

# **Central Settlements in Neolithic Jordan**

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## Summary on Ba'ja 1997, and Insights From the Later Seasons<sup>1</sup>

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### Introduction

The Late Pre-Pottery Neolithic site of Ba'ja has become famous for its extreme setting. Up to now, no other early sedentary community has been known for having chosen such a shielded and hidden location. However, "defensive" settings or structures could have been more common for early Neolithic sites than currently assumed. Ba'ja has triggered many speculations about its choice of location. It may well be that this hitherto unique piece of evidence from southern Jordan demands more than one - and more than a pragmatic - explanation. To mention just a few: Local environmental pressure caused conflict between neighboring LPPNB sites and as a result communities moved into more protected settings; the wealth created by the production of luxury goods (sandstone rings) required cutting oneself off from the outside world; the favorable hydrological conditions of the gorge (*siq*) provided a year-round source in an otherwise water-poor area (Gebel, in press); or even more, an unknown symbolic/ psychological factor made the setting ritually attractive because it was only accessible through the "vagina-type of channel" of the *siq* (Gebel 2002b).

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<sup>1</sup> The authors thank Bo Dahl Hermansen, deputy director of the Ba'ja Neolithic Project from 1999 onwards, for contributing to the insights after 1997, presented here. The aim of this report is to offer a summary of 1997 by the co-directors of the first season, enriched by insights from later seasons. This contribution also summarizes results provided by several other authors in Gebel and Bienert *et al.* 1997: T. Krämer, B. Müller-Neuhof, R. Neef, J. Timm, and K.I. Wright; the faunal remains of 1997 are published by von den Driesch/ Cartajena/ Manhart in this volume. The excavations in Ba'ja were followed by an international symposium on the *Central Settlements in Neolithic Jordan* (Petra Mövenpick, 21- 25 July, 1997), organized by the authors of this contribution and subject of the present volume.

LPPNB Ba'ja is also named Ba'ja II in other publications (*cf. e.g.* Müller-Neuhof 2002). All dates mentioned in this contribution are calibrated BC.

## Discovery and Archaeological Activities up to 1997

The LPPNB village rests on a former intramontane basin within the steep sandstone formations some 10 km north of Petra and 5 km north of Beidha, respectively (Fig. 1). By normal systematic survey means, the site would not have been expected to be found. The site was first discovered by M. Lindner and his team, who presented some chipped lithic surface finds to H.G.K. Gebel in 1983 (for the history of finding Ba'ja *cf.* Gebel and Bienert 1997a, Lindner 1996). Since it was a bi-directional Neolithic blade industry, together with a typical PPNB celt, and the tentatively described location appeared strange for a PPNB site, all efforts were taken by H.G. Gebel to relocate the site in autumn 1984. In connection with his project named "Palaeoenvironmental Investigations in the Greater Petra Area- Holocene Research" (P.I.G.P.A., carried out for the Tübingen Atlas of the Middle East; Gebel 1986, 1988, 1990, 1992; Gebel and Starck 1985), three soundings were carried out in late 1984, together with a short surface reconnaissance. These allowed to identify more precisely the nature and date of the site. A chain of settlements already existed in the MPPNB of the area (Beidha, Shaqarat Mazyad, adh-Dhaman; Kirkbride 1968, Gebel 1990), which testified to the first permanent settlements in the region. These MPPNB occupations may not have formed the substratum for the following LPPNB in the area; they well can have been absorbed by the "arriving" mega-site paradigm from the north (*cf.* Gebel, this volume).

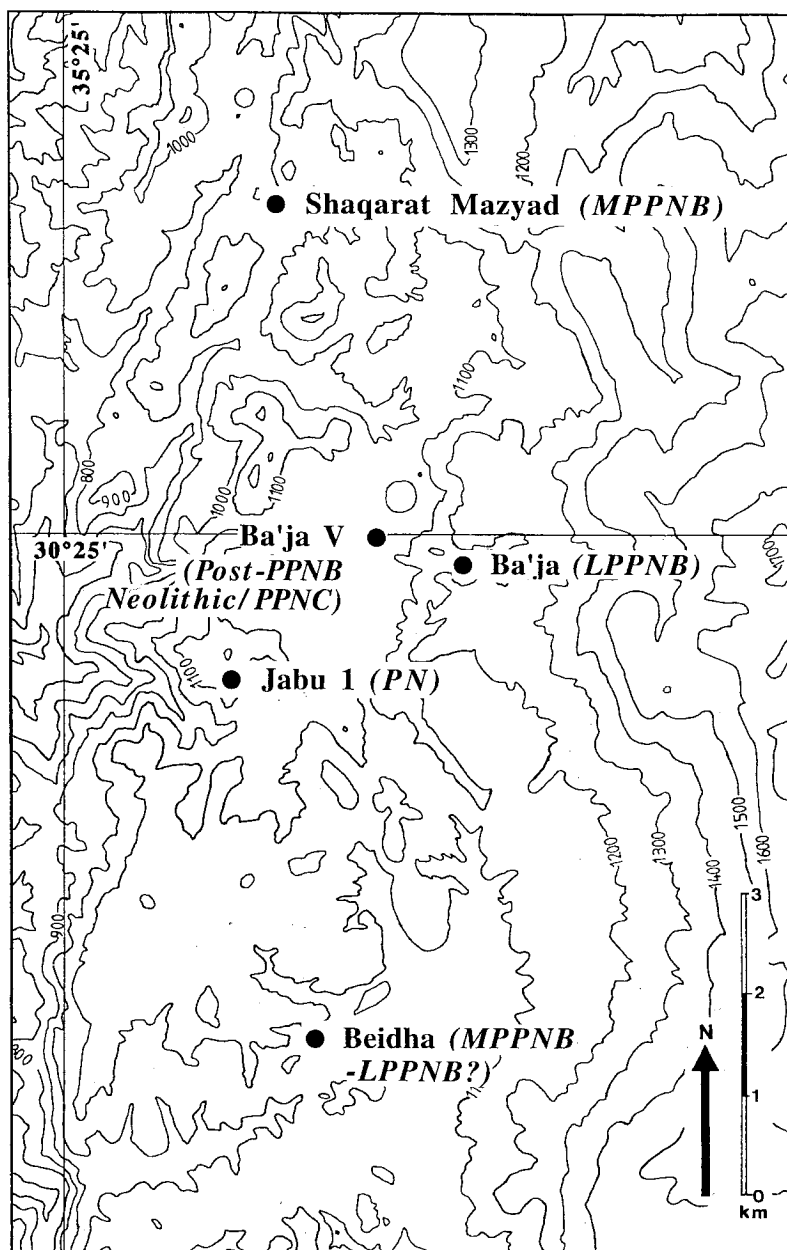


Fig. 1. Geographical locations of Early Neolithic sites in the immediate Ba'ja region. <drwg. H.G.K. Gebel>

In the years after the first investigations (1984), Ba'ja's protected setting, the difficult access and the magnificent setting made it an attractive place to visit for only a few insiders. In 1996 H.-D. Bienert approached H.G.K. Gebel for an in-field cooperation, since it had become imperative to contribute to the mega-site discussion by also investigating a smaller regional LPPNB center away from the corridors of that LPPNB large settlement expansion. In August 1996 H.-D. Bienert and H.G.K. Gebel visited the site to investigate details for large-scale excavations on the spot. After this

preliminary inspection plans were discussed to start fieldwork in summer 1997 (Bienert and Gebel 1997a, b; Gebel and Bienert 1997a).

### Large-Scale Excavations in 1997<sup>1</sup> (Pl. 3.B)

Due to the financial support by the Deutsche Forschungsgemeinschaft (DFG), the Orient Department of the German Archaeological Institute (DAI), the German Protestant Institute of Archaeology in Amman, and ex oriente e.V. at Free University of Berlin, it was possible to conduct a first season of large-scale excavations between June 16 and July 20, 1997. The project was jointly directed by the authors (Bienert and Gebel 1997b, 1998; Gebel and Bienert 1997b; Gebel and Bienert *et al.* 1997). During this field operation at Ba'ja 250 m<sup>2</sup> in 10 5x5m squares were opened in the terraced housing area where the steep slope climbs up from the *siq* to the flatter areas (Area C), forming at this spot a spur-like crest. Furthermore, two test units were opened, one above bedrock at the lowermost fringes in Area C (TU1, a step trench) and the second one in the so-called "Snake Valley" (TU2), a small wadi immediately north of the site where LPPNB ashy trash layers with huge quantities of animal bones and chipped lithics were found in a "sediment trap". (Fig. 2)

From 1999, excavations at Neolithic Ba'ja were continued (Pl. 4) under the auspices and with the support of ex oriente at Free University of Berlin, with H.G.K. Gebel as director and Bo Dahl Hermansen from the Carsten Niebuhr Institute, Copenhagen University, as deputy director.

### Site Location and Topography (Figs. 1-3, Pls. 1-2)<sup>2</sup>

The LPPNB site of Ba'ja rests on the eroding terraces of an intermontane basin in the steep sandstone formations some 11 km north of the ancient Nabataean city of Petra (near the modern town of Wadi Musa) (Lindner 1996). To approach the site, it is necessary to hike and partly climb through a narrow - often only 1.5 m wide - gorge with vertical rock facades of up to 70 m height for about half an hour, at several spots crossing large barriers of fallen rocks which reach heights of up to 5 m. The location of the site (35° 27' 45" E / 30° 24' 55" N) is called "al-Mehmad" by the local bedouins and belongs to the territories of the al-Amarin tribe (Gebel and Bienert *et al.* 1997: 228-229, Fig. 2, Pl. 1A-B). The Neolithic site is bordered by the Siq al-Ba'ja to the south and vertical rock formations to the north. Its longitudinal axis is oriented SW-NE and is about 290 m in length, with a width that varies from about 20 m at the western and eastern accesses to about 90 m in the central area (Hartl-Reiter 1997). The occupation area in the later 8th millennium BC is about 1.2-1.5 ha.

<sup>1</sup> Working at the site is a tough enterprise; it demands more investment into logistics and security than other field projects in the Near East require. The site has no "open" water sources nearby and almost no shady areas. All the water, food, equipment and finds have to be brought up/ down by carrying and climbing through the *siq* for half an hour. No easier/ efficient track was found yet for transporting materials than that afforded by climbing through the *siq*. The entrance of the *siq* (Pl. 3.A) can be reached from the Jabu Plain west of the site by a four wheel drive, coming through Siq Umm al-Hiran north of the Beidha/ al-Hishi/ Wadi Araba junction near al-Beidha Housing. On the site, there are no possibilities for personal hygiene; work was characterized by limited comfort, permanent stress on one's ankles (up to 40° steep slopes, *cf.* Fig. 2), few flat areas to rest, the every-day danger of snakes and climbing accidents, *etc.* Two camps are needed to run the project: a base camp at al-Beidha Housing (including a permanent dig douse), and the dig camp on the site.

In 1997, a staff of 22 permanent team members from Germany, Jordan, the United States, England, and Sweden worked at the site, assisted by up to 24 local workmen. As part of the project, a site and a vicinity survey have been carried out by B. Müller-Neuhof. A team of 2-3 surveyors also recorded the site's topography, including the bordering *siq*, wadi, and rock formations, by means of 5 m-contour lines across the c. 1.2-1.5 ha area of the site (Fig. 2). The six-day vicinity survey aimed at identifying possible outliers of the Neolithic occupation. However, neither 1997 nor later indications were found which would point to the existence of other Neolithic settlements beside Ba'ja in the immediate vicinities. In 1999, a campsite of the FPPNB/ PPNC was found near the entrance of Siq al-Ba'ja (Müller-Neuhof 2002: 176-177), most probably representing the shift to mobile life after the LPPNB after Ba'ja was deserted.

<sup>2</sup> C. Hartl-Reiter (1997) had to correct the reference height for the topographical chart of Ba'ja, published as Fig. 4 in Gebel and Bienert *et al.* 1997: all levels presented there are 88 m too low. The correct heights are given in the new topographical chart, Fig. 2 of this contribution, attesting that Ba'ja is located between 1150 and 1185 m a.s.l. The *siq* bottom extends from 1125 to 1154 m a.s.l. below the site's area.

Table 1. Ba'ja : Topographical Units of LPPNB Ba'ja (cf. Fig. 3)

Area	Setting, topographical features, and drainage directions	Commonly referred to as
Area A	narrow, agriculturally terraced western slope (NE-SW)	"The Towel"
Area B	flat surface southwest of the site's highest part (no major drainage direction)	"The Saddle"
Area C	steep slope with the majority of the LPPNB terraced housing on the site's eastern extension (various drainages, N-SE/S/SW)	"The Amphitheater"
Area D	uppermost northern parts of the site with dense surface evidence of LPPNB walls (Area G belongs topographically to this area; NE-SW)	"The Acropolis"
Area E	small narrow slope with many wall remains starting north of Area B, ending in the wadi ("Snake Valley") bordering the site in the north (SE-NW)	"Snake Valley Slope"
Area F	southern central steep slope (W-S and NW-SE)	
Area G	small uppermost part of the site east of Area D (NW-SE)	
Area H	easternmost part of the site with little archaeological surface evidence (N-S/SE)	"The Restroom Area"
Area I	low terrace above the <i>siq</i> with no archaeological surface evidence (N-SW/S/SE)	

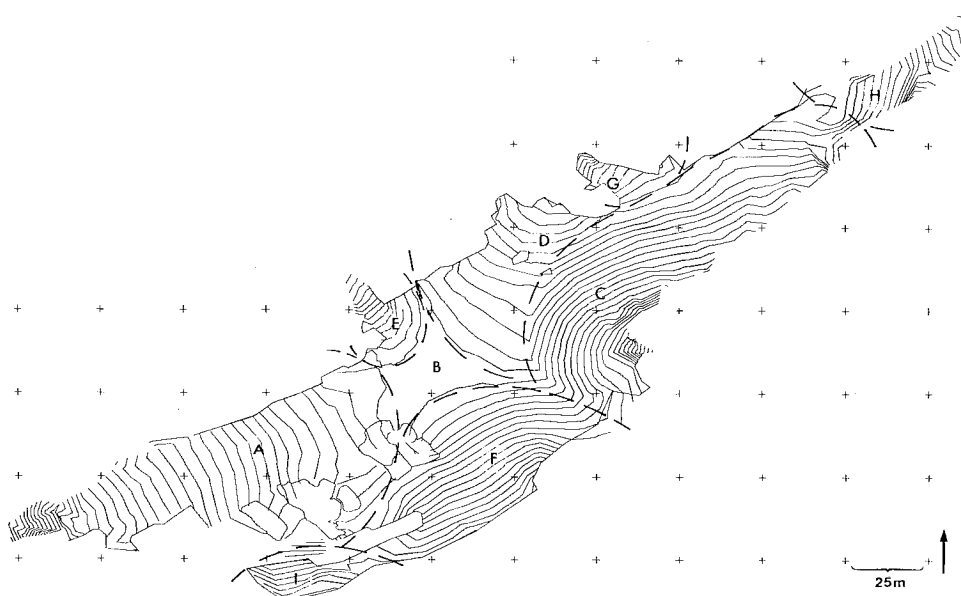


Fig. 3. Ba'ja: Designations of topographical site units.

Ba'ja lies in a cold-temperate, semi-arid zone. The average annual precipitation is around 200-250 mm, but there are large fluctuations in this area. In the small valleys and rock crevices where runoff water can collect, small, well-developed stands of the evergreen oak (*Quercus calliprinos* s.l.) can be found. On more exposed places in rock crevices, for example, one can find pistachio trees and shrubs (*Pistacia atlantica* or *P. khinjuk*) and the Phoenician juniper (*Juniperus phoenicea*).

### Site Preservation and Stratigraphical Features

The present-day surface is the result of aeolian, fluvial, and anthropogenic action, and, of course, gravitation. Some deflation affected the thin fine-grained top soil, which helped concentrate the Neolithic building debris to form a stone pavement in larger parts of the site. Rain occurs as isolated strong events from late autumn to early spring. Erosion forms are represented by rill and gully erosion. The erodibility is very high, especially in Areas C and F with their high relief intensity; erodibility in Areas A and D is weaker. In flat areas, e.g. central Area B, huge "colluvial" deposits mixed with anthropogenic layers rest against well-preserved walls - a phenomenon, for which no proper explanation for now exists.

The settlement layout considerably influenced erosion and sedimentation on the slopes of Ba'ja. The massive presence of architecture and building debris protected from deflation, and the terrace and room walls hindered erosion and helped accumulate colluvial material upslope behind the structures. During its use and after the settlement was deserted, the small rooms were quickly filled by building debris (wall plaster, ceilings, roofs, and walls). In the "colluvial" deposits (e.g. central Area B), rubble layers alternate with sandy deposits and cultural layers, whose inclinations are parallel with the slope, while settlement layers and the architecture are bedded horizontally. This resulted in an obliquely leveled surface with walls outcropping from the settlement underneath.

The reinforced terrace wall in C1/11 and the "half" wall fragments in the southern parts of C1 and C2 (Fig. 4) give evidence for an important problem facing the Ba'ja residents: walls sliding down slopes. A "slipping" of complete rooms or even parts of buildings probably did not need a specific layer agent since the pressure of hundreds of tons of structures on the soft sediments underneath created enough instability in the terraced housing. The settlers were aware of this problem: between the western and eastern terrace walls in C1 - C11 and C2 - C12, at a relatively firm setting on the aforementioned spur, stratified and possibly two-storied architecture with wall heights of up to 2.2 m has been found.

We have reconstructed a general sequence of stratigraphical events for Ba'ja (Gebel and Bienert *et al.* 1997: Table 2), which was confirmed in later seasons. The actual sequence at an individual spot often is more complex. It is extremely difficult to identify major building phases, since groundplans were altered through added walls and reinforcements, blockage of passages, closures and insertions of wall openings and staircases (e.g. Pl. 5). Otherwise, groundplans "raised" by using the older walls as foundations. There is strong evidence of second floors, or walls shared by two rooms/ building levels (split-level architecture). Subphases seem to represent locally restricted functional changes, most likely associated with social factors.

As of yet (by the 2000 season), no detailed information can be given on the deeper stratigraphy in the excavated areas (Figs. 5-6). Elevational evidences from various spots may indicate that there is no substantial building phase below, that we are dealing with groundplans growing vertically on top of older walls. Observations at nearby Basta revealed a possibly long-term use of LPPNB structures, using stable groundplans and spatial order, with little alteration compared with Ba'ja and 'Ain Jammam (Waheeb and Fino 1997). The duration of occupation at Ba'ja points in the same direction, although building in Ba'ja suffered more from the special topographical impacts and constraints.

### **Building Techniques (Figs. 4-6, Pls. 5-6)**

For the wall stones, nearby tabular sandstone was preferred as raw material. The nearest source identified is in Area I (Fig. 3). We have not so far gathered enough experience to be able to identify the early Neolithic quarries, if identifiable at all, since 9000 years of erosion interfered with the evidence. Four different sizes of wall stones were identified by B. Borowski and C. Laude, of which three were shaped outside of the residential area. Products of on-site stone re-shapening were used for floor beds and between the wall faces. Four types of floors have been attested: temporary or "beaten" earth floors and intentionally constructed lime plaster and stone slab floors. The latter two are much rarer than the earth floors; lime plaster floors should not have survived too often, since we found evidence of plaster recycling in the later season. Red-stained and creamy-colored (stained?) plaster coats are attested, covering a "stratigraphy" of beds made of gravel, fine-grained stones, and lime spreads and the final coats. All these layers had a thickness of 5-6 cm, and extended up onto the interior wall as in a bathtub. The earliest floors can be founded directly on room fills or on the virgin soil (Gebel and Bienert 1997: Pl. 5:C); channel-like subfloor constructions as known from Basta Nissen *et al.* 1987, 1991; Gebel *et al.* 1988; Gebel and Muheisen 1997), es-Sifiya (Mahasneh 1997), 'Ain Jammam, Khirbet Hammam, and 'Ain Ghazal have not been attested in Ba'ja.

The walls of Ba'ja rarely have foundations; since it was a standard of building to continue building on older walls/ groundplans, foundations appeared obsolete. The earliest walls were founded directly on the soft virgin soil, or were built directly on a floor (e.g. Gebel and Bienert 1997: Pl. 5:C).

All wall qualities have been attested, ranging from single-row cobble walls to properly set double-faced walls made of selected regular thick local sandstone slabs that were roughly dressed and stabilized by "interwedged" smaller stones in parallel courses (Gebel and Bienert 1997: Pl. 5:D). Double-faced walls - most around 60 cm thick - were not linked with headers, which caused a considerable structural instability in these slope settings; the spaces between the two faces were filled with mortar and smaller stones. Silty-sandy mortar was used for all the walls. Another element of structural instability are walls meeting without bonding, which might be also a result from later re-organization of groundplans. To confront structural instability, the Neolithic architects "enforced" walls by adding another one in front or building buttresses. We assume that mud plaster covered all the walls. There is little evidence of stained lime wall plaster preserved; for a wall painting with abstract motifs *cf.* Gebel 2001. Although the wall techniques at Ba'ja evidence a high skill in setting "aesthetic" and regular courses and precisely built corners and wall openings, the constructive skills and the structural know-how of the builders was restricted to a "naive" static understanding. Basically, the builders were not able - 500 years after real architecture had entered the area - to cope with the dangers of an earthquake-afflicted region and the extreme slopes on which they settled.

### Domestic Architecture (Figs. 4-7, Pls. 5-6)

The architecture excavated at Ba'ja represents the typical and well-known cellular LPPNB architecture. The groundplans roughly match with those of most of the other LPPNB mega-sites in Jordan. A pre-planned, at least intentional house plan seems to be inherent in the architecture (*cf.* below). The characteristics of this architecture are 1) small quadrangular/ rectangular/polygonal rooms connected by wall openings, 2) rooms were built, apparently without open spaces, on terraces in a *pueblo*-like manner (Fig. 7), and 3) double-faced walls with nicely set courses with interwedged smaller stones. The cells or small rooms appear to be centered around a large room, probably a courtyard (Areas B-North, C, and D; Figs. 4-6). These groundplans strongly resemble the Basta House (*cf.* Gebel *et al.*, this volume: Fig. 1). Since the steep slopes of Ba'ja did not allow extended terraces to carry buildings of this size, their groundplan had to use different levels and room shapes (curvilinear, polygonal) to adopt to the contour lines. There is good evidence of two-storey buildings in Ba'ja, and several findings witness split level buildings, using staircases to connect the floors and levels (Pl. 5). Recent discussions and reconstructions see basements in the excavated groundplans carrying a second floor (Gebel and Hermansen 2001; *cf.* the reconstructions of M. Kinzel in Figs. 7.A-B).

The principal rooms of Area C are more or less rectangular and thus probably planned on even terraces (Fig. 4). Terrace walls were also found (the one running NNW-ESE in Squares C11/C1, and one N-S and somewhat bent in Squares C12/C2); both these walls protected the large rooms between them, most likely fortifying the spur-like topography. Their thickness and weight might have caused stability problems; e.g., the terrace wall in Squares C11/C1 was reinforced by a second wall on the west. Since that action did not seem to provide reasonable stability for the rooms on the terrace, three buttresses were added, partly built over the first reinforcement wall (for a more detailed description of the layout *cf.* Bienert and Gebel 1998 and Gebel and Bienert *et al.* 1997). Excavations in 1999 and 2001 revealed that this buttressed wall could once have been the outer wall of the building on the spur, creating here a kind of monumental "facade" in one period of the occupational history of the site. In the seasons following 1997 it became clearer that (Gebel and Hermansen 1999, 2000, 2001) we were dealing with shifting functional units in Ba'ja: originally intended groundplans (courtyard/ large rooms with cells around) were steadily re-organized through the insertion of walls, wall openings, and staircases, creating new combinations of rooms. Most likely this results from changes in family structures and property. The upper occupation in Area D suggests that long walls running downslope structured space (Fig. 5, Pl. 6.A) in the later phases of Ba'ja: these now became stable elements of the residential areas, while the room walls between (which run parallel to the contour lines, and therefore are less stable/ tend to lean downslope) became subject of necessary groundplan alterations.

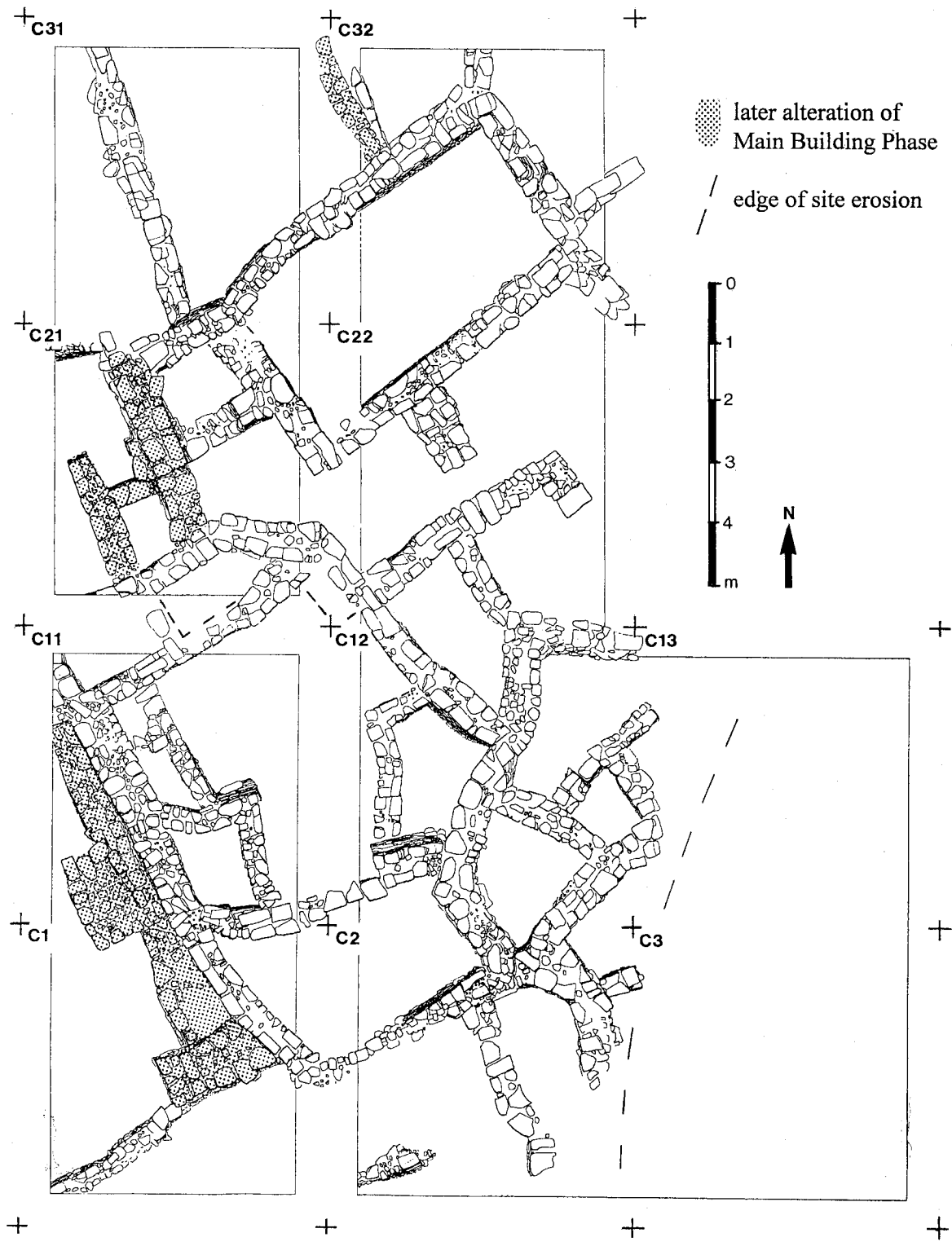


Fig. 4. Baja 1997, Area C: layout of residential architecture (Main Building Phase, with later alterations).  
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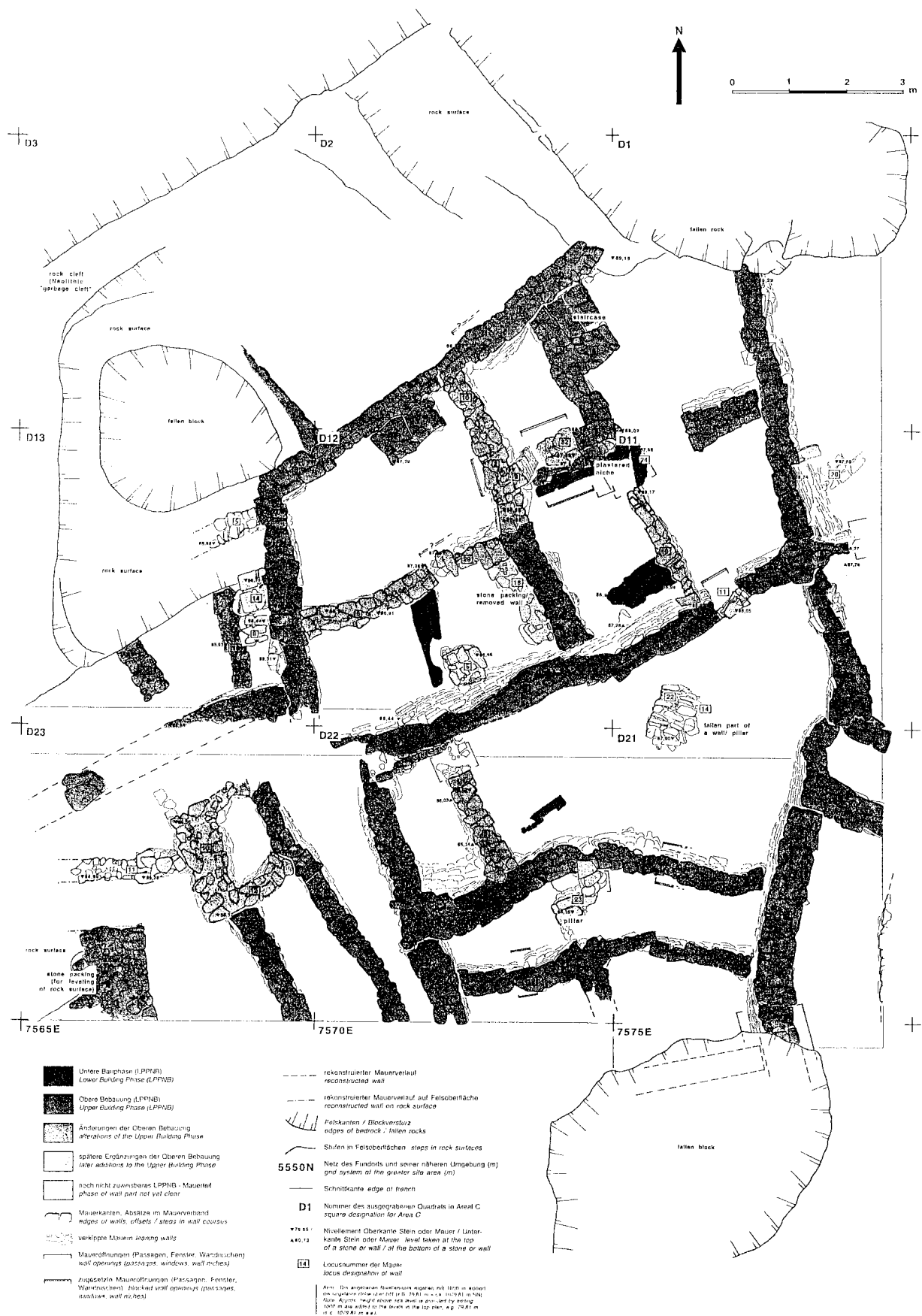


Fig. 5. Ba'ja 1999, Area D: layout of residential architecture (with building phases). <field records B. Borowski, edited by B. Borowski and H.G.K. Gebel>

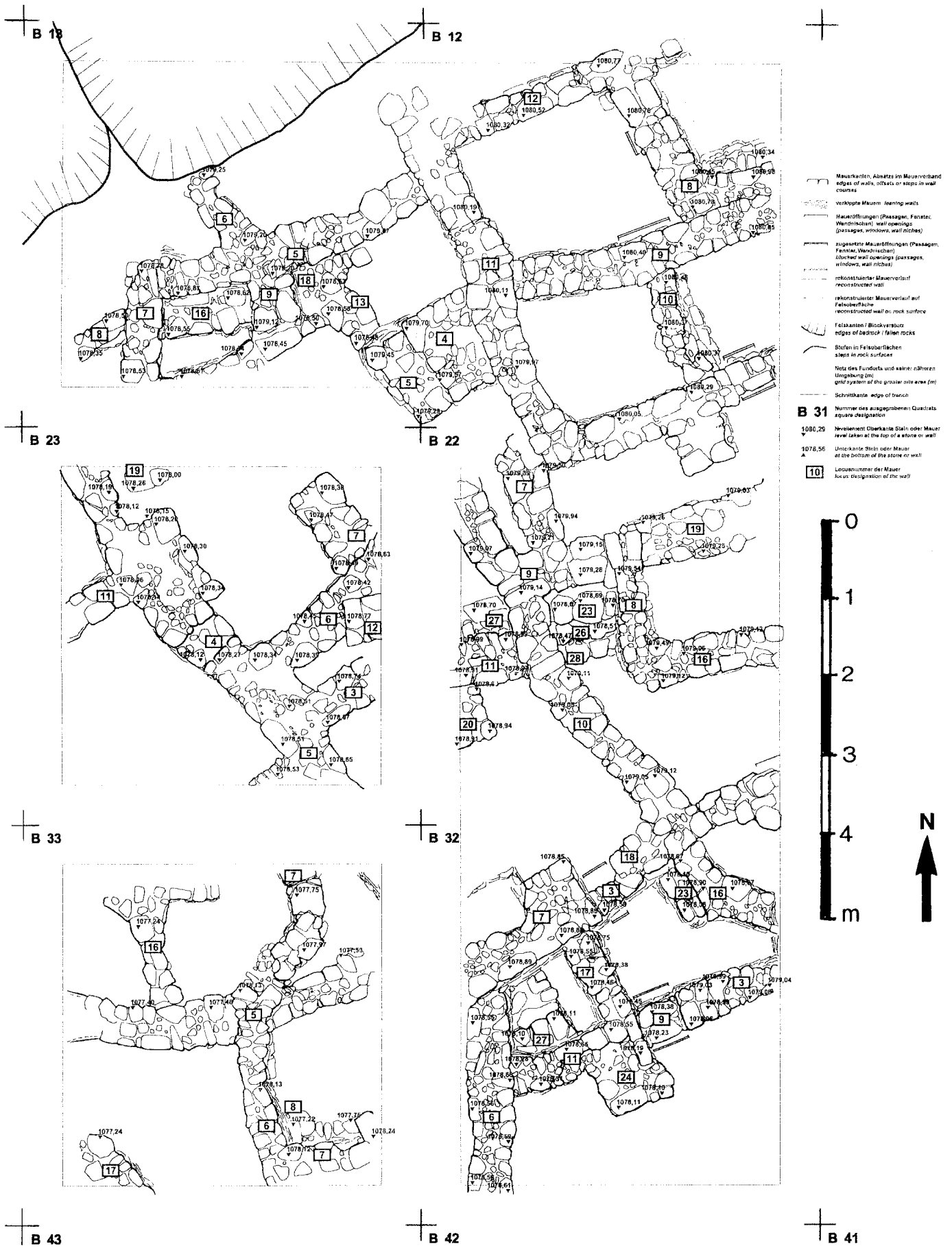


Fig. 6. Ba'ja 2000, Area B- North: layout of residential architecture.  
<field records and editing by B. Borowski and C. Laude>

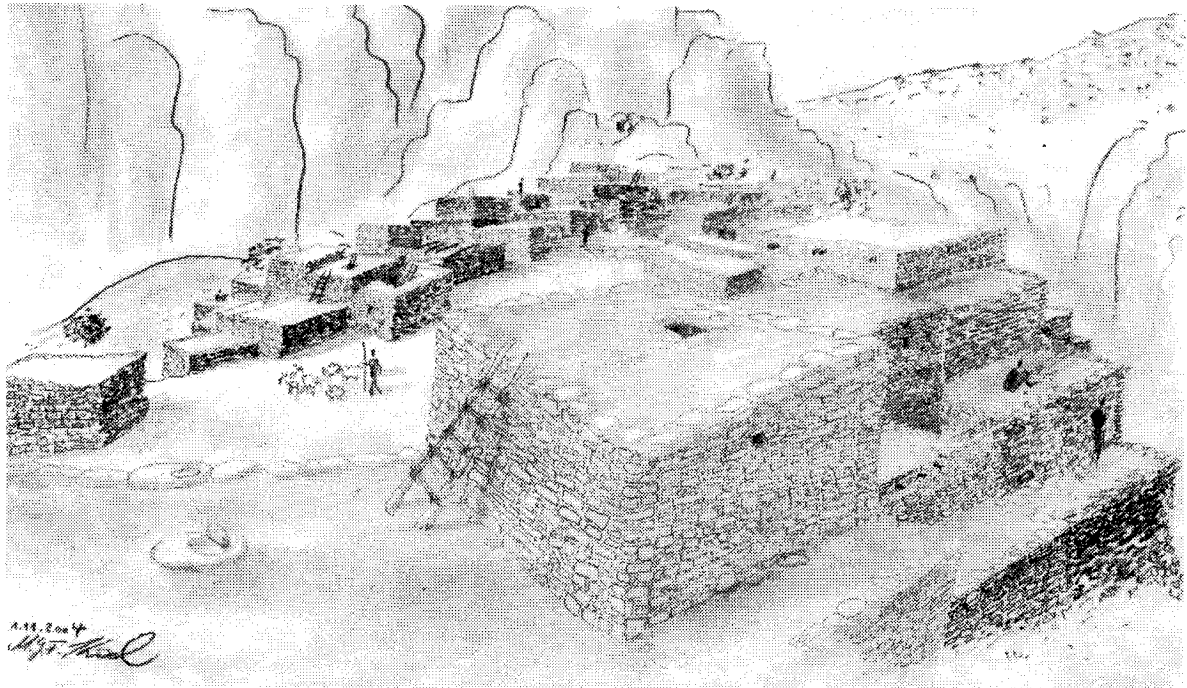


Fig. 7.A. Ba'ja: Reconstructed view from SSW. <by M. Kinzel>

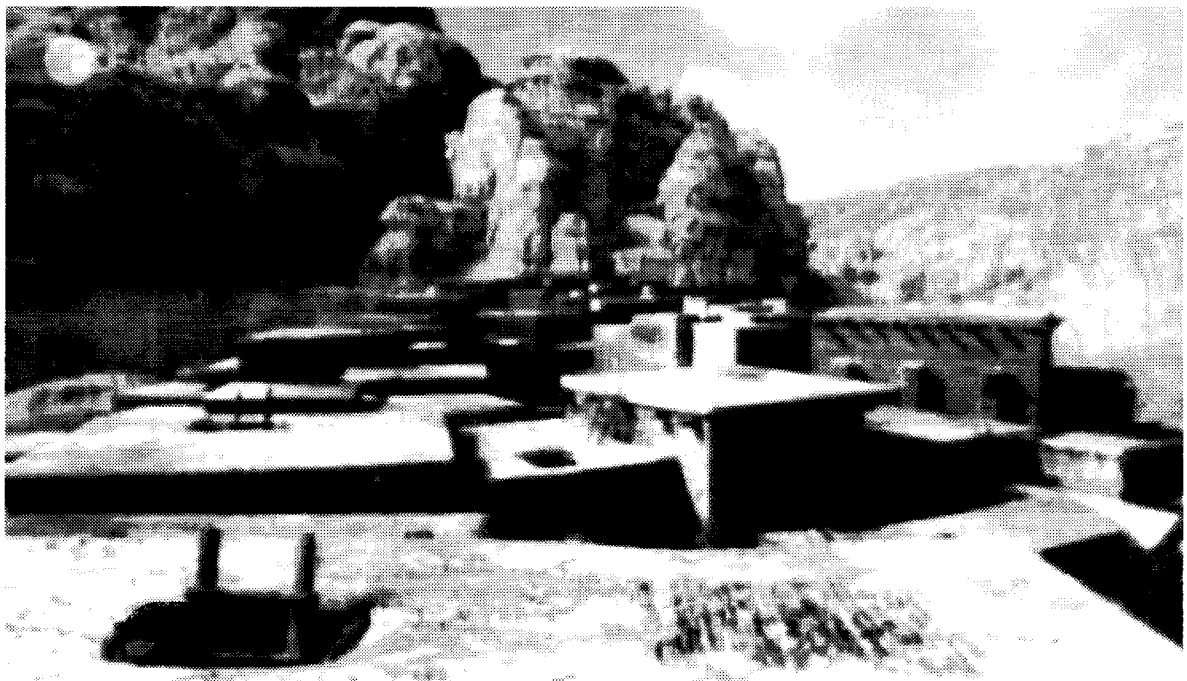


Fig. 7.B. Ba'ja: Reconstructed view from SW. <by M. Kinzel, ZDF>

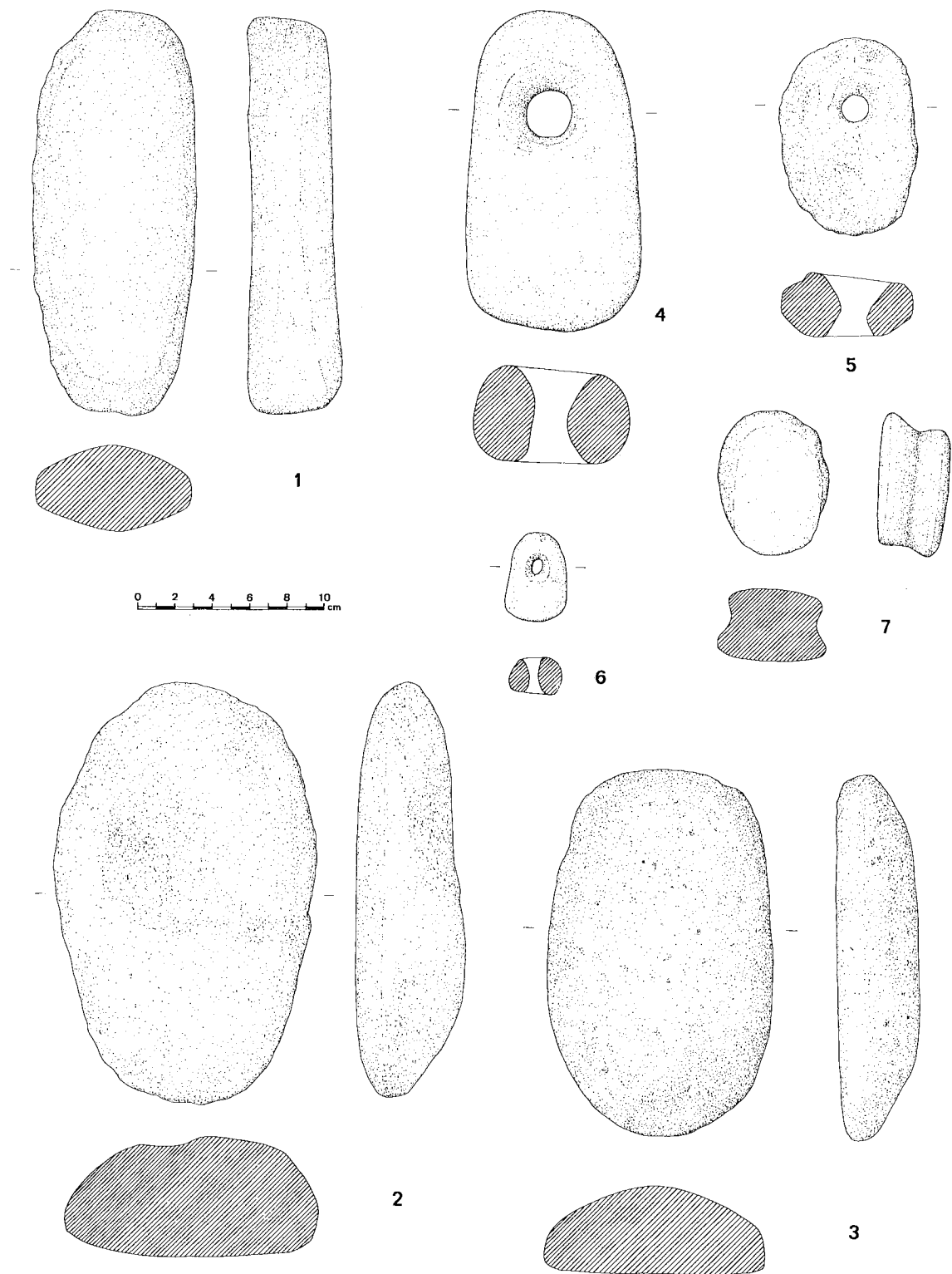


Fig. 8. Ba'ja 1997, Ground stone industry: 1-3 handstones (6023.2, 6019.6, 6019.4), 4-6 weights (6078.4, 6008.2, 6091.19), 7 "waisted stone" (weight?; 6046.8). <drwgs. S. Shraideh>

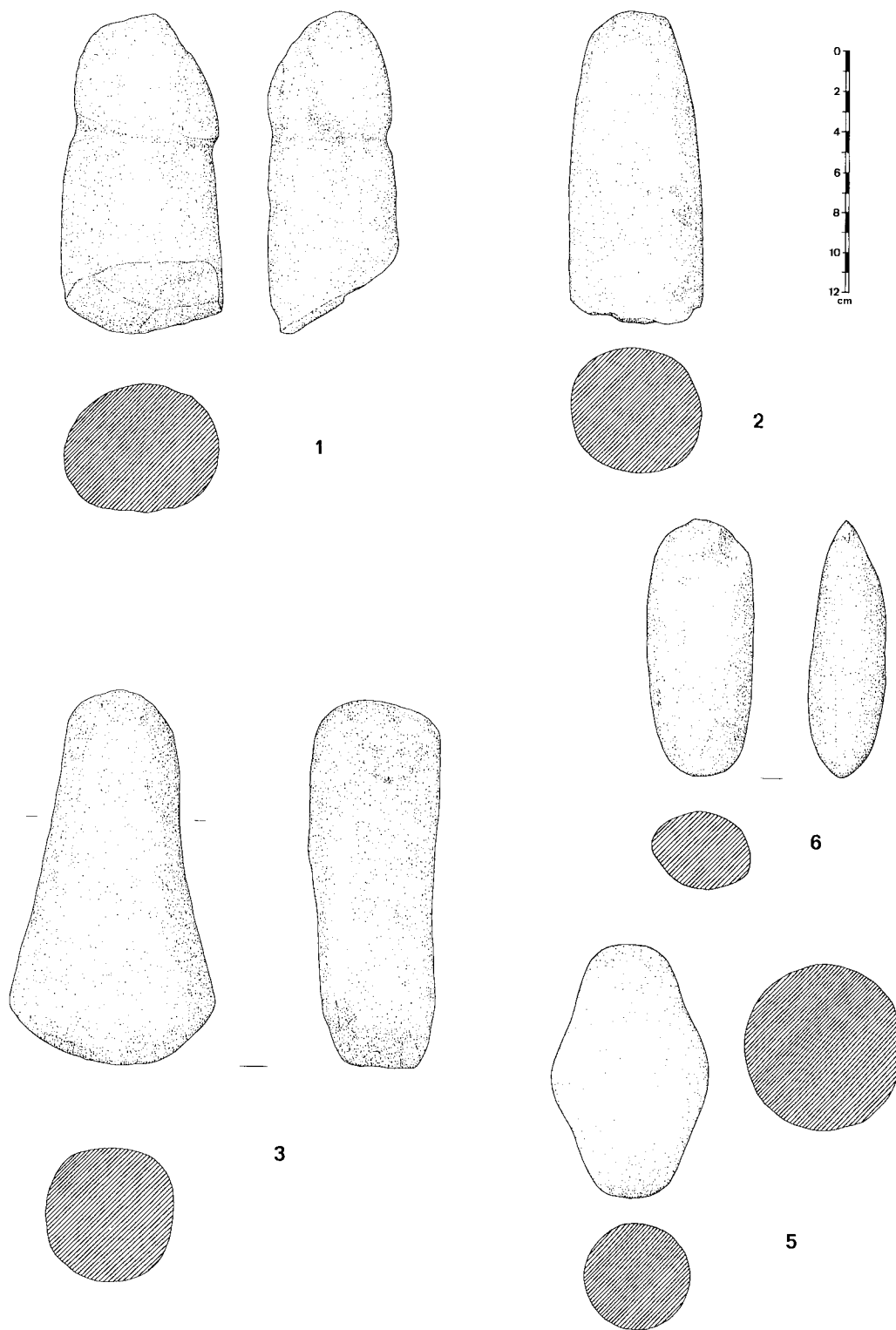


Fig. 9. Ba'ja 1997, Ground stone industry: 1 phallus-shaped pestle/ weight (6042.22), 2-3 pestles (6065.8, 6053.5), 5 "waisted stone"/ pestle (6028.18), celt-like item (6077.3). <drwgs. S. Shraideh>

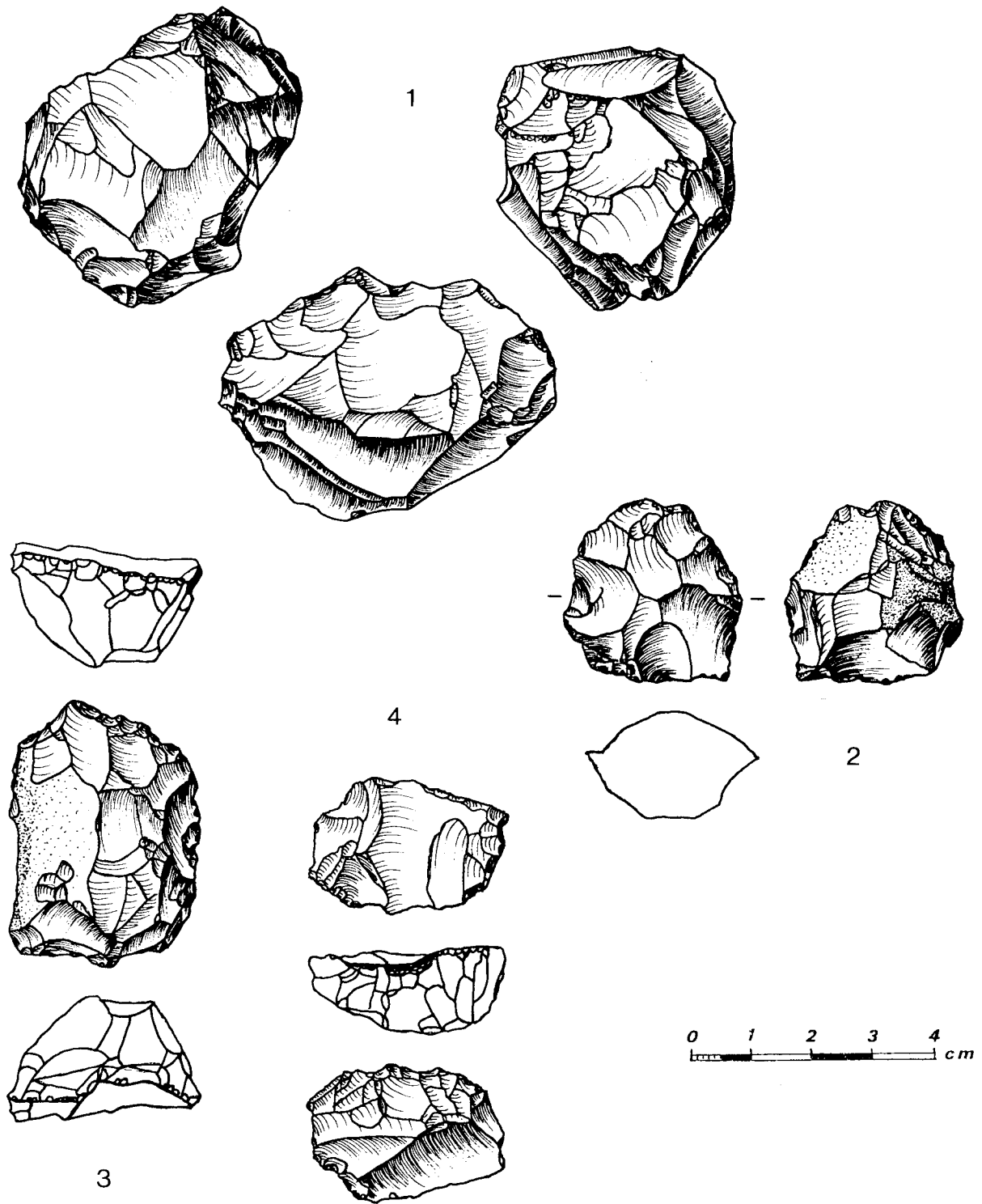


Fig. 10. Ba'ja 1984, Flint industry: various non-naviform cores (2-4: reused as scrapers). <drwgs. I. Raidt>.

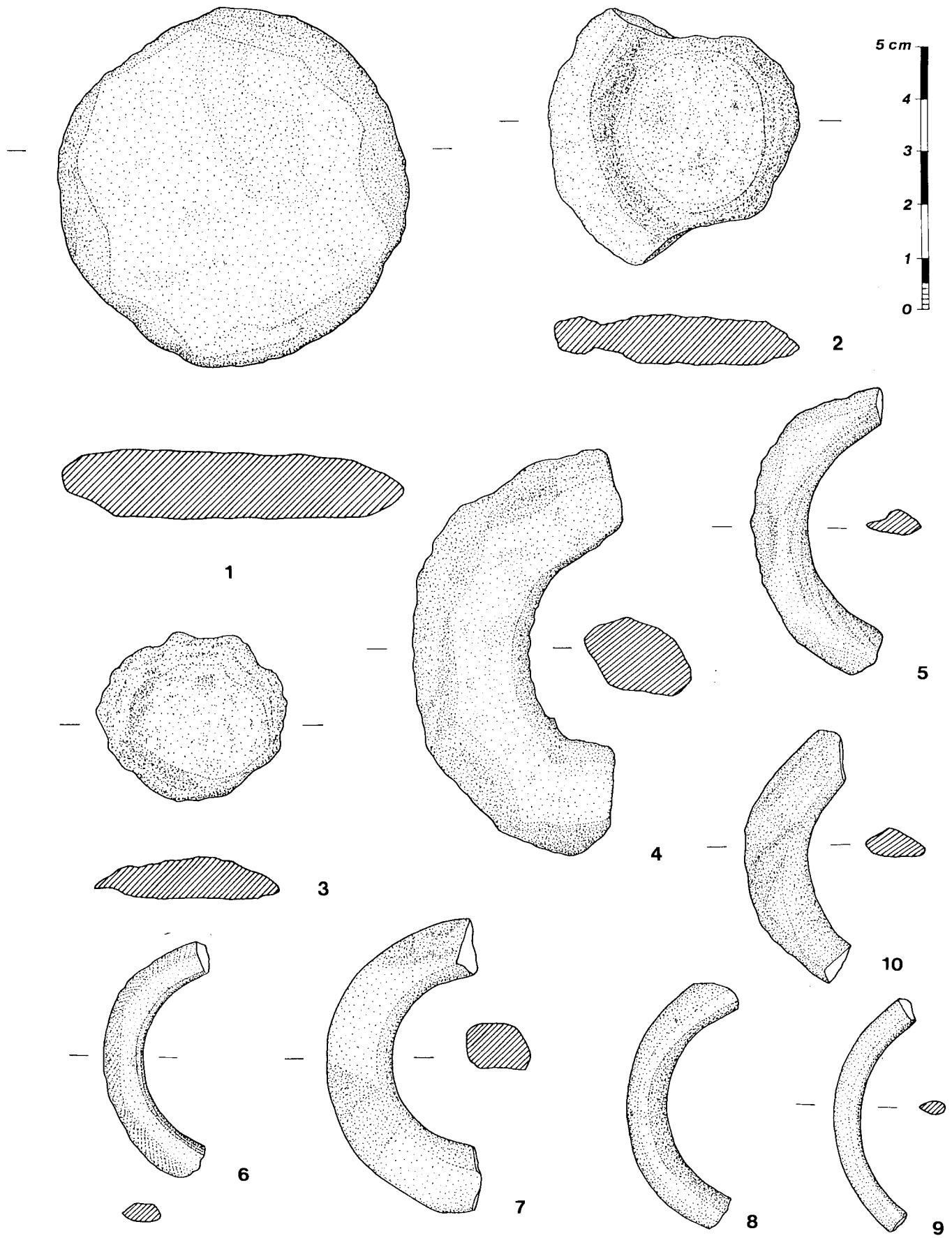


Fig. 11. Ba'ja 1997, Waste of ring production stages: 1 raw disk (ring production Stage 1, 1209.3), 2-3 concentric engraving products (Stages 3, 4b; 1241.1, 1209.7), 4-6,10 raw rings (Stages 4a, 5a; 1256.1, 1277, 1254.1a, 1200.2), 7-9 finished rings (Stage 6a; 1245.1, no?, 1286.1 ). <drwgs. S. Shraideh>

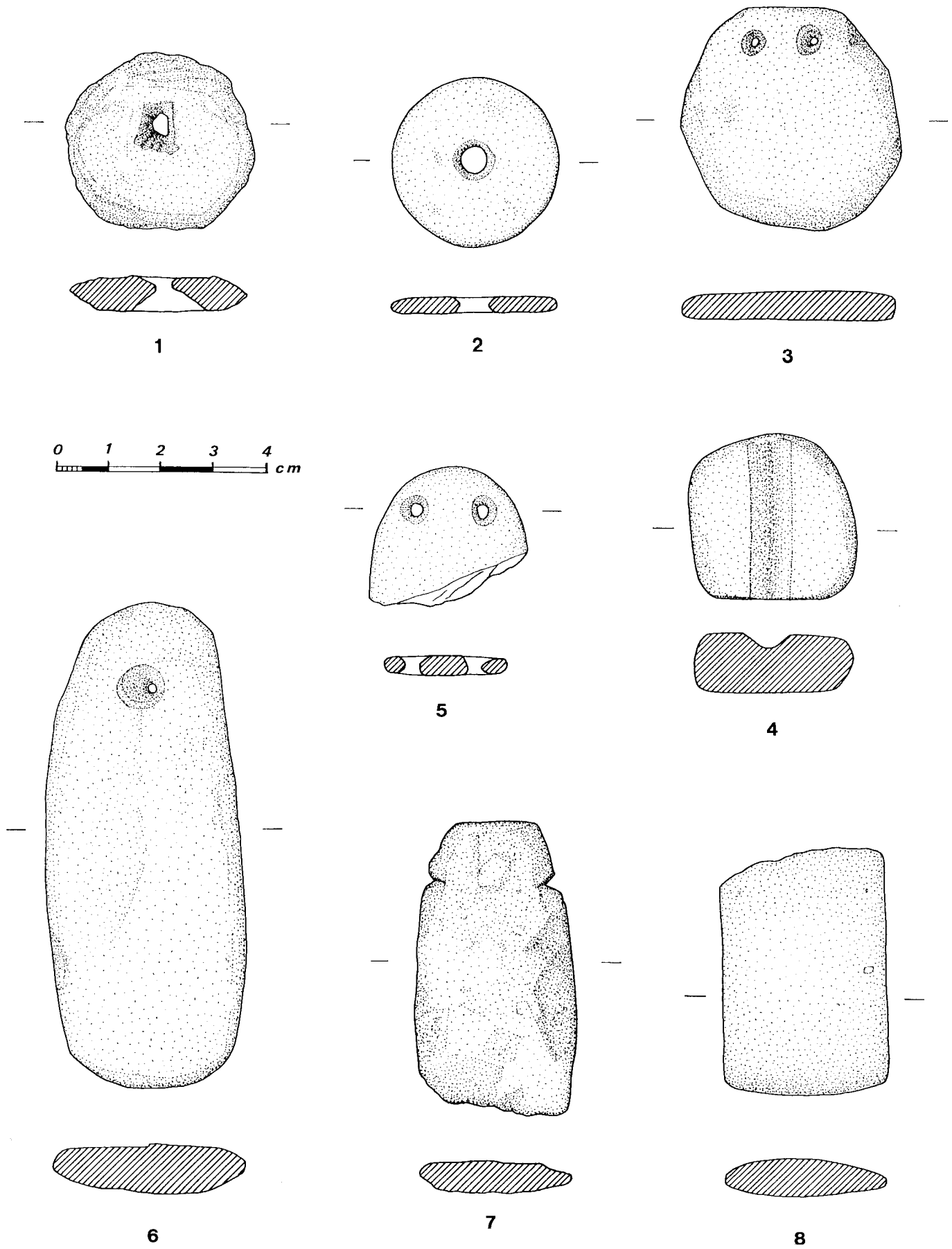


Fig. 12. Ba'ja 1997, Various sandstone items: 1 perforated interior sandstone disk (ring production Stage 5b; 1231.3), 2 perforated sandstone disk (1259), 3,5 perforated sandstone pendant? (406.4, 406.3), 4 "grooved stone" (1805), 6-8 sandstone paletts (1801,1800,1224.11). <drwgs. S. Shraidch>



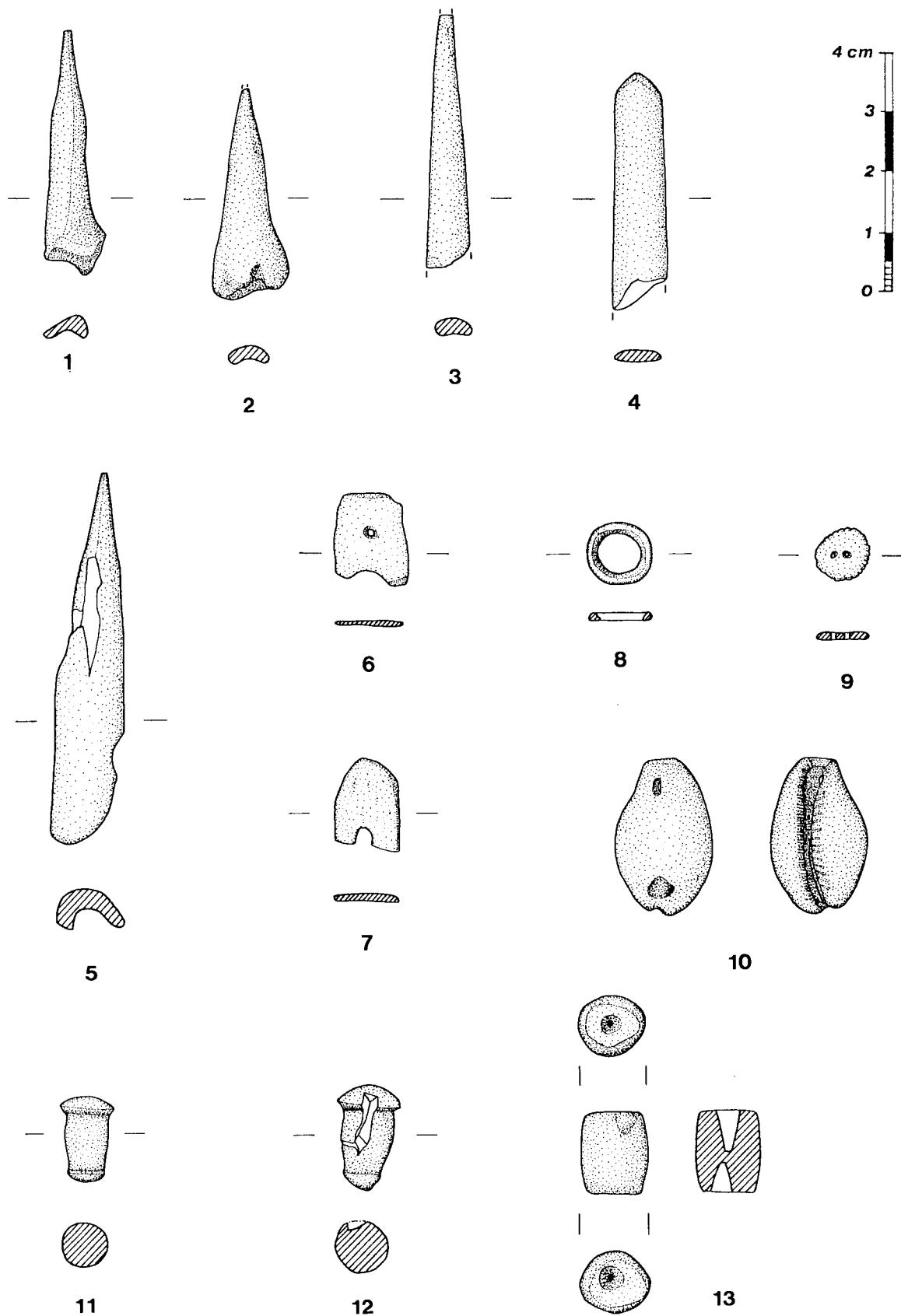


Fig. 13. Ba'ja 1997, Bone and ornament industries: 1-3,5 bone awls, 4,6-7 bone spatula (fragments), 8 mother-of-pearl ring, 9 mother-of-pearl button, 10 perforated cowrie shell (*Cypraea* sp.), 11-12 marl? ear ornaments, 13 greenstone bead (unfinished). <drwgs. S. Shraideh>

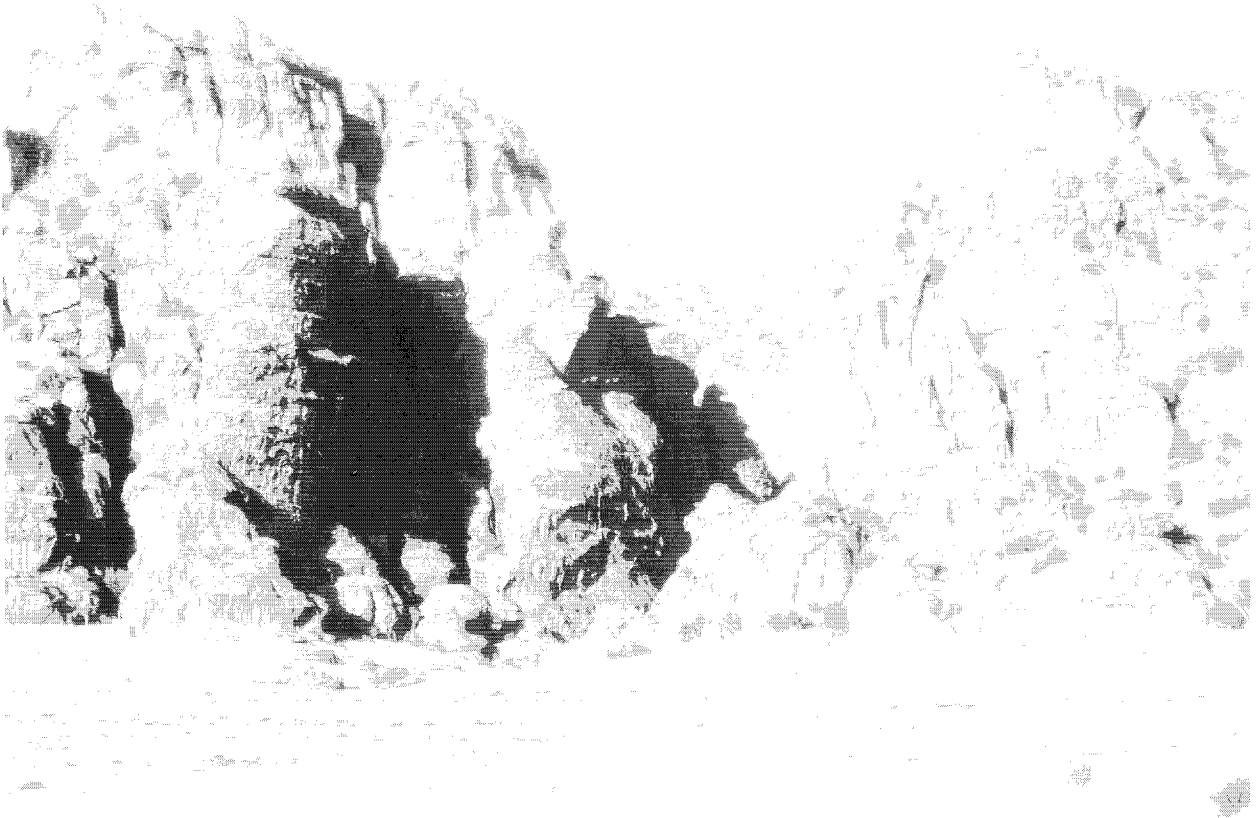


Pl. 1. Ba'ja 1998; View of the intra-montane basin from WNW. <photo H.D. Biener>





Pl. 2. Baija 1984: A site panorama from NE (160°), B site panorama from SSE (130°). <photo H.G. Gebel>



Pl. 3A. Entrance of *Siq al-Ba'ja* (arrow), the gorge leading up to the LPPNB site from the Jabu Plain (foreground): view towards E. <photo H.G.K. Gebel>



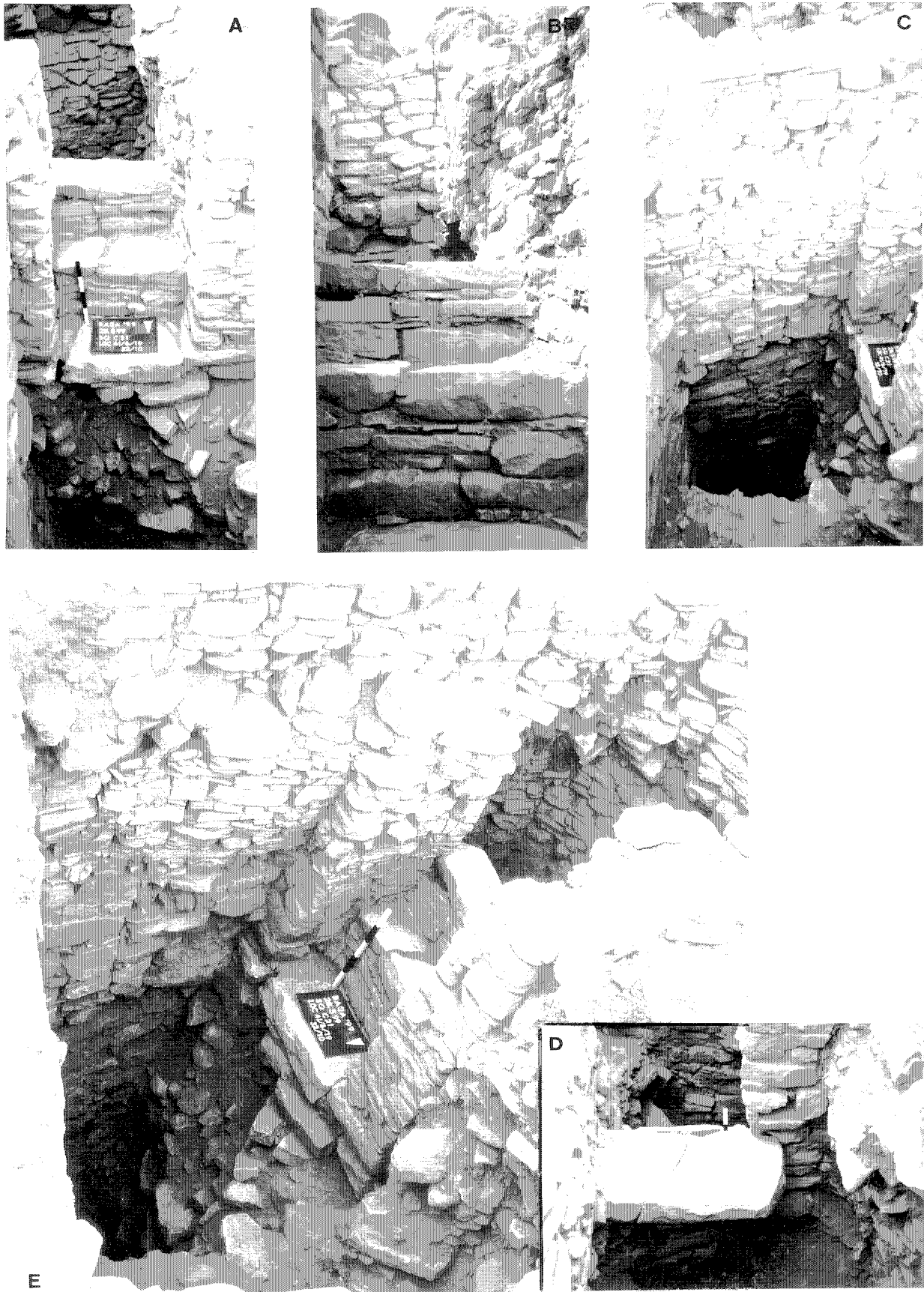
Pl. 3B. Ba'ja 1997: View of the site from SSE with excavation Area C. <photo: S. Schatz-Haerle>





Pl. 4. Ba'ja 1999-2003: Development of excavations since 1999: site views from SSW in 1999 (A),  
In 2000 (B), in (C), and 2003 (D) (photos B. Borowski, K. Traulsen)





Pl. 5. Ba'ja 2000, Area C: Various views of the staircase finding in C 21 (Loci 6,10,19,32,41): A-B from N, C from W with deep sounding, D from S, E from WNW <photos H.G.K. Gebel>



Pl. 6.A. Ba'ja 1999, Area D: terraced residential architecture from NNE. <photo H.G.K. Gebel>



Pl. 6.B. Ba'ja 1999, Area D: terraced residential architecture from SW. <photo H.G.K. Gebel>

Rooms were inter-connected by wall openings which were in most cases made for ventilation and lighting and have nicely built jambs and lintels of large tabular sandstone. It seems that the access into the rooms was exclusively through the ceilings (*cf.* also Figs. 7.A-B). No doorways or other sorts of passages were found during any one of the seasons. In instances where two-storied structures existed, the lowermost rooms might have played the role of a basement preserving the produce of the inhabitants from climatic impacts. Outer house walls appear to have had no windows. This makes the house complex look like a communal fortified complex, not easy to enter and easy to control. We are most likely dealing with architecture with an internal orientation (Gebel 2002a). If we may speak of "public" and "private" sectors in Ba'ja at all, communication between the units may have occurred via the roofs of the terraced housing, the roofs serving as "public" (= communal) spaces for the settlement.

### **The Stone, Baked Clay and Bone Industries (Figs. 8-13)**

The primary production of the chipped flint industry rarely attests naviform cores and their typical preparation waste. Instead, bi-directional cores remind of the intention of the naviform technology. Unidirectional blade cores are represented in addition to many flake cores, too. Cores are generally quite rare, and flint workshops have not been found yet at Ba'ja. The tool kit appears somewhat restricted as compared with Beidha and Basta. It comprises the following tool classes: 1. heavy-duty tools: hammerstones (frequent), celts (frequent), adzes, and chisels; 2. non-formal tools (all sorts of retouched blades and flakes); 3. formal tool types: leaf-shaped arrowheads (frequent), tanged arrowheads, scrapers (frequent), borers with tips <2mm, heavy duty borers, and denticulated blades (rare). We interpret the blank production and tool kit as representing household needs rather than representing manufacturing goods on an "industrial" surplus scale or for trade. The tools used for chiseling/ graving the sandstone rings (see below) have not been identified yet.

Stone vessels, especially the delicately worked vessels appear to be quite rare compared with Basta. Most of the Ba'ja ground stone tools are made on local sandstone varieties, which is not the best for grinding/ pounding and nutrition purposes. Handstones comprise the most numerous class of ground stone tools (70-80 %). The deep querns known from MPPNB Beidha are missing in the Ba'ja collection. In the following we list the types attested in a pre-excavation surface collection, Ba'ja, according to K. Wright in Gebel and Bienert *et al.* (1997):

Grinding slabs/ querns: saddle-shaped grinding slabs, trough grinding slabs, slab/querns, miscellaneous

Mortars: most likely not in common use in Ba'ja

Bifacial handstones (shapes): ovate/planoconvex, ovate/triangular, loaf/oval, loaf/lens, loaf/triangular, loaf/plano-irregular, rectilinear/lens, rectilinear/ triangular, rectilinear/plano-irregular, irregular *a posteriori*, ovate

Perforated stones: counterpoise weights

Multiple tools: miscellaneous pestles/ handstones

The most outstanding LPPNB luxury object found at Ba'ja is the sandstone ring. Revealed in all its manufacturing stages, it is clear that Ba'ja was a production center and a source of further distribution of this product. Their production shows labor division and a clear *chaîne opératoire*, and seems to have taken place in most households. The precise function of this artefact type, always interpreted as being an ornament, is actually not clear at all (*cf.* Starck 1988: "pendants or clasp-like ornaments", or arm bangles). For the individual production stages *cf.* Gebel and Bienert *et al.* 1997.

One of the most outstanding finds of the 1997 season is the presence of burnt clay sherds of clay representing vessels or container-like installations. They were found in the easternmost chain of rooms in Area C (Fig. 4). The consolidation of their clay minerals is not or only partly reversible, thus we may technologically speak of baked sherds. But culturally, they are not considered pottery, since they do not represent mass-produced containers. For a more detailed description *cf.* Gebel and Bienert *et al.* 1997.

The bone industry represents the known spectrum of artefacts known from LPPNB inventories.



## The Ornament Industries (Fig. 13)

Ornaments are, apart from the sandstone ring products, comparatively rare in Ba'ja. Their contextual evidence seems to concentrate around burial findings, or the removal of burials respectively. The objects found were made of soft limestone, exotic minerals (e.g. greenstone), Red Sea molluscs incl. mother-of-pearl, and consist of pendants, rings, buttons, and other sewn-on objects.

## Subsistence Evidence

On the faunal remains, *cf.* von den Driesch, Cartajena and Manhart, this volume. Exploited wood belonged to a juniper species, most probably the Phoenician juniper, and less commonly to the pistachios, most probably *Pistacia atlantica* or *P. khinjuk*. Oak seems to have been rare or absent. Collected fruits are wild pistachios, hawthorns (*Crataegus azarolus/aronia*) and figs (*Ficus* sp.). Remains of cultivated plants were scarce, suggesting that crop plant cultivation was less important in PPNB Ba'ja. Only a few remains (the so-called glume bases and spikelet forks) from the processing of emmer wheat (*Triticum dicoccum*), have been retrieved. An area suitable for large fields should have been the Jabu Plain in front of the entrance of Siq al-Ba'ja.

## Summary of the Main Results of 1997, and Reference to Insights from Later Seasons

- 1) The material culture of Neolithic Ba'ja dates exclusively to the Late Pre-Pottery Neolithic B (2nd half of the 8th mill. BC). The ruins were used by Neolithic squatters while being buried under the remnants of their own decay and – in some flat spots of the site – under rubble accumulations of unknown origin.
- 2) Architectural remains resemble the findings in Basta, al-Baseet, 'Ain Jammam, Ghwair 1, and es-Sifiya, but only partly those in Beidha, 'Ain Ghazal, Wadi Shu'aib; the domestic units are multi-roomed and consist of rectangular and polygonal room (1-2 m<sup>2</sup>) rows around courtyard-like open spaces. Room/ building units are attached to each other without open spaces or passages (a communal space probably existed in central Area B). The units could expand over two terraces (split-level architecture), and could have two storeys. The rooms were accessible through staircases, wall openings, ceiling openings (assumed), large central rooms/ courtyards, and - from outside - by the roof tops. Building layouts were executed by skilled specialists, but repairs and minor alterations might have been done by less skilled members of the community. There are clear deficits in the builders' competence in building statics.
- 3) Architectural subphases altered groundplans within the framework of the major terrace walls. Subphases can be distinguished by additions onto existing wall tops, blockage or insertion of wall openings, as well as additions to the groundplan, *e.g.* insertion of walls, reinforcement buttresses, and walls to stabilize a terrace and the rooms behind.
- 4) Even the steepest slopes of the site were occupied by architecture (the architecture east of the excavated Area C was eroded by aquatic forces in post-occupational times). We have to assume dense occupation on all the site's territory that even forced the use of vertical space (Gebel 2002a).
- 5) A rich ground stone industry indicates food-processing areas in the houses, including on the roofs. The use of stone vessels is rarely attested.
- 6) In the chipped lithic industry the contemporary, highly specialized naviform technique is almost missing (instead, a non-naviform bi-directional blade technology imitates this technology). The tool kit mirrors no specialization and reflects household activities only.
- 7) Baked clay sherds of containers/ vessels are probably the remains from ovens (*tabuns*). The latter were either intentionally burnt or exposed to fire, often beyond 550°C.

8) The site was a production center for sandstone rings which were made in most of the households; their manufacture shows labor division, about which we assume to have played a major role for the development of the settlement's exchange pattern (trade) and the site's wealth.

9) Food plants included, at the very least, emmer wheat, wild pistachios and perhaps figs. Juniper and pistachios were exploited as fuel and timber. Animal protein in the diet came from the following species (*cf.* von den Driesch *et al.*, this volume: domestic: sheep/goat, goat, sheep, cattle, dog - wild/ domestic: goat, cattle, pig/boar - wild: gazelle, onager, African wild ass, hyrax, cats, foxes, panther, boar, hare. Hunting played a minor role in Ba'ja compared to herding (85-90%).

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