Gary Rollefson
Whitman College
rollefgo@whitman.edu

Gary Rollefson

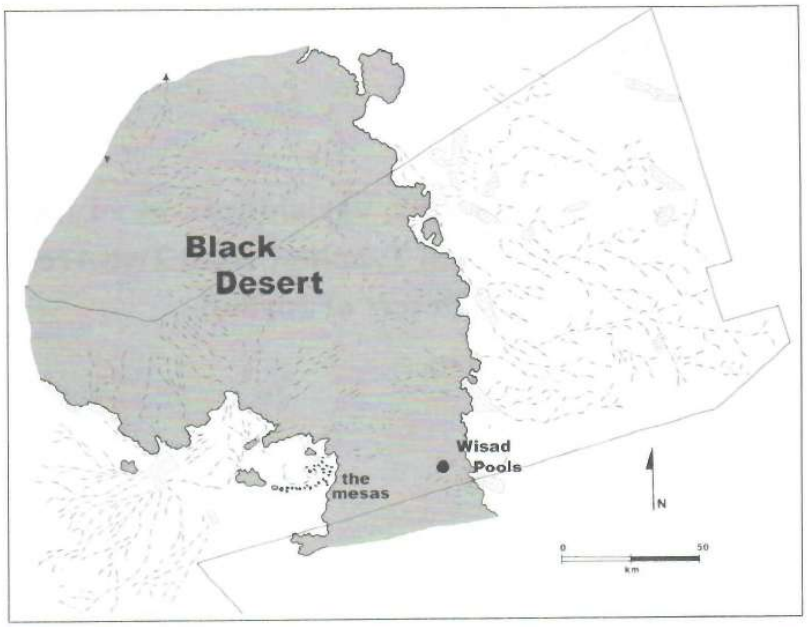
Late Neolithic Variability in Lithic Technology and Typology from Two Areas of the Black Desert of Jordan

Introduction

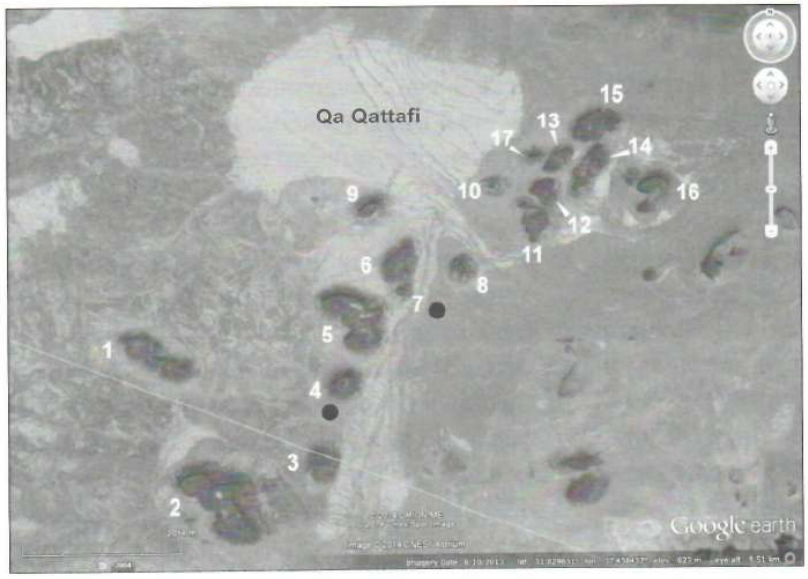
Creating things that don't exist in nature is one of the things that separate us from the rest of the animal world. What we make – and how we make them – often separate one human community from others as to what is proper in terms of group traditions. For most of human prehistory tools, and especially stone tools, were essential to acquire and process resources that were necessary for survival. Variation in specific tool types (such as arrowheads) and the techniques used to produce them (perhaps through pressure flaking) reflect either temporal change and/or technological customs of social units that pass on those "proper" forms and techniques from generation to generation. Of course, the presence or absence of specific tools probably reflects, in part at least, the resources a group may have sought, so that seasonally, plant and animal populations in a particular locale may have differed considerably, and the tools at camp sites and semi-permanent settlements will have varied in consequence. But if annual seasons and the age of sites in different parts of a given ecosystem are held constant, observable differences in typology and technology might provide clues to the presence of different social communities undertaking the same essential tasks, but undertaking them differently; in essence, different cultural prescriptions to obtain and use what a group needs.

Wisād Pools and the Wādī al-Qāṭṭafī Mesas

The eastern *bādiyah* of Jordan includes vast areas of gravelly limestone plateaus (the hamad) and the broad band of the Black Desert, an enormous flood basalt the stretches across the panhandle of Jordan from deep into Syria and on into Saudi Arabia, called the *ḥarra* in Arabic (FIG. 1). The mesas are flat-topped remnants of the original flood basalt plain that has undergone considerable erosion and earth movement over the past 14 million years (FIG. 2). The basalt layer is *ca.* 30m thick, overlying the Wādī ash-Shallāla Chalk and Umm ar-Rujūm chert limestone formations (*cf.* Rabba 2005). A similar stratigraphy occurs at Wisād Pools, although less detail has been published. Current mean rainfall is between 50-100mm during October-March/April at both locations, which characterizes this territory as a hyperarid desert. Flint occurs in the underlying chalk/limestone



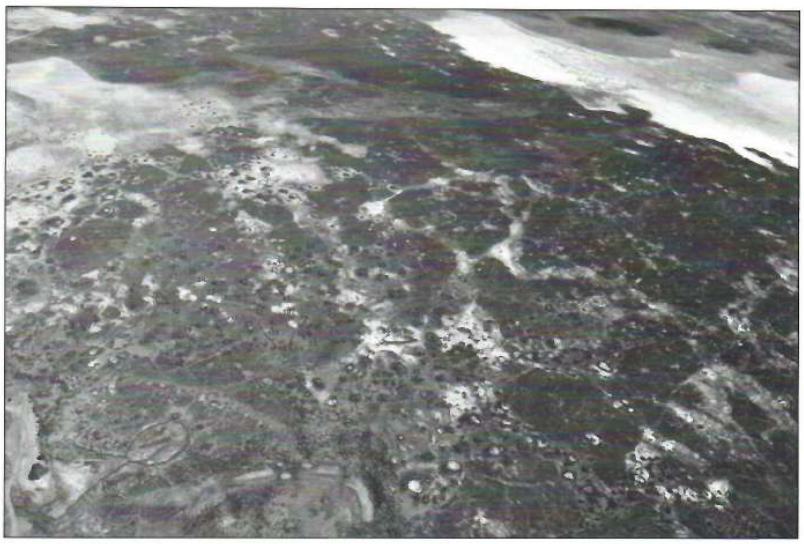
1. Location of the Wādī al-Qaṭṭāfī mesas and Wisād Pools in the Black Desert. (after Betts 2013: Fig. 1.2).



2. Google Earth view of the mesas in the Wādī al-Qaṭṭāfī.

formations, although the Umm ar-Rujūm material is of poor quality, while the chalk formation produces excellent tool stone.

As of 2015, eight seasons of survey and excavation have been undertaken at the southwestern edge of the harra on basalt covered mesas in the Wādī al-Qāṭṭafī and on the eastern edge of the basalt expanse at Wisād Pools (*e.g.* Rollefson *et al.* 2012, 2018; Rowan *et al.* 2015; Wasse *et al.* 2012). Pedestrian and drone surveys have revealed dense architectural remains in both regions, with estimates of *ca.* 600 buildings (not including animal pens) at the bases of the mesas and at least 300 buildings in the core of the huge Wisād Pools site (FIG. 3). Early Neolithic (especially Late PPNB) sites are sparsely distributed and generally ephemeral campsites with no surviving architecture (if there ever was any). It is in the Late Prehistoric period (PPNC, Late Neolithic, Chalcolithic, and Early Bronze Age) when substantial construction took place, and there are clear cases of reuse of earlier



3. Aerial photo of the core region of Wisād Pools; view to the NE.

buildings by Safaitic-speaking pastoralists. Late Chalcolithic/Early Bronze Age presence occurs atop some of the mesas, and perhaps many of the large tumuli and tower tombs at Wisād are datable to this period as well.

It is principally by chance that the excavations at Wādī al-Qāṭṭafī and Wisād Pools have only sampled PPNC and Late Neolithic structures. Two structures in the Wādī al-Qāṭṭafī (SS-11 at Mesa 4, also known as "Maitland's Mesa" and SS-1 at Mesa 7) produced radiocarbon dates from the end of the PPNC period to the later part of the Late Neolithic TABLE 1). At Wisād Pools, three structures (W-110, W-66, and W-80) were investigated, and all radiocarbon dates fall in the PPNC to earlier Late Neolithic period (TABLE 1).

Faunal remains were numerous and well preserved at Mesa 7 and at W-66 and W-80 at Wisād. Preliminary sampling indicates the residents of the two regions were hunter-herders in terms of subsistence economy, with gazelle dominating the inventory, but with domesticated caprines accounting for about 10% of the bones.

Chipped Stone Tools

(TABLE 2), provides a breakdown of the tool types from Structure SS-1 at Mesa 7 and from W-80 (FIG. 4) at Wisād Pools. Non-formal tools (retouched and utilized flakes and blades) at SS-1 were more than twice as important in the inventory (17.5%) as at W-80 (8.3%). The formal tools also show some major distinctions between the two assemblages, although the detailed tool types obscure the trends. (TABLE 3), provides absolute and relative frequencies of the prominent tool classes, and there are clear differences in the foci of activities in the two buildings. Arrowheads are a minor constituent

Table 1. Radiocarbon dates from the Wādī al-Qāṭṭafī mesas and Wisād Pools.

Site	Structure	Sample	Location in sequence	calBC, 2σ
Mesa 4	SS-11	Beta-346614	Main occupation	5,480-5,320
Mesa 7	SS-1	Beta-431871	Just above 431871	6,455-6,390
Mesa 7	SS-1	Beta-431872	Near floor	6,490-6,430
Wisād Pools	W-66	Beta-346212	Floor plaster	6,600-6,460
Wisād Pools	W-80	Beta-366675	Late in fill	5,710-5,610/5,590-5,570
Wisād Pools	W-80	Beta-395440	Late in fill	5,765-5,670
Wisād Pools	W-80	Beta-395441	Middle of fill	5,890-5,740
Wisād Pools	W-80	Beta-366677	Middle of alcove	6,000-5,840
Wisād Pools	W-80	Beta-366676	Near floor	6,590-6,580/6,570-6,440

Table 2. Chipped stone tool types from the 2015 season at structure SS-1, Mesa 7, and W-80 at Wisād Pools.

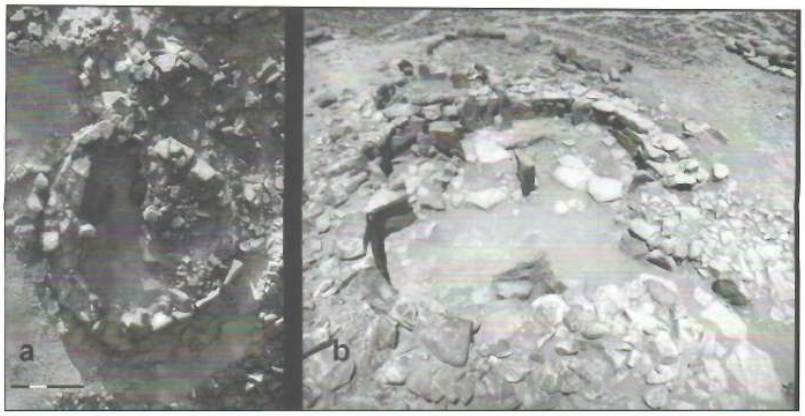
	SS-1			W-80		
Type	**n**	**%**	**%›**	**n**	**%**	**%'**
Projectile point	72	4.4	5.4	638	27.2	32.0
Sickle	1	0.1	0.1	2	0.1	0.1
Burin	644	39.2	48.4	58	2.5	2.9
Truncation	45	2.7	3.4	89	3.8	4.5
Endscraper	16	1.0	1.2	34	1.4	1.7
Sidescraper	52	3.2	3.9	136	5.8	6.8
Tabular scraper	2	0.1	0.2	37	1.6	1.9
Other scraper	0	0.0	0.0	4	0.2	0.2
Notch	98	6.0	7.4	189	8.0	9.5
Denticulate	75	4.6	5.6	200	8.5	10.0
Perforator	1	0.1	0.1	29	1.2	1.5
Awl	1	0.1	0.1	0	00	0.0
Borer	29	1.8	2.2	142	6.1	7.1
Drill	150	9.1	11.3	102	4.3	5.1
Biface	11	0.7	0.8	10	0.4	0.5
Axe/adze	2	0.4	0.2	0	0.0	0.0
Pick	0	0.0	0.0	2	0.1	0.1
Chopper	6	0.1	0.5	2	0.1	0.1
Chisel	0	0.0	0.0	3	0.1	0.2
Wedge	28	1.7	2.1	96	4.1	4.8
Unifacial knife	28	1.7	2.1	105	4.5	5.3
Bifacial knife	8	0.5	0.6	17	.7	.9
Seam knife	5	0.3	0.4	18	.8	.9
Ṭawīlān knife	20	1.2	1.5	1	.0	.1
Backed element	2	0.1	0.2	15	.6	.8
Tanged blade	1	0.1	0.1	6	.3	.3
Lunate	0	0.0	0.0	1	.0	.1
Rectangle microlith	1	0.1	0.1	0	0.0	0.0
Bladelet, retouched	11	0.7	0.8	11	.5	.7
Other	22	1.3	1.7	49	2.1	2.5
Subtotal	1331		100.4	1996		100.0
Retouched flake	39	2.4		85	3.6	
Retouched blade	100	6.1		51	2.2	
Utilized piece	148	9.0		59	2.5	
Unclassifiable	24	1.5		155	6.6	
Total	1642	100.0	100.0	2346	100.0	

of the inventory at SS-1, while at W-80 they make up nearly a third of all formal tools. But the case for burins is just the opposite, and with this class at nearly half of the tools, SS-1 takes on a character of a "burin site"; the greater diversity of burins at W-80 (40% are on truncations, while two-thirds are truncation burins at SS-1) points to a broader range of uses of burins at the Wisād Pools structure. Because burins are so dominating at SS-1, it is not surprising that the relative presence of the other tool classes are much lower compared to W-80, with

Table 3. Comparison of major formal tool classes from SS-1 and W-80.

	SS-1		W-80	
Tool class	**n**	**%'**	**n**	**%'**
Projectile points	73	4.4	638	32.0
Burins*	644	48.4	58	2.9
Scrapers	70	4.3	211	10.6
Notches/Denticulates	173	10.6	389	19.5
Drills, borers, *etc.*	181	13.7	273	13.7
Knives	61	4.6	141	7.2

* Note: Two-thirds of the burins at SS-1 are on truncations while only 40% of the W-80 burins are on truncations.

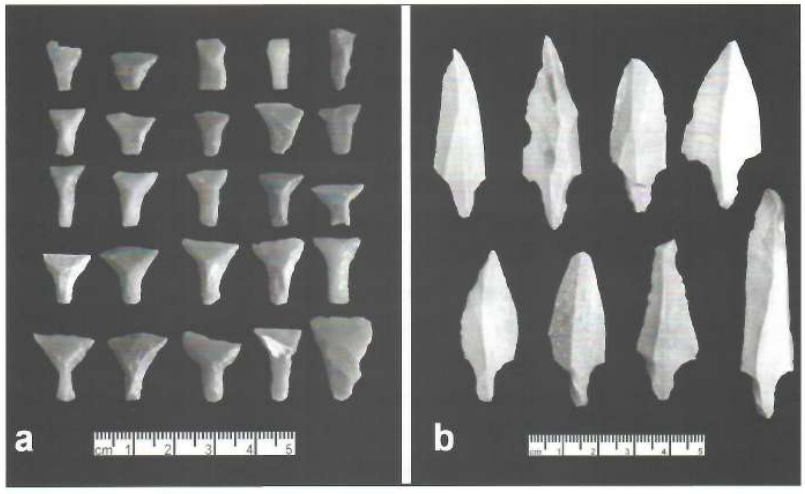


4. A. Overhead view of SS-1 at the end of the 2015 season. B. Overview of the complexity of structure W-80 at Wisād Pools.

scrapers and notches/denticulates more than twice as important at W-80, and knives (including unifacial bifacial, and Ṭawīlān versions) also much stronger at Wisād. It is only in terms of drills and borers that the two assemblages reflect equal proportions, which suggests that bead-making was practiced at similar levels of effort at both sides of the Black Desert. In summary, the tools from SS-1 indicate a highly specialized set of activities, and while the arrowheads at W-80 show an emphasis on hunting, in general the Wisād building indicates a much broader range of domestic undertakings.

Just as there is a striking distinction in the production of arrowheads at the two sites, there is also a marked difference in the kinds of arrowheads that were made. With seven-eighths of the points, W-80 obviously relied very heavily on transverse arrowheads; in contrast, not a single transverse arrowhead was recovered from SS-1. On the other hand, the much larger and heavier Bādiyah point was relatively important at SS-1, while this point type was absent at W-80 (FIG. 5). Whether these differences indicate, among other aspects, different hunting strategies or differences in the availability/preference for certain game animals must await more intensive faunal analysis.

Drills and borers were equally important in the tool kits at SS-1 and W-80, although burin spalls at SS-1 as blanks for the tools perhaps reflects the concentration on burin production at the structure (TABLE 5). The *mèches de forêt* – nominally used for drilling organic material such as wood or bone/antler – may point to some variation in local resources, as indicated by oak and tamarisk charcoal from hearths inside W-80 (*cf.* Rollefson *et al.* 2018).



5. a. Transverse arrowheads from W-80. b. Bādiyah points from SS-1. (Photos by G. Rollefson).

Table 4. Projectile point types from the 2015 season at structure SS-1, Mesa 7and from W-80 at Wisād Pools.

	SS-1			W-80		
Type	**n**	**%**	**%›**	**n**	**%**	**%'**
Transverse	0	0.0	0.0	536	84.0	87.3
Haparsa	18	26.9	38.3	34	5.3	5.5
Nizzanim	5	7.5	10.6	13	2.0	2.1
Herzliya	8	11.9	17.0	19	3.0	3.1
Bādiyah	10	14.9	21.3	0	0.0	0.0
Byblos	4	6.0	8.5	4	0.6	0.7
Other	2	3.0	4.3	8	1.3	1.3
Subtotal	47		100.0	614		100.0
Preform	10	14.9		12	1.9	
Tang only	4	6.0		3	0.5	
Unclassifiable	6	9.0		9	1.4	
Total	67	100.0		638	100.0	

Chipped Stone Technology

(TABLE 5), shows that burin spalls were more frequently used for drills and borers at SS-1, but more complete information is in (TABLE 6), where debitage selection for all of the formal tools is indicated. At the outset, it should be noted that unclassifiable debitage was three times higher at W-80 than at SS-1, and this is probably due to the emphasis on transverse arrowheads at the former site; the transverse arrowheads were made on fragments of debitage, and while bladelets and blades were probably the main resource used, the small size and absence of diagnostic aspects (especially parallel edges and parallel ridges, which identify blade/lets) resulted in the unclassifiable status.

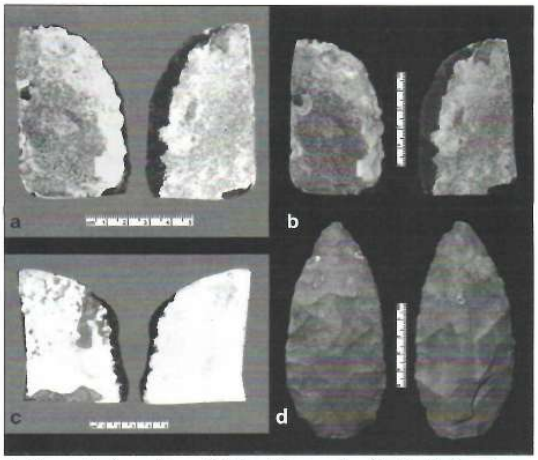
Table 5. Drill types from the excavations at M-7 Structure SS-1, 2015. And at W-80, Wisād Pools.

	SS-1			W-80		
Type	**n**	**%**	**%›**	**n**	**%**	**%'**
On blade/let, symmetrical	52	35.1	38.8	14	25.9	41.2
On blade/let, asymmetrical	25	16.9	18.7	8	14.8	23.6
On burin spall, symmetrical	24	16.2	17.9	7	13.0	20.6
On burin spall, asymmetrical	33	22.3	24.6	5	9.3	14.7
Subtotal	134		100.0	34		100.1
Mèche de forêt	3	2.0		15	27.8	
Double-ended	1	0.7		1	1.9	
Bit only	10	6.8		1	1.9	
Indeterminate	0	0.0		3	5.6	
Total	142	100.0		54	100.0	

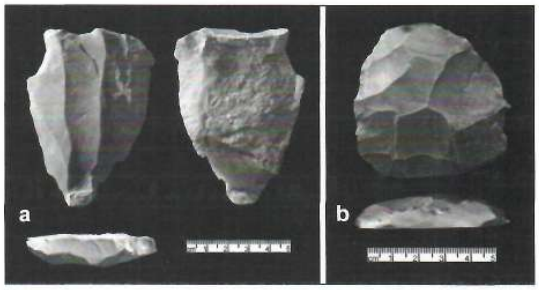
Table 6. Debitage blanks for tools of the 2015 season at M-7 and at W-80, Wisād Pools.

	SS-1			W-80		
Debitage type	**n**	**%**	**%'**	**n**	**%**	**%'**
Ordinary blade	684	51.5	55.7	922	39.3	50.4
Naviform blade	0	0.0	0.0	4	0.2	0.2
Unknown blade type	1	0.1	0.1	1	0.0	0.1
Bladelet	97	7.3	7.9	79	3.4	4.3
Flake	292	22.0	23.8	735	31.3	40.2
CTE	31	2.3	2.5	18	0.8	1.0
Burin spall	70	5.3	5.7	27	1.2	1.5
Microflake	1	0.1	0.1	2	0.1	0.1
Debris	0	0.0	0.0	1	0.0	0.1
Core, nodular	10	0.8	1.0	12	0.5	0.7
Core, tabular	26	2.0	2.1	17	0.7	0.9
Chunk/ thermal spall	9	0.7	0.7	4	0.2	0.2
Levallois blade	0	0.0	0.0	3	0.1	0.2
Levallois point	1	0.1	0.1	2	0.1	0.1
Levallois flake	0	0.0	0.0	1	0.0	0.1
Jafr flake	1	0.1	0.1	0	0.0	0.0
Flake of bifacial production	5	0.4	0.4	0	0.0	0.0
Subtotal	1228		100.2	1828		100.0
Unclassifiable	100	7.2		518	22.1	
Total	1328	99.8		2346	100.0	

Blades dominated both assemblages, and this is expected in view of the emphasis on burins at SS-1 and projectile points at W-80. The much higher use of flakes at W-80 is reflective of a higher incidence of scrapers and notches/denticulates, tool classes that were much less frequent at SS-1. Tools made on cores were mostly tabular scrapers and seam knives that were relatively more important at SS-1 (FIG. 6). The presence of reworked Levallois products is an interesting insight into recycling flint in these two areas where flint resources were somewhat scarce.



6. Seam knives from SS-1. (Photos by G. Rollefson).



7. Blade cores from SS-1 (left) and W-80 (right). (Photos by G. Rollefson).

Core types are tabulated in (TABLE 7), and the abundance in both buildings is remarkable[1]. Once again, the details of (TABLE 7) are difficult to appreciate, so (TABLE 8), presents a look at core classes. The nearly equal blade/let core frequencies at SS-1 and W-80 (FIG. 7) mirrors, in a limited way, the similar use of blade/lets for tool manufacture in both assemblages (TABLE 6). But flake cores are four to five times as frequent as blade/let cores, which might seem contradictory to the information in (TABLE 6). However, iterating that flint sources are not immediately available to the people at Wisād Pools and the Wādī al-Qāṭṭafī, it is not surprising that the raw material was husbanded intensively, and that cores very likely underwent considerable changes in morphology and technical details as the nodules or tabular cores were reduced to barely manageable objects (FIG. 8). As cores became smaller and smaller, it is highly likely that what started out as blade cores eventually were worked down to the point that only short and broad flakes could be produced. With this in mind, the higher per-

Table 7. Absolute and relative frequencies of core types from the 2015 season at SS-1, Mesa 7, and at W-80, Wisād Pools.

	SS-1			W-80		
Type	**n**	**%**	**%›**	**n**	**%**	**%›**
Bladelet core	23	4.1	5.2	21	2.0	2.6
Blade core	21	3.7	4.8	15	1.4	1.9
Opposed platform non-naviform blade core	11	2.0	2.5	2	0.2	0.2
Single platform radial core	8	1.4	1.8	19	1.8	2.4
Bifacial radial core	9	1.6	2.0	23	2.2	2.9
Microflake core	18	3.2	4.1	132	12.4	16.4
Core on flake	22	3.9	5.0	75	7.1	9.3
Single platform, single face flake core	71	12.7	16.1	125	11.8	15.5
Single platform, multiface flake core	12	2.1	2.7	68	6.4	8.4
Single platform, single face blade core	78	13.9	17.7	74	7.0	9.2
Single face, multiplatform flake core	25	4.5	5.7	44	4.1	5.5
Multiface, multiplatform flake core	69	12.3	15.6	131	12.3	16.3
Pyramidal	5	0.9	1.1	3	0.3	0.4
Semi-pyramidal	17	3.0	3.9	15	1.4	1.9
90° change-of-orientation core	52	9.3	11.8	59	5.6	7.3
Subtotal	441		100.0	806		100.2
Manuport				6	0.6	
Casual core/tested piece	34	6.1		32	3.0	
Unclassifiable fragment	85	15.2		208	19.6	
Total	560	100.0	100.0	1062	100.0	

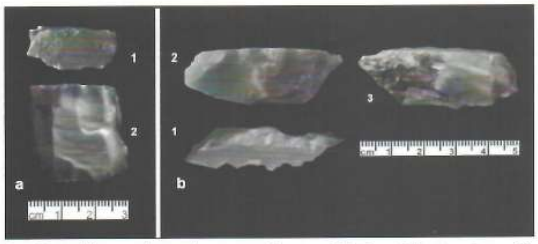
1. W-80 was roughly 6 m in diameter, and SS-1 slightly smaller at around 5 m diameter. Only half of SS-1 was excavated in 2015, so the relative abundance of cores at the two buildings is similar.

centage of flake cores at SS-1 might be more an index of intensive reduction compared to W-80. The greater importance of pyramidal cores and cores of 90° Change-of-Orientation (FIG. 9) at SS-1 is difficult to interpret at the present stage of core analysis.

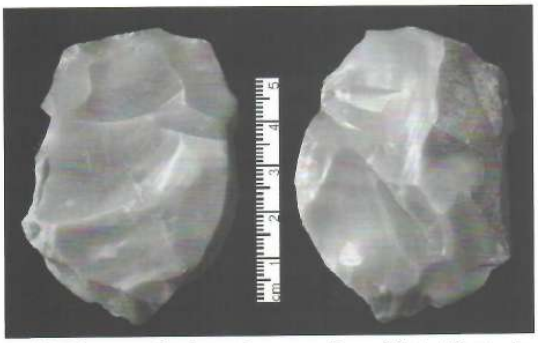
Table 8. Comparison of major core classes from SS-1 and W-80.

	SS-1		W-80	
Core class	**n**	**%**	**n**	**%**
Blade/let	55	12.5	113	13.8
Flake	294	66.7	486	59.6
Microflake	18	4.1	132	16.2
Pyramidal	22	5.0	18	2.2
90° C-o-O	52	11.8	59	7.2

A prominent disparity in cores is the 16.2% "microflake cores" at W-80, almost four times the amount at SS-1. Microflake cores are defined s pieces whose maximum dimension does not exceed 20 mm, although at W-80 many of them have maximum dimensions nearer 10 mm (FIG. 10). Many of the microflake cores from both sites resemble the small "polyhedrons" reported by Cropper (2006), who has called into question the assumption the "core" status of these artifacts. The even tinier microflake cores at W-80 might seem to lend support to Cropper's skepticism, for often the negative scars indicate that the last flakes to be removed were shorter than 10 mm. However, in view of the importance of the small transverse arrowheads at W-80, many of the microflake cores may be the final exhaustion stage of blank production of transverse points. (TABLE 9) presents the dimensions of complete transverse arrowheads from W-80.



8. Heavily reduced core from SS-1. (Photo by G. Rollefson).



9. 90 Change-of-orientation core from SS-1. (Photo by G. Rollefson).

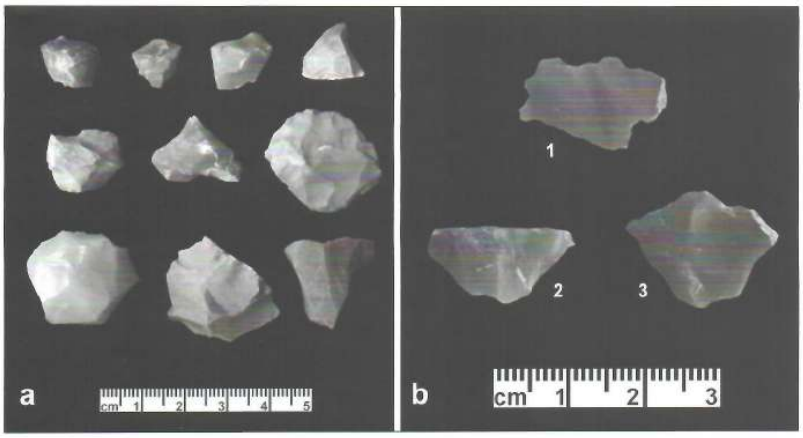
Table 9. Dimensions in millimeters of transverse arrowheads from W-80.

	n	Min	Max	Mean	S.D.
Length	532	7	29	14.9	3.6
Width	532	4	28	13.2	3.5
Thickness	532	1	9	3.6	1.3

Discussion and Concluding Remarks

The preliminary analysis of the technotypological aspects of chipped stone assemblages from SS-1 at Mesa 7 and at W-80, 50 km to the east of the Wādī al-Qāṭṭafī, reveals some strong differences in what was being manufactured and how the production of tools varied. The two structures are essentially contemporaneous, and the landscape and biotic resources on both edges of the Black Desert were probably essentially the same, although even minor differences in microhabitats may have influenced both vegetation and faunal populations; certainly, the landscapes were very different during the Late Neolithic than what can be experienced in the region today (Rollefson *et al. n.d.*).

Betts has raised the question of how many different populations of hunter-herders there were in the Black Desert during the PPNC/Late Neolithic periods (2013: 186-188). Based on details of details of core preparation, she has rejected the notion that PPNC herders from the western farmlands, including 'Ain Ghazal, were the herder-hunters of the eastern edge of the Black Desert at Burqu', located less than 100 km NNE of Wisād Pools. While that may be the case, details of the technotypological aspects of



10. Microflake cores from W-80. (Photo by G. Rollefson).

western Late Neolithic agro-pastoralists remain sketchy, and more detailed study of the material from the mesas and Wisād Pools must be carried out to compare the technotypology of these areas with the Burqu' region and with, for example, 'Ayn Ghazāl.

One thing is clear, though: our understanding of the conditions of a hunter-herder way of life during the PPNC/Late Neolithic is very different from what we had appreciated only a decade ago. The pastoral element of the colonization of the *ḥarra* and *ḥammād* was an event of major proportions Rollefson *et al.* 2014), a development that greatly increased the absolute numbers of people in a region that was much better watered and vegetated than today. How many hunter-herding groups from different "origins" there were remains to be determined.

Bibliography

Betts, A. 2013. *The Later Prehistory of the Badia. Excavations and Survey in Eastern Jordan: Volume 2.* Oxford: Oxbow Books.

Cropper, D. 2006. Chipped Stone Polyhedrons from Late Neolithic Umm Meshrat I, Jordan. *Paléorient* 32 (1): 85-97.

Rabba, I. 2005. *The Geology of Umm Nukhayla and Wadi al-Qattafi Areas. Map Sheets No. 3453-II and 3453-1.* Amman: The Hashemite Kingdom of Jordan Natural Resources Authority.

Rollefson, G., Rowan, Y., Perry, M. and Abu-Azizeh, W. 2012. The 2011 Season at Wisad Pools, Black Desert: Preliminary Report. *ADAJ* 56: 29-44.

Rollefson, G., Rowan, Y and Wasse, A. 2014. The Late Neolithic Colonization of the Eastern Badia of Jordan. *Levant* 46(2): 1-17.

Rollefson, G., Rowan, Y., Wasse,A., Kersel, M., Hill, A.C., Lorentzen, B., Ramsay, J. and Jones, M. 2018. Excavation of Structure W-80, a Complex Late Neolithic Building at Wisad Pools, Black Desert. *ADAJ* 59: 531-544.

Rowan, Y., Rollefson, G., Wasse, A., Wael Abu-Azizeh, W., Hill, A.C. and Kersel, M. 2015. The "Land of Conjecture:" New Late Prehistoric Discoveries at Maitland's Mesa and Wisad Pools, Jordan. *Journal of Field Archaeology* 40 (2): 176-189.

Wasse, A., Rollefson, G. and Rowan, Y. 2012. A Seventh Millennium BC Late Neolithic Village at Mesa 4 in Wadi al-Qattafi, Eastern Jordan. *Neo-Lithics* 12/1: 15-24.