

## Household and Death, 2: Preliminary Results of the 12<sup>th</sup> Season (2018) at Late PPNB Ba`ja, Southern Jordan

Hans Georg K. Gebel, Marion Benz, Christoph Purschwitz, Hala Alarashi, Joachim Bauer, Julia Gresky, Blair Heidkamp, Bellal Abuhelaleh, Lucia Miškolciová, Arnica Keßeler, Barbora Kubíková, Denis Štefanisko, Martin Strauss, and Kai Wellbrock

### Season's Operations and General Aims (H.G.K.G.)

Embedded within the research history of Greater Petra Area's Early Neolithic (since 1981, *cf.* Gebel *et al.* 2017), the 12<sup>th</sup> season of the Ba`ja Neolithic Project took place from June 23<sup>rd</sup> – July 20<sup>th</sup>, 2018. The season represents the second of field work for the DFG-Project *Household and Death in Ba`ja*<sup>1</sup>, hosted by the Institute for Near Eastern Archaeology at Free University of Berlin and co-directed by Hans Georg K. Gebel, Marion Benz and Christoph Purschwitz.

Ba`ja is located in a secluded setting of the rugged sandstone mountains (Fig. 1; *cf.* Gebel *et al.* 2017 for more general site and project information) north of Beidha village near Wadi Musa. The site is best accessible by climbing through the narrow *siq al-Ba`ja*; therefore, any excavation requires a lot of logistical investment, physical strength by the team, and the acceptance of technical and conservational limits.

This season's main aims were to further enlarge the corpus of findings and data for the Household and Death subject, both from excavations in the deeper strata of the site's Areas C and D (Figs. 2-3) as well as by "shelf research" on relevant finds and samples of previous seasons. Apart from general archaeological work, findings attesting the spatial and ontological relationships between households and burials received special interest. Discoveries at Ba`ja hardly show a direct living household – burial relationship. Instead, we are dealing with the complexity of interacting intramural burials – or an intramural burial ground –, ritually deposited (transformed) household inventories, household dumps, and remains of active households (Gebel *et al.* 2017). In epistemic terms, the 2018 excavation work also served the holistic and integrated research on the development of the Neolithic social organization and ethos at Ba`ja, mirrored by household and sepulchral practices.

Initial discussion with the president of Yarmouk University, H.E. Prof. Dr. Zeidan Kafafi, and the Dean of the Faculty of Archaeology and Anthropology at Yarmouk University, Prof. Dr. Hani Hayajneh, took place for two future joint projects: The restoration and presentation of the extraordinary child Burial Loc. C1:46 in Room CR 36.1 (*cf.* below) in a Jordanian museum, and a cooperation for a future Eastern Jafar Joint Archaeohydrological Project between Yarmouk and Lübeck Universities.

### An Extraordinary Child Burial in CR36.1, Loc. C1:46 (M.B., J.G., H.A.)<sup>2</sup>

This season, two burial contexts were uncovered: one was the accumulation of several individuals (*cf.* description of Room CR17), the other was a single child burial in Room CR 36.1 (Figs. 2, 4-5).

In Room CR17, beside the remains of a male adult, human bones of a juvenile girl (15 years  $\pm$  36 months) and a c. 6-10 years old child were found. Similar to the collective burial of Room CR34 (Gebel *et al.* 2006a), this deposit was covered with stones. Co-occurring isolated teeth and bones, mixed grave goods and the high amount of charcoal pieces in the pit might indicate a sort of secondary inhumation. In terms of funeral formality, this accumulation of human remains contrasts strongly with the child burial uncovered in Room CR36.1.

In Room CR36.1, excavations continued down to natural soil. A report on the room fills and architecture will be presented elsewhere (Purschwitz *et al.* in prep.), so that we can focus on the child burial in the following. A white plastered surface (Loc. C1:20) had already been identified in 2016 in the eastern part of Room CR36.1 as a possible grave cover (Gebel *et al.* 2017: Figs. 7 and 11). However, this season's excavation of the supposed burial exceeded all expectations.

The grave was segregated from the western part of the room by a small wall (Loc. C1:60). It was sealed by a layer of tiny limestone gravels, probably recycled from the floor which had been destroyed for the burial pit. The whole construction – except for the uppermost stone slabs of the small western wall (Loc. C1:60) – was coated with white plaster that ran onto the surrounding walls, indicating that the grave was younger than the architecture. Below this white surface, white Ordovician sandstone slabs, fixed in silty sand-mortar, covered the grave. Some of these fragments fitted together forming an oval plate of about 65 x 40 x 3 cm. One or two fragments had been found upside down proving the deliberate destruction of the slab outside the grave before they were placed in the grave cover. Since the broken edges of the fragments showed no abrasion and matched so precisely, the slab must have been smashed shortly before deposition, as clear impact points were not visible. It appears that this may have happened by simply stamping with a foot. Two stone slabs were stained red. Furthermore, the grave cover comprised five grinding stones.

Below this cover, an ovoid grey-reddish sandstone slab (max. 82.5 x 49 x 3-4 cm) was placed over two vertical parallel plates of grey-reddish “schistic” sandstone (Fig. 5). The southern part of the grave area was additionally bordered by a small wall. In the eastern area, the grave undercut the Wall Loc. C1:16 for about 10 cm. The burial pit had been dug through the floors (Loc. C1:64/68/[67?]) into the sterile *plaza*-like sediment for about 20 cm on which the Neolithic layers rest. After the deposition of the child, the grave pit was filled with homogenous, almost sterile fine-grained silty sand. Between the chest and the legs of the skeleton, a lump of red pigment was found.

In the western part, between the small Wall Loc. C1:60 and the grave pit, and on top of the original floor (Loc. C1:64), there was a layer of white chalky stones embedded in silty sand. On top of them several stone slabs were deposited. The western border and these slabs overlapped, indicating that their construction must have been contemporaneous.

The grave construction resembles the grave of the adult individual in Room CR35 (Loc. C10:408; Gebel et al. 2017: Figs. 6-7). The cist-like construction also recalls burials from Shkārat Msaied (Hermansen 2017) and Wadi Hemmeh (Makarewicz and Rose 2011), but its truly hermetic sealing and the play of colours of white and red are unique, topped only by the burial itself (see below).

The buried child was an about eight-year-old girl ( $\pm 24$  months). She was resting on her left side in a crouched position. Her feet touched the western border of the pit and her back leaned against the northern slab (Fig. 6). The skull had turned down on its face. All her bones were stained red, but the sediment around the



Fig. 1 Ba'ja helicopter view from E in Spring 2007. (Photo: D. Kennedy)

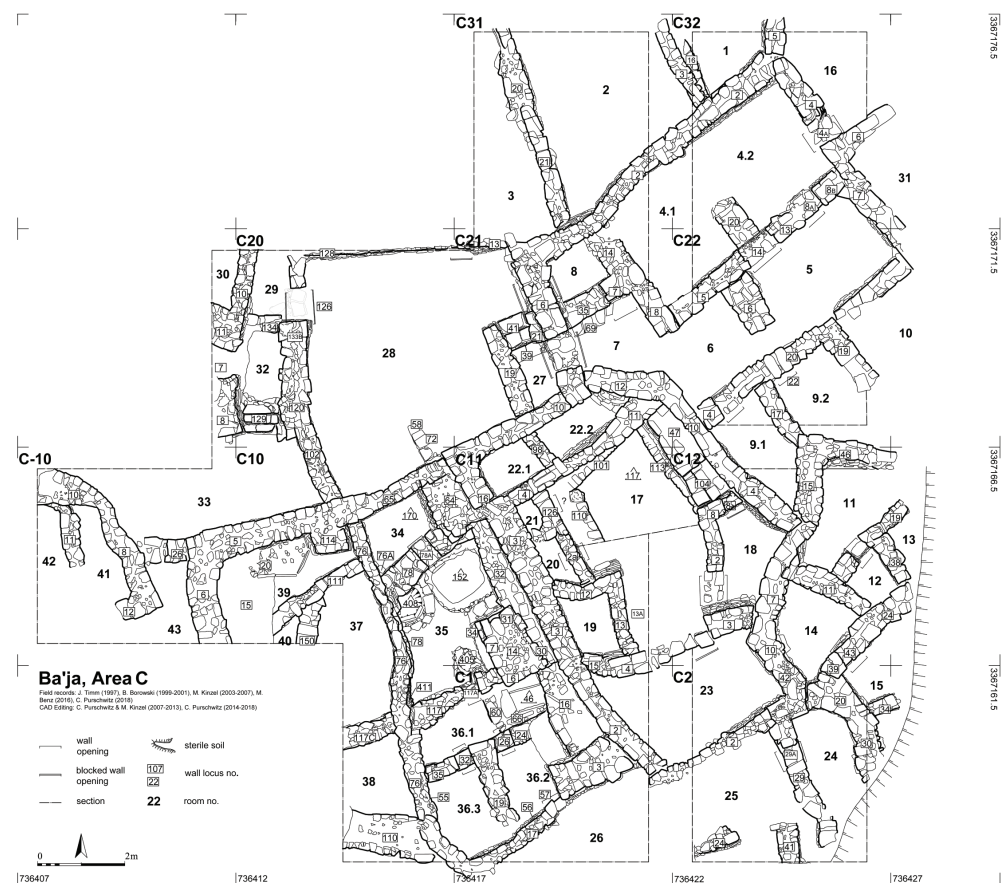


Fig. 2 Ba'ja, Area C architecture. (Drawing: M. Kinzel and C. Purschitz)

bones was obviously not coloured by pigments, except for the area around the red pigment lump (see above). The outer surfaces of the bones were stained red while the inner parts, e.g. the internal lamina of the skull, remained unstained; at least the skull was intact when the colour was applied. She was possibly wearing cloths coloured in red, or her skin had been stained in red. The preserved anatomical connections contradict a secondary deposition and thus make the colouring of the bones themselves improbable.



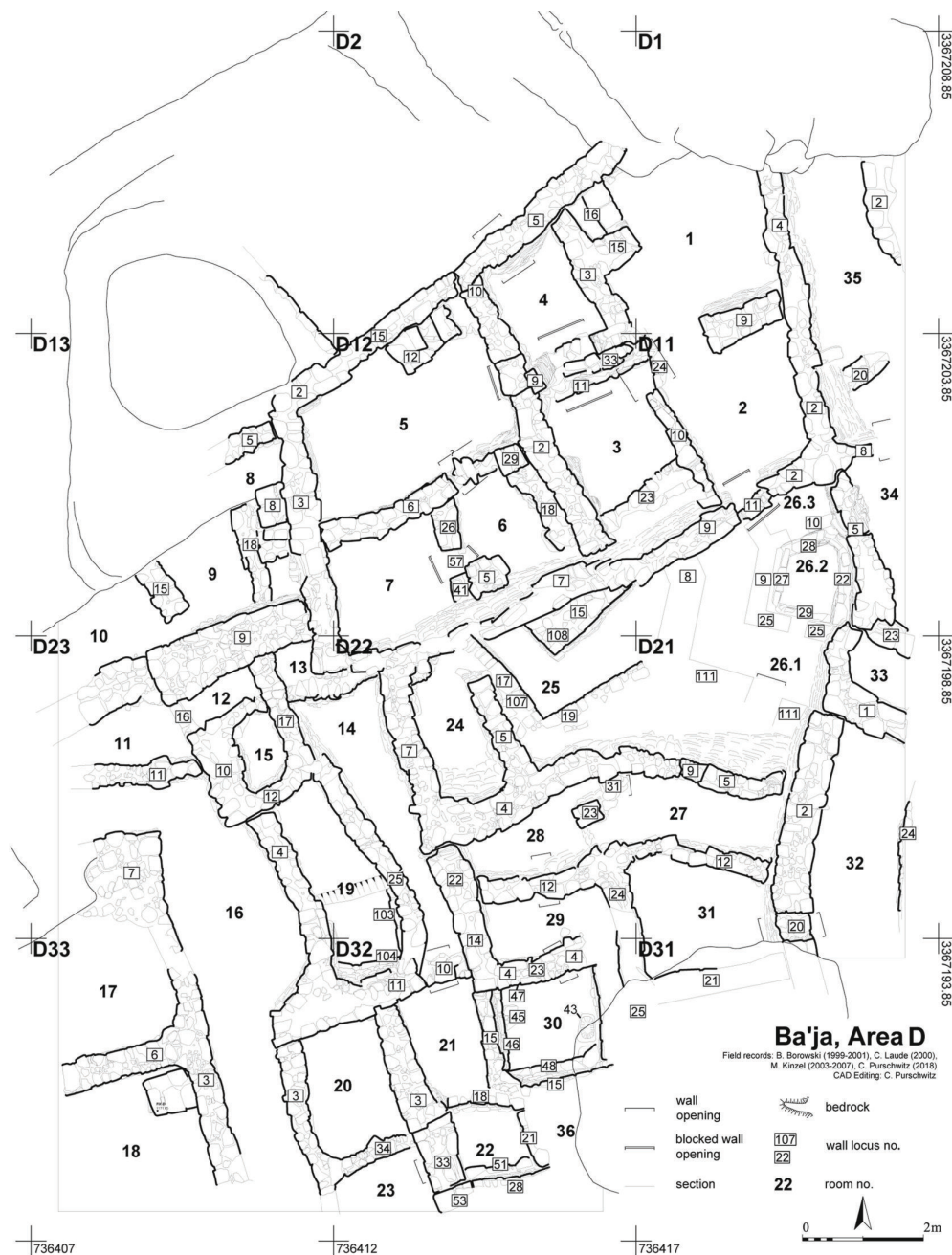


Fig. 3 Ba'ja, Area D architecture. (Drawing: M. Kinzel and C. Purschwitz)

The girl's necklace underlines the high esteem ascribed to her. Composed of more than 2500 beads and other elements, it was organized by a mother-of-pearl ring with perforated and denticulated extensions (Fig. 7). The beads of the necklace had slipped in the area of the chest, the neck and the left shoulder (Fig. 8). The position of the ring in front of the chest and small ring beads in the holes of the appendices suggest that it was used as a central "spacer" (Fig. 9). Similar objects were discovered with two infant burials at Ba'ja and at the late PPNB site of Basta, about 20 km southeast of Ba'ja (Gebel and Hermansen 2001: Fig. 7A; Gebel 2002: Fig. 10). The beads are mostly tiny ring disc beads of red coloured silicified limestone, as well as some barrel shaped and a few cylindrical beads of the same material. These contrasted with white, partly

translucent cylindrical beads, possibly from fossilized *Tridacna* shell (B.D. Hermansen, pers. comm.). This play of colours of red and white was interrupted by five turquoise disc beads and two black spherical beads of hematite and an oval double-holed bead of the same material. The position of this item on the neck suggests that it was used as a "closing-buckle". This object seems extraordinary for the late PPNB as items of this type were considered characteristic for the Natufian (Bar-Yosef Meyer and Porat 2008). However, similar objects made of malachite were also found in Harifian contexts (Goring-Morris 1991: 199), in North Mesopotamia at the PPNB sites of Mureybet and Jerf el-Ahmar (Alarashi 2014), and in the PPNB phases of Anatolian sites such as Çayönü (Lichter 2007: 316).

The jewellery confirms close relations between the sites of Basta and Ba'ja. It also testifies access to far-reaching exchange networks (Hermansen 2004; Spatz 2017) for the procurement of exotic green stone beads which became increasingly important

during the Pre-Pottery Neolithic (Wright and Garrard 2003; Hauptmann 2004; Maier 2008; al-Nahar 2014; Thuesen and Kinzel 2018). The repeated association of these specific mother-of-pearl rings with children suggests that these objects manifest a specific identity of the children for the people assisting the burial ritual.

The burial ritual can thus be reconstructed quite well (Table 1). Further analyses of the beads and anthropological investigations, including stable isotope and a-DNA, may provide important information on familial relationships and personal identity. Even though this burial is extraordinary for the Neolithic and even though it contrasts with other children burials at Ba'ja (see also Gebel *et al.* 2017), it would be premature to consider it an unambiguous evidence for institutionalized heritable hierarchies.



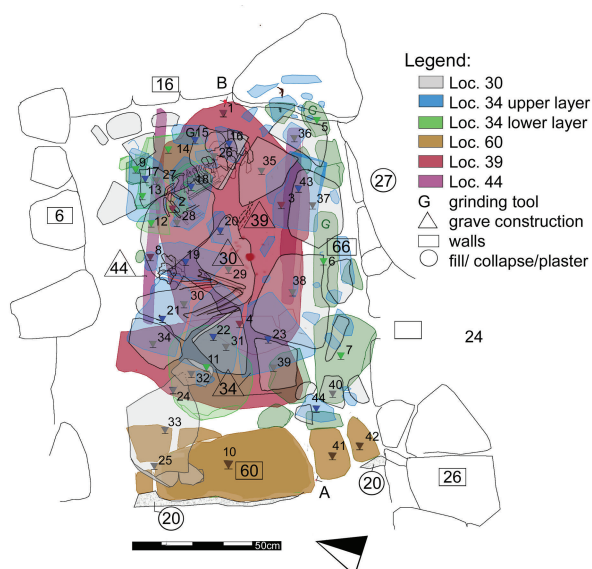


Fig. 4 Eastern Room CR36.1, grave construction: Cist burial of the 8 yrs ( $\pm 24$  months) old girl (Loc. C1:46). (Drawing: C. Purschwitz; for the levels cf. Table 3; compiled and digitalized data: M. Benz)



Fig. 7 Eastern Room CR36.1, Burial Loc. C1:46: (Selection of) necklace elements of the child comprised more than 2500 beads, most of them being tiny red limestone ring beads and cylindrical shell beads. The mother-of-pearl ring appears to be a spacer while the black double-perforated mineral bead – according to its position on the neck – probably served as a buckle. Lump of red pigment found in the grave. (Photo: H.G.K. Gebel)



Fig. 5 Eastern Room CR36.1, Burial Locus C1:46: Grave cover with the large slab in the eastern part; red stained stone and the small wall in the west, bordering the grave. (Photo: M. Benz)



Fig. 6 Eastern Room CR36.1, Burial Loc. C1:46: All bones of the young girl and some parts of the grave sediments around the lump of red pigment were stained in red. (Photo: M. Benz).



Event	Activities
1)	Cutting a pit through the floors Loci C1:64 and C1:68, probably also Loc. C1:67; undercutting Wall Loc. C1:16 for about 10 cm; preparing the corpse for the burial by grinding red colour on some white stone slabs; possibly colouring clothes or the corpse with red pigment/or painting the skin; Putting the necklace around the head of the child
2a)	Constructing the Walls Loc. C1:66 and possibly starting with Loc. C1:60
2b)	Fixing the southern and northern border of the pit with two vertical large slabs (Loc. C1:44) and some smaller slabs west of the northern slab of Loc. C1:44, comprising one of the slabs on which red pigment had been ground. Filling the space between the northern vertical slab of the grave cist and the Wall Loc. C10:117 with stones and sand/mortar.
3a)	Putting silty sand (similar to the mortar of the Walls Loc. C1:66 and C1:60 but looser) on top of the floor Loc. C1:64 between the Wall Loc. C1:60 and the grave pit, placing the chalky limestones (Loc. C1:63) on it, putting two large stone slabs and some smaller ones (Loc. C1:39-west) to fill the area in the south of the slabs. Fixing the vertical slabs with mortar (Loc. C1:65).
3b)	Adding more stone slabs on Loc. C1:60 [NB: The stones of Loci C1:60 and C1:39 overlap partly and thus were probably deposited in one event, but with Loc. C1:60 forming a clear border.]
4)	Placing the child in the grave; putting the red pigment in the space between her legs and arms; due to gravity the head of the child turned on its face to the left shoulder. Most of the beads/chains of the necklace accumulated in the area of the left shoulder, the neck and the chest. Their <i>in situ</i> position suggests that they were enchained on strings, spaced by the mother-of-pearl ring and closed in the back by a black mineral buckle.
5)	Closing the grave cist with the large stone slab (1) of Loc. C1:39
6)	[Possibly during burial ritual a fire was lit in front of the grave in the western area of the room; the round dark coloured circular patch of sediment (Loc. C1:70) might hint at that activity]; Destroying the prepared or available oval Ordovician sand stone slabs (Loc. C1:34)
7)	Covering the whole space between Walls Loc. C1:60 and C1:16 with up to three layers of the destroyed stone slabs, including a second plate on which pigment had been ground and five grinding stones.
8)	Covering the stone layer with mortar (Loc. C1:29) to fix the (recycled?) small limestone gravels on top (Loc. C1:20)
9)	Plastering the grave cover and the front of Loc. C1:60 with white lime plaster, except for the upper most layer of Loc. C1:60 [not drawn].
10)	No further activities could be recorded in relation to the ritual or memory activities around the grave, although it cannot be excluded that the ash/charcoal layer in Loc. C1:61 immediately in front of the grave is related to some rituals.

Table 1 Reconstruction of the child burial ritual in Room CR36.1 (events numbered a-c might be interchangeable).

Objects	Field numbers
CR36.1	
In the grave cover, Loci C1:33-34	
5x Grinding tools	106004 106019 106021 106044 106047
Use retouched flint flake with notch	102019
Objects inside the grave: C1:42 and C1:46, pigment and necklace (in total more than 2500 items, cf. Fig. 7)	
5x turquoise disc beads	100814.Zc, Box 3 100814.117 100814.166 100814.Zb, Box 3 100814.W, Box 3, ECXXX
2x Hematite spherical beads	100814.E 100814.B
Ovoid black buckle 29.5mmx21.5mmx5mm (hematite); double perforation (d: upside 4.7-5mm; downside 3mm);	100814.154
>2500 red limestone and shell beads (of cylindrical, ring [almost <1cm] and barrel shape)	100814
Mother-of-pearl ring: spacer	100814.20
Lump of red pigment	107907
CR17	
Above grave cover Loc. CR17:109-115	
2x polished fragments of limestone celts (Fig. 11)	105801
Basal fragment of a blade-based flint dagger (Fig. 11) Basal fragment of a blade (of a projectile or other point)	102042 102047

Table 2 List of objects found in both graves in Rooms CR17 and CR36.1. Mineralogical identifications of the beads' raw materials by M. Martin and G. Gerlitzki.

Objects	Field numbers
Associated with human bones CR 17:117	
A flint blade	102048
A cowrie shell (with the upper part of the shell destroyed)	100805
Pieces of red pigment	107816
Animal bones (1x horn core n°13, 1 scapula n°51, 1 vertebra? n°22, 1 indet. n°45)	104031 104044 104051 104052

Table 2 (Continued).

Levels of the grave construction burial CR36.1, Ind. 1							
ID	m a.s.l.	ID	m a.s.l.	ID	m a.s.l.	ID	m a.s.l.
1	1165.07	12	1165.09	23	1165.12	34	1165.21
2	1165.05	13	1165.11	24	1165.15	35	1165.24
3	1165.07	14	1165.15	25	1165.19	36	1165.26
4	1165.05	15	1165.15	26	1165.18	37	1165.26
5	1165.17	16	1165.13	27	1165.18	38	1165.24
6	1165.08	17	1165.15	28	1165.17	39	1165.21
7	1165.03	18	1165.13	29	1165.18	40	1165.14
8	1165.05	19	1165.12	30	1165.17	41	1165.14
9	1165.07	20	1165.12	31	1165.18	42	1165.15
10	1165.08	21	1165.15	32	1165.21	43	1165.18
11	1165.08	22	1165.13	33	1165.18	44	1165.18

Table 3 Levels of the grave cover of the single child burial in Room CR36.1.



## Excavations in CR17, and Another Collective Burial (C.P., M.B., J.G.)

Investigations in Room CR17 aimed at completing the excavation of the room fill to increase our data on non-ritual household inventory disposals. The lower room stratigraphy was checked for its potential on sepulchral contexts. In order to document an E-W section through the entire room, CR17 was divided in two parts with only the northern half being excavated (Fig. 10).

The upper room fill is marked by a 1.50 m deep pit (Loc. CR17:107 filled by Loci CR17:103A and CR17:103B), which is very likely the modern looting pit reported by the first investigations at Ba'ja in 1984 (Sounding II or III, *cf.* Gebel 1986, 1988).

The excavation of the C11/ C12 baulk revealed a staircase (CR17:104) which abuts on its southwestern border to Wall C12:4=C22:12. Its lowermost step connects to the Buttress C12:47, indicating their contemporaneity in construction. There is a clear joint between the staircase and Wall C12:8, although the temporal distance of both constructions may not have been very long as both are related to the same mud floor (CR17:106).

The staircase, the buttress and several walls (*i.e.* C12:8, C12:47, C11:4=C21:11, CR17:104, CR17:108) were founded on a 10-15 cm thick layer of stone rubble, which sealed the wall tops of an earlier building level. Three walls of this lower level, *i.e.* CR17:101, CR17:110, and CR17:113, were excavated. They form a room of similar orientation, but of slightly different layout than the younger phase of the room. The upper room fill consisted of a more than 1m thick

layer of rather loose sediment (with bits and chunks of charcoal, fragments of plaster, lumps of mud/



Fig. 8 Eastern Room CR36.1, Burial Loc. C1:46: Most of the beads slipped in the neck's and left shoulder area of the child. The black buckle was found beneath the neck. (Photo: M. Benz)



Fig. 9 Eastern Room CR36.1, Burial Loc. C1:46: Position of the mother-of-pearl ring in front of the chest hints at its function as a spacer. (Photo: H. Alarashi)



mortar, smaller-sized stone collapse while stones larger than 15 cm occur only sporadically). Artefacts were rare except for a high number of grinding tools ( $n=23$ ). The homogeneous matrix and composition of this deposit suggest one or a few related intentional disposal events of unrecycled components of collapsed building materials (with an obvious lack of wall stones). Although speculative, there is good evidence that this layer relates to the earthquake event(s) which have been noted at various spots at Ba`ja (Gebel and Kinzel 2007; Kinzel 2013; Gebel *et al.* 2017).

The lowermost room fill consisted of collapse material (Loc. CR17:109) superimposing a plaster floor (CR17:114) and a pit. Loc. CR17:109 appears to have been used as a casual surface for some time as its top is quite horizontal and Walls CR17:110 and CR17:113 had been built on it. In the eastern part of the room, below Loc. CR17:109, a concentration of ash and charcoal (CR17:115) on top of a pile of up to fist-sized stones (CR17:116) could be observed. The latter covered a shallow pit which was cut through the Floor CR17:114. In the pit, human bones of at least three individuals (one female juvenile [ $15\text{yrs} \pm 36\text{ months}$ ], one child [ $m>w$ ;  $8\text{yrs} \pm 24\text{ months}$ ] and one possibly male adult) and animal bones were discovered in association with two polished limestone celts, a tip of a blade-based flint dagger; a cowrie shell, a flint blade and pieces of red pigment (*cf.* Table 2, Figs. 11-12). Some of the skeletal remains were still in anatomically correct positions. Further excavation and the ongoing anthropological analyses will improve our understanding of the context and character of this deposit.

### Excavations in Room CR5, Exposing a “Steppe Signal”? (B.K., L.M.)

The intended continuation of excavations in Rooms CR6 and 7 in Square C21 and C22 was suspended, because Wall Loc. C21:8 (Fig. 2) was found partially collapsed upon arrival for the season. A support wall was inserted in Room CR6 in order to stabilise the surrounding and deeply excavated architectural remains. Due to these circumstances, excavations were shifted to the adjacent Room CR5 which was last excavated in 1997. After cleaning Loc. CR5:30, a layer contain-

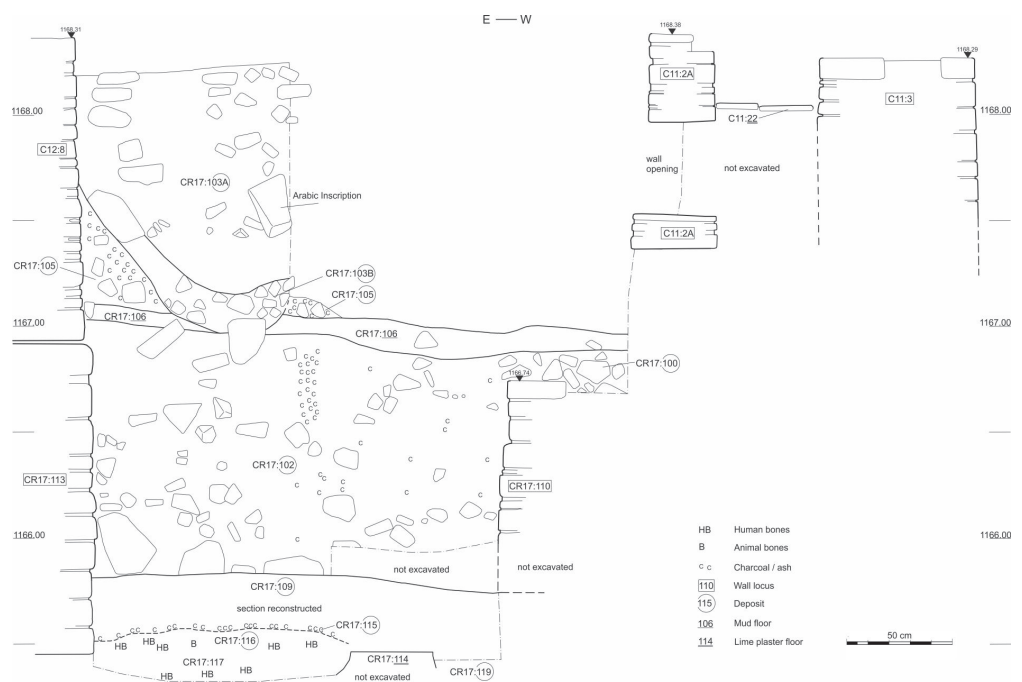


Fig. 10 Room CR17: E-W section through the room fill. (Drawing: C. Purschwitz)

ing the remains of a collapsed/eroded roof, wall stones and fragments with imprints of charred wood as large as 5-8 cm (!) were revealed (Loc. CR5:31); Below it, a room filled of rubble was located (Loc. CR5:34). A bi-facially pressure-flaked projectile point (F.no 102020) with dimensions and a shape typical for the 7<sup>th</sup> millennium, was found in the room Fill Loc. CR5:37 near Wall C21:8A, together with a larger part of a charred beam.

Following Loc. CR5:34 in the western part of Room CR5, a thick ashy deposit (Loc. CR5:35) extended

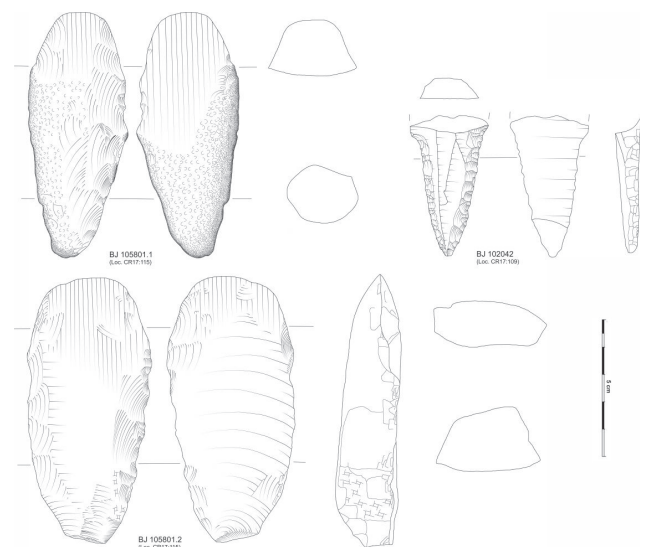


Fig. 11 Room CR17, Burial Loci CR17:119 and CR17:115: Items associated with human bones on top of the grave: polished limestone celts (F.no. 108801.1-2, Loc. CR17:115); base of flint dagger made on a large blade blank (F.no. 102042, Loc. CR17:109). (Drawings: C. Purschwitz)



Fig. 12 Room CR17, Burial Loci CR17:117: At least three individuals were deposited in a pit in CR17 (excavation of Loc. 117 and anthropological analyses are not completed yet). (Photo: M. Benz)

between Walls C22:14, C22:13, C22:6, C22:20 (Fig. 13) containing ash-stained bones and artefacts (flints, stone ring and grinding tool fragments, malachite, and a clay figurine fragment: Fig. 16), all with traces of burning, and at least four charred wooden beam fragments suitable for dendrochronological analysis (F.no 107216).

Under the rubble fill in the eastern part of CR5, a layer (Loc. CR5:38) of plaster/ mortar-type of material containing sherd-like fragments was uncovered, preliminarily interpreted as remains of building material.

In the central parts of CR5 (Loc. CR5:36) isolated sherds of chaff-tempered baked/unbaked clay were found. Excavations in the central western part of CR5 exposed dark grey “sherds” resting on stones (Loc. CR5:39). A red-yellowish clay surface (Loc. CR5:41) hosted sherd-like material, too. It was founded on a dense layer of grit averaging 1 cm in dimensions and mixed with plaster. Excavating Loc. CR5:35 revealed a loose red-yellowish sediment below the ashy deposit, appearing pit-shaped in the cross-section. It may represent either disintegrated material of the sherds (*tabūn*?), or it could be the local *samagah* prepared/stored for making a *tabūn*. In Loc. CR5:42, mineral token-like items (Fig. 17) and a good collection of charred peas occurred (Fig. 18; identification by R. Neef).

Loc. CR5:38 in the eastern part of CR5 was followed by a thick deposit (Loc. CR5:40) of collapsed well-dressed wall stones, flat and angular stones with pieces of mortar attached and dumped grinding tools (Fig. 14). At the bottom of Loc. CR5:40, a broken empty limestone basin (Fig. 15: F.no 106805) was found, possibly resting on the same level as a formal trilith (Fig. 15: F.no 107216) erected by 3 dressed, re-

spectively elongated shaped stone slabs. The fact that the slab elements of the trilith were still standing indicates a quick burying of the locus.

Wall Loc. CR5:55, uncovered in the south of Room CR5 and next to Wall Loc. C22:19, closed the room. The western buttress (Wall C22:6) was built upon the fill of CR5 during a later building phase.

While standing stones are attested with Neolithic settlements in the Transjordanian Highlands (Kafafi 2011), the very distinctive triliths, or trilith groups, – to the extent known and according to our knowledge – mark ritual and burial spaces in the eastern deserts’ Late Chalcolithic to EBI (e.g. in Qulban Beni Murra, cf. Gebel 2013; in Dhofar the same struc-



Fig. 13 Room CR5 with Walls Loc. C22:14 and C22:6, and section under Wall Loc. C22:6. (Photo: C. Purschwitz)

tures date to the late Iron Age (Garba 2017) while at the same time commonly addressed as Neolithic (e.g. in Salalah’s Frankincense Museum). However, triliths seem to be insignificant for the moderate zones of the Southern Levant. If the Ba’ja trilith is not a “formal accident” appearing in the LPPNB/PPNC, could it represent an early “steppe signal”? Ba’ja’s contacts with the





Fig. 14 Room CR5, Loc. CR 5:40: Deep deposit of collapsed well-dressed wall stones, flat and angular stones with attached mortar, and dumped grinding tools. (Photo: M. Benz)



Fig. 15 Room CR5, Loc. CR5:40: Fractured limestone basin (F.no. 106805) associated with a – still standing – trilith (F.no. 107216), erected by shaped stone slabs. (Photo: M. Benz)

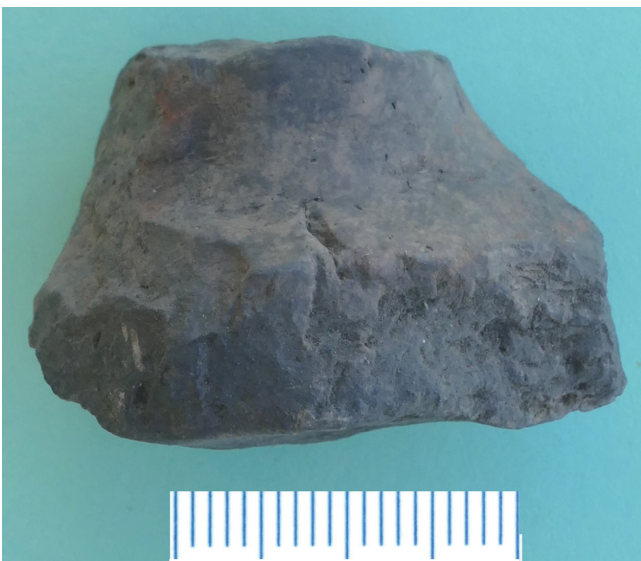


Fig. 16 Room CR5, Loc. CR5:35: Clay figurine fragment (F.no. 101626), most probably the base of a human "stick-shaped" figurine as known from es-Sifiyeh. (Photo: H.G.K. Gebel)



Fig. 17 Room CR5, Loc. CR5:42: Token-like sandstone and quartz items (F.no. 101811): two flat cylindrical ones of sandstone; one cone-shaped of sandstone, broken at tip and bottom; one cone-shaped of quartz, broken at tip). (Photo: H.G.K. Gebel)



Fig. 18 Room CR5, Loc. CR5:42: Selection from a well-preserved assemblage of charred peas (F.no. 107417; identification by R. Neef). (Photo: H.G.K. Gebel)



eastern steppes are evident (dagger raw materials, including the daggers' manufacture?; ostrich egg shells; faunal remains).

The findings in Room CR5 have to await further excavation to reach a better chronological and functional understanding. As of yet, the aforementioned post-LPPNB arrowhead made from an exotic material, the trilith's ritual and geographic implications, and the overall puzzling findings of CR5's layers make it difficult to assess the nature of these fills: Are we dealing with later ritual impact, secondarily transforming a LPPNB household?

### Excavation of Room CR22.2, and More From a Buried Household (L.M.)

Rooms CR22.1 and CR22.2 form one structural unit, separated by the Wall Loc. C11:98. They are part of the Building CV, separated from adjacent large Room CR17 by Walls Loci C11:4 and C11:11.

The layers of these rooms were previously interpreted as intentionally buried inventories of a terminated household (Gebel *et al.* 2017). During the 2018 season, excavations continued in Room CR 22.2 exposing four different layers (Loci C11:40-43) and are described in the following from top to bottom: an ashy black-grey sandy sediment (Loc. C11:40 in the central part of the room); an ashy sandy deposit with a high content of small round stones (approximately 5%) (Loc. C11:41); a layer of compact plaster material, partly crumbly (southern and southwestern part of the room); yellowish, greyish to reddish-brown in colour and containing small bits of charcoal, big well-dressed stones (presumably from a collapsed wall), as well as round and angular stones of various sizes (Loc. C11:42); and an ashy silty deposit of orange to greyish colour (Loc. C11:43). (Fig. 19)

The finds retrieved during the 2018 season resemble those of 2016, representing traces of household activities and household production items. Loci C11:40 and C11:41 provided high amounts of fragmented, mostly burnt bones, fragments of finished sandstone rings, lithic debitage and two cores, grinding stone fragments as well as fragments of worked bone implements. In addition, chunks of red pigment, a stone bead and pieces of shells were found in Loc. C11:41.

Loc.C11:42, first recognized only adjacent to the room's walls, turned out to cover the entire room and contained many fragmented animal bones. Flint debitage and tools (*e.g.* the fragment of a projectile point and a drill), fragments of sandstone rings representing all production stages (among which is a small coin-shaped sandstone disc; Fig. 20), ostrich eggshell fragments and a complete bone awl and worked bone fragments were all found embedded into the compact plaster material. A complete whetstone, a fragmented and a complete small handstone were also part of the assemblage. Under the layer of stones, four concentrations of low-fired grit-tempered sherds showed up (*cf.* below: More on



Fig. 19 Room CR22.2, Loc. CR 11:42-43: Layer of compact plaster material, charcoal, big well-dressed stones presumably from a collapsed wall (Loc. 42); ashy silty deposit of orange to greyish colour (Loc. 43). (Photo: M.Benz)



Fig. 20 Room CR22.2, Loc. CR 11:42: Unusual coin-shaped sandstone disc (F.no 101210). (Photo: H.G.K. Gebel)



Plastic Vessels). In the south and southwestern room parts (Loc. C11:42) a stone slab was found. A larger part of an animal, interpreted as an intentional deposition, appeared immediately underneath the slab. Loc. C11:43 yielded many small pieces of charcoal, significant amounts of large fragmented burned and unburned bones, larger flint debitage, sandstone ring fragments in various stages of production, and fragments of worked bones.

## Excavations in Area D (H.G.K.G., C.P.)

### Rooms DR25/26.1

Excavations in Room DR25/26.1 showed that the space – formerly considered to be a large courtyard – was confined and segmented (Fig. 3). It comprised several small rooms and narrow corridors of a multi-level architecture. It also became obvious that high-energy impacts must have totally deformed the layout of this space. Walls were strongly tilted, deformed and displaced, often showing cracks running through several stone layers (Fig. 21). It is clear now that Wall Loci D22:17 (DR26:107), D22:19 and DR26:111 do not represent an earlier phase but are simply the lower *in situ* part of the heavily tilted Walls Loci D22:4, D22:5, and D21:5; they were displaced by 50 to 80 cm towards the south. The character of these deformations may point to typical earthquake damage which have also been observed in Areas B-South and C (Gebel and Kinzel 2007; Gebel 2009; Kinzel 2013). However, a systematic analysis and damage record is needed to exclude other scenarios. (although the room fill stratigraphy supports an earthquake thesis). The room fill of DR26.1 is marked by thick layers of wall collapse (wall debris, mortar/wall plaster) with embedded parts of collapsed, but still bonded wall fragments and patches or lenses of upper plaster floors/ceiling material which are distributed throughout the lower fill stratigraphy (*i.e.* Loci DR26:103, DR26:105, DR26:106, DR26:112). This collapse contains deposits of finds of different types. Most prominent are the remains of a deposited celt/



Fig. 21 Room DR25, Wall Loci D22:4 and D22:19: High-energy wall damage. (Photo: M. Benz)

adze workshop (*i.e.* a dozen unfinished celt/adzes of all production stages and high numbers of the typical thinning flakes; Fig. 22), found associated with numerous ground stone tools ( $n < 20$ ). Together with the remains of a sandstone ring workshop, these findings refer to domestic production. Other finds include a human molar, several shell beads, and dozens of small red pigment balls (Fig. 23). These finds partly may belong to a disturbed ritual environment, probably linked to the collective burial in Room DR26.2 (DR26:26; *cf.* Gebel and Hermansen 2001).



Fig. 22 Room DR26, Loc. DR26:112: Remains of a redeposited celt workshop with hammerstones (F.no 102059; debitage not depicted). (Photo: H.G.K. Gebel)

### Rooms DR19, DR22 and DR30

In the southern Rooms DR19, DR22, and DR30, the main and lower room fills were excavated. These room fills mainly comprised collapsed wall and roof material with poor evidence of later artefact or dump disposals. There was a concentration of sandstone ring production waste in association with a reamer-like pestle in DR19 (F.no 106067.2) which was either dumped here or entered the room fill while the roof was collapsing. A concentration of 8 ground stone tools (2 complete handstones, 6 fragments) were found in the upper main



Fig. 23 Room DR26, Loc. DR26:106: Selection of complete small red pigment balls (F.no 107918), most probably re-deposited from a ritual/ burial context (collective burial of 2001 in DR26.2). (Photo: H.G.K. Gebel)

fill of DR22 and may have been once stored on the roof. Floor levels were reached in DR22 and DR30, both representing compact mud floors. While in Room DR22, the Floor Loc. D32:50 was devoid of artefacts, Floor Loc. D32:42 in Room DR30 carried some artefact concentrations (animal bones, a handstone, a hammerstone) as well as installations. The latter comprised a small stone platform (D32:45) and opposite to it, a large grinding slab installation (D32:43) which had obviously been transformed into a second stone platform (D32:43a) at a later point in time. As a general feature, wall projections were found slightly above the level of the latest floor. Such projections have been noted in DR19 (Locs DR19:103 and DR19:104), DR22 (D32:51), and DR30 (D32:46-48). They may also indicate the presence of an earlier building level or are the relicts of beam supports of a multi-storied building, as similar situations can be created by modifying upper rooms into lower rooms (Kinzel 2013; cf. also Gebel 2006a; Gebel et al. 2006; Gebel and Kinzel 2007).

### Ground Stones of the Season (B.H.)

Analysing the ground stone assemblage from Ba`ja is an integral part of the Household and Death - Project. The only previous analyses of the Ba`ja ground stone assemblages were 1) the surface finds studied by Karen Wright (Gebel et al. 1997: 247-249) and 2) a selection of handstones (*manos*) by Philipp Rassmann (2008).

There are ten seasons of ground stone materials to be identified and analysed. In 2018, the incoming ground stone finds were assessed and at the same time

Tool Type	Quantity	Percentage of 2018 Ground Stone Assemblage (n=176)
Handstones ( <i>mano</i> )	140	79%
Grinding slabs	12	7%
Rubbers	11	6%
Mortars	3	2%
Weights	1	1%
Miscellaneous/ unknown	9	5%
Total	176	100%

Table 4 Frequencies of ground stone tool types of the 2018 season.

the evaluation of the stored assemblage also started. With only a small percentage of the overall stored ground stone assemblage analysed, we will highlight here the 2018 ground stone finds only (Table 4). In a second step, the assemblages' contextual significance within the site and within the entire PPNB period will become subject of a later study.

The primary raw material of the heavily used ground stone items consists of local sandstone varieties. From the 2018 field season a total of 176 ground stone tools were unearthed and recorded.

The majority of ground stone tools from the 2018 assemblage are handstones, the upper moving grinding tool used in conjunction with a slab or mortar. Of the identifiable handstones, 62 are complete, 65 are fragments, and 3 are incomplete. The most common form of handstones from the 2018 assemblage has two working surfaces, a biconvex cross section, and were also utilized laterally. Additionally, handstones with sub-rectangular plans and cross sections are present in the assemblage.

Slabs, the stationary lower grinding implement, are larger and oblong with at least one flat or concave working surface. All of the slabs from this season are standard utilitarian slabs with the exception of one large slab that was used more likely as a basin. Mortars are also stationary lower grinding implements with the differentiation of having a deep indent as the working surface. The limited number of mortars recovered in 2018 indicates that slabs were more widely used than lower grinders.

The weights from the 2018 season are "pyramid" shaped with a biconically drilled perforation close to the flat-topped narrow end.

### Searching for Household Use-Wear on Chipped Stones (D.Š.)

With the intention of reconstructing household and other activities by wear traces on chipped stone tools (potential traces of transportation/storage, hunting/defense and ritual activities), more than 800 tool samples from 9 different supposed domestic contexts, one grave (Loc. C10:408) and one blade depot from a household (B74:2) were selected during the 12<sup>th</sup> season at Ba`ja. Apart from the Neolithic chipped stone tools, local flint raw material groups were gathered in the region to support our holistic approach to chipped stone tools. It



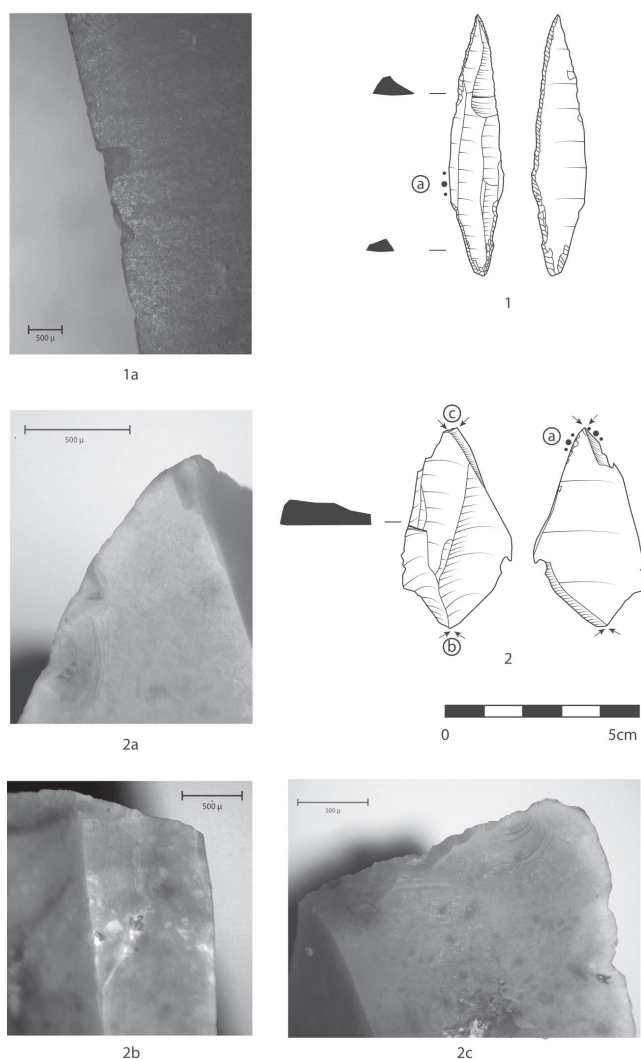


Fig. 24 Examples of common use-wear traces.

1 Sample Use-wear ID 441 (from F.no 52014; B22:18): Complete Byblos projectile point made of Flint Raw Material Group 2, using a bidirectional blank. Piece does not exhibit any use-wear traces related to intended projectile shape/ function; left dorsal edge: unretouched. 1a exhibits extensive damage (feathered irregular scarring accompanied by polish) which results from medium hard material such as wood. Since this damage is occurring only on one unretouched part, it is possible to relate it to either a previous use of the blank, or the wear of a longer transport. – 2a-c Sample Use-wear ID 413 (from F.no 22415; B12:27): Double dihedral burin made on a large blade-flake. Top working edge with several re-sharpening acts and extensive damage by large step fractures and rounding, possibly resulting from an engraving motion which also developed polish. This pattern is also visible on the basal part of the tool in 2c. (Photos/drawings: D. Štefanisko)

includes and combines replicative, techno-typological, raw material and use-wear and trace analysis with contextual analysis.

Numerous use-wear studies (e.g. Andrefsky 1997: 136; Stemp *et al.* 2015: 2; Van Gijn 1990: 144) have proven the chance to extract (real) functional information beyond the – often misleading – typo-, respectively morphological classification of tools. So far, only a small portion of Ba`ja's chipped stone tools collection

had been analysed, using low-powered microscopy in order to screen assemblages for promising samples to carry out high-powered microscopy. The latter especially aims to record use-wear traces variability which is needed for a testable replication within the subsequent experimental program.

Although only a small number of samples has been analysed so far, a wide range of actually and possibly used areas has been identified already (Fig. 24). These traces represent results of expected activities such as bone engraving, projectile point utilization and extensive transport, wood processing, cereal and soft plant processing, ornament production, hide and meat processing, and other activities. Stone tools and their biographies are direct results of these activities and behaviours in the socio-economic system at Ba`ja. The everyday life of a household and its spaces/rooms is recorded in these stone tool biographies, yielding a notion on the variety or homogeneity with which we can distinguish or connect certain activity groups. Furthermore, such results have the potential to bring additional and substantiated insights into LPPNB craft specialization, labour division, commodification and the underlying social, economic and cognitive territories.

### More on Vessels Made on Plastic Materials (L.M.)

More evidence on Ba`ja's baked "clay" industry (Gebel and Bienert 1997: 251; Gebel *et al.* 2017: 28-30) was uncovered during this season. Evidence again came from Area C, Rooms CR5 and CR22.2.

Room CR5 yielded a concentration of large body of chaff – (herbivore dung?) tempered sherds (101606.1-11) designated as Loc. CR5:36, embedded in Loc. CR5:38 (a plaster-mortar layer) (Fig. 25). In the middle of CR5 (Loc. CR5:35: thick ash deposit), single pieces of chaffed (un)baked clay sherds were found. Two pieces (F.nos 101612, 101615) had the shape of a rim or bottom (min. thickness: 24-28 mm), possibly belonging to a *tabūn*, a vessel or a container-like installation. On some fragments, the finger lines and brushing traces or traces of wet smoothing on both surfaces (*i.e.* remains of the manufacturing process) can be seen. All the pieces were heavily chaff-tempered, also showing angular limestone inclusions of some 2-20 mm. The "sherds" varied in colour from very light (pale yellow, reddish grey or light grey) to reddish brown, dark grey, pointing to an inconsistent exposure to fire and temperature. The thickness of the sherds varied (18-50 mm), and some of them showed black reduction cores.

In Room CR22.2, exclusively in Loc. C11:42 (a plaster-like deposit under a layer of stones), fragments of low-fired grit-tempered sherds (F.no 101601) appeared. They were made of the same material as the rim sherd found in the Room CR22.2 during the 2016 season (Gebel *et al.* 2017: 29-30). They were very fragmentary and survived only as slightly curved body parts with thickness of 6-12 mm. In the northeastern part of the room, two more clusters of these grit-tem-



Fig. 25 CR5, Loc. CR5:36 in Loc. CR5:38: Rim from a concentration of chaff - (herbivore dung?) tempered sherds (F.no 101606). (Photo: H.G.K. Gebel)

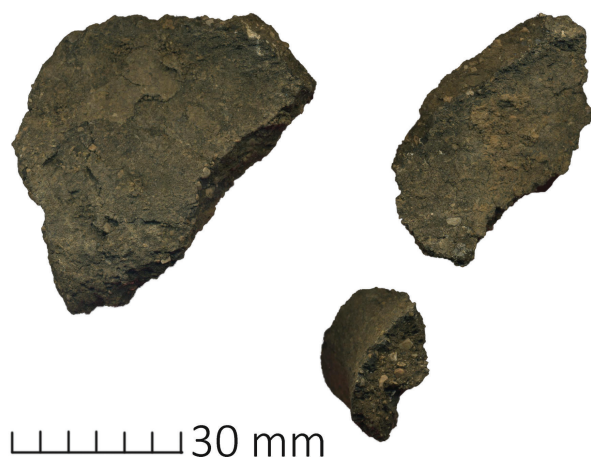


Fig. 26 CR22.2, Loc. C11:42: Grit-tempered sherds (F.no 101617). (Photo: H.G.K. Gebel)

pered sherds (F.nos 101605, 101617; Fig. 26) were unearthed; in the south and the southwestern parts of Loc. C11:42, another concentration (F.no 101620) appeared.

The manufacture process and the material's analysis of Ba`ja's baked/unbaked plastic vessel industry, or thermoplastic wares, are subject of an ongoing archaeometric analysis.

### Body Ornaments 1997-2018 (H.A.)

The 2018' study season was dedicated to the preliminary examination of all the items from all Ba`ja seasons presumably attributable to body ornamentation. Except for the sandstone rings considered as "commodity coupons" (Gebel 2010), beads, pendants, shell rings, unfinished objects, raw minerals and unmodified shells generally used for ornaments (Bar-Yosef Mayer 1997; Abu Laban 2014; Alarashi 2014) were registered in a database. The assemblage (Table 5) consists of objects discovered in different contexts, including those of Burial Loc. C10:408 excavated in 2016 (Gebel et al. 2017). The child necklace (Loc. C1:46 in Room CR36.1) discovered in 2018 is presented elsewhere in this contribution.

Form	Material	Stage	Areas					Total
			A	B	C	D	?	
Anatomic	Bone	Finished	1					1
	Shell	Finished	18	26	24	2		70
		Unfinished		1	1			2
		Unpierced	1	9	5	2		17
		?	1		2			3
Geometric	Shell	Finished	22	17	23	4		66
		unfinished?	1		1			2
		?	2	1				3
	Coral	Finished		1				1
	Stone	Finished	1	6	10	4	1	22
		Preform					1	1
		Recycled			1			1
		Unfinished			1	1		2
		unfinished?			1			1
		raw material			3	1		4
Singular	Shell	Finished	2					2
	Marl	Finished		2	1			3
Irregular	Ostrich shell	raw material			1			1
	Stone	Unfinished			1			1

Table 5 Assemblage of the studied ornament objects discovered at Ba`ja between 1997 and 2018.

The objectives of the study season were: the assessment of the preservation of state of the items, the documentation of the form, material and type diversity of the beads and the identification of bead-making activities at the settlement.

The good state of preservation of the surfaces (Fig. 27) allows microscopic analyses and a reliable taxonomical identification for those shells with their natural pattern preserved (Fig. 27d, i). Items made of mother-of-pearl are quite fragile and in several cases the nacre is disaggregating in layers (Fig. 27q).

The elements of ornaments at Ba`ja are made of biogenic (shell, coral, bone) or mineral-based materials (rocks, minerals, clay). Shells are the most common (Fig. 28).

Although precise determinations of materials are ongoing, several aspects can already be mentioned. First, the shell species are remarkably diverse. They belong to three mollusc classes, more than ten families, and several genera for some families (e.g. cowrie shells). Second, the shells predominantly originate from the Red Sea. Third, beside silicified limestones of various shades of red, which dominate in the newly discovered child grave (cf. above), green-coloured and exotic stones were favoured.

The objects were classified at the level of their forms: anatomic, geometric or singular (Alarashi 2014). The typological identification will be made through comparisons with objects from contemporaneous neighbouring sites (e.g. Basta). Yet, the typological diversity is obvious and represented by the typo-functional families of "beads" (Fig. 27s-w), "pendants" (Fig. 27m), "rings" (Fig. 27n,o) and "lip plugs" (Fig. 27r). The presence of two or more perforations of certain beads and rings suggests their use as "spacers"





Fig. 27 Ornaments from Ba'ja Seasons 1997ff. Shell (a-j, s, t), mother-of-pearl (k-q), marl (r), stone (u-z). Anatomic forms (a-g, i, j), geometric (h, l-p, s-w, y, z) and singular (q, r). (Photo: H. Alarashi)

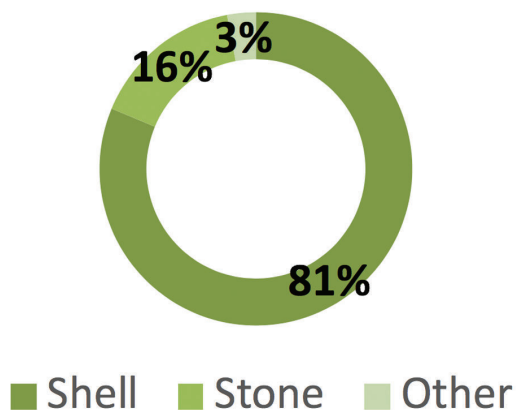


Fig. 28 General percentages of materials used for ornaments at Ba'ja. (Graph: H. Alarashi)

or buckles (Fig. 27i, l, p, y) within complex ornaments (*i.e.* several rows or strings).

Intensively excavated areas of the settlement have revealed relatively similar proportions of objects

(Table 5) both finished and unfinished (Fig. 27i,w,y). Unpierced shells (Fig. 27g), large fragments of mother-of-pearl (Fig. 27k) and raw carnelian (Fig. 27x), malachite, and native copper are also regularly found. These elements attest bead-making activities at the settlement, ranging from simple piercing (shells) to an elaborate complex *chaîne opératoire* (mother-of-pearl rings, some stone beads). The technological study will give clues regarding the quality of the production and the technological investments required. The detailed analysis of the contexts through in-depth comparisons between the buildings is also expected to identify differences/similarities in terms of types and accessibility/ acquirement of certain materials.

### Worked Bone Industry (B.A.)

51 bone artefacts were found in the 2018 season, representing 4 categories. The assemblage includes the material retrieved from the “bones general” bags arriving from the dig; all specimens underwent archaeozoological analysis. The recording followed a parameters' list, and classification is based on the knowledge on Ba'ja's worked bones obtained from the 2016 season (Abuhelaleh in Gebel *et al.* 2017). Manufacturing and use-wear were documented by stereomicroscopy.

The four categories or classes into which items fall are: 1. Pointed objects including awls, needles, pins, perforation points, and flat pointed tools. 2. Spatulas. 3. Ornaments, and 4. other objects including manufacturing waste (Fig. 29).

Pointed objects show particular shapes and sizes. We included the pins in this category since the six respective pieces have long and thick cylindrical shafts similar to needles' dimensions. Of the 6 flat pointed objects, some have sharp pointed and some have arched ends (Fig. 30). The 6 needle fragments show section diameters between 3-6 mm. A special case is an extremely thin (1.4 mm) needle with a tiny eyelet and preserved length of 5.5 cm (F.no 105009). This extraordinary piece will receive a special publication. Awls are most numerous, represented by 22 fragments of various portions of the tools, testifying also a wide range of dimensions and shapes in this tool class, some shorter than 50 mm in their latest stage (some objects show the re-sharpening of points). Two medium-size burnt awls have been used most intensively: They have a highly smoothed inclination in the medial part of the shaft, representing the use-wear impact of the hand. One most likely was used by a left-handed person, judging from the direction and location of smoothed area (Fig. 30:E, F.no 105025).

The 5 incomplete spatulas were made from large-size animals (Fig. 31). One of the spatulas is highly smoothed, has a thickness of less than 4 mm, and may have been used for highly delicate work; one spatula's end is pointed in a triangle's shape, which is quite uncommon for the site (Fig. 31.C).

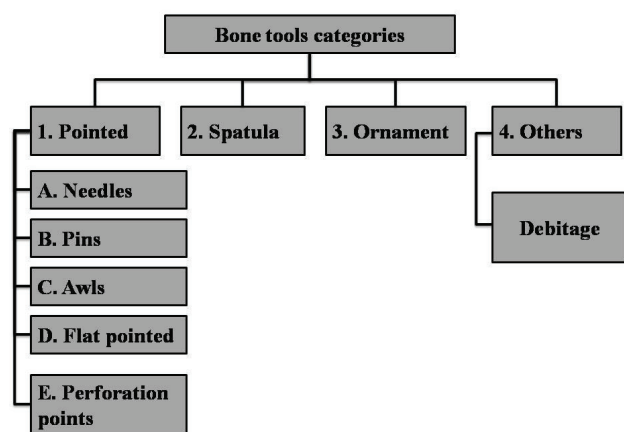


Fig. 29 Suggested worked bone categories of Ba`ja. (Graph: B. Abuhelaleh)



Fig. 30 Pointed bone tools. A pin F.no. 105000, B pin F.no. 105006. C needle F.no 105015, D small awl F.no 105010, E large awl F.no 105025. (Photos: B. Abuhelaleh)

The ornament category is represented by a bone ring fragment (surface not smoothed; lateral parts smoothed).

The 5 debitage items stem from O/C metatarsals and other fragments; some of this debitage is burned with resulting in dark brown to black colours. The debitage specimens will be subject to a later study when a statistically sufficient amount of material is available.

The small and unique tibia shaft (F.no 102028, 125 mm in length) still hafting a small bone (!) blade with sawing marks will be also subject of a separate publication of special bone tools from LPPNB Ba`ja.

The use-wear of Ba`ja's worked bone industry reflects quite diversified craft activities. Not only weaving, needle and leather working is attested: We have

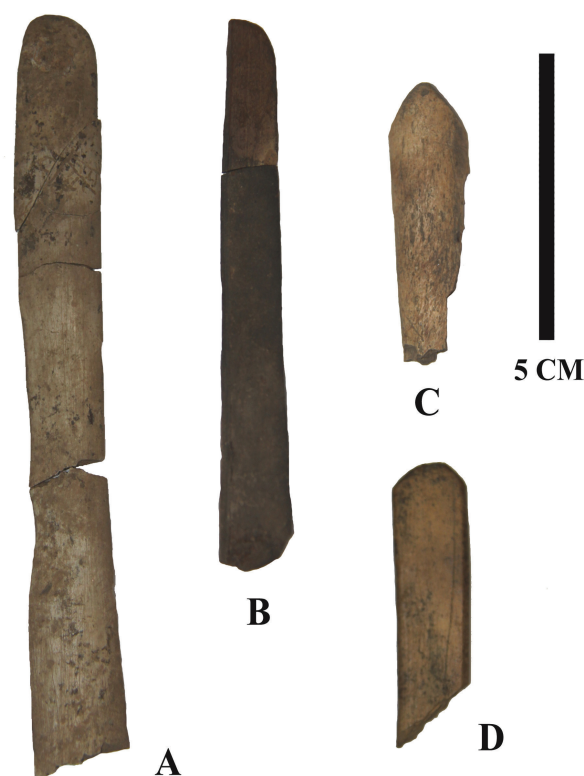


Fig. 31 Bone spatulas. A F.no 105009, B F.no 105017, C F.no 105027, D F.no 105019. (Photos: B. Abuhelaleh)

now indications for more intricate work which up to now has been not identified for a Neolithic community.

### Initial Phytolith Sampling (A.K.)

Phytolith analyses provide a way to understand better the usage of ground stones. Apart of stylistic or typological classification, the phytolith sampling can provide a deeper knowledge about which materials were grinded, helping to identify the exact use(s). In a first step, individual stones were to be sampled to define their usage. In a further step, the analysis of complete inventories can reveal, for example, if certain households were somehow specialized within the village.

To approach these questions, 130 samples from ground stones, especially grinding tools and stone vessels, were taken in the 2018 season in an initial step. The majority of the samples were taken infield during excavation: While the stone tool was still *in situ* soil samples were taken from above and – after removal – directly beneath the artefact. To eliminate/minimize the possibility of contamination, control samples were taken from the nearby surroundings to check if the sampled material attached to the stones is part of the fill or represents remains of use.

During further work, artefacts recovered in previous years were also sampled. For this, surfaces were washed with distilled water which were then collected and dried, resulting in the remains being attached to the ground stone.



### Ba`ja's Neolithic Water Supplies. A Short Archaeo-hydrological Reconnaissance (K.W., M.S.)

During June 2018, a short reconnaissance of Ba`ja's hydrological setting took place. Previous considerations regarding Ba`ja's water sources were published by Gebel (2004). So far, no hydraulic installations were encountered with the Early Neolithic occupation on the intra montane basin/terrace, or the gorges below. Therefore, our hydrological reconnaissance was aimed at a more detailed understanding of the potentials of the inhabitants' possible water management and daily water supply, and to evaluate related archaeohydrological questions. As of yet, *siq al-Ba`ja* and the adjacent northern gorge are considered to be the water supply for the Neolithic site.

The site is located at c. 1150 m a.s.l. on the foothills of the outcropping fissured Ram-Sandstone formations which are principally a quite good aquifer (UN-ESCWA and BGR 2013). Due to topography, using groundwater directly on the intra montane terrace of the site can be ruled out. Theoretically, it seems possible to convey groundwater from springs in the upper catchment (Fig. 32) towards Ba`ja like the Nabateans of the region did.

Nevertheless, during the Early Holocene the yield of some springs in the upper catchment – when groundwater recharge was higher – may have contributed to *siq al-Ba`ja*'s possible perennial or intermediate water flow. Depending on the springs' yield, it must have been either a continuous surface stream serving the settlement's water demand, or just an intermediate flow which is invisible in the *siq*'s gravels (*cf.* the suggestion in Gebel 2004). Today, the mean precipitation rate is 135 mm per year (Fick and Hijmans 2017). Considering climatic shifts since Early Holocene, we assume wetter conditions with higher precipitation for the time of the early Neolithic (Kouki 2006: 36), resulting in higher groundwater recharge rates.

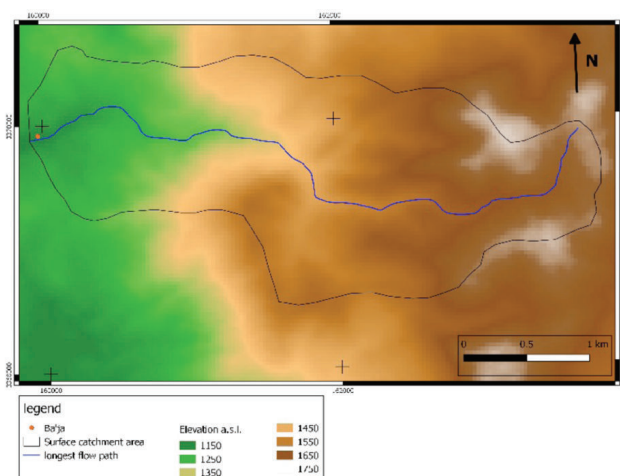


Fig. 32 Eastern surface drainage catchment of Wadi/Siq al-Ba`ja/ the Early Neolithic site of Ba`ja (elevations after SRTM 2004 – 2018/Consortium for Spatial Information, CGIAR-CSI). (Graph: K. Wellbrock, M. Strauss)

A detailed description of the narrow *siq al-Ba`ja* with widths as less as 1.60 m below the site and unknown gravel depths of several meters is provided by Gebel (2004: 28-29). The author suggests dams in the *siq* which have been maintained to retain surface runoff to create open reservoirs and/or to fill the gravel deposits, once an episodic or periodic flash flood occurred. In addition, we suggest considering the storage of water in the wadi sediments. Furthermore, the exploitation of perennial intermediate flow in the sediments' layers should be considered as a potential water supply.

Ba`ja's surface catchment area comprises about 6 km<sup>2</sup> according to remote sensing data (Jarvis *et al.* 2008). The highest peaks inside the catchment area are found at its eastern edges at elevations over 1700 m a.s.l. The longest flow path measures c. 5 km in horizontal and 550 m in vertical directions. Thus, the mean gradient of the catchment's surface is extremely steep, representing an average inclination of 11 %. The *siq*, or wadi gorge, next to the site has a moderate inclination of up to 3 %. At several spots, the *siq*'s sandstone bedrock also shows steps of up to 3-4 m in height while most parts of the *siq* are filled by gravels.

Hydrologically, the rain intensity<sup>3</sup> of a storm event having a return period of two years is about 9 mm/h (or: 25 l/s\* ha) in present times. Considering the topography and an almost absent vegetation, a peak discharge<sup>4</sup> as high as 12.75 cbm/s should be considered every second year on a statistical base. In the narrow *siq*<sup>5</sup>, this causes a runoff event having a flow depth of more than 2.5 m and a flow velocity of more than 3.3 m/s. The resulting shearing stress is then about 580 N/m<sup>2</sup> which allows for the easy transporting of stone blocks with a diameter of up to 1m. This indicates clearly that such events can change the sedimentary environments in the *siq* dramatically. Most likely, all sediment and gravel layers above the *siq*'s bedrock will be moving during such an event. Heavy flash floods can even cause a considerable change of the *siq*'s gravel and boulder topography making the access to the site in some years less or more difficult (observations by H.G.K. Gebel since 1984). Only when the flow rate reduces at the end of a flash flood, are sediments deposited. In this case, the pores between the sediments are saturated.

The surface runoff coefficient in the Early Holocene has to be expected lower than today's 0.85 due to the more semiarid conditions and more vegetation, especially in grass-covered areas/pastures of the catchment.

It is most likely – even obvious – that the *siq* has been crucial for daily water supply, despite its dangerous torrential flash floods. For a more sound understanding, further research has mainly to focus on 1) a hydrogeological survey of the upper catchment in order to identify former Early Holocene springs having contributed to an intermediate or even permanent surface flow in the *siq*; 2) excavations of *siq* fills to evaluate potential subsurface water storage; and 3) hydrologic-hydraulic modelling of storm events and related flash floods for the *siq*, considering changing surface-runoff conditions as a consequence of climate changes.

## Household and Death. Socio-Neurobiological Potentials (J.B.)

The aim of our research stay at Ba`ja was to understand the site's potentials for socio-neurobiological research on its early Neolithic community, and to support the project's transdisciplinary Work Packages V.I (Cognition and Ethos at Ba`ja), V.2 (Identities of Active and Transformed Households) and V.3 (Identities of the Dead). By translating our theses and the results of previous socio-neurobiological, evolutionary and cognitive sciences research (Bauer 2008, 2011) into hypotheses applicable to findings reflecting the ethology and ontology of the Ba`ja community, we aim to reconstruct the levels of corporate behaviour as well as stress and conflict management in the Neolithic village. Since the unexpected frequency of intramural burials demands special attention in this framework, the inhabitants' thanatological dispositions have to become an important part of the novel transdisciplinary enterprise (Bauer and Benz 2013). Basically, our season's stay confirmed a clear potential of the site's discoveries for a research on socio-neurobiological and cognitive dispositions while it also showed how much this depends on archaeological interpretation (e.g. the commodification and territoriality models in use, or concepts like cultural memory, habitus society, transformation of household items, etc.).

From a social neurobiology perspective, the following major questions arose by personally experiencing the site's habitat and seeing the finds and findings:

- 1) Which motivations and dispositions are behind the choice of, and living at, the dramatic and secluded location during the beginning of sedentary lifeways?
- 2) What type of flat – or incipiently stratifying – social hierarchy dominated village life at Ba`ja, and were determinants of the socio-neurobiological frameworks?
- 3) Which evidences do we have for the corporateness and corporate identities (*sensu* Benz 2017; Gebel 2017) of Ba`ja's inhabitants, also explaining how they understood themselves?
- 4) How did the formation of identities process and manipulate the dead and death?

Motivations and dispositions: Excavation results illustrate that the community was living under spatially highly agglomerated conditions while crafts and commodities indicate accelerating diversifications. It cannot be excluded that self-protective behaviour was behind the choice of the remote location, protecting both fragile outside relations as well as wealth and tangibles of the settlement.

Social hierarchy: Since direct archaeological evidence for hierarchies is a difficult matter to trace, consequently the cognitive and socio-neurobiological

foundations for hierarchies are difficult to state. However, the clearly different social statuses as well as ritual and symbolic treatments attested with the intramural burials and their removal are highly significant for hierarchical patterns and social differentiation. Their socio-neurobiological potentials appear quite promising, maybe even giving the chance for statements on childhood statuses (larger number of Infans I-II burials). Advanced crafts attesting structured labour may not be a signal for hierarchical structures: It might well have encouraged more corporateness and flat hierarchies in these sectors.

Corporate Identities: Seemingly, hard or direct evidence attesting corporate identities is missing at Ba`ja. The material inventory appears more of a conventional character than attesting corporateness. However, insights let us expect more the rule of implicit corporate identities following the understanding „we know who we are“, not expressing this by tangibles. If that is correct, we should assume generally flat hierarchical structures at Ba`ja which already allow the expression of „elite“ statuses like Burial Loc. C10:408 in Room CR35 (Gebel et al. 2017).

Sepulchral Identities: Ba`ja inhabitants' obvious thanatological dispositions appear to carry significant neurobiological and socio-neurobiological information. While research at Ba`ja has exposed the need to enter this field only now, and almost no prehistoric research is traceable for this yet, our project has begun – as a consequence of this season – to prepare the foundations for this research.

## Room Biographies. Revision of Approaches to Ba`ja's Stratigraphies (C.P., M.B., H.G.K.G.)

Excavating Area C's lowermost occupations with its intramural burial ground, and by having full access to the walls' building, re-building, dismantling, and repair events, in this season, it became definitely clear that our current concepts of building phases at Ba`ja do not meet the complex reality of the site's "ever-vegetative" architecture and space use. For instance, neighbouring rooms offer contradicting information on related building sequences, or the two faces of one and the same wall show different contexts to very different building events. However, our new concepts do not affect the understanding of the general architectural sequence, or main building phases (*sensu* Gebel et al. 2006a; Kinzel 2013). For the understanding of general architectural stratigraphy, the supra-empirical approach by modelling of the general phases still appears as a reliable approach, at least area-wise. Especially, Ba`ja seems to offer good chances to separate such main phases through identifying cross-room rebuilding after an earthquake (Gebel and Kinzel 2007): Gaining insights into Ba`ja's building caesuras following at least one such high-energy event at Ba`ja is planned for the 2019 spring season.



Event	Activities
<b>Event series 1 Initial Occupation</b>	
1-1a	<i>Preparation of building ground, probably clearance of surface and extraction of natural sediments construction material (mortar)</i>
1-1b	Construction of Walls C1:56, C11:32=C1:16, C10:411, and probably C10:68.
1-1c	Probably contemporary to 1-1b: Construction of Wall C10:117 which separates a 10m <sup>2</sup> space (4.4 by 2.25 m, includes space of Rooms CR34, CR35, and CR35.1)
1-1d	<i>Construction and organisation of floor or surface</i>
1-2	<i>Habitational events and daily use of space incl. maintenance</i>
1-3	Unknown event (probably resulting in damaging and/ or partial collapse of Wall C10:411)
<b>Event series 2 Restoration and compartmentalization of space into three Rooms CR34, CR35, and CR35.1 (in the following only events of Room CR35 are considered; the exact position of events marked with * within Phase 2 is unclear)</b>	
2-1a	Partial dismantling of Wall C10:411
2-1b	<i>Clearance of space (including removal of depositions and surfaces of Phase 1) and probably also extraction of natural sediments as construction material</i>
2-1c	Reorganisation and compartmentalization of space into Rooms CR34, CR35, and CR35.1 by constructing Walls C10:78 and C11:34
2-1d*	Construction of Upper Storey Wall C10:76
2-1e	Construction of Floor C10:86=146=403
2-1f	Roofing of Room CR35 (and CR35.1)
2-2a	<i>Habitation and use (no evidence preserved)</i>
2-2b*	Construction of step-like feature (C10:124) to facilitate access to Room CR35.1
2-2c	<i>Cleaning of floor surface</i>
<b>Event series 3 Reuse of room as collective burial ground (the exact sequence of events marked with * within Phase 3 is unclear)</b>	
3-1*	Constructing elite Burial C10:408, digging a pit through floor into natural sediments, constructing a stone cist and covering the cist by stone slabs and a coat of plaster (for a more detailed event sequence see Benz <i>et al.</i> 2019, Tab. 2)
3-2*	Inserting double Burial C10:405, digging a pit through floor into natural sediments, covering the pit by a stone slab (for more details see Gebel <i>et al.</i> 2017).
3-3*	Multiple burial C10:152, digging a pit through floor into natural sediments, covering the pit by a stone slab and placing a used grinder (F.no 47825), with traces of red liquids on top (for more details see Gebel <i>et al.</i> 2006a).
3-4*	Blocking of wall opening to CR34 (C10:78A), placing of an anthropomorphic clay figurine on or over the threshold
3-5	Continuing decay of roof and infiltration of very fine sediments in the NW room part of Room CR35 and in Burial C10:408 (equal to 2a-1k?)
3-6	Deposition of wall collapse, mortar/ plaster, roof material which filled the lower room up to 1.00 m; probably related to seismic high energy event/ earthquake
<b>Event series 4 Restoration of settlement and reorganisation of space (the exact sequence of events marked with * within Phase 4 is unclear)</b>	
4-1a	<i>Clearance of damages; clearance of wall tops of phase 1-2 walls; recycling of wall stones from collapsed/ damages walls</i>
4-1b*	(Re)construction of Walls C11:3 and C11:16 (probably on top of wall remains of Phase 2 occupation)
4-1c*	Restoration of partly collapsed/ dismantled Wall C10:68.
4-1d*	Construction of the foundation of "monumental" Buttresses C10:64 and C11:14 on cleared tops of phase 1/2 walls (i.e. C10:78, C10:117; C11:34) and if not possible on (unconsolidated) collapse (i.e. C10:79=118 in CR34).
4-1e*	Deliberate massive backfills (c. 1.80 m) of unrecycled building materials from collapse building to prepare the building ground and to adjust differences in levels
4-1f*	Completing western part of "buttress building" by construction of Walls C10:5=6=C10:114
4-1g	<i>Roofing of space?</i>
4-2a	Habitation and use of "buttress building" which includes the formation of temporary Floor C10:25a
4-2b*	Construction and use of Installation C10:19=C10:100
4-2c*	Digging of Pit C10:126
4-2d*	Use of Grinding Installation C1:7
4-3	Abandonment of building and beginning decay
4-4	Damages in walls and buttresses due to a seismic high energy event; vertical cracks in Buttress C11:14, heavy southernly inclination of Buttresses C11:14, C1:3 and Wall C1:17; probably collapse of roof and upper parts of walls and buttresses (e.g. C10:62)
<b>Event series 5 Post occupation and site formation (events not included here)</b>	

Table 6 Reconstructed event sequence of Room CR35. Events and activities in *italics* have not been preserved in the archaeological record.

For the „ever-vegetative“ building and fill events of rooms or connected rooms, however, our approaches by this season came under basic revision: We started to test if the densely agglomerated and terraced LPPNB building stratigraphies can be understood better and more realistically by an integrative and room-wise reconstruction of sequential wall building and fill events. Only in a second step, if possible at all, these room biographies should be merged into a more coherent picture for neighbouring rooms until – idealistically – a base is reached to identify a housing unit within the overall complexity of the building-and-fill stratigraphy. This room biographical approach would also serve to better

integrate the understanding of building and depositional events (*i.e.* integrating the building and archaeological stratigraphies in a more detailed manner), thus helping an ontological understanding of sequential space use including the erosive processes involved. This approach can also be applied for a more honest treatment of vaguely identified or impossible attributions of wall and other spatial events in stratigraphical discussions.

As an example, we present in the following a summary on the reconstructed room biography of Room CR35 which demonstrates the aforementioned hyper-complexity of horizontal and vertical constructions, modifications and depositions (Table 6, Figs. 33-34).

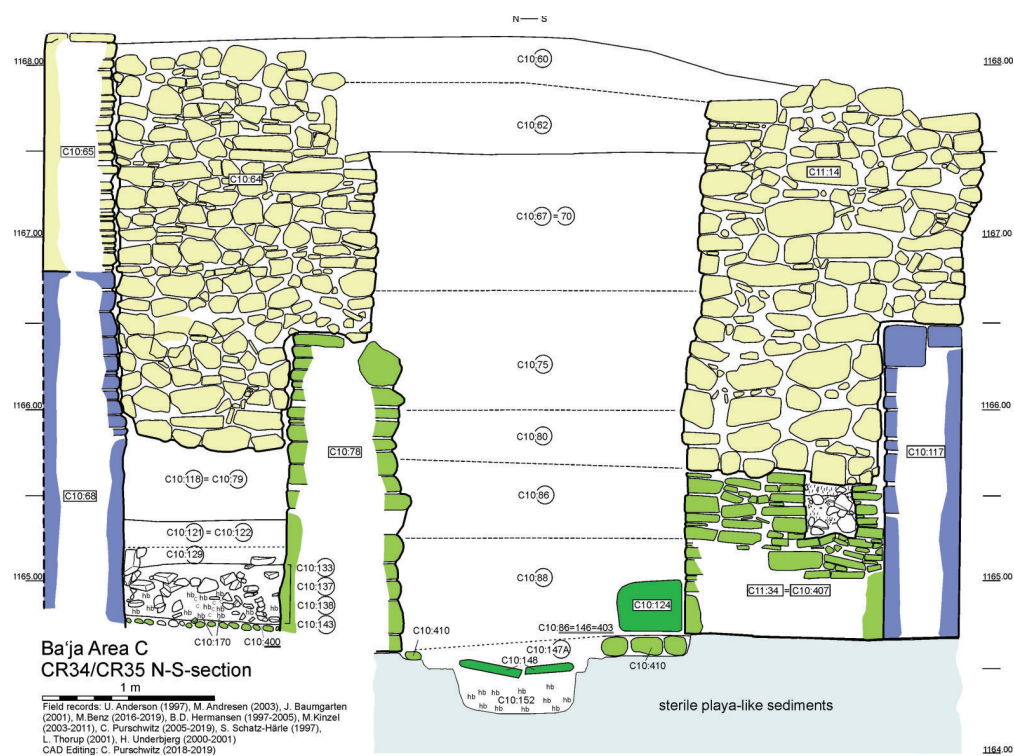


Fig. 33 Reconstructed room fill section of Rooms CR34 and CR35 (for general legend see Gebel 2006b: Fig. 1; hb refers to human bones). (Graph: C. Purschwitz)

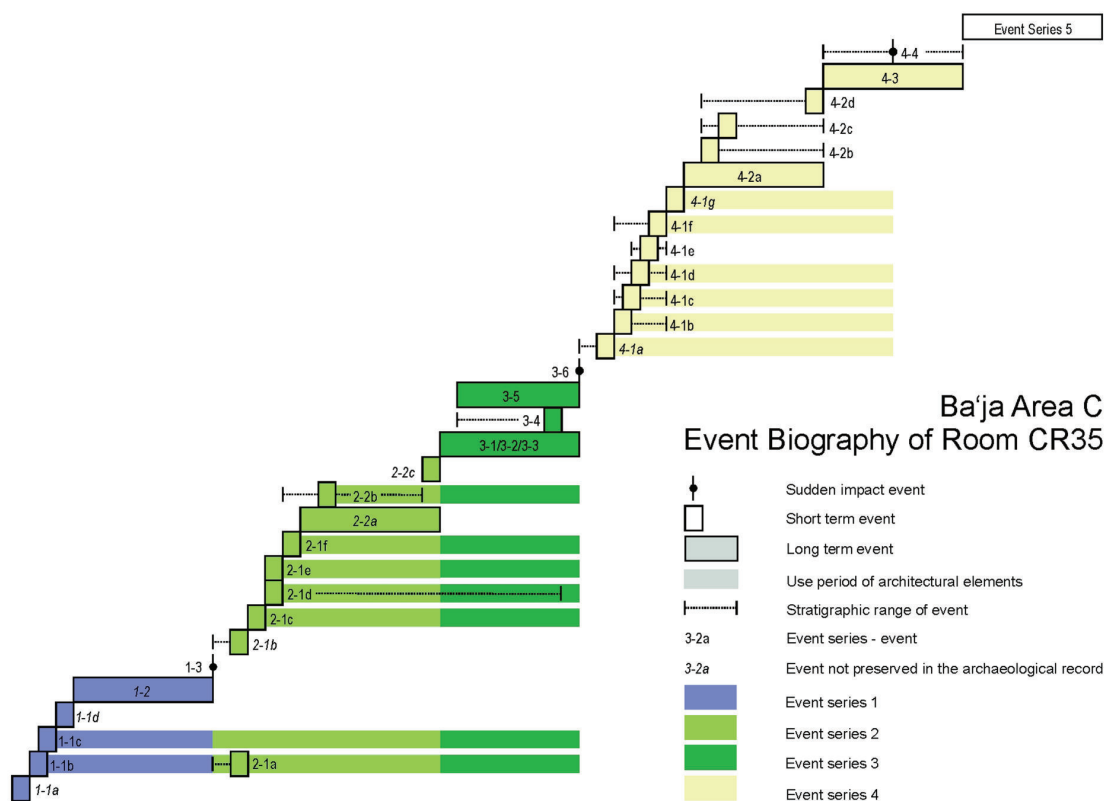


Fig. 34 Gant chart of event sequence interpretation (i.e. events' biography) of Table 6. (Graph: C. Purschwitz)



Needless to say, our biographic reconstruction of Room CR35 is not final. There are much more aspects to be considered (such as the biographies of other rooms and objects found therein). It aims not only to document and illustrate our ongoing discussion, but also to present the formation of research concepts and ideas for investigating, understanding and explaining the remains of the complex stratigraphy and “ever-vegetative” architecture as is typical for southern Levantine Mega-sites such as Ba`ja (for more details we refer to Purschwitz *et al.* forthcoming).

### Season’s Significant Results, Progressing Research (H.G.K.G., M.B., C.P.)

This season’s discoveries advanced the research framework of the *Household and Death in Ba`ja* - Project considerably, but also created new questions and revealed gaps where more evidence is needed. Thanks to this recent research we are now closer to a deep-knowledge understanding of Ba`ja’s and Jordan’s late 8<sup>th</sup> millennium BCE. The new evidence confirms that. For the period in question, sedentary village life was characterised by acceleration, agglomeration and heterogeneity processes in architecture, crafts, social structures, value and cognitive systems. Being part of the Transjordanian LPPNB Mega-Site-Corridor, Ba`ja’s lifeways were certainly embedded in, and depending to an unknown extent on the regional and supra-regional developments of settlement networks and hierarchies, including especially the socio-economic evolvments on the eastern steppe cultures (early pastoralism, productive kite economies, runoff water management, and other) and changing climate. These entanglements should be elaborated further and without which our most recent results remain premature.

### Room Biography Approach

One of the most important results of the season is a fundamental re-framing of our previous understanding of houses in Ba`ja, both in terms of building stratigraphy and social structures. Our previous notion that the architecturally defined building units reflect social groups using room sets over longer periods by a continuous spatial re-structuring may not reflect the real social ontologies behind. Both the “ever-vegetative” horizontal and vertical alterations of room and floor networks by all sorts of construction, re-building, dismantling, repair, and depositional events – or: the interacting biographies of living, terminated and sepulchral spaces – deserve a more detailed, integrated, holistic, and room-/space-oriented consideration of all functional and stratigraphic features. In other words, the occupational data as represented by the layers’ individual character and content have to be linked more cohesively with the respective wall phases. This need became more evident when the lowermost occupations with

its intramural burial ground were excavated, and when full access to the walls’ biographies above virgin soil was granted. Theoretically, the supposed earthquake(s) at Ba`ja and their building caesuras may help to identify contemporary layers and wall repairs which, otherwise, are very difficult to identify across rooms. The new approach (*cf.* the example in this contribution: Table 6, Figs. 33-34) considers reconstructing the biography of sequential wall phases and fill events room for room before such a room biography is linked with neighbouring ones in a second step. A third step would try to see if neighbouring rooms can be identified as jointly functioning domestic units at a given time. We should also thus keep in mind that our modern house concepts may possibly not apply to the housing concepts of habitus communities that we assume for Ba`ja (Gebel 2017).

### Intramural Burial Ground and Burials C1:46 and CR17:117

The presence of an intramural burial ground in contact with the site’s natural deposits was confirmed for Area C, yielding two more burials. 1) An elaborate and massive burial cist – inserted in Room CR36.1 – containing the burial of a c. 8-year-old girl (Loc. C1:46) endowed with a complex, presumably multi-string necklace of more than 2500 beads in the neck area. A large piece and some crumbles of red pigment were also found in the loose sandy and homogeneous grave fill. The grave’s vertical side slabs were covered by 3 (!) layers of carefully placed stone slabs that were deliberately smashed prior to depositing, and one large complete oval stone plate. This child burial appears extraordinary for the Neolithic and contrasts much with the other children burials at Ba`ja (*e.g.* C10:405, *cf.* Gebel *et al.* 2017: Fig 10). Its preliminary and cautious understanding should consider intrinsic and ascribed characteristics of the girl as possible reasons for her special burial: on the one hand, a strong emotional relationship, ideological, social reasons or, on the other hand, pathological or outstanding cognitive capacities and skills of the child. The elaborate burial might also indicate an institutionalised status of children/girls.

2) The other inhumation (Loc. CR17:117) represents a hitherto incompletely excavated, less formal depositing of human bones. A headless sub-adult skeleton (lower mandible attested) seems to be related to another adult individual and child. Additional finds in the pit comprise animal and other human bones (including a red-stained finger; some heat-affected bones), two limestone celts with polished edges, few red pigment crumbles, a fragment of a marl ring, a possible basal “blade dagger” fragment, and another small flint blade (Fig. 11).

These new burials reassert that at Ba`ja we are dealing with a greater variability of graves types, ranging from individual burials with/without cists to collective room burials and rather “informal” depositions of hu-

man remains; grave goods are common. Resting above these burials, a series of household depositions testify the formal or ritual termination of household inventories, often connected with evidence of burning, as well as remains of living households. The nature of the intramural burial ground in Area C will be subject of further investigations.

### ***Burnt Household of Room CR5 and the Buried Household Remains of Room CR 22.2***

Excavations in Room CR5 revealed the remains of a burnt household. Large pieces of charred timber covered ashy layers containing a variety of household materials: extensive *in situ* scatters of the thick-walled ware representing *tabūn*-like installations, a plate, and a globular large vessel; bone tools; handstones and grinding slab fragments; an *in situ* oval sandstone basin or vessel (Fig. 15); and a trilith-type arrangement of ashlar (Fig. 15).

The continued excavation of Room CR 22.2 uncovered more material from a terminated (buried) household, including more fragments of a low-fired grit-tempered thin-walled ware which technologically is not yet pottery.

Both rooms are considered extremely important sources of information for the Ba`ja's inhabitants behaviour related to *Household and Death*.

### ***Resumed Area D Excavations***

Resumed excavations in Area D aimed at locating findings relevant for the project's *Household and Death* topic which should be addressed in the next season. A number of findings from this season exhibit/indicate the relevance to the topic. South of the collective burial excavated in 2001, the remains of a celt and blade workshop were found in a fill constituted also of material fallen from an upper floor (Fig. 7). Two new loci in Area D confirmed the practice of inserting celts in walls (Fig. 6); possibly representing a magic practice to "enforce" walls (Gebel 2002). Room DR32 gave *in situ* evidence of food processing while DR19 contained the refuse of a sandstone ring workshop deposited in the room's fills.

### ***Social Neurobiology at Ba`ja***

The participation of the project's social neurobiologist confirmed again Ba`ja's potential to apply socio-neurobiological, evolutionary and cognitive sciences approaches to reconstruct the ethos (*sensu* their ethological and ontological dispositions) of the Neolithic inhabitants. In that respect, not only the archaeological evidence for corporate behaviour is important:

The role of the intramural burial ground is becoming increasingly significant for understanding the inhabitants' thanatological dispositions in order to identify the social role of the dead and death in the community.

### ***Ba`ja's FPPNB/PPNC***

The stratified find of a Yarmoukian-type arrowhead in Room CR5 and previous testimony for a FPPNB/PPNC presence or occupation request a better understanding of Ba`ja's occupational end(s).

For the Yarmoukian-type arrowhead of CR5:34 (F.no 102020) a natural intrusion appears unlikely. Further excavation and radiocarbon dating, especially for its trilith context, is needed to exclude that we deal with a later *do ut des*-finding as recorded from Basta (Hermansen 1997).

### ***Analyses of Flints and Ornaments***

In 2018, we started a comprehensive program on the biographies of objects, from the procurement and *chaîne opératoire* to the use and discard of objects. Use-wear analyses as well as the identification of raw materials and phytolith analyses are an integral part of this focus. These analyses will provide promising information on the transmission of knowledge and household or community-based organization of crafts. It will also help to understand the regional wide networks in which the community of Ba`ja participated. Preliminary results underline the supra-regional character of the raw material procurement. Use-wear traces on ornaments will give important clues on grave goods, whether they represented used objects or were especially made for the burial ritual.

### ***Backfilling Ba`ja's Trenches***

An intense backfilling with stones and sediment sacks started this season, exceeding much such activities of the former years. Due to the insufficient on-site availability of soft sediments (small room - architecture filled with high share of stones) and the site's inaccessibility for large amounts of backfill material from outside we are forced to use also excavated stone rubble to fill rooms. A retaining wall inserted in Room CR6 helped both backfilling the Rooms CR6 and 7 as well as stabilizing the Neolithic architecture around.

### ***Ba`ja's Community Spaces?***

Hitherto, the coherent picture of domestic architecture in Areas B, C, D, and F led us away from expecting community buildings in the settlement. However, the results of the 2018 season provide more and more signals of "wealth" and hierarchy from the settlement's layers. We therefore see the need to more clearly verify the existence or non-existence of supra-household facilities (communal buildings, corporate spaces) which weren't encountered yet: Ba`ja's architectural heterogeneity and variability has to be evaluated to a greater extent. For communal buildings, most promising localities might be the upper parts of the site (*i.e.* the upper eastern part of Area D, or the upper part of Area G between the rocks). For a safer understanding of the



Ba'ja's social structures and future research strategy, we started to plan larger test units in the respective locations during the 2019 spring season (BJ19a). This is turning away from the previous concept not to open new squares at the site which now appears justified in the light of this highly important potential evidence.

*Acknowledgements:* The 2018 excavations were made possible again by the permit of the Department of Antiquities of Jordan (DoA) and its director-general Monther Jamhawi; by Aktham Oweidi, Director of Excavations and Surveys; Ahmad Lash, Head of Loan Sector; Abdallah M. Bawareed, our DoA representative; and other staff of the DoA: They granted their most efficient in help and warm cooperation for our field research. Main sponsor of the season was again the Deutsche Forschungsgemeinschaft (DFG, GZ:BO 1599/16-1), Bonn, with ex oriente at Free University of Berlin and private sponsors complementing budget needs. 11 permanent and 5 part-time team members, 10-14 workmen, and the DoA representative granted the success of works carried out on the site and in Beidha base camp. Prof. Dr. Dominik Bonatz, Director of the Institute for Near Eastern Archaeology, supported the season from the side of Berlin Free University.

Aside from the co-directors and our devoted workmen, sacrificially contributing team members of the 2018 team were Muhammad Khair al-Atrash, Hala Alarashi, Blair Heidkamp, Abdallah Jalaban (cook), Lucia Miškolciová, Arnica Keßeler, Barbora Kubíková, and Denis Štefanisko (part-time members: Joachim and Hedi Bauer, Martin Strauss, Kai Wellbrock, and Bellal Abuhelaleh).

For the analysis of the mineral beads' raw materials, we are grateful to Dr. Manfred Martin and Melissa Gerlitzki of the State Department of Geology, Freiburg.

Language editing was carried out by our colleague Andrew K. Lawrence, Bern University.

**Hans Georg K. Gebel (H.G.K.G.)**  
Institute for Near Eastern Archaeology,  
Freie Universität Berlin  
and ex oriente at Freie Universität Berlin  
hggebel@zedat.fu-berlin.de

**Marion Benz (M.B.)**  
Institute for Near Eastern Archaeology,  
Freie Universität Berlin  
and ex oriente at Freie Universität Berlin  
marion.benz@orient.uni-freiburg.de

**Christoph Purschwitz (C.P.)**  
Institute for Near Eastern Archaeology,  
Freie Universität Berlin  
and ex oriente at Freie Universität Berlin  
purschw@zedat.fu-berlin.de

**Bellal Abuhelaleh (B.A.)**  
Al Hussein Bin Talal University

Petra College for Tourism and Archaeology  
bellal.abuhelaleh@gmail.com

**Hala Alarashi (H.A.)**  
Cultures et Environnement, Préhistoire, Antiquité,  
Moyen Âge (CEPAM), Nice  
hala.alarashi@free.fr

**Joachim Bauer (J.B.)**  
International Psychoanalytic University, Berlin  
prof.joachim.bauer@posteo.de

**Julia Gresky (J.G.)**  
Abt. Naturwissenschaften,  
Deutsches Archäologisches Institut, Berlin  
julia.gresky@dainst.de

**Blair Heidkamp (B.H.)**  
blair.heidkamp@gmail.com

**Lucia Miškolciová (L.M.)**  
Centre of Prehistoric Archaeology of the Near East  
(PANE), Masaryk University, Brno  
miskolcilucia@gmail.com

**Arnica Keßeler (A.K.)**  
keardo@gmx.de

**Barbora Kubíková (B.K.)**  
Centre of Prehistoric Archaeology of the Near East  
(PANE), Masaryk University, Brno  
barbora.kubikova.89@gmail.com

**Denis Štefanisko (D.Š.)**  
Centre of Prehistoric Archaeology of the Near East  
(PANE), Masaryk University, Brno  
dstefanisko@gmail.com

**Martin Strauss (M.S.)**  
Department of Architecture and Civil Engineering,  
Laboratory for Urban Water Management, Lübeck  
University of Applied Sciences  
martin.strauss@th-luebeck.de

**Kai Wellbrock (K.W.)**  
Department of Architecture and Civil Engineering,  
Laboratory for Urban Water Management, Lübeck  
University of Applied Sciences  
kai.wellbrock@fh-luebeck.de

## Endnotes

<sup>1</sup> The Ba'ja Neolithic Project continues by the „deep-knowledge project“ *Household and Death in Ba'ja* in which different approach lines unite for the subject: Neolithic commodification and territoriality (responsibility Gebel), the dead and death (responsibility Benz), and household production (responsibility Purschwitz). The project represents a transdisciplinary enterprise on which some more than 15 specialist researchers cooperate.

<sup>2</sup> Due to a shift in locus designation standards, reference to Ba'ja's loci is made in two ways: either e.g. the square-wise designations like e.g. C22:6 (Area C Square 22: Locus 6), or our recent room-wise designations like e.g. CR17:104 (Area C, Room 17: Locus 104).

<sup>3</sup> Assuming an average flow velocity in the catchment of 1.5 m/s (related to the topography) and taking into account the maximum flow distance (5,000 m) as well as a duration of roughly 60 min. Rain intensities are deduced from Jordan's IDF-relationship of the time period 1983-2005 (CEC – Sajdi and Partners 2011).

<sup>4</sup> Assuming a peak runoff coefficient of 0.85 and the catchment size of 6 km<sup>2</sup>.

<sup>5</sup> Assuming a width of 1.6 m, a slope of 2.5 % and a Manning's n of 0.0333.

## References

- Abu Laban A.  
2014 The use of marine shells at the Neolithic site Shkarat Msaied, Jordan. In: K. Szabó, C. Dupont, V. Dimitrijević, L. Gómez Gastélum and N. Serrand (eds.), *Archaeomallacology: Shells in the archaeological record*. British Archaeological Reports. International Series 2666: 9–17. Oxford: Archaeopress.
- Alarashi H.  
2014 *La parure épipaléolithique et néolithique de la Syrie (12e au 7e millénaire avant J.-C.) : Techniques et usages, échanges et identités*. PhD Thesis. Lyon: Université Lumière-Lyon 2.
- Andrefsky W.  
1997 Thoughts on stone tool shape and inferred function. *Journal of Middle Atlantic Archaeology* 13: 125–144.
- Bar-Yosef Mayer D.E.  
1997 Neolithic shell bead production in Sinai. *Journal of Archaeological Science* 24: 97–111.
- Bar-Yosef Mayer D.E. and Porat N.  
2008 Green stone beads at the dawn of agriculture. *Proceedings of the National Academy of Sciences* 105(25): 8548–8551.
- Bauer J.  
2008 *Das kooperative Gen. Abschied vom Darwinismus*. Hamburg: Hoffmann und Campe.  
2011 *Schmerzgrenze – Vom Ursprung alltäglicher und globaler Gewalt*. München: Blessing.
- Bauer J. and Benz M.  
2013 Epilogue. Neurobiology meets archaeology: The social challenges of the Neolithic processes. *Neo-Lithics* 13/2: 65–69.
- Benz M.  
2017 Changing medialities. Symbols of Neolithic corporate identities. In: M. Benz, H.G.K. Gebel and T. Watkins (eds.), *Neolithic corporate identities*. Studies in Early Near Eastern Production, Subsistence, and Environment 20: 135–156. Berlin: ex oriente.
- Benz M., Gresky J., Štefanisko D., Alarashi H., Knipper C., Purschwitz C., Bauer J. and Gebel H.G.K.  
2019 Burying power: New insights into incipient leadership in the Late Pre-Pottery Neolithic from an outstanding burial at Ba'ja, southern Jordan. *PLoS ONE* 14(8): e0221171. <https://doi.org/10.1371/journal.pone.0221171>
- CEC – Sajdi and Partners  
2011 Rainfall – Intensity, Duration, Frequency - Relationship manual (IDF Curves) for Jordan, September 2011. Report. ([www.cec.com.jo](http://www.cec.com.jo))
- Fick S.E. and Hijmans R.J.  
2017 WorldClim 2: New 1-km spatial resolution climate surfaces for global land areas. *International Journal of Climatology* 37: 4302–4315.
- Garba R.  
2017<sup>2</sup> Triliths. The stone monuments of Southern Arabia. Unpub. manuscript: L'Orientale University Napoli.
- Gebel H.G.K.  
1986 Die Jungsteinzeit im Petra-Gebiet. In: M. Lindner (ed.), *Petra. Neue Ausgrabungen und Entdeckungen*: 273–308. München: Delp.  
1988 Late epipalaeolithic-aceramic Neolithic sites in the Petra-Area. In: A.N. Garrard and H.G. Gebel (eds.), *The prehistory of Jordan. The state of research in 1986*. British Archaeological Reports. International Series 396.1: 67–100. Oxford:  
2002 Walls. Loci of forces. In: H.G.K. Gebel, B.D. Hermansen and C. Hoffmann Jensen (eds.), *Magic practices and ritual in the Near Eastern Neolithic*. Studies in Early Near Eastern Production, Subsistence, and Environment 8: 199–133. Berlin: ex oriente.  
2004 The domestication of water. Evidence from early Neolithic Ba'ja. In: H.D. Bienert and J. Häser (eds.), *Men of dikes and canals. The archaeology of water in the Middle East*. Orient-Archäologie 13: 25–36. Rahden: Marie Leidorf.  
2006a The domestication of vertical space. The southern Jordanian case of steep-slope LPPNB architecture. In: E.B. Banning and M. Chazan (eds.), *Domesticating space: Construction, community, and cosmology in the late Prehistoric*. Studies in Early Near Eastern Production, Subsistence, and Environment 12: 65–74. Berlin: ex oriente.  
2006b The stratigraphy and locus data. In: H.G.K. Gebel, H.J. Nissen and Z. Zaid (eds.), *Basta II. The architecture and stratigraphy*. bibliotheca neolithica Asiae meridionalis et occidentalis and Yarmouk University, Monograph of the Faculty of Archaeology and Anthropology 5: 11–132. Berlin: ex oriente.  
2009 The intricacy of Neolithic rubble layers. The Ba'ja, Basta, and 'Ain Rahub Evidence. *Neo-Lithics* 1/09: 33–50.  
2010 Commodification and the formation of Early Neolithic social identity. The issues as seen from the southern Jor-



- danian Highlands. In: M. Benz (ed.), *The principle of sharing. Segregation and construction of social identities at the transition from foraging to farming*. Studies in Early Near Eastern Production, Subsistence, and Environment 14: 35-80. Berlin: ex oriente
- 2013 Arabia's fifth-millennium BCE pastoral well cultures: hypotheses on the origins of oasis life. *Proceedings of the Seminar for Arabian Studies* 43: 1-16.
- 2017 Neolithic corporate identities in the Near East. In: M. Benz, H.G.K. Gebel and T. Watkins (eds.), *Neolithic corporate identities*. Studies in Early Near Eastern Production, Subsistence, and Environment 20: 135-156. Berlin: ex oriente.
- Gebel H.G.K. and Bienert H.D., with contributions by Krämer T., Neef R., Müller-Neuhof B., Timm J. and Wright K.I.
- 1997 Ba'ja hidden in the Petra Mountains. Preliminary results of the 1997 investigations. In: H.G.K. Gebel, Z. Kafafi and G.O. Rollefson (eds.), *The Prehistory of Jordan, II. Perspectives from 1997*. Studies in Early Near Eastern Production, Subsistence, and Environment 4: 221-262. Berlin: ex oriente.
- Gebel H.G.K. and Hermansen B.D.
- 2001 LPPNB Ba'ja 2001. A short note. *Neo-Lithics* 2/01: 15-20.
- Gebel H.G.K. and Kinzel M.
- 2007 Ba'ja 2007: Crawl spaces, rich room dumps, and high energy events. Results of the 7<sup>th</sup> Season of Excavation. *Neo-Lithics* 1/07: 24-32. Berlin: ex oriente.
- Gebel H.G.K., Benz M., Purschwitz C., Kubíková B., Štefanisko D., al-Souliman A., Tucker K., Gresky J. and Abuhelaleh B.
- 2017 Household and death: Preliminary results of the 11<sup>th</sup> season (2016) at Late PPNB Ba'ja, Southern Jordan. *Neo-Lithics* 1/17: 18-36.
- Gebel H.G.K., Hermansen B.D. and Kinzel M.
- 2006a Ba'ja 2005: a two-storied building and collective burials. Results of the 6<sup>th</sup> season of excavation. *Neo-Lithics* 1/06: 12-19.
- Gebel H.G.K., Nissen H.J. and Zaid Z. (eds.)
- 2006b *Basta II. The architecture and stratigraphy*. bibliotheca neolithica Asiae meridionalis et occidentalis and Yarmouk University and Monograph of the Faculty of Archaeology and Anthropology 5. Berlin: ex oriente.
- Goring-Morris N.A.
- 1991 The Harifian of the Southern Levant. In: O. Bar-Yosef and F.R. Valla (eds.), *The Natufian culture in the Levant*. Archaeological Series 1: 173-216. Ann Arbor: International Monographs in Prehistory.
- Hauptmann A.
- 2004 'Greenstones' from Basta. Their mineralogical composition and possible provenance. In: H.J. Nissen, M. Muheisen and H.G.K. Gebel (eds.), *Basta I. The human ecology*. bibliotheca neolithica Asiae meridionalis et occidentalis and Yarmouk University, Monograph of the Faculty of Archaeology and Anthropology 4: 169-176. Berlin: ex oriente.
- Hermansen B.D.
- 1997 Art and ritual behaviour in Neolithic Basta. in: H.G.K. Gebel, Z. Kafafi, and G.O. Rollefson (eds.), *The prehistory of Jordan II. Perspectives from 1997*. Studies in Early Near Eastern Production, Subsistence, Production, and Environment 4: 333-343. Berlin, ex oriente.
- 2004 Raw materials of the small finds industries. In: H.J. Nissen, M. Muheisen and H.G.K. Gebel (eds.), *Basta I. The human ecology*. bibliotheca neolithica Asiae meridionalis et occidentalis and Yarmouk University, Monograph of the Faculty of Archaeology and Anthropology 4: 117-125. Berlin: ex oriente.
- 2017 Death, feasting, and memory culture at early Neolithic Shkārat Msaied, southern Jordan. In: L.B. Christensen and J.T. Jensen (eds.), *Religion and material culture. Studying religion and religious elements on the basis of objects, architecture, and space*: 169-197. Turnhout: Brepols.
- Jarvis A., Reuter H.I., Nelson A. and E. Guevara
- 2008 Hole-filled SRTM for the globe Version 4, available from the CGIAR-CSI SRTM 90m Database (<http://srtm.csi.cgiar.org>).
- Kafafi Z.A.
- 2011 Upright stones of the Neolithic village 'Ayn Ghazal: Location and function (Jordan). In: T. Steimer-Herbet (ed.), *Pierres levées, stèles anthropomorphes et dolmens. Standing stones, anthropomorphic Stelae and Dolmens*. British Archaeological Reports. International Series 2017: 123-129. Oxford: Archaeopress.
- Kinzel M.
- 2013 *Am Beginn des Hausbaus. Studien zur PPNB-Architektur von Shkārat Msaied und Ba'ja in der Petra-Region, Süd-jordanien*. Studies in Early Near Eastern Production, Subsistence, and Environment 17. Berlin: ex oriente.
- Kouki P.
- 2006 Environmental change and human history in the Jabal Harūn area, Jordan. PhD thesis. Helsinki: University of Helsinki. Archaeology.
- Lichter C.
- 2007 Steinperle N° 202. In: Badisches Landesmuseum (ed.), *Vor 12.000 Jahren in Anatolien. Die ältesten Monumente der Menschheit*: 316. Stuttgart: Theiss.
- Maier R.
- 2008 *Grünsteine und Grünsteinperlen aus Beyda, Jordanien*. Unpublished M.A. Thesis. Bochum: Ruhruniversität.
- Makarewicz C. and Rose K.
- 2011 Early Pre-Pottery Neolithic settlement at el-Hemme: a survey of the architecture. *Neo-Lithics* 1/11: 23-29.

al-Nahar M.

- 2014 `Ain Ghazal and Wadi Shueib: Neolithic personal ornaments. In: B. Finlayson and C. Makarewicz (eds.), *Settlement, survey, and stone. Essays on Near Eastern prehistory in honour of Gary Rollefson*: 243-256. Berlin: ex oriente.

Purschwitz C. et al. in prep. *Roombiographies. Re-assessing complex LPPNB architecture in Ba`ja*. (working title)

Rassmann P.

- 2008 Stones on state. Assessing the use of handstones as tools to process stone artifacts at PPNB Ba`ja in southern Jordan. In: Y.M. Rowan and J.R. Ebeling (eds.), *New approaches to old Stones. Recent studies of ground stone artifacts*: 82-98. London: Equinox.

Spatz A.J.

- 2017 Ornamental shell beads as markers of exchange in the Pre-Pottery Neolithic B of the Southern Levant. In: D.E. Bar-Yosef Mayer, C. Bonsall and A.M. Choyke (eds.), *Not just for show. The archaeology of beads, beadworks and personal ornaments*: 69-80. Oxford: Oxbow.

Stemp W., Watson A. and Evans A.

- 2015 Surface analysis of stone and bone tools. *Surface Topography: Metrology and Properties* 4.

Thuesen M.B. and Kinzel M.

- 2018 Stone beads from Shkārat Msaied. *Neo-Lithics* 2/18:3-7.

UN-ESCWA and BGR

- 2013 Saq-Ram Aquifer System (West). In: *Inventory of Shared Water Resources in Western Asia*: 297-316. Beirut.

Wright K.

- 1997 Ground stone industry. In: Gebel H.G.K. and Bienert H.D., Ba`ja hidden in the Petra Mountains. Preliminary results of the 1997 investigations. In: H.G.K. Gebel, Z. Kafafi and G.O. Rollefson (eds.), *The prehistory of Jordan, II. Perspectives from 1997*. *Studies in Early Near Eastern Production, Subsistence, and Environment* 4: 247-249. Berlin: ex oriente.

Van Gijn A.L.

- 1990 *The wear and tear of flint. Principles of functional analysis applied to Dutch Neolithic Assemblages*. *Analecta Praehistorica Leidensia* 22. Leiden: Leiden University.

Wright K. and Garrard A.

- 2003 Social identities and the expansion of stone bead-making in Neolithic Western Asia: New evidence from Jordan. *Antiquity* 77(296): 267-284.