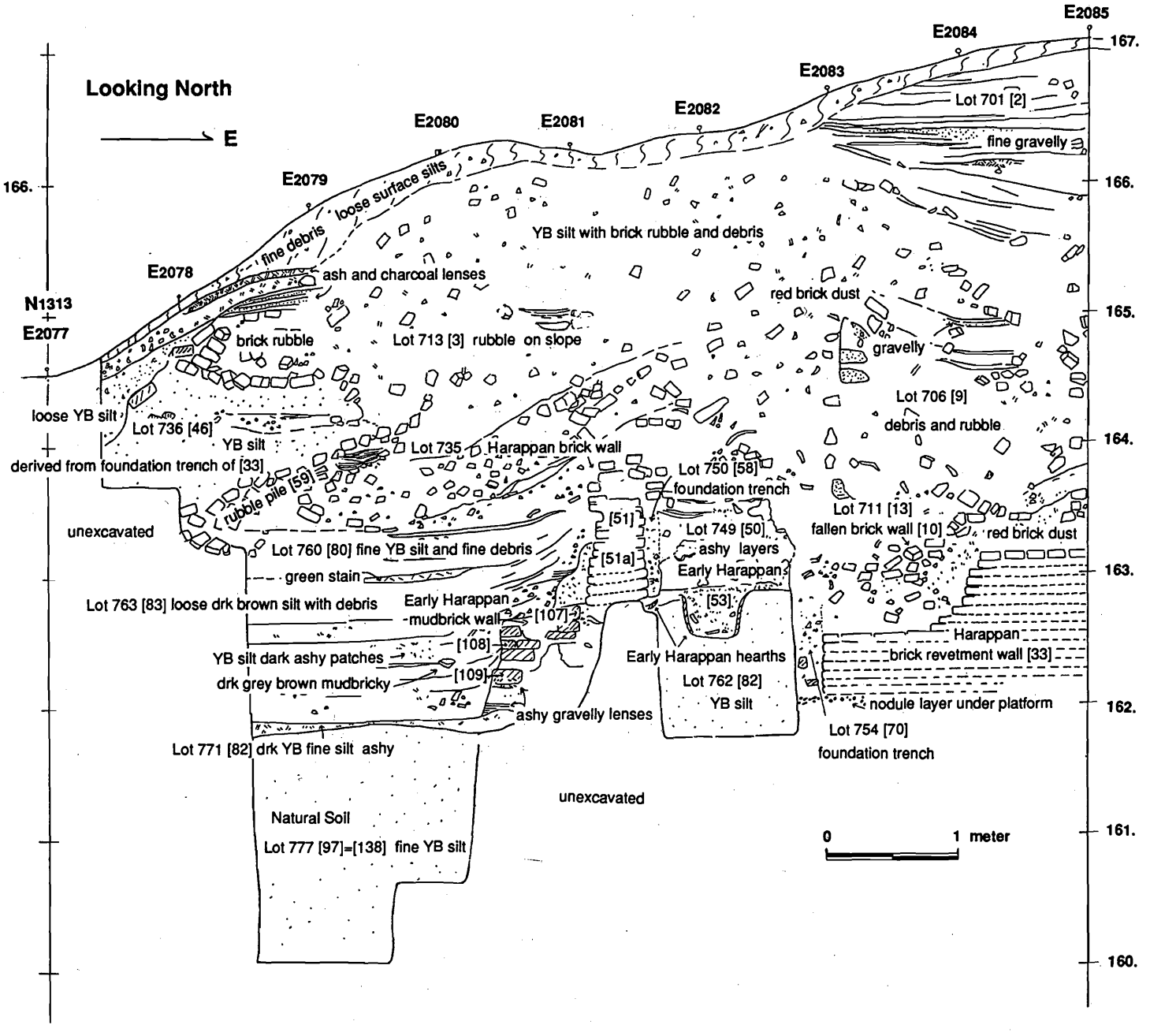

Figure 13.26: Harappa 1988: Mound E, northwestern slope: east-west section at edge of mound, facing north.

provide a new understanding of the cultural sequences that are represented on Mound E.

The excavations on Mound E represent only a small portion of the mound, and yet they have revealed some important new features that may change our perception of how the Indus cities were built up. The step trench revealed successive platforms or revetments and foundations of mud-brick combined with baked brick, extending from the base of the mound, right to the top. These mud-brick structures were not built at one time, but are the result of many separate phases of construction (Figure 13.22).

The latest platforms are at the top of the mound and are associated with Late Harappan, Cemetery H, type pottery. These platforms overlie "mature" Harappan structures that include habitation, kitchen, and domestic dump areas.

Beneath these latest Harappan structures are earlier mud-brick platforms that overlay a series of eroded and reconstructed platforms. The mud-brick platforms and retaining wall appear to have been strengthened by a baked brick revetment or facing (Feature #[33] in Figures 13.24, 13.25, and 13.26). Traces of this baked brick revetment (#[33]) have been found to the west of the mud-brick revetment wall. This structure was about 2 meters wide at the base, with a sloping exterior face. Based on calculations of toppled courses of brick, it is estimated that this baked brick facing stood some 3 to 4 meters high from natural soil to the crest of the mound. Similar structures found by Wheeler on Mound AB were interpreted as a defense wall. Further excavations will be conducted to clarify the function of this massive brick structure. It will then be essential to make detailed comparisons with Mohenjo-daro where the German research team is suggesting that the construction of massive platforms was an intentional first stage in site construction (Jansen 1987; Leonardi 1988).

An earlier north-south wall of baked brick (Feature #[51]) has been found approximately 75 cm farther to the west of the large baked brick structure (Feature #[33]—Figures 13.24, 13.25, and 13.26). This wall has been traced for some 25 meters, and it too is oriented in correspondence with the structures exposed by Wheeler on Mound AB. The long wall appears to have been rebuilt at least once, and the western face is badly eroded. This suggests that the eastern face was covered with earth, while the western face was exposed to water erosion and salt damage by seepage and evaporation.

Beneath this baked brick wall are earlier mud-brick structures that were not completely exposed during the 1988 season (Figure 13.26). They may represent earlier mud-brick walls that were replaced by the baked brick wall, or they could be unrelated structures that were demolished to build the long brick wall. The ceramics associated with these earlier mud-brick structures are characteristic of the Early Harappan phase as defined by M.R. Mughal on the basis of material from Kot Diji and Jalilpur (Mughal 1970, 1974). There has been some ancient mixing of the strata due to the fact that the Harappans dug into these early levels to construct their baked brick structures, but we were able to locate some undisturbed Early Harappan strata associated with primary context hearths containing charcoal. These lie directly on top of natural alluvium. Some of the Harappan structures that have cut entirely through the Early Harappan levels are also lying directly on top of natural soil (Figure 13.26). Test pits were sunk to a depth of one meter below the top of the natural soil, and deeper corings were made to confirm the fact that this is natural sediment.

In summary, the step trench on the northwestern face of Mound E provides a continuous sequence of habitation and construction from the Early Harappan ("Kot Dijian") occupations on natural soil through the Harappan to the Late Harappan ("Cemetery H") occupations on the top of the massive mound. In addition to the masses of pottery, figurines, terra-cotta bangle fragments, and other artifacts, we have been able to collect a wide selection of faunal materials, soil samples for palaeobotanical studies, and most important, clusters of carbon samples for radiocarbon dating.

b. Pottery Kiln

In addition to the large step trench, a 5 × 5 meter area associated with vitrified kiln wasters was excavated on the northwestern slope of Mound E (Figure 13.27 and 13.28). The Harappan strata are characterized by many sequential layers of floors with red burned patches and no ash. These are interpreted as working floors that have been periodically cleaned and flattened. The precise pyrotechnological activity has not yet been determined and will require some additional excavations.

Beneath these burned floors, are the remains of a large updraft kiln that appears to have been used to fire pottery and other ceramic objects (Figure 13.28). It does not appear to have been used for metal smelting. The terra-cotta vessels, bangles, and figurines found in association with the kiln have been collected very carefully, with detailed recording of provenience and micro-stratigraphy in order to reconstruct the process of site formation and erosion associated with the use and abandonment of the kiln.

In addition to the ceramic artifacts, these strata contain worked antler and bone, a mass of botanical information in plant impressions, charcoal pieces, and ash. Soil samples for pollen analysis have also been collected from all major stratigraphic units, providing

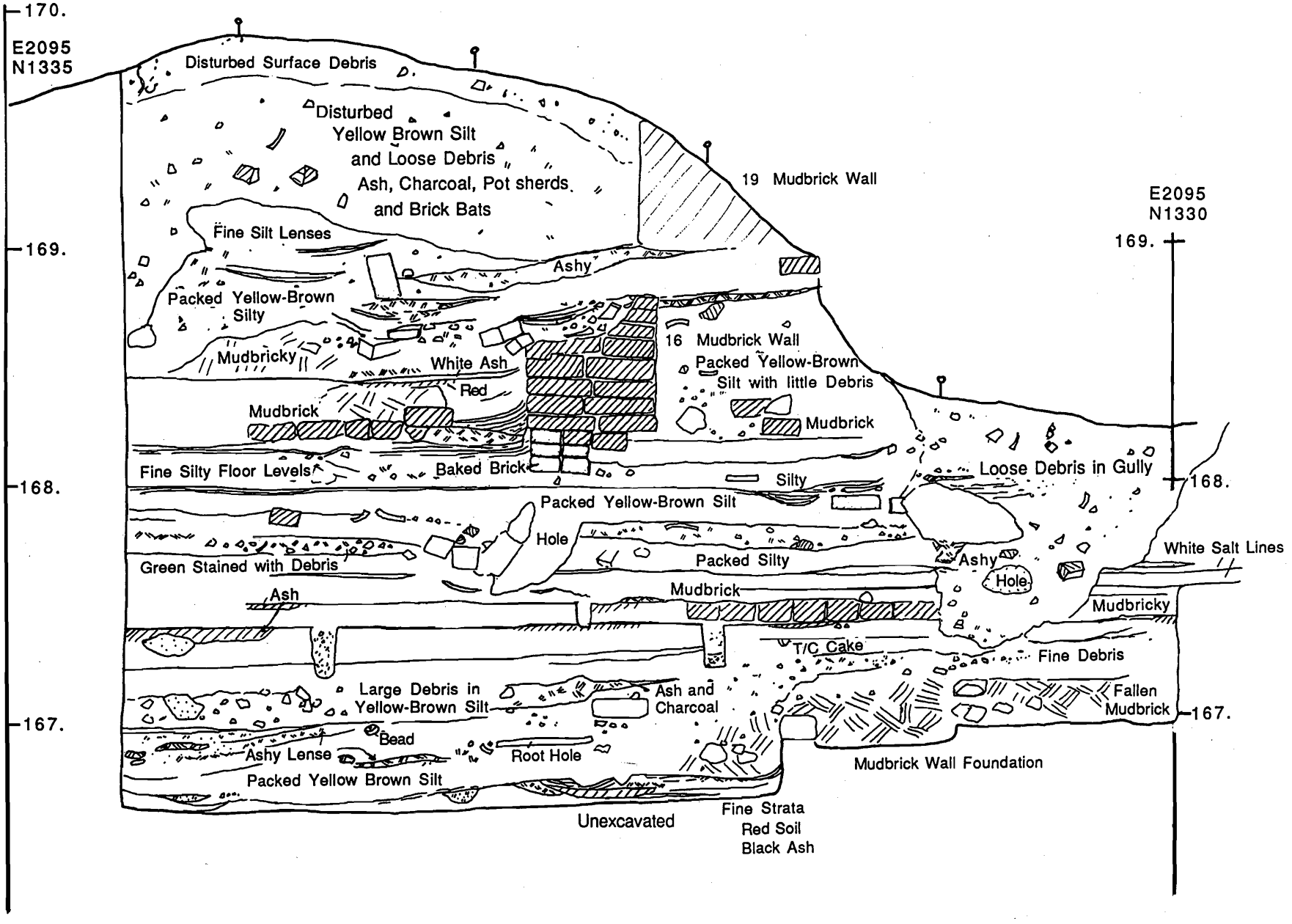

Figure 13.27: Harappa 1988: Mound E, northwestern slope above kiln: north-south section, facing east.

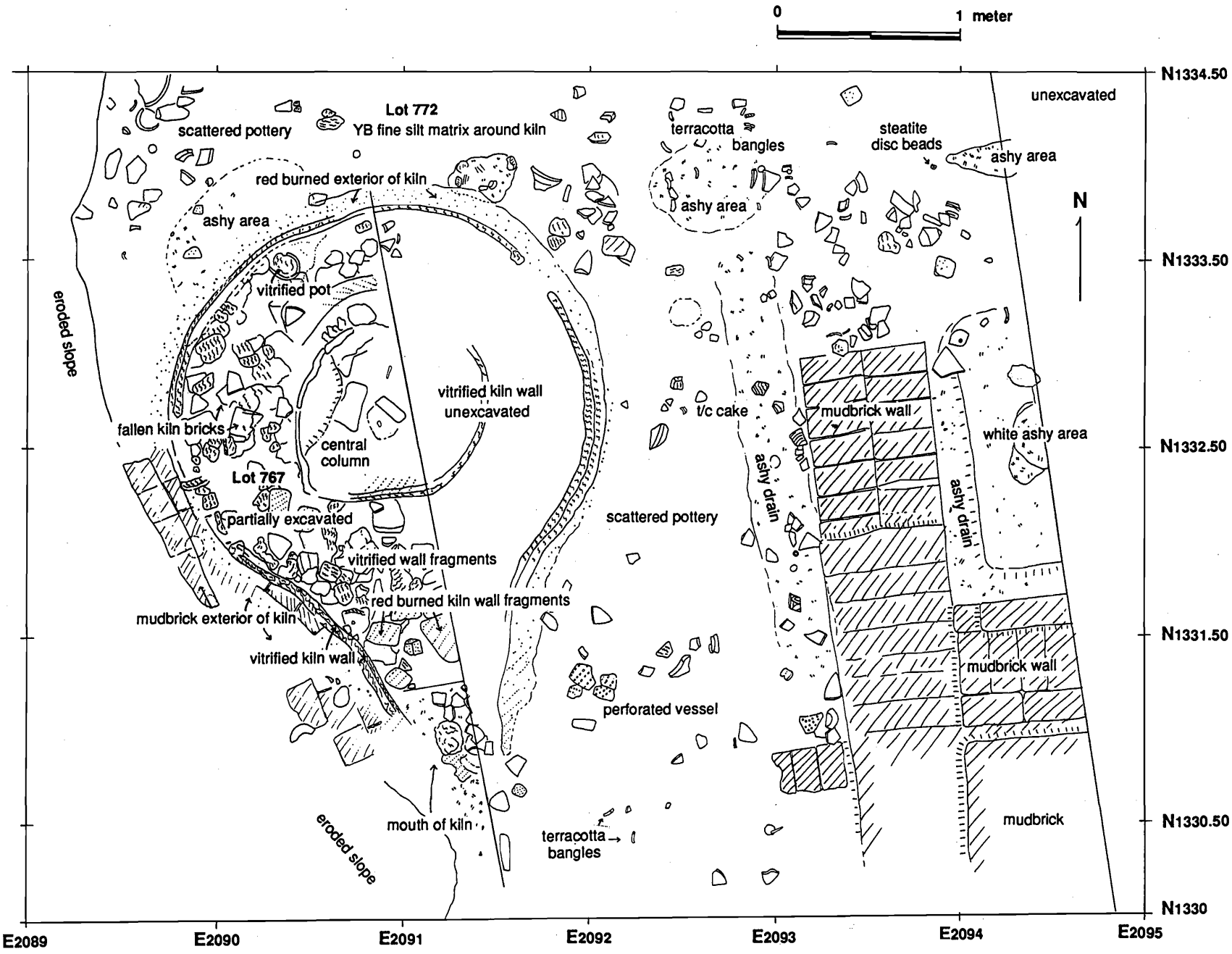

Figure 13.28: Harappa 1988: Mound E, northwestern slope: plan of kiln area.

a continuous sequence from the construction of the kiln to the Late Harappan habitation of this area of the mound. Further excavations will be conducted to expose mud-brick architecture associated with the kiln and to further expand the excavations around and below the kiln.

c. Top of Mound

The excavations on the top of Mound E revealed that underneath the thick layer of disturbance left by the brick robbers, there are large, relatively undisturbed Harappan structures. A large 10 × 8 meter area was opened to obtain horizontal exposure of the uppermost preserved structures on the mound (Figures 13.29 and 13.30). The preliminary analysis of some of these areas suggests the presence of multiple levels of habitation units constructed of baked and mud-bricks along an east-west street that was equipped with drains and sump pits. Many hearths and redeposited hearth material were found within and around the structures from which many charcoal samples were taken for radiocarbon dating. The types of artifacts recovered from the architectural contexts reveal the presence of domestic activities such as food processing and cooking, as well as craft activities. The range of craft activities includes chert tool manufacture and use, steatite working, bone working, and possibly the manufacture and processing of agate and carnelian. At this stage of our analysis it is not possible to say if these craft activities are associated with domestic contexts or if they represent workshops or secondary dumps from workshop areas. Further limited excavations will help clarify these questions.

The presence of brick robbers and their disturbance of the mound is well documented in the excavations. Pockets of fine laminated silt bands were found throughout the excavations attesting to the historic pits from which bricks were removed that were later filled with aeolian and water-washed sediments. Also, a 1/4 anna East India Company coin dating from 1835 was found at 1.3 meters below the surface amongst brick robber pit debris.

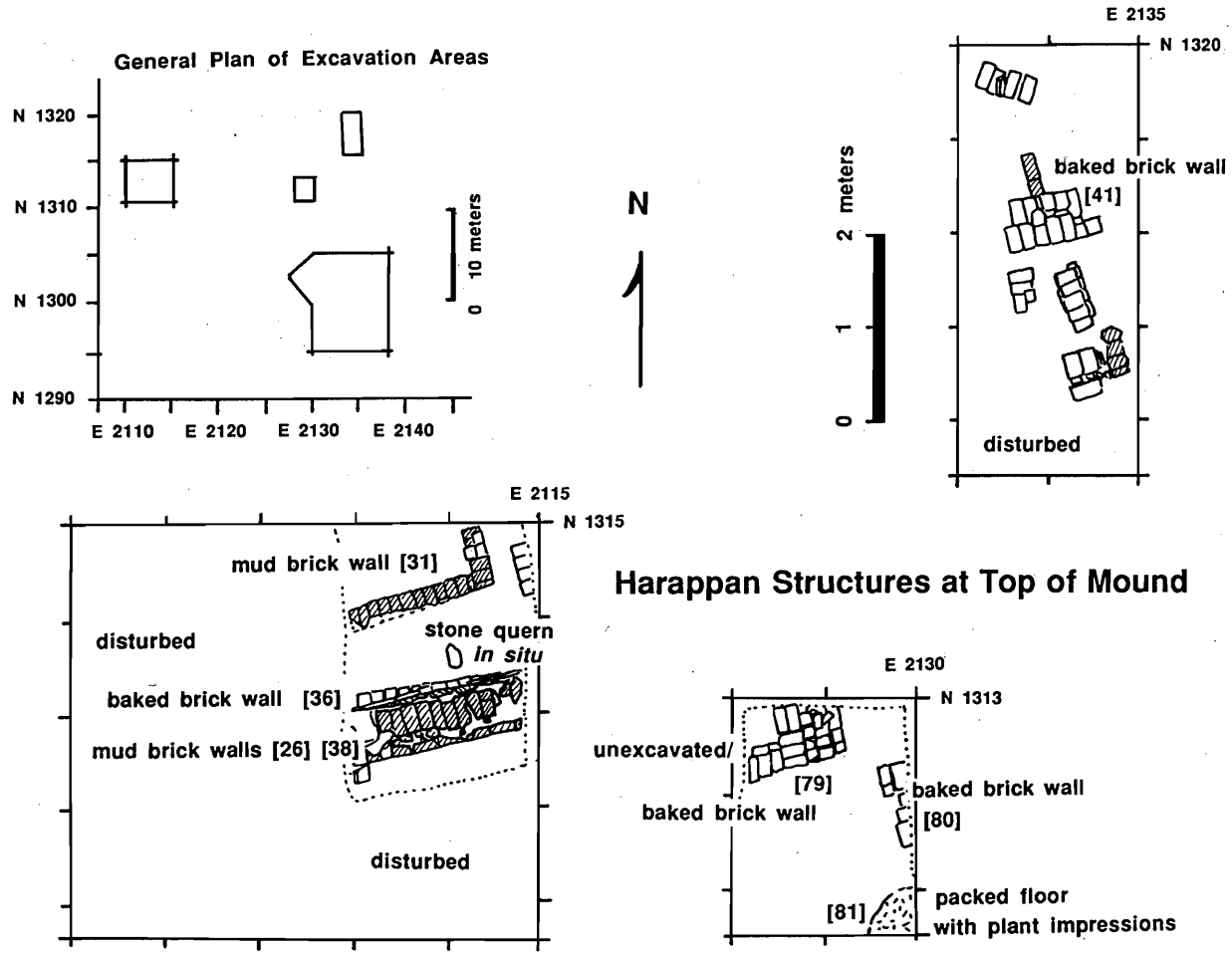

Figure 13.29: Harappa 1988: Mound E, northwestern corner on top of mound: plan of Harappa structures.

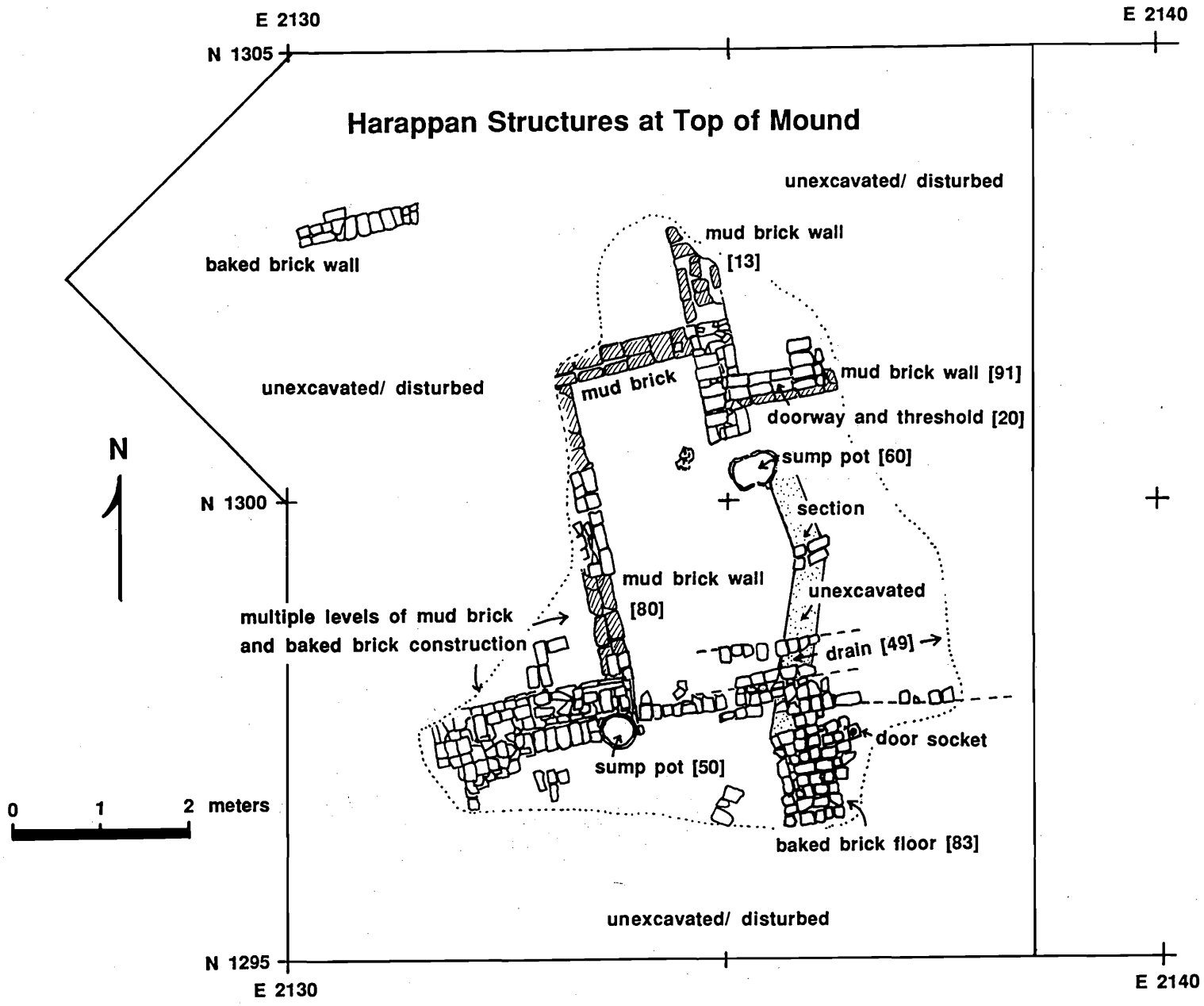

Figure 13.30: Harappa 1988: Mound E, northwestern corner on top of mound: plan of Harappan structures.

The third area of Mound E investigated this season was the southwest slope where earlier surface surveys had noted fired brick walls. Due to limited time and personnel, only one week of excavation was undertaken, but the presence of fragmentary Harappan architecture was confirmed, and a large steatite seal with a bull motif and script (Figure 13.31) was found in the debris covering the Harappan structure. Only six other seals with this motif have been reported from the earlier excavations at Harappa. Excavations along this southern slope will be expanded in future seasons.

4. Collection of Samples for Radiocarbon Dating

During the excavations, special attention was paid to gathering carbon samples from primary contexts for radiocarbon determination. To date, sixty-three samples from good stratified contexts covering the entire range from the Early to the Late or post-Harappan phases have been collected. They will provide the first series of archaeometric dates from Harappa. [*See Chapter 4 in this volume.*]

5. Studies of Specific Artifact Categories

a. Pottery

At Harappa, pottery is the single largest category of artifacts, as it is at all sites of the Indus culture. The Harappan cemetery excavations yielded a splendid collection of complete and/or restorable vessels [*Figures 5.1 and 5.2 in Chapter 5 of this volume*]. During the 1988 season alone, 169 vessels were registered and added to the Reserve Collection of the Harappa Museum. Partial tabulation and classification of the tens of thousands of individual sherds have been accomplished, but their complete study and analysis will require considerably more time. Technological studies of the pottery industry, including manufacturing and firing techniques, decorating procedures, and functional analysis, are being conducted by Rita Wright.

The preliminary study of the burials shows that the number of vessels per grave varies from one or two to as many as fifty. Statistical and distributional studies of the specific types of vessels associated with different varieties of burials are in progress. Several interesting

Figure 13.31: Harappa 1988: Bull seal from southern edge of Mound E.

details, however, have been noted. For example, although the vast majority of the pottery from the burials appears to have been unslipped and unpainted, there have been instances during the excavations when faint traces of applied colors have been detected on the surfaces of vessels but which vanish almost immediately after exposure to the drying effects of the air. Our conservation staff has been working on methods to preserve these fragile traces at least long enough for them to be documented properly. For example, during the third season, certain vessels, especially those in burial excavation Lot 219, were found to be covered with a thick white encrustation that appeared to be original decoration and not just a natural surface deposit. Laboratory tests showed the surface material to be gypsum. These coatings are extremely fragile and subject to dissolution during the vessel desalinization procedure. The procedures were modified to assure better preservation of these delicate surfaces.

The pottery and sherds from the other two excavation areas are providing new information of a very different nature. From the excavations on Mound AB and Mound E, sherds of both the Early Harappan and the Late Harappan (Cemetery H) phases have been collected from stratified contexts. They are being classified and described using the same basic methods used for the "mature" Harappan pottery so that consistent comparisons can be made among the three groups. This will provide an important corpus of new material relating to the questions of the antecedents and descendants of the Harappan phase populations.

b. Figurines

Of the figurines collected and tabulated during the third season, 54% are anthropomorphic and 46% are animal including a few bird forms. About 70% of these figurines came from Mound E. The second highest proportion, about 22%, came from the thick debris deposits covering the cemetery area but not from the graves.

The animal figurines (Figure 13.14) are especially difficult to identify to species. The bodies and legs of most quadruped mammals including non-humped cattle, buffalo, sheep, and even dogs are so stereotyped that they are often identical. It is usually other details such as distinctive horns, or the lack of them, that distinguish specific species. The detailed study of these figurines is being done in conjunction with faunal studies by our zooarchaeologist, Richard Meadow, who is setting up specific criteria for their identification.

The preliminary study of the anthropomorphic figurines (Figure 13.15) indicates that females are far more numerous than males, varying from more than 4 to 1 during the first two seasons to more than 7 to 1 in the 1988 season. The standing female figures are characteristically nude except for a hip belt that hides the pubic area. Elaborate headdresses and necklaces are usually added. It remains to be seen whether the different types of such ornamentations designate different functions for the individual figurines or whether they are simply *ad hoc* stylistic preferences.

The questions of overall significance and function of the figurines remains one of the basic problems. None have been found yet in archaeological contexts that provide clues to their use. However, there are certain varieties of female figures, such as those depicting food preparation and other domestic activities, that suggest mundane functions rather than that of Mother Goddess figures for at least some of the female representations.

Male figurines are depicted as entirely nude with an occasional simple necklace or headband. A few examples are ithyphallic, suggesting a fertility function, but others are in poses that do not appear to be ritualistic. Currently, the study of all the categories of figurines is focusing on the detailed description and analysis of typological and stylistic features and on the manufacturing techniques involved in their production.

c. Other Specialized Crafts

Samples of raw materials and of manufactured objects such as faience bangles and beads, stone beads, stoneware bangles, and metal objects have been collected for laboratory analysis. Manufacturing procedures are being studied in the laboratory, as well as through experiments, to actually replicate the techniques.

B. *Palaeoenvironmental Studies*

1. Palaeozoological Studies

The animal remains, bones and teeth, provide a major body of data for reconstructing the ancient environment and the human response to and use of it. Large quantities of faunal remains have been collected during the first three years of the Harappa project. This season, Richard Meadow continued his analysis, concentrating on samples from the fill overlying the Harappan cemetery. Faunal remains from these levels are plentiful and recovery from the screened sample pits is excellent, but the bones are highly fragmented and thus time-consuming to analyze.

Almost 1800 specimens were recorded. Of those, 231 were used to calculate the percentages of different forms represented in the collection. Some 41 percent come from sheep or goat and 48 percent from cattle or water buffalo, although only two bones of the last were positively identified. Among the 33 caprine bones identified as sheep or goat, 94 percent are from sheep, confirming the observation made on the basis

of last season's analysis that goats appear to be poorly represented at Harappa. Finally, 10 percent of the remains are from wild mammals including large and small deer, nilgai, boar, and blackbuck, and one percent are from dog.

As work continues on the faunal collection from Harappa, material from specific areas of the site will be examined in relation to its archaeological context and compared to that from other areas and other time periods in order to determine if there is variation through space or change through time in the exploitation of different kinds of animals.

2. Pedological and Palaeoclimatic Studies

Amundson and Pendall returned to Harappa to continue their field studies. [*For detailed reports on these studies see Pendall (1989); Pendall and Amundson (1990a, 1990b); and Chapter 3 in this volume.*] Attention this season was directed toward studying the soils and sediments within the site that are associated with excavated areas. Chemical analyses of soil samples and grain size analyses are being used to distinguish natural from archaeological deposits as well as to study the environment of deposition (e.g., whether the sediments were deposited in still or moving water, by wind, or by human action). Samples were collected from stratified profiles, walls, floors, hearths, and mud-bricks in order to permit characterization of these kinds of contexts.

Pendall conducted a soil survey of an eight square kilometer area around the archaeological site and the modern town of Harappa. Auger borings placed at 150 to 200 meter intervals along north-south and east-west transects were described in the field to a depth of 150 to 300 centimeters according to the Soil Survey Manual. Described were: the soil Munsell color, texture, consistency, presence; description of carbonate nodules (*kankar*) or seams of calcite, gypsum, and other soluble salts; and depth to parent material or water table. Soils with similar properties were grouped together as mapping units and classified according to the USDA Soil Taxonomy. A soil map was prepared using a topographic map of 1:50,000 scale as a base [*Figure 3.4 in Chapter 3 of this volume*].

The survey of the natural soil surrounding Harappa shows a dynamic and youthful environment because the meandering of the river Ravi has caused aggradation of the floodplain. The youngest geomorphic surface in the area is the lowest channel north of Harappa city and mound. The next oldest geomorphic unit is loosely termed "Subrecent." The dating of subrecent soils is difficult since no datable materials were recovered. However, judging from relative soil development, this unit can be placed between 500 and less than 7,000 years in age. It is found mainly north and east of the mound, as well as in a band to the south. The oldest surface is late Pleistocene in age and was deposited by the river Ravi when rapid glacial melting and erosion of foothill soils was taking place. Its most noticeable feature is the presence of large and dense calcite nodules (*kankar*) which have formed over time by the downward movement of carbonates. The radiocarbon age of the single sample of inner portions of these calcite nodules so far tested (7080±120 BP—Beta 21520) indicates that the soil reflects environmental conditions which existed prior to Harappan occupation.

These pedogenic carbonate nodules in soil at Harappa were recognized as a potential tool for interpreting environmental conditions prior to human occupation which began some 5,000 years ago. Carbon isotopes in pedogenic carbonate have the potential to be used to identify the vegetation type and density that existed during calcite formation. The basic conclusions of the lab tests are that the carbon isotope ratios of pedogenic carbonate in inner portions of nodules forming at Harappa reflect an arid climate with a very low soil respiration rate and sparsely vegetated conditions in early Holocene times. Whether the past pedogenic environment suggested by this data differs significantly from present natural conditions is not known with certainty and indicates a need for further investigation.

C. *Conservation and Site/Museum Development*

1. Personnel

The conservation laboratory was under the supervision of Donna Strahan who assisted in its original designing and outfitting. She was assisted this season by Harriet (Rae) Beaubien of the Philadelphia Museum of Art and Toseef-ul-Hassan of the Archaeology Conservation Laboratory, Lahore. Wassem Ahmed, Senior Chemist at the Lahore Museum, assisted in the lab for one month.

2. Conservation and Restoration of Excavated Materials

Because of the extreme salt problem at the site, desalinization was again a primary concern. The procedure was essentially that established during the second season, namely the soaking of the artifacts in distilled water for five to ten days or until the salt content was reduced to around 100 parts per million at which point they are deemed safe for storage.

As in the previous year, consolidation of friable terra-cotta objects was achieved with the application of 5% Acryloid B-72 in acetone after the object had air dried. Experiments are ongoing to improve the consolidation techniques. Reconstruction of vessels was

achieved through the use of the adhesive consisting of 50% B-72 in acetone. Losses or cracks were sealed with Acryloid B-72 and filled with plaster of Paris.

A variety of other materials were treated in the laboratory. For example, some of the copper alloy objects contained thread/string pseudomorphs on their surfaces. Mechanical removal of surface dirt was the only treatment performed on these objects. They were stored in air-tight containers with dry silica gel.

A silicone rubber mold was made of the only complete inscribed seal found this season. Baked Fimo molding clay impressions were made of all sealings and inscribed sherds. Assistance was given to the physical anthropologists in consolidating and reconstructing excavated cemetery bones by filling gaps with plaster.

The conservators assisted the museum curator in treating some of the delicate materials on display that required cleaning or repairing. Most in need of attention was the human burial display from the 1966 excavations in Cemetery R37. The intense summer heat had deteriorated the underlying materials supporting the skeleton, and some damage to the bones had resulted. Kennedy and Lovell, working with the conservators, removed the skeleton, replaced the cloth base, cleaned and repaired bones where necessary, and reinstalled the display.

3. Assistance to Site Curator

Two new displays were installed in the museum. The elaborate and unique headdress of microbeads discovered in a female burial during the 1987 season was displayed in a special dust-proof case in the jewelry section of the museum. Special authorization had previously been obtained to export the headdress for microexcavation and conservation by Donna Strahan at the Conservation Analytical Laboratory of the Smithsonian Institution, Washington, DC.

A representative burial from the current excavations was installed in the museum opposite the 1966 burial display. The burial was reconstructed inside a glass case, with a collection of funerary pottery and a complete extended burial laid out in a rough hewn wooden coffin. This represents one of several arrangements of pottery and coffins noted in the excavations. Such new displays with bilingual explanatory labels help visitors understand more about the ancient Harappans and also why the new excavations are being conducted.

D. *Training Program*

1. Pakistani Graduate Students

For the third year, Dr. Javed Husain brought graduate students from the University of Karachi for training. Also, for the second year, four students from Shah Abdul Latif University (Khairpur, Sindh) participated in the program. Rose Drees, of the University of Wisconsin, Madison, served as coordinator for the training program.

2. Conservation and Museum Personnel

For the second year, Toseef-ul-Hassan of the Department of Archaeology's Conservation Laboratory, worked with the Project's conservators in the Harappa field lab. Participating in all aspects of the work, desalinization, cleaning, repairing and restoring of artifacts, he has received practical training and experience in the basic techniques required in a modern field laboratory.

Two officers from Lahore Museum also participated in the laboratory and field training program. Waseem Ahmed working in the laboratory for one month, and Shahbaz Khan worked with J.M. Kenoyer on Mound E excavations as well as on various conservation projects.

Fourth Season: January—March, 1989

Objectives for the Fourth Season

A. *Excavations and Analyses of Scientific Samples*
  1. Mound E
    a. Natural Soil
    b. Early Harappan Levels
    c. Harappan Levels
  2. Mound AB
  3. Collection of Samples for Analyses and Dating
    a. Pottery
    b. Figurines
    c. Copper Artifacts
    d. Stoneware Bangles
    e. Faience
    f. Ground and Chipped Stone Tools
    g. Bead Manufacture
    h. Carbon Samples for Dating

B. *Palaeoenvironmental Studies*
  1. Palaeozoological Studies
  2. Palaeobotanical Studies

C. *Conservation*

D. *Training Program*
  1. Pakistani Graduate Students
  2. Conservation and Museum Personnel

Description of Work Accomplished

A. *Excavations and Analyses of Scientific Samples*
  1. Mound E
    a. Natural Soil

The natural soil on which the earliest settlement was situated consists of a yellowish-brown silty sand that appears to represent river deposits, presumably of the ancient river Ravi. The height of the natural soil on which the settlement was established is 162.60 AMSL. This is 1.6 meters higher than the traces of the natural soil that were found in excavations between Mound E and Mound AB as well as to the south in the cemetery and in test pits west of Mound AB (300 meters in both direction). Although this elevation may result from the removal of natural sediments in the surrounding areas by human activity or later erosion, it is also possible that it represents a higher elevation on the ancient plain that was considered optimal for establishing the early settlement. Sedimentological studies done by Elise Pendall have also concluded that the site was situated on an elevated natural surface.

b. Early Harappan Levels

We have decided to use the term Early Harappan in a very general sense. At this time we do not know precisely how the culture and technology of these earlier inhabitants of Harappa contributed to, or resulted in, the later fully urban society of the Harappan phase. It was undoubtedly a very complex process of transition with some continuities and many discontinuities. Only after the final analysis of the artifacts and architecture will we be able to define more clearly what is meant by Early Harappan, Harappan, and Late Harappan.

The earliest cultural levels of the site can be attributed to the Early Harappan phase as defined by Mughal (1970, 1974). This interpretation is based on the preliminary observations of ceramics that are identical to examples reported from the Early Harappan levels at Kot Diji (Khan 1965), Jalilpur (Mughal 1972, 1974), and Rehman Dheri (Durrani 1988). In addition to ceramics, we have found grey fired bangles, stone blades made from a dark grayish chert, a stone celt, stone beads, and human figurines of a type that is not found in the following "mature" Harappan phase (Figure 13.32). Certain categories of artifacts found in these Early levels do, however, continue into the later "mature" Harappan phase. These artifacts include specific ceramic types, figurines, triangular terra-cotta cakes, terra-cotta toys and red fired bangles. The detailed study of these artifacts will hopefully clarify some of the questions about change and continuity between the Early and the "mature" Harappan phases.

We have located primary occupation levels of the Early Harappan phase all along the northwestern edge of Mound E, and in the section we have mapped Early Harappan deposits that form a mound that is 2.5 to 3 meters high at its exposed western edge (Figures 13.33, 13.34, and 13.35). The types of deposits include hearths, accumulations of domestic debris, and traces of mud-brick walls. One wall, associated with a small kiln, is made from small mud-bricks (7 × 12 × 34 cm), while another larger wall at the northwestern perimeter of the site is made of bricks that are much larger (10 × 20 × 40). These walls are only partially exposed, but the orientation is northwest to southwest at an angle of approximately 10° west of true north.

One exciting discovery in the Early Harappan levels is a small circular kiln, 50 × 60 cm in diameter and approximately 40 cm high. This kiln has a unique firing structure made by placing the upper half of a large pot in the center of the kiln. This vessel and another large pot found inside the kiln are both Early Harappan vessel types. The fuel appears to have been placed on the outside of the broken pot as well as on the inside. However, the interior of the pot is vitrified and reduced while the exterior is oxidized. This suggests that the objects being fired may have been placed inside the pot for a high temperature reduction that would have resulted in dark grey or black color.

In our excavations, we have discovered at least five and possibly six different walls that are made of large mud-bricks (10 × 20 × 40 cm) and are associated with Early Harappan ceramics. Two of these walls are quite eroded and are sealed by Early Harappan deposits, while the other three or four were built on the natural soil or by cutting foundation trenches into Early Harappan deposits.

The most complete wall (Feature #[164]) extends north-south for over 15 meters (Figure 13.33). It is two meters wide and stands approximately two meters high (Figure 13.35). A possible corner of this wall has been identified but the eastern extension has been completely obliterated by later construction. A second wall (Feature #[235]) was built after this wall #[164]. It is 2.5 meters wide and has a well defined corner and eastern extension that continues for about four meters. Both of these walls (#[164] and #[235]) are made from mud-bricks that have several distinct colors of clay. These different colors represent different source areas for the clay, and one can hypothesize that the bricks were prepared in different areas around Harappa and brought to the site for construction of these massive walls. The precise function of the walls is not clear, but since the exterior face is invariably eroded and the interior face is not eroded, they may have functioned as retaining or revetment walls. They could have served to protect the edge of the mound from floods or erosion as well as presenting a formidable elevation to discourage unwanted intruders.

These walls represent a fairly massive scale of architecture, and it is not likely that this scale of construction would have been undertaken on an individual basis; rather it may reflect some form of Early

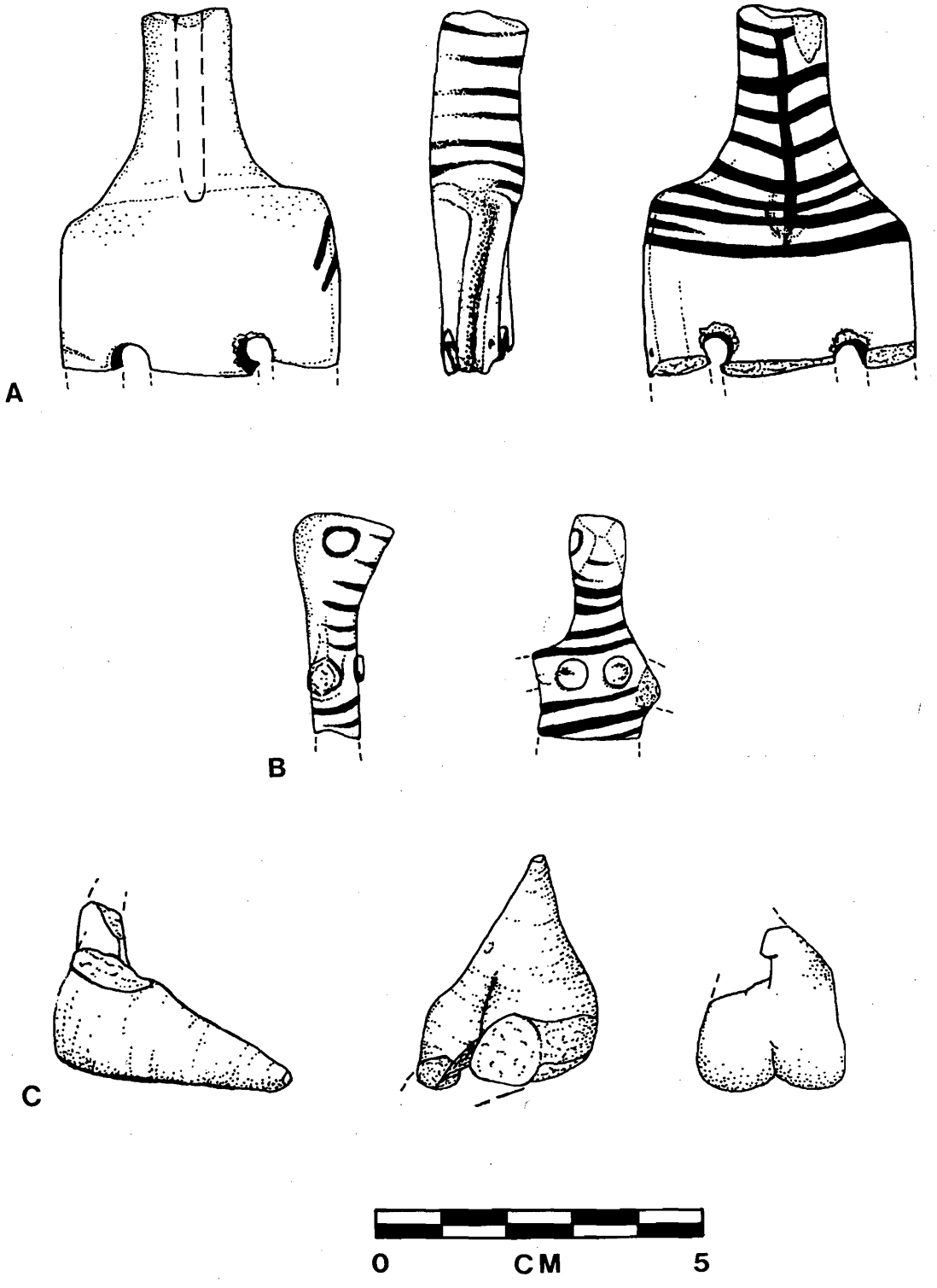

Figure 13.32: Harappa 1988: Early Harappan phase figurines from excavations in north-western corner of Mound E.

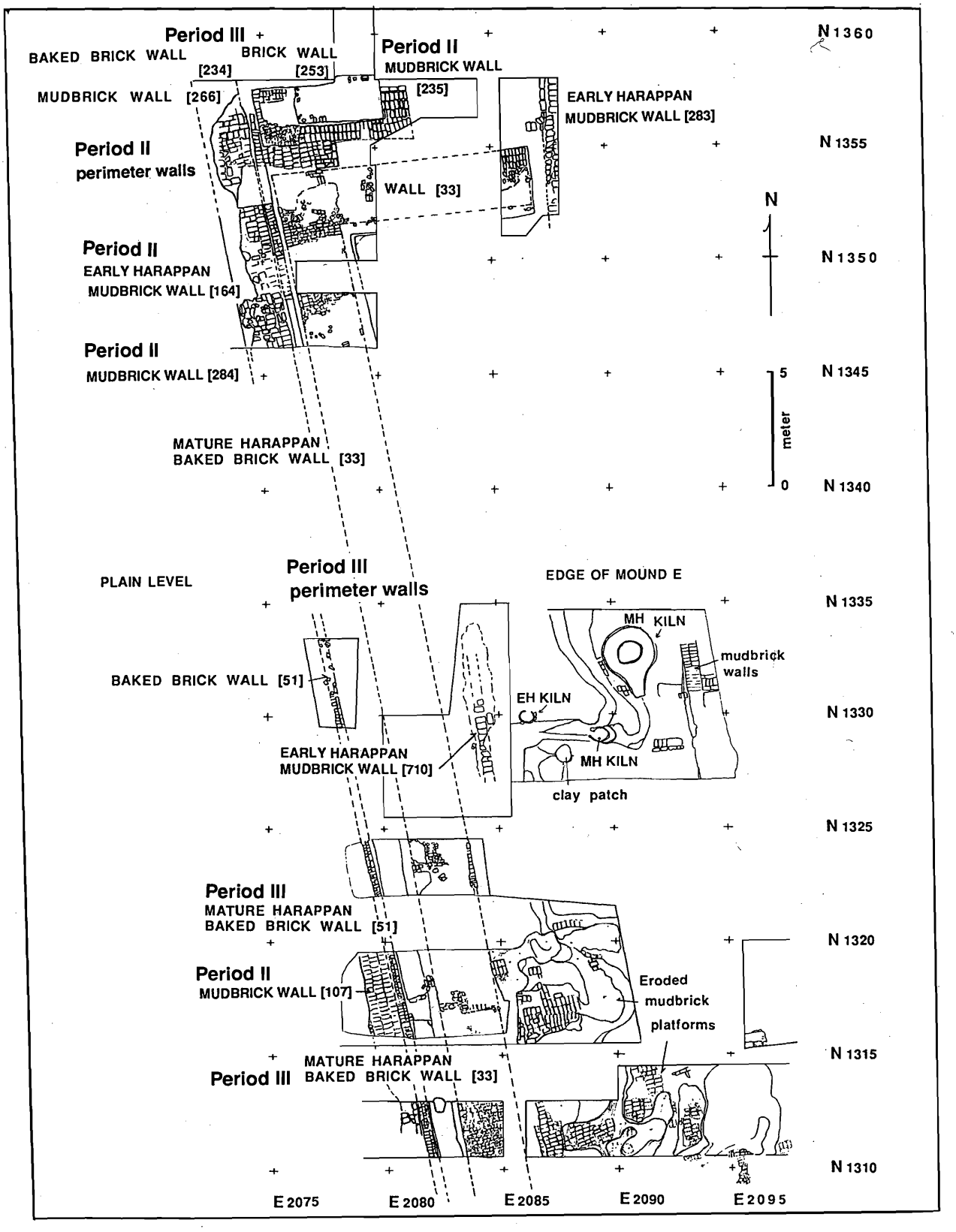

Figure 13.33: Harappa 1989: Mound E, northwestern corner: plan of Early Harappan and Harappan phase architecture.

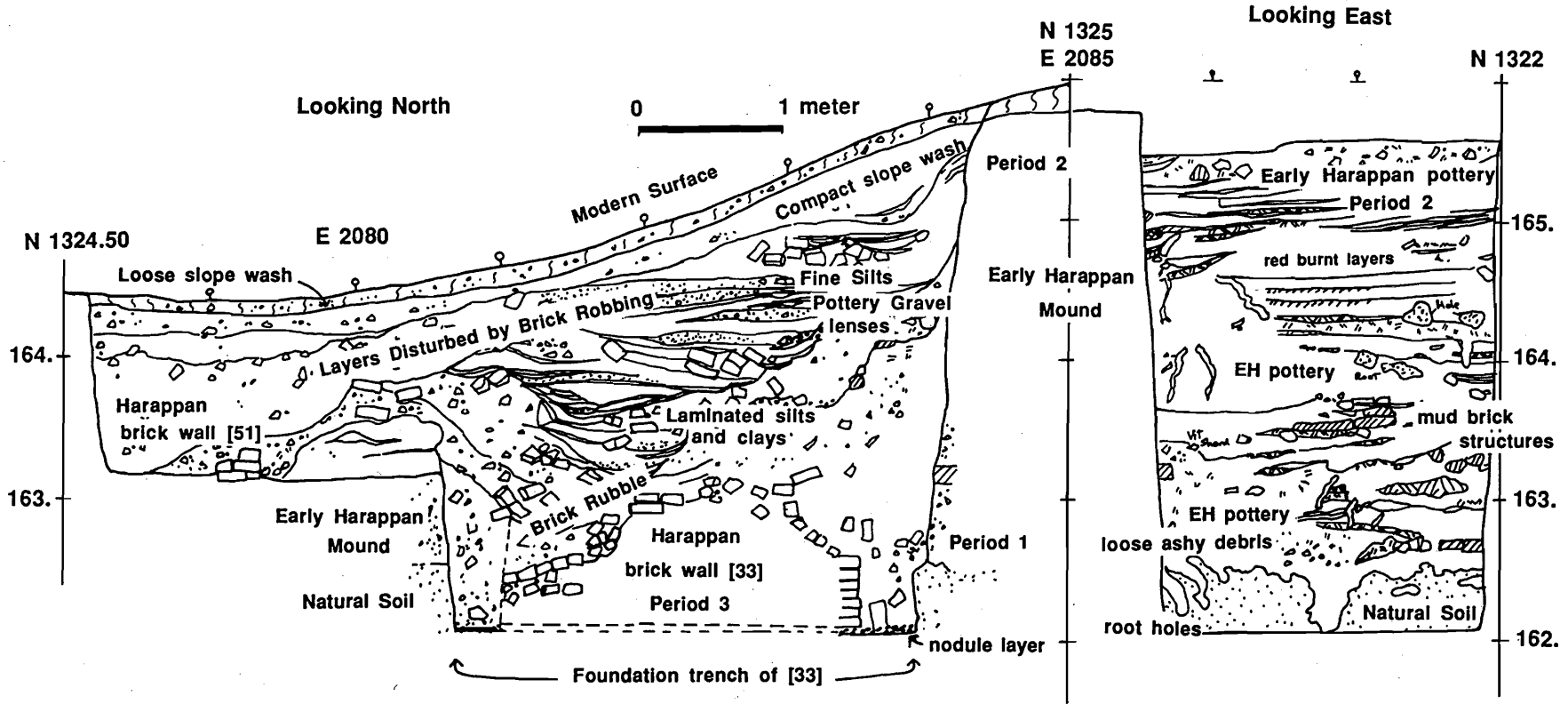

Figure 13.34: Harappa 1989: Mound E, northwestern corner: section through Harappan phase deposits and Early Harappan mound, facing north and east.

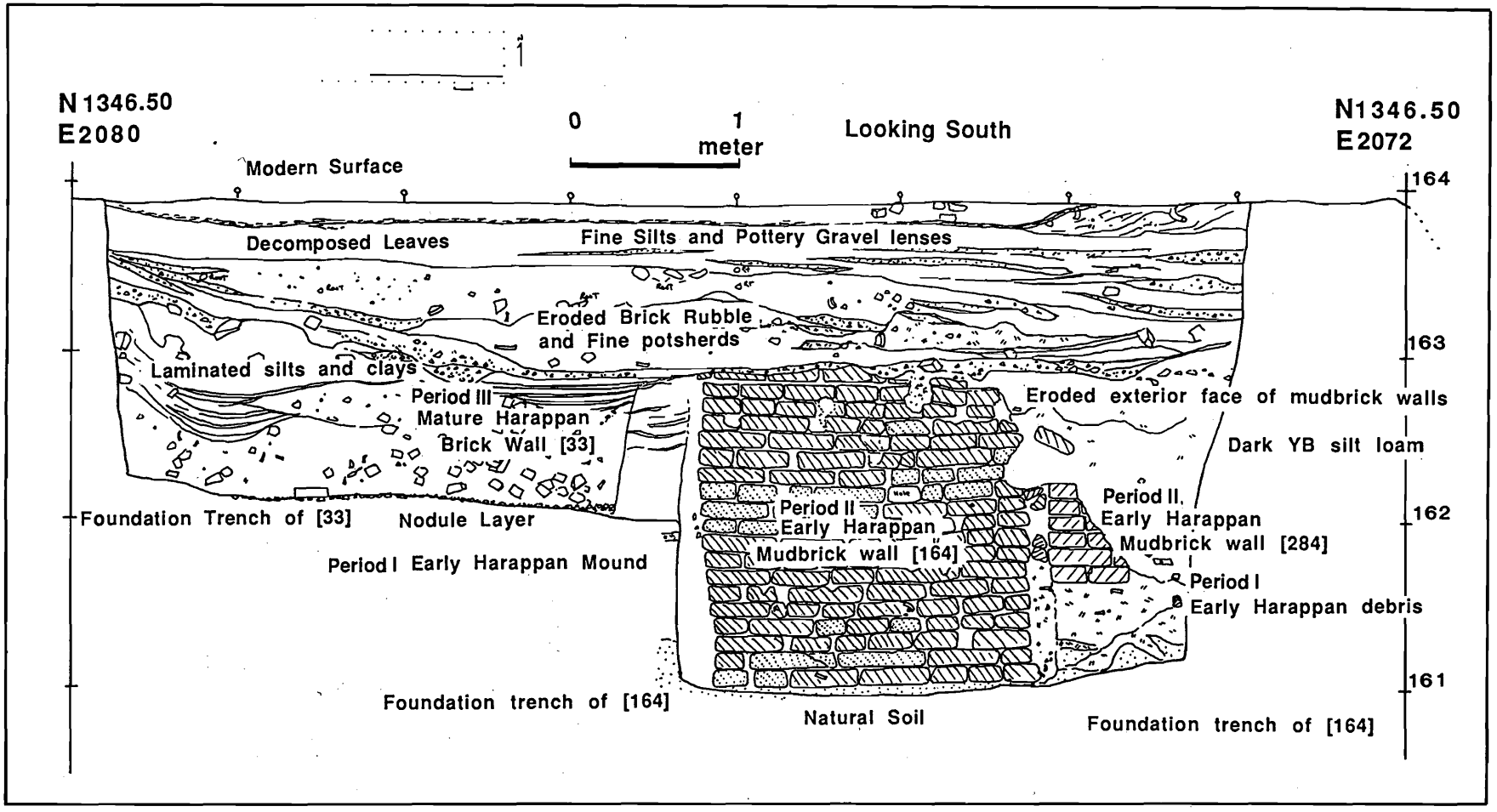

Figure 13.35: Harappa 1989: Mound E, northwestern corner: section through perimeter walls, facing south.

Harappan social organization with the ability to mobilize and control the production of large quantities of mud-bricks as well as the labor involved in the construction of the walls.

c. Harappan Levels

Excavations on Mound E uncovered a relatively thin wall of baked brick (Feature #[51]) that is approximately 45 to 50 cm wide and has now been traced for over 35 meters (Figure 13.33). It has been rebuilt at least three times and the exterior edge is heavily eroded, while the interior face is still intact. This pattern suggests that it may have functioned as a retaining rather than a free-standing wall. Evidently it did not do its job well, because the Harappans later built a larger and more massive structure, wall (Feature) #[33]. They did this by cutting through the thin wall and digging a large foundation trench that essentially shaved off the edge of the Early Harappan and "mature" Harappan mound to a height of 3.5 to 4 meters (Figure 13.34). The foundation trench cut through the Early Harappan layers and down into natural soil. Before building the wall the architects laid a thin layer of overfired nodules along the entire length of the trench, and it is interesting to note that the level of the bottom of the wall has only a 2 cm variation along its entire exposed length (45 meters).

The brick sizes in wall #[33] are generally 7.5 × 16 × 34 cm which is the same size as the mud-bricks used during the Harappan phase. The wall is 2.5 meters wide, with brick bonding the same as in the earlier mud-brick platforms. It is aligned in the same orientation as the Early Harappan mud-brick walls (10° west of true north) and even has the same corner angle (83°). The eastern extension is nine meters long and ends abruptly with no evidence for a gateway or entrance. In one area we have been able to reconstruct a height of 3 meters, but the actual wall is preserved to only 1.3 meters. Although the exterior face is battered at a very small angle of 5°, the angle of the foundation trench on the interior edge of the wall suggests that it was constructed with a more pronounced batter and rested against the face of the mound. On the basis of the present excavations there is no indication that this wall was free standing. Therefore it too seems to have functioned as a revetment or retaining wall, indeed a very massive one.

Just east of the Early Harappan kiln, described above, a small kiln of the Harappan phase was discovered (Figure 13.33). The small Harappan kiln is structurally different from the Early Harappan kiln in that it is tear-drop shaped and has a definite opening to the west for air and possibly fuel (80 × 75 × 30 cm deep). A preliminary interpretation is that this kiln was used as a pit-kiln that was plastered to form a domed covering, presumably with vent holes. After each firing the structure was broken open and then rebuilt. One interesting feature in the mouth of the kiln is the concentration of numerous low fired triangular terra-cotta cakes and *mushtikas* (potato shaped clay lumps with finger impressions). Their presence at the mouth of the kiln could be explained as a method for allowing air into the kiln and at the same time effectively sealing in the heat. Traditional potters in Pakistan place old pots or stones at the mouth of similar kilns for this particular purpose.

The small Harappan kiln is covered by more strata containing kiln wasters and ash, indicating further ceramic production in this area of the site. Again this hypothesis is confirmed by the presence of the slightly later, but much larger kiln just to the north that was partially excavated during the 1988 season (Figure 13.28). This larger kiln measures almost 2 meters east-west and 3 meters north-south. It is tear-drop shaped with an extended opening to the south for air or fuel. The precise construction and operation of this kiln is under study.

Large quantities of vitrified pottery were found around the kiln and in eroded strata on the slopes. In layers associated with its use was found a chuck-mould for making the base of large storage jars and a wide range of "mature" Harappan pottery that may have been produced in the kiln. These types include dish-on-stand, medium-to-large painted pots and jars, perforated vessels, and medium-to-large plain wares, but no evidence for the production of pointed base goblets or smaller plain wares. In these levels we also found fragments of hematite used for making pigments, bone spatulas and worn stone blades for trimming, and patches of fine clay that may represent the areas where potters were mixing or wedging the clay. [*See also Chapter 6 in this volume.*]

2. Mound AB

Although excavations were resumed inside the Harappan well (Figure 13.21), the operation was halted for safety reasons after clearing only 75 cm below the previous season's levels. The cracks and bulging in the lower exposed wall were more pronounced than they were in the third season, so a substantial concrete cap was put on top to preserve the well as it is and for possible future investigations.

During the previous season, large quantities of Late Harappan (Cemetery H) sherds and mud-bricks that are not of the standard Harappan phase size were observed along the crest of the western side of the gully. This evidence suggested that that some Late Harappan architecture had escaped the 19th century brick robbers.

One north-south trench was opened along the crest and three smaller east-west trenches were extended over the crest of the gully. The results of these excavations show that most of the deposits on this part of Mound AB are disturbed debris layers resulting from brick robbers' activities and natural erosion. In the east-west trenches, the level of Harappan structures was reached, which included baked brick walls, possible drain fragments, and a hearth. There was no evidence for habitation levels of the Late Harappan phase, and it is assumed that this area of the site has been completely destroyed by historical period brick robbing and natural erosion. Several historical period burials were encountered in the north-south trench. These burials were left *in situ*, re-covered, and excavation was not continued in these areas.

Two test trenches were excavated on the plain level between Mound AB and Mound E. In both trenches natural soil was reached at approximately 161.07 meters AMSL. In the upper levels of these trenches historical period structures using Harappan phase bricks were identified. Below these late structures the strata were comprised of pits and debris dumps filled with Late Harappan or Harappan pottery. In one level it appears that there was a paving of crushed brick and pottery that may have been a roadway of the Harappan phase. The lowest level of silty wash above the natural grey soil contained small fragments of Early Harappan pottery and grey bangle fragments.

3. Collection of Samples for Analysis and Dating

a. Pottery

Several members of the staff worked with the pottery this season: Dales, assisted by graduate student Paul Christy Jenkins focused on the typological classification system; Rita Wright and J. Mark Kenoyer were concerned with the technological aspects of the raw materials and the manufacturing and firing procedures; and Rose Drees studied the Cemetery H pottery. Archaeometric analysis of the pottery is being conducted by Rita Wright in order to define continuities and/or discontinuities between the Early Harappan and Harappan phases. Her studies involve characterization of the raw materials used in the preparation of the clays, the slips and paints, and the temperatures used to fire the ceramics. Complemen-tary studies involving petrographic analyses of the ceramics are being conducted at the University of Wisconsin, Madison.

The initial documentation of the Harappa pottery was based on the classification of the Mohenjo-daro pottery published by Dales and Kenoyer (1986) (Figure 13.36). As we anticipated, differences immediately became apparent between the pottery of the two sites, and the classification system is being modified to accommodate them.

The revised Harappa classification system is superior to that used at Mohenjo-daro because it is based almost exclusively on complete vessels rather than the incomplete forms and sherds available for the Mohenjo-daro study. In addition to the newly excavated vessels, there is an enormous reserve collection of complete vessels in the museum storeroom from earlier excavations. Dales and Jenkins are developing a handbook of basic pottery forms and their variations. The technical and artistic characteristics of each form category will be added. With this handbook it will be possible, in most instances, to identify pottery categories from sherds so that more accurate distribution studies can be made of specific pottery types. [*See also Chapter 5 in this volume.*]

Rose Drees began cataloging the newly collected Late Harappan, Cemetery H pottery. She obtained permission to study some of the complete vessels from Vats's 1927-28 cemetery excavations that are stored in the site museum. Vats published only a limited number of the complete vessels and even for those, the drawings and photographs are so small as to be almost useless (Vats 1940).

b. Figurines

More than 550 non-anthropoid figurines were collected during the fourth season. In conjunction with the expedition's zooarchaeologist, we are developing a multi-variant coding system for these figurines. The correlation tests are not complete but the preliminary study suggests the following breakdown:

Animal Type	#	%
Quadruped Mammals*	133	24.5
Horned Quadrupeds*	88	16.2
Cattle	164	30.3
Water Buffalo	58	10.7
Rhinoceros	34	6.3
Sheep/Goat	15	2.8
Other**	50	9.2

*Not more specifically identified

**Dog, Cat, Primate, Bird, Turtle, Elephant, Unicorn

These figures suggest that cattle outnumber sheep/goat by 10 to 1; cattle outnumber water buffalo by 3 to 1; and cattle outnumber rhinos 5 to 1. Of the 164 identifiable cattle, *Bos indicus* outnumber other types of cattle by 2 to 1.

After refining the identifications of these figurines, comparisons will be made with the ratios of species known at Harappa from the actual faunal remains to see what, if any, meaningful relationships there are

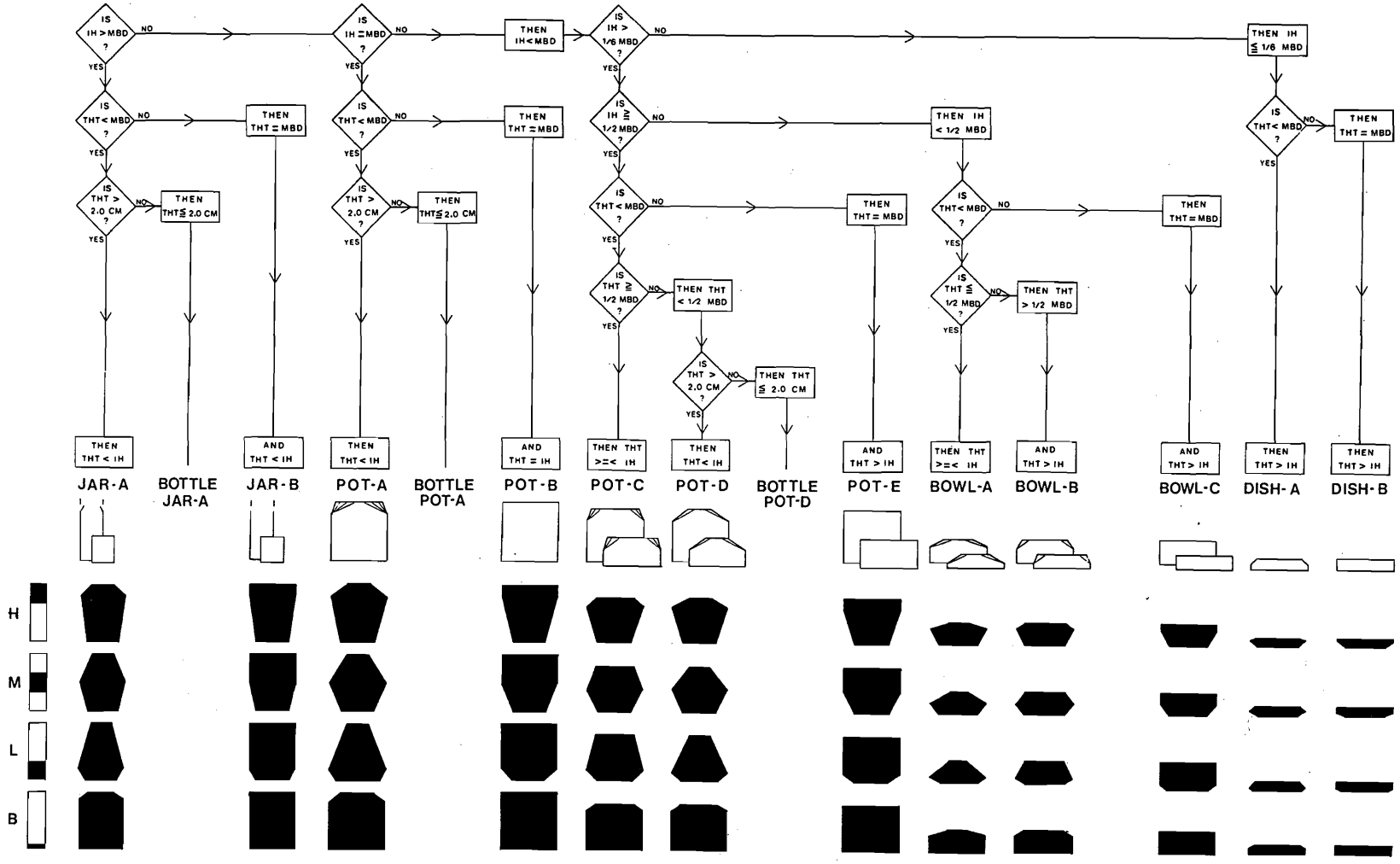

Figure 13.36: Flow chart of vessel forms created for classification of Mohenjo-daró ceramics (Dales and Kenoyer 1986).

between figurines and animals actually exploited by the Harappans.

During this season, 58 anthropoid figurines were recorded, making a total of 615 for the four years of excavations. Determining the function of anthropoid figurines is always difficult, especially when no contemporaneous, written records exist that might give clues to religious, apotropaic, or other specific functions. Given that no temples or household shrines have been identified at Indus sites, one can only speculate as to a religious significance for the figurines. What can and is being done is to make a detailed attribute analysis of the sex, body postures, gestures, facial representations, ornamentations, and headdresses. When the distributional and multivariate studies are completed, it is anticipated that some functional patterns will become apparent.

c. Copper artifacts

Samples from copper artifacts are being analyzed at MASCA (University Museum, Philadelphia) by Vincent Pigott and Elizabeth Reistroffer. They are studying the elemental composition and microstructural features of the samples and the technology involved in the production of each specific object.

d. Stoneware bangles

The remarkable stoneware bangles are being studied by Massimo Vidale and M. J. Blackman at the Smithsonian's Conservation Analytic Laboratory. [*See Blackman and Vidale (1992).*] In order to reconstruct the manufacturing processes of the bangles, specimens from Harappa have been compared with the bangles of Mohenjo-daro. This combined data set has allowed us to record the micro-morphological features of a substantial group of specimens. In addition to the study of the ancient bangles, J.M. Kenoyer and M. Vidale have been involved in the replication of stoneware bangles to better understand the technology and production stages.

The analysis of the chemical composition of the clays used at Harappa reveals that they can be distinguished from the clays used for the production of bangles at Mohenjo-daro. Approximately 100 samples of stoneware bangles and related ceramic artifacts from Mohenjo-daro and the preliminary series of samples from Harappa (including samples of clays used by modern potters at Harappa city) were analyzed through instrumental neutron activation analysis at the reactor facilities of the National Institute of Technology and Standards, Gaithersburg, MD. This analysis revealed that the clays used at Mohenjo-daro appear to be fairly homogeneous, while the Harappa samples show a range of clay types that fall into two major categories: bangles made from clay that is chemically similar to clays found in the region today, and bangles that are chemically identical to the bangles produced at Mohenjo-daro. This evidence suggests that some of the stoneware bangles were probably made in Mohenjo-daro and carried to Harappa, either intentionally by traders or unintentionally through the movement of people wearing the bangles. This is the first time such information has been available, and it is extremely important for our analysis of intersite movement of specialized ceramic commodities. The chemical and spatial analysis of additional samples from Harappa will help us to understand the role of stoneware bangles in Harappan society. [*See also Chapter 5 in this volume.*]

e. Faience

Research on faience production at Harappa is being undertaken by Pamela Vandiver and Blithe McCarthy at Smithsonian's CAL. [*See McCarthy and Vandiver (1990) and Chapter 5 in this volume.*] Various archaeometric techniques are being used to determine the composition, firing temperatures, colorants, and forming processes of the different types of faience objects. Experimental faience produced by Kenoyer and also by McCarthy are being utilized in comparison with the archaeological materials from Harappa.

f. Ground and Chipped Stone Tools

Another area of archaeometric analysis that is being conducted at Harappa is the study of raw materials used to manufacture pecked, ground, and chipped stone implements and tools. The various stones used for making these objects were acquired from distant sources in the hills of the Potwar Plateau, Baluchistan, Rohri, Sindh Kohistan, and even as far away as Jaisalmer, Rajasthan. A comprehensive sample of raw materials from Harappa have been collected for characterization and comparative analysis with rock samples from known source areas. These samples are being studied by J.M. Kenoyer and Jim Burton at University of Wisconsin, Madison, using X-ray defraction and electron microprobe. At the present 10 samples have been analyzed and 30 additional samples are in the process of analysis.

g. Bead Manufacture

Harappa has produced a wide variety of stone beads made from a range of raw materials. None of these materials are available in the alluvial plains. All of the stone beads, therefore, represent trade contacts with regions where the raw materials were available. As most of these regions were within the domain of the Harappa culture, we hypothesize that their distribution reflects internal trade networks. Some of the raw materials—for example, carnelian, banded agate,

and amazonite—occur in Gujurat, India. Lapis lazuli was probably obtained from the Chagai Hills in Baluchistan or from the mines in Badakshan, Afghanistan. Various colors of steatite could have come from Baluchistan or from Rajasthan. Variegated jaspers and limestones could have been acquired in the Kohistan or Baluchistan region as well as from Rajasthan, Kathiawar, Kutch, or Saurashtra. The identification of specific source areas is being done through the collecting of modern samples of raw materials for comparative studies using petrographic characterization and trace element analysis.

Studies of bead manufacturing techniques are also being conducted by J.M. Kenoyer. Some of the raw materials are microcrystalline silicates and can be easily flaked, while other crystalline materials were fashioned by grooving and splitting, sawing, or simply grinding. One of the most important manufacturing stages is the drilling of the beads. Every excavated bead is being studied to determine the type of drilling technique used. Silicone impressions of the drill holes are made and these casts are being studied by Kenoyer and Jim Burton under the Scanning Electron Microscope at the University of Wisconsin, Madison.

h. Carbon Samples for Dating

This season we continued to collect carbon samples from primary context deposits ranging from the earliest to the latest levels of Mound E. To date, 20 samples have been submitted for dating. [*See Chapter 4 in this volume.*]

B. *Palaeoenvironmental Studies*

1. Palaeozoological Studies

It is clear from the analysis by Richard Meadow of the collection of animal bones excavated during the 1986 season on Mound AB, that wild animals including deer, blackbuck and gazelle, fish, turtles, and birds were important to at least part of the population during the "mature" Harappan phase. This hypothesis requires confirmation from other parts of the site since the use of different animals for food may have varied through the ancient city according to what sections of the population had access to different animal resources.

With the discovery of extensive Early Harappan deposits at Mound E, we can also address the question whether the exploitation of animals changed during the transitional period that saw the development of the full urban period.

During the fourth season, all the previously excavated faunal materials were cleaned for analysis. A number of samples from Mound E were examined and documented and other materials from that area were selected for export to the Peabody Museum, Harvard University, for study.

There are often difficulties in differentiating some of the skeletal parts of water buffalo and cattle and of humped and non-humped cattle, as well as other forms of large bovines. As a result, Meadow and James Knight made a collection of bones of recently deceased animals from modern 'bone-pits' located outside of Harappa town. Specimens from 43 animals were collected and prepared by simmering in laundry detergent. These include bones of water buffalo, zebu cattle, horse, donkey, and mule. A complete collection of these modern specimens is stored at Harappa to assist future researchers who may wish to study faunal material from other archaeological sites in Pakistan.

2. Palaeobotanical Studies

The palaeobotanical materials collected this season, mainly by using flotation techniques, include a large percentage of carbonized seeds. Botanical samples were taken to the University of Wisconsin, Madison, for cleaning and identification by Heather Miller and Seetha Reddy. Steve Weber of the University of Pennsylvania has also assisted in the identifications and analyses. These and future collections will provide the first systematically recovered plant assemblage from a large, urban period Harappan site.

A wide range of of plants has been identified from samples collected on Mound E, spanning the Early Harappan and Harappan phases. The remains examined to date are primarily winter grain crops of wheat and barley, together with a fine collection of legumes. Also, there are remains of wild seeds, including many "weedy" types, and seeds of various small, wild grasses. In addition to the carbonized seeds, we have collected numerous impressions of grasses and seeds that were found in the packed clay and silt floors of structures and in mud-bricks.

Carbonized wood samples, including those found around the kiln area, have been collected and sent to Stéphanie Thiébalt (Laboratoire de Paléobotanique, Montpellier, France) for identification.

C. *Conservation*

The field laboratory was supervised this season by Harriet Beaubien of the Smithsonian's Conservation Analytical Laboratory. She was assisted again by Toseef-ul Hasan of the Department of Archaeology's laboratory in Lahore Fort as well as by Barbara Dales and Dawn Morton.

Desalinizing, cleaning, and restoring excavated materials occupied most of the time of the conservation personnel. Also, the staff continued to work with the site curator in specific matters relating to conservation of museum artifacts.

D. *Training Program*

1. Pakistani Graduate Students

Eight graduate students from the University of the Punjab, Lahore, participated in a one month field training program.

2. Conservation and Museum Personnel

Toseef-ul-Hassan worked for the third time in the conservation laboratory. Tariq Masud, Lahore Museum, received training and practical experience in various aspects of field excavation and specialized training in matters relating to the conservation of artifacts.

Fifth Season: January—March, 1990

New Terminology

Through the analysis of the data collected from the 1986-1989 excavation seasons, we have decided to use a preliminary chronology consisting of five distinct periods specific for the site of Harappa. These periods consist of Period 1 (Early Harappan), Period 2 (Transitional), Period 3 ({"mature"} Harappan), Period 4 (Harappan/Late Harappan Transition) and Period 5 (Late Harappan/Cemetery H). We expect to use these Period numbers throughout subsequent preliminary reports.

Objectives for the Fifth Season

A. *Excavations*
   1. Northwestern Corner of Mound E
   2. Southern Slope of Mound E

B. *Analyses of Specific Categories of Artifacts*
   1. Pottery
   2. Figurines
   3. Inscriptions
   4. Miscellaneous

C. *Palaeoenvironmental Studies*
   1. Palaeozoological Studies
   2. Palaeobotanical Studies

D. *Conservation*

E. *Training Program*
   1. Pakistani Graduate Students
   2. Illustrators

Description of Work Accomplished

A. *Excavations*

1. Northwestern Corner of Mound E

In the fifth season, excavations at the northwestern corner of Mound E were expanded to obtain more information on the transition from the pre-urban to the full-urban periods (Figure 13.37). Three adjacent trenches were excavated, covering an area of approximately 15 × 15 meters. The Period 1 and 2 levels were accessible in an area of 10 × 2 meters along the edge of the mound. In this narrow area, we exposed habitation debris associated with mud-brick walls. Two different structures with sets of parallel east-west walls were mapped. The bricks of these Period 1 and 2 walls measure approximately 10 × 20 × 40 cm. While the Period 1 and 2 bricks are larger than Period 3 bricks, their dimensions are in the same ratio. Although the excavated area is limited, these walls indicate the presence of rooms or houses of the Early Harappan (Period 1 or 2) occupation that have the same cardinal orientation as subsequent Period 3 structures.

In addition, during the 1990 season, in a 5 × 5 meter area near the Period 1 exposures just described, we removed approximately three meters of Period 2 and 3 deposits. In future seasons, this excavation will facilitate horizontal exposures of Period 1 domestic structures. The transition layers in this area are dominated by ceramic production debris, hearths, and large quantities of carbonized grains and other plant remains.

The fact that all of the strata in the 5 × 5 meter excavation area are deposited horizontally suggests that during Periods 1 and 2 there was a substantial retaining wall at the edge of the slope or that the mound extended much farther to the west. Although evidence of a Period 1 and 2 wall has not been discovered, previous excavations at the edge of the mound have demonstrated that, during Period 3, a large retaining wall, two meters wide and over three meters high, was constructed at the edge of the mound. It is possible that during the preceding transitional period, in the position of the currently visible Period 3 retaining wall, there may have been an earlier mud-brick revetment wall or platform that has not survived.

Overall, the area appears to have been continually occupied without a major hiatus. Within this continuous sequence, however, change was observed in the composition of deposits (Figure 13.38). Superimposed on the thin, multiple horizontal deposits are thick, massive layers containing baked brick fragments and red brick dust. The introduction of baked brick architecture is one of the defining characteristics of Period 3. The alteration in deposition, however, may reflect a change in the range of activities conducted in the area. Further analysis of the artifacts collected from these well-stratified deposits will offer fresh clues to the evolution of Period 3, Harappan, culture from its Period 1 and 2, Early Harappan, roots.

2. Southern Slope of Mound E

During the 1990 season, six separate but closely related excavation areas were opened along a large

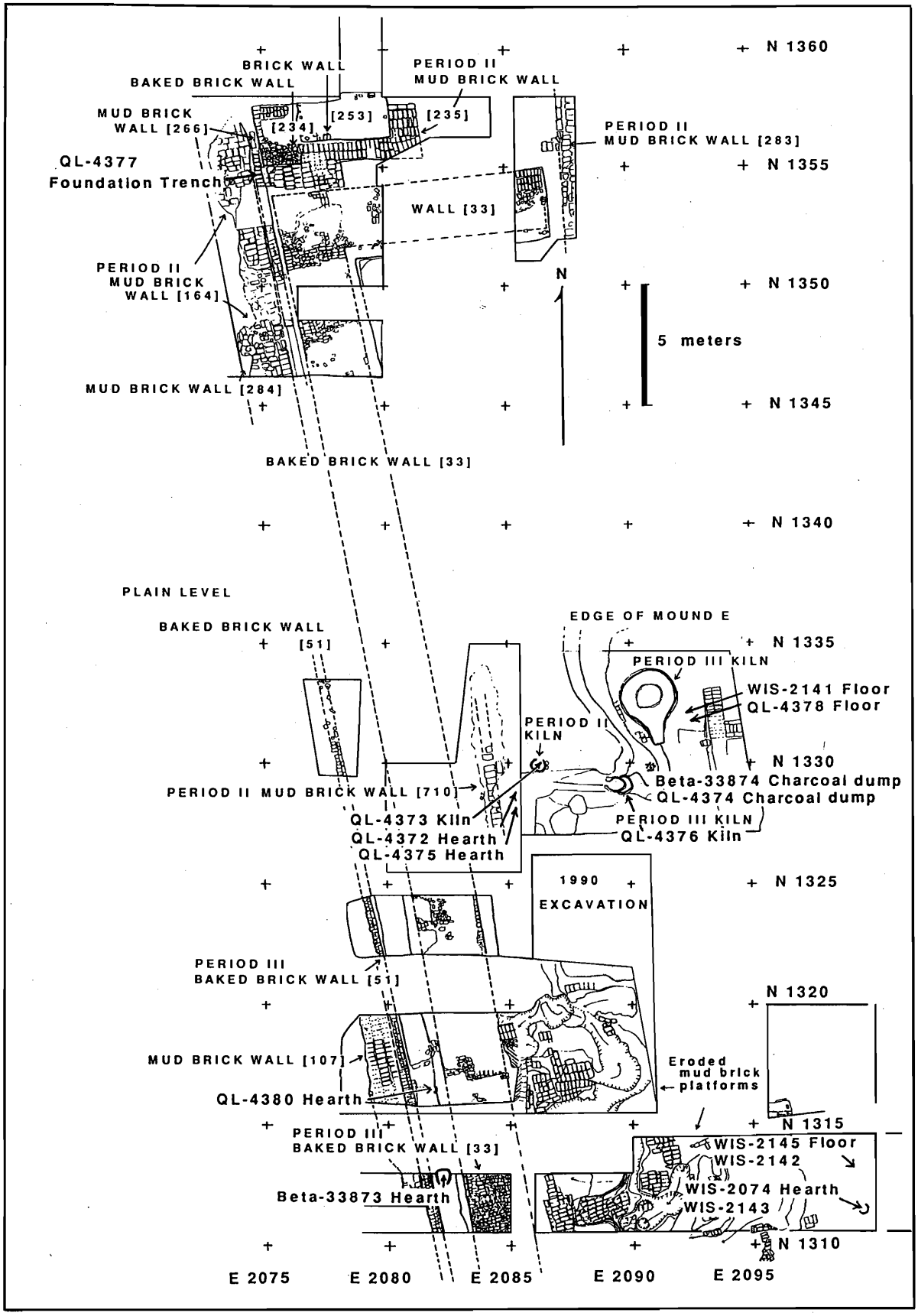

Figure 13.37: Harappa 1990: Mound E, northwestern corner: plan of Early Harappan and Harappan phase architecture.

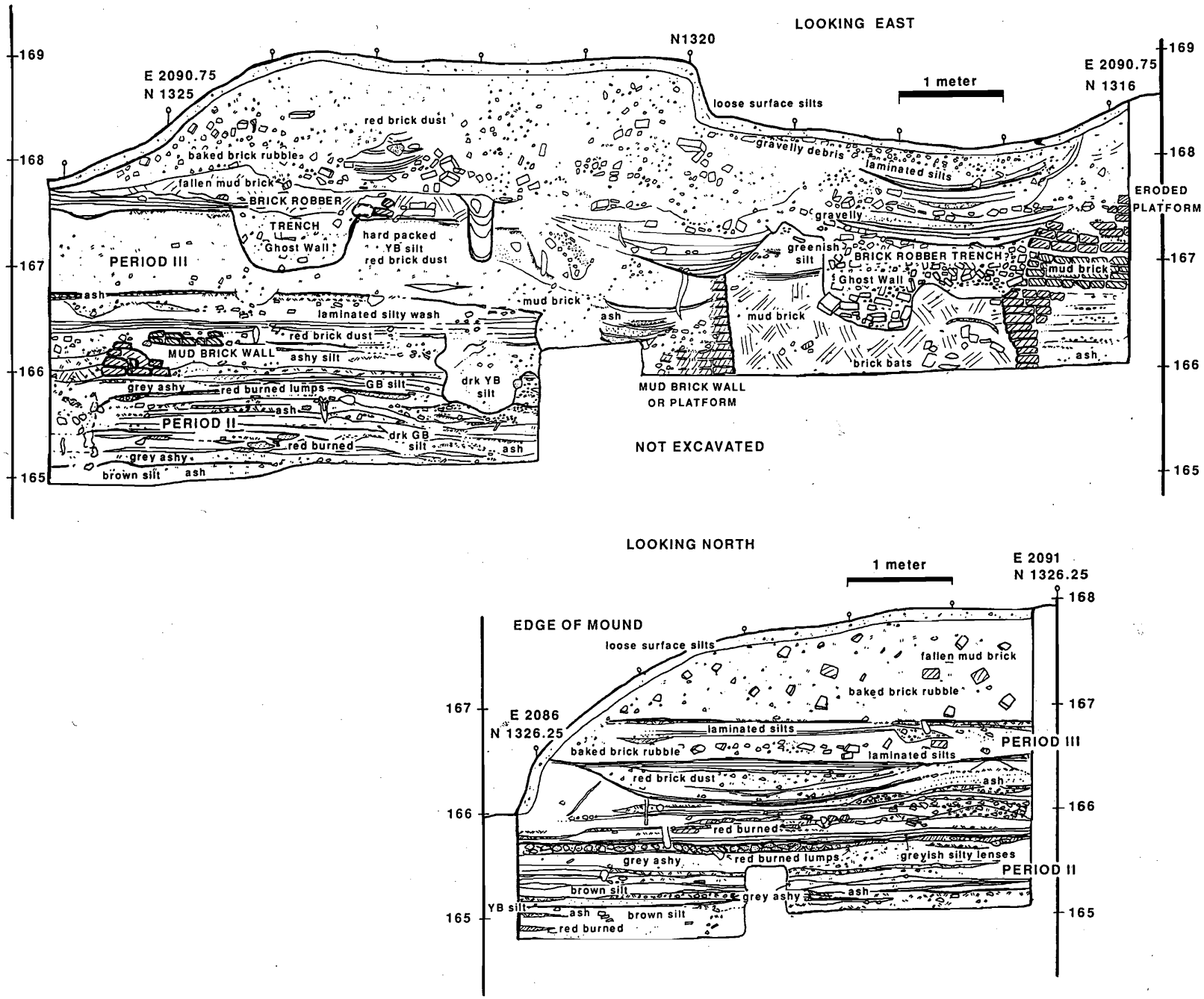

Figure 13.38: Harappa 1990: Mound E, northwestern corner: sections through Period 2 and Period 3 deposits, facing east and north.

north-south erosional gully on the southern slope of Mound E. For the purposes of this season's report, these operations, in order from north to south, are designated as Areas A to F (Figure 13.39).

The major feature that was found in Areas B, C, and D during the 1990 season is an impressive five meter wide street. This street is designated NS2355 because it lies along the East 2355 meter grid line. The street has been traced for some 30 meters from the southern edge toward the center of the mound.

To the south, in Area E, an east-west aligned baked brick drain is located across the projected southern axis of street NS2355. This structure may represent a drain crossing the path of the NS2355 street or may be associated with an intersecting east-west thoroughfare that is as yet unexposed.

In Area B, the maximum width of the street in Period 3 (Harappan) is approximately 5 meters. In Area C, a narrow brick paving and drain may represent an encroachment into the street that restricted the flow of traffic during the latest phase of Period 3. The street surface in this latest phase is pitted with pot holes and with what appear to be north-south oriented cart tracks filled with refuse (Figure 13.40).

The levels of street NS2355 were excavated to natural soil in Areas B and C with exposures of 2 × 3 meters and 2 × 5 meters, respectively. At the lowest levels of the street it was again possible to define what appear to be cart tracks (Figure 13.41). In these street levels Early Harappan sherds were recovered. The north-south alignment of these cart tracks associated with Period 1 sherds indicates that the street orientation remained constant from the earliest levels through to the final occupation of this area in Period 3.

Area A (Figures 13.42 and 13.43), a 10 × 5 meter unit, is located farthest inside the mound and is situated to the east of the alignment of street NS2355. Our excavations exposed Period 3 habitations consisting of baked brick walls constructed on top of massive mud-brick foundation platforms. Most of the latest Period 3 baked brick walls had been robbed, but drains and the interior fill of the rooms were preserved. The lowest exposed levels revealed a room or courtyard with numerous superimposed hearths. A small drain (Feature #[68]) exited the room and flowed south to join a larger east-west drain (Feature #[46]) which may be associated with an east-west alley-way or small street.

Ceramics collected from the lowest excavation levels in Area A are associated to Period 3, but there are some sherds with stylistic similarities to Period 1 and/or Period 2 pottery. Much of the refuse in the pair of successive drains consists of pottery, and changes in specific Period 3 ceramic forms are recognizable.

In Area B, a 5 × 10 meter trench was excavated across the gully to determine the width of the street and to expose habitation structures on either side. On the western edge of the street there is evidence for large structures that had been robbed of their baked bricks presumably during the mid-19th century. A north-south wall was defined along the western edge of the street from the outlines of the robber trench. Similarly to the east, a second pillaged wall demarcated the eastern edge of the street. Traces of baked brick walls, mud-brick pavings, and an unusual hearth were uncovered on the east side of the street. These domestic features are very similar to better preserved structures to the south in Area C. Two faience tokens, one flat-rectangular and one triangular in section, were recovered from within the habitation deposits of Area B (Figure 13.44h-i). A small trench, 2 X 3 meters in area, was excavated to natural soil along the eastern edge of the street. The lowest street level consisted of natural soil churned with a darker brown silty loam.

In Area C, south down the slope of the mound from Area B, an area of approximately 10 × 10 meters was excavated to obtain a stratigraphic sequence down to natural soil and to horizontally expose the Period 3 structures that had been identified through the surface surveys.

At the lowest levels of Area C, considerable deposits containing Period 1 and 2 pottery, hearths, and mud-brick structures were exposed (Figure 13.45). Two phases of mud-brick construction were identified. The earliest structure is a north-south wall associated with Period 1 and 2 pottery and resting on natural soil, while the later one is a fallen wall seen in section. The brick sizes are approximately 6 × 16 × 28 cm. Above these structures are approximately 1.5 meters of laminated ash and silt deposits with Period 1 and 2 pottery. Several superimposed hearths were excavated that contained datable carbon and concentrations of charred grain. This pattern of superimposed hearths suggests that domestic structures were located adjacent to the north-south street and that this pattern of habitation was continued into Period 3. Preliminary investigation of the ceramics and the associated artifacts suggest that there is no major hiatus or cultural break between the Period 1 and 2 and Period 3 levels in this area of Mound E.

Lying directly above the Period 1 and 2 material are deposits with Period 3 pottery and a mud-brick structure. Only a portion of the mud-brick structure was exposed, but it appears to consist of two rooms containing domestic debris. These mud-brick walls were eroded and sealed by a deposit of refuse that included almost complete carcasses of cattle and bones of sheep/goat and dog. The presence of this deposit

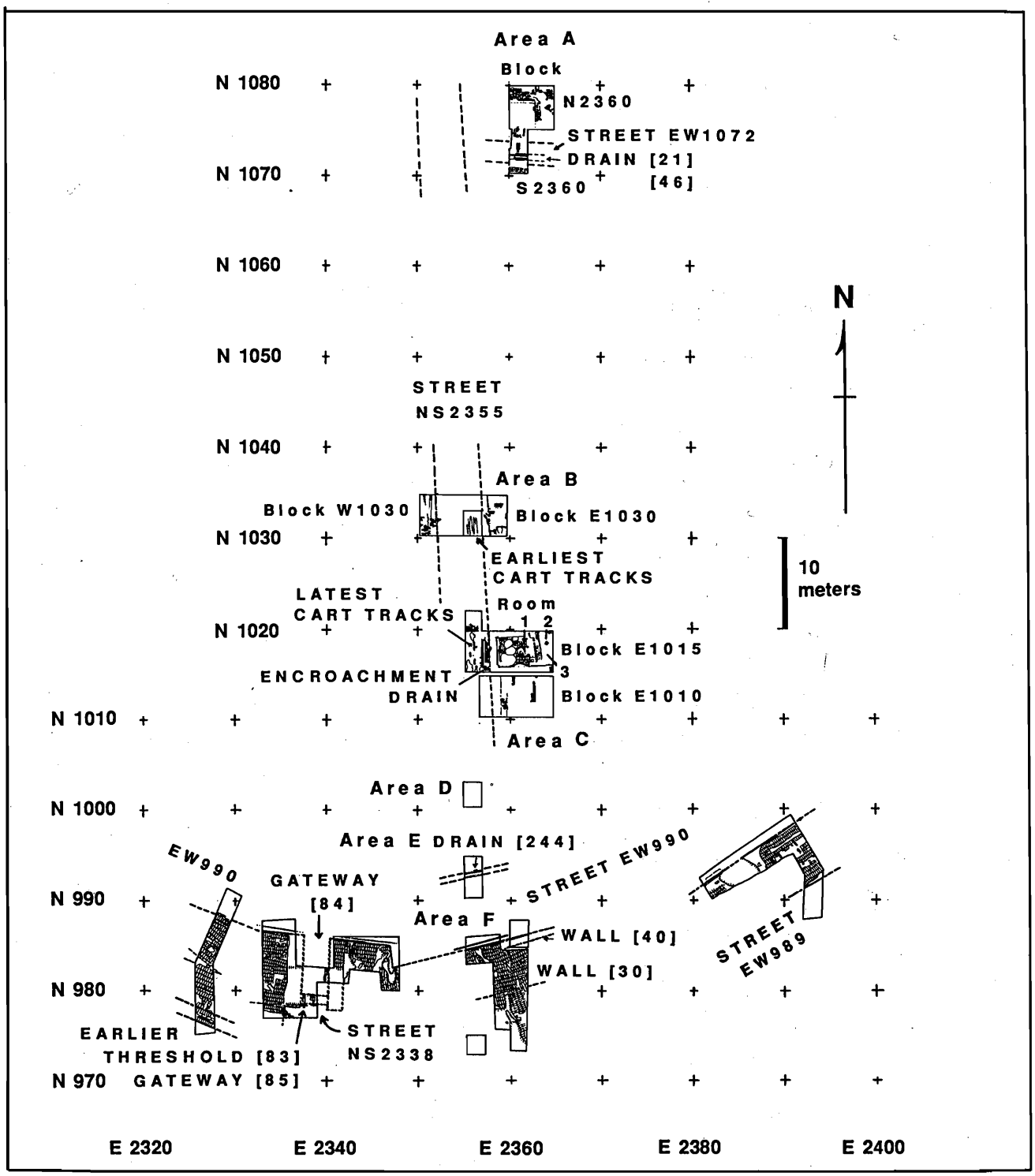

Figure 13.39: Harappa 1990: Mound E, southern slope: general plan of area excavated.

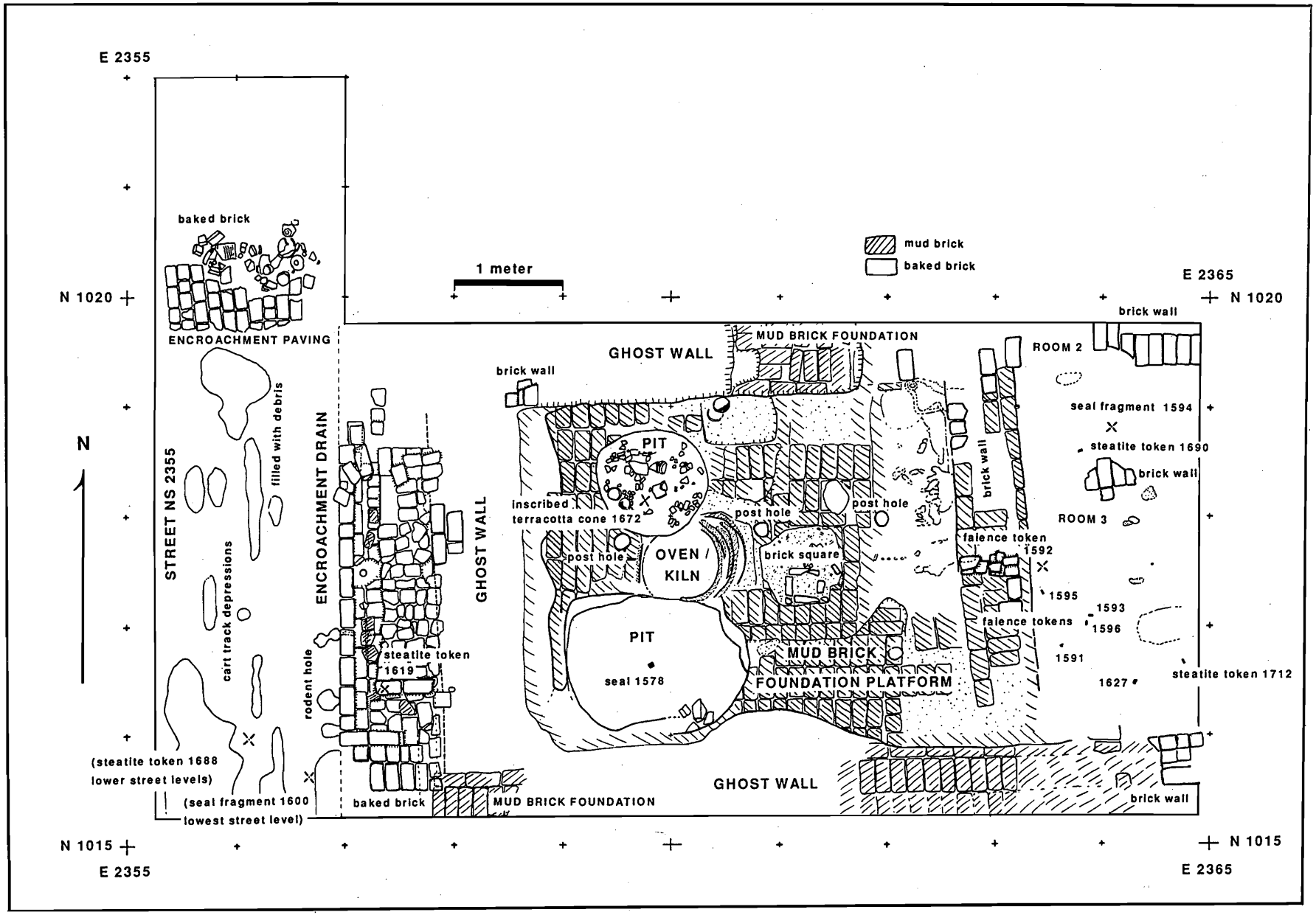

Figure 13.40: Harappa 1990: Mound E, southern slope, area C: plan view of Harappan phase (Period 3) house structure and upper street levels.

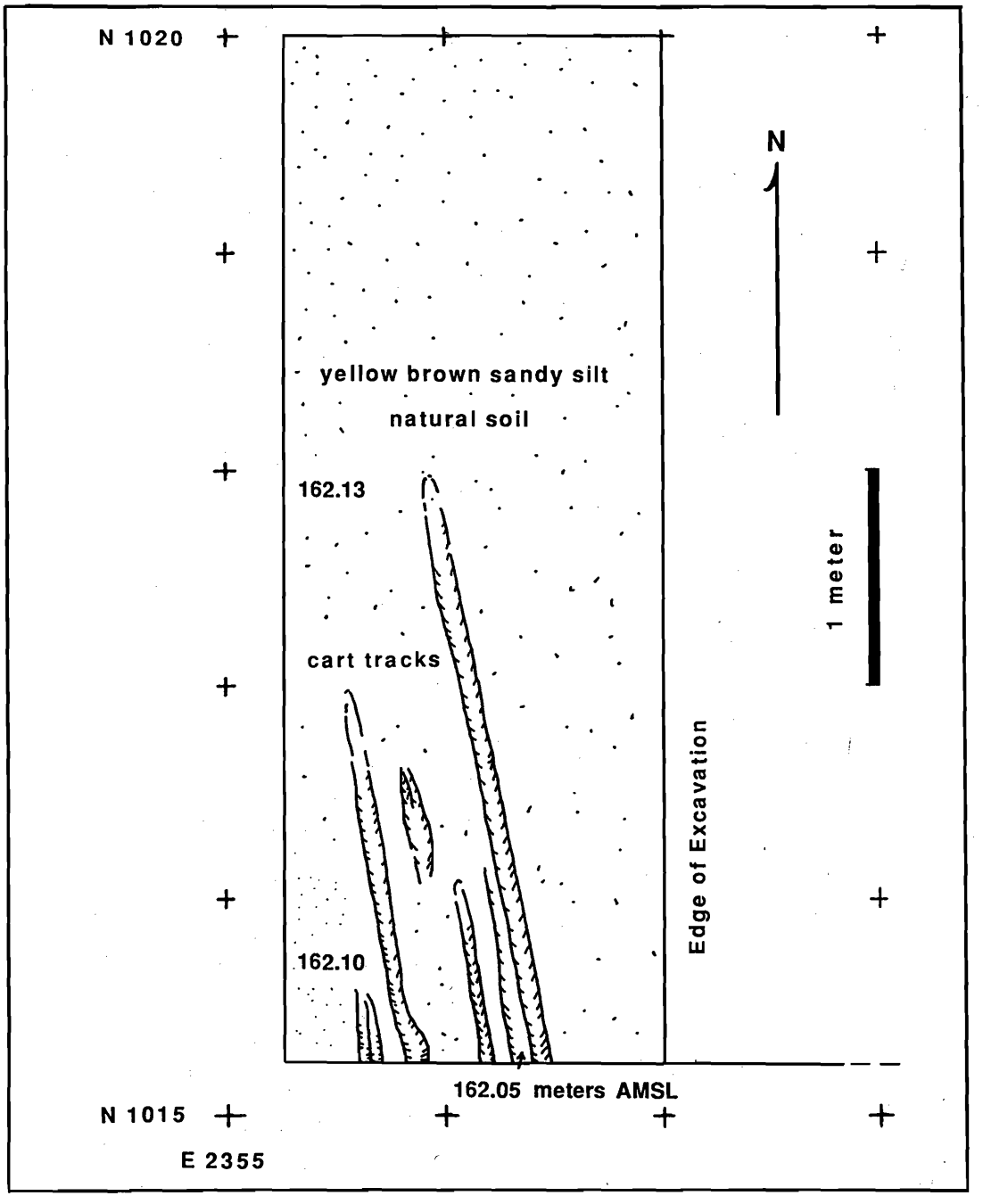

Figure 13.41: Harappa 1990: Mound E, southern slope, area C: plan of lowest street level (Period 2).

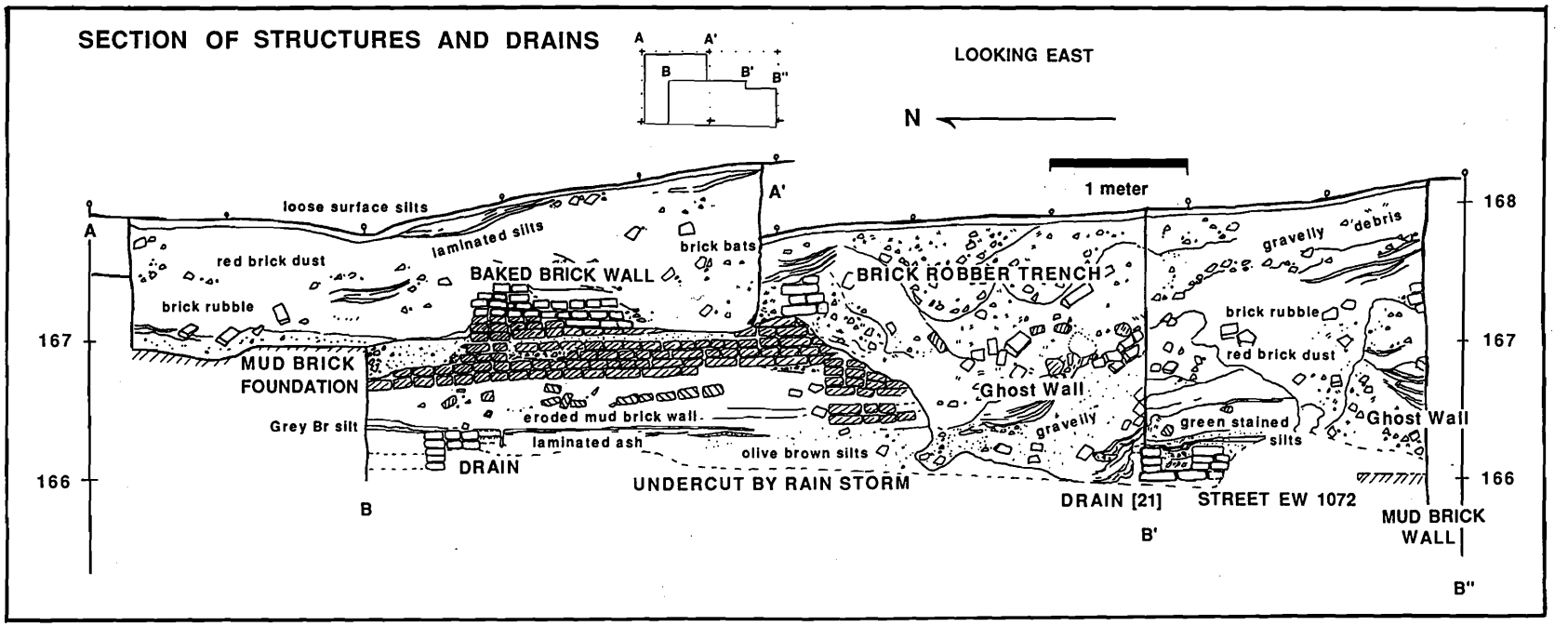

Figure 13.42: Harappa 1990: Mound E, southern slope, area A: section of Harappan phase structures and drains, facing east.

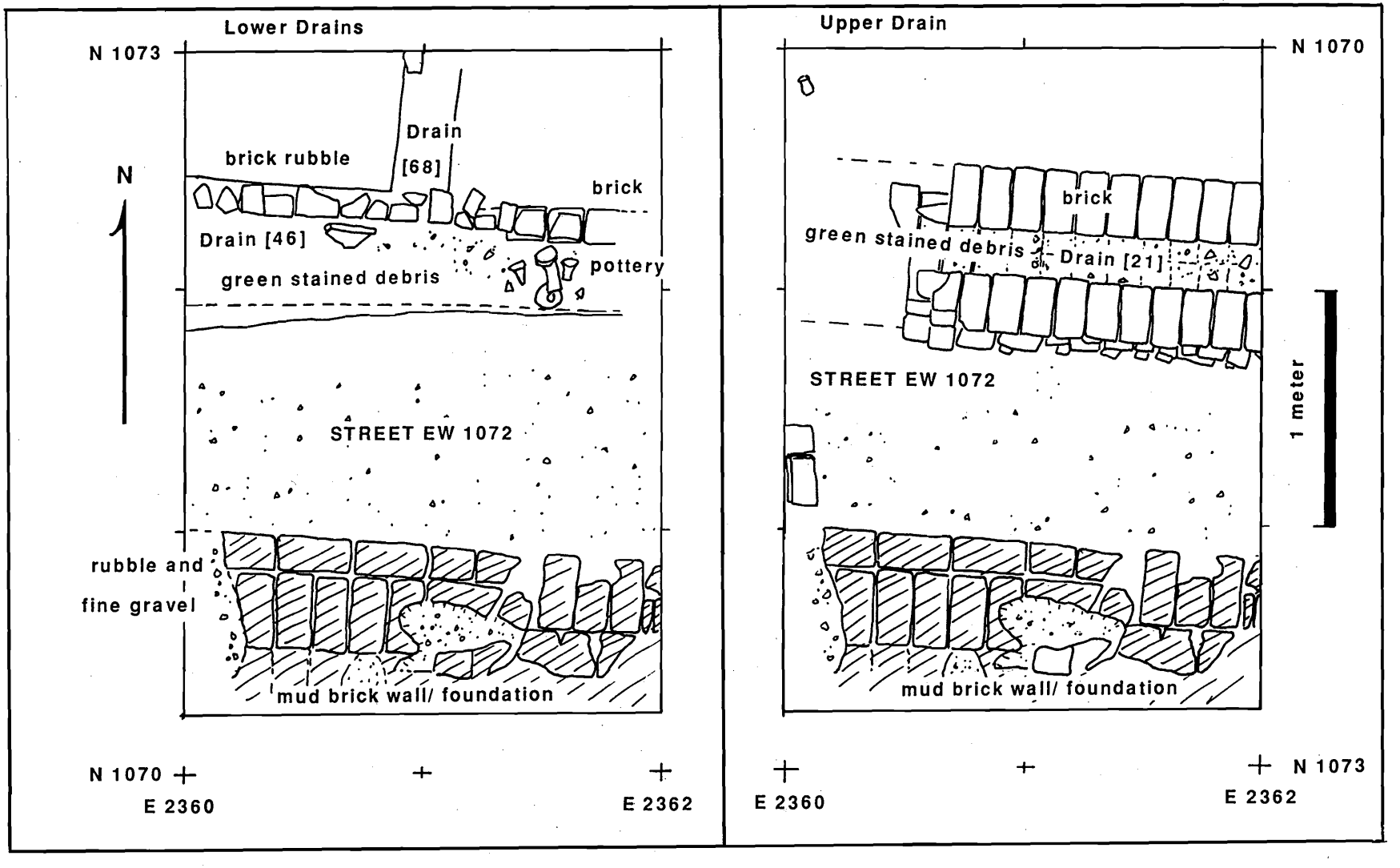

Figure 13.43: Harappa 1990: Mound E, southern slope, area A: plan views of drains.

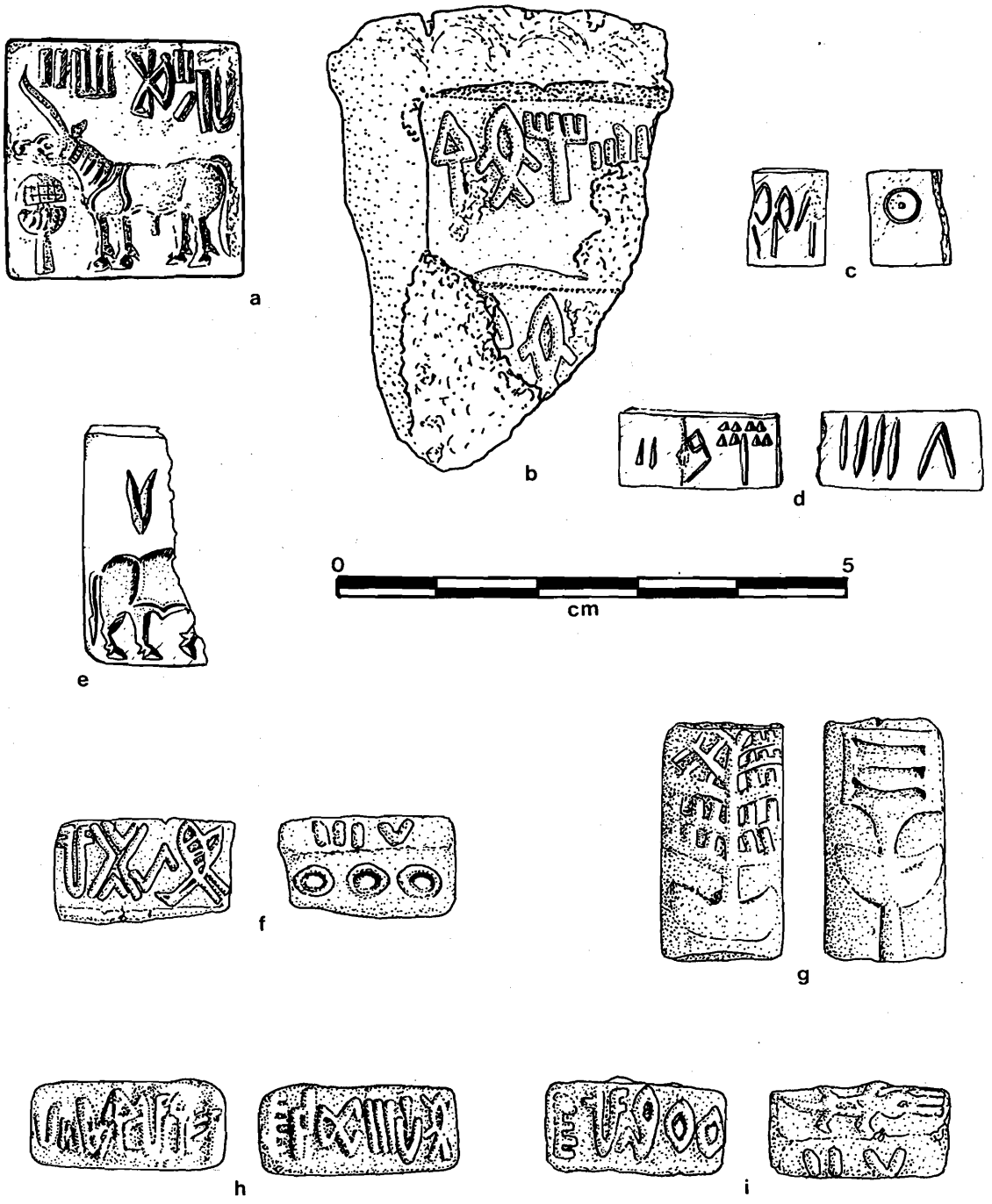

Figure 13.44: Harappa 1990: Objects with script from Mound E, southern slope. (a) Intaglio steatite seal (H90-1618/3250-1) from upper street levels, area C, Period 3B/C. (b) Terracotta sealing (H90-1686/3043-35) from upper street levels, area C, Period 3B/C. (c) Inscribed steatite token fragment (H90-1619/3154-1) from under drain #[14] next to upper street levels, area C. (d) Inscribed steatite token (H90-1688/3056-18) from upper street levels, area C. (e) Intaglio steatite seal fragment (H90-1600/3166-1) from lower street levels, area C, Period 3A. (f) Three sided faience token (H90-1628/3124-4) from houses next to street, area A, Period 3B. (g) Faience token (H90-1687/3103-1) from surface above street, area A, Period 3B/C. (h) Faience token (H90-1601/3094-1) from houses next to street, area B, Period 3B. (i) Three sided faience token (H90-1591/3033-1) from houses next to street, area B, Period 3B.

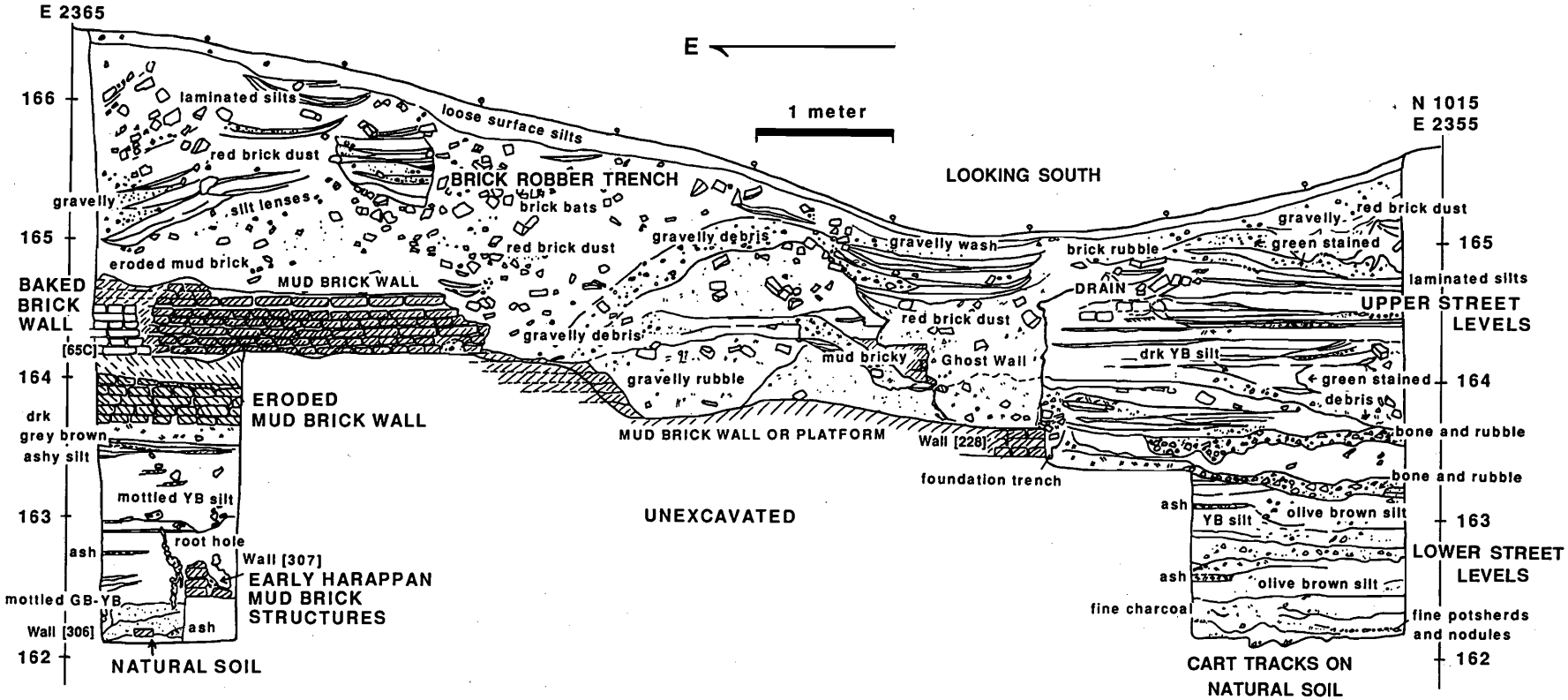

Figure 13.45: Harappa 1990: Mound E, southern slope, area C: section of street facing south.

suggests that the structure was probably abandoned and used as a dump for some time before it was leveled off and rebuilt.

The final phase of building involved the construction of a massive mud-brick foundation platform (Feature #[28]) upon which was constructed a house made with baked bricks (Figure 13.40). Due to brick robbing, the baked brick walls of the latest structures are missing. However, the mud-brick foundation platforms and interior household deposits were undisturbed.

Inside this house structure, Room 1 lies adjacent to the street and may have been a covered courtyard with a wooden superstructure or roof. Three distinct post holes were found along an east-west line in the center of the room. A small kiln or oven (Feature #[36/46]) and several pits filled with domestic debris were excavated in this room.

To the east of Room 1, divided by baked brick walls, are what appear to be two interior rooms (Rooms 2 and 3) of the house built almost directly above and aligned with earlier mud-brick walls. Although the baked brick walls had been robbed, a paving made from broken brick bats sealed the floors of these two rooms, which consisted of hard-packed conglomerate of pottery, bone, charcoal, and nodules. The artifacts found in the debris within these rooms included pottery, stone tools, beads, terra-cotta figurines, and toys. Most important are nine objects with Harappan script (Figure 13.46c-k). These objects came from various levels of floor debris and fill within the two rooms.

Combined with the two objects found in Room 1 (Figure 13.46a-b), a total of eleven objects with Harappan script were found in the three rooms of this house. These include two steatite intaglio seals (one complete and one broken) with the common unicorn animal motif and short inscription; three identical rectangular molded faience tokens with script on both faces; one molded rectangular token with script only on one face; one flat triangular token and one flat lunate token with script on both faces. In addition to the faience tokens, two inscribed and fired steatite tokens and one terra-cotta cone with a crudely incised inscription were also found (Figure 13.46).

Throughout all of the levels of the street and the house, large quantities of faunal and floral remains were recovered. These samples provide a relatively continuous record of the types of animals and plants being used and discarded in this area of the city. [*See Chapters 7 and 8 in this volume.*]

In Area D, south of the house structure in Area C, a 3 × 2 m pit was excavated along the alignment of the street NS2355 (Figure 13.39). In this area, hard-packed layers of horizontally deposited brick bats and sherds covered a thick accumulation of green stained refuse in what may have been a street. These deposits correspond to the street levels found to the north.

In Area E, south of Area D and also along the alignment of street NS2355, excavations in a 5 × 2 meter unit exposed an east-west aligned baked brick drain (Feature #[244]) (Figures 13.39 and 13.47). Although the exposure was small, the drain (#[244]) clearly slopes from east to west. It cuts across the projected path of the north-south street NS2355 and may represent an east-west street. Further excavation is needed to clarify this question.

In Area F, south along the line of the street NS2355, a test pit revealed the presence of two superimposed massive mud-brick walls (Features #[30] and #[40]) that conform to the curvature of the southern edge of Mound E (Figures 13.39 and 13.47). This initial test trench (2 × 3 meters) was excavated to natural soil and showed that the construction of the earliest wall (Feature #[40]) occurred on a gently undulating natural surface. Instead of digging a level foundation trench, the Harappan builders appear to have stepped the lowest courses of bricks to accommodate the irregular surface. In this initial exposure, the wall #[40] is oriented at approximately 28 degrees north of east (Figure 13.48), and the bricks (10 × 20 × 40 cm) were made of clean, grey-brown clay containing some *kankar* nodules. The mortar contained some Period 3 potsherds. Other pottery found beneath the wall confirms that wall #[40] was built during Period 3. It is not possible to determine how high this wall stood, but it appears to have been a free standing wall.

Following considerable erosion of the early wall, the second wall (Feature #[30]) was constructed almost one meter inside the line of wall #[40] and oriented c. 18 degrees north of east in this exposure (Figures 13.48 and 13.49). Again the bricks were made of grey-brown clay with *kankar* nodules and the mortar contained occasional potsherds of Period 3.

Numerous extensions and exploratory trenches were made to understand the extent of wall #[30] (Figure 13.47). The result of these excavations revealed that a massive mud-brick wall extended in an arc for over 73 meters along the southern edge of the mound. A break in the wall appears to have been an entrance or gateway (Feature #[84]), and there is evidence for an earlier entrance as well (Feature #[85]). Two distinct sets of street levels (street NS 2338) are visible passing through the entrance or gateway.

The similarities in mud-brick color and composition suggest that wall #[30] andthe gateway were built in one major episode. The original width of wall #[30] ranges from 5.4 to 6.5 m in two areas, but at the gateway it is 8.5 meters wide. Later repairs (Figure 13.47) and additions had been made on the exterior

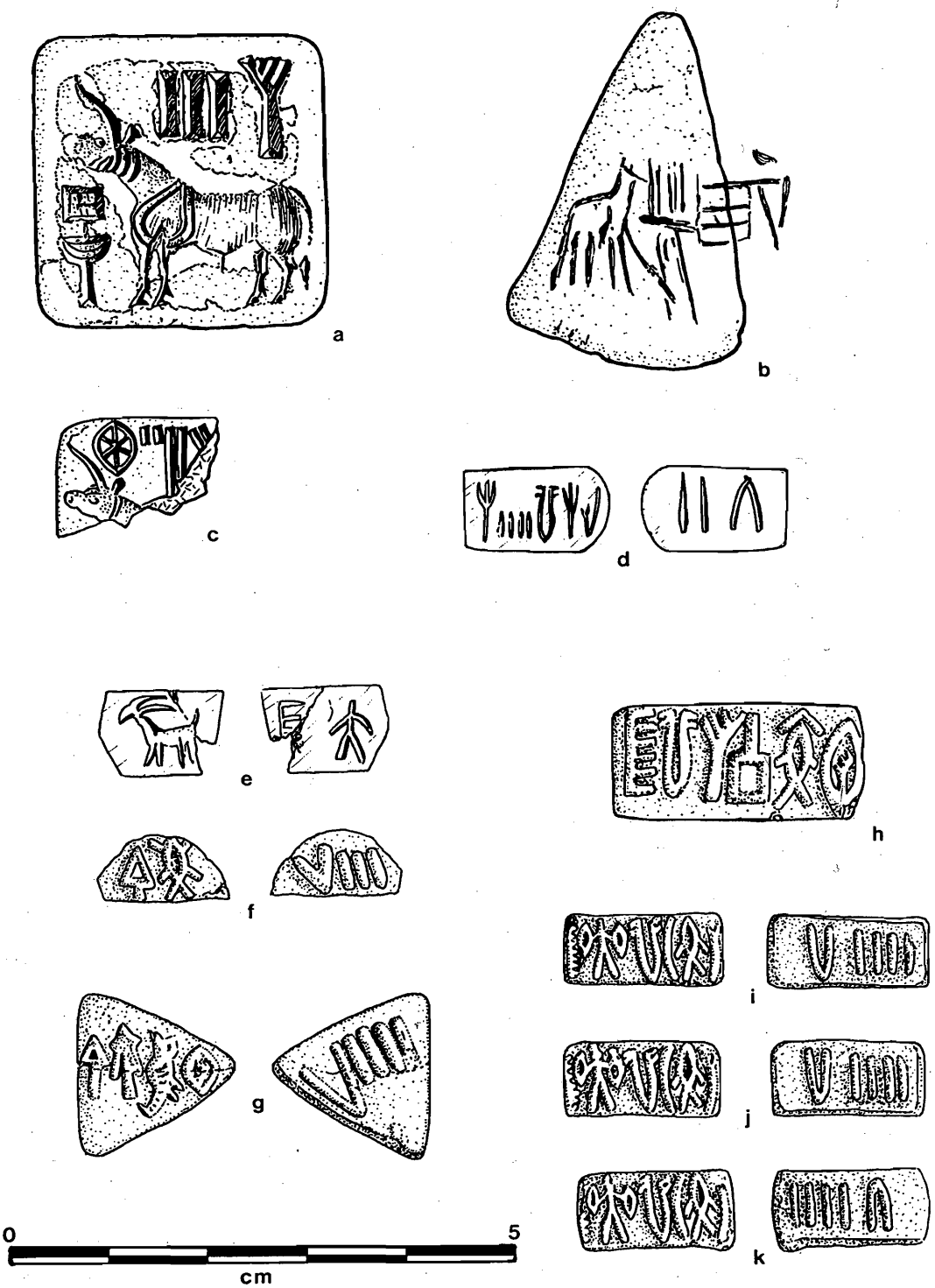

Figure 13.46: Harappa 1990: Objects with script from Mound E, southern slope, area C. (a) Intaglio steatite seal (H90-1578/3038-1) from pit in room 1 (see Figure 13.40). (b) Inscribed terracotta cone (H90-1672/3063-5) from pit in room 1 (see Figure 13.40). (c) Intaglio steatite seal fragment (H90-1594/3064-10) from room 2. (d) Inscribed steatite token (H90-1690/3064-11) from room 2. (e) H90-1712/3255-4 Inscribed steatite token from room 3. (f) Faience token (H90-1627/3255-1) from room 3. (g) Faience token (H90-1597/3157-1) from room 3. (h) Faience token (H90-1592/3042-4) from room 3. (i) Faience token (H90-1595/3155-3) from room 3. (j) Faience token (H90-1596/3155-4) from room 3. (k) Faience token (H90-1593/3064-9) from room 3.

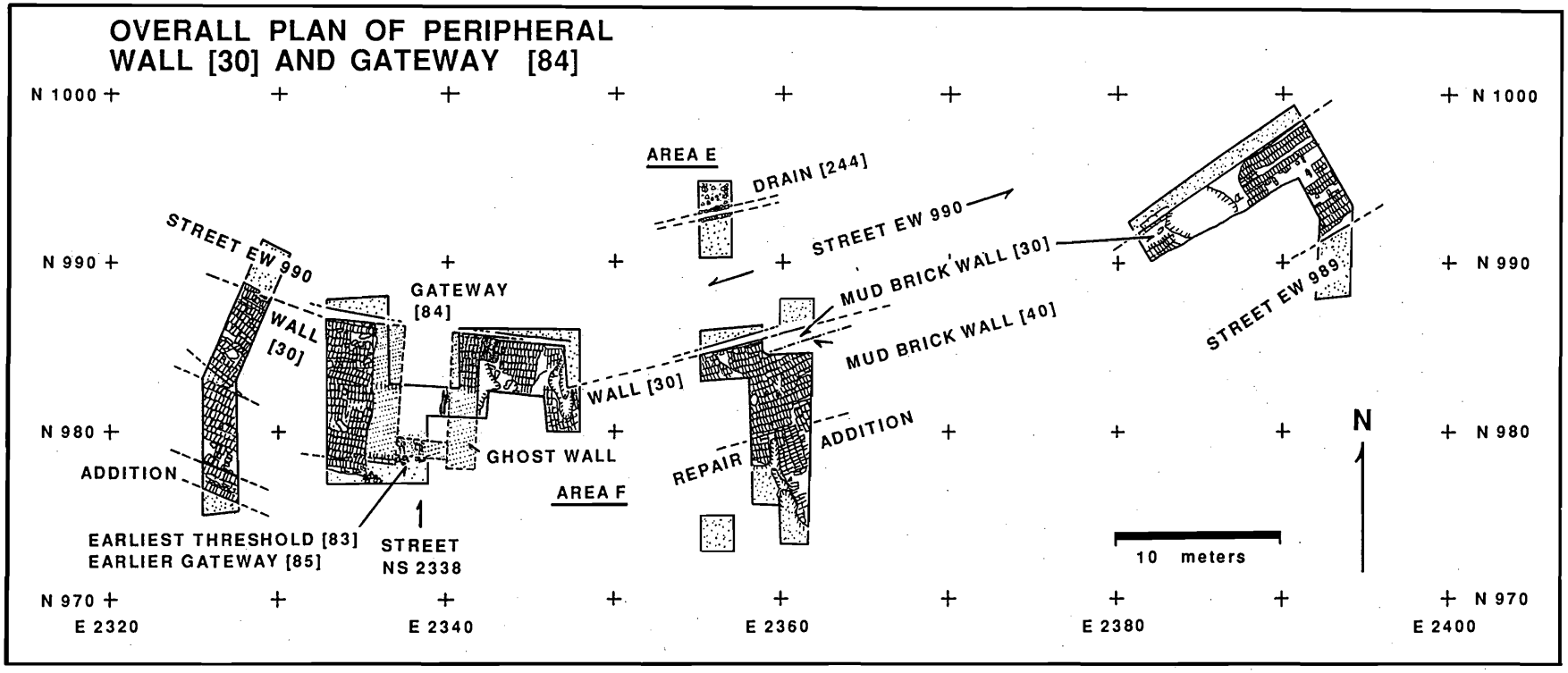

Figure 13.47: Harappa 1990: Mound E, southern slope, area F: overall plan of peripheral wall and gateway.

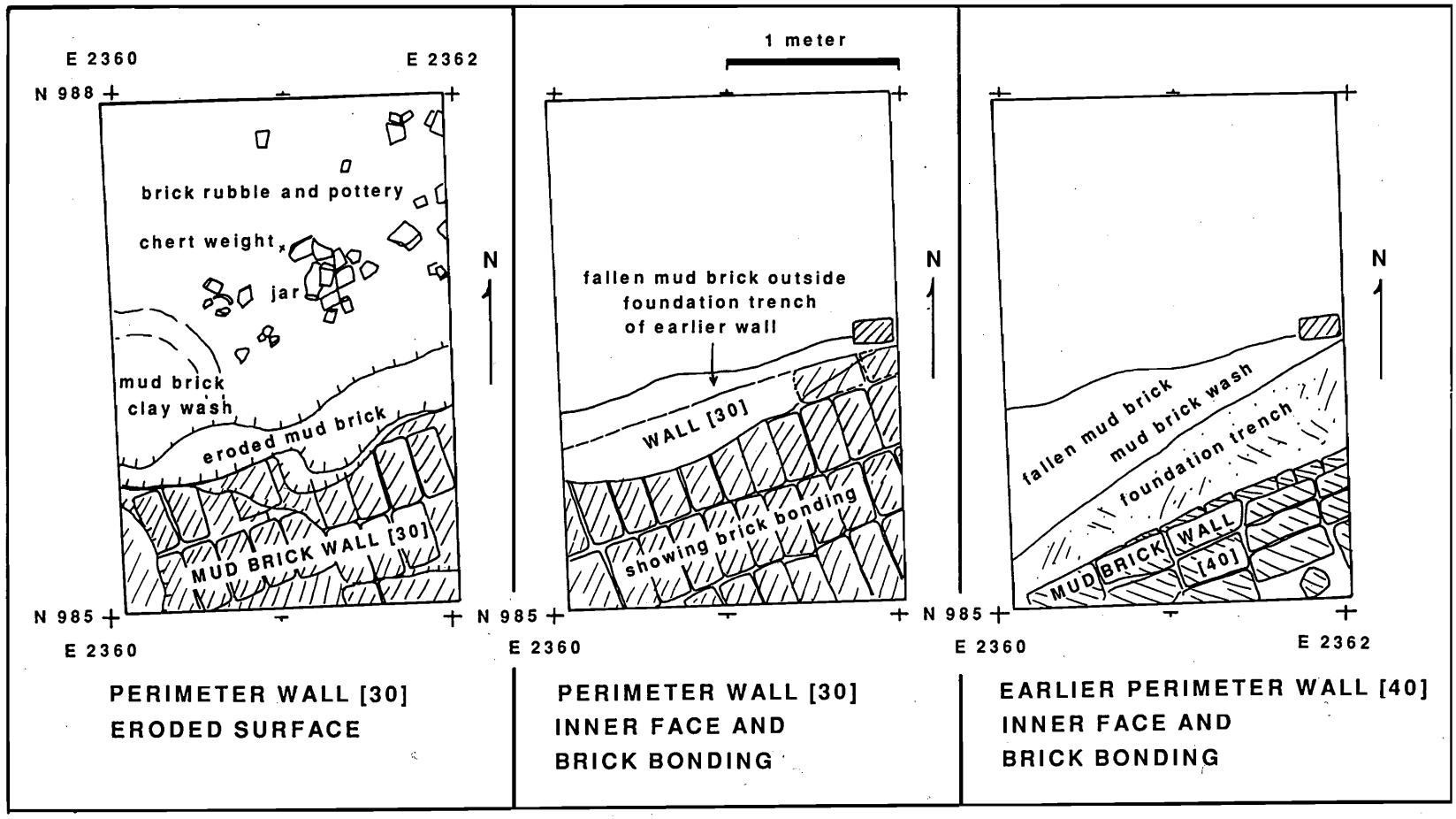

Figure 13.48: Harappa 1990: Mound E, southern slope, area F: plan of perimeter wall excavation showing sequence of building, erosion, and rebuilding.

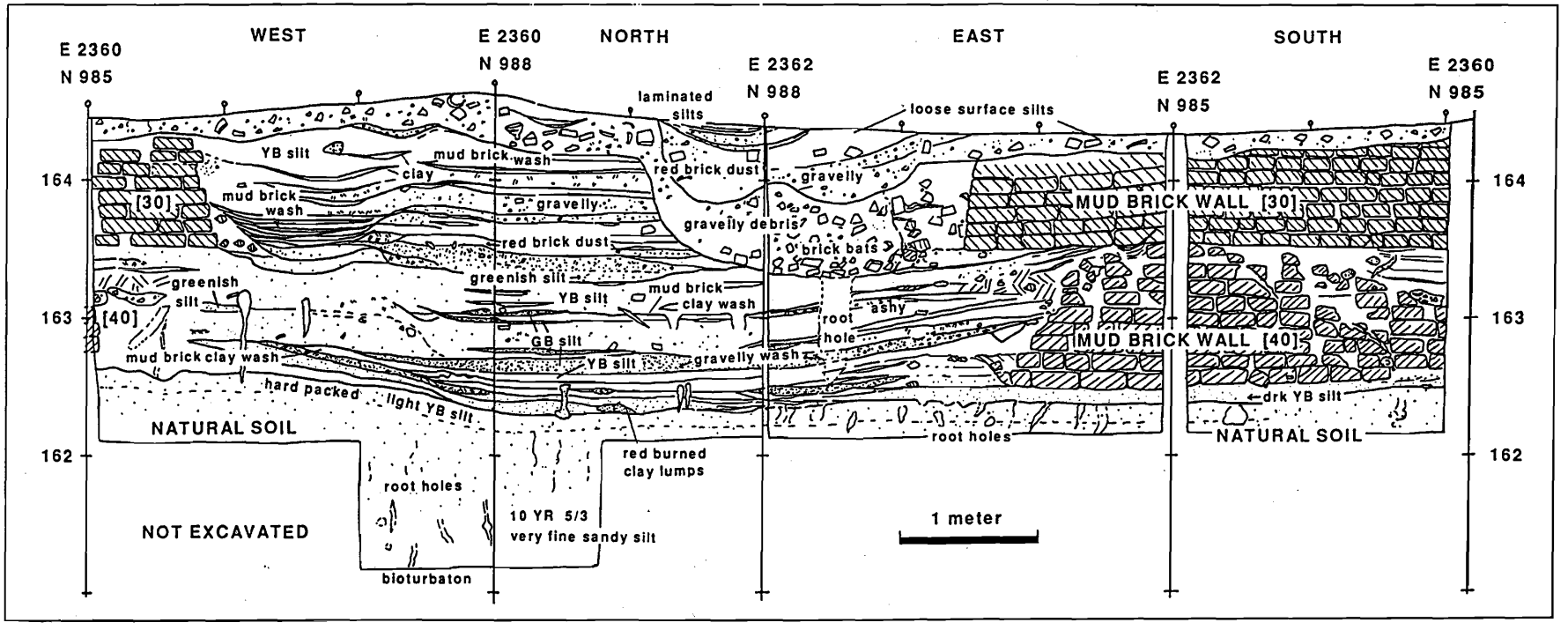

Figure 13.49: Harappa 1990: Mound E, southern slope, area F: section showing sequence of building, erosion, and rebuilding of perimeter walls (see Figure 13.48).Facing west, north, east, and south from left to right.

face of the wall at various points, and in one section they expand the width of the wall to 11.8 meters. Some of the additions may have been for bastions or towers or simply for wide platforms on the exterior of the wall.

Although the gateway area had been severely disturbed after it fell out of use, in one area we found a portion of the baked brick facing still bonded to the mud-brick wall (Feature #[30]) (Figure 13.50). The outlines of the brick-scavenged walls are clearly visible in section and indicate that the entrance way was 2.8 meters wide (Figure 13.51) and was faced with baked brick walls that were 1.6 meters thick and had one meter deep foundations.

In excavating the eroded remains of wall #[30], it was important to try and determine if this was a free standing wall or simply a series of low platforms at the edge of the mound. This question was partially answered in two different sections of the gateway area where brick robbers had removed the massive baked brick facing. Without the protection of this facing, the mud-brick wall began to erode and was eventually undercut. Portions of the wall fell down into the trench left by the brick robbers and were preserved until they were excavated in 1990. By carefully outlining the fallen bricks it was possible to determine that when the brick robbers removed the baked brick facing, the mud-brick wall stood ten courses (1 meter) above the level of wall #[30] (Figure 13.52a-b). Further excavations will hopefully provide more clues for understanding the original height and full extent of this massive wall.

The baked brick facings of gateway #[84] were built on top of a mud-brick paving that was two bricks thick (20 cms). This paving runs underneath the mud-brick walls on both sides of the gateway and probably represents the plan of the wall that was first laid out on the ground by the Harappan architects. There is no mud-brick paving extending across the entrance itself.

Many questions regarding the walls, gateway, and streets remain to be answered through further excavation and more detailed analysis of our excavation data. The discovery of two phases of wall and gateway construction raises numerous questions about the organization of Mound E and its relationship to other mounds, such as Mound AB or Mound F. It is still not clear if the walls at the southern edge of the site are contiguous and/or contemporaneous with the massive brick revetment wall that was built in Period 3 on the western edge and northwestern corner of Mound E.

B. *Analyses of Specific Classes of Artifacts*

1. Pottery

Approximately 1,000 excavated units of ceramics were sorted and tabulated this season representing over 400,000 sherds of Early Harappan (Period 1), Transitional (Period 2), and Harappan (Period 3) affinities. Most of the work was accomplished by Paul Christy Jenkins, Rita Wright, and Chris Kostman with assistance from other members of the team.

Of importance is that over 25% of the 1990 season's sherd collection consists of Early Harappan and Transitional forms (Periods 1 and 2). Their study is fundamental for determining the degree and rate of cultural change occurring in the transformation to the full urban period.

In addition to the typological, stylistic, and distributional studies being conducted by Jenkins and Dales, Wright has continued studying the technological and manufacturing aspects of the Harappan ceramic industry. This season she began an analysis of fingerprints on the vessels. Over 250 impressions of prints were made in an attempt to determine whether genetic relationships can be traced among the ancient potters.

2. Figurines

Carl Lipo and G.F. Dales have been working on the documentation and analysis of the figurines. This season, Lipo tabulated and described some 190 figurines and fragments, one-third of which are anthropoid and two-thirds are animals. As described in earlier reports, the identification of animal species is a major problem. A computer-based recording system is being used for the animal figurines in an attempt to recognize significant associational patterns of facial, horn, and other details that can be used for species identification.

3. Inscriptions

The 1990 season was rich in finds of materials bearing Indus script. Thirty inscribed objects were accessioned (25 are illustrated in Figures 13.44, 13.46, and 13.53). The most important of these are the 11 items found within the Period 3 house and 7 additional objects from the adjacent houses and street areas (Figures 13.44 and 13.46; see discussion above). The discovery of these objects in closely associated strata represents the use of at least four major types of objects with script by the occupants of the house over a relatively short period of time: true stamp seals, faience tokens, steatite tokens, and inscribed terracotta objects. The relationship between the house structure, the inscribed materials, and the large wall and gateway, and the implications for the identification of special commercial activities carried out here, is a subject for further investigation.

4. General

Various classes of artifacts provide valuable information concerning technology, trade/exchange networks for procuring raw materials, and changes in aesthetic tastes. This season, 436 objects, or groups of

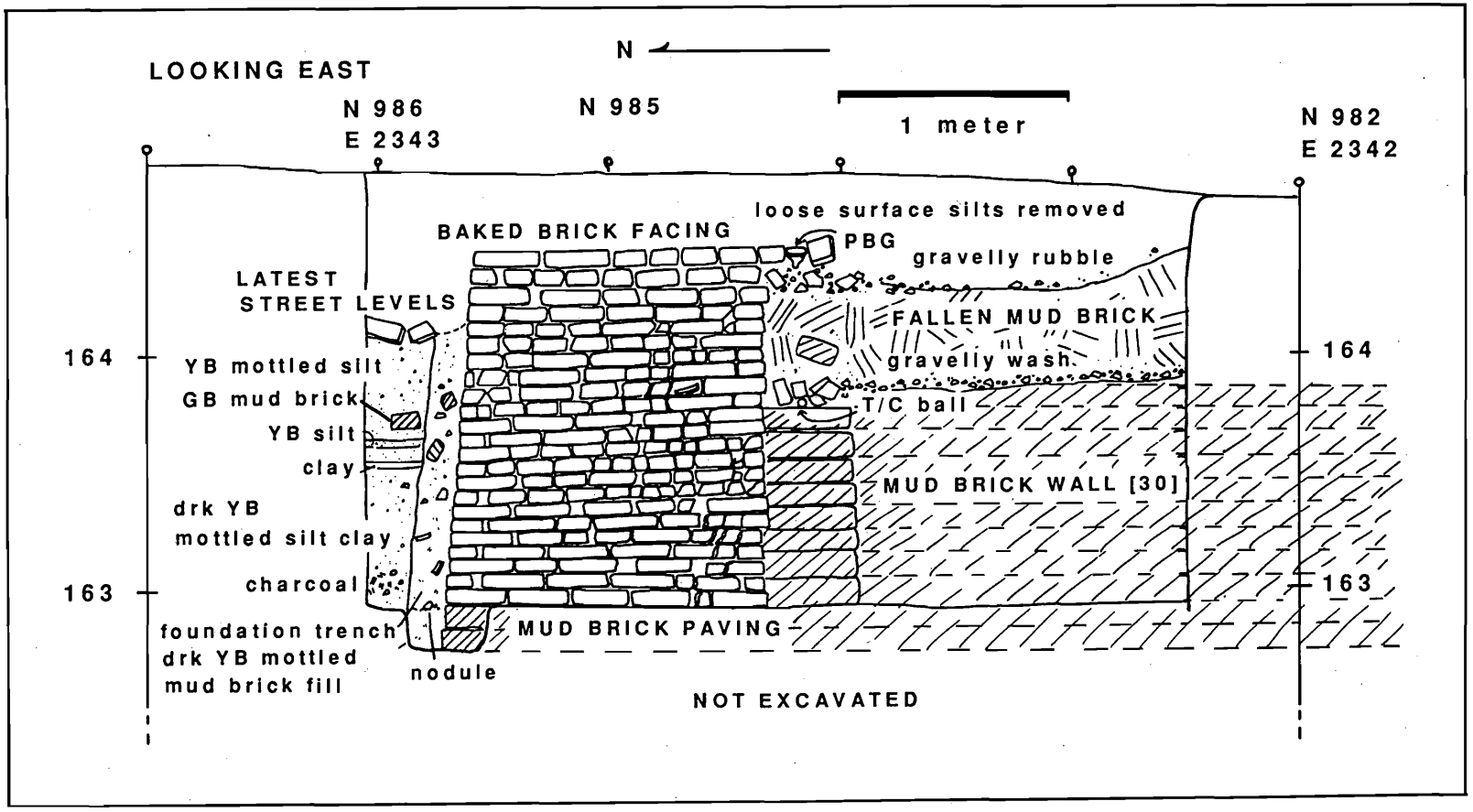

Figure 13.50: Harappa 1990: Mound E, southern slope, area F: section of brick facing and foundation of perimeter wall at east edge of gateway, facing east.

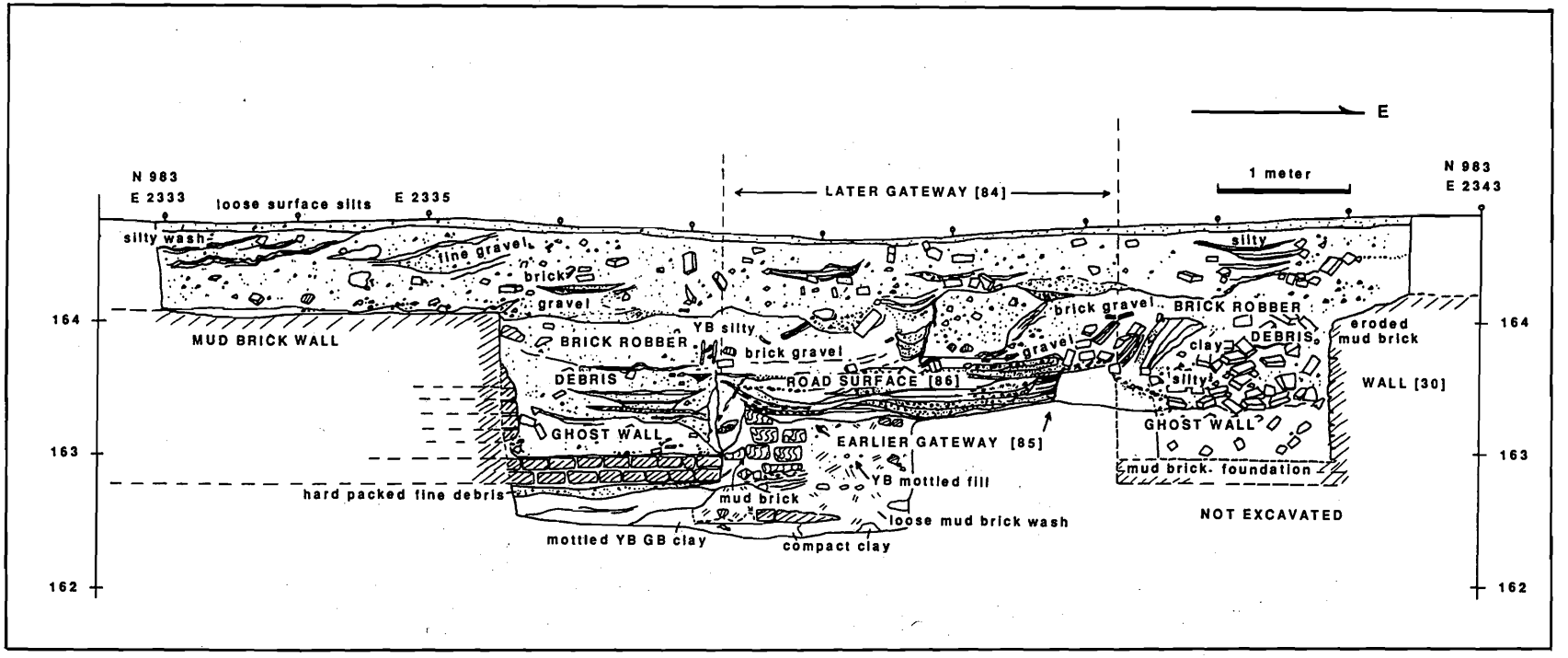

Figure 13.51: Harappa 1990: Mound E, southern slope, area F: section across gateway, facing north.

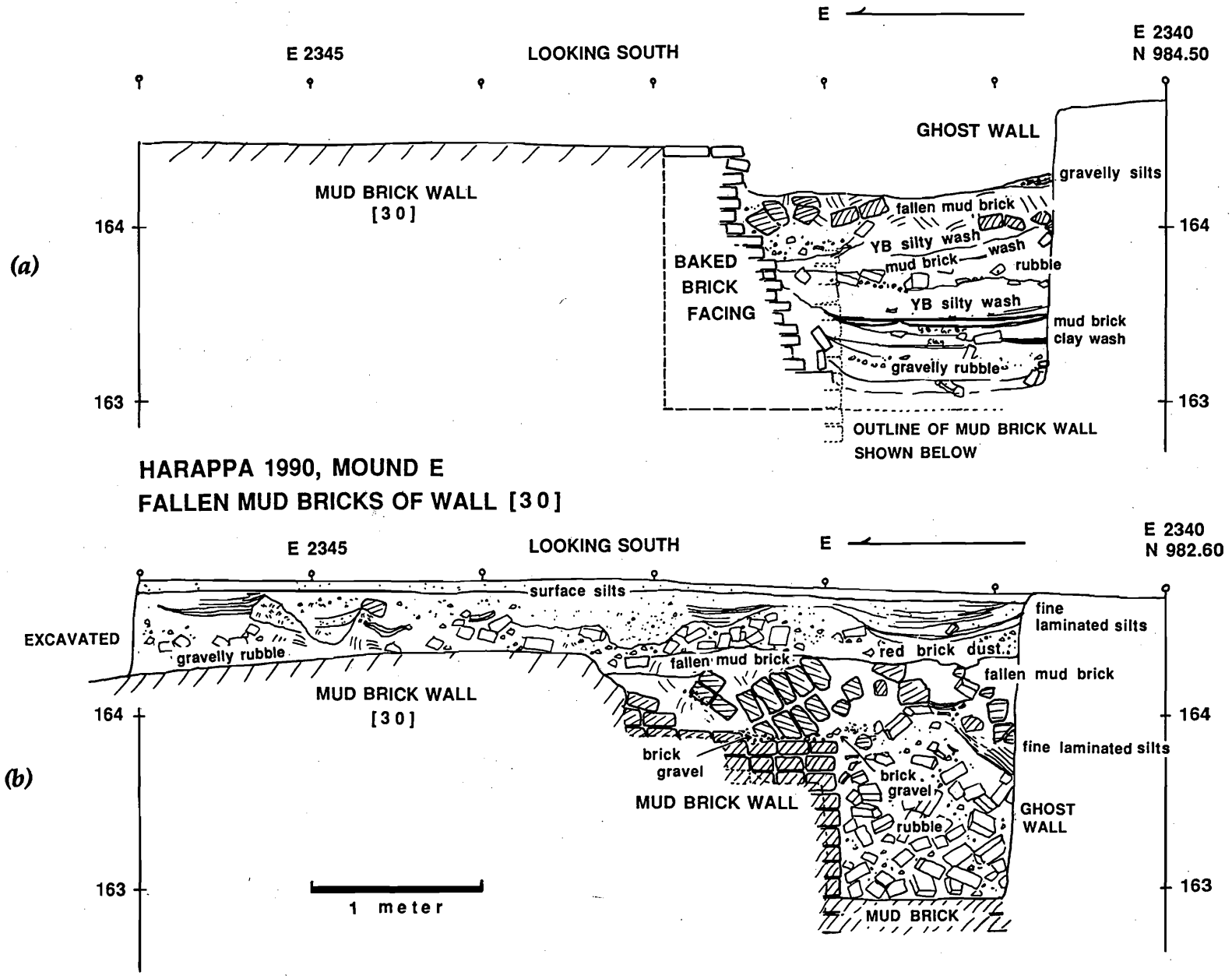

Figure 13.52: Harappa 1990: Mound E, southern slope, area F: sections showing fallen mud-bricks of perimeter wall, facing south.

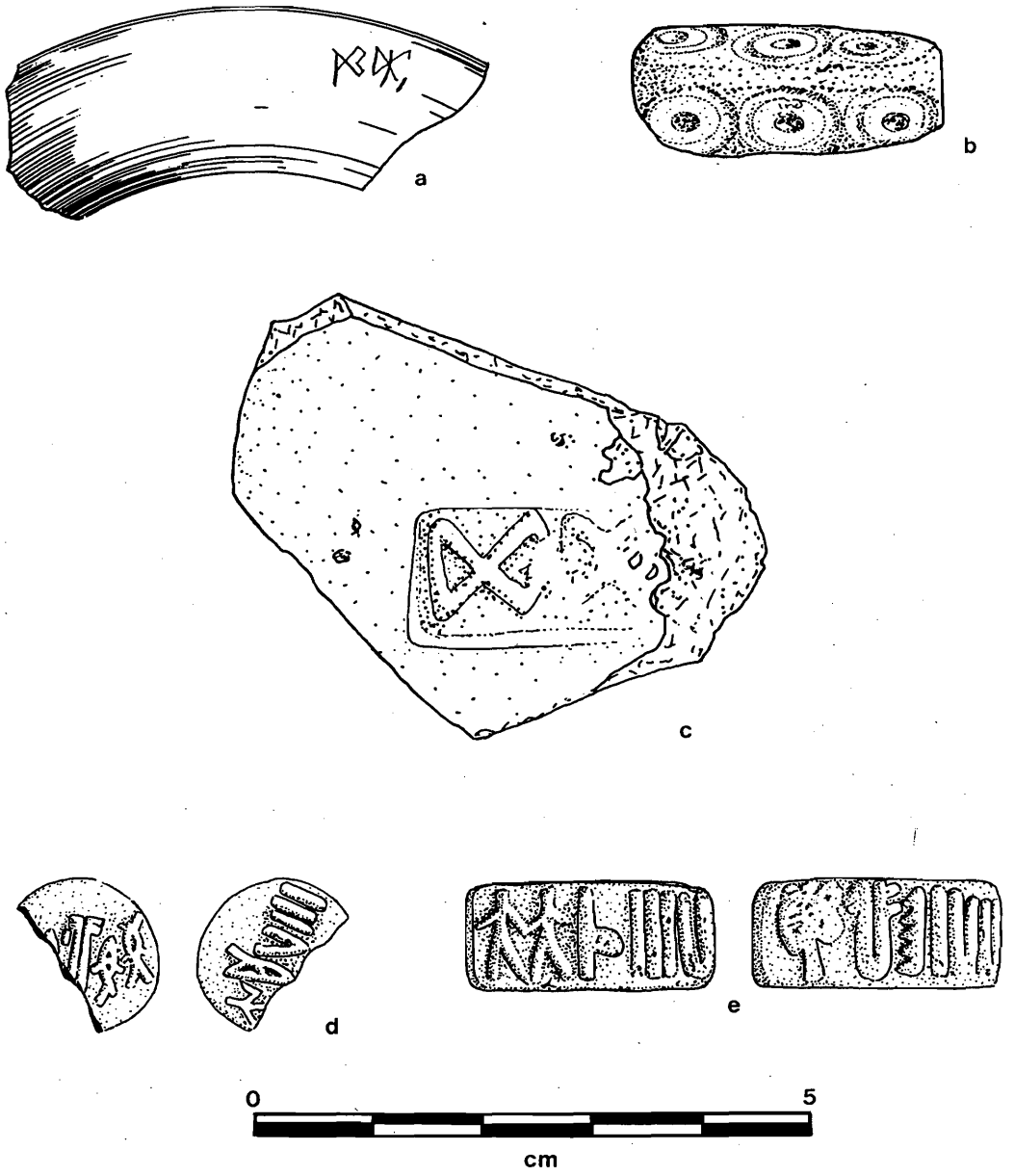

Figure 13.53: Harappa 1990: Objects with script from Mound E, southern slope. (a) Inscribed grey stoneware bangle fragment (H90-1575/3014-2) from surface above Period 3 houses. (b) Three-sided faience token (H90-1576/3011-17) from surface above Period 3 street. (c) Potsherd with seal impression (H90-1590/3011-95) from surface above Period 3 street. (d) Round token (H90-1571/2074-8) from south slope surface wash. (e) Rectangular token (H90-1572/3000-1) from surface of Mound E, provenience unknown.

similar objects (e.g., beads) were registered and accessioned to the reserve collection at the Harappa Museum, and thousands more fragmentary artifacts were recorded and tabulated for study. A wide range of materials is represented including terra cotta, faience, stoneware, shell, bone, ivory, gold, copper, lead, steatite, serpentine, lapis lazuli, carnelian, agate, chert, and various jaspers and other hard and semi-precious stones. Although the copper and copper alloy artifacts are badly corroded, winged arrowheads, blades, chisels, balance pans, and various pins and other ornaments were identified.

Also continued in the 1990 season were the technological experiments concerned with the forming and firing of pottery, faience, stoneware bangles, lithic implements, and beads.

C. *Palaeoenvironmental Studies*

1. Palaeozoological Studies [*See Chapters 7 and 8 in this volume.*]

Richard Meadow continued his study of the animal remains, assisted by Tonya Largy of Harvard University. Preliminary study this season of the remains from Period 2 and Period 3 street deposits from the southern edge of Mound E confirms the presence of a wide range of wild fauna although the assemblages are dominated by bones of cattle, water buffalo, sheep, and goats. The cattle in particular show a range of sizes from relatively small cows to enormous draft bulls. As in material from previous seasons, sheep bones are much more common than those of goat, and some of the sheep were very large, suggesting special breeding practices. Water buffalo remains are rare but there is admittedly some difficulty in distinguishing the bones of water buffalo and cattle.

In addition to the larger animals, remains of fish, small mammals, birds, rodents, reptiles, and even crab claws were recovered as a by-product of the flotation process used to recover the botanical remains.

To increase the accuracy of making identifications of the larger animals, the collection of modern bones from the Harappa city 'bone pits,' started in 1989, was continued.

2. Palaeobotanical Studies

The collection of plant remains was conducted by Heather Miller. More than 2,750 liters of sediments from more than 185 excavated units were processed for carbonized plant remains using the project's flotation machine. A large quantity of ancient plant remains was recovered from domestic and debris contexts of all phases of occupation along the southern slope of Mound E. Important will be the comparison of remains from the pre-urban (Periods 1 and 2) and the full urban period (3).

D. *Conservation*

The field laboratory this season was under the supervision of Harriett Beaubien of the Smithsonian's Conservation Analytical Laboratory. She was assisted by Julie Lauffenberger of the same institution. As in previous seasons, most of the conservation problems resulted from damage to the artifacts caused by the high salinity of the soil. Desalination procedures continued with emphasis on artifacts selected for accessioning and those kept for study collections. Repair and restoration work was performed on all accessioned objects requiring such attention.

As for conservation efforts on the site, all drains, water diversions, and other efforts to protect the excavations from erosion were checked and repaired where necessary. Mud-brick and plaster walls were constructed around the kilns that were excavated at the northwestern corner of Mound E during the 1989 season. The excavations of the massive mud-brick wall system and entrance way discovered this season along the southern edge of Mound E were covered with fine river sand and then refilled with soil to protect them for future excavations and study. A small trench was also dug across one area of the Old Police Station mound, at the eastern extremity of Mound E, in order to discourage the use of the mound as a roadway by the local Harappa buses. This motorized activity during the past few years has been destructive to the mound and has induced undue erosion.

E. *Training Program*

1. Pakistani Graduate Students

The intended field training program for graduate students from the University of the Punjab and Shah Abdul Latif University (Khairpur) was cancelled due to unforeseen circumstances.

2. Illustrators

Significant progress was made in the training of archaeological illustrators this season. Shokat Ali Shad and Rifa'at Saif Dar of Punjab University have become quite proficient at illustrating pottery and small finds.

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