EASTERN BĀDIYAH ARCHAEOLOGICAL PROJECT: PRELIMINARY REPORT ON THE 2018 EXCAVATION SEASON AT LATE NEOLITHIC STRUCTURE W-80, WISĀD POOLS

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1. Introduction

For four weeks between 25 May and 22 June 2018, the Eastern Bādiyah Archaeological Project was once again camped by Wisād Pools in Jordan's Black Desert (**Fig. 1**). The primary objective of the season was to continue excavation of structure W-80, previously investigated in 2013 and 2014 (Rollefson *et al*. 2013; Rowan *et al*. 2015a; Rollefson *et al*. 2018a). Radiometric dates indicate that W-80 was repeatedly occupied between at least the mid 7th and mid 6th millennia cal BC, represented in the southern Levant by PPNC / Yarmoukian and Wādī Rabāḥ cultural entities and in the northern Levant and upper Mesopotamia by the Final PPNB / Early Pottery Neolithic and Halaf. Elsewhere in Mesopotamia, the Hassuna, Samarra and earlier 'Ubaid cultural entities held sway, while adjacent areas of the Arabian peninsula were characterised by the Northern Arabian Early Neolithic and Arabian Middle Neolithic. Evincing its geographical location, cultural reflections from all of these areas are manifest in the archaeological record of Wisād Pools.

Additionally, we wished to investigate a representative example of the Timnian-type (Rosen 2017: ch. 8) hut-and-enclosure compounds that cluster around the margins of the core area of Black Desert Neolithic (BDN [Wasse *et al*. in press]) structures surrounding the pools. This was done to test the hypothesis advanced by Betts *et al*. (2013: 189) that hut-and-enclosure compounds appear relatively late in the local Late Neolithic (LN) sequence. To that end, we conducted limited test excavations at structure W-400, located approximately 650m north of W-80.

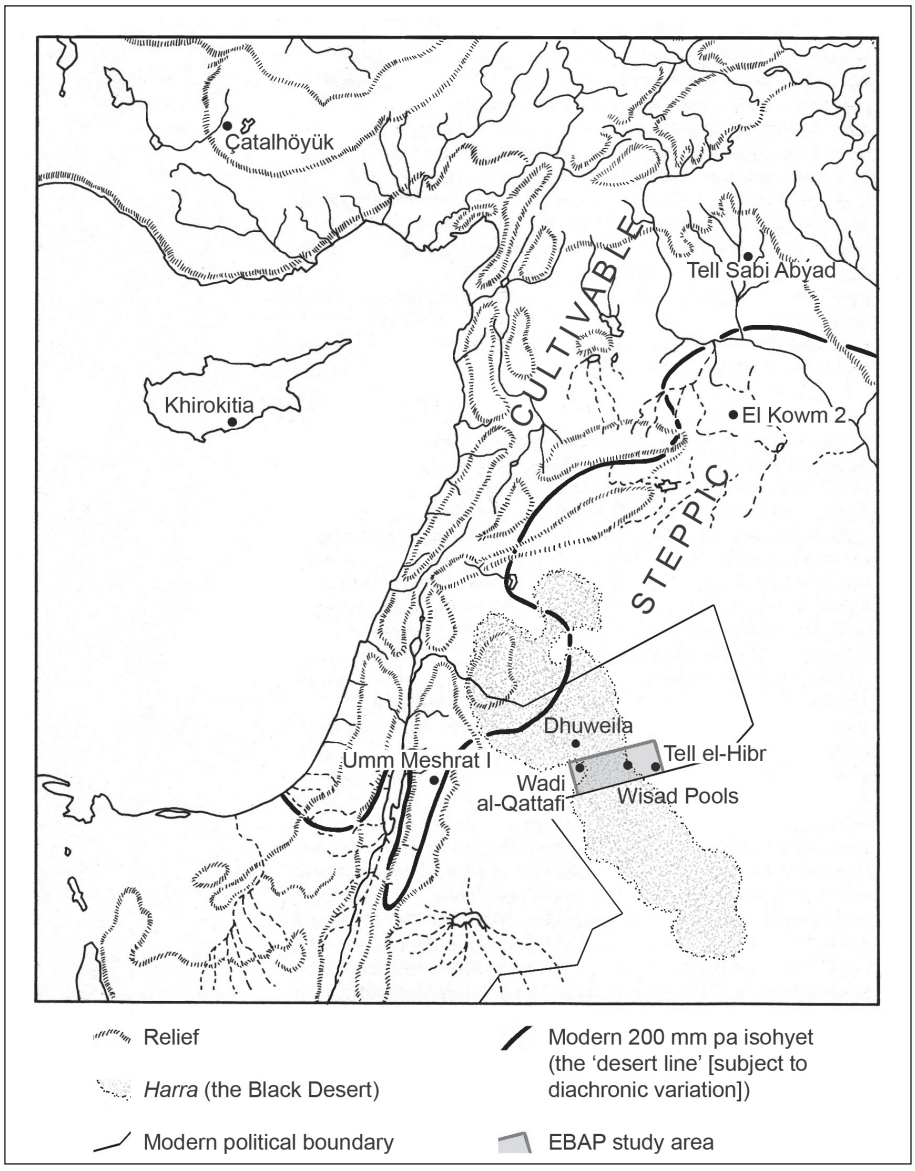
2. Structure W-80

2.1. Methods

In 2018, the single-context recording system utilised at W-80 in previous seasons was refined with the aim of improving spatial and chronological resolution. A 1×1m grid was dropped into the structure and excavation proceeded by subdividing the single-context record into 1×1m squares excavated in 5-cm spits. As has been the case since 2013, almost 100% of cultural deposits were dry-sieved through a 5-mm mesh; substantial flotation samples were also taken (see 5.1 below).

2.2. Stratigraphy and Phasing

As excavation and analyses of W-80 are still ongoing, it would be premature to offer a definitive interpretation of our results. It is clear that this substantial, somewhat rambling structure was repeatedly occupied, abandoned, modified and rebuilt over prolonged periods. Indeed, no two sections of walling are exactly alike. In the later stages of its use, W-80 saw increasingly segmented use of internal space that was manifest in repeated subdivision. On at least one occasion, deep cuts were made into earlier deposits for the purpose of erecting or underpinning internal dividing walls of substantial upright basalt slabs. The mixing of deposits that resulted has made it difficult to reconstruct the architectural sequence with certainty across all parts of the structure. Notwithstanding these challenges, after three seasons of excavation some general observations regarding the prehistoric stratigraphy and phasing can be made with a reasonable degree of confidence. These are summarised below, from earlier to later.



1. Map showing the EBAP study area and location of sites mentioned in text (excepting al-Shabah located almost 500km south of Wisād Pools [base map after Mellaart 1975: fig. 21]).

2.2.1. (?) Early LN

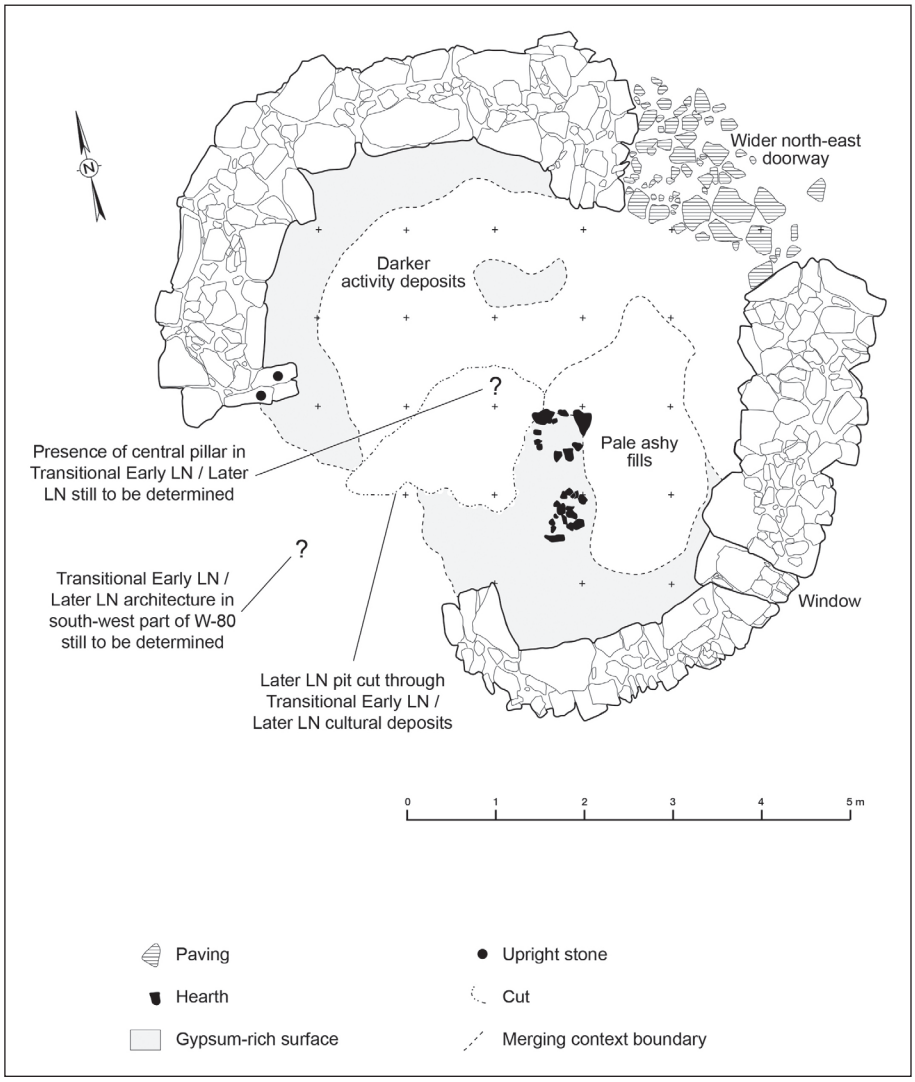
In the closing days of the 2018 season, confirmation of our suspicions (Rollefson *et al*. 2018a: 537) that W-80 might predate the Later LN (Baird's [1993: 77-78] steppe-specific, projectile-point-based periodisation used henceforth) was discovered. Separated from the overlying Transitional Early LN / Later LN (see 2.2.2 below) deposits in the south-eastern part of the interior by 5 - 10cm of extremely compact, reddish brown sand-silt with gypsum streaks, likely the remnants of a Transitional Early LN / Later LN gypsum-rich surface laid over a thickness of natural sediment, was an underlying paved surface. This consisted of smooth basalt slabs, some up to 1m in length, which were distinctive on account of their olivinitic hue. To date this has not been seen elsewhere in W-80, nor in the immediate vicinity of the structure. Some of these pavers underlie the base of the vertical interior slabs of the south-east wall of W-80 by almost 20cm and, indeed, continue beneath them. The relationship of this paved surface to the structural components of W-80 exposed so far thus remains to be determined, as does its ultimate extent. What is significant is that the radiometric date associated with the Transitional Early LN / Later LN (Beta 366676 [see 2.2.2 below]) provides a *terminus ante quem* for this phase of activity, in all probability pushing it back into the Early LN if not earlier. In this respect it might be reiterated that quite substantial Late PPNB cultural deposits are known from the area immediately west of Pool 1 (Wasse and

Rollefson 2005: 17 [for location see Rowan and Hill 2014: fig. 1]). As a substantial hearth between two of the pavers associated with the (?) Early LN yielded multiple radiometric samples, we are hopeful that this phase will be directly dated in due course.

2.2.2. Transitional Early LN / Later LN

This phase of activity (**Fig. 2**) is associated with an earlier, 2.3-m-wide iteration (Rowan *et al*. 2015a: 6, fig. 12) of the main doorway in the north-east wall of W-80, which has a roughly paved threshold extending across its full width. The phase is characterised by the degraded remnants of a gypsum-rich surface (see also 2.2.1 above) over which cultural deposits accumulated. The surface was thickest and best preserved around the northern and southern perimeter of W-80's interior, but in all probability originally extended across its full extent as indicated by preserved patches elsewhere. There is good evidence to suggest that the centre of the structure was more heavily disturbed in this and subsequent phases than its periphery, which doubtless contributed to the differential preservation of the surface. One previously reported radiometric date has thus far been obtained from these deposits. This yielded a range of 6,590 - 6,440 cal BC (Beta 366676 [Rollefson *et al*. 2018a: tab. 2]), straddling the Early LN / Later LN transition. In general terms, the cultural deposits associated with this phase consisted of pale ashy fills covering small, short-lived, stone-lined hearths (**Fig. 3**) and a high proportion of fire-cracked rock in the south-eastern part of the structure, with darker activity deposits elsewhere that seemed superficially associated with small grinding stones and heavily-worked cores.

No evidence for subdivision of the interior



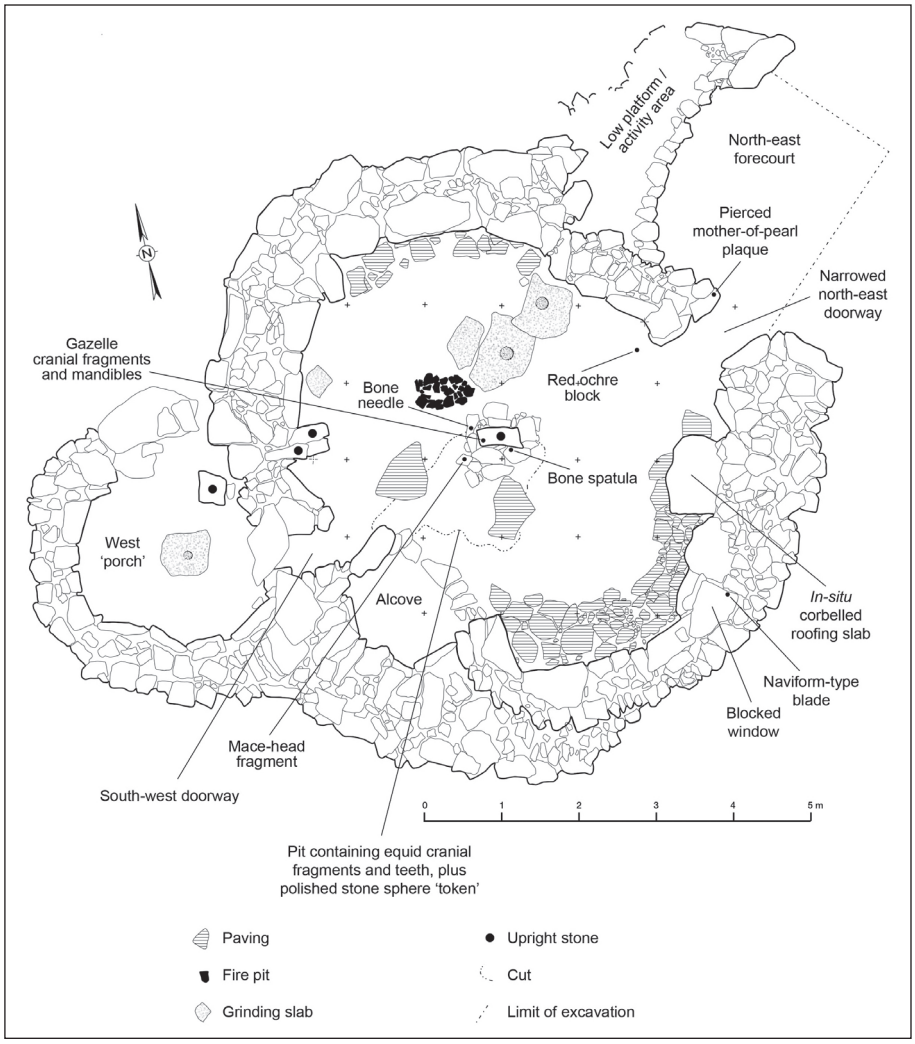
2. Schematic plan of W-80 during the Transitional Early LN / Later LN phase (±6,590 - 6,440 cal BC).

3. Small, short-lived, stone-lined hearth of the Transitional Early LN / Later LN phase; note disturbance by Polyphylla sp. beetle larvae.

during the Transitional Early LN / Later LN was found and none of the stone-built installations and large, *in-situ* grinding slabs with central mortars so characteristic of the subsequent Later LN phase (see 2.2.3 and 2.4 below) have been discovered to date. The abundance of ashy deposits in the interior hints that refuse disposal may not have been a priority, which is in turn suggestive (Hardy-Smith and Edwards 2004: 255-257 and references therein) of relatively intermittent use and concomitantly low site-occupation intensity (Munro 2004: S7). A major deficiency in our current understanding of the Transitional Early LN / Later LN phase is that, owing to disturbance associated with later remodelling (see 2.2.3 below), we have so far been unable to reconstruct the architecture of the south-western part of W-80 during this phase, nor have we ascertained whether a central pillar was a feature of the structure at that time.

2.2.3. Later LN

It is currently not known whether the Later LN phase of activity (**Fig. 4**) segued directly out its precursor or if there was an intervening break in occupation. Similarly, it is not certain for how long it endured, nor if occupation was



4. Schematic plan of W-80 during the Later LN phase (±5,765-5,570 cal BC); internal installations represent earliest sub-phase.

continuous or intermittent. Two previously reported radiometric dates can confidently be attributed to this phase: one of 5,765 - 5,670 cal BC (Beta 395440 [Rollefson *et al*. 2018a: tab. 2]) from a fire pit immediately south-west of the central pillar and the other of 5,710-5,570 cal BC (Beta 366675 [Rollefson *et al*. 2018a: tab. 2]) from a slightly later sub-phase within the main structure.

The Later LN phase began with a far-reaching remodelling of W-80. This included the narrowing of the main north-east doorway to *ca.* 0.6m (Rowan *et al*. 2015a: 4, 6, fig. 12) and the construction of the even narrower subsidiary south-west doorway. The latter gave access to the so-called west porch with its *in-situ* grinding slab with central mortar (Rollefson *et al*. 2013: 12, figs. 6, 9b) and thence to the west forecourt enclosure (*ibid*.: 12, fig. 6). A clear shift to incorporating external space within the bounds of the structure seems thus to have occurred. Establishing whether this was correlated with an increased focus on herding at W-80 is a goal of ongoing faunal analysis.

Within W-80, a substantial irregular pit (see also 2.6 below) containing a large number of equid cranial fragments and teeth (*cf.* Wasse 2019: 274-275) was cut through the Transitional Early LN / Later LN deposits in the area between the south-west doorway and central pillar. This pit was at least secondarily associated with the erection or underpinning of the central pillar and north wall of the alcove (Rollefson *et al*. 2013: 12, figs. 6, 7a [see also **Fig. 4**]) and is one reason for our imperfect understanding of whether or not these architectural elements were part of the Transitional Early LN / Later LN structure. It is hoped that the forthcoming processing of extant additional radiometric samples will shed light on the matter.

There is good evidence (Rowan *et al*. 2015a: fig. 5) to suggest that a corbelled basalt-slab roof existed over at least part of the south-eastern quadrant of the structure during this phase, likely utilising the central pillar as a support. It's unclear if this extended over the entire structure; the lower volume of potential roofing slabs in the north half suggests otherwise. Nevertheless, it does seem probable that - at the very least - a cantilevered overhang of large basalt slabs existed around the internal perimeter in this area. Such a construction would have provided shelter from the elements for stored items or perhaps even young animals. The possibility that there was an organic component to any superstructure, perhaps including tamarisk beams, reeds or woven bulrush leaves (see 5 below), must also be considered.

As at aḍ-Ḍuwaylah (Betts *et al*. 1998: 48, figs. 3.16-17), a general focus on paving at least part of the individual spaces within the newly expanded bounds of W-80 characterised the Later LN. This included the alcove and so-called west porch, as well as the vestibule inside the south-west doorway (Rollefson *et al*. 2013: 13, fig. 6; Rowan *et al*. 2015a: 4, fig. 7a). Additionally, paved areas or perhaps low benches were installed around the northern and south-eastern internal perimeters (Rollefson *et al*. 2013: 12, figs. 6, 7b) of the main structure. A marked contrast with the previous phase can be seen in the installation of superimposed sequences of large grinding slabs with central mortars in the northern half of the structure (Rowan *et al*. 2015a: 5-6, fig. 9). Substantial fire pits lay in the spaces between these slabs, representing a migration of the focus of burning from the southern (see 2.2.2 above) to the northern part of the structure. Slightly later, a rectangular bin (*ibid*.: 6, fig. 10) was constructed along the inner face of the west wall of the northern area. The general impression gained is of a shift from short-lived, expedient hearths in the lee of the high walls around the south-eastern quadrant of the structure, perhaps with shelter from the wind being foremost in mind, to the establishment of a more formalised and heavily invested cooking and food-preparation area in the north. This may also have freed up sheltered sleeping space in the south-eastern quadrant. Interestingly, the Transitional Early LN / Later LN gypsum-rich surface was comparatively better preserved under the heavy grinding slabs and paving of this phase. This is further evidence - if any were needed - that disturbance of accessible earlier deposits is endemic within W-80, whether by *Polyphylla* sp. beetle larvae (*cf.* Betts *et al*. 2013: 54 [see also **Figs. 3 and 18**]), other burrowing animals or indeed the human occupants of the structure. This has serious and as yet unquantified implications for the integrity of our stratigraphic analyses, which must at this stage be regarded as broad brush.

Some of the most far-reaching changes associated with the onset of Later LN phase relate to the aforementioned narrowing of the main north-east doorway. This was achieved by inserting a blocking wall within the northern part of the much wider Transitional Early LN / Later LN entrance, creating the back wall of a north-east forecourt. The latter was flanked by a low, curving wall to the north-west, above which lay a raised, partially paved activity area or low platform. Vast quantities of chipped stone and bone refuse were found on and around this platform, raising the possibility that it served as a focus for some combination of primary processing outside the main structure and secondary disposal of waste from the interior. Either might be taken as indicative of a higher degree of sedentism than hitherto (Hardy-Smith and Edwards 2014: 255-257). At the same time, evidence for internal partitioning of the main structure increased (Rollefson *et al*. 2013: 11-13, fig. 5; Rowan *et al*. 2015a: 4, fig. 7a).

The reason for these changes at W-80 remains a matter for speculation. A straightforward functional interpretation of the narrowing of the doorway, perhaps linked to the desirability of reducing its width in response to climatic change, or to prevent uncontrolled encroachment of the interior by livestock, is possible. At the same time, it's undeniable that the newly constructed north-east forecourt would have imposed a degree of separation between the now-private interior and public outside world. Many of the observations noted above bring to mind Hardy-Smith and Edwards' (2014: 256) proposal that "[i]ncreased formalization in the use and maintenance of space for separate activities is correlated with increased efforts in keeping the house clear of accumulated materials". Indeed, the restricted access, increased investment in exclusive installations and storage, internal compartmentalisation and an increasing emphasis on privacy generally that has been documented at W-80 might serve as a textbook example of increasing household autonomy.

2.2.4 Final LN

It's clear that at least part of the Later LN roof and possible cantilevered overhang (see 2.2.3 above) had collapsed into W-80 prior to the Final LN phase. This possibly intentional act would have significantly reduced the space within the structure and was likely accompanied by a deliberate blocking of the south-west doorway and vestibule. The remaining useable space in the eastern two-thirds of W-80's interior was patched up with areas of rough paving, as well as some roughly corbelled roofing. The southern part of the Final LN structure saw several episodes of subdivision, representing a continuation of the trend first seen in the previous phase, whilst the northern part seems to have remained open plan. It's possible that the uppermost of the large grinding slabs with central mortars were reutilised in this phase. The platform on the north-west side of the north-east forecourt remained in use, but by this stage had spilled into the forecourt itself, covering most of its area with the result that access to W-80 was now via a narrow, curving 'corridor', partially paved, that snaked past the slumped platform (**Fig. 5**). As refuse and stone accumulated atop the platform, it was tidied up with areas of rough paving on more than one occasion.

During the Final LN phase, it seems that the by now ancient main structure of W-80 functioned less as a heavily invested place of primary residence than as an expedient and likely intermittently utilised "windbreak with numerous renovations for a variety of tasks, including butchering, grinding stone activity, lithic production, and bead manufacture" (Rowan *et al*. 2015a: 4). Although the nature of the cultural deposits hints at repeated intermittent visits over many years, in the absence of any radiometric dates for this phase it's imprudent to speculate as to its temporal extent or the intensity of occupation it represents. The latest

5. Final LN phase entrance 'corridor' to W-80, curving past the platform to left which now fills the north-east forecourt.

Table 1: Tool types and classes from W-80, 2018.

Tool type	n	%	Class	n	%
Projectile point	141	17.4	Points	141	17.4
Burin	32	4.0	Burins	32	4.0
Truncation	19	2.3	Truncations	19	2.3
Endscraper	15	1.9	Scrapers	71	8.8
Sidescraper	52	6.4	Notches	64	7.9
Tabular/fan scraper	4	0.5	Denticulates	124	15.3
Notch	64	7.9	Knives	64	7.9
Denticulate	124	15.3	Drilling tools	61	7.5
Unifacial knife	38	4.7	Bifaces	9	1.1
Bifacial knife	16	2.0	Wedges	118	14.6
Seam knife	10	1.2	Polyhedrons	67	8.3
Backed element	11	1.4	Pecking stones	4	0.5
Tanged blade	1	0.1	Other	36	4.4
Perforator	3	0.4	**Total**	**810**	**100.0**
Borer	28	3.5			
Drill	30	3.7			
Biface	9	1.1			
Wedge	118	14.6			
Polyhedron	67	8.3			
Pecking stone	4	0.5			
Microliths	7	0.9			
Other	17	2.1			
Subtotal	**810**	**100.0**			
Retouched flake	51	(4.9)			
Retouched blade	33	(3.2)			
Utilized piece	53	(5.1)			
Unclassifiable	96	(9.2)			
Total	**1043**	**(100.0)**			

In addition, there were six bone awls, three bone needle fragments and a bone spatula. More bone tools will be identified as faunal analysis continues.

radiometric date associated with the Later LN (Beta 366675 [see 2.2.3 above]) provides a *terminus post quem* for the Final LN phase of the mid 6th millennium cal BC. This sits well with Baird's (1993: 78) caveated attribution of arrowhead assemblages containing an absolute predominance of transverse points (see 2.3 below [also **Tables 3 and 4**]) to the 6th and 5th millennia cal BC.

2.3. Chipped Stone

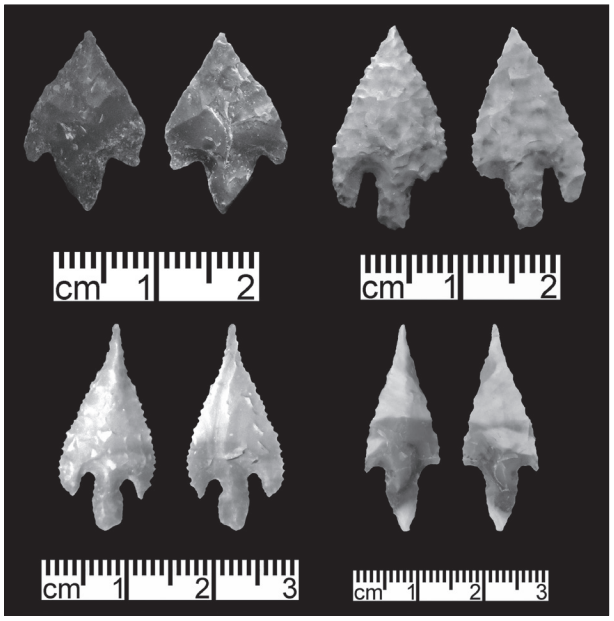
A total of 810 formal tools was recovered during the 2018 season from W-80 (**Table 1**). Blanks for formal tools relied heavily (62.4%) on blades and bladelets (**Table 2**). A variety of flake types made up the bulk of the other blanks, and 13 formal tools were made on recycled older flakes and cores (including one Levallois flake).

Although projectile points played a significant role in the tool inventory at 17.4%, this is only about half of the rate for the upper layers of the structure excavated in 2013 and 2014

Table 2: Debitage blanks for formal tools from W-80, 2018.

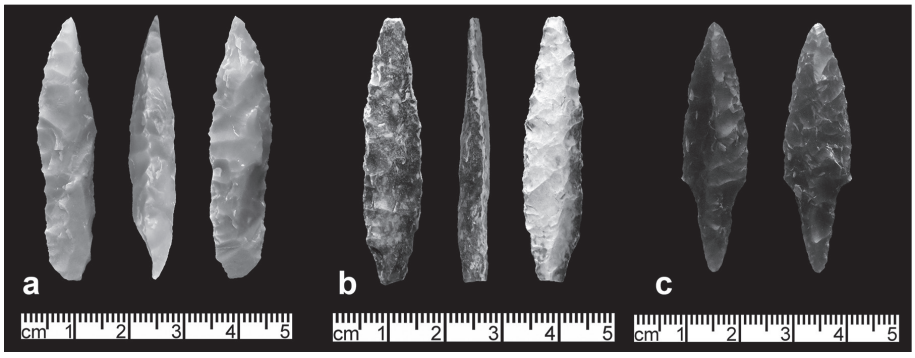
Debitage type	n	%
Ordinary blade	308	54.7
Naviform blade	1	0.2
Bladelet	42	7.5
Flake	166	29.4
CTE	7	1.2
Burin spall	10	1.8
Microflake	1	0.2
Core, nodular	11	2.0
Core, tabular	4	0.7
Other	13	2.3
Subtotal	**563**	**100.0**
Unclassifiable	249	(30.7)
Total	**812**	**(100.0)**

(Rollefson *et al*. 2018a). Of the 132 classifiable arrowheads (*cf.* **Table 3**), 88 (66.7%) were versions of transverse types, which contrasts considerably with the 87.3% level seen in the upper levels from earlier excavation seasons (*ibid*.: tab. 5). Haparsa points (**Fig. 6**) dominated the non-transverse types at 70.6% (24 of 34). A 'new' projectile point type called the 'bolt' (**Fig. 7**) was collected in 2018, although other bolt types were found on the surface at Wisād 1 (Wasse and Rollefson 2005: 17) in 2011. Bolts bear bifacial covering retouch, have thick lenticular cross-sections, and weigh *ca* 3gm. Because of their weight, bolts were probably dart points propelled by spear-throwers (*cf.* Eighmey 1992: 165-167). Credible comparanda from the Arabian peninsula have been presented by Drechsler (2009: Appendix 1).



6. Haparsa points from W-80 (photographer G.O. Rollefson).

Tables 3 and 4 show the distribution of classifiable arrowhead types by phase of occupation. The (?) ELN phase remains incompletely excavated and yielded no arrowheads in 2018. **Table 4** is especially informative, since it shows a continuous increase in the relative importance of transverse arrowheads between the Transitional Early LN / Later LN and Final LN. The data in **Table 4,** coupled with the aforementioned radiometric dates (see 2.2 above), lend support to the assertion of Garrard *et al*. (1994: 87-88 [see



7. (a), (b) 'Bolts' from W-80; (c) Byblos point from W-80 (photographer G.O. Rollefson).

Table 3: W-80 projectile point types by phase, 2018 (upper table: absolute frequency; lower table: relative frequency).

	T1 (n)	T2 (n)	T3 (n)	T4 (n)	Hap (n)	Niz (n)	Hrz (n)	Byb (n)	Oth (n)	Unc (n)	Total (n)
FLN	12	7	6	2	1	0	0	0	1	0	29
LLN	17	3	6	0	9	4	0	1	2	2	44
ELN/LLN	17	10	8	0	14	6	1	2	3	6	67
Total	**46**	**20**	**20**	**2**	**24**	**10**	**1**	**3**	**6**	**8**	**140**

	T1 (%)	T2 (%)	T3 (%)	T4 (%)	Hap (%)	Niz (%)	Hrz (%)	Byb (%)	Oth (%)	Unc (%)	Total (%)
FLN	41.4	24.1	20.7	6.9	3.4	0.0	0.0	0.0	3.4	0.0	100.0
LLN	38.6	6.8	13.6	0.0	20.5	9.1	0.0	2.3	4.5	4.5	100.0
ELN/LLN	25.4	14.9	11.9	0.0	20.9	9.0	1.5	3.0	4.5	9.0	100.0

There was also one arrowhead ('Other' type) collected from the surface and not included in the table.

T1 Stemmed Transverse T2 Unstemmed transverse T3 Rectilinear/ trapezoidal
T4 Unclassifiable transverse Hap Haparsa Niz Nizzanim Hrz Herzliya
Byb Byblos Oth Other Unc Unclassifiable

also Baird 1993: 77]) that transverse arrowheads were introduced to the *bādiyah* sometime during the earlier 7th millennium cal BC.

Burins (**Table 5**), drills (**Fig. 8; Table 6)** and scrapers were all represented at low to medium levels of importance among formal tools, a pattern that is consistent with the analysis of earlier excavation samples. Burins were scattered across several classes and are relatively poor in truncation burins, the class that normally characterises LN burins in the *bādiyah*. Drills are absolutely rare in the 2018 sample, suggesting a lack of focus on such activities in the earlier levels of W-80; bladelet blanks for drills are more numerous than burin spalls, challenging widely held views of the purpose of truncation burins. Among the 'Other' tools found in 2018 is a pedunculated and serrated knife, possibly attached to a cord hung around the neck (**Fig. 9b**); there is a virtual twin illustrated from LN aḍ-Ḍuwaylah (Betts *et al*. 1998: fig. 4.32-4). Another pedunculated tool in the shape of a miniature fan scraper was recovered from structure W-66 (Rollefson *et al*. 2011; Rowan *et al*. 2015b) at Wisād Pools in 2011 (**Fig. 9a**).

Two types that appeared in higher levels were wedges (**Fig. 10**) and polyhedrons (**Figs. 11 and**

Table 4: Stratified comparison of classifiable transverse and other arrowheads from W-80, 2018.

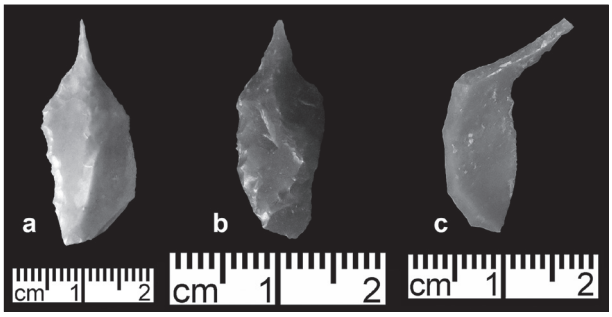
	Trans		Non-Trans		Ratio
	(n)	(%)	(n)	(%)	(T : NT)
FLN	27	93.1	2	6.9	13.5 : 1
LLN	26	61.9	16	38.1	1.6 : 1
ELN/LLN	35	57.4	26	42.6	1.3 : 1

Table 5: Burin types and classes from W80, 2018.

Type	n	%
Simple	2	7.1
On break	6	21.4
Angle	1	3.6
Double simple	1	3.6
Double on break	1	3.6
Opposed simple-simple	3	10.7
Simple transverse	1	3.6
Transverse from lateral retouch	1	3.6
Straight dihedral	2	7.1
Canted dihedral	1	3.6
Opposed simple-dihedral	1	3.6
Concave truncation	5	17.9
Double concave truncation	2	7.1
Opposed concave-convex truncation	1	3.6
Subtotal	**28**	**100.0**
Indeterminate	3	(9.7)
Total	**31**	**(100.0)**
Class	**n**	**%**
Simple	14	50.0
Transverse	2	7.1
Dihedral	4	14.3
Truncation	8	28.6
Total	**28**	**100.0**

Table 6: Drill types from W-80, 2018.

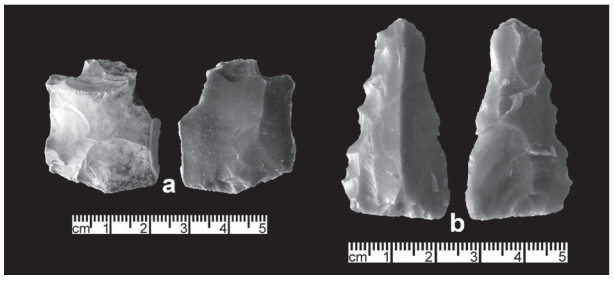
Type	n	%
Bladelet, symmetrical	11	44.0
Bladelet, asymmetrical	1	4.0
Burin spall, symmetrical	3	12.0
Burin spall, asymmetrical	6	24.0
Mèche de forêt	4	16.0
Subtotal	**25**	**100.0**
Bit only	5	(16.7)
Total	**30**	**(100.0)**



8. (a), (b) Needle-sharp drills from W-80; (c) skewed drill from W-400 (photographer G.O. Rollefson).

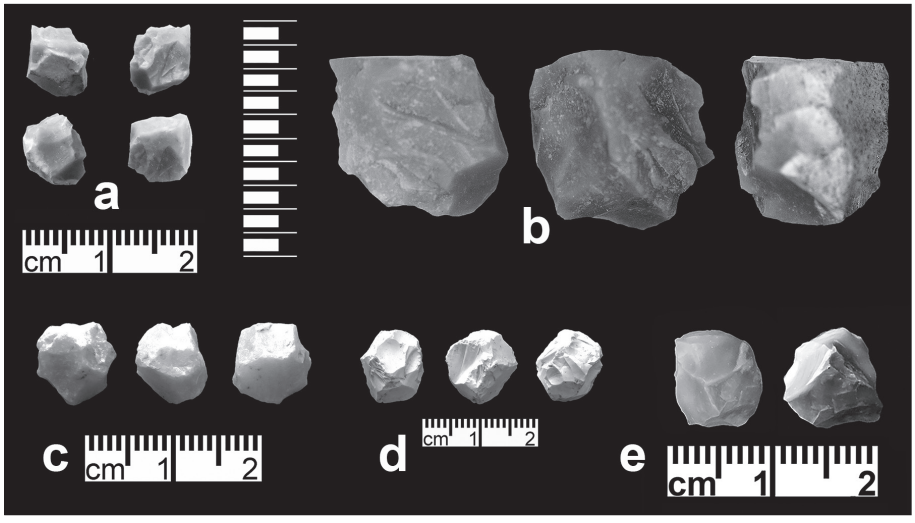
9. (a) Pedunculated seam knife from W-66; (b) pedunculated serrated knife from W-80 (photographer G.O. Rollefson).

12). More frequent than any other tool type except points and denticulates, wedges (or *pièces esquillées* / splintered pieces) are generally small flakes or blades that bear opposed battering on the ends of the piece (bipolar wedges) or on the lateral edges (lateral wedges), or both. In view of the marshy environs around Wisād Pools (see 5 below), wedges would have been useful for splitting wood and reeds.

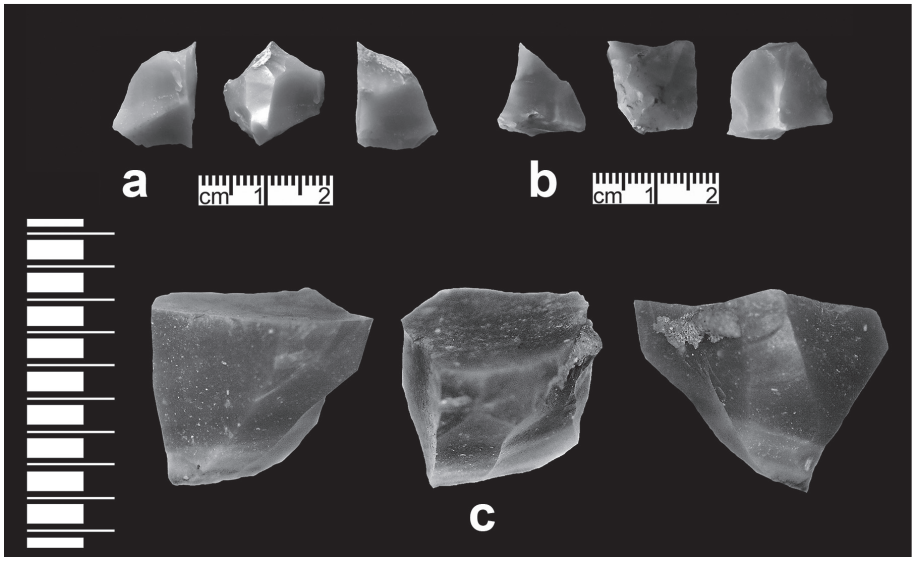


10. (a) Wedge with heavy patination on one surface from W-80; (b) denticulated wedge from W-80 (photographer G.O. Rollefson).

Polyhedrons are small flaked artefacts that occur in shapes such as spheroids, cuboids, or pyramids (although the separation into such categories is not always easy). Polyhedrons were first recognized by Cropper (2011) in her analysis of the Yarmoukian artefacts from Umm Mashraṭ I, near Mādabā in the highlands of western Jordan. Resembling tiny cores, their dimensions are so small that they and the flakes they produced do not have any apparent utilitarian function. As the maximum dimension of polyhedrons is consistently less than 20mm, "it is possible that polyhedrons exist at other sites but have been overlooked" (*ibid*.: 84). Cropper's proposal that they may have been gaming pieces is plausible, although the possibility that they were part of a simple system of quantification or record keeping cannot be excluded. There is a total of 162 polyhedrons from W-80 (including the 2013-14 and 2018 seasons),



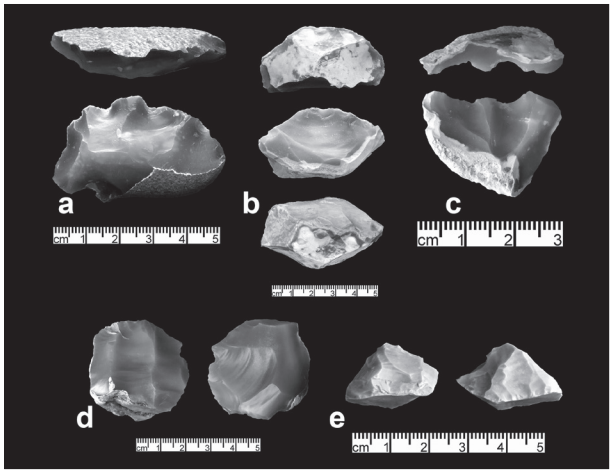
11. (a), (b) Cuboid polyhedrons from W-80; (c), (d), (e) spheroid polyhedrons from W-80 (photographer G.O. Rollefson [note scale in (b) is 10 mm]).



12. Pyramidal polyhedrons from W-80 (photographer G.O. Rollefson [note scale in (c) is 10mm]).

accounting for 5.5% of all formal tools; another 41 polyhedrons (5.1% of formal tools) come from nearby contemporaneous W-66 (Rollefson 2019). 'Tools' is perhaps a misnomer for polyhedrons, but it is important to note their popularity compared to utilitarian pieces. Notably, only six polyhedrons were recovered from M7 SS-1, a result that adds to the distinction of chipped stone tool differences between W-80 and M7 in such areas as burins and transverse arrowheads (*ibid*.).

The cores from the 2018 season (**Fig. 13**) are presented in **Table 7**. With the word 'blade' in the name, there are 61 blade cores (28.9%), although this is misleading. Pyramidal, semi-pyramidal, 90° change-of-orientation and core on flake could also have produced blades. Furthermore, in view of the intensive core reduction, a mistake in blade removal may have eliminated all indications of the core's original technological status. One aspect of the cores from W-80 is the high degree of reduction (**Fig. 13a, c**), indicating a practice of coping with the scarcity of good quality flint in the immediate vicinity of the site (the closest known source is 19km to the south-east at Tall al-Ḥibr. Another example of parsimony is the reuse of earlier cores, some Palaeolithic (*e.g.* **Fig. 13b**), in addition to the scavenging of discarded older flakes and blades. Microflake cores, which have maximum dimensions of 30mm (but larger than 20mm), are rare and may simply be the continuation of the metric array of polyhedrons.



13. Cores from W-80: (a), (c) Exhausted single platform single face flake cores; (b) Palaeolithic core or biface re-purposed as a Late Neolithic single platform single face flake core; (d) 90° change-of-orientation blade / flake core; (e) pyramidal core (photographer G.O. Rollefson).

2.4. Ground Stone

As in past seasons, handstones dominate the ground-stone assemblage excavated in 2018 (see **Table 9**). Virtually all of the ground-stone artefacts excavated at W-400 are handstones; all are made of basalt. At W-80, the highest relative frequency of ground-stone items (44%) is also handstones made of basalt. Grinding slabs and grinding slabs with a central mortar, also of basalt, are next in terms of frequency. As already noted (see 2.2.2 above), the very large, *in-situ* grinding slabs with a central mortar seem on current evidence to be particularly associated with the Later LN phase of occupation. Not all ground-stone artefacts from W-80 are basalt. Smaller, thin-worked pieces of sandstone, about 14% of the ground stone assemblage from 2018, appear to be palettes or small ground-stone fragments.

2.5. Special Finds

The list of special finds (**Table 8**) contains the general variety of artefacts commonly found at LN sites in the *bādiyah*. Two particular pieces associated with the Later LN phase

Table 7: Absolute and relative frequencies of all cores from W80, 2018.

Core Type	n	%
Bladelet core	8	3.8
Blade + bladelet core	2	0.9
Naviform blade core	2	0.9
Opposed platform non-naviform core	6	2.8
Single platform single face blade core	36	17.1
Single platform multiface blade core	6	2.8
Multiple platform multiface blade core	1	0.5
Single platform single face flake core	22	10.4
Single platform multiface flake core	12	5.7
Multiplatform single face flake core	14	6.6
Multiplatform multiface flake core	35	16.6
Single face radial core	3	1.4
Pyramidal core	6	2.8
Semi-pyramidal core	4	1.9
90° change-of-orientation core	13	6.2
Microflake core	7	3.3
Core on flake	32	15.2
Other	2	0.9
Subtotal	**211**	**100.0**
Tested piece	10	(3.3)
Unclassifiable	39	(12.8)
Manuports	45	(14.8)
Total	**305**	**(100.0)**

Table 8: Special finds from W-80, 2018.

Material	n	Material	n
Ceramic sherds[1]	13	Clinopyroxene spheres	1
Stone beads[2]	32	Pounders[4]	3
Shell beads	21	Quartzite fragment	1
Bone beads	2	Shaped white stone	1
Dabba marble pendants	3	Polished stone	1
Sandstone palettes	6	Polished stone sphere 'token'	1
Sandstone rubbers[3]	6	Red ochre stained flake	1
Sandstone fragments	4	Stone bracelet fragments	7
Sandstone cylinder	1	Chalk ring	1
Flint cylinder	1	Mica fragments	4
'Mace-head' fragments	3	Red ochre pieces[5]	3
Mother-of-pearl plaque	1	Carnelian chunks	5
Mother-of-pearl fragments	5	Gaming piece?	1

1. All Yarmoukian; six from a single pot-break?
2. Nine are of Dabba marble, two of carnelian.
3. One stained with red ochre.
4. One stained with red ochre.
5. One is a core measuring 106×90×45mm; weight 580gm.

demand special comment, however, for they are indeed special.

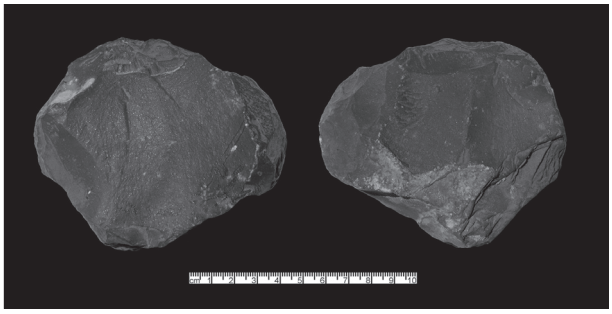
The first is a large block of red ochre (**Fig. 14**) weighing 580gm. It might be considered to be a 'core' of red ochre in view of the numerous broad negative flake scars on both surfaces; its mass indicates that it may have been associated with industrial use (but see 2.6 below). In addition to its popular association with symbolism (Hovers *et al*. 2003), ochre's decay-impeding properties also make it useful in hide tanning (Rifkin 2011). In this regard, there may be a connection with a possible gazelle-hide industry in the eastern *bādiyah* (Bar-Yosef 2016; Martin *et al*. 2016: 216; Wasse 2019: 272-274). Ochre has also been shown to be effective for developing a mastic for hafting stone tools (Wadly 2005).

Table 9: Ground stone from W-80 and W-400, 2018.

Type	W-80		W-400	
	n	%	n	%
Grinding slab	4	8.0	1	11.1
Grinding slab with central mortar	2	4.0		
Handstone	22	44.0	7	77.8
Rubber	3	6.0		
Pebble	4	8.0		
Pestle	1	2.0		
Palette	4	8.0		
Pounder	1	2.0		
Multi-functional	4	8.0	1	11.1
Groove or incised	2	4.0		
Fragment	3	6.0		
Total	**50**	**100.0**	**9**	**100.0**

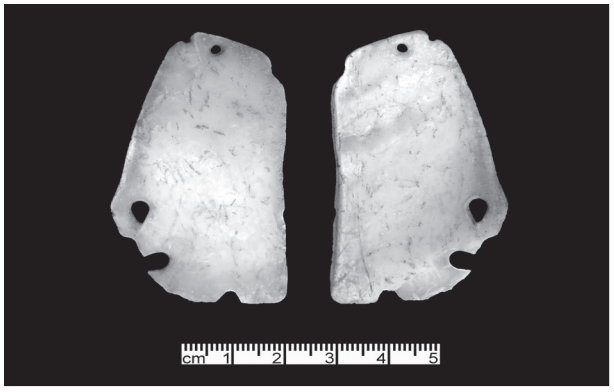
Red ochre is also known as 'jeweller's rouge' and is used to achieve high polish on decorative objects, potentially including the stone sphere, likely a so-called 'token' (*cf.* Schmandt-Besserat 1992; note also a possible incised, conical stone 'token' fragment from structure M7 SS-1 at Wādī al-Qaṭṭāfī [Rollefson *et al*. 2017: fig. 16a]), and 'mace-head' fragment at **Fig. 15a-b**. In this context, it's worth noting that polished stone 'tokens', including spheres, have been particularly associated with the Mesopotamian Hassuna and Samarra cultures of the later 7th and earlier 6th millennia cal BC (Schmandt-Besserat 1992: 46-47), as well as with the later 'Ubaid culture (Carter 2018: 54-63).

The second special find of significant interest is a perforated plaque - or 'link' - of mother-of-pearl (**Fig. 16**). Mother-of pearl fragments have been relatively numerous at Wisād Pools, but the size of the plaque seems imbued with particular importance, either for the person who wore it, or for the building where it was



14. Red ochre block found just inside W-80 Later LN phase north-east doorway (photographer G.O. Rollefson).

15. (a) Polished stone sphere 'token' from W-80 Later LN phase pit between central pillar and south-west doorway; (b) 'mace-head' fragment from foundation deposit around base of W-80 central pillar; (c) bone spatula from foundation deposit around base of W-80 central pillar (photographer G.O. Rollefson).



16. Perforated mother-of-pearl plaque from behind north-west jamb of W-80 north-east doorway (photographer G.O. Rollefson).

recovered. A very similar object, identified as *Unio* sp. freshwater mussel and similarly dated to *ca* 6,400 - 5,700 cal BC, was recovered from Level AV at el-Kowm 2 in the Syrian steppe (Stordeur [ed.] 2000: 210-211, fig. 2a, 304, fig. 1). This hints at the probable existence of extensive pan-*bādiyah* hunting and herding networks at this time (*cf.* Wasse 2019).

2.6. Structured Placement of Objects

A phenomenon that has been recorded at W-80 since excavation began in 2013, though not necessarily recognised for what it was, concerns the structured placement of objects in areas of the structure that were of particular interest to those who used it. Foremost amongst these were the north-east doorway in its narrowed, Later LN iteration and the central pillar.

The substantial worked block of red ochre already noted (see 2.5 above; also **Figs. 4 and 14**) was found pressed vertically into the ground just inside the north-east doorway (**Fig. 17**). In this regard, it may be noted that at Çatalhöyük red ochre was found "sprinkled on burials, and on *thresholds between rooms especially*" (Hodder 2006: 190 [our emphasis]). The large, perforated mother-of-pearl plaque (see 2.5 above; also **Figs. 4 and 16)** was secreted in the wall adjacent to and slightly above the same threshold, placed vertically immediately behind the north-western upright of the doorway (**Fig. 17**). Additionally, a naviform-type blade was discovered in the blocking of a window in the well-preserved south-east wall of the main structure (see **Fig. 4**). It may be significant that all of these finds were located at physical and potentially conceptual vulnerabilities in the structure that gave access to its interior ('domus' [*sensu* Hodder 1990]) from the outside world ('agrios' [*ibid.*]). It's therefore conceivable that they may have served some apotropaic function (*cf.* Gebel 2002). A distal lion phalanx found under a paving slab in the south-eastern quadrant of W-80's interior may have performed a related 'strengthening' function, perhaps being "placed [there] during... construction... to act as a delegate of humans against threatening external forces" (Hodder 2006: 189). The substantial Later LN irregular pit containing equid cranial fragments and teeth in the area between the south-west doorway and central pillar has already been mentioned (see

17. Red ochre block in situ (circled) just inside W-80 Later LN phase north-east doorway; location of perforated mother-of-pearl plaque in wall behind north-western jamb of doorway also shown (cross [see also **Fig. 4***]).*

2.2.3 above). Of particular interest here is the fact that it also yielded the aforementioned polished stone sphere 'token' (**Fig. 15a**).

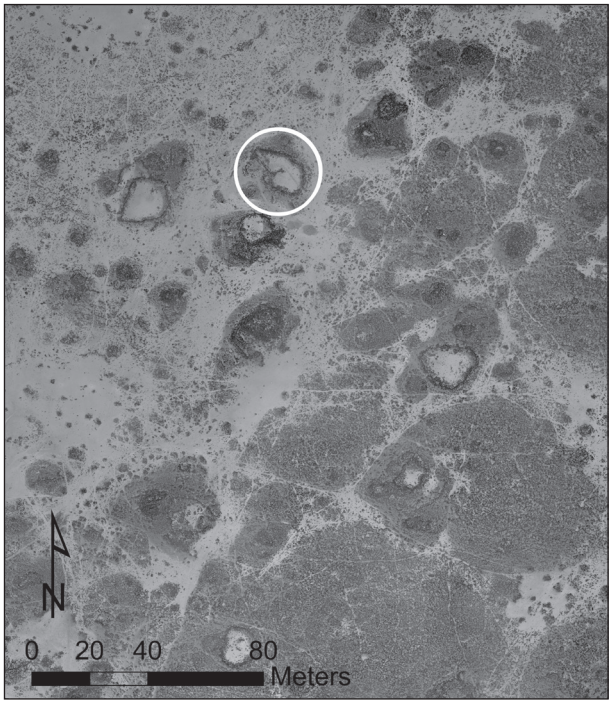
Considerable careful work was done in 2018 around the central pillar in the interior of W-80. Buttressing stones seem to have been placed around its base at the start of the Later LN phase, but sadly it proved impossible to ascertain whether the pillar itself was a Later LN or earlier erection. What was discovered, however, were intriguing foundation deposits directly under the buttressing stones (see **Fig. 4**), atop but not within the abovementioned pit fill. These consisted of gazelle cranial fragments and at least five mandibles placed carefully at the base of the pillar (**Fig. 18**), as well as a fine bone spatula (**Fig. 15c**) and the aforementioned polished 'mace-head' fragment (**Fig. 15b**). In a subsequent sub-phase of the Later LN, a previously reported cache of gazelle / caprine astragalae (Rowan *et al*. 2015a: 6, fig. 11b) was deposited at the base of the same pillar, with another (*ibid*.: fig. 11a) just inside the main northeast doorway, close to but 18cm higher than the abovementioned red ochre block.

These observations suggest, first, that a fully functionalist interpretation of the central pillar may be inadequate and, second, that the structured placement of objects around the main doorway was relatively enduring behaviour at W-80, at least during the Later LN. Furthermore, it seems clear that when the structure was remodelled at the start of that phase, every effort - both physical and symbolic, if indeed these can or even ought to be separated in the LN context - was made to ensure its prosperity and protection. As a concluding aside, it can be noted that the recurring structured deposition of mace-head fragments, the vertical placement of objects in the ground and the utilisation of red ochre or other such pigment has been documented in closure deposits at distant though near-contemporary Khirokitia on Cyprus (Le Brun 2017: 233-235, figs. 6, 9). The potential significance of this is discussed in detail elsewhere (Wasse and Clarke 2020).

3. W-400

Owing to the primary focus of work at W-80, our 2018 excavations at W-400 **(Fig. 19)** were limited in scope. This complex was selected for investigation because it was an unlooted, relatively small, Timnian-type (Rosen 2017: ch. 8) hut-and-enclosure compound of a type we were already familiar with from previous research along Wādī al-Qaṭṭāfī (Wasse *et al*. 2012).

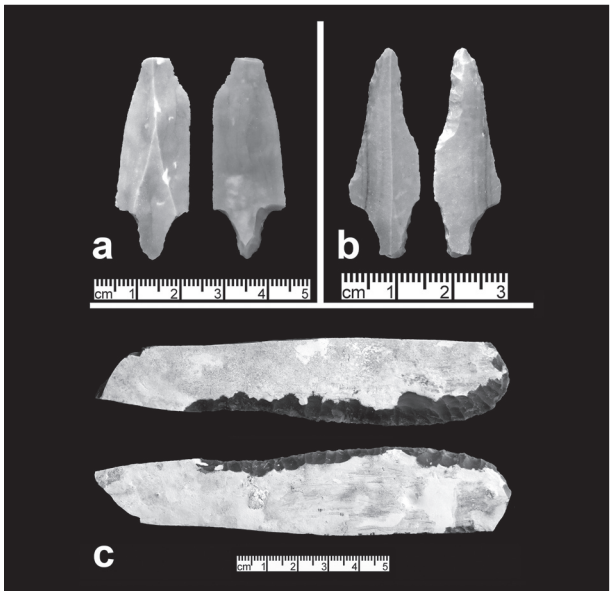
18. Later LN phase foundation deposit of gazelle cranial elements and mandibles at base of central pillar; note disturbance by Polyphylla sp. beetle larvae.



19. Aerial view of hut-and-enclosure compounds, including W-400 (circled), on the north-west margin of the LN core area at Wisād Pools.

As only a relatively small amount of sediment was excavated, the number of recovered chipped stone artefacts was low. They included two *bādiyah* points and a bifacial seam knife (**Fig. 20**). The seam knife has a close parallel with one from LN aḍ-Ḍuwaylah (Betts 1998: fig. 4.28-1). A highly skewed small drill was also unearthed **(Fig. 8c)**, as well as a blade core on a blade. Small finds from W-400 were also limited in number. They included seven clinopyroxene spheres ('false obsidian' [*cf*. Betts 1985: 51-52]), seven carnelian chunks, three Dabba marble fragments, a small fragment of red ochre and two stone beads.

Although the material recovered from W-400 is suggestive of a LN date for this structure, it's too early to speculate as to whether it may have been contemporary with all or part of the occupation at W-80 and W-66. The attached enclosure suggests that it may have been occupied by herders, while the two Badiyah points hint at a closer cultural affiliation with sites such as M7 SS-1 in Wādī al-Qaṭṭāfī (Rollefson *et al*. 2016: table 2, fig. 7, 2017: tab. 5, fig. 7c-d [see also Nishiaki 2019: 184-185, 187 re. Badiyah points in the Syrian and Iraqi steppe]) than with W-80 and W-66 less than a kilometre to the south. The location of W-400 some distance from the pools on the margins of the LN core of the site is intriguing, raising the possibility that prime locations closer to the water may already have been taken by more established users of the locality. If supported by future research, the implication that multiple social groups may concurrently have exploited the resources of Wisād Pools would present an exciting opportunity to explore notions of territoriality, exclusivity and access during the LN.



20. (a), (b) Badiyah points from W-400; (c) bifacial seam knife from W-400 (photographer G.O. Rollefson).

4. Ceramic Petrography

Ceramic petrography was conducted on 18 pottery samples recovered from W-66 and W-80 during the 2013 and 2014 seasons. All of the diagnostic decorated sherds could be attributed to the Yarmoukian cultural entity; most of the plain body sherds displayed the remnants of red slip. Of particular interest was the provenance of the raw materials used to manufacture this pottery, given the paucity of known clay resources in the vicinity of Wisād Pools and the high probability that this pottery was made elsewhere and carried in. Petrographic analysis was undertaken using methods adapted from those proposed by Quinn (2013) and Whitbread (1995).

Petrographic analysis revealed that all pottery samples were made using calcareous clays, tempered with grog and / or chaff. Six distinct clay sources were identified, based on the mineralogy of their silt-sized (<60μm) inclusions. This constitutes a much higher degree of clay variation when compared to other LN sites with petrographic data available, especially when the small assemblage size at Wisād Pools is taken into account (Goren 1991; Cohen-Weinburger 2002: 139; Gibbs 2008: 257-258; Braun and Kafafi 2019). The clay sources identified at Wisād Pools fall into two main groups: those with silt-sized, rounded basalt grains and related minerals (olivine; pyroxenes; plagioclase) and those without basalt grains.

Whilst the precise sources of the clays used to manufacture the W-66 and W-80 pottery cannot be determined at this stage, the three clay fabrics containing silt-sized basalt grains could plausibly have originated from the Black Desert region. It should once again be emphasised, however, that clay deposits have not been identified to date in the vicinity of Wisād Pools. Fabrics containing basalt inclusions are known from LN 'Ayn Ghazāl (Braun and Kafafi 2019), which suggests that pottery was circulating between the basaltic regions of the southern Levant - potentially including the Black

Desert, but perhaps more likely the Jaulan and Hauran - and the Jordanian highlands. Owing to the ubiquity of basalt in the Black Desert, the three clay fabrics lacking basalt grains almost certainly originated outside that region. It therefore seems likely, owing to these factors as well as the infrequency of pottery at the site generally, that ceramics were made elsewhere and brought to the Wisād Pools area. At W-80 in particular, the wide variation evident in clay fabric mineralogy and the fact that the majority of analysed sherds can be attributed to a single phase, the Later LN, suggests the presence of several contemporary yet distinct ceramic communities of practice. Overall, the petrographic evidence supports the notion that a number of networks, at least some of which extended beyond the Black Desert, may have converged at Wisād Pools during the LN. The apparent absence of diagnostic, post-Yarmoukian sherds remains puzzling, however, in view of radiometric and stratigraphic evidence for the utilisation of W-80 during the second quarter of the 6th millennium cal BC and thereafter.

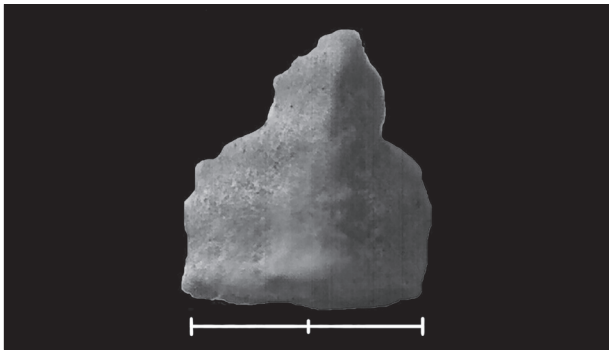
5. Climate, Vegetation and Subsistence

In recent years, it has become abundantly clear that the landscape and vegetation around Wisād Pools would have been significantly more verdant and better resourced during the LN than the grimly arid conditions that characterise the locality today (Rowan *et al*. 2017, 109-110 and references therein). Regional isotopic data have suggested that "[t]he time interval between 8.5 and 7ky [was] characterized by a... deluge period when annual precipitation was extremely high" (Bar-Matthews *et al*. 1999: 91 [see also Bar-Matthews and Ayalon 2004: 385; Rosen 2017: 83-84]). At Wisād Pools, this is manifested by the documented presence of oak stands, marsh plants and perhaps willow in their respective environmental niches (Rowan *et al*. 2017, 109-110 [see also 5.1 and 5.2 below]).

A priority for future research will be to try to build up a picture of diachronic change in the climate and environment of the EBAP study area (see **Fig. 1**) during the LN, paying particular attention to the interplay between anthropogenic factors and the potential impact of the longer 8.2ka climate event of *ca* 6,300 - 6,000 cal BC (Mottram 2016: 40) in shaping resource availability and site-occupation intensity. In this regard, it's worth reiterating that evidence for a possible episode of soil erosion or deflation dated by OSL to 7.9±0.7ka (Ikram 2016: 27, 31-32) has been recovered from a mudpan at the southern edge of Wisād Pools.

5.1. Botanical Remains

Sediment samples recovered in 2018 from hearths and fire pits yielded, through the flotation process, an interesting assortment of plant remains that contribute to our understanding of environment and seasonality at Wisād Pools. From the 11 samples that were analysed (nine from W-80; two from W-400), 15 different genera, as well as specimens from five families that could not be more specifically identified, were documented. All taxa are wild, although a large Gramineae (cereal-sized but poorly preserved) and legume warrant further investigation. As in previous seasons (Rollefson *et al*. 2018: tab. 1), the most abundant seed was from the genus *Arnebia* (Arnebia) **(Fig. 21)**, which were not charred and were a whitish yellow colour. Species in this genus are commonly desert annuals or perennials and have roots that can produce a red or violet dye (Feinbrun-Dothan 1978: 68-70; Betts *et al*. 1998: 188); they are also known to havea many medicinal properties (Rollefson *et al*. 2018: 537 and references therein). It may be noted in passing that sparse charred remains of Arnebia were found in both Late PPNB and LN contexts at aḍ-Ḍuwaylah (Betts *et al*. 1998: 188, tab. 9.2). *Aizoon* (stonecrop) is the next most common genus in the 2018 samples from Wisād Pools; it has many species that are generally herbs or low shrubs. These plants can be found in dry watercourses and oases in hot deserts (Zohary 1966: 74-75).



21. Arnebia nutlet from W-80 (scale is 2mm; photographer Jen Ramsay).

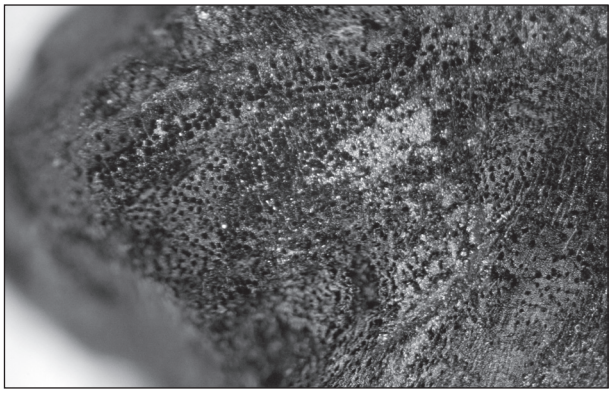
The remaining genera recovered in 2018, though sparse in number, provide evidence of a local desert environment as well as indications of at least seasonal precipitation and, in some presumably nearby locations, more verdant conditions than today. Species in genera such as *Melilotus* and *Cladium*, which are generally found in more hydrophilic environments including moist soil, marsh or in proximity to riverbeds, were identified. Genera that have species more commonly associated with desertic environments include *Aizoon*, *Astragulus*, *Erodium*, *Malva* and *Phalaris*. Interestingly, these genera also have species that are commonly found in fields and in more lush environments. All species identified flower between January and June, except *Cladium* sp., which flowers between April and September and *Phalarus*, which flowers between March and August. Consequently, it seems likely that at least some hearths and fire pits were utilised - through perhaps not exclusively - in the spring, likely the months of April and May.

Fragments of parenchymateous tissues were recovered and are likely *Ficus* sp. (fig); there are also achenes, that is to say seeds, of fig in two samples. Similar fig remains were identified in samples recovered from structure M7 SS-1 at Wādī al-Qaṭṭāfī in 2015 (Rollefson *et al*. 2016: 6). It should once again be emphasised that this need not imply that fig trees were growing locally, although that possibility cannot be excluded, as the fruits have excellent storage properties and can be transported over long distances. Also found in the samples under discussion here was evidence of wild grasses (Gramineae) in the form of carbonised grains and a culm node. Three samples of seed recovered from charcoal samples were identified as indeterminate nutshell, perhaps wild almond (*cf. Prunus fenzliana*) or other *Prunus* sp. pits; this would correspond with charcoal identifications. The sediment samples also contained possible eggshell, bone fragments and snail shells, the analysis of which will commence shortly.

5.2. Charcoal

Anthracological analyses of charcoal samples recovered at Wisād Pools in 2018 yielded evidence for wood being collected from a variety of ecological zones. Amongst the identified samples, deciduous oak and *Prunus* are representative of open park woodland, whilst *Anabasis*, other Chenopdioideae, *Zygophyllum* and tamarisk are more indicative of arid and / or steppic environments, including the banks of brackish watercourses or ephemeral pools. Regarding the *Prunus* specimens, there are a few different species in this genus that have similar anatomy, including apricot, almond, plum and sour cherry; wild almond is perhaps the most likely candidate here. Of particular interest is the identification of Salicaceae (*cf. Salix* sp. [willow]) charcoal **(Fig. 22)** from a hearth provisionally attributed to the Later LN phase, as this taxon requires perennial fresh water. As with fig, this need not imply that willow trees were growing in the vicinity of the site, although that would be in concordance with other lines of evidence suggesting that conditions were distinctly better watered during at least part of the LN than today. A degree of caution is warranted, however, as the identified specimen came from a twisted epicormic shoot. This raises the possibility that the specimen was derived from a basket or similar (*cf*. Hurcombe 2014), which may of course have been carried in from elsewhere.

Regarding diachronic change, park woodland taxa are present throughout the long W-80 sequence and, if anything, are more abundant during the Later LN. It should be emphasised that deciduous oak is fairly sensitive to browsing. This implies the presence of locations within the site catchment that had sufficient water to support park woodland that weren't at the same time exposed to the depredations of domestic stock.



22. Salicaceae (cf. Salix sp. [willow]) charcoal from W-80 hearth provisionally attributed to the Later LN phase (25× magnification; photographer Brita Lorentzen).

5.3. Faunal Remains

Once again, abundant faunal remains were recovered in 2018, especially from structure W-80. The assemblage is currently under analysis.

6. Conclusion

In the ten years since the establishment of the EBAP in 2008, our understanding of what we have recently defined as the BDN (Wasse *et al.* in press) has been transformed. It seems increasingly probable that the multi-faceted and far-reaching changes documented at Wisād Pools and Wādī al-Qaṭṭāfī (*inter alia* Wasse and Rollefson 2005; Rollefson *et al*. 2011, 2013, 2016, 2017, 2018a, 2018b; Wasse *et al*. 2012; Rowan *et al*. 2015a, 2015b, 2017) during the later 7th and earlier 6th millennia cal BC were not 'some subtleties o' the desert', but were part of much wider regional transformative processes (*e.g*. Daune-Le Brun and Le Brun 2016 [Khirokitia]; Nieuwenhuyse *et al*. 2016 [Tall Sabi Abyad]) playing out concurrently along the entire arc of the upper Mesopotamian and Levantine 'desert line' (*sensu* Lewis 1987) (Wasse and Clarke 2020).

If that breathtaking geographical scope weren't enough, recent data suggest that parts of south-central Anatolia may have witnessed many of the same changes, at the same time and likely for similar reasons. "[A]rchitectural and spatial changes at… Çatalhöyük provide evidence for deeper economic and social changes taking place at *ca*. 8.2kyBP and in subsequent centuries. Smaller, more independent, and more self-sufficient households emerged, replacing the previously dominant communal organisation" (Roffet-Salque *et al*. 2018: 4). In the opposite direction, the recent discovery of a Levantine-type mace head at al-Shabah in the Great Nefud desert (Scerri *et al*. 2018: fig. 5a) hints at a formative role for steppic Levantine cultural entities such as the BDN in the long-posited movement of mobile herders into Arabian peninsula during the later 7th and 6th millennia cal BC (*e.g.* Uerpmann *et al*. 2000: 233). This supposition is supported by the close alignment of extant radiometric dates from Wisād Pools with Drechsler's (2009: 161-163, fig. 1) schema for the Neolithisation of Arabia. This posits peaks of 'extensification' (*sensu* Shennan 2018) between 6,700 and 6,400 cal BC and after 6,000 cal BC, separated by a climate-influenced retreat to environmental refugia during the later 7th millennium.

In sum, emerging evidence suggests that sites such as Wisād Pools and Wādī al-Qaṭṭāfī, crossroads on the steppe, may have been important hubs of cultural exchange between disparate regions for at least some of the period in question. As "[f]undamental transitions... must have required a strong impetus" (van der Plicht 2011: 237), a shaping role for the 8.2ka climate event in these events may reasonably be assumed. However, to attribute sole causality to climate change is to deny agency to human factors that may have been as influential, if not more so, in shaping the path of events. As the EBAP moves into its second decade, investigation of these issues will be a priority, balancing supraregional interpretative frameworks against the elucidation of detail at the local level.

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