

# JABAL JUHAYRA, 2015-2016: EXCAVATIONS OF THE LAYER 3 (PRE-POTTERY NEOLITHIC B) SETTLEMENT

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## Introduction

Our long-term research project in southern Jordan (JBPP [the Jafr Basin Prehistoric Project]) is focused on tracing the process of pastoral nomadization on the arid margins of the southern Levant. Towards this goal, we have conducted comprehensive investigations at a dozen archaeological sites - varying in both date and character - since the reconnaissance survey in 1997. A series of research outcomes was recently synthesized in the form of the 'Jafr chronology', which has enabled us to outline the key episodes in a sequential way (Fujii 2013).

Since March 2014 the project has proceeded to Phase 5, the prime goal of which is to develop the detail of the Jafr chronology and offer further insight into the formation processes of *badia* society in southern Jordan. We selected several promising sites towards this goal. Jabal Juhayra, our main concern here, was the second target following Tor Ghuwayr 1-3, a composite Early Bronze Age burial field on the northern fringe of the Jafr Basin (Fujii, Adachi, Yamafuji *et al.* n.d.). The excavation started in September 2014 and was completed with the fifth season in June 2016. The first two seasons dealt with the Layer 2 encampment dated to the Late Neolithic/Chalcolithic transitional (hereafter LN/Chalcolithic transitional) phase (Fujii 2015; Fujii, Adachi and Nagaya 2018). This report summarizes the research outcomes of the Layer 3 (Pre-Pottery Neolithic B [hereafter PPNB]) settlement that was intensively excavated over the subsequent three seasons.

## The Site and Site Setting

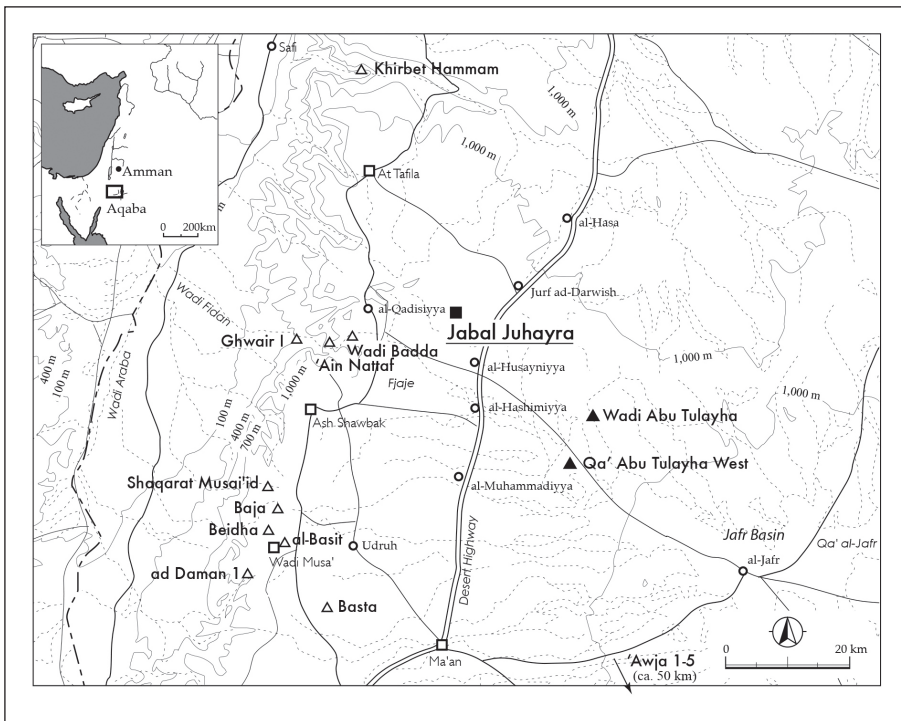
Since the reports cited above refer to this issue in some detail, no repetition is needed here.

We would like to re-emphasize the following two things, however. One is the intermediate character of the site setting. Jabal Juhayra is situated in a transitional zone between the sedentary cultural sphere to the west and the steppe desert to the east, which is probably the reason for its eclectic character mentioned below (Fig. 1). The other is its unique site topography. Unlike contemporary sites in and around the basin, the site is located on the scoria slope of an isolated volcanic hill (Fig. 2). This peculiar topographic condition is one reason for unique features such as rockshelter dwellings and rock-cut cisterns that characterise the PPNB settlement.

## The Excavations

As mentioned above, the first two field seasons dealt with the Layer 2 (LN/Chalcolithic transitional) encampment. We clarified its overall picture and stratigraphy in Area 1 and defined its southeastern limit in Area 2. In addition, we set up Areas 3 and 4 to examine the character of a robust masonry wall that was slightly exposed on the lower part of the northern slope. The surface cleaning in Area 3 attested the northern extension of this robust wall, but test excavation in Area 4 failed to find any clear evidence for its southward extension.

The subsequent three seasons addressed a comprehensive excavation of the underlying Layer 3 settlement (Fig. 3). The third season, which took place in June 2015, was focused on the full-fledged excavation of Area 3 and revealed that the robust masonry wall briefly examined in the second season was a part of a stone-built barrage belonging to the Layer 3 settlement. In addition, we newly opened Area



1. Jabal Juhayra: site location and surrounding sites.

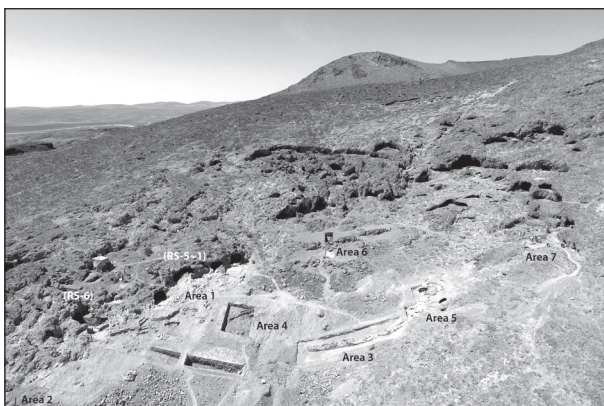
5 behind Area 3 and found several rock-cut cisterns belonging again to Layer 3.

The fourth season in August-September the same year began with an enlarged excavation of Area 4 that had been tested in the second season. Again, no clear evidence for the southern extension of the barrage wall was attested, but two terrace walls belonging to the Layer 3 settlement were found instead. Then, we newly set up Area 6 to examine the stratigraphy of two large terrace walls exposed in the upper valley and, at the same time, enlarged Area 5 to trace the westward extension of the rock-cut cisterns discovered in the third season. After these operations, we addressed an extensive excavation in Area 1 that constitutes the main body of the Layer 3 settlement. The excavation showed that

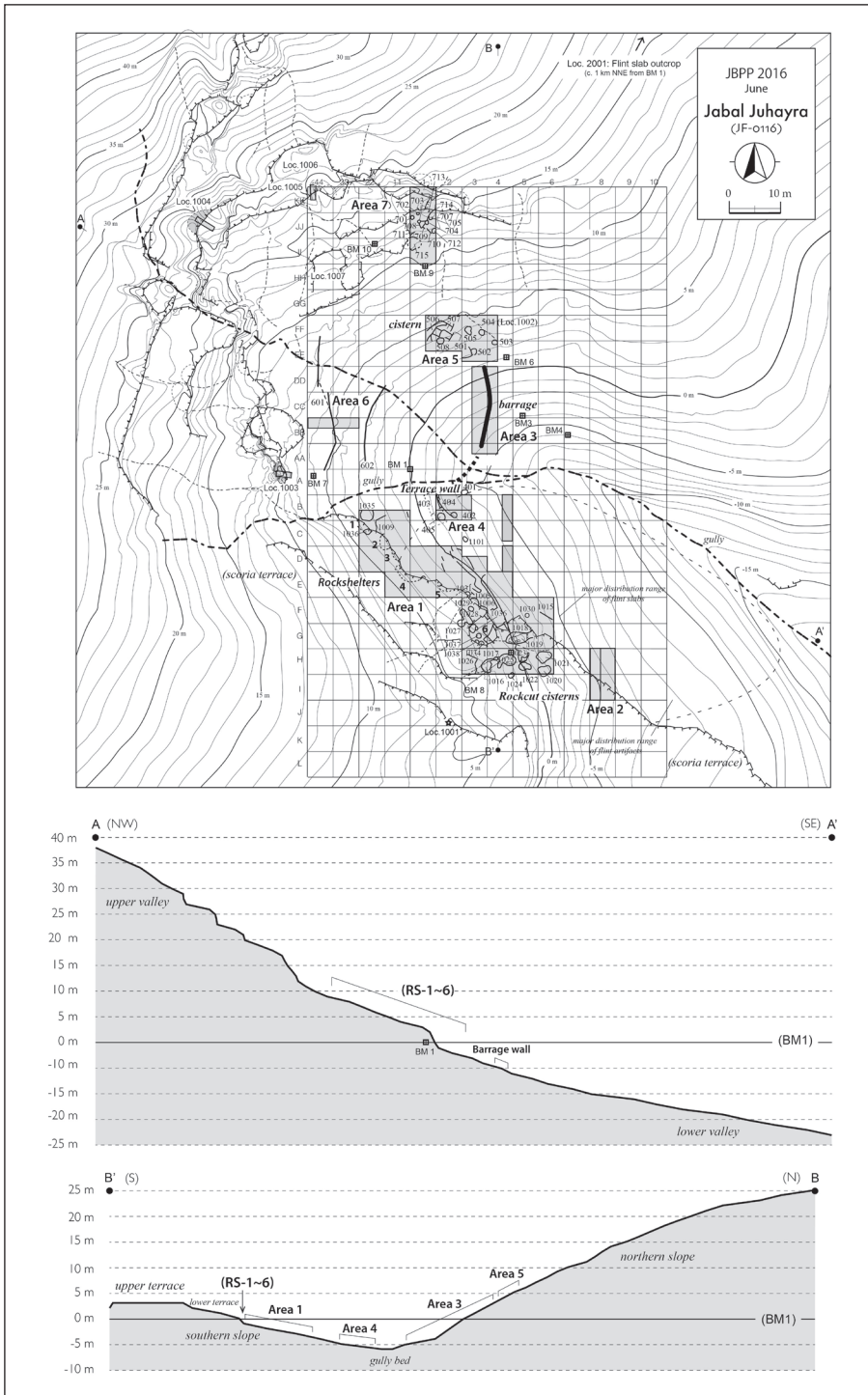
the six rockshelters were used as dwellings in Layer 3 as well, and that they were associated with a few dozen rock-cut cisterns and several terrace walls. Subsequently, we opened Area 7 in search of the northern counterpart of the Layer 3 rockshelter settlement in Area 1 and found several small features.

The fifth and final season in June 2016 was devoted to complementary works aimed at examining the details of the Layer 3 settlement. To begin with, we addressed an enlarged excavation of Rockshelter 6 in Area 1. This continued excavation was intended to scrutinize its western part - which had remained buried under overhanging scoria rocks - but halfway the operation was abandoned again due to increasing danger. We then moved to Area 7 and enlarged it to confirm that several features excavated in the last season formed, together with newly found ones, a small-scale open-air sanctuary.

The excavated area of the seven major operation areas amounted to *c.* 900 square meters, and the excavated soil was roughly estimated at 200-300 cubic meters. The general site stratigraphy was described in the last report, and no repetition is needed. The only thing to be added is the stratigraphic correlation between the northern and southern slopes across a small gully flowing down the center of the site. In view of the commonality in soil property, C<sub>14</sub> data,



2. Jabal Juhayra: aerial view of the site (looking W).



3. Jabal Juhayra: site-contour map and elevations.

structural remains and small finds, it is safe to say that the stratigraphy of both slopes corresponds to each other. Thus, Layers 3-1 on the southern slope are equivalent to Layers 3'-1' on the northern one, respectively. It is needless to say that the scoria layers (*i.e.* Layers 5 and 5') and their weathered deposits (Layer 4 and 4') form a common foundation layer(s) for the Layer 3/3' settlement on both slopes.

### Layer 3 Settlement: Structural Remains

The excavations revealed some sixty structural remains and small features, which were divided broadly into the following five types: (1) six rockshelter dwellings diagonally traversing the southern edge of Area 1, (2) a stone-built barrage stretching north to south in Area 3, (3) some thirty rock-cut cisterns dotted in Areas 1, 5 and 7, (4) several terrace walls found in Areas



1 and 4, and (5) a dozen small features scattered in Areas 1 and 7. What follows is an area-by-area overview of these structural components that constituted the Layer 3 settlement.

*Area 1*

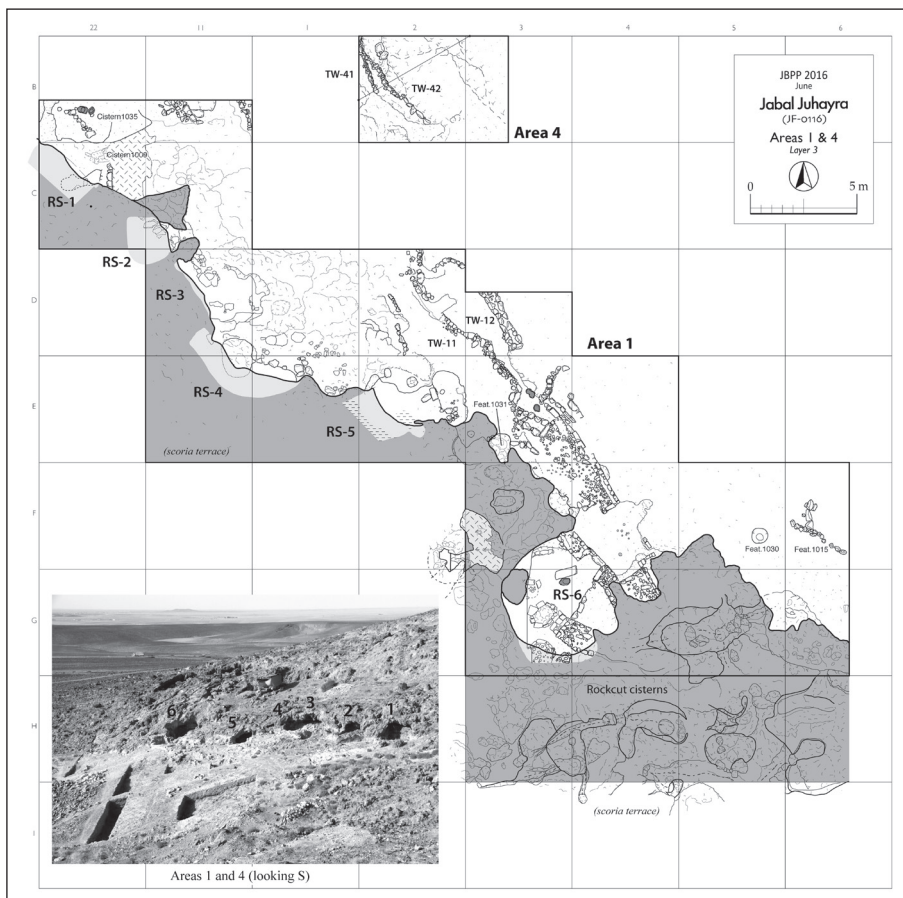
Area 1 represents the core of the Layer 3 settlement, containing six rockshelter dwellings, several terrace walls, some twenty rock-cut cisterns and several open-air small features (Fig. 4). Overall, they were aligned along the scoria terrace to constitute a northeast-facing, elongated structural complex c. 40m in total length.

Rockshelter 6

What most attracted our attention was Rockshelter 6 at the southeastern edge of the complex. This large rockshelter incorporated a quasi-masonry rectangular structure measuring c. 6-7m in frontage, at least c. 8-9m in depth and c. 2-3m in estimated ceiling height (Fig. 5; Fig. 6). Unlike the Layer 2 structures, this built-in structure used standardized flint slabs c. 20-30cm long and c. 5-10cm thick as

major construction materials, which were probably procured at layered flint outcrops exposed along a small *wadi* c. 1km NNE of the site. In addition, small flint slabs and scoria/basalt pebbles were also used as adjustment or filling material in the masonry walls.

What characterizes this rockshelter dwelling is its unprecedented construction method. Surprisingly, it was constructed by means of attaching masonry walls to the inner surfaces of the rockshelter, which had been modified in advance to a predetermined form. Thus it might be more correct to define it as a modified rockshelter associated with facing walls rather than a masonry structure incorporated into a rockshelter. However, the attachment of the facing walls was restricted to deliberately crafted rock-cut protrusions that took advantage of the irregular surfaces of the rockshelter, with the intermediate parts between any two adjacent protrusions being mostly left bare. (The only exception to this was the southern side of the front room, which was covered with a low masonry wall.) It is precisely for this reason why the masonry walls take on a patchy appearance.



4. Jabal Juhayra: plan of Areas 1 and 4 (Layer 3).



The floor utilized the exposed surface of the scoria bedrock layer (*i.e.* Layer 5), which was carefully pecked and ground down to produce a smooth surface. A few floor renewals were recognized in the middle room, indicating that the rockshelter was continuously used for a certain period. As for the roof, at least the rear half of the rockshelter dwelling was covered with scoria eaves when we started the excavation. It is because our excavation took place, removing the overhanging rocks, that the post-excitation rockshelter dwelling seemingly looks hypaethral.

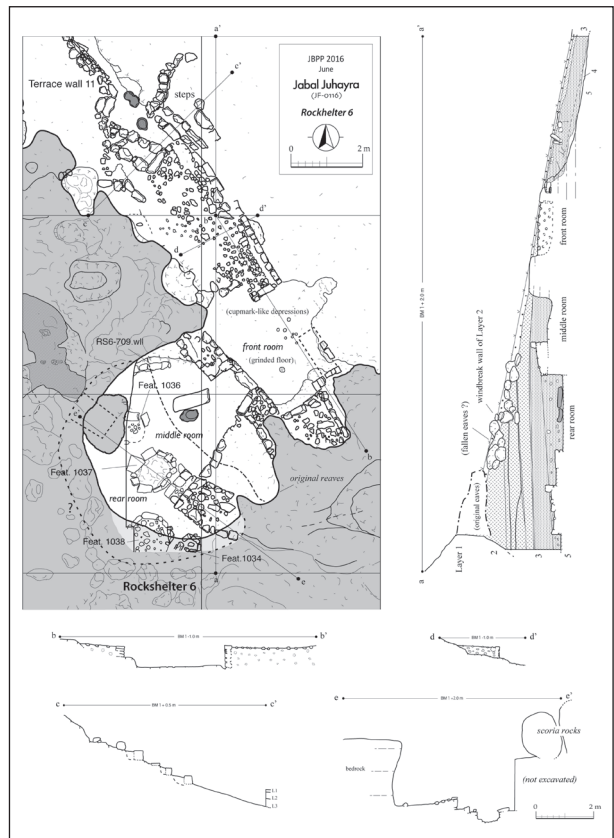
In terms of typology, the structure had a tripartite rectangular plan, being equipped with a gabled entrance and two pairs of buttress-like partition walls. (Only the observer's rear right wall remains to be attested owing to the increasing danger posed to the excavators.) Thus, it can be regarded as a rock-cut, built-in version of the 'pier-house' that was common at Middle to Late PPNB (hereafter M-LPPNB) settlements in the southern Levant (Byrd and Banning 1988). It appears that the constructors made every effort to create a pier-house within a rockshelter that was restrictive in various aspects, which highlights the extent to which the pier-house architectural tradition was deep-rooted in the PPNB southern Levant. Viewed in this light, the eclectic construction can be understood as a desperate attempt to resolve the differences between two incompatible components.

The details of the three rooms are as follows. To begin with, the front room measured *c.* 4m wide by *c.* 1.5m in floor depth, being equipped with a pair of carefully finished front walls (**Fig. 7: 1**). Since the observers' left wall was poorly preserved, the details of the entrance are unknown except that it opened to the northeast and was probably *c.* 1-1.5m wide. Several cup-mark-like depressions *c.* 5-10cm in diameter were found on the carefully ground floor inside the entrance (**Fig. 7: 2**).

The second or middle room was slightly larger in size than the front room, measuring *c.* 5m wide and *c.* 2m deep. The doorway leading from the front room was fringed with a pair of upright gate stones and paved with a large threshold stone (**Fig. 7: 3**). Both parts used undressed limestone boulders. While the observer's right masonry wall was placed on a low rock-cut



5. Area 1: general views of Rockshelter 6 (looking SW or W).



6. Area 1: plan and section/elevations of Rockshelter 6.





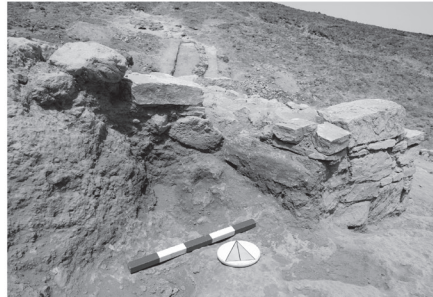
1. Front room: front walls (looking S).



2. Front room: floor (looking SW).



3. Middle room: entrance (looking SW).



4. Middle room: NW wall (looking N).



5. Middle room: SE wall (looking E).



6. Middle and rear rooms (looking W).



7. Rear room: Feature 1034 (looking SW).



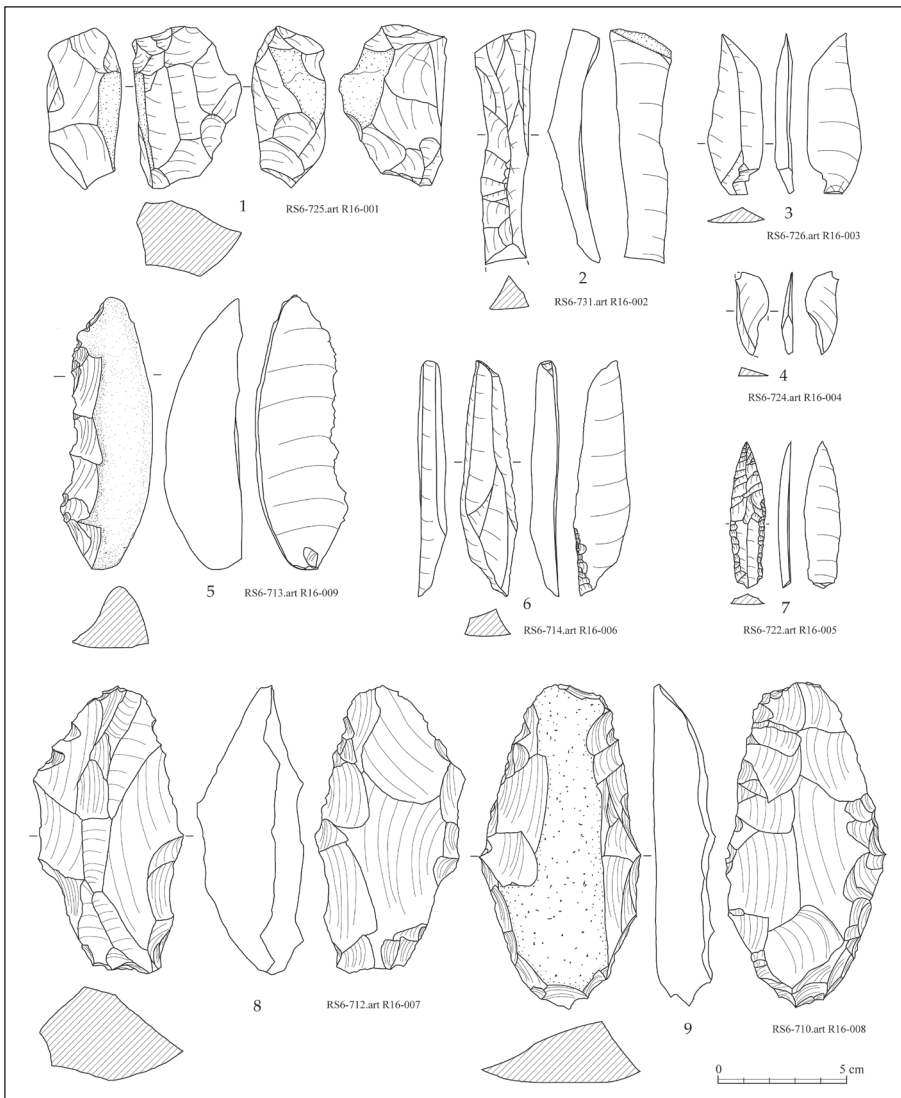
8. Rear room: cache on Feature 1037 (looking N).

7. Area 1: close-up views of the three rooms of Rockshelter 6.

protrusion produced in advance (**Fig. 7: 4**), the left facing wall was attached so as to ‘wrap’ the lower half of a narrow rock-cut protrusion *c.* 1m high (**Fig. 7: 5**). This demonstrates that the constructors of the built-in structure adopted different methods flexibly depending on the situation. The floor was on two levels, with its southeastern half forming a small platform delimited with upright slabs *c.* 10cm high, two facing walls and the bare side surface of the rockshelter. Meanwhile, the other half of the room was integrated with the doorway to form a flat working space,

where a basin quern and rectangular working table, both made of limestone, were placed side by side (**Fig. 7: 6**).

As mentioned above, the rear room has yet to be entirely excavated. A low masonry wall was found attached to a small rock-cut protrusion, but its northwestern counterpart remains to be attested because a huge overhanging rock is still in the way of excavation. The floor included two slab-lined hearths (Features 1037 and 1038) *c.* 0.8-1m in diameter and *c.* 0.2-0.5m in depth (**Fig. 7: 6**), with the former yield-



8. Area 1: cached artifacts from Feature 1037 in Rockshelter 6.

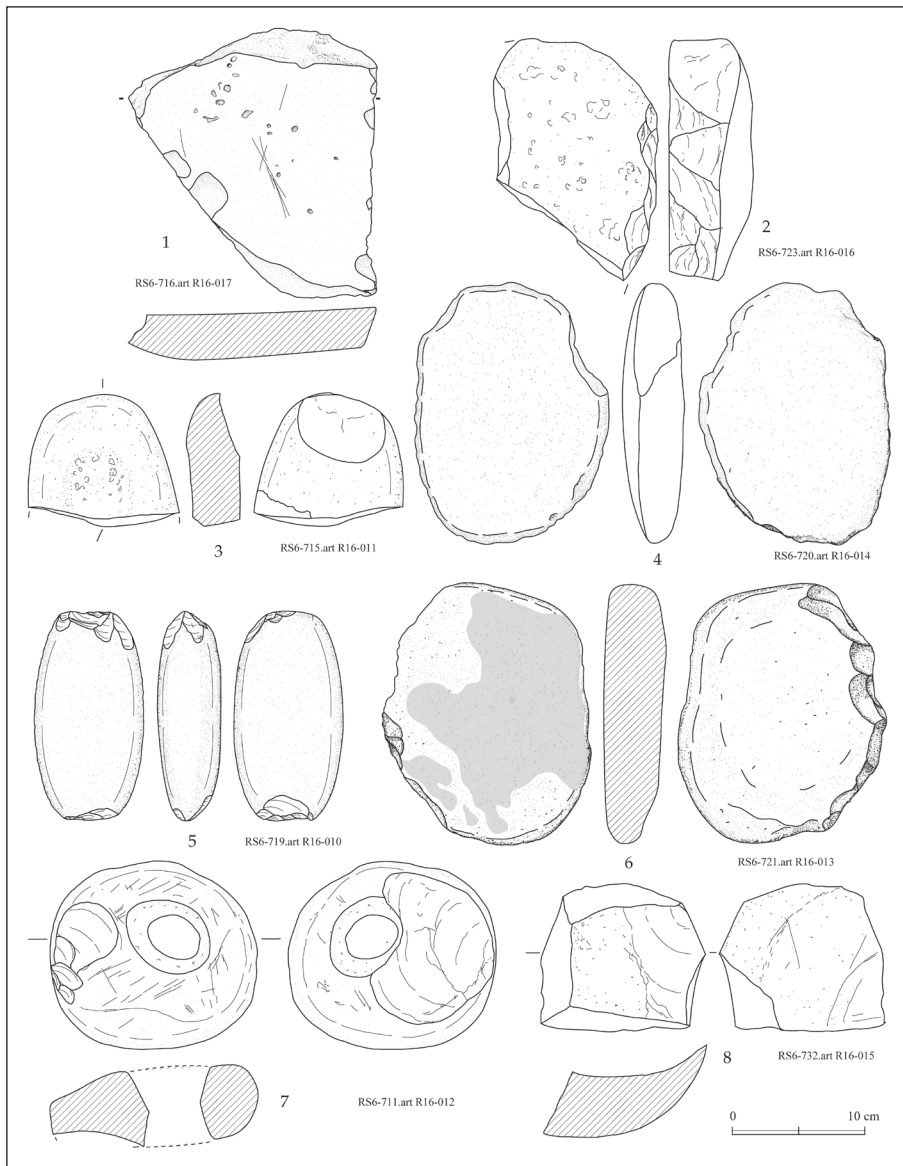
ing nine chipped flint artifacts (**Fig. 8: 1-9**), two flat quern fragments (**Fig. 9: 1-2**), five grinding slabs (**Fig. 9: 2-7**) and a stone-vessel fragment (**Fig. 9: 8**). All of these were placed in the top of the hearth fill and formed a cache-like concentration of artifacts (**Fig. 7: 8**). In addition, an upright slab-lined round feature (Feature 1034), *c.* 0.5m in diameter and *c.* 0.6m in height, was found in the southern corner of the room (**Fig. 7: 7**). Ashy deposits including burned pebbles were within it, but no artifacts were found in this case. Parallel examples of this unique feature are attested on the slope in front of the rockshelter (Fujii, Adachi and Nagaya 2017: fig. 7) and in the open-air sanctuary in Area 7 on the opposite slope (**Fig. 23**). Furthermore, the contemporary outpost of Wādī Abu Tulayha (Fujii 2008a: fig. 17) and the subsequent encampment of Khashm al-‘Arfa (Fujii, Adachi, Yamafuji *et*

*al.* 2013: figs. 4, 13-14) yielded similar features, suggesting that such types of small feature were standard for the Jafr Neolithic.

#### Rockshelters 5-1

The other five rockshelter dwellings were much smaller in scale and not associated with full-scale modification and a careful finishing process (**Fig. 10: 1**). Thus, they can probably be regarded as deteriorated forms of Rockshelter 6. Suggestive in this regard is a techno-typological sequence amongst them. Rockshelter 5 - nearest to Rockshelter 6 - was not only equipped with a short, freestanding masonry wall and a bare rock-cut protrusion in its entrance space, but was also partly paved with clay or scoria cement as described below (**Fig. 10: 2; Fig. 11: lower**). Although undressed basalt/scoria cobbles were used as wall materials instead of





9. Area 1: cached artifacts from Feature 1037 in Rockshelter 6.

standardized flint slabs, we can argue that this rockshelter dwelling retains the atmosphere of Rockshelter 6. Once again, a quern and large working table were found *in situ* on the floor near the entrance.

The combination of a short masonry wall and a bare rock-cut protrusion was present but barely recognizable at Rockshelters 4 and 3 (Fig. 11: upper), with the front wall of Rockshelter 2 being reduced to a pair of bare rock-cut protrusions (Fig. 10: 3; Fig. 12). Rockshelter 1 was devoid even of rock-cut protrusions, although two pairs of nested querns and grinding slabs were once again found near its entrance (Fig. 10: 4-5; Fig. 12). Such a technological sequence probably represents a gradual separation from the PPNB architectural

tradition within the sedentary cultural sphere. Given that the overlying Layer 2 encampment used the same rockshelters without adding any modification, an opposite sequence (*i.e.* the development of Rockshelter 1 towards 6) seems unlikely.

#### Terrace Walls

Several terrace walls were found on the relatively steep slope in front of the rockshelters, but most of them were poorly preserved and intermittent. The only exception to this was Terrace Wall 11, which created an anthropogenic terrace *c.* 8m wide, *c.* 5m deep and up to *c.* 0.7m high in front of Rockshelter 5 (Fig. 4; Fig. 13). The question is the specific use of this terrace. Similar terraces found at Dhra' have been



1. General view of RS-5~1 (looking SW).



2. General view of RS-5 (looking S).



3. General view of RS-2 (looking W).



4. General view of RS-1 (looking SW).



5. Nested grinding tools in front of RS-1 (looking SW).

10. Area 1: general and close-up views of Rockshelters 5-1.

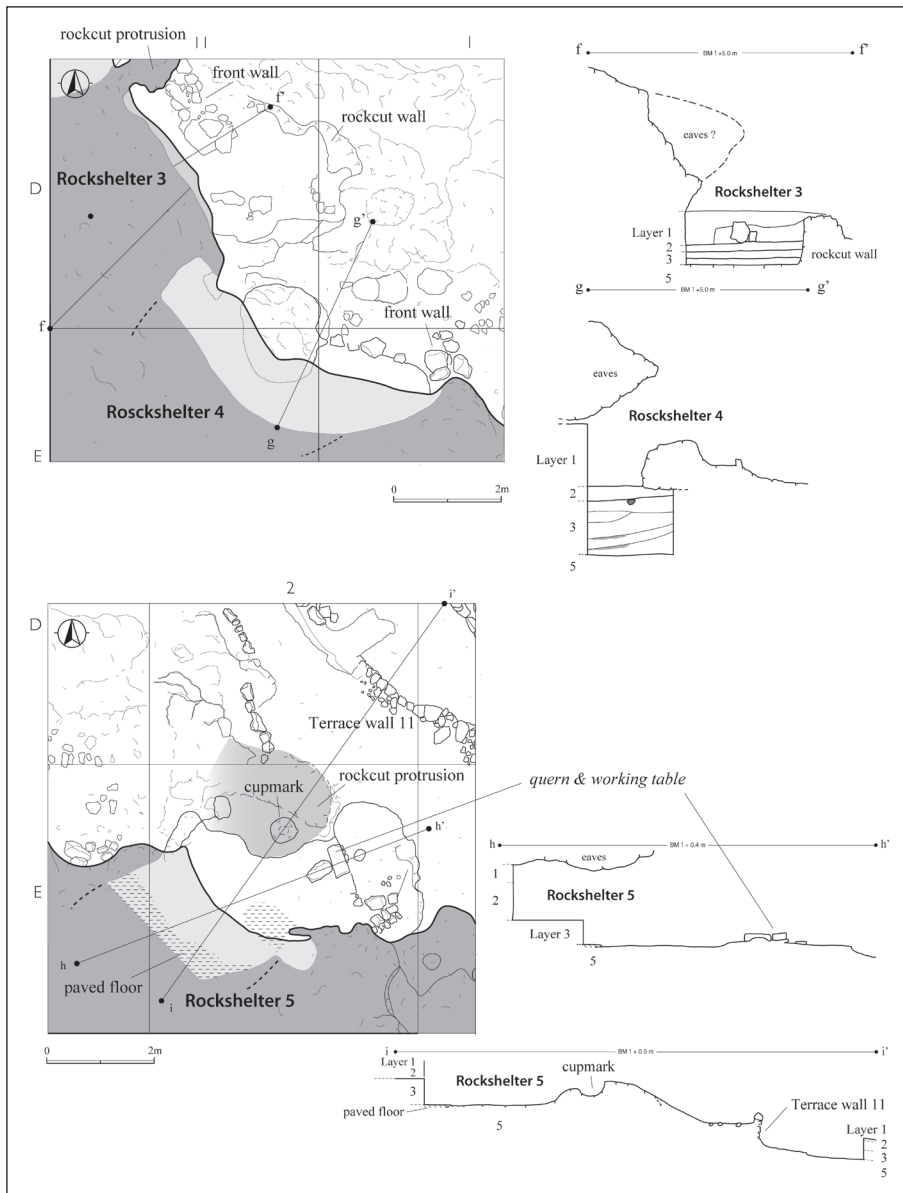
regarded as cultivated land (Kuijt and Mahasneh 1998), but it is still uncertain whether the same applies to this case.

Incidentally, the terrace incorporated stone-built steps *c.* 1-2m wide into its southeastern edge. A similar, albeit much larger-in-scale, example has been reported from Ghuwayr I, a contemporary settlement in the Wādī Faynān area *c.* 25km west of Jabal Juhayra (Simmons and Najjar 2003), suggesting that such steps were common to PPNB settlements established on a steep slope. A notched and grooved

stone weight, a chronological marker of the Jafr PPNB, was found *in situ* on an upper step (Fig. 32: 11).

#### Rock-Cut Cisterns

Some twenty rock-cut, mostly open-air cisterns were found in Area 1. Most of them were concentrated on a gentle scoria slope behind Rockshelter 6 (Fig. 14; Fig. 15), but a few large examples were also found on flat terrain in front of Rockshelter 1 (Fig. 10: 4; Fig. 12). They were divided into several types, including



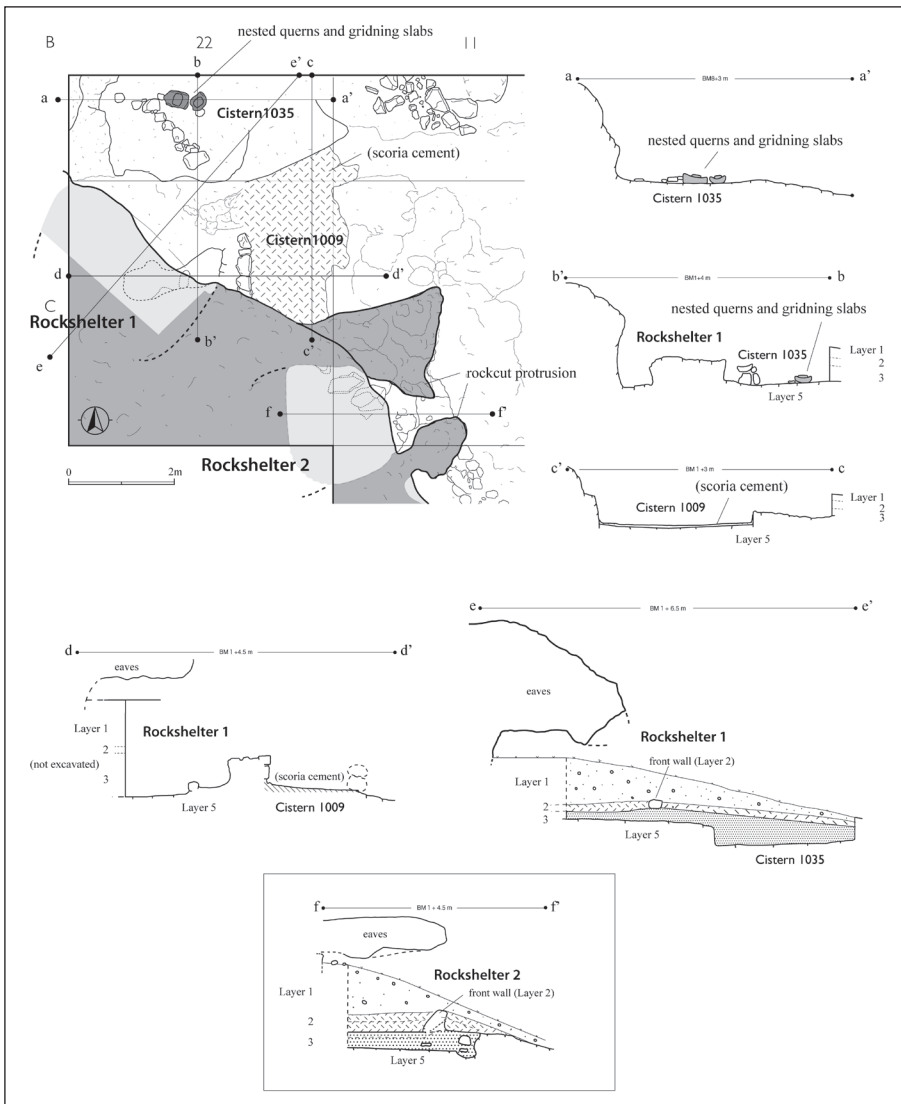
11. Area 1: plans and sections/elevations of Rockshelters 5-3.

irregular depressions less than 1-2m in diameter (or longer axis) and less than 0.5-1m deep (Fig. 15: 3), cylindrical or bursiform pits *c.* 1m in diameter and depth, shaft-tomb-like hollows more than 1m in depth (Fig. 15: 4-5), and roughly square, tub-like facilities *c.* 2-3m across and *c.* 0.5m in floor depth (Fig. 15: 2; Fig. 10: 4). The cisterns behind Rockshelter 6 were primarily simple depressions or the pit-type examples, whereas those in front of Rockshelter 1 consisted only of the more developed, tub-type ones.

In terms of technology, the cisterns fell into the following three types: merely pecked examples, (pecked and then) carefully ground ones, and (pecked, ground and finally) floor-paved

ones. It is needless to say that the surface treatment of the two latter types was intended to enhance the waterproof properties of the cisterns. While the small cisterns behind Rockshelter 6 were produced taking advantage of natural depressions and are simple in terms of both typology and surface treatment, the full-fledged cisterns in front of Rockshelter 1 were created by modifying the original topography to a considerable degree and were more carefully finished using scoria cement (*i.e.* Portland cement with minute scoria grains as major admixture). The maximum pondage of the simple cisterns is not more than 1 cubic meter, whereas that of the tub-type examples is estimated at a few cubic meters. Some of the small cisterns (*e.g.*





12. Area 1: plans and sections/elevations of Rockshelters 2-1.

Cisterns 16, 17 and 25) were not only equipped with a natural or rock-cut ditch for collecting runoff surface water, but were also connected with each other via a short channel and formed a small water-catchment complex to enhance water storage.

The question at hand concerns their chronological correlation with the adjacent rockshelter dwellings, but this is difficult to answer because most of them are exposed on the scoria bedrock layer and are, therefore, devoid of stratigraphic evidence - to say nothing of *in-situ* finds. A couple of exceptions were tub-type Cisterns 1009 and 1035 in front of Rockshelter 1, both of which were constructed on the upper surface of Layer 4 or 5 and, at the same time, were entirely buried by deposits of Layers 3-1 (Fujii 2015: fig. 8) (Fig. 10: 4; Fig. 12: upper). Furthermore, the floor of Cistern 1035 yielded

two pairs of nested querns and grinding slabs as well as typical PPNB flint artifacts (Fig. 10: 5). Thus, at least these two cisterns demonstrably belonged to the Layer 3 rockshelter settlement. Nothing can be said about the simple cisterns



13. Area 1: general view of the features in front of Rockshelter 5.



1. Rock-cut cisterns behind Rockshelter 6 (looking NW).



2. Cistern 16 (looking SW).



3. Cistern 17 (looking SW).



4. Cistern 27 (looking W).



5. Cistern 27 (close-up view of ground floor)

14. Area 1: general and close-up views of rock-cut cisterns behind Rockshelter 6.

behind Rockshelter 6, but similar examples in Area 5 that are described below will provide stratigraphic evidence for their dating.

### Small Features

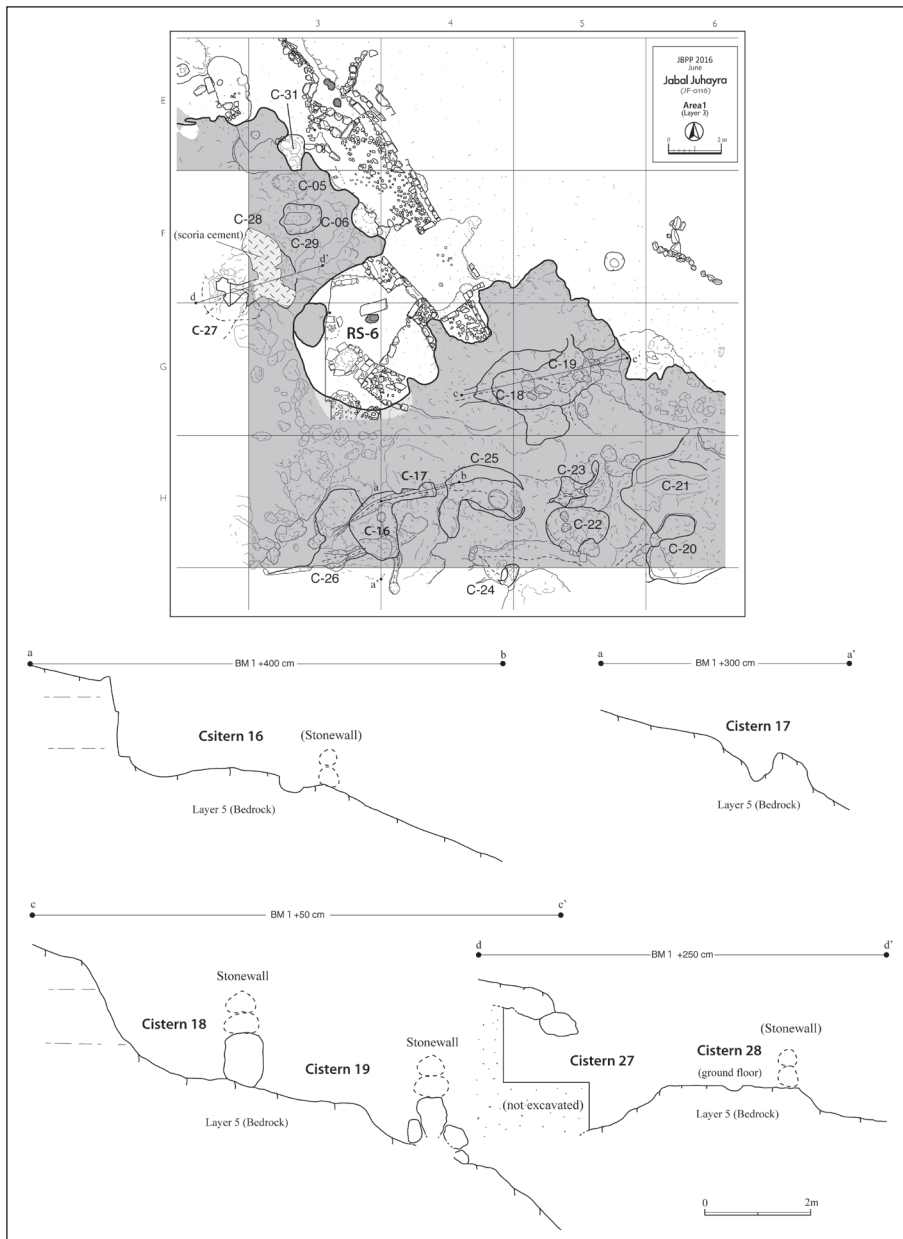
A few small, upright-slab-lined features similar to Feature 1034 in Rockshelter 6 (**Fig. 7: 7**) were found on the slope in front of the rockshelter dwellings. Unlike the large, oval examples referred to in the last report (Fujii, Adachi and Nagaya 2017: fig. 14: 3-4), they belonged to

Layer 3. Again, nothing other than ashy deposits was found within them. It appears that they were related to some ritual, but further scrutiny is required to validate the tentative interpretation.

### *Area 2*

The second season's excavation had already proved that this area was not only devoid of structural remains but also scarce in artifacts. For this reason, no complementary operations took place during the subsequent three seasons.





15. Area 1: plans and elevations of rock-cut cisterns behind Rock-shelter 6.

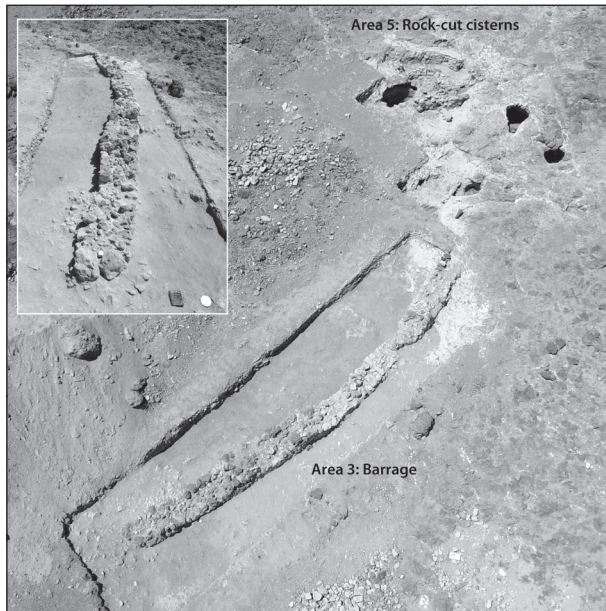
### Area 3

As mentioned above, this elongated operation area was set up in the third season for the purpose of exploring the overall picture of the robust masonry wall that was slightly exposed on the northern slope. The excavation revealed that it was built on Layer 4' (thin yellowish silty clay deposits) or 5' (the scoria bedrock layer) and was covered entirely with Layers 3'-1' deposits (**Fig. 16; Fig. 17**). Thus, there is little doubt that it was coeval with the rock-shelter dwellings in Area 1. This chronological perspective was corroborated by a C14 date on charcoal remains from nearby floor deposits as well (**Table 1**). The excavation also showed

that: (1) the robust masonry wall stretches downward from the middle part of the steep slope but is interrupted *c.* 5m short of the present gully bed; (2) it is constructed by a rubble-core, dry-walling technique using undressed or halved basalt/scoria cobbles up to *c.* 50cm long; (3) it measures *c.* 16m in preserved total length, *c.* 1-1.2m in width and up to *c.* 0.8m in preserved height, having a vertical interval of *c.* 5m between both preserved ends; (4) while the northern half of the wall is constructed with smaller cobbles, inferior in construction quality and slightly incurved toward the upstream, its southern half was almost straight and more carefully constructed using larger stones; (5)



the upper half can thus be regarded as a sort of a guiding wall to direct surface runoff water flowing down on the scoria slope; and (6) only the lower half represents the main body of the barrage.

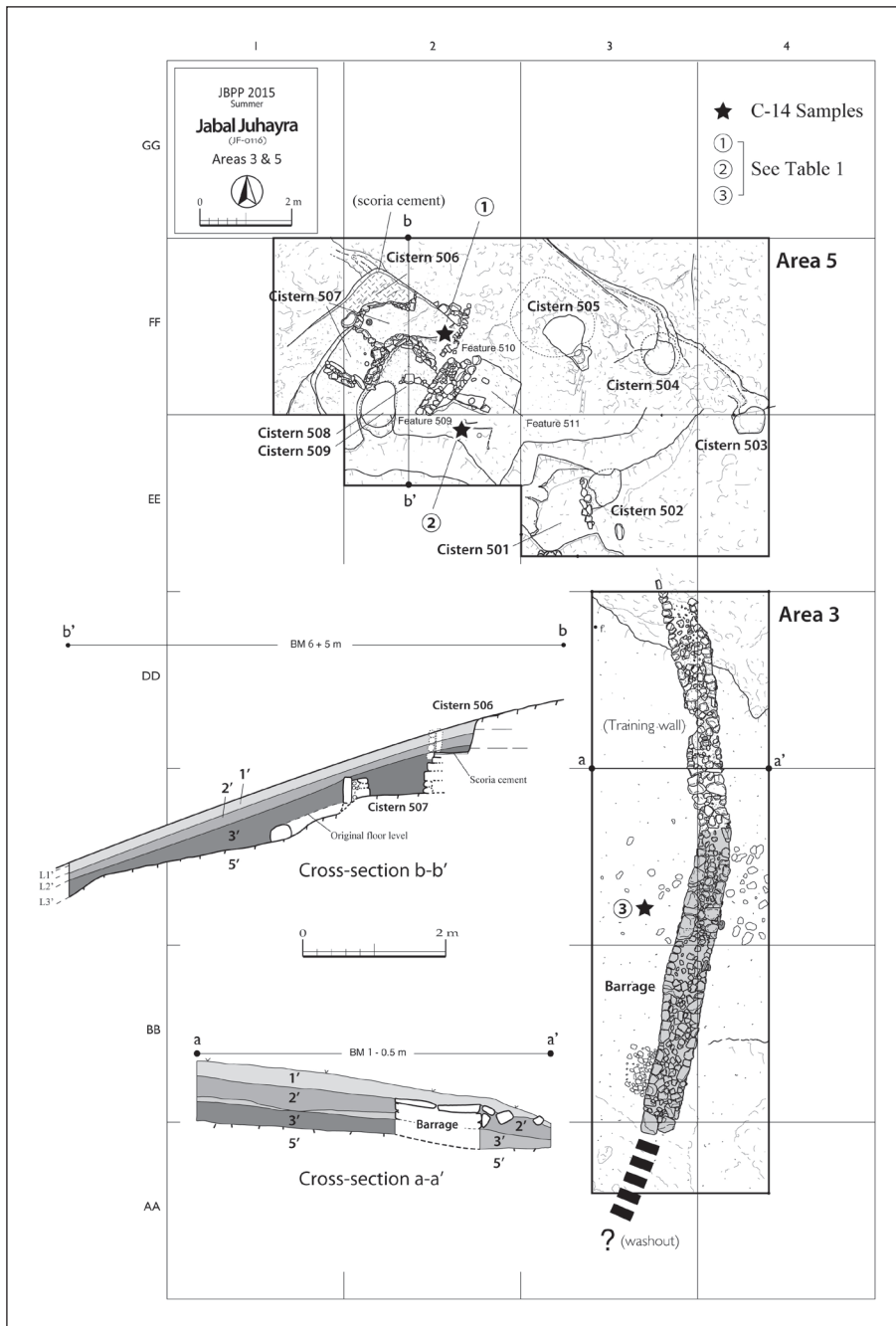


16. Areas 3 and 5: aerial view of the barrage and cistern system on the northern slope (looking NW).

The function of this masonry wall requires no further argument. Unlike the other masonry walls, only this wall is located immediately beside the gully (or, more precisely, near the confluence of two tributaries) and stretches orthogonally across the bed of the converged gully (Fig. 3). There is no doubt that the preserved wall alignment represents part of a small-scale barrage. The storage capacity of the main body of the barrage is estimated at a few dozen cubic meters. It seems most unlikely, however, that the barrage was intended for long-term water storage because, unlike the cisterns, no clear efforts to enhance waterproofing could be discerned. Even if fluvial deposits filled up the gaps between wall stones and thereby achieved a certain degree of waterproof effect, the use of the structure as an impounding dam is still doubtful. Further doubt is cast on such an interpretation by the fact that the main body of the barrage is fashioned in a relatively delicate form considering the strong sideways water pressure that might be expected. What then was the wall used for? A hint as to how the question might be approached was gained by the excavation at Area 4.

**Table 1:** Jabal Juhayra: C14 data from the Layer 2 and 3 settlements (as of July 2016).

Layer	Area	Feature/Square	Locus	IAAA-	Libby Age (yrBP)	calBC (2σ)	Remarks
2	1	RS-5	507_5	150202	5700±30	4614-4457 (95.4%)	Rockshelter dwelling
	1	RS-6	505_2	143894	5760±30	4700-4539 (95.4%)	"
	1	RS-6	506_3	143895	5750±30	4689-4521 (95.4%)	"
	1	RS-6	601	150532	6050±30	5027-4847 (95.4%)	"
	1	RS-6	602	150533	6100±30	5080-4936 (80.2%)	"
	1	RS-6	603	150534	5930±30	4848-4721 (93.2%)	"
	1	RS-6	604	150535	6070±30	5053-4896 (92.5%)	"
	1	RS-6	605	150536	6180±30	5219-5042 (95.4%)	"
3	1	RS-3	603	151272	8840±30	8015-7791 (54.5%)	Rockshelter dwelling
	1	RS-4	612	151270	8150±30	7190-7059 (83.6%)	"
	1	RS-6	625	151268	8510±30	7590-7527 (95.4%)	"
	1	RS-6	626	151269	8430±30	7574-7460 (95.4%)	"
	1	RS-6	507_2	143896	8350±30	7515-7342 (95.4%)	"
	1	RS-6	734	160311	8470±30	7584-7503 (95.4%)	"
	2	RS-7	508_2	143898	8370±31	7523-7352 (95.5%)	"
	3	CC-3	210	150530	8290±30	7467-7248 (85.1%)	Barrage (Fig. 17: ③)
	4	Trench	104_2	143899	8530±30	7595-7535 (95.4%)	Small feature
	4	402	502	143898	8230±30	7349-7126 (92.4%)	Terrace Wall 401
	5	EE-2	104	150531	8390±30	7535-7422 (76.2%)	Cisterns 506/507 (Fig. 17: ①)
	5	FF-2	207	151267	8170±30	7196-7065 (75.4%)	Cisterns 506/507 (Fig. 17: ②)
	7	JJ-1	104	151273	7250±30	6215-6050 (95.4%)	Open-air Sanctuary
7	JJ-1	117	151274	8570±30	7610-7539 (95.0%)	"	
7	702	505	151275	8220±30	7345-7123 (91.0%)	"	



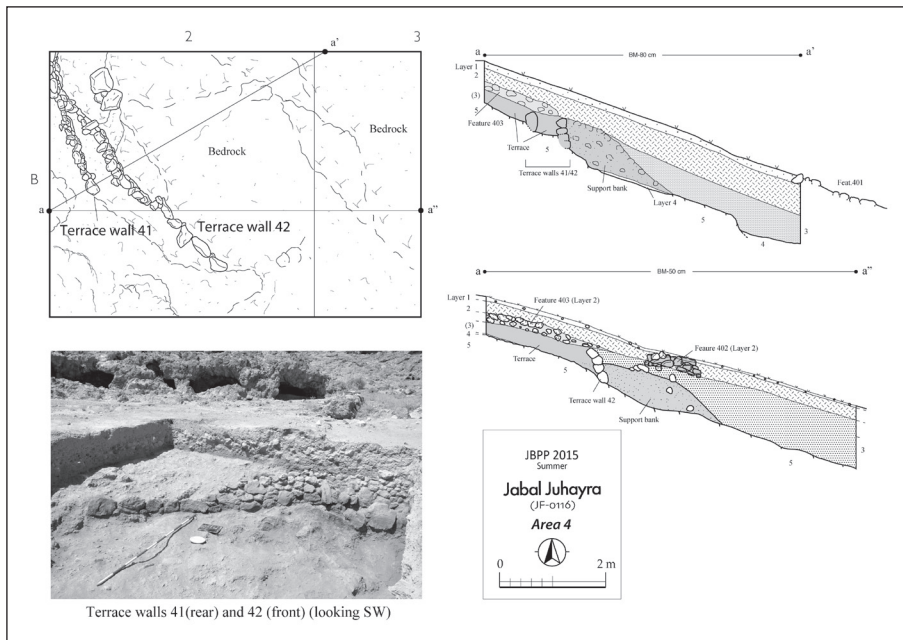
17. Areas 3 and 5: plan and sections of the barrage and cistern system.

**Area 4**

As mentioned above, Area 4 was set up to trace the southward extension of the barrage wall attested in Area 3, but no clear evidence for it was confirmed despite the relatively extensive excavation. Thus, it is conceivable that the south wing of the barrage wall, together with its central part across the gully, was entirely washed away by repeated floods or, possibly, was non-existent from the beginning.

What we found instead were two masonry terrace walls stretching in the NW-SE direction

along the contour lines (**Fig. 18**). Small, undressed scoria/basalt cobbles were used as their construction materials. The upper wall measured *c.* 2m long and *c.* 0.3m in preserved height, whereas the lower one was at least *c.* 5m in length and up to *c.* 0.5m in preserved height. In terms of stratigraphy, both walls were based on Layer 4' or 5' and covered with Layer 3'-1' deposits. Of significance is the fact that they roughly overlapped the supposed extension line of the barrage wall, which possibly suggests that they were combined with the barrage-like



18. Area 4: plan and sections of Terrace Walls 41 and 42.

gully barrier to form basin-irrigated terrace fields. This is all the more likely because most of the Neolithic barrages in the Jafr Basin are known to have been constructed for basin irrigation (Fujii 2010b). Pollen/phytolith analysis of archived terrace-deposit samples kept in our local storage is expected to shed new light on this intriguing issue.

*Area 5*

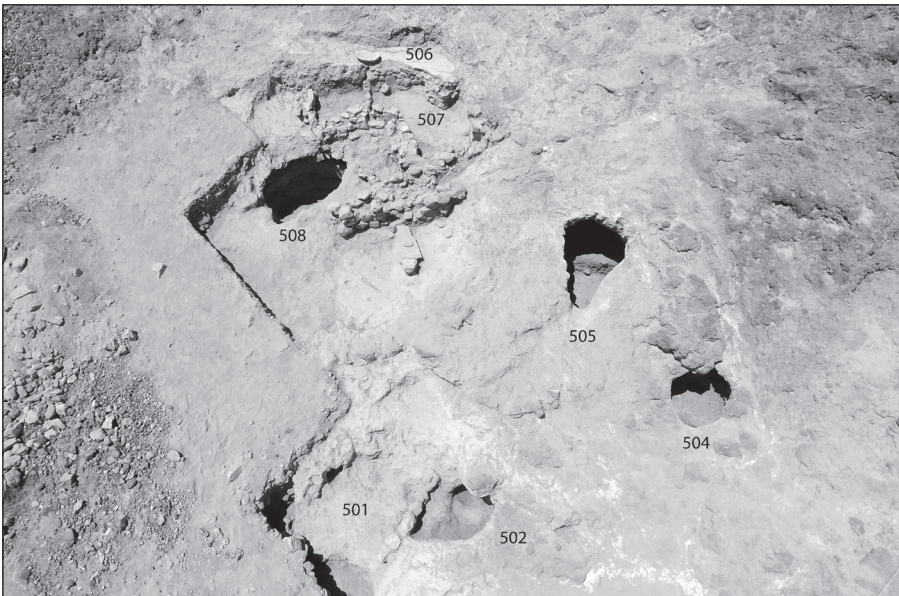
The excavation in Area 5 on the northern slope revealed a total of eight rock-cut cisterns. In terms of techno-typology, they could be divided broadly into two groups (Fig. 19; Fig. 20).

The first group consisted of pit-type cisterns, most of which were concentrated in the north-eastern part of the operation area. These were further subdivided into cylindrical or bursiform examples (Cisterns 502-504 [Fig. 19: 4]) and shaft-tomb-like examples with a short, sloping approach and overhanging ceiling (Cisterns 505 and 508 [Fig. 17: 5]). The former were small in size, measuring *c.* 1m in diameter and *c.* 0.8-1m in floor depth, whereas the latter were slightly larger in scale, measuring up to *c.* 2m in diameter and up to *c.* 1.5m in floor depth. As with the rock-cut cisterns in Area 1 on the southern slope, most of these simple cisterns were equipped with a natural or anthropogenic ditch for collecting surface runoff water. What differentiated them from their southern counterparts

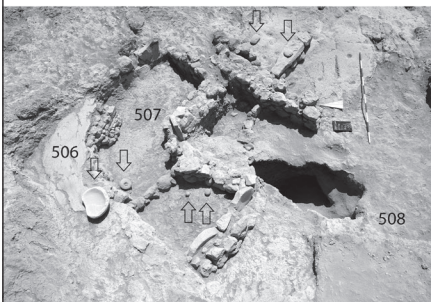
was their standardized form and the more careful finishing of the floor, both of which lend them a more sophisticated appearance. In terms of stratigraphy, two examples (Cisterns 502 and 508) were cut into Layer 5 and, at the same time, were buried under Layer 3'-1' deposits. It follows that they constituted a part of the PPNB rockshelter settlement. Meanwhile, the other three cisterns (Cisterns 503, 504 and 505) were exposed on the scoria slope and were, therefore, devoid of such stratigraphic evidence. It is noteworthy, however, that one of them (Cistern 504) included a cache of more than five hundred homogeneous PPNB flint artifacts in its lower fill layers.

The second group occupied the southwestern part of the operation area, consisting of a roughly square tub-type cistern (Cistern 501) and a once again square, yet terrace type, composite cistern (Cisterns 506, 507 and 508). The former was *c.* 1.5m across and *c.* 0.4m in floor depth, being connected to a small pit-type cistern (Cistern 502) with a short stone wall intervening in between them. Its maximum pondage is estimated at *c.* 1-2 cubic meters. Meanwhile, the latter example was not only larger in scale but also very different in structure, being a three-tiered, composite cistern *c.* 3m on one side and *c.* 1.5m in vertical interval (Fig. 19: 1). The upper two cisterns were hook-shaped, whereas the bottom one (which occupied the dead space left by the two upper hooked

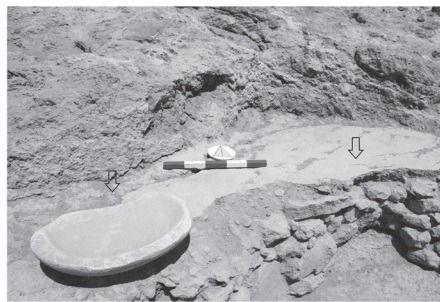




1. Cisterns in Area 5 (looking N).



2. Terrace-type cistern 506/507/508 (looking E).



3. Scoria-cement floor of Cistern 506 (looking N).



4. Pit-type cistern 504 (looking N).



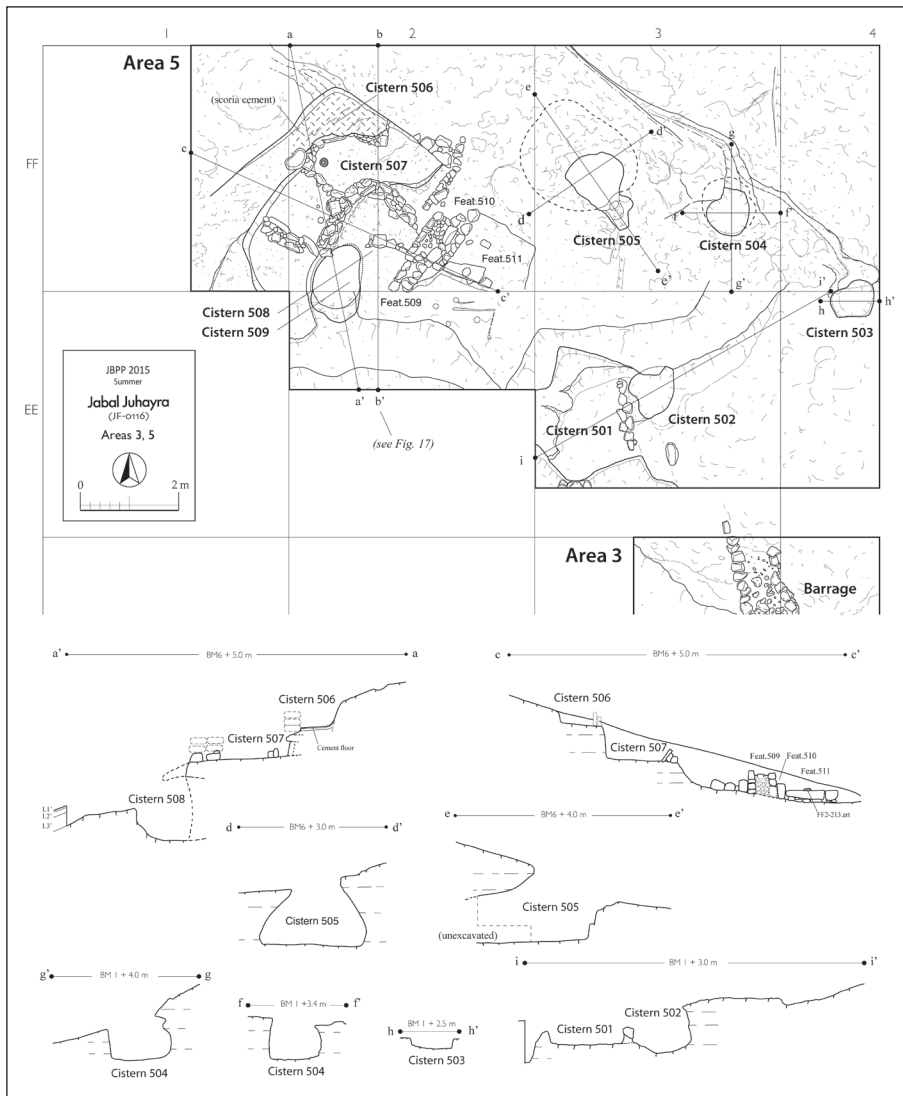
5. Pit-type cistern 505 (looking SW).

19. Area 5: general and close-up views of rock-cut cisterns.

cisterns) was roughly square in general plan. Interestingly, this terrace-type, composite cistern was dug ('rotated') at a planar angle of 45 degrees to the surrounding scoria slope, which is an ingenious device for saving labor as well as coping with strong sideways water pressure.

The uppermost, hooked cistern was relatively well preserved, having two rock-cut sidewalls and a flat floor sealed with scoria cement. However, as with Cistern 1009 in Area 1, the hooked damming bank that presumably equipped the two lower sides was entirely washed out, excluding the foundation courses built on the edge

of the middle terrace. A small aqueduct for taking in surface runoff water stretched from its northern corner towards the slope above. The maximum pondage of this cistern is estimated at a few cubic meters. The middle cistern had much in common with the uppermost one, except that it was slightly larger in width. Meanwhile, the lowest cistern (Cistern 508) still preserved a robust damming wall on its eastern side. In addition, a shaft-tomb-type cistern (Cistern 509) was dug into the southern floor of this cistern. This rather *ad hoc* feature might have been added to increase overall storage capacity,



20. Area 5: plans and sections/elevations of the rock-cut cisterns.

or to compensate for lost capacity within the bottom cistern caused by erosion damage.

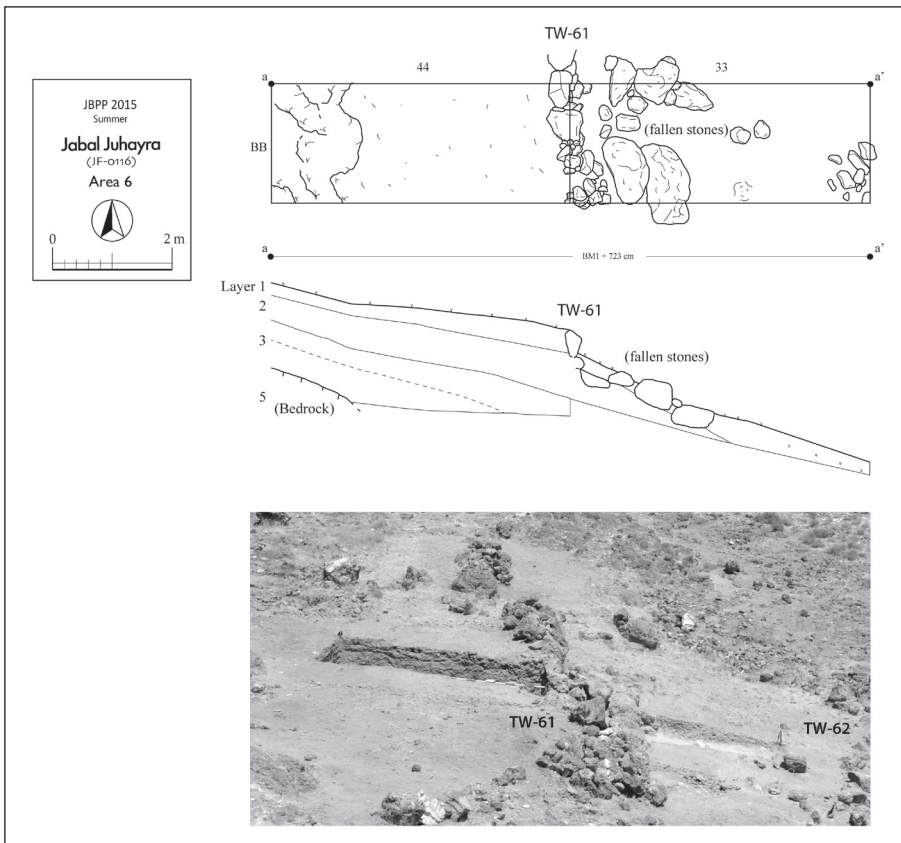
In terms of stratigraphy, this composite cistern was constructed on the bedrock layer and buried under Layer 3'-1' deposits. Thus, it demonstrably dates back to the PPNB. Once again, several grinding implements and a large working table were found here *in situ* on the floor or beside the lower damming wall, suggesting that some sort of kitchen work took place beside the water supply (Fig. 19: 2-3; Fig. 30: 10; Fig. 31: 5). It is needless to say that they resembled the groundstone artifacts found in the rockshelter dwellings on the opposite slope. Among others, an upright grinding tool with an off-center handle hole, which was found at the northern corner of the middle cistern (Fig. 33: 2), bore a strong resemblance to one of the cached artifacts in Rockshelter 6 (Fig. 9: 7). This fact, coupled

with the stratigraphic correlation, highlights the contemporaneousness between the water-catchment system on the northern slope and rockshelter dwellings on the southern slope. Two C14 dates from the operation area also corroborate this interpretation (Fig. 17; Table 1).

#### Area 6

Two large terrace walls traversed the uppermost part of the valley from north to south (Fig. 3). We set up a 2x10m trench across the upper wall (Terrace Wall 61) and examined its stratigraphy (Fig. 21). As a result, it turned out to belong to Layer 1 and, therefore, had nothing to do with the stratified Neolithic settlement buried under Layer 3-1 deposits. No structural remains other than the terrace wall were found, but hundreds of PPNB flint artifacts were recovered - especially from lower fill layers. This





21. Area 6: plan and section of Terrace Wall 61.

fact suggests that an open-air flint workshop existed nearby, but we abandoned further excavation owing to time constraints.

#### Area 7

Area 7 was set up in search of the northern counterpart of the rockshelter dwellings in Area 1. However, what we confirmed was limited to several small features and two rock-cut cisterns only; no full-fledged structures were attested in the rockshelter (Fig. 22; Fig. 23). The former were concentrated in a flat, open-air space in



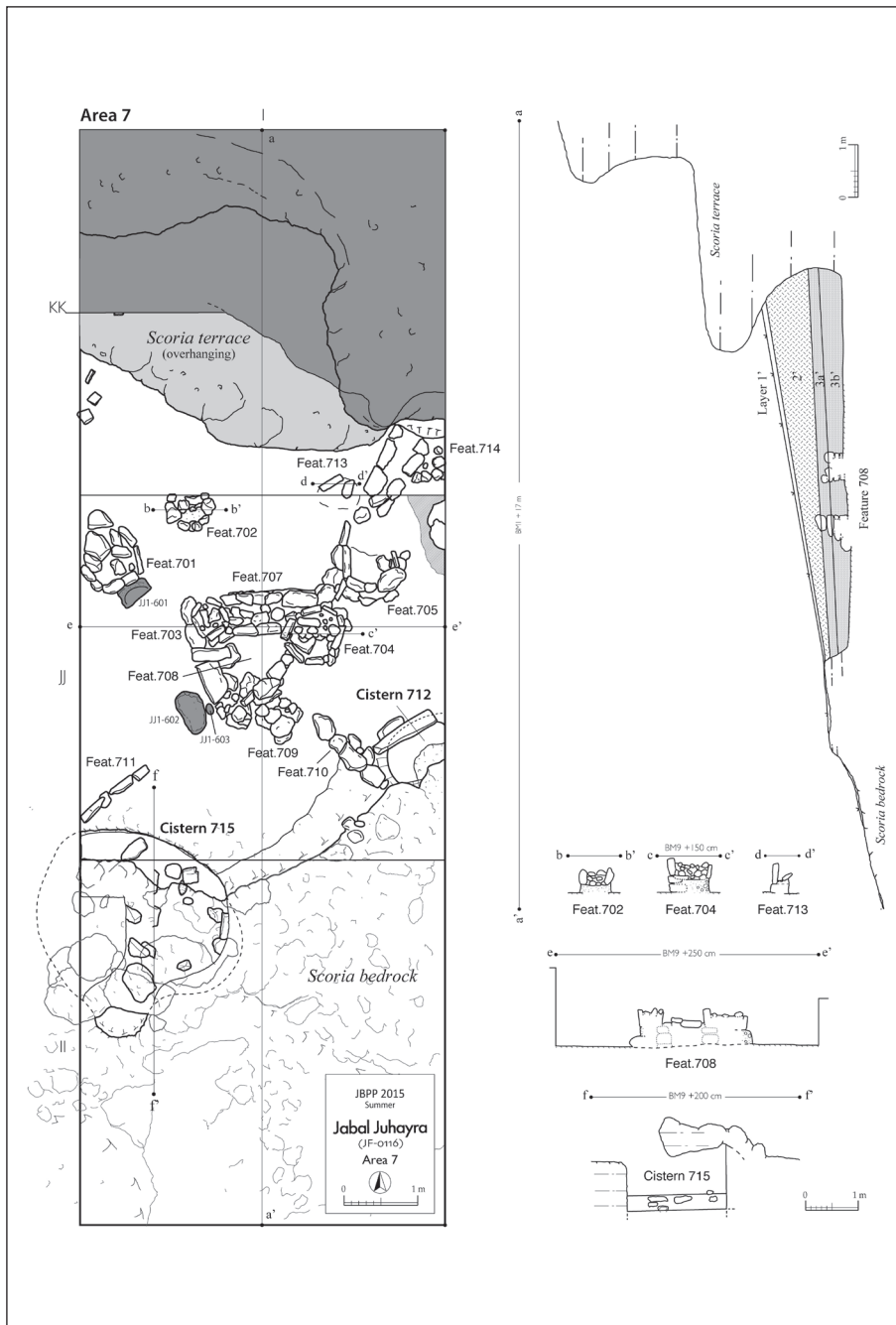
22. Area 7: general view of the open-air sanctuary (looking NNW).

front of the empty rockshelter, and consisted of a total of seven upright-slab-lined round features (Features 701-705, 709 and 713). Three of them (*i.e.* Features 703, 704 and 709) were connected to each other by means of three short masonry walls, forming a triangular complex *c.* 1.5m across (Feature 708). They belong to Layer 3' and can be regarded as outdoor versions of a similar feature found in the rear room of Rockshelter 6 (FIG. 7: 7).

Meanwhile, the two pit-type cisterns *c.* 1-2.5m in diameter (Cisterns 712 and 715) were cut into the scoria bedrock layer (Layer 5') exposed in the southern half of the operation area and were subsequently buried under Layer 3'-1' deposits. Both of them were inferior in construction quality and resembled the simple cisterns behind Rockshelter 6 rather than the carefully finished cisterns in the neighboring Area 5.

It is our present interpretation that all features in this operation area are relatively early in date and roughly coeval with Rockshelter 6. It is possible that they belonged to a yet-to-be-identified early rockshelter dwelling(s) on the northern slope. Future excavation is expected to shed new light on the issue.





23. Area 7: plan and sections/elevations of the open-air sanctuary.

### Supplementary Operations

In addition to the excavations described above, we conducted the following supplementary operations as well. What we addressed first was an inspection of a dozen rockshelters at the head of the small valley (**Fig. 3**). No signs of Neolithic occupation were attested at the stage of surface survey, but we test excavated three of them (Rockshelters 1001-1003) just to make sure (**Fig. 24**). The results were as anticipated, and neither structural remains nor diagnostic artifacts were found. It also turned out that their



24. Rockshelter 1005: general view after test excavation (looking NE).

floor deposits are much thinner (up to *c.* 0.5m) than those of the rockshelters in Area 1. Both facts suggest that none of the rockshelters at the head of the valley were used as dwellings, at least in the Neolithic period. Seeing that no dung layer other than recent ones was confirmed, it is also unlikely that they were used as animal pens for the Neolithic rockshelter settlement. Incidentally, the intensive survey also located a few square, rock-cut cisterns *c.* 8-10m across and at least *c.* 1m in floor depth (*e.g.* Localities 1006 and 1007 in **FIG. 3**). These exceptionally large cisterns might possibly have something to do with a Roman or Islamic beacon station on the hilltop of Mt Juhayra, but further investigation is needed to tackle this interesting issue.

Another target of the supplementary operations was a small flint concentration (Locality 1001) found on a narrow scoria ledge *c.* 10m behind Rockshelter 6 (**Fig. 25**). We briefly examined it and confirmed that the flint concentration, *c.* 0.5m in diameter and *c.* 10cm thick, contained 27 irregular blades and 26 flakes including one calcite product. Neither core- and debitage-class products nor retouched tools were included. The absence of naviform core-and-blade components is suggestive of a post-PPNB date for the flint collection, while the absence of cortical knives implies a pre-LN/Chalcolithic date. In this sense, it might possibly represent a short stay between the two stratified Neolithic settlements.

In addition, we carried out a brief survey around the site and located a small-scale layered outcrop of cortical flint slabs (Locality 2001) at a point *c.* 1km northeast of the site (**Fig. 3**). As suggested above, there is a high probability that the outcrop served as a source of the standardized construction materials used for the facing walls of Rockshelter 6.

### **Layer 3 Settlement: Small Finds**

The Layer 3 settlement yielded a huge number of artifacts, of which chipped-flint artifacts and grinding implements made of scoria or limestone were overwhelmingly predominant. Other artifacts included stone vessels, miscellaneous stone products, bone tools and shell/snail ornaments, but these were much less common. As in the case of the overlying Layer 2 encampment, the lack of artifact variety seems

to suggest the involvement of a small-scale, high-mobility population group. Since the close examination of these small finds is still in progress, we will only give their category-by-category overview.

### *Chipped Flint/Calcite Artifacts*

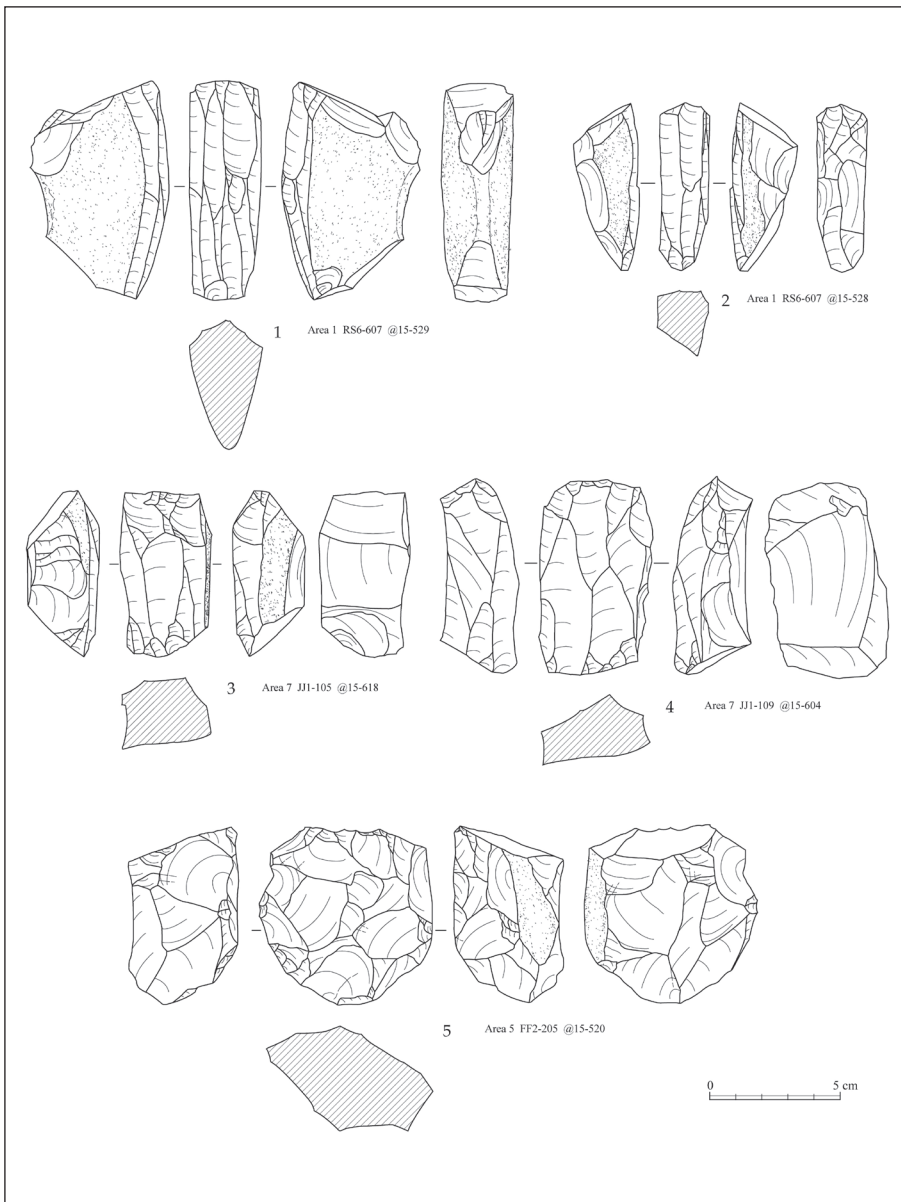
More than ten thousand chipped-stone artifacts were found in the Layer 3 settlement. The vast majority of them were made on high-quality Eocene flint, but several dozen calcite products were also included. No obsidian artifacts were found. The raw material of the flint products was probably procured from layered outcrops extending along the northern edge of the adjacent Jafr Basin, but the material source of the calcite products is still unknown.

The core- and debitage-class products centered around naviform core-and-blade components that mark the M-LPPNB flint assemblage in the Levant (**Fig. 26: 1-4**). Crested blades and core tablets related to them were also found frequently. Besides, single-platform blade or flake cores and change-of-orientation flake cores also occurred in small numbers (**Fig. 26: 5**). The existence of these core- and debitage-class products corroborates that most, if not all, of the retouched tools described below were produced within the settlement.

What characterized the tool class products was the predominance of hunting weapons, which broadly consisted of Badia points (**Fig. 27: 1-14**) and Amuq-type points (**Fig. 27: 15-25**). No typical examples of Jericho- and Byblos-type points were attested. Second commonest were drills (**Fig. 28: 1-7**), which were usually made on blades and equipped with a relatively long and robust tip. Other tool-class



25. Locality 1001: general view before excavation (looking S).



26. Jabal Juhayra: chipped flint artifacts from Layer 3.

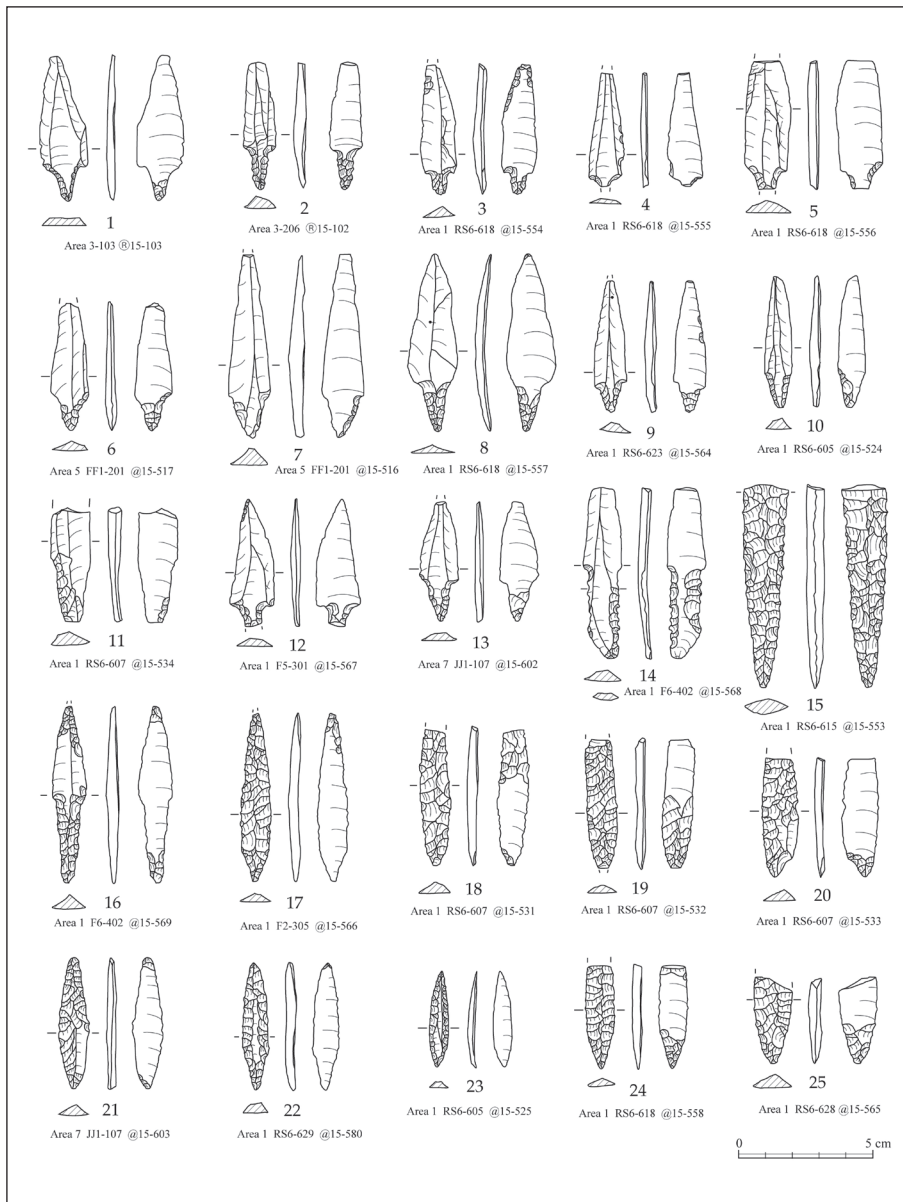
products included serrated blades (**Fig. 28: 8**), angle or dihedral burins (**Fig. 28: 10-12**), notches/denticulates (**Fig. 28: 13**), side or end scrapers (**Fig. 28: 14**), elongated bifacial tools (**Fig. 28: 9**), cortical knives (**Fig. 29: 1**), and axes (**Fig. 29: 2**), but their frequency was much lower than the two major tool types. In addition, heavy-duty digging tools made of large flint flakes or elongated basalt rods were also attested (**Fig. 29: 3-7**). The basalt products had a length of up to *c.* 30cm and a weight of *c.* 0.5-0.8 kg, being equipped with a robust, chisel-like working edge at their distal end. They were probably used for digging the rock-cut cisterns and modifying the inner surfaces of the rock-shelters.

### Grinding Implements

The Layer 3 settlement yielded eighty-three querns and fifty-two grinding slabs, all of which were made of limestone or scoria/basalt. The querns were dominated by large, oval, basin-type products *c.* 50-60cm long and *c.* 25-30cm wide (**Fig. 30**). Most displayed large flaking scars where their edges had been trimmed.

The grinding slabs, on the other hand, centered around relatively large, semi-rectangular products *c.* 15-20cm long and *c.* 12-15cm wide, but smaller, round to oval examples *c.* 10-15cm in diameter or length also occurred to a lesser extent (**Fig. 31**). The former are unique to the Layer 3 settlement at Jabal Juhayra and have no parallels at contemporary sites in the Jafr



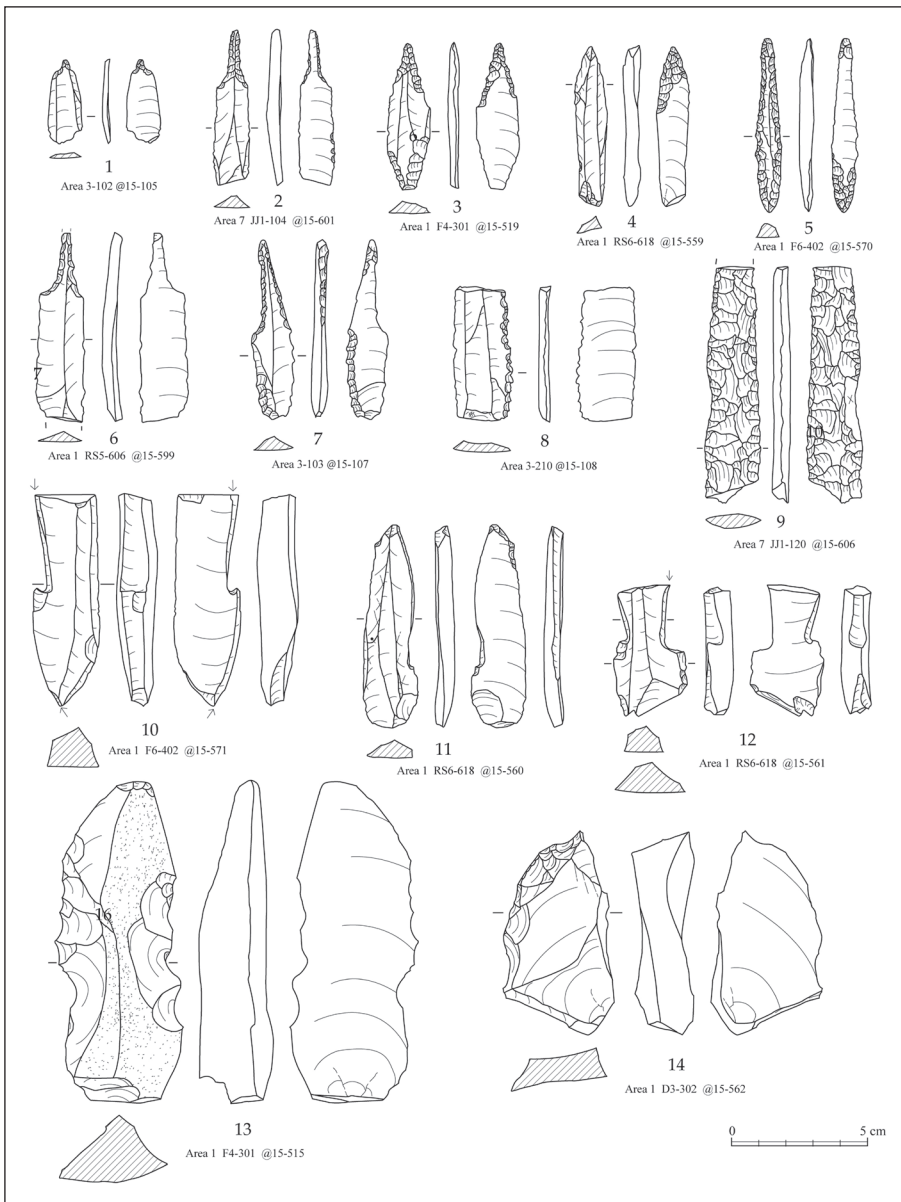


27. *Jabal Juhayra: chipped flint artifacts from Layer 3.*

Basin known to date. (This fact will become important in discussing their specific use.) In addition, a stamp-like scoria product with a flat base and small knob handle also falls into this category (**Fig. 31: 9**).

The frequency of grinding utensils, together with the occurrence of serrated blades and the probable existence of basin-irrigated terraced fields, suggests that exploitation of plant resources - including cereal plants - was among the major subsistence activities practiced at the Layer 3 rockshelter settlement. In fact, as noted above, some of the grinding implements were found *in situ* beside the large cisterns in Areas 1 and 5, implying that the processing of plant foods - probably including cereal grains -

accounted for a significant portion of everyday life at the rockshelter settlement. It should be added, however, that a few flat querns retained red granules of probable scoria origin on their working surface (*e.g.* **Fig. 30: 12**). These were possibly associated with the production of scoria cement used for paving the floors of the tub-and terrace-type rock-cut cisterns. The same is true of the large, semi-rectangular grinding slabs, some of which might have been used in combination with the red-stained querns to produce the paving material. It is also highly probable that they were used independently for smoothing the uneven surfaces of the rock-cut cisterns and rockshelter dwellings. Seeing that they have a large working surface not always



28. *Jabal Juhayra: chipped flint artifacts from Layer 3.*

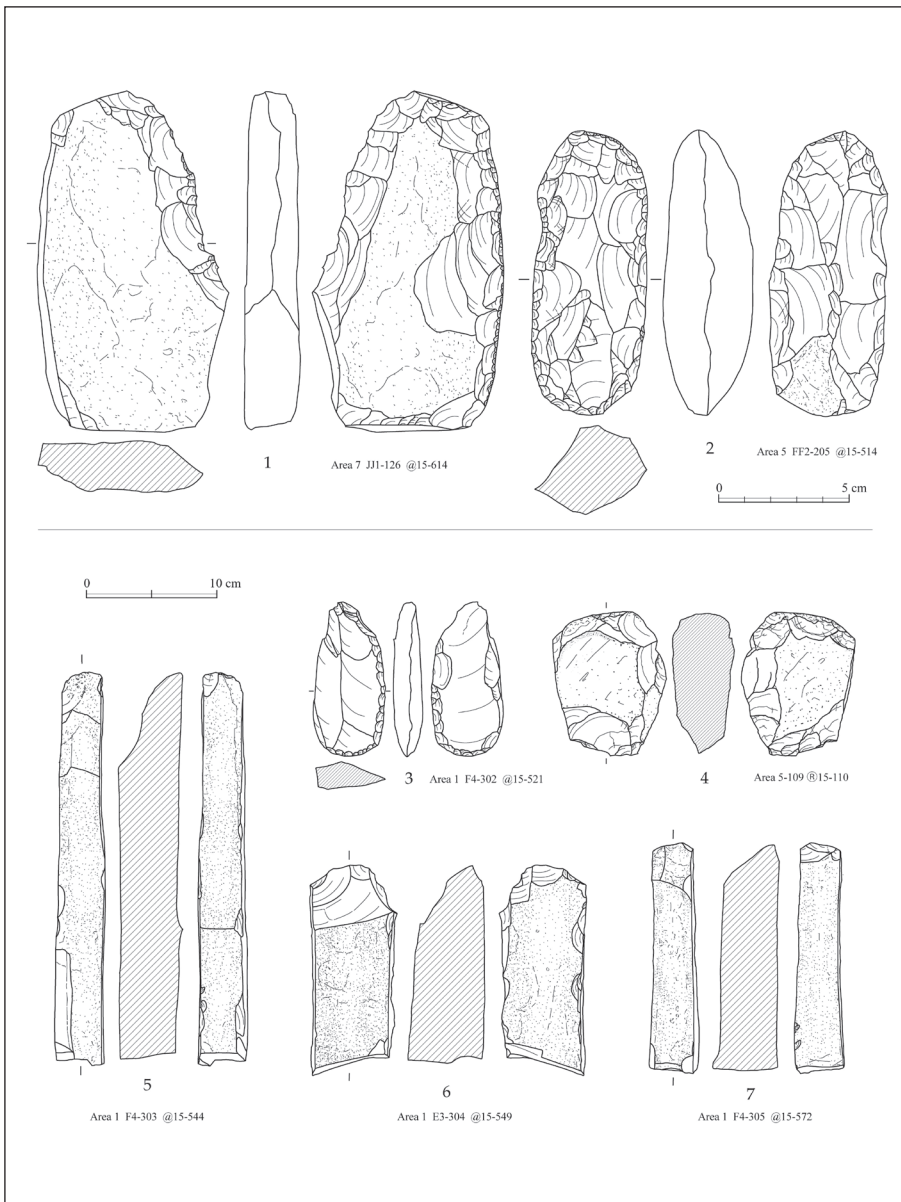
fitting the concavity of the querns - and that they are limited to the rockshelter settlement of Jabal Juhayra - the latter interpretation might be more likely.

### Stone Vessels

Stone vessels are the third most common artifact class, and twenty-seven products occurred in various contexts. They were divided broadly into small scoria/basalt products *c.* 10-15cm in diameter and large limestone products up to *c.* 50cm in diameter (**Fig. 32**). The frequency of the former can be understood as a phenomenon unique to the rockshelter settlement on the volcanic hill. Meanwhile, the latter products were probably produced using raw materials brought

into the settlement. In terms of vessel form, the scoria/basalt products centered around small cups and shallow bowls, whereas the limestone products are limited to shallow basins with a gently incurved rim. The development of stone vessels is comparable with the Jafr PPNB outposts, including Wādī Abū Ṭulayḥah (*e.g.* Fujii 2008a: fig. 30).

In addition, the assemblage included a flint bowllet, a unique miniature vessel produced taking advantage of a natural shallow depression on a cortical flint slab (**Fig. 32: 8**). Though collected as a surface find beside Area 5, the occurrence of this unique artifact *c.* 6-7cm in diameter illustrates that the Juhayra Layer 3 settlement was incorporated into the extensive



29. *Jabal Juhayra: chipped flint/basalt artifacts from Layer 3.*

trade network of the Late PPNB southern Levant (Fujii 2010a, 2012; Gebel 1999; Wilke *et al.* 2014). A similar, yet larger, scoria product was also found, but it is uncertain whether it falls into the same category (Fig. 32: 9).

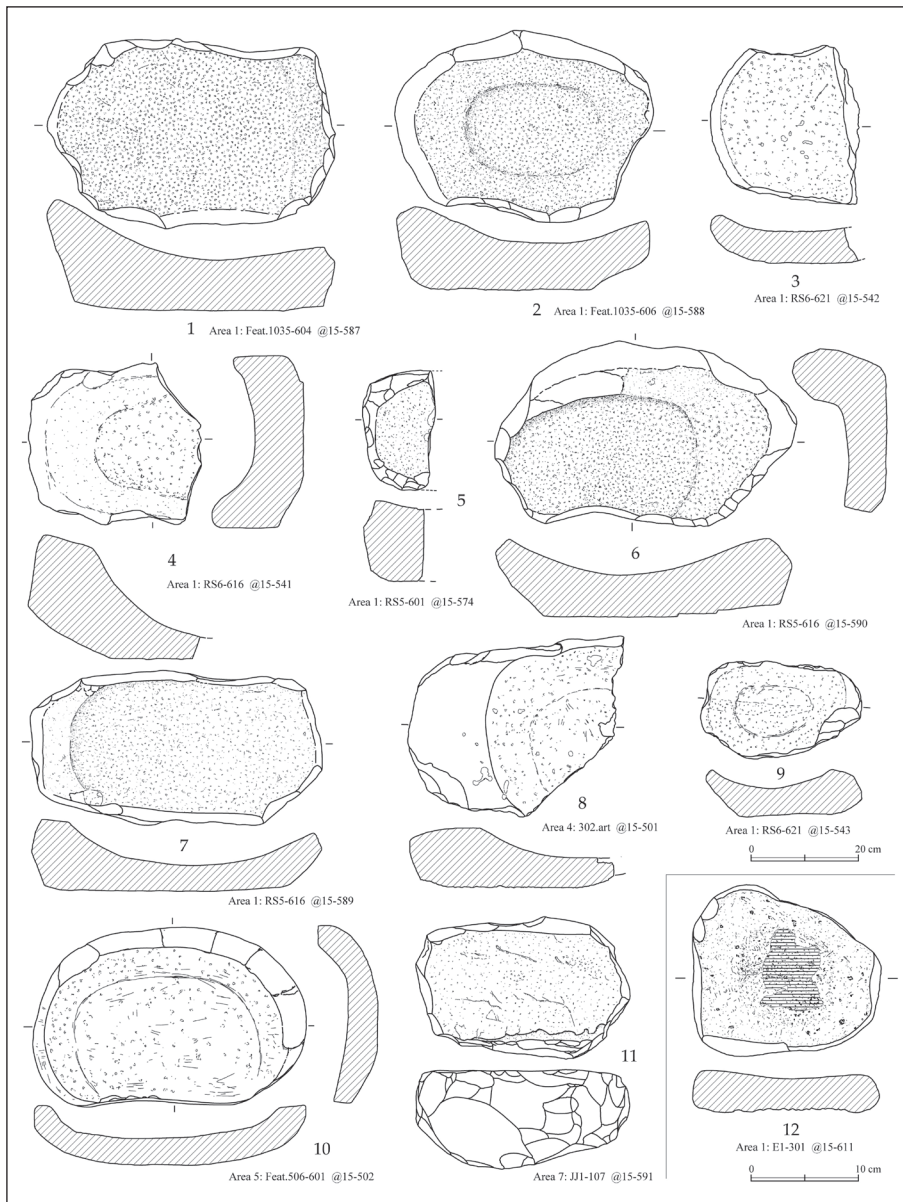
#### *Other Stone Products*

Other stone products included a notched and grooved stone weight (Fig. 32: 11), a chronological marker of the Jafr PPNB (Fujii 2010b). This large basalt product has a length of *c.* 35cm, thickness of *c.* 10cm and weight of *c.* 27 kg. As described above, it was found *in situ* on the steps in front of Rockshelter 5. A petroglyph depicting a quadruped with a long curling tail, probably a cheetah or a panther, was added to

the upper edge of one surface. This iconography was ~12cm long and produced by a pecking technique, both of which are characteristic of PPNB petroglyphs in the Jafr Basin (Fujii 2008b).

Also included in this category were three oval to semi-triangular limestone or scoria products with an off-center hole *c.* 5cm in diameter. They were relatively large in size, measuring *c.* 15cm in diameter or longer axis and *c.* 1.5-2 kg in weight. As described above, one of them was included in the cache-like artifact concentration found in the rear room of Rockshelter 6 (Fig. 9: 7). Meanwhile, one of the remaining two was recovered from a lower fill layer of Cistern 505 (Fig. 33: 1), and the other





30. *Jabal Juhayra*: querns from Layer 3.

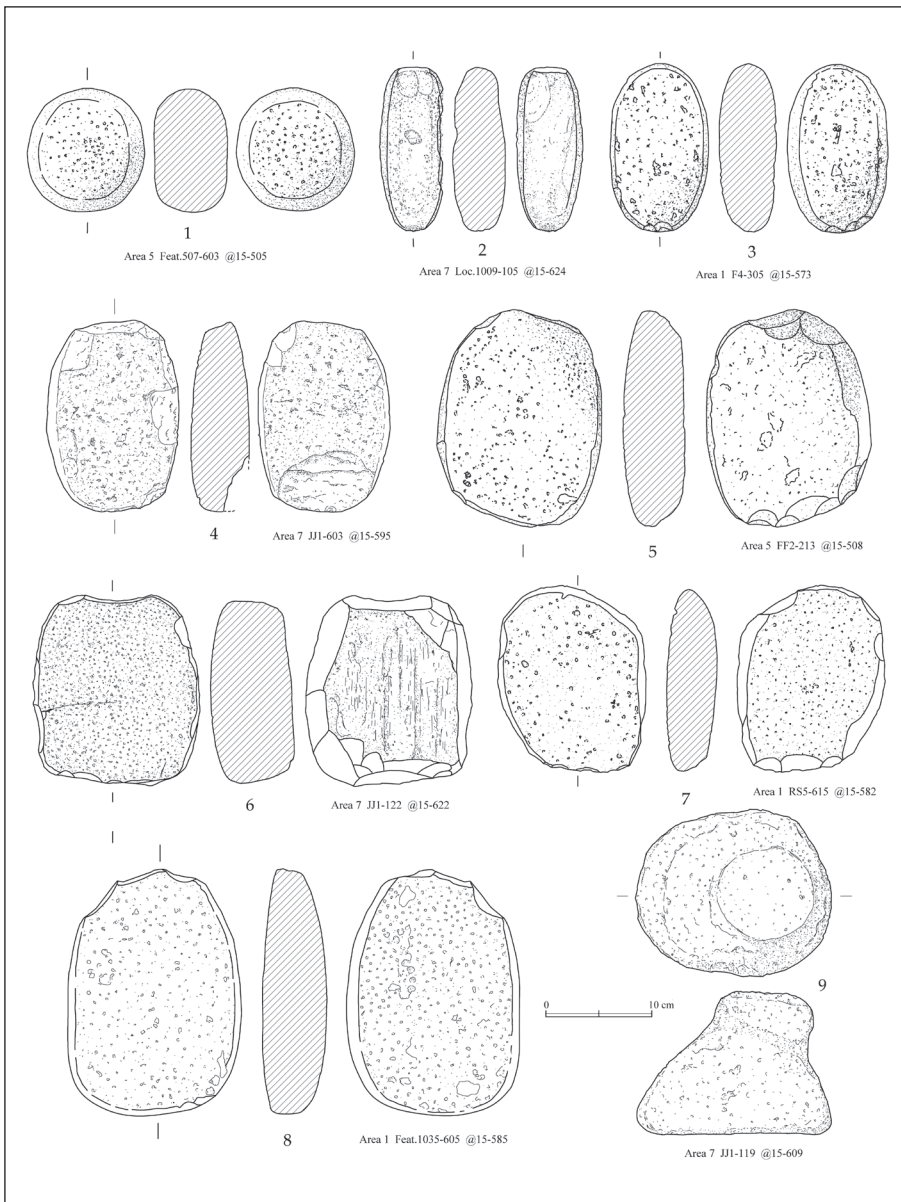
was found on the floor of Cistern 507 (**Fig. 33: 2**). Seeing that two of the three occurred in the context of water-catchment facilities, and that they retained use wear on their lateral surfaces, they are thought to have been used as upright smashing and/or grinding implements. Similar products have been reported from ‘Ayn Abu Nukhayla (Kadowaki 2014: fig. 17.5), a contemporary settlement in the Wād īRumm drainage basin.

In addition, several *ad hoc* whetstones made of sandstone or limestone also occurred (**Fig. 33: 3-4**). They measured *c.* 5-10cm long, having a rod-like appearance rather than a standard slab-like shape. As with the semi-rectangular grinding tools described above, they were

possibly used for smoothing the uneven surfaces of the rock-cut cisterns.

#### Bone Tools

In contrast to the frequency of faunal remains, animal-bone tools were extremely scarce, being limited to a baton-like rubbing tool *c.* 5cm long (**Fig. 33: 5**), a tip fragment of a semi-rectangular spatula *c.* 2cm wide (**Fig. 33: 6**), a robust pointed tool *c.* 8cm long (**Fig. 33: 7**), and two slender awls *c.* 5-6cm long (**Fig. 33: 8-9**). Most of them exhibited remarkable sheen on their working surface(s) or edge(s), suggesting repeated use on a soft material such as leather. A scarcity of animal-bone tools is amongst the remarkable cultural traits of the



31. *Jabal Juhayra: grinding tools from Layer 3.*

Jafr PPNB, including Wādī Abū Ṭalayḥah (e.g. Fujii 2006a, 2006b).

#### *Adornments*

Adornments were even scarcer, consisting only of a very thin, button-like shell product with a hole *c.* 1cm in diameter (Fig. 33: 10) and a fragment of a cowrie shell (Fig. 33: 11). The scarcity of adornments is another characteristic of the Jafr PPNB.

#### **Faunal/Botanical Remains**

Hundreds of faunal remains were recovered from the Layer 3 settlement, especially the floor deposits of the rockshelter dwellings. Future archaeozoological analyses are expected to shed

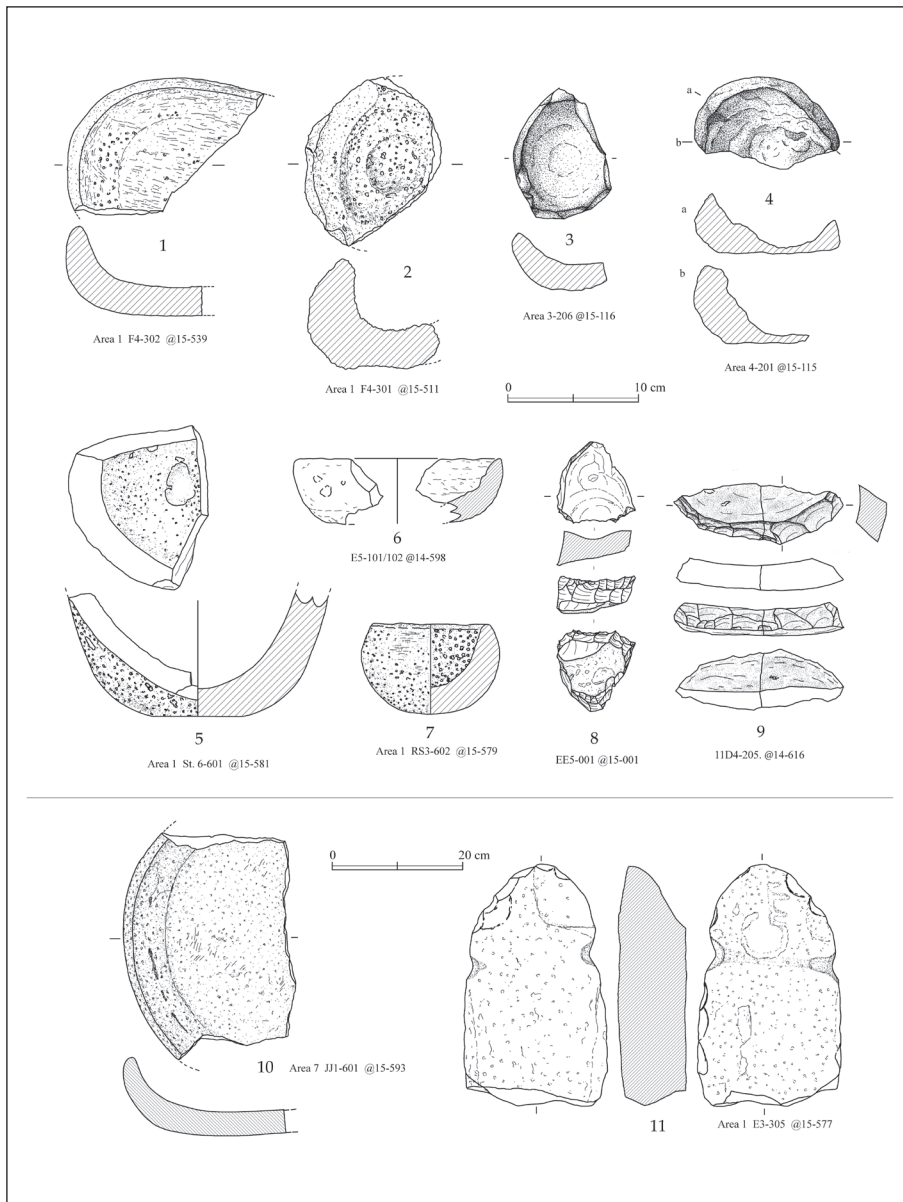
light on the exploitation of animal resources at, and the environmental conditions around, this unique settlement. In addition, several dozen liters of floor deposit and hearth fill were retained for archaeobotanical analysis.

#### **Discussion**

This series of excavations has shed light on the overall picture of the Layer 3 rockshelter settlement. To conclude, we will briefly discuss its general traits. We would like to point out in advance that the following perspectives are still tentative and need further verification.

#### *General Profile of the Settlement*

The Layer 3 settlement consists of the six

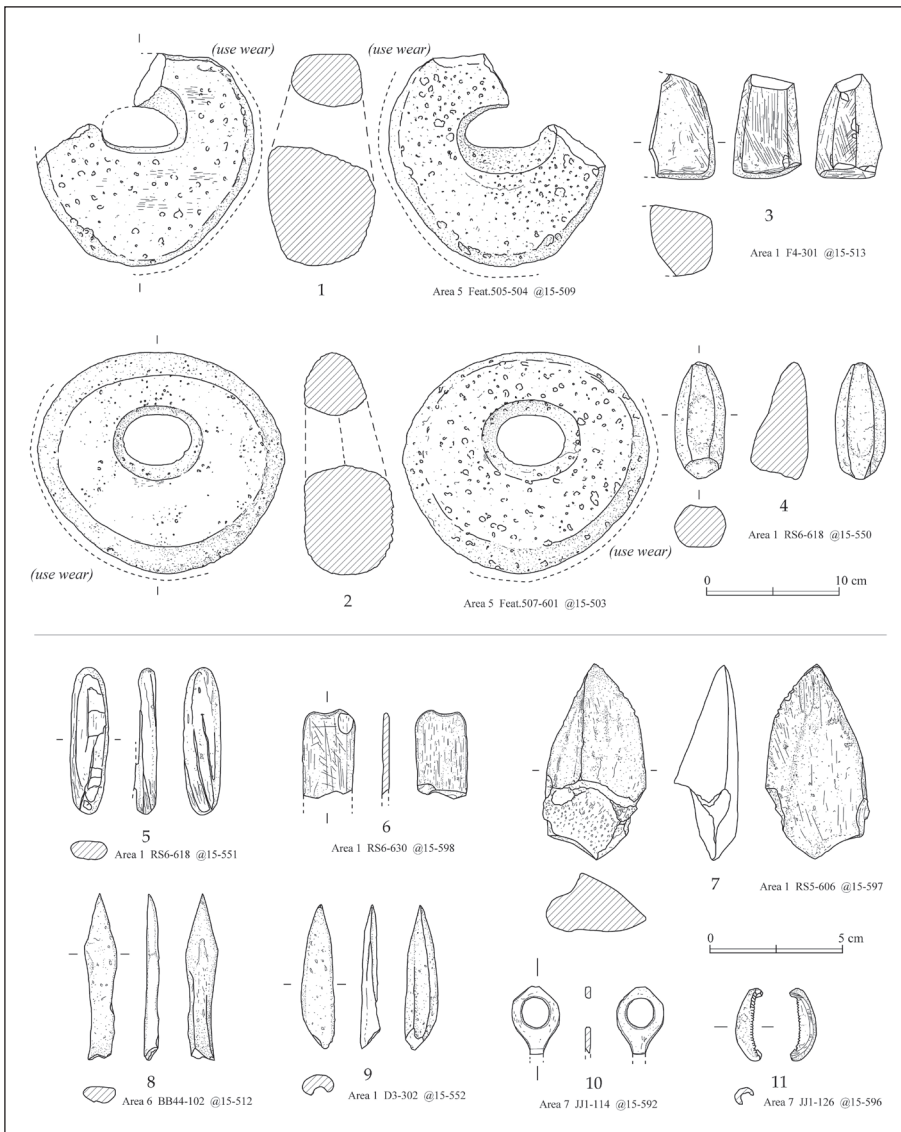


32. *Jabal Juhayra: stone vessels and stone weight from Layer 3.*

rockshelter dwellings in Area 1 and their ancillary facilities dotted over the seven operation areas, being roughly estimated at *c.* 0.5ha in total area. In view of the research outcomes in Areas 2 and 6, and Localities 1003-1005, it seems unlikely that the rockshelter dwellings extend beyond Area 1. Meanwhile, the terrace walls in Area 1, the rock-cut cisterns in Area 5, and the ritual features and cisterns in Area 7 are potentially more widely distributed than presently demonstrated. However, even taking that possibility into consideration, the fact remains that the composite settlement is small in scale. It is safe to say that the settlement represents an outpost, a standard settlement form of the Jafr PPNB.

The combination of an outpost-size settlement and barrage/cistern system has also been attested at Wādī Abū Ṭulayḥah (Fujii 2007a, 2007b, 2009, 2014) and Wādī Ghuwayr 17/106 (Fujii, Adachi, Quintero *et al.* 2011; Fujii, Quintero *et al.* 2011; Fujii, Adachi, Endo, Yamafuji *et al.* 2012, 2013). What differentiates the Juhayra complex from the other two is its unique topography, which lies behind its combination of features including rockshelter dwellings, rock-cut cisterns and terrace walls. In contrast, the other two complexes are located in the middle of the flat, flint-strewn desert (*hamada* in Arabic) and, for this reason, are marked by semi-subterranean masonry dwellings, similarly semi-subterranean cisterns,





33. *Jabal Juhayra: miscellaneous stone products, bone tools, and shell ornaments from Layer 3.*

and large-scale basin-irrigation barrages not associated with terrace walls. The coexistence of these two distinct types of outpost complexes illustrates that the PPNB population groups in the Jafr Basin coped successfully with the diversity of topographic conditions within their extensive territory. The unique character of the Juhayra complex can be understood in this context.

### Dating

A dozen C<sub>14</sub> dates are available for dating the Layer 3 settlement. Aside from two exceptions (IAAA-151272 and -151273), all of them converge on a limited time range around 7,500-7,200 calBC, indicating that the settlement dates to the first half of the Late PPNB (Table 1). The built-in pier-house and occurrence of

diagnostic finds such as Amuq-type points and the flint bowlet support the results of the radiometric dating. In addition, the existence of the overlying Layer 2 (LN/Chalcolithic transitional) rockshelter encampment warrants the validity of the dating from another angle (Fujii, Adachi and Nagaya n.d.).

Thus, we can conclude that the settlement is roughly coeval with the other two Jafr PPNB outpost complexes referred to above. What is important here is that unlike the other two, it is located in an intermediate zone between farming communities to the west and desert outposts to the east. Thus, the settlement is expected to bridge the two distinct cultural zones and contribute to a comprehensive understanding of the initial process of pastoral nomadization in southern Jordan.

### Intra-Site Architectural Sequence

The next issue is the intra-site structure/feature sequence of the composite settlement. This issue has two aspects: the chronological relationship between the northern and southern structural complexes, and the intra-complex structure/feature sequence. As for the first issue, there is no remarkable difference in C14 dates between Areas 3, 5 and 7 on the northern slope and Areas 1 and 4 on the southern slope. Thus, it is conceivable that the six rockshelter dwellings and the various features dotted on both slopes combined to form a unified settlement. As noted above, the commonality of small finds between both slopes also supports such an interpretation.

This is not necessarily to say, however, that every feature in the complex was constructed concurrently. It is possible that minor gaps intervened between them. Noticeable in this regard is the aforementioned techno-typological sequence of the six rockshelter dwellings, which suggested that the settlement began with the rock-cut, built-in pier-house in Rockshelter 6, proceeded through the eclectic Rockshelters 5-2, and ended with the simple Rockshelter 1 without any remarkable modification. Given this, it would follow that the rock-cut cisterns in Area 1 developed from the simple pit-type examples behind Rockshelter 6 toward the tub-type ones in front of Rockshelter 1.

Taken together, we can tentatively conclude that the Layer 3 settlement started with the combination of the rock-cut, built-in pier-house in Rockshelter 6 and the simple rock-cut cisterns behind it, then gradually shifted northwestwards, and ended eventually with Rockshelter 1, quite simple in itself but associated with the tub-type cisterns. The question is at what stage in this sequence the settlement was equipped with the barrage-and-cistern system on the opposite slope, but this is difficult to pinpoint. It is our present interpretation that the well-organized barrage/cistern system on the northern slope was added during, or possibly after, the second half of the rockshelter sequence.

### Site Function

A key to approaching this issue is the seasonality of the settlement, but the research outcomes are ambiguous and admit various

interpretations. The settlement is located on the arid margins and is very small in scale, scarce in artifact variety and centers around the more or less *ad hoc* rockshelter dwellings. From these viewpoints, we can define it as a temporary encampment that accommodated a small-scale, high-mobility population group. Nevertheless, it is also possible to regard it as a rather stable - not to say sedentary - settlement in view of the existence of the built-in pier-house, the construction of the full-fledged water-catchment facilities, and the development of heavy-duty stone products. However, seeing that such an eclectic character is shared with the Jafr PPNB outposts, an interpretative framework that places the terms 'sedentary' and 'temporary' in binary opposition might, in itself, be inappropriate in this case. Taking this into consideration, it seems reasonable to assume that the Layer 3 rockshelter settlement represents a fixed, yet seasonal, outpost used constantly every year.

Another important clue to site function is the character of subsistence activities. The research data are suggestive of an eclectic character in this aspect as well. While the predominance of projectile points in the tool kit highlights the importance of hunting activities, the frequency of grinding implements and occurrence of serrated blades imply that the exploitation of plant resources also played an important role in the site's economy. Although detailed faunal data are not yet available, it is also highly likely that the rockshelter dwellers were engaged in livestock herding. In view of these considerations it would follow that, as evidenced at Wādī Abū Ṭulayḥah (Hongo *et al.* 2013; Nasu *et al.* 2010), the Layer 3 rockshelter dwellers at Jabal Juhayra directly - yet on a smaller-scale - transplanted the risk-mitigating, composite subsistence strategy common to their parent settlements into their outpost. In this sense, the settlement by no means represents an isolated encampment of desert dwellers. Rather, it should be regarded as a subsidiary outpost closely tied to a parent settlement to the west.

From the above, it is tentatively concluded that the Juhayra Layer 3 rockshelter settlement represents a fixed, yet seasonal, outpost of a small-scale population group derived from a parent settlement under the Mediterranean climatic regime. It should be added, however, that

the settlement's stability as a fixed outpost was not kept at the same level throughout its whole occupational history. In fact, the architectural sequence in Area 1 suggests that lifeways at the outpost gradually shifted from the relatively stable occupation represented by Rockshelter 6 towards more temporary visitations as suggested by Rockshelters 5-1. The *ad hoc* reuse of the same rockshelters by the Layer 2 inhabitants can also be understood as an extension of the same general trend. It is noteworthy that the site function of the Layer 3 settlement underwent remarkable change in its short occupational history.

### Archaeological Implications

The Layer 3 rockshelter settlement has a few significant archaeological implications. To begin with, it has offered a final conclusion on the dating issue of the Jafr barrage-and-cistern system that was questioned by some scholars (e.g. Finlayson *et al.* 2011: 203-204; Flohr *et al.* 2011: 123). What offered a breakthrough regarding this issue was the stratigraphy of, and C<sub>14</sub> dates from, Areas 3 and 5, both of which clearly demonstrate that the Jafr barrage-and-cistern system dates back to the PPNB period. The occurrence of PPNB artifacts also corroborates the dating. Amongst other data, several querns and grinding slabs found *in situ* on the floor of Cisterns 506 and 507 in Area 5 highlight the fact that part of the water-catchment system was used as a food-processing place within the Layer 3 settlement (**Fig. 19: 2-3**). The same applies to Cistern 1035 in front of Rockshelter 1, where two pairs of nested querns and grinding slabs were found *in situ* on its floor (**Fig. 10: 4-5**). Similar objects occurred in the adjacent rockshelter dwellings, again indicating that both facilities were used in combination as part of a unified settlement. It also deserves consideration that the pit-type Cistern 504 in Area 5 contained approximately five hundred naviform core-and-blade components in its lower fill layers. The only regretful matter is that the central part of the barrage wall is entirely washed out and, for this reason, it was not possible to confirm the incorporation of stone weights and pillar sockets, a unique custom common to PPNB barrages in the basin (Fujii 2013: 63-67). Aside from this, accumulated evidence clearly indicates that the

Layer 3 settlement was associated with a well-organized barrage-and-cistern system (Fujii 2016). There is no doubt that the settlement represents the third example of the Jafr PPNB outpost complex, following Wādī Abū Ṭulayḥah and Wādī al-Ghuwayr 17/106.

Second, the settlement has provided a key to tracing subsequent penetration into arid terrain. Our previous reports argued that the initial process of pastoral nomadization in the Jafr Basin is traceable through the gradual replacement of the PPNB triple set (*viz.* outpost, barrage and cistern) with the loose combination of a small encampment such as Khashm al-‘Arfa (Fujii, Adachi, Yamafuji *et al.* 2013) and an open-air sanctuary such as Harrat al-Juharya (Fujii 2005), Qā‘ Abū Ṭulayḥah (Fujii 2000, 2002, 2003) and the ‘Awja sites (Fujii, Adachi, Endo *et al.* 2013; Fujii, Yamafuji *et al.* 2012). However, this perspective was based on rather patchy datasets. The excavations at Jabal Juhayra have now shed new light on this long-standing issue. Although a two-millennium gap still intervenes between Layers 3 and 2, the stratified Neolithic settlement unexpectedly contains all five of the major components referred to above (*i.e.* PPNB outpost-size settlement, barrage and cistern on the one hand, and post-PPNB encampment and open-air sanctuary on the other). This has enabled us to bracket the episode at hand more tightly - at the same site. In fact, the technological sequence of the six rockshelter dwellings and the existence of an overlying Layer 2 encampment have offered a glimpse into the gradual shift from parent-settlement-based transhumance, through eclectic lifeways, to full-fledged pastoral nomadism.

In addition, the Layer 3 settlement has shed new light on the issue of the parent settlements of the Jafr PPNB outposts. Our previous argument suggested that the Jafr PPNB outposts derived from sedentary farming communities to the west (e.g. Fujii 2013), but this was no more than an anticipation based on the interactive flow of materiel and artifacts between the two adjacent areas. The discovery of the built-in pier-house in the intermediate zone has corroborated anew that the initial pastoral transhumants in the PPNB Jafr Basin derived from a Beidha Layer 2 type settlement to the west.



### Concluding Remarks

The excavations at the Layer 3 rockshelter settlement of Jabal Juhayra have revealed a unique Neolithic culture adjacent to the Fertile Crescent. Amongst other aspects, the built-in pier-house in Rockshelter 6 has bridged the sedentary PPNB and the Jafr outpost PPNB in many respects. In addition, the barrage and cisterns attached to the settlement have brought the issue of the dating of the water-catchment system in the basin to a final conclusion. It is no longer disputable that the Jafr outpost PPNB was sustained by such an advanced water-use technology.

Jabal Juhayra is a stratified Neolithic settlement exceptionally rare outside the Fertile Crescent. The transition from the Layer 3 (Late PPNB) settlement to the Layer 2 (LN/Chalcolithic transitional) encampment, together with the architectural sequence of the six rockshelter dwellings, illustrates the initial process of pastoral nomadization in southern Jordan. In this sense, the stratified settlement is expected to play an integrative role in bundling up patchy datasets collected previously in the basin, as well as bridging the two adjacent cultural zones. We would like to continue our efforts towards gaining a deeper understanding of this key site.

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