JABAL JUHAYRA, 2014-2015: EXCAVATIONS OF THE POST-PPNB LAYER

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Introduction

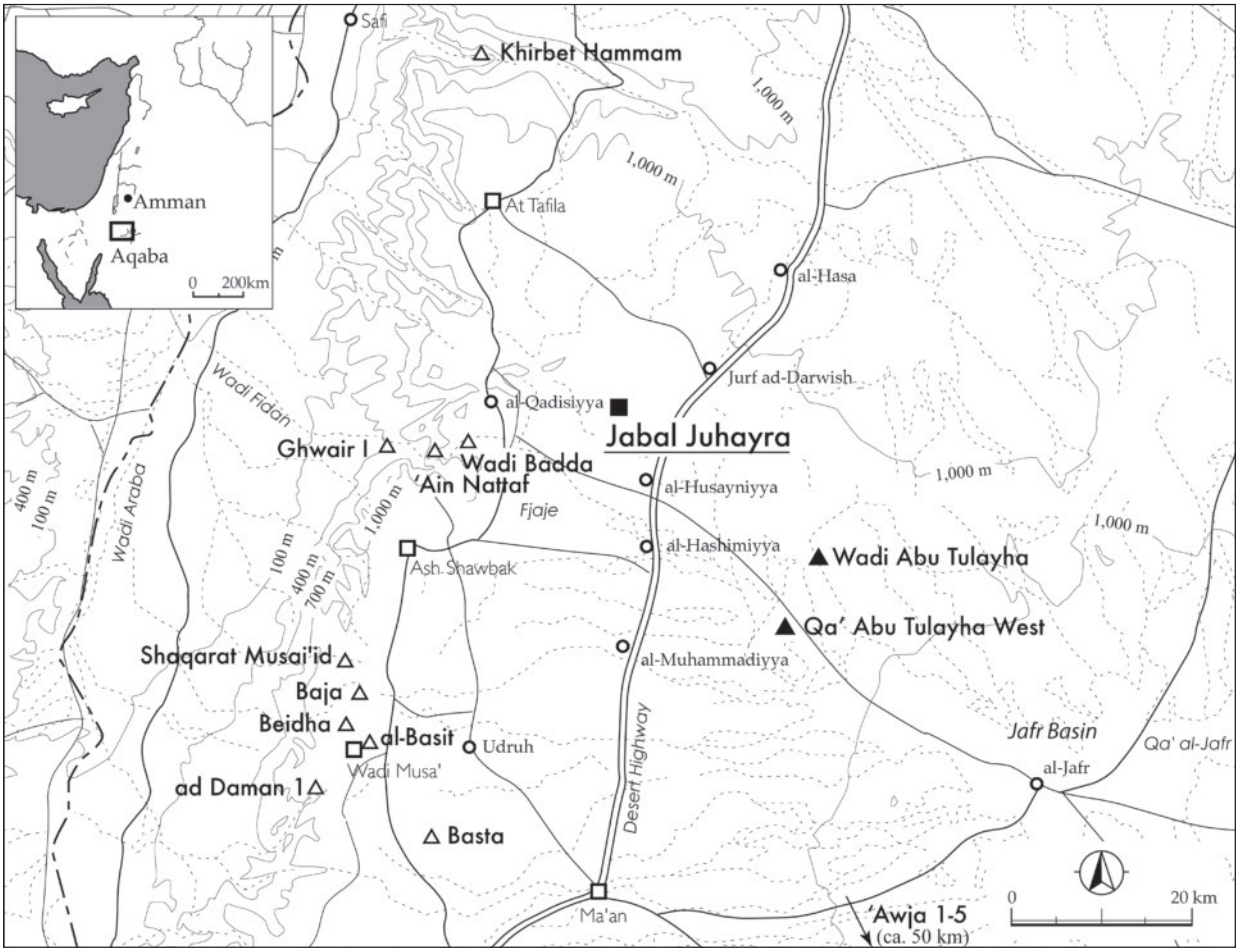
Our long-term research project (JBPP: the Jafr Basin Prehistoric Project) commenced in 1997, with a view to tracing the process of pastoral nomadization in southern Jordan. Since then, we have investigated a few dozen archaeological sites varying in both date and character. The first target of the project was Qa' Abu Tulayha West, a Late Neolithic (hereafter LN) to Early Bronze Age (EBA) open sanctuary located in the northwestern part of the basin (e.g. Fujii 2003). The excavations, which took place over six years (from 1997 until 2002), provided the first insights into the later prehistory of the Jafr Basin, our main research field. The second phase (2003-2004) dealt with several EBA burial fields, which allowed us to refine the second half of the chronological perspective suggested at Qa' Abu Tulayha West (e.g. Fujii 2005a). The third (2005-2008), and fourth (2009-2013) phases made an about-turn, to address comprehensive excavations at the Pre-Pottery Neolithic B (PPNB) outpost of Wādī Abu Tulayha (e.g. Fujii 2006a, 2006b, 2009a) and its surrounding Neolithic barrage systems (e.g. Fujii 2007a, 2007b, 2010a, 2010b, 2014b; Fujii, Adachi, Endo *et al*. 2012, 2013; Fujii, Adachi, Quintero *et al*. 2011; Fujii, Adachi, Yamafuji *et al*. 2013b). The series of research outcomes was synthesized to produce the *Jafr chronology*, which then enabled us to roughly sketch the formation process of nomadic society in southern Jordan (Fujii 2013).

Phase 5 of the project commenced in the spring field season of 2014. The research objective of the latest phase is to scrutinize socio-cultural correlations between sedentary farming communities to the west and nomadic societies to the east and, in so doing, develop the details of the Jafr chronology; to date, we have conducted three field seasons. The first one, which took place in March 2014, was devoted to a survey and test sounding at the Tor Ghuwayr sites, EBA burial fields at the northeastern edge of the basin (Fujii *et al*. in this volume). The second field season, implemented in August the same year, first continued a previous excavation at the remote burial fields, and then a preliminary excavation at Jabal Juhayra, our main concern here. The third season in March 2015 embarked on a fully-fledged excavation at the latter site, and confirmed the existence of a stratified prehistoric settlement. The excavation is still unfinished, and expected to take at least another season to complete. This interim report summarizes the research outcomes of the first two seasons, which mostly dealt with a post-PPNB layer.

The Site and Site-Setting

The site of Jabal Juhayra (N: 30˚39′01.20″/ E: 035˚45′41.34″/ Elevation: *c*. 1212 m) is located in the hilly limestone terrain at the northwestern corner of the Jafr Basin, southern Jordan (**Figs. 1, 2**). In terms of topography, the site occupies the southeastern flank of an isolated volcanic hill of the same name, extending in a NW-SE direction along a north-facing steep slope, which is sandwiched between a two-tiered scoria terrace and a small gully (**Figs. 3, 4**). What differentiates it from other Neolithic sites in and around the basin is its location on a scoria bedrock layer, which is the key to understanding the unique character of the site.

The site was located for the first time during our general survey in December 2001 and has



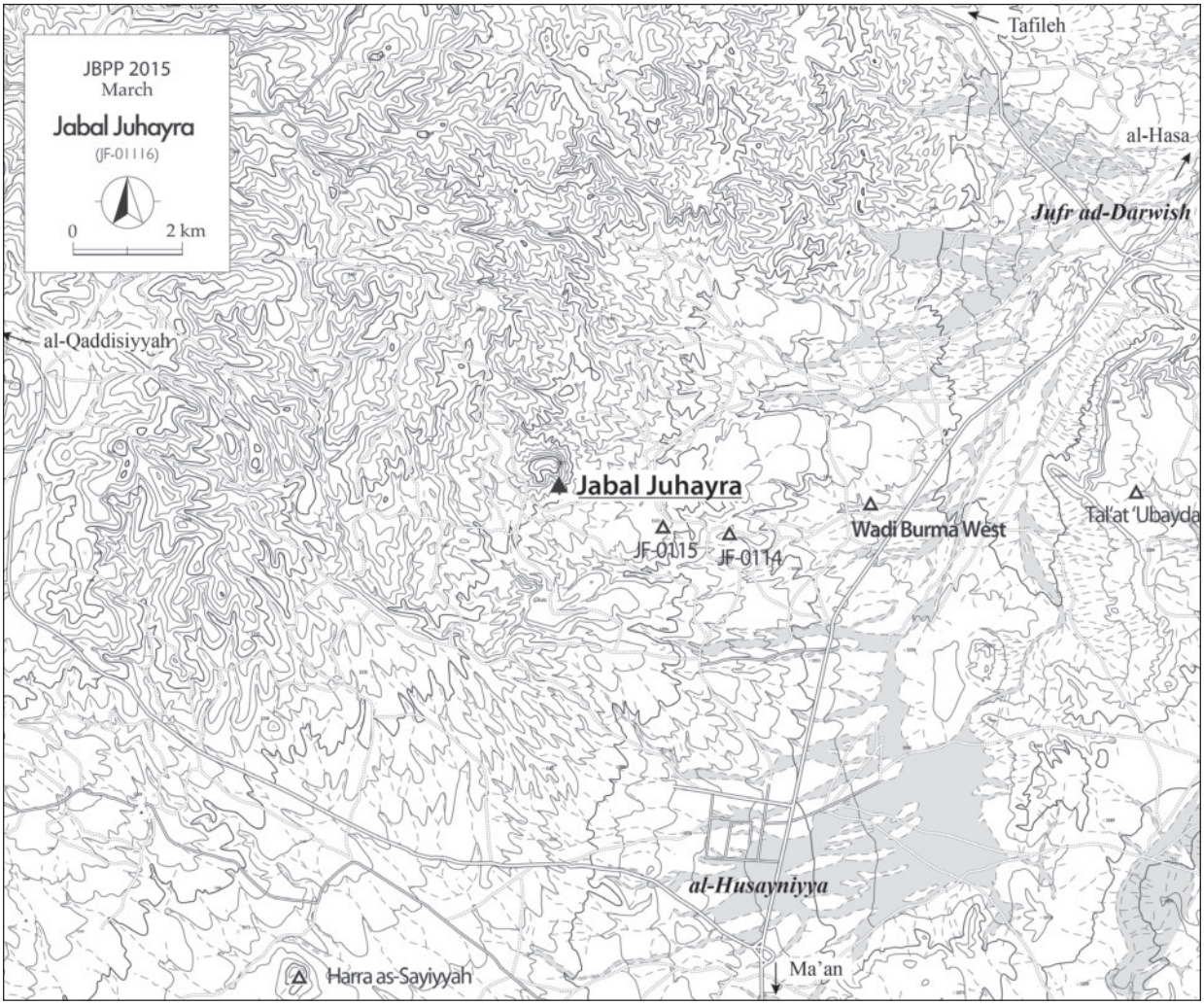
1. Jabal Juhayra: Neolithic sites in and around the Jafr Basin.

been briefly reported elsewhere (Fujii 2002a; Fujii and Abe 2008). Since then, we have repeated the surface survey, in preparation of a future fully-fledged investigation, but more than ten years passed before we started the excavation. The reason for the long delay was that we unexpectedly spent much more time investigating Wādī Abu Tulayha and its surrounding Neolithic barrage systems than we expected, and we have only recently noticed that the site is in danger of disappearing, due to industrial-level scoria mining. It is for this reason that we finally embarked on the excavation.

The setting of Jabal Juhayra is a little more favorable in comparison with other Jafr sites. For instance, the average annual rainfall around the site is *c*. 100 mm, which is nearly twice as much as the central part of the basin (Jordan National Geographic Center 1984: 114). Another point of significance is the fact that stands of wild pistachio trees still survive in a small valley *c*. 10 km west of Jabal Juhayra (Nasu 2013). Both facts suggest that the site is (and probably was) located in an intermediate zone, between the sedentary cultural sphere and nomadic society. In this sense, the site has great significance for the main issue of the current phase, namely, the socio-cultural correlations between the two areas, which is another reason we started the rescue excavation.

The Excavation

To begin, we set up an arbitrary benchmark (BM-1) at the presumed northwestern corner of the site, and covered the major distribution range of surface finds, especially flint artifacts, with a 10 m by 10 m major grid system (**Fig. 5**). The excavation began in the southeastern part of Area 1, where a few intermittent wall alignments were exposed on the present ground surface. We opened a 20 m long by 2

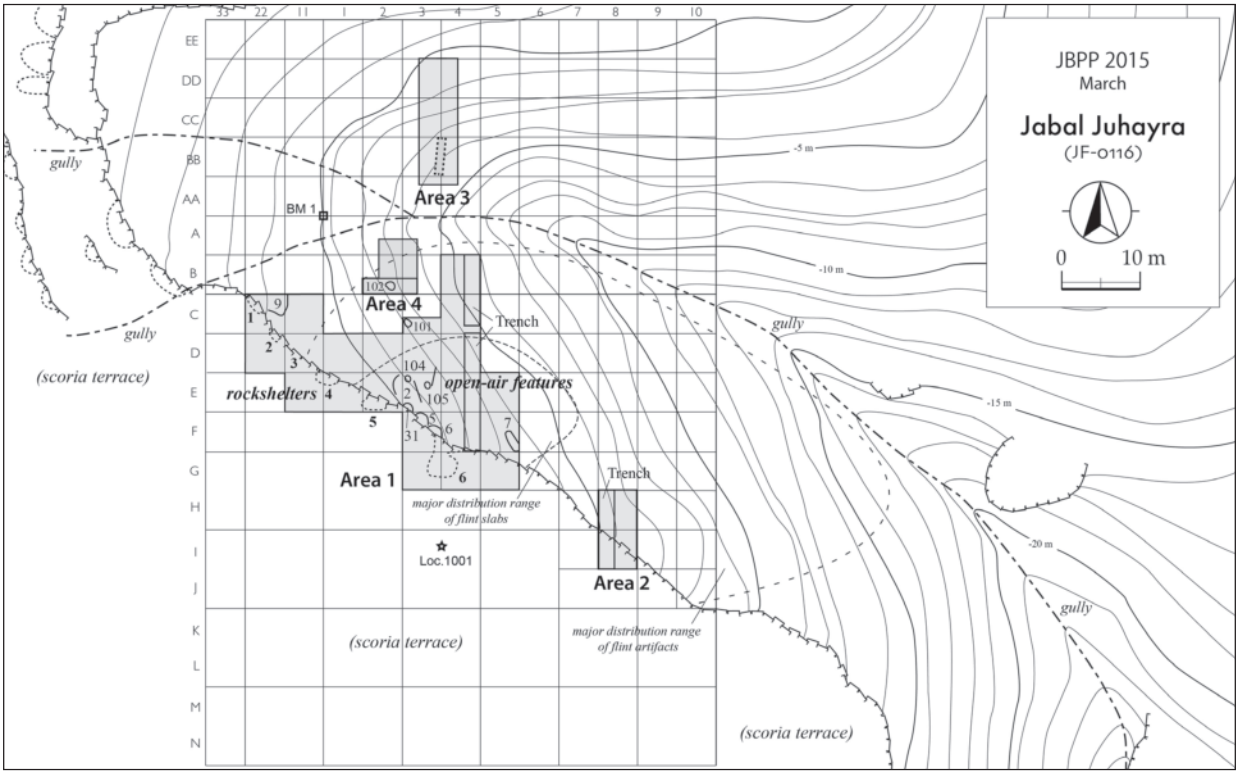


2. Jabal Juhayra: Topographic map around the site.

3. Jabal Juhayra: Distant view of the site (looking W).

4. Jabal Juhayra: General view of the site (looking W).

m wide test-trench across the steep slope, and examined the general site stratigraphy. Then, we gradually enlarged the main operation area northwestward, following the continuation of structural remains. In parallel with this work, we opened Area 2 in an effort to define the southwestern limit of the settlement. In addition, we also set up another two operation areas (Areas 3 and 4) across the gully, both of which aimed to trace the extension of a barrage-like



5. Jabal Juhayra: Site contour map and operation areas.

masonry wall slightly exposed on the northern slope of the gully.

The first two seasons focused on the excavation of Areas 1 and 2. Area 3 was merely surface-cleaned, and Area 4 was trench-excavated at its southern edge. The excavations used a 5 m by 5 m minor grid system, which subdivided the major one. The excavated zones of Areas 1 and 2 total 605 sq. meters (= 24. 2 minor squares), with the volume of excavated soil estimated at *c*. 100-150 cubic meters. Due to time constraints, only some of the floor deposits and hearth contents were subjected to a 3 mm mesh dry sieving.

The general site stratigraphy disclosed at the two operation areas, especially the long trench in Area 1, is summarized as follows:

Layer 1 or the surface layer (*c.* 3-50 cm thick) consists of light-brown in color, loose in texture, silty-sand deposits, including numerous scoria pebbles and cobbles;

Layer 2 (*c.* 5-70 cm thick) contains grayish-brown, slightly compact, silty-sand deposits, including scoria pebbles to a lesser extent;

Layer 3 (up to *c.* 130 cm thick) represents dark brown, compact silty-sand deposits, sparsely including scoria pebbles;

Layer 4 (*c.* 2-10 cm thick) contains yellowish orange, relatively compact silty deposits, which are occasionally replaced by a blackish sand layer, probably of scoria origin; and

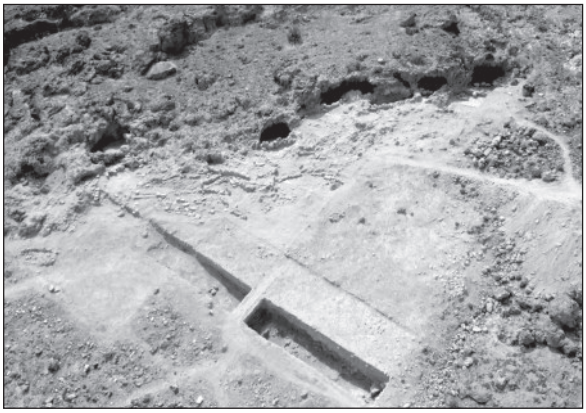
Layer 5 is a scoria/basalt bedrock layer.

Incidentally, Layer 4 was not always present, with Layer 3 directly overlying Layer 5 in some locations. In addition, an ashy layer of pyroclastic flow origin (*c*. 50-100 cm thick) blocked the rear of the rockshelters referred to below. Overall, the deposits inside the rockshelters were thick, whereas those on the slope were relatively thin due to erosion. It is for this reason that the thickness of each layer has such a wide range of variation.

Aside from a few intermittent wall alignments found in Layer 1, all the excavated structural remains were founded on the lower surface of Layer 2 or 3. We designated them Layer 2 or 3 structures/features, respectively. As mentioned above, the first two seasons focused on the excavation of Layer 2, but a few underlying structures/features were partly exposed in the course of the excavation.

Layer 2: Structural Remains

Area 2 included no structural remains, but the excavation of Layer 2 in Area 1 revealed two distinct types of structural remains: scoria rockshleters and miscellaneous open-air features (**Figs. 6, 7**). The latter were found in the trench of Area 4 as well.



6. Jabal Juhayra: Aerial view of Area 1 (looking SW).

Rockshelters

A total of six semi-circular or amorphous rockshelters (Rockshelters 1-6) were aligned along the lower scoria terrace at an interval of *c*. 1-10 m (**Fig. 8**). They all opened to the northeast, facing the open-air features in front of them. (Incidentally, the term '*rockshelter'* may be arguable, since a few of them are more like a simple 'rock shadow'. The reason we adopted it was that scoria boulders of various sizes, which had probably fallen from original eaves, were piled up in front of the rock shadows.)

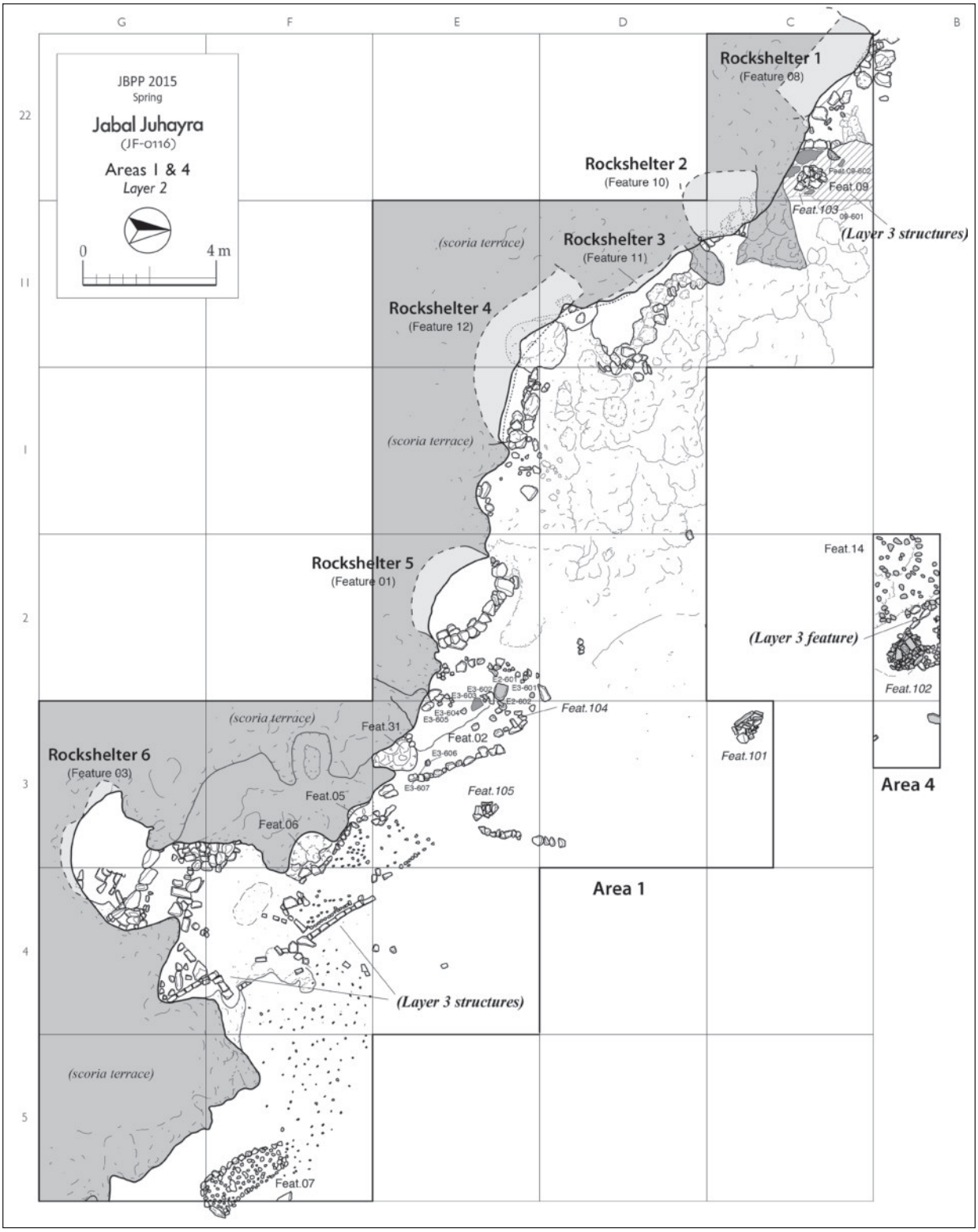
All six rockshelters were small in scale, with frontage *c*. 2-4.5 m, depth *c*. 0.5-2 m, and preserved ceiling height up to *c*. 1.5 m. As mentioned above, the rears were blocked with pyroclastic flow layers, which formed an alternate layer together, with upper and lower scoria layers. It would follow that the series of rockshelters were formed by the erosion of the intermediate soft layer. Thus, there is no doubt that the rockshelters themselves are natural features, but a few of them have traces of anthropogenic modification on their sidewalls and ceiling.

Another reason we identified them as prehistoric dwellings was that they not only yielded flint artifacts and animal bones, but also were equally equipped with a curvilinear masonry wall at their entrance space (**Figs. 9-11**). The front walls were a single row wide and up to a few courses (or *c*. 0.5 m) in preserved height, and constructed of undressed scoria cobbles and boulders *c*. 20-50 cm long. They were very simple in structure, and no traces of clay mortar were recognized. Nevertheless, small rubble was occasionally inserted into a gap between the cobbles as *ad hoc* adjustment material. In terms of stratigraphy, all the front walls (and the floors inside them) were founded on the lower surface of Layer 2. Thus, it is conceivable that the simple masonry walls were added as protection or windbreak for the rockshelter dwellings behind them. Seeing that no entrance was incorporated, the dwellers probably entered and left the dwellings by stepping across the low walls. It is possible, however, that temporary entrance sealing makes it difficult to distinguish an entrance (Fujii n.d.).

The inside space of the rockshelter dwellings was empty and, apart from a few questionable stone alignments, no small features were found. However ashy deposits, including charcoal remains, were sparsely dotted on the floor of a few rockshelters, suggesting that the dwellers occasionally made a fire for cooking and/or heating. The existence of the hearth-like ashy deposits, coupled with the occurrence of numerous flint artifacts and faunal remains, demonstrates that the rockshelters were used as dwellings rather than animal pens.

Open-Air Features

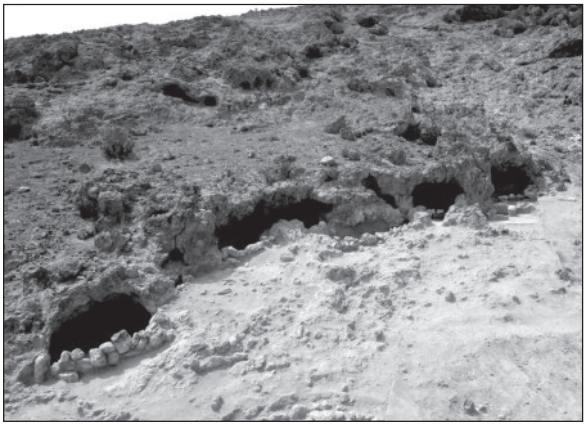
A dozen open-air features occupied the upper edge of the steep slope, a narrow belt in front of the rockshelters (**Figs. 12-15**). They were founded on the lower surface of Layer 2, sharing the same stratigraphy as the rockshelter dwellings behind them. The locational relationship between the two is significant. Most of the open-air features avoided the wide space in front of Rockshelters 1-4 and, instead, were concentrated on a narrow block diagonally in front of Rockshelters 5 and 6 (**Fig. 7**), which means they chose the only place which did not impinge on access to any of the rockshelters. Only Feature 07 was separate from the feature cluster, located at the southeastern corner of Area 1; but, as with the others, it was arranged not to block the approach to Rockshelter 6.



7. Jabal Juhayra: Plan of Areas 1 and 4 (Layer 2).

Such careful location choice is suggestive of functional compartmentalization between the two contemporary structural entities.

Overall, the open-air features were poorly preserved, so precise plans were often difficult to define. It appears, however, that they fall



8. Jabal Juhayra: General view of Rockshelters 1-5 (looking SW).

into the following two types: rectangular or oblong features *c*. 3-5 m wide and *c*. 1-2 m deep (Features 2, and 4-7), and round to oval small features, *c*. 0.5-1 m in diameter or major axis (Features 101-105). In addition, several intermittent wall alignments, probably remnants of either of the two types, were dotted in and around the feature cluster.

The rectangular/oblong features were constructed from undressed scoria cobbles *c*. 10-30 cm long, with their major axis understandably following the contour lines of the steep slope. The walls had entirely collapsed, leaving the foundation course only. However, as fallen stones were sparse, and the foundations were uneven, it is possible that the features were neither walled nor roofed. Given that their walls were a single, or at most a few, course(s) high from the beginning, it would follow that the features were of symbolic, or at least impractical, character. Neither entrance nor hearths were incorporated, but a few of them (e.g. Feature 07) were paved with scoria pebbles; sporadically, traces of floor pavement were also recognized at the remaining features. Our first impression was that the rectangular/oblong features were sparse in traces of day-to-day life. This was reinforced by the scarcity of *in situ* artifacts as well. Although hundreds of flint artifacts were found in and around the features, many of them occurred in secondary contexts and, therefore, can be taken as stray finds which had probably drifted from the adjacent rockshelters. Several grinding implements were also found, but most of them were used, together with the scoria pebbles, as floor-pavement material.

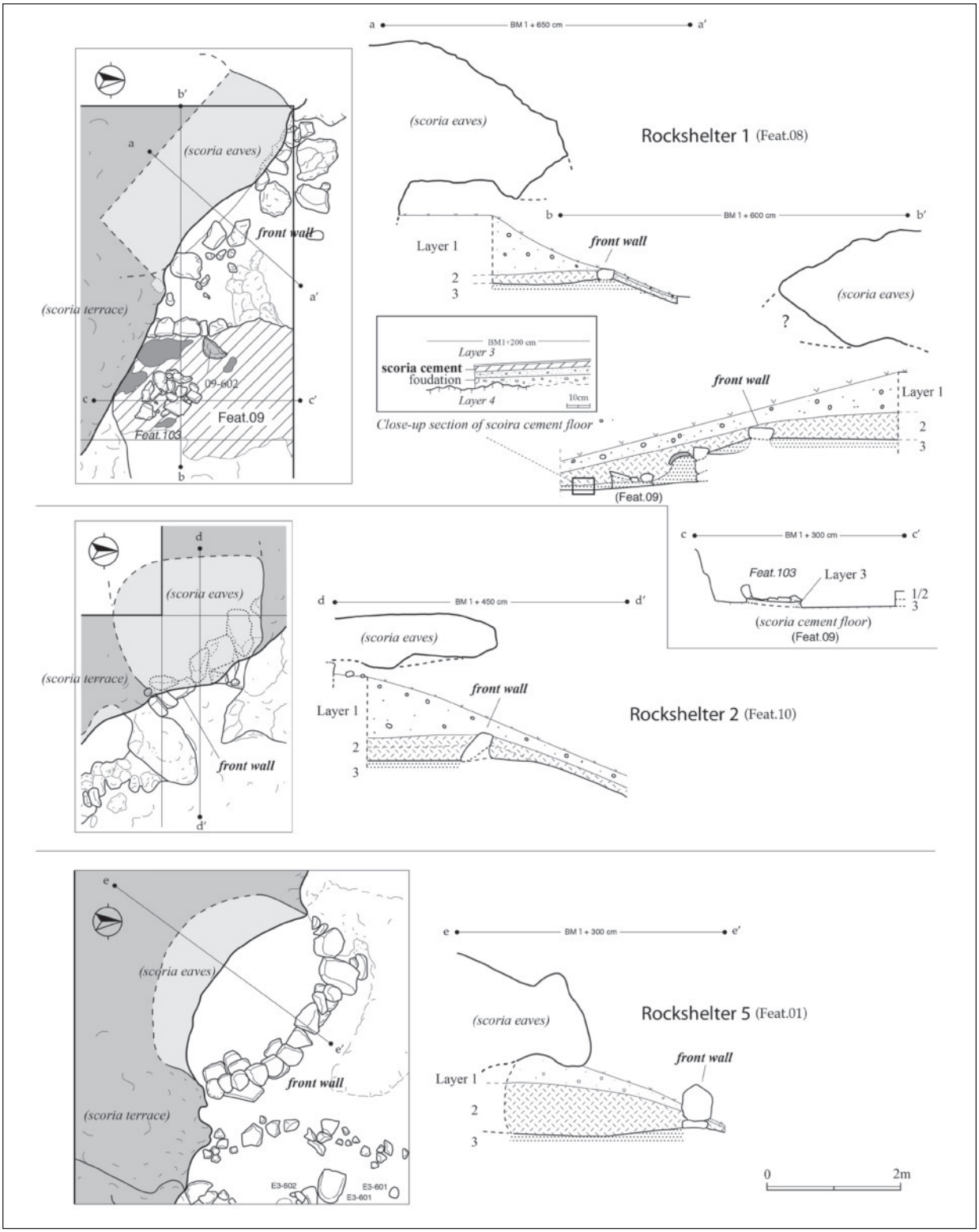
Meanwhile, the round/oval features were relatively well-preserved, and still retained the original walls, lined with upright scoria slabs (**Fig. 14:6-8**). They were capped and/or paved with slabs, but nothing was uncovered inside. Hence, their specific use is still unknown. It should be noted, however, that they are often incorporated into the front wall of a rectangular/oblong feature to form a composite unit. Most typical are Features 104 and 105, both of which were built-in at the observer's right front corner of Features 02 and 04, respectively (**Fig. 13**). Although a few meters apart from each other, a similar combination is recognized between Features 101 and 13, on the one hand, and Feature 07 and a partly exposed stone concentration in front of it, on the other hand (**Fig. 7** ; **Fig.14: 5**). In addition, two features in Area 4 also appear to form a similar unit. Thus, it is conceivable that composite units were the norm for the Layer 2 open-air features. Another point of great importance is the fact that the minor components of the units were more carefully constructed and, for this reason, in better condition than the major ones. This possibly means that the former, rather than the latter, formed the core of a composite unit. This tentative interpretation becomes important when discussing the function of the unique units.

Layer 2: Small Finds

Small finds from the Layer 2 deposits were scarce in both number and variety considering the large excavation area, limited to approximately one thousand flint artifacts, a dozen grinding implements, and a few hundred faunal remains only. The scarcity in artifact variety is characteristic of the Layer 2 settlement.

Chipped Stone Artifacts

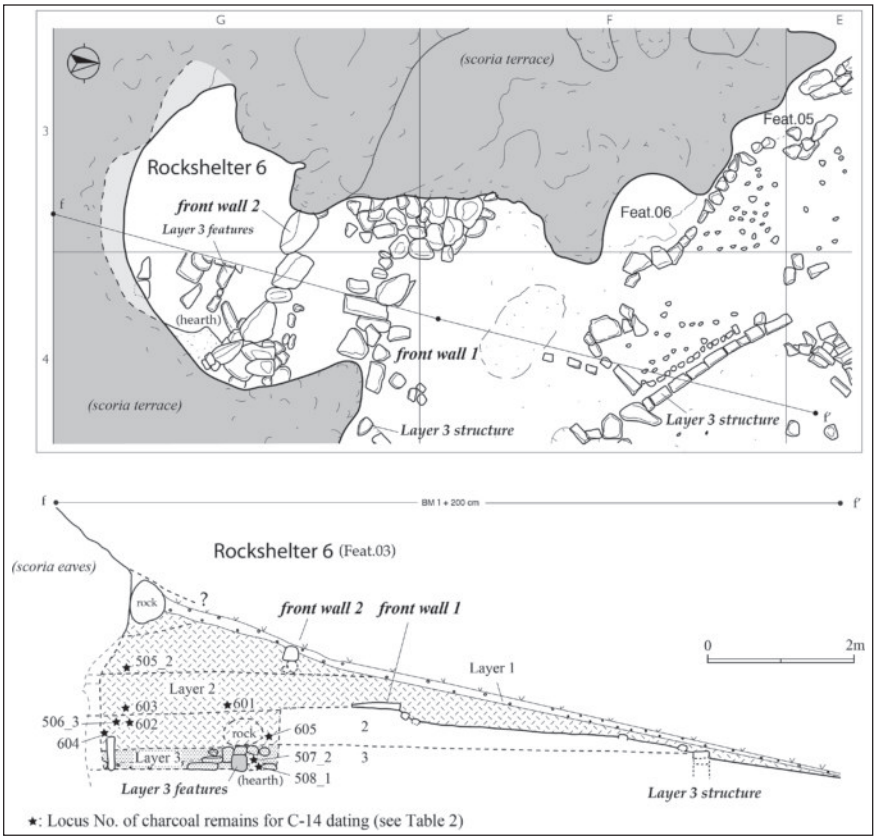
A total of 1,119 chipped stone artifacts were recovered from the Layer 2 deposits in Area 1. (Several dozen flints were found in Area 3, but are omitted from the following discussion.) The finds from the open-air features slightly outnumbered those from the rockshelters. However, as noted above, *in situ* finds concentrated on the latter, being rare in



9. Jabal Juhayra: Plans and sections of Rockshelters 1, 2, and 5.

the former. In terms of raw material, the vast majority of the artifacts were made of high-quality Eocene flint ubiquitous in the Jafr Basin, with exceptions limited to two calcite flake/blade blanks and two heavy-duty digging tools made of coarse basalt.

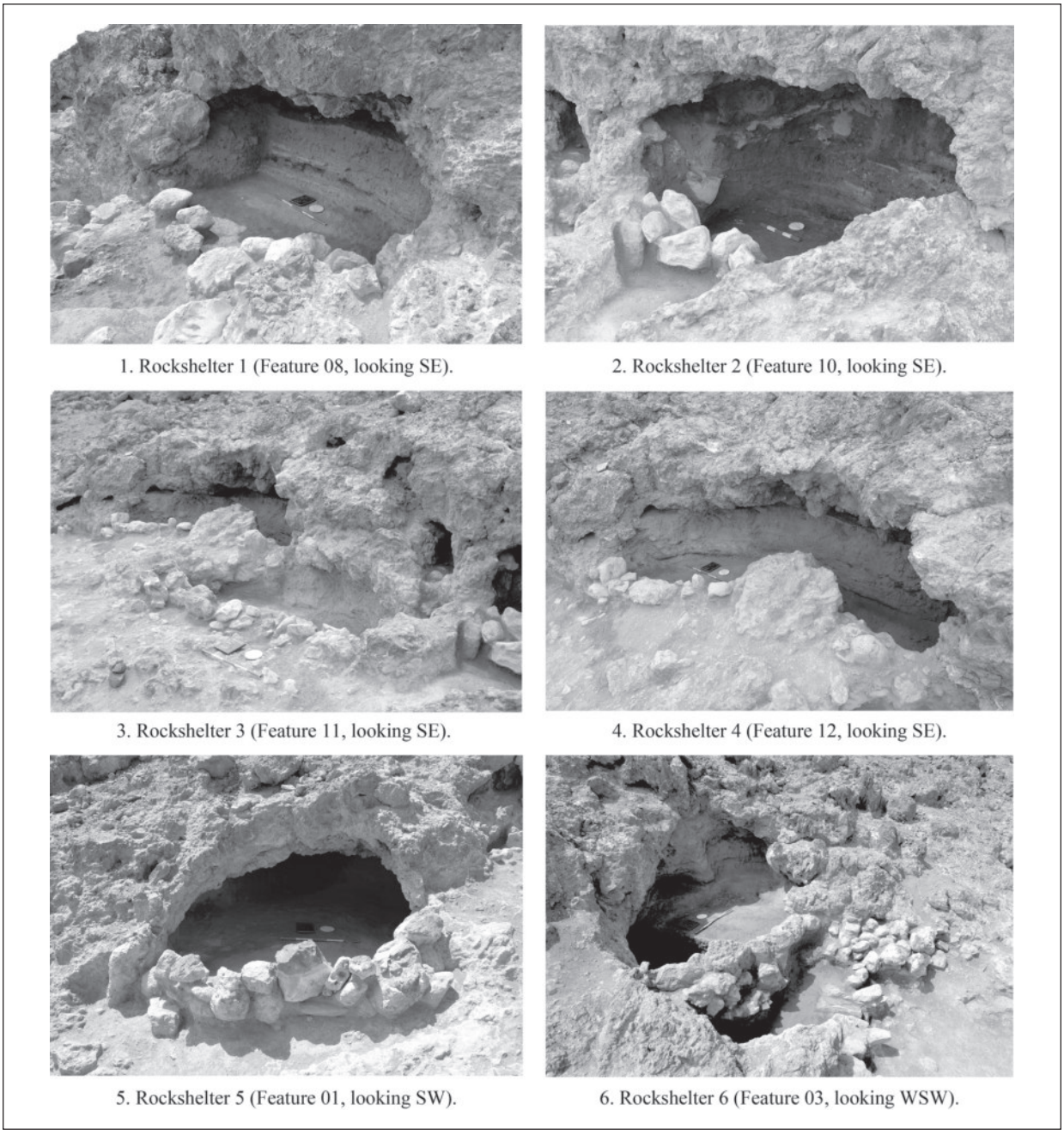
The assemblage consisted of five cores, 1084 debitage class samples, and 28 retouched tools (**Table 1**). In addition, two small hammer stones made of cortical flint were also included. Overall, the assemblage is flake-oriented, suggesting a post-PPNB date for the Layer 2 settlement. Another remarkable trait of the assemblage is the scarcity of cores and primary



10. Jabal Juhayra: Plan and section of Rockshelter 6.

Table 1: Jabal Juhayra: Inventory of chipped stone artifacts from Area 1 (Layer 2).

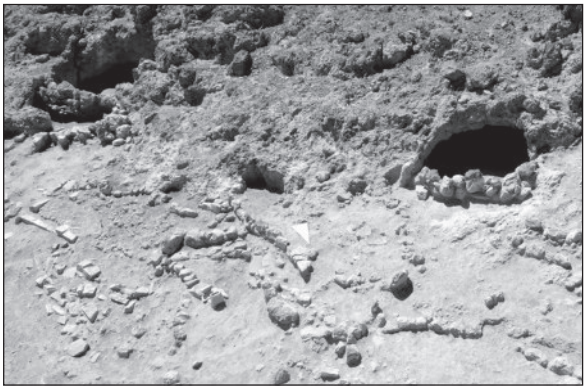
	Rockshelters			Open-features			Total		
	N	%	(%)	N	%	(%)	N	%	(%)
Hammer stone	**0**	**0.0**	-	**2**	**0.3**	-	**2**	**0.2**	-
Core	**3**	**0.7**	-	**2**	**0.3**	-	**5**	**0.5**	*100.0*
Naviform (blade core)	0	0.0	*0.0*	1	0.2	*50.0*	1	0.1	*20.0*
Opposed platform (blade core)	1	0.2	*33.3*	0	0.0	*0.0*	1	0.1	*20.0*
Remnant (flake core)	2	0.5	*66.7*	1	0.2	*50.0*	3	0.3	*60.0*
Debitage	**383**	**95.3**	*100.0*	**586**	**97.8**	*100.0*	**969**	**96.8**	*100.0*
Crested piece	1	0.2	*0.3*	5	0.8	*0.9*	6	0.6	*0.6*
Core tablet	1	0.2	*0.3*	2	0.3	*0.3*	3	0.3	*0.3*
Burin spall	1	0.2	*0.3*	0	0.0	*0.0*	1	0.1	*0.1*
Flake	294	73.1	*76.8*	365	60.9	*62.3*	659	65.8	*68.0*
Blade	86	21.4	*22.5*	212	35.4	*36.2*	298	29.8	*30.8*
Chip/ Chunk	0	0.0	*0.0*	2	0.3	*0.3*	2	0.2	*0.2*
Tool	**16**	**4.0**	*100.0*	**9**	**1.5**	*100.0*	**25**	**2.5**	*100.0*
Points	2	0.5	*12.5*	3	0.5	*33.3*	5	0.5	*20.0*
Cortical knife	3	0.7	*18.8*	0	0.0	*0.0*	3	0.3	*12.0*
Borer	0	0.0	*0.0*	2	0.3	*22.2*	2	0.2	*8.0*
Burin	0	0.0	*0.0*	1	0.2	*11.1*	1	0.1	*4.0*
Denticulate	0	0.0	*0.0*	2	0.3	*22.2*	2	0.2	*8.0*
Notch	1	0.2	*6.3*	0	0.0	*0.0*	1	0.1	*4.0*
Scraper	2	0.5	*12.5*	0	0.0	*0.0*	2	0.2	*8.0*
Adze	1	0.2	*6.3*	0	0.0	*0.0*	1	0.1	*4.0*
Digging tool	2	0.5	*12.5*	0	0.0	*0.0*	2	0.2	*8.0*
Retouched flake	4	1.0	*25.0*	1	0.2	*11.1*	5	0.5	*20.0*
Retouched blade	1	0.2	*6.3*	0	0.0	*0.0*	1	4.0	*4.0*
Total	**402**	**100.7**	-	**599**	**100.3**	-	**1001**	**100.5**	-



11. Jabal Juhayra: General view of Rockshelters 1-6.

elements such as core tablets (**Fig. 16:3**). This fact, coupled with the absence of flint nodules as raw material, suggests that initial core preparation took place somewhere else, probably near flint outcrops in the Jafr Basin. Interestingly, two robust flake/blade blanks were found side-by-side in the southeastern floor of Feature 02 (**Fig. 16: 1, 2**). They were probably used, together with surrounding scoria pebbles, for floor pavement of the feature.

Tool classes include points/arrowheads (**Fig. 16:4-6**), cortical knives (**Fig. 16:7-9**), and retouched flakes (**Fig. 17:6-7**) as major components. The points/arrowheads were the most frequent of the three (21.4 percent of the corpus), but the possibility of contamination from underlying Layer 3 deposits cannot be completely ruled out. Unlike other post-PPNB assemblages in the Jordanian Badia (e.g. Betts 1998, 2013; Cropper 2011), neither Haparsa/



12. Jabal Juhayra: General view of the open-air features in Area 1 (looking SSW).

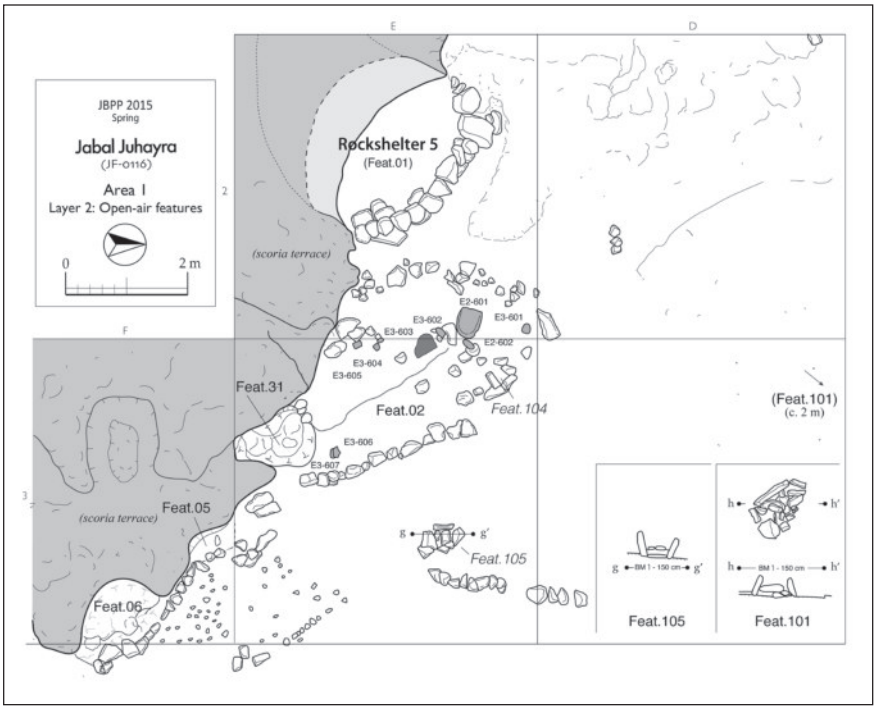
Herzliya/Nizzanim points, nor transverse arrowheads, were included. Meanwhile, cortical knives are common tools in every post-PPNB assemblage in Jordan, but our samples are relatively small in dimension (< 7-8 cm long) and irregular in profile. Other tools included robust denticulates (**Fig. 17:1, 2**), end- or sidescrapers (**Fig. 17:3, 4**), burins (**Fig. 17:1**), drills, a notch, and an adze-like tool. Burins (and burin spalls) centered on angle type examples, but their frequency is lower than for other desert assemblages. In addition, two heavy-duty digging tools, with remarkable edge damage, were found in a lower fill layer of Rockshelter 5 (**Fig. 18**). They were probably used for leveling the uneven floors of the rockshelters and/or preparing their jaggy walls. Their size and unique morphology reminded us of "*diagonally truncated stone bars"* common to Neolithic sites in the Jafr Basin (e.g. Fujii 2009a: Fig. 19).

Overall, the Layer 2 flint assemblage is marked by the predominance of hunting weapons and butchering tools, with scarce evidence for other subsistence activities. Another point of significance is the frequency of *ad hoc* tools which often retain a cortical surface. Both traits mean techno-typological retrogression from the PPNB flint industry, suggesting the involvement of post-PPNB pastoral nomads.

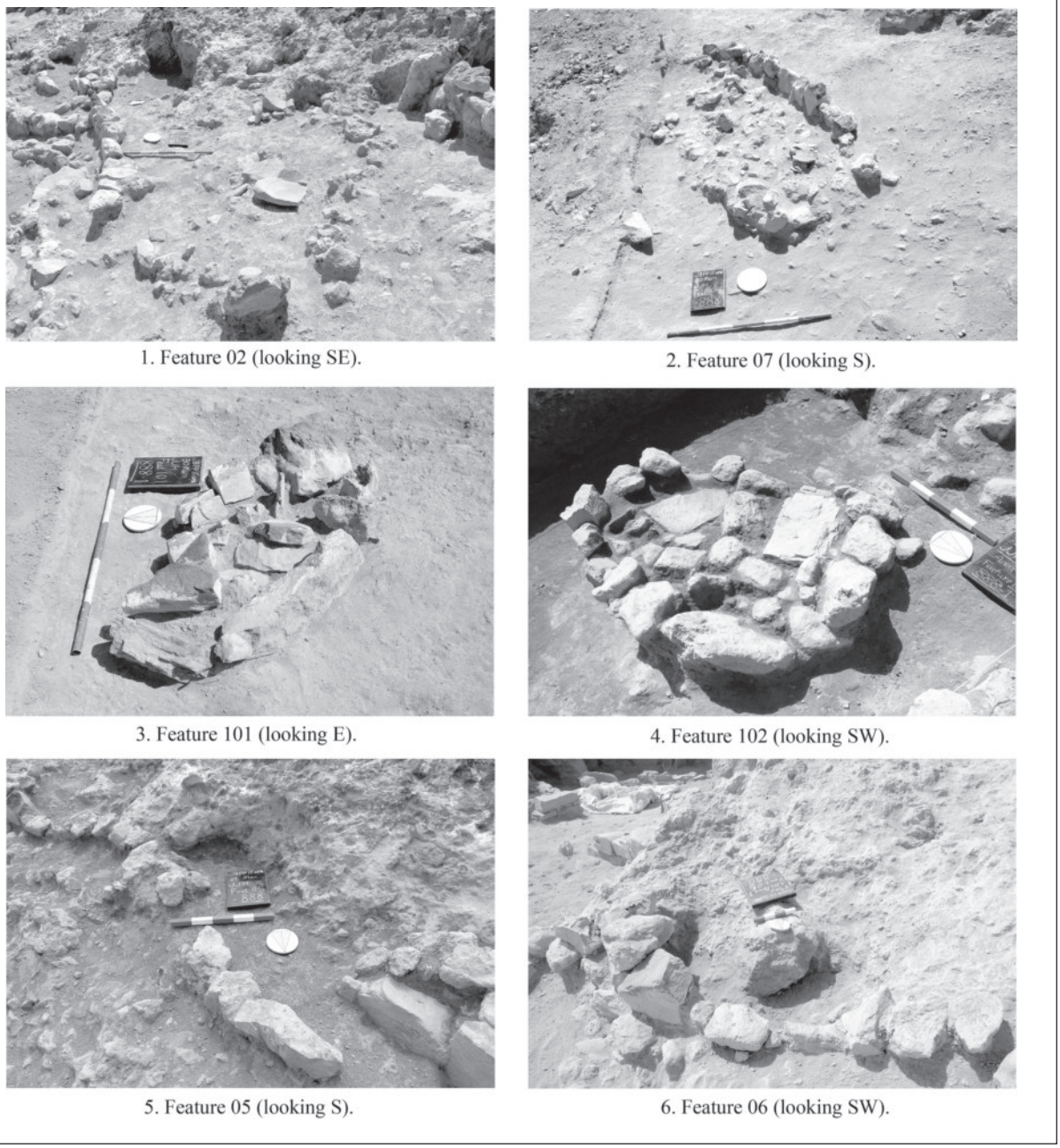
Grinding Implements

Grinding tools consist of eight limestone querns (**Fig. 19**) and six grinding slabs, made from sandstone or scoria/basalt (**Fig. 20**). As noted above, many occurred as floor-pavement materials in the rectangular/oblong features and, therefore, could be taken as stray finds.

The querns vary in morphology from a trough type object more than 45 cm long (**Fig. 19:1**), basin-like *c*. 43 cm in diameter (**Fig. 19: 3**), to small, flat examples *c*. 20 cm in width (**Fig. 19:2- 4**). No remarkable use-wear was recognized, but one of them retain orthogonal scratches and traces of reddish material,



13. Jabal Juhayra: Plan and sections of the open-air features in Area 1 (Layer 2).



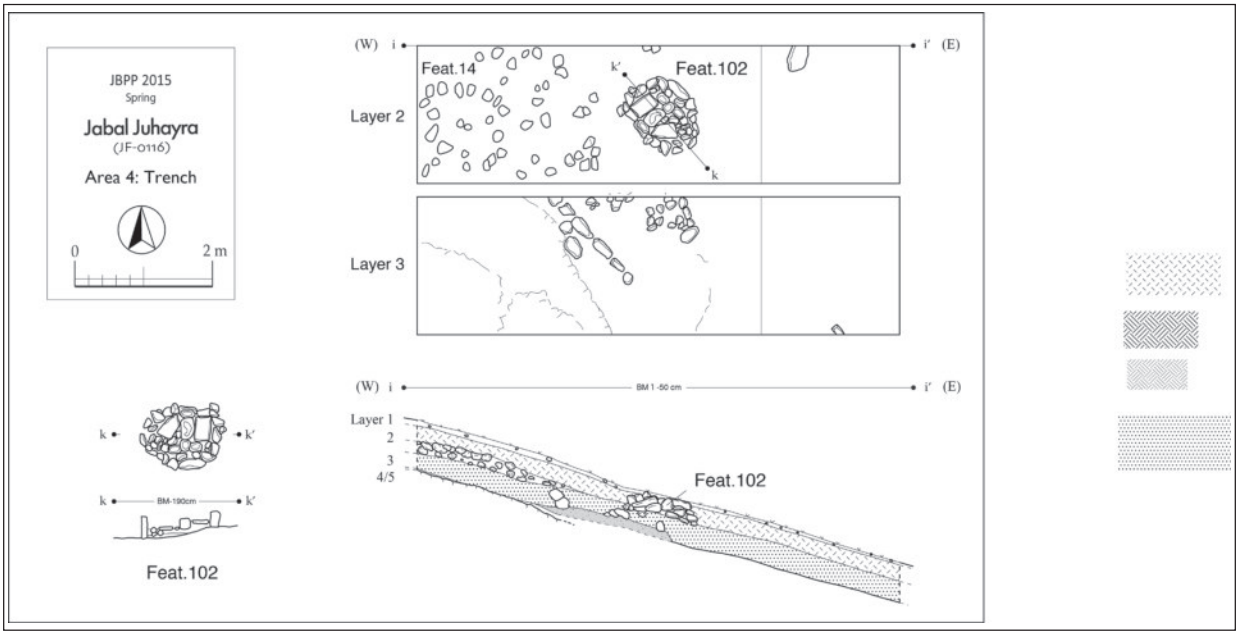
14. Jabal Juhayra: General view of the open-air features in Areas 1 and 4 (Layer 2).

probably scoria grains, on their slightly concave working surface (**Fig. 19: 4**).

Meanwhile, grinding slabs vary from small, elongated examples (**Fig. 20: 1, 2**) to relatively large, oval objects (**Fig. 20: 3-6**). As with the flat querns referred to above, one of them was stained red, probably with scoria grains (**Fig. 20: 5**). Suggestive in this regard is the existence of a cistern-like feature in Layer 3. As described below, its floor was paved with scoria cement (i.e. Portland cement including minute scoria grains as major admixture). This implies the possibility that the two red-stained objects (or, possibly, all the grinding tools) are derived from the underlying layer. Their conversion to floor-pavement materials may also be understood in this context.

Faunal / Floral Remains

A few hundred faunal remains were recovered



15. Jabal Juhayra: Plans and sections of Area 4 trench.

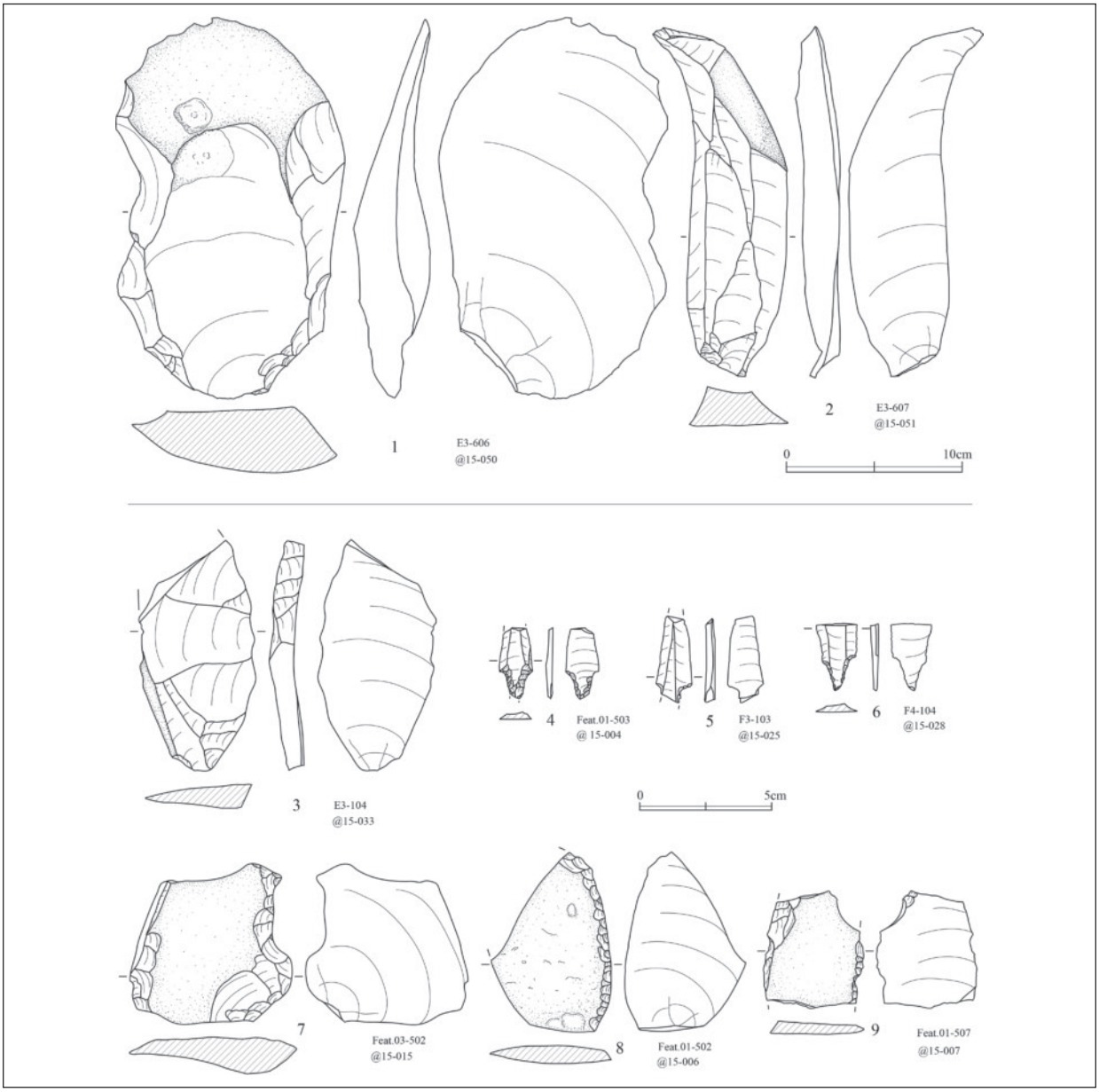
from the Layer 2 deposits, especially those in the rockshelters, but no analysis has taken place yet. In addition, litter from a few dozen floor deposits and hearth contents of the rockshelter dwellings has been stored for future water flotation. These analyses are expected to provide insights into the exploitation strategy of animal and plant resources at the Layer 2 settlement.

Layer 3: Structural Remains and Small Finds

Three kinds of structural remains which probably belong to Layer 3 were confirmed to be in association with overlying Layer 2, one of which was a few intermittent masonry wall alignments exposed at the southeastern part of Area 1 (**Fig. 7; Fig. 21: 1, 2**). Unlike the overlying structural remains, this feature was constructed from standardized cortical flint slabs *c*. 20-30 cm long and *c*. 5-10 cm thick, forming a rectangular structure (probably of a ground type). There is little doubt that the fully-fledged structure dates back to the PPNB period. Small finds in and around it included chipped flint/calcite artifacts (**Fig. 22: 1-17**), grinding implements, stone vessels, animal bone tools (**Fig. 22: 18**), adornments made from snail shell, and faunal remains. The flint/calcite assemblage centered on naviform core-and-blade components, corroborating the chronological perspective suggested above. The use of semi-transparent reddish calcite as raw material, the frequency of points/arrowheads, and the absence of cortical knives, also support the tentative dating. The occurrence of a few small *flint/scoria bowlets* (**Fig. 22: 19**) is important, as these certify dating of the Layer 3 settlement to the PPNB (Fujii 2009b, 2012; Gebel 1999; Gubenko and Ronen 2014; Wilke *et al.* 2014).

The second feature is a cistern-like installation, which was found in front of Rockshelter 1, *c*. 20 cm below Feature 103 from Layer 2 (**Fig. 9; Fig. 21: 3**). This unique feature was not only cut *c*. 50 cm into a scoria bedrock layer, but was also partly edged by a mortared masonry wall, and carefully paved with scoria cement. Thus, it was probably used as a small-scale water storage facility which supplied drinking water to the inhabitants of the Layer 3 settlement. Incidentally, a similar cement floor was found at Askli Höyük, a large PPNB settlement in central Anatolia (Hauptman and Yalcin 2000). Both examples can be understood to be a local variant of plastered floors in volcanic areas. Mineralogical analysis currently in progress is expected to shed new light on the technological innovation.

No less important is a masonry wall slightly exposed on the present ground surface of Area 3 (**Fig. 21: 4**). This wall, *c*. 1 m wide and at least *c*. 10 m long, was constructed using the rubble core technique; its location and orientation

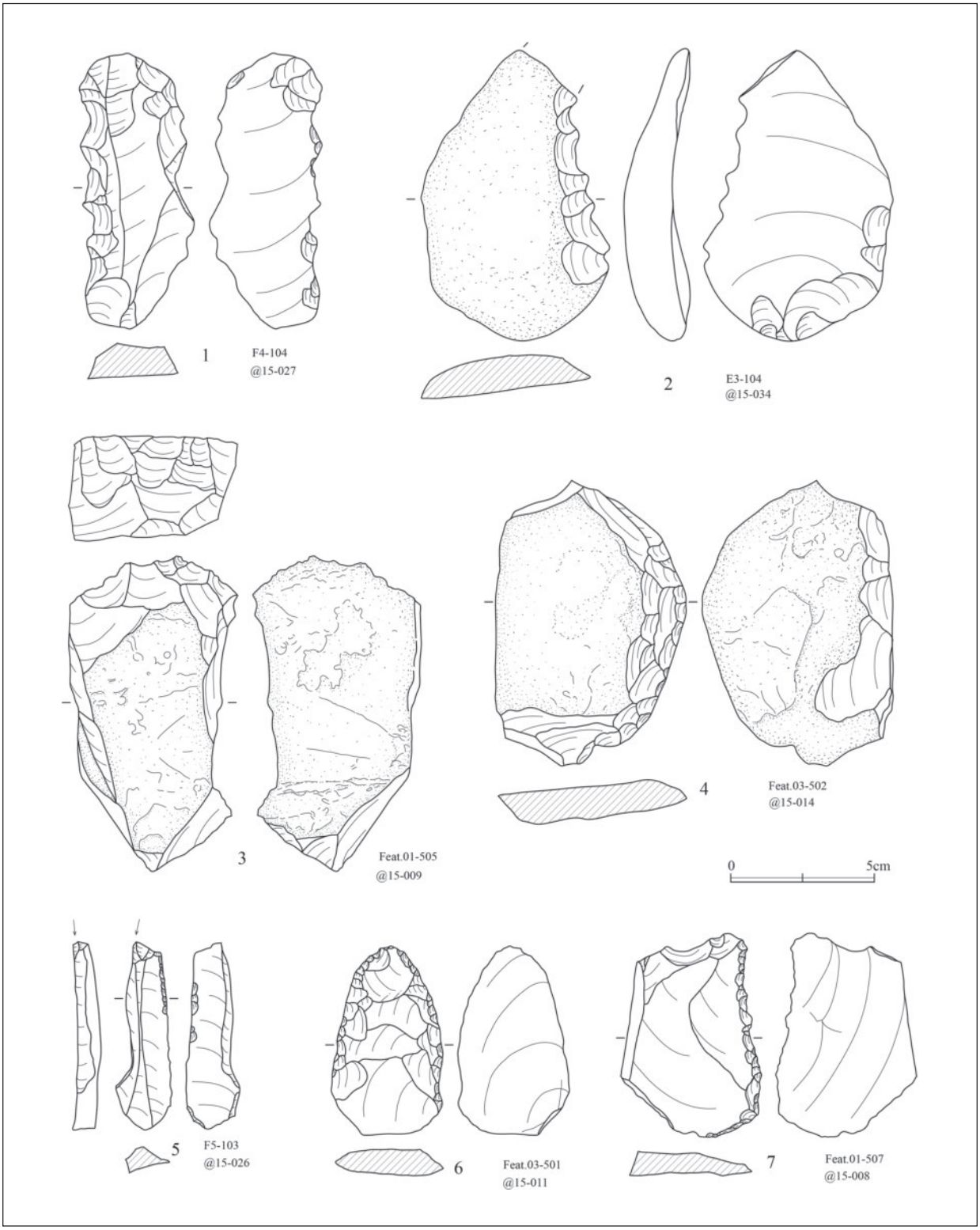


16. Jabal Juhayra: Chipped flint artifacts from Layer 2.

is of particular interest. Unlike all other wall alignments, including those in Layers 2, only this robust wall was located near the gully (more precisely, at a point slightly downstream of the convergence of two tributaries) and stretched orthogonally across the converged gully (**Fig. 5**). Hence, its use is self-evident. Although its southern extension is yet to be confirmed in Area 4, there is no doubt that the wall represents part of a small-scale barrage which collected seasonal runoff water flowing down the scoria slope. A similar example has been found at Wādī Badda, a contemporary settlement c. 15 west of Jabal Juhayra (Fujii 2007c: Figs. 4 , 5; Fujii 2010a: Figs. 13 , 14), suggesting that, unlike more remote outposts, such small-scale wadi/gully barriers were standard for PPNB settlements in the hilly terrain to the west. Subsequent excavations are expected to shed light on the overall picture of the Layer 3 settlement.

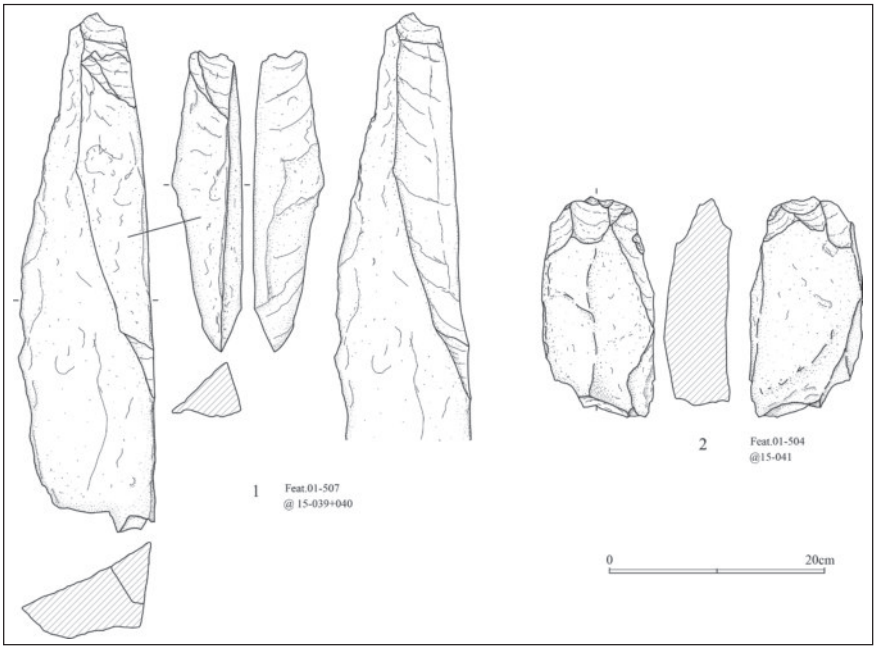
Discussion

Excavation of the Layer 2 settlement at Jabal Juhayra provided valuable insights into the post-PPNB Jafr Basin, which had thus far been



17. Jabal Juhayra: Chipped flint artifacts from Layer 2.

poorly understood. The following discussion deals with its date, function, and archaeological implications. We would like to point out in advance that the following perspectives may be subject to minor revision, depending on subsequent research outcomes.



18. Jabal Juhayra: Chipped flint artifacts from Layer 2.

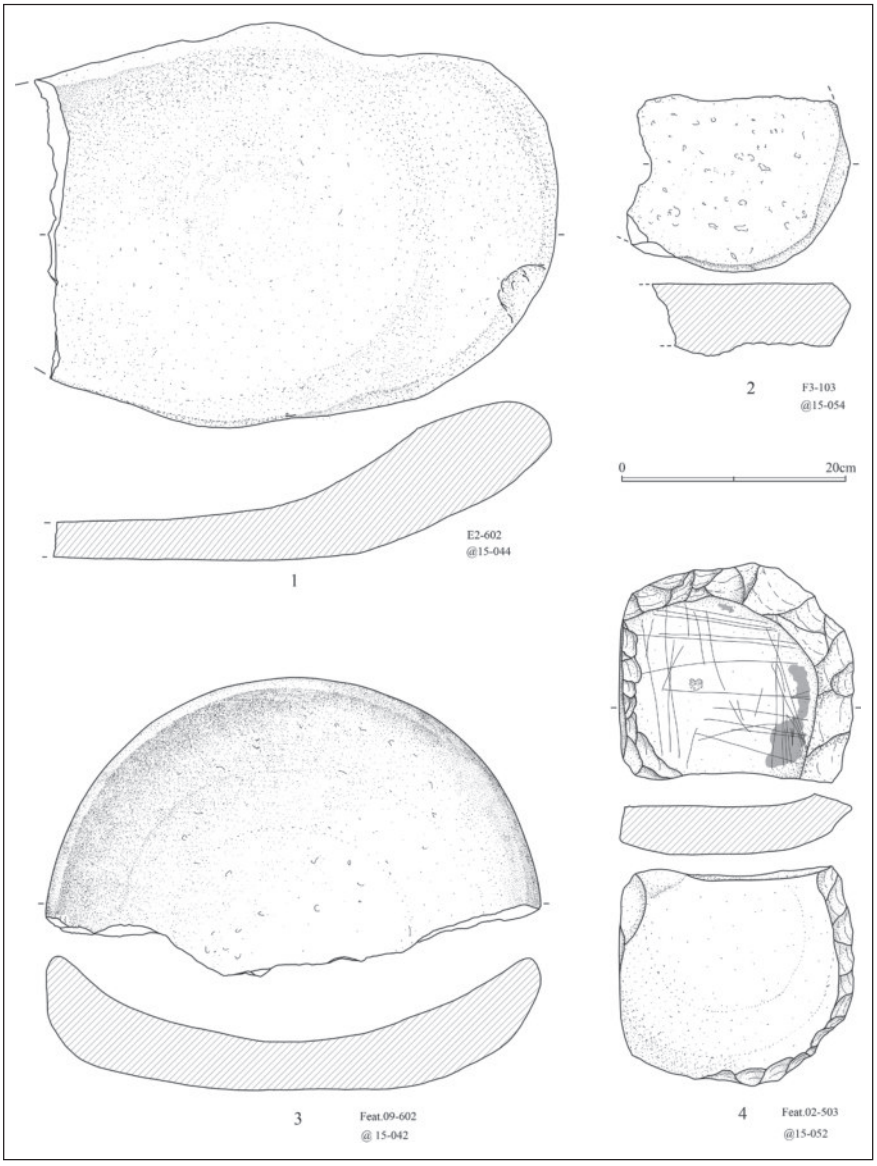
Date

A total of six C-14 dates are available for the stratified settlement (**Table 2**). To begin with, two dates from the Layer 2 deposits converge on a limited time range *c*. 6600-6500 *cal.* B.P, suggesting that the upper settlement falls into a threshold stage between the LN and the Chalcolithic. The small finds, especially the flake-oriented flint assemblage centering on the cortical knives, are compatible with this chronological perspective. However, two dates are not enough to draw a final conclusion. This is even more apparent when we consider that periodization of the few millennia subsequent to the PPNB is still controversial (e.g. Garfinkel 2009; Gilead 2009; Goring-Morris and Belfer-Cohen 2014; Levis 2014; Lovell and Rowan 2011; Rowan and Golden 2009). (It is for this reason that we have used the somewhat cryptic term *post-PPNB*.) It is safe to say, however, that the Layer 2 settlement at Jabal Juhayra follows Khashm al-'Arfa, a final LPPNB to initial LN encampment recently excavated in the eastern Jafr Basin (Fujii, Adachi, Yamafuji *et al*. 2013a).

Incidentally, the remaining four C-14 dates (all from the Layer 3 deposits), fall equally within a time range of 9500-9100 cal. B.P. It then follows that the lower settlement dates back to the LPPNB, probably to the first half. The aforementioned observations (the existence of fully-fledged rectangular structures, the predominance of naviform core-and-blade components, and the occurrence of the small flint/scoria bowlets) are also in agreement with the tentative dating. Therefore, our present understanding is that the Layer 3 settlement at Jabal Juhayra is roughly coeval with the western half of Wādī Abu Tulayha (Fujii 2009: Table 1).

Site Function

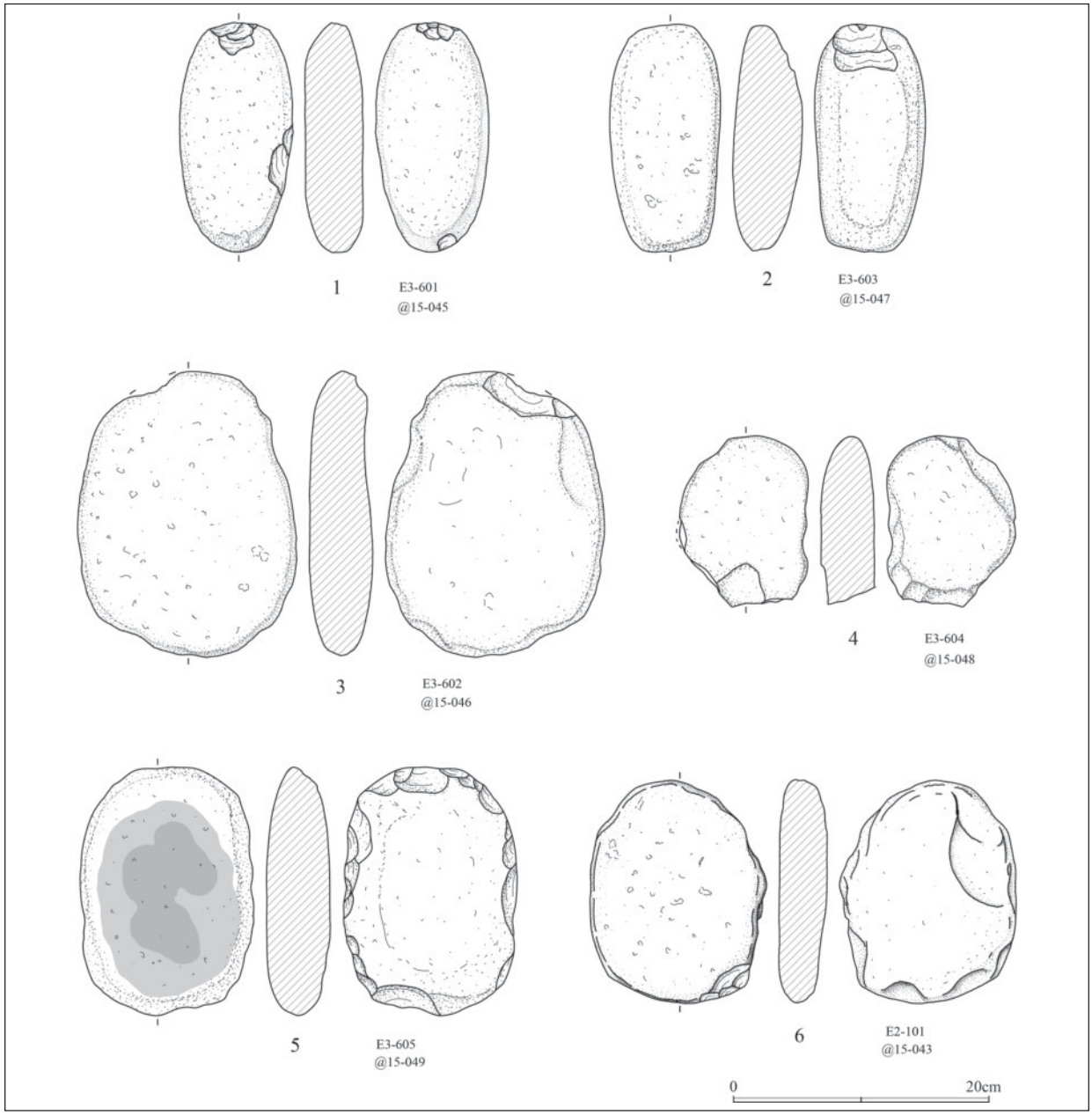
The Layer 2 settlement consists of six rockshelters and a dozen open-air features. Assuming that both edges of this elongated settlement are marked by Rockshelter 1 and Feature 07, respectively, its total area would be estimated at *c*. 0.05 ha or less (= *c*. 40-50 m by *c*. 5-10 m). This value is approximately one-tenth of the standard settlement size of preceding PPNB farming communities, but roughly equivalent to that of post-PPNB desert encampments. It is indisputable that the settlement was used by a small group with high mobility; namely, pastoral nomads. The location in the arid terrain, the *ad hoc* nature of the structures, and the lack of artifact variety, also support this interpretation. Although faunal analysis has not yet begun, it is intriguing to hypothesize that the small settlement was used as a summer camp by initial pastoral nomads who, as with modern local nomads, made a round trip on a seasonal basis between the steppe/desert to the east and the hilly terrain to the west.



19. Jabal Juhayra: Groundstone artifacts from Layer 2.

The question is the relationship between the rockshelters and the open-air features. How should we understand the coexistence of the two distinct types of structural entities? This admits of various interpretations. It is most unlikely, however, that a minor (i.e. stratigraphically indiscernible) chronological gap between the two causes the inexplicable phenomenon, because the techno-typological differences between them is too large to be taken as change or development in such a short period. Instead, in view of the careful spatial compartmentalization noted above, it is more reasonable to assume that the two structural entities coexisted and were used for different purposes.

How, then, were they used? A possible explanation would be that, while the open-air features were used as seasonal dwellings by prehistoric pastoral nomads, the rockshelters were utilized as *ad hoc* corrals for their livestock. This seems all the more plausible, due to the fact that modern local nomads often use the rockshelters for the same purpose. However, we should also recall the aforementioned fact that traces of day-to-day life (i.e. the number of *in situ* artifacts, the frequency of animal bones, and the existence of hearth-like ashy deposits) are much denser in the rockshelters than the open-air features. This fact leads us to the opposite interpretation; namely, an assumption that the rockshelters functioned as temporary dwellings



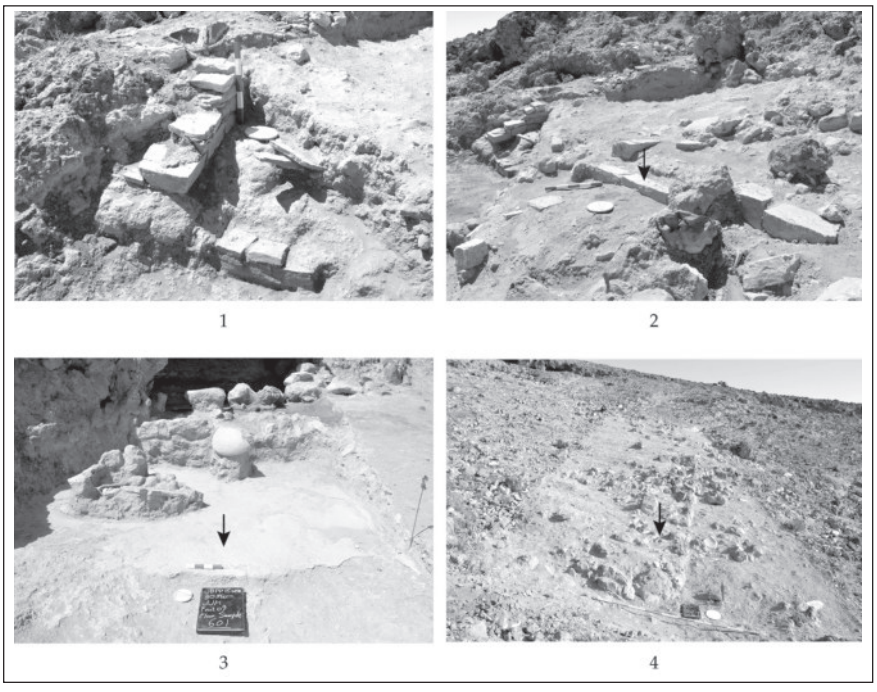
20. Jabal Juhayra: Groundstone artifacts from Layer 2.

rather than animal pens. The existence of similar examples at Tall al-Hibr, a late Chalcolithic/ EBI site in the eastern Jordanian Badia (Betts 1992; Betts *et al*. 2013: 143-155), suggests that rockshelter dwellings were commonly used by the initial pastoral nomads in Jordan.

What, then, were the open-air features used for? It is most unlikely that such distinctive types of features were equally used as dwellings. Thus, the remaining possibility is that they were limited to use as workshops or storehouses, or even perhaps as facilities for some impractical purpose. However, it is difficult to make any definite decisions regarding use, because the available evidence is restricted to monotonous artifacts. A hint, if any, is the fact that an oblong feature and a small feature are often combined to form a composite unit. Another point of significance is the fact that the units thus formed are laterally connected, or arranged in parallel with each other. These unique traits (and the scarcity of traces for day-to-day life) are shared with post-PPNB, pseudo-settlement types of open sanctuaries at Harrat al-Juhayra (Fujii

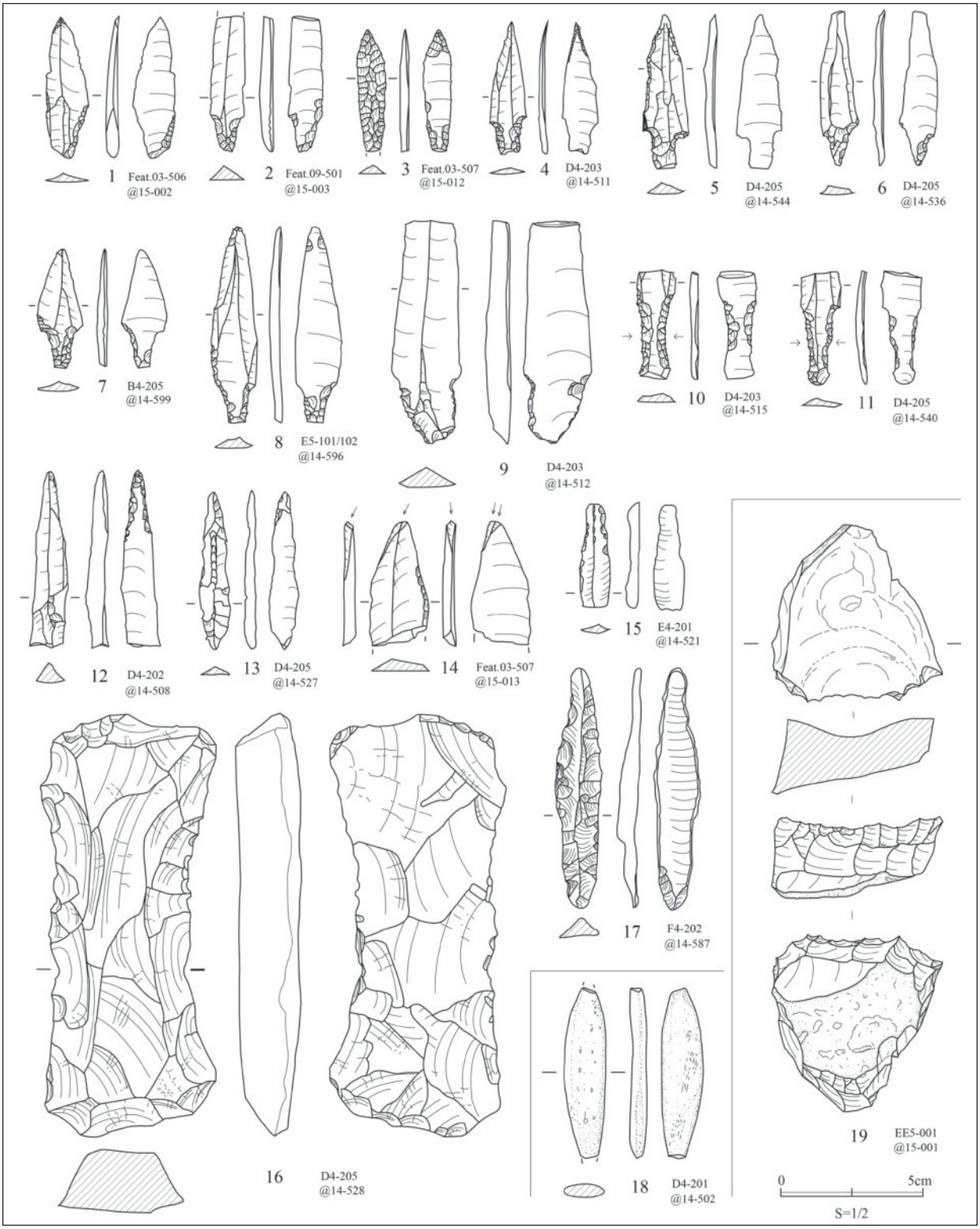
Table 2: Jabal Juhayra: C-14 data from the Layer 2 and 3 settlements (as of June 2015).

Sample No.	Material	Area	Structure/Feature	Locus	Context	uncal. B.P.	cal. B.C. (2σ)	Probability
Layer 2 settlement								
IAAA-150202	chacoal	I	Rockshelter 5	507_5	floor deposits	5703 ± 28	**6564 - 6407**	95.4
IAAA-143894	chacoal	I	Rockshelter 6	505_2	floor deposits	5763 ± 29	**6650 - 6489**	95.4
IAAA-143895	chacoal	I	Rockshelter 6	506_3	lower fill layer	5751 ± 29	**6639 - 6471**	95.4
IAAA-150532	chacoal	I	Rockshelter 6	601		6048 ± 30	**6977 - 6797**	95.4
IAAA-150533	chacoal	I	Rockshelter 6	602		6102 ± 31	**7030 - 6886**	80.2
							7156 - 7099	12.3
							7070 - 7045	2.2
							7085 - 7078	0.6
IAAA-150534	chacoal	I	Rockshelter 6	603	floor deposits	5926 ± 28	**6798 - 6671**	93.2
							6831 - 6819	2.2
IAAA-150535	chacoal	I	Rockshelter 6	604	floor deposits	6065 ± 29	**7003 - 6846**	92.5
							6815 - 6800	2.9
IAAA-150536	chacoal	I	Rockshelter 6	605	floor deposits	6181 ± 29	**7169 - 6992**	95.4
Layer 3 settlement								
IAAA-143896	chacoal	I	Rockshelter 6	507_2	hearth fill	8351 ± 33	**9465 - 9292**	95.4
IAAA-143897	chacoal	I	Rockshelter	508_1	hearth fill	8371 ± 33	**9473 - 9302**	95.4
IAAA-143898	chacoal	4	Trench	502_1	lower fill layer	8225 ± 32	**9299 - 9076**	92.4
							9055 - 9032	3.0
IAAA-143899	chacoal	4	Trench	104_2	lower fill layer	8534 ± 32	**9545 - 9485**	95.4



21. Jabal Juhayra: Partly exposed structural remains of Layer 3.

2005b), Qa' Abu Tulayha (Fujii 2000, 2002b), and 'Awja sites (Fujii 2014a; Fujii, Yamafuji *et al*. 2012; Fujii, Adachi, Endo, Yamafuji *et al*. 2013). It appears that the composite units of Jabal Juhayra had something to do with them. It is our present interpretation that the Juhayra open-air features represent a subsequent form of the 'Awja 4 open sanctuary, which are dated



22. Jabal Juhayra: Small finds from Layer 3.

to the latter half of the LN; namely, one of the final forms of the pseudo-settlement type of open sanctuaries unique to arid peripheries of the southern Levant (Fujii, Adachi, Endo, and Yamafuji 2013: Fig. 34; Fujii 2014c: Fig. 13).

The discussion above leads us to a belief that

the Layer 2 population group, probably pastoral nomads, encamped in the rockshelter dwellings and took part in communal ritual(s) at the unique open sanctuary in front of them. Given this, it would follow that the Layer 2 settlement at Jabal Juhayra is a composite site, used for day-to-day activities as well as for ritual ceremonies, but further verification is required to substantiate the hypothetical perspective.

Archaeological implications

Jabal Juhayra is a very important site in regards to tracing the initial process of pastoral nomadization in southern Jordan, firstly because it is located in an intermediate zone between the desert and the sown, and secondly because it includes both PPNB and post-PPNB settlements. Wādī Abu Tulayha meets the first condition, and ‘Ain Ghazal clearly meets the second (e.g. Rollefson and Rollefson 1993); however, for the time being, only Jabal Juhayra fulfills both requirements. In this sense, the significance of this unique site cannot be too strongly emphasized. Although an in-depth discussion must await the excavation of Layer 3, the following two points deserve continued attention.

To begin with, excavation results from Jabal Juhayra probably revalidate our previous perspective that the initial stage of pastoral nomadization in southern Jordan is traceable through the process of replacing the PPNB triple set (a substantial agro-pastoral outpost, a barrage, and a cistern) with the post-PPNB small encampment and open-air sanctuary (Fujii 2013). Unlike other Neolithic sites in the basin, Jabal Juhayra appears to contain all three structural entities and, for this reason, makes it possible to trace key episodes more sequentially; this applies equally to the small finds. The excavations highlight the decrease in artifact variety during the course of the transition, which probably mirrors a reduction in group size and an increase in group mobility. In this double meaning, Jabal Juhayra would be the third core of the Jafr chronology, after Wādī Abu Tulayha and Qa‘ Abu Tulayha.

In a broader context, research outcomes from this study have the potential to shed new light on the regional variation of pastoral nomadization in the Jordanian Badia. To cite one example, while the post-PPNB (yet pre-EBA) Jafr Basin is characterized by the existence of unique open sanctuaries, the absence of small points and transverse arrowheads, and the infrequency of burins and drills, the opposite is probably the case at Azraq and its surrounding areas during the same period (e.g. Betts *et al*. 1998, 2013; Rollefson 2013; Rollefson, Rowan *et al.* 2012, 2014; Rollefson, Wilke *et al.* 2014). Nevertheless, both the unique settlement pattern (centering on ephemeral encampments including rockshelters) and the techno-typological shift into the flake-oriented flint industry (including cortical knives) are common to both regions. These two contradictory facts probably suggest that pastoral nomadization in the Jordanian Badia proceeded in local contexts with individual aspects, yet in a similar framework as a whole.

Concluding Remarks

The first two excavation seasons at Jabal Juhayra have provided valuable insights into the post-PPNB culture in the Jafr Basin. Of particular interest is the coexistence of rockshelter dwellings and open-air features. The former have attested to the high-mobility settlement pattern of initial pastoral nomads, whereas the latter have offered a glimpse into their ritual life. Once complete, the series of research outcomes from this study will enable us to trace the formation of nomadic society in southern Jordan in more detail; however, the excavation is still incomplete, with subsequent field seasons expected to clarify the overall picture of the stratified settlement.

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