THE DEEP-TIME NECROPOLIS AT AL-WISĀD POOLS, EASTERN BĀDIYA, JORDAN

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Introduction

At the end of a survey of the greater Wādī as-Sarḥān area in 2002 (Wasse and Rollefson 2005, 2006), two of us (GR and AW) visited one final site on the basis of information from a colleague that we might find Neolithic material there. Al-Wisād Pools did indeed have exposures of both Pre-Pottery Neolithic B (PPNB) and Late Neolithic (LN) artifacts, but since we were at the end of the survey season with still many hours of travel before we would arrive back in ʻAmmān, we paid scant attention to other archaeological evidence at the time.

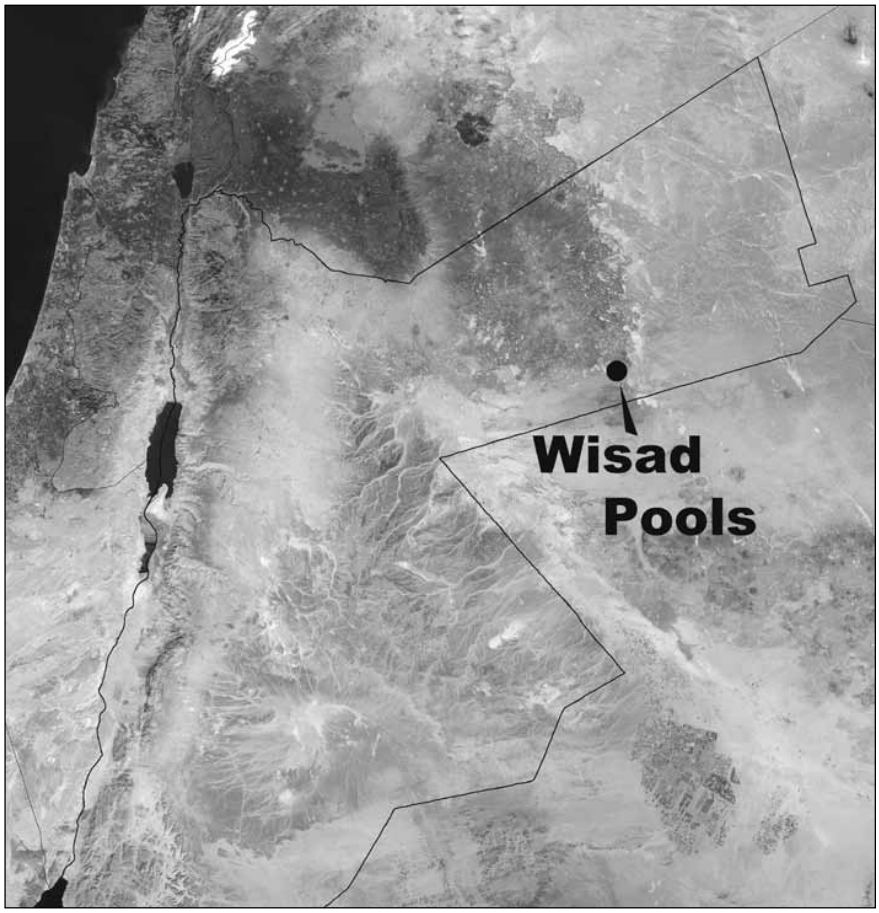
Five years later, on the way back to ʻAmmān from some other sites we had found during the 2002 survey at Jabal adh-Dharwa, we stopped again at al-Wisād Pools for a closer examination of the PPNB situation, and it was at this time that our eyes were lifted from the surface of the site and we saw the extent of the ancient structures that spread virtually from horizon to horizon. We were staggered: almost as far as the eye could see, concentrations of basalt blocks rose from the ground as broad mounds or low towers or large circles or chains of rectangular constructions. Clearly, none of this was Early Neolithic, but it was also almost certain that we were gazing across a vast prehistoric landscape that had been altered slowly over hundreds of generations, over thousands of years. How could we have missed this astonishing vista during our first visit?

On our return to ʻAmmān, with a pause at ʻMaitland's Hillfort', we resolved to develop a systematic investigation of the al-Wisād Pools necropolis as well as complementary Late Prehistoric occurrences among the numerous basalt-covered mesas east of Azraq. All three of us arranged for a project to map the Early and Late Prehistoric architecture in both areas, beginning with two four-week seasons at al-Wisād Pools in 2008 and 2009.

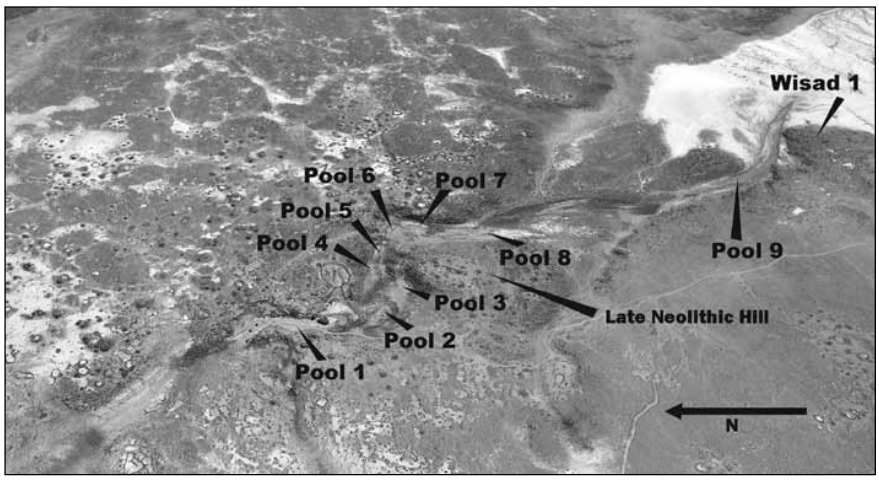
Al-Wisād Pools

Al-Wisād Pools consists of a series of natural depressions in the bedrock of a short wadi (*ca*. 1.2km long) that leads from one plateau to another approximately 8 - 9m lower in elevation near the eastern end of the Black Desert, just north of the border with Saudi Arabia at the al-Wisād Bādiya Police Post (**Fig. 1**). Access to the site is via a torturous, primitive track across the basalt countryside, requiring about four to four and a half hours to travel the *ca*. 120km ESE of North al-Azraq.

Al-Wisād is located in hyper-arid desert conditions (average precipitation less than 50mm / yr), and today winter rainfall is sporadic in the sense that there is no rainfall in any one spot for several years at a time. Nevertheless, when rain does fall, the upper plateau acts as a collection basin, and even a relatively small amount of precipitation can find its way into Wādī al-Wisād and fill the pools, some of which are deep enough (up to 1.5m) so that water can be retained for a considerable time. We have detected nine pools in the wadi (**Fig. 2**) that differ markedly in size. The depth of the pools can be seen by noting the height of the silt line above the wadi bed (note difference in color in (**Fig. 3**), where the lighter shade indicates the presence of silt deposited on the basalt blocks in the wadi). The capacity of Pool 1 was measured by taking 20 cross-section measurements along the 160m length of the depression, with an average cross section of 14.3m in width by 0.93m in depth. Pool 1, then, had a demonstrated capacity of more than 2,000m^3 (over a half-million US gal-



1. Location of al-Wisād Pools at the eastern edge of the basalt desert in Jordan's panhandle.



2. Distribution of the pools at al-Wisād and the location of the Late Neolithic village of Wisad 1 (Photo: D. Kennedy).

lons), which would have been an extraordinarily attractive location for herding groups. Simple visual inspection indicates that Pools 2-8 are much smaller in capacity. Pool 9 appears to have been more than 600m long, but at present it does not appear to have a depth appreciably greater than around 30-40cm. If the pool had an average width of *ca*. 30m, this would amount to around 6,500m^3 (more than 1.7 million US gallons), but its shallowness indicates it may have lost volume quickly under hot desert conditions. Even so, the situation of al-Wisād 1, a small semi-permanent LN (*ca*. 5,500 - 5,000 cal BC) village at the end of Pool 9, indicates that this resource was sufficient at times for a lengthy stay. The high density of pecked rock art representing an

3. View to north-east of al-Wisād Pool 1. The lighter color in the center of the photo is silt that has been deposited on the basalt blocks in Wādī al-Wisād during winter rains (Photo: G. Rollefson).

array of animals and 'desert kites' overlooking the pools suggest they held an attraction for millennia (Rollefson, Rowan and Wasse 2008).

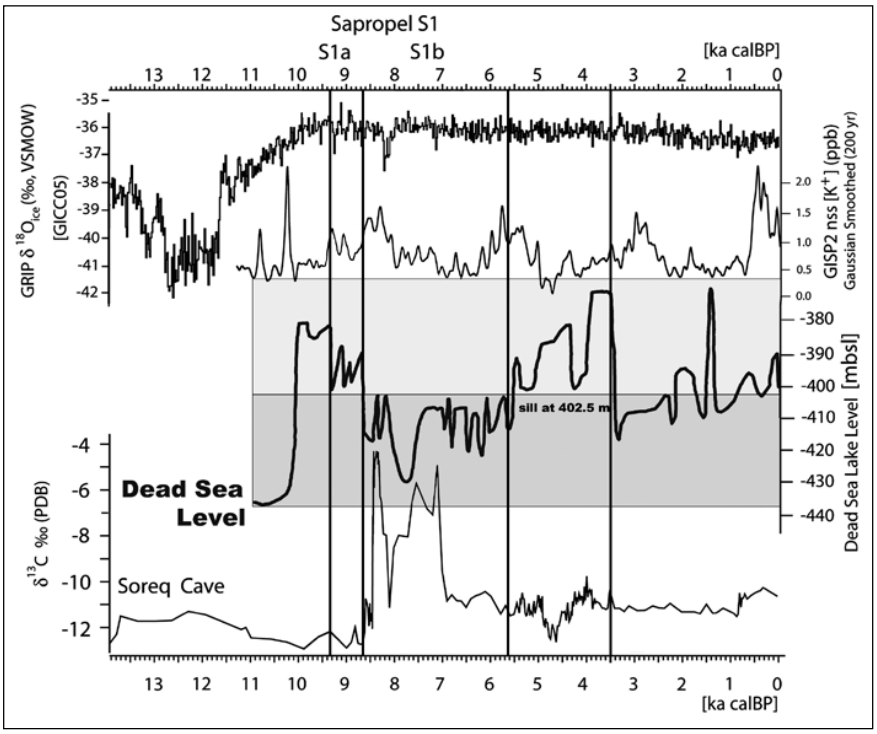
While we have counted nine pools, some of these are clearly artificially created by the placement of barrages constructed at various points along the length of the wadi. This is clearly the case between Pools 2 and 3,4 and 5,5 and 6, and 6 and 7. When these check dams were built is not known at the present time, but in part the barrages may have served to reduce the flow into Pool 9, where overflow on to the adjacent *qā'* (mudpan) would have essentially wasted the precious liquid.

The Bādiya and Water

The Jordanian Bādiya ('badlands') includes the uncultivable steppe and desert that extend northward out of the Arabian Peninsula. The eastern Bādiya, which includes the basalt plains and mesas of the 'Black Desert', was exploited by Paleolithic, Epipaleolithic and Neolithic hunter-gatherers who were dispersed across the territory (e.g. Betts 1998; Maher *et al*. n.d.; Richter *et al*. 2009; Rollefson *et al*. 1997). As populations of villagers grew during the Neolithic period in the western agricultural areas of the southern Levant, the Bādiya came under closer scrutiny by people whose herds of sheep and goats began to need pasture land that increasingly competed with farmland; the otherwise unproductive vegetation in the steppe and desert could be converted to meat, hair and wool, and dairy products. Herders therefore began to move from the arable countryside into the arid areas with their animals during the rainy months, not returning to the farming areas until after the harvests were in (Köhler-Rollefson 1992; Rollefson and Köhler-Rollefson 1993). As capital in the form of live animals grew with increasing intensification of the Bādiya, location of seasonal water sources became more and more important. Critically, this development was unfolding as precipitation was becoming more and more unpredictable.

The level of water in the Dead Sea basin has become an important yardstick for the reflection of changes in rainfall over time. One landmark that has emerged is the ridge - or 'sill' - that separates the northern and southern basins of the Dead Sea, the top of which is 405.2m below sea level (**Fig. 4**). When water level is above the sill, a single large body of water fills the basin, but when water level falls to more than 405.2m below sea level, two smaller bodies of water form or - as is the case today - the southern basin dries up completely. Since the Dead Sea is a closed drainage system, prior to the modern drain on water capacity due to large scale irrigation, it was precipitation that played the most important role in the level of the water.

Figure 4, then, is an indicator of changing rainfall patterns from 14,000 (calibrated) years ago at the left of the graph until modern times at the right. The lighter shading indicates when water levels were high (at least above the sill), while the darker shading indicates low wa-



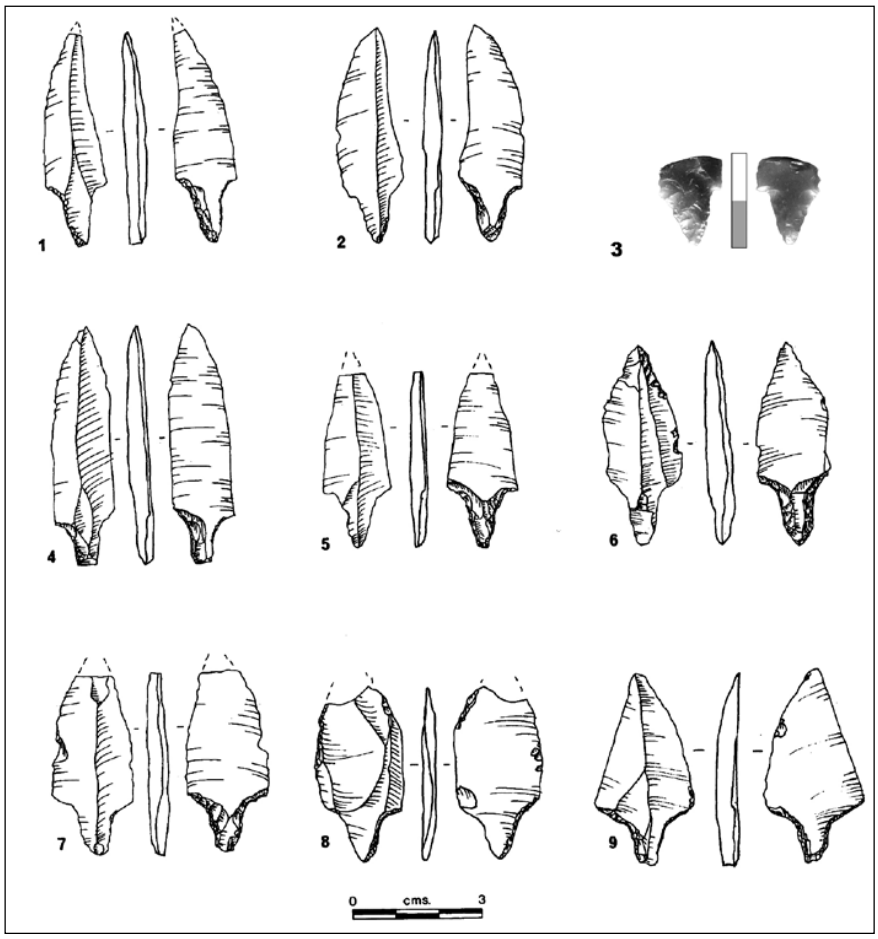
4. Graphs of changes in various climatic proxies for the southern Levant, with a focus on Dead Sea levels as representative of rainfall variation (the light and dark shaded areas). The first vertical line from left corresponds broadly with the shift from the MPPNB, the second line from left marks the end of the PPN and the beginning of the Pottery Neolithic / LN, the third line is the transition from the Middle to the Late Chalcolithic, and the vertical line to the right is perhaps generally coincident with the transition from the Middle to Late Bronze Age periods (modified from Weninger 2009: fig. 2).

ter levels / rainfall. The first vertical line from left corresponds broadly with the shift from the Middle Pre-Pottery Neolithic B (MPPNB), the second line from left marks the end of the Pre-Pottery Neolithic and the beginning of the Pottery Neolithic / LN, the third line is the transition from the Middle to the Late Chalcolithic, and the vertical line to the right is perhaps generally coincident with the transition from the Middle to Late Bronze Age periods. Although direct correlations between rainfall patterns and cultural changes have recently been strongly challenged (Maher *et al*. 2011), there are nevertheless strong relationships between Dead Sea levels and finely dated isotope variations in the Soreq Cave speleothems that suggest rainfall was significantly higher during the Late Chalcolithic and the EBII / EBIII transition (Matthews and Ayalon 2011: 168-169), reflecting increased rainfall much higher than today. Although there were significant drops in precipitation within the Chalcolithic itself and between the Late Chalcolithic and Early Bronze I, rainfall was still higher than at present and certainly greater than during the LN (Pottery Neolithic in the west and 'Desert Neolithic' in the east). The changes in Dead Sea levels during the LN indicate relatively rapid oscillations in runoff, from short periods of severe drought to times of rainfall almost as high as present conditions.

The fluctuations in precipitation would have had major impacts on farming in the west, but there would also have been significant simultaneous influences in terms of quantity and quality vegetation in the Bādiya that supported the herds of pastoral nomads. More seasonal water that was more evenly distributed across the landscape on a more reliable basis would have periodically sustained larger herds of sheep and goats as well as larger numbers of people who herded them. Wealth was relatively easy to accumulate during times of climatic amelioration in the Bādiya, and we can see the consequences of that wealth in terms of mortuary behavior at al-Wisād Pools.

Wisad 1: A Semi-Permanent LN Village

At the south-eastern end of Wādī al-Wisād and a meter or so above the southern end of Pool 9 is a small cluster of circular and sub-rectangular enclosures that likely represents a semi-permanent village of huts and animal pens spread across *ca*. 3 hectares (Wasse and Rollefson 2005: 17). The village can be dated by the presence across the site of small LN arrowheads (**Fig. 5**) that are variants of Betts' Bādiya points



5. 1 - 2, 4 - 9: LN Bādiya points from the basalt region of Jordan's eastern desert (Betts 1998: fig. 4.14); 3: Bādiya point from Wisad 1 (Photo: G. Rollefson).

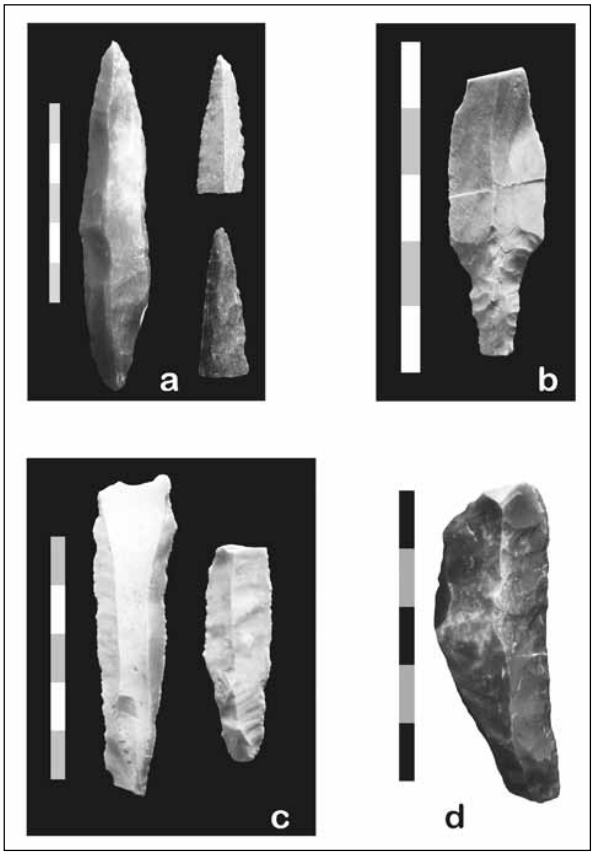
(Betts 1998: Fig. 4.14). The occupation would appear to coincide with the rapid increase of precipitation between 5,500 - 5,000 cal BC indicated in **Fig. 4**, when water in the pools at al-Wisād would have been more predictable. The degree of permanent settlement can not be determined on the basis of surface evidence, but the potential capacity of Pool 9 suggests that water was not necessarily the limiting factor for sustained residence at the site. The number of animal pens (5-6, with an estimated average diameter of 10-15m) suggests that a combined herd of *ca*. 70-100 animals may have depleted pasturage in the local vicinity relatively rapidly, forcing herdsmen to have taken the sheep and goats far enough away that they may not have returned to the village at night. But this scenario also might include the situation where small children and the elderly may have remained behind at Wisad 1 for a considerable period, moving only when distances between the herds / herdsmen and the resident families demanded relocation of the latter. It is possible that some degree of cereal cultivation along the edge of the *qā'* just to the south could have helped sustain a resident population (cf. Henry *et al*. 2003).

One of the imposing features of Wisad 1 is the presence of a prominent tower tomb (looted) with a preserved height of less than 2m but a diameter of *ca*. 5m at the base. The occurrence of this tomb on the village site raises the possibility that the use of tower tombs may have begun as early as the LN, and that some similar structures elsewhere at the al-Wisād Pools necropolis are also this early. Support for this relationship comes from site Jabal adh-Dharwa 2 (Wasse and Rollefson 2005: 16), approximately 50km to the south-west of Wisad 1, which is another semi-permanent village (*ca*. 0.5 hectares, not counting *ca*. 10 animal pens located on a lower terrace to the east and north-east) with LN artifacts and a looted tower tomb whose backdirt yielded human bone and ostrich eggshell. Jabal adh-Dharwa 2 is situated on a terrace of the

eponymous hill about a kilometer south-west of sizeable *qā'* that would have provided water for a relatively long period of time. Projectile points here are heavier, almost bolt-like, than the thinner Bādiya points of Wisad 1.

Techno-typological Chronology of the al-Wisād Pools Necropolis

The pools at al-Wisād attracted human groups for millennia, stretching back as early as the Early Epipaleolithic (*ca*. 22-15,000 cal BC) based on dense accumulations of bladelets, bladelet cores, and tools, when water attracted animals that then attracted hunters. The bulk of Epipaleolithic artifacts came from the summit of 'Late Neolithic Hill'. MPPNB and Late PPNB (LPPNB) projectile points were mostly found just to the west and above Pool 1 and reveal that this geological oddity was also a popular location in the 8th millennium cal BC (**Fig. 6**). Late Neolithic Hill, as the name suggests, is an area of densely distributed cores, debitage, and tools of the LN period; it occupies the hollow of Wādī al-Wisād between Pools 4 and 8 (**Fig. 2**).



6. a-b: PPNB projectile points; c: PPNB knives; d: knife or scraper of uncertain age (Photo: G. Rollefson).

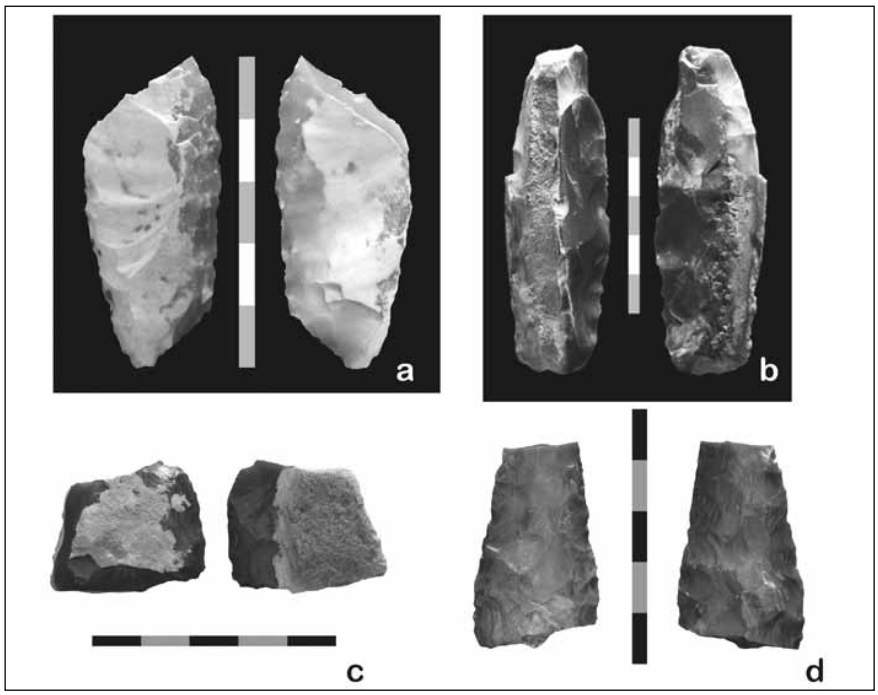
The concentration of LN artifacts on Late Neolithic Hill (and the Epipaleolithic density as well) suggests this was a favored locale for manufacturing tools; the top of the hill provides a good viewpoint of the entire wadi pool system as well as a commanding view of both the upper plateau and the large *qā'* that begins at the edge of the village of Wisad 1. Although the LN visitors to the site were undoubtedly pastoralists, they would still undoubtedly have been heavily reliant on hunting game such as gazelle, onager, oryx, ostrich and other prey. But whereas the Epipaleolithic artifacts are essentially restricted to the summit of Late Neolithic Hill (and the MPPNB and LPPNB artifacts to a terrace above Pool 1), LN artifacts are found across the entire expanse of the necropolis as well as at the village of Wisad 1 (**Figs. 7-9**).

Other artifacts reflect later use of the site as well. Three transverse arrowheads (**Fig. 10**) probably date to the LN / Early Chalcolithic transitional period (e.g., *ca*. 5,200-4,700 cal BC), as Betts' work in the area between Jabal Qurma to Qaṣr Burqu' has shown (Betts n.d.). Although no complete specimens have been recovered so far, pieces of cortical scrapers (or 'tabular scrapers') are scattered sparsely across the site. These could be as early as the LN, but are more likely to be from the Chalcolithic or earlier Early Bronze Age periods (**Fig. 11**). Spread across the necropolis there are also small concentrations of debitage and diffuse scatters of non-diagnostic stone tools that are probably mostly attributable to the Chalcolithic or earlier Early Bronze Ages.[1]

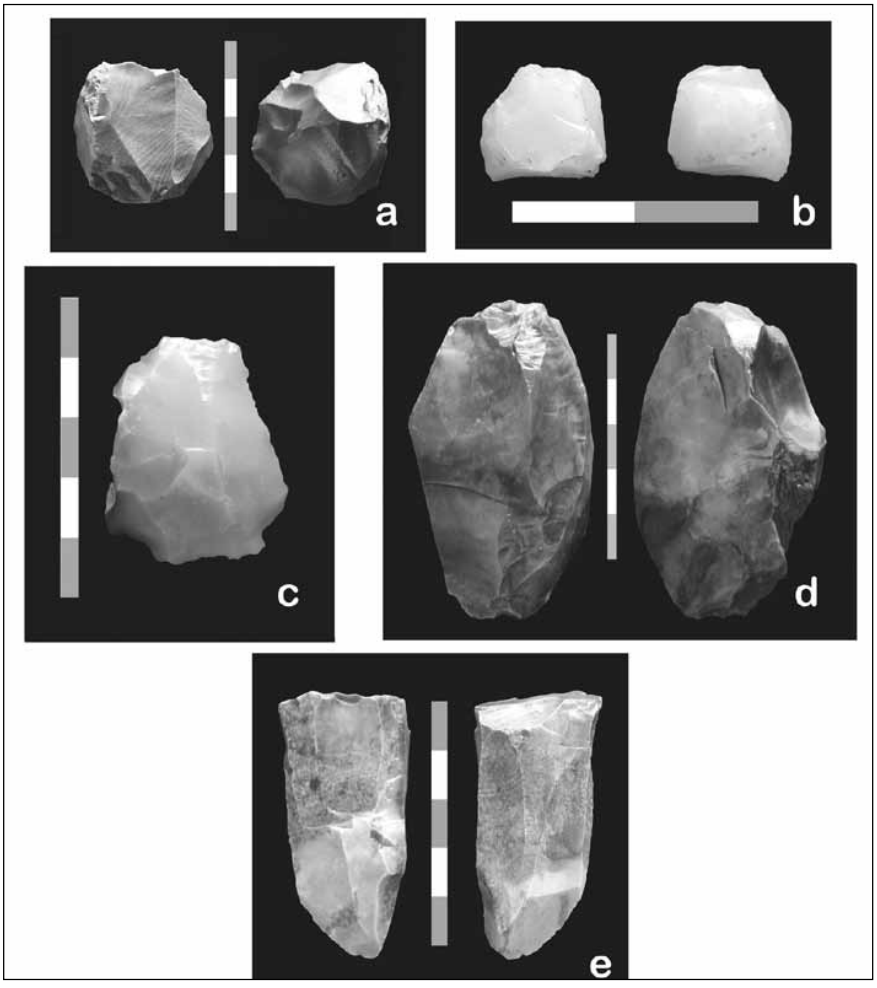
Architectural Variability at the al-Wisād Pools Necropolis

The 2008 season provided us the opportunity to experience the variety of different structures at al-Wisād. While one of us (AW) concentrated in the central part of the necropolis immediately around the pools (where most of the more imposing mortuary architecture was located), the

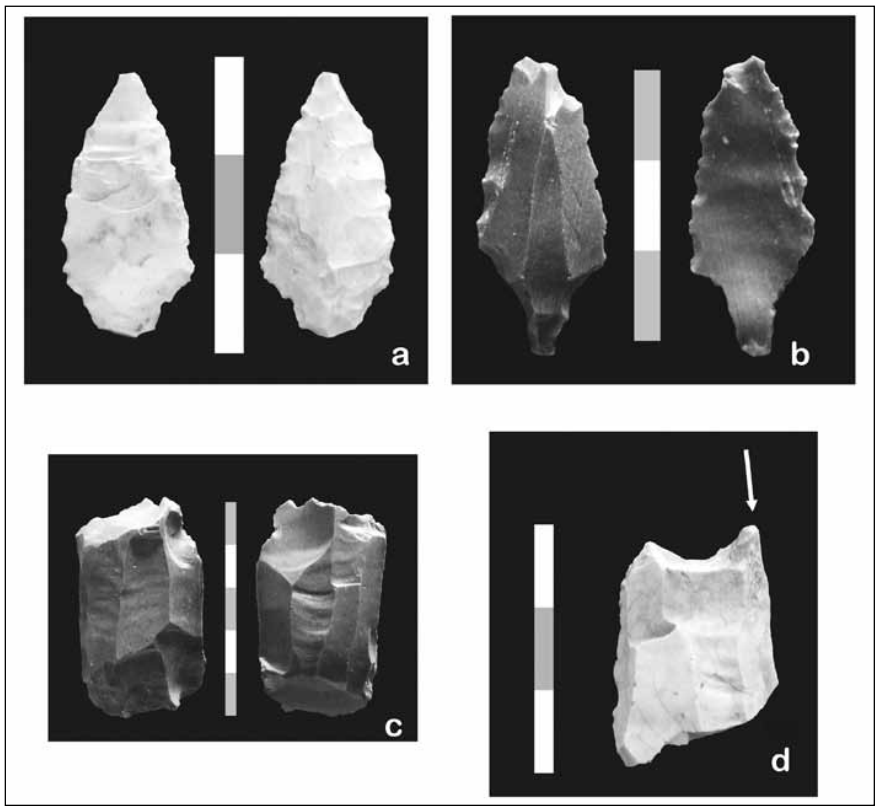
1. Rees dated the tower tombs to the Safaitic period based on the presence of inscriptions on many of them. He also suggested that they were constructed by the Roman army for use as guard houses (1929: 391-392). This is a classic example of not acknowledging the terminus ante quem concept.



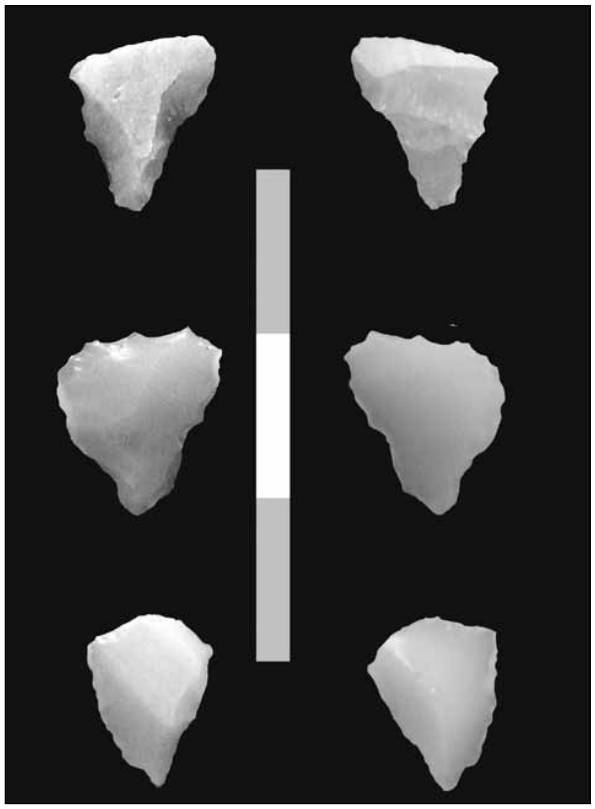
7. Bifacial knives from the core area of al-Wisād; a: LN chalcedony knife; b: unfinished knife; c - d: bifacial knife fragments (Photo: G. Rollefson).



8. Cores from the core area of al-Wisād; a, c, e: LN; b: tiny core (1cm maximum dimension) of unknown age; d: Epipaleolithic blade core (Photo: G. Rollefson).



9. a-b: LN arrowheads; c: LN blade core; d: probable LN truncation burin (Photo: G. Rollefson).

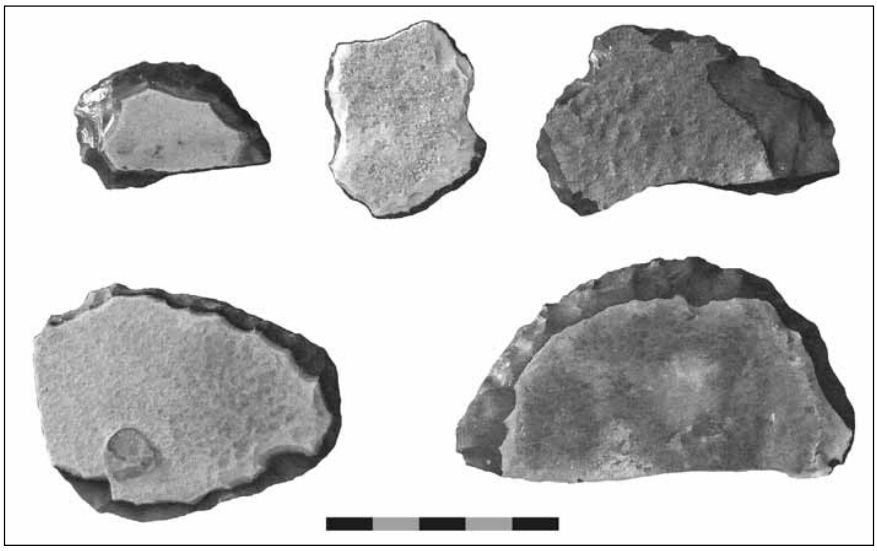


10. LN - Early Chalcolithic transverse arrowheads from al-Wisād Pools (Photo: G. Rollefson).

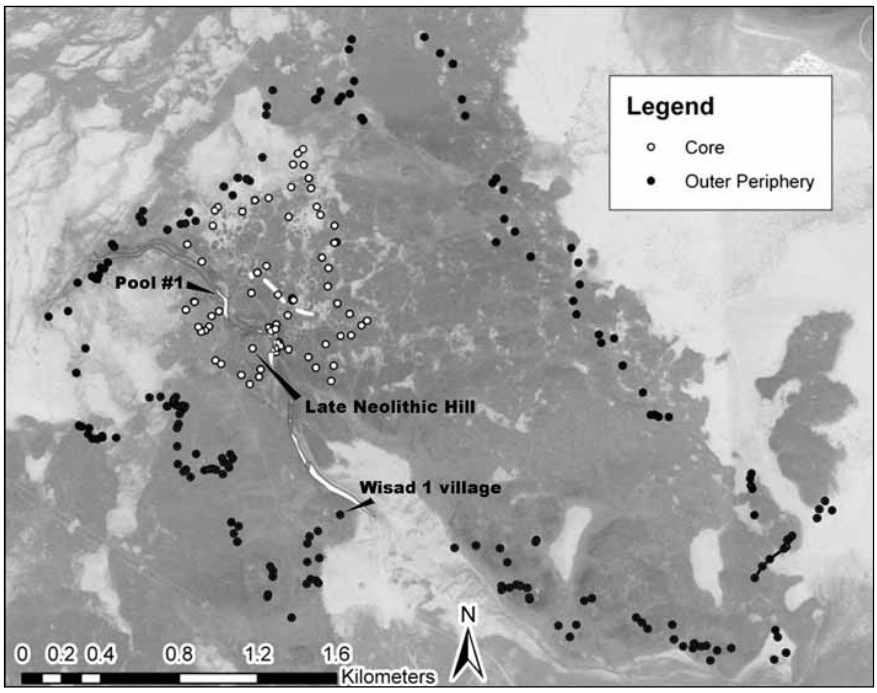
other two of us (YM and GR) explored the fringes of the site. All three of us located the centers of structures (mortuary, residential, pastoral and ritual) using hand-held GPS devices (**Fig. 12**). In 2009, 119 of the structures were mapped using a total station, but hundreds more remain to be sited (**Fig. 13**). In addition to small cemeteries of individual Islamic burial cairns (especially in the peripheral area alongside small mudpans), a very preliminary assessment suggests that there are at least ten major structural types, some with sub-types.

Type 1a

The most noticeable buildings are the tower tombs (**Fig. 14**). Tower tombs are known throughout most of the desert areas of the Arabian Peninsula, as far south as Yemen (e.g., Braemer *et al*. 2001). Tower tombs at al-Wisād have been preserved to just under 2m in height, with basal diameters of 5-7m; others from the basalt-covered mesas at Wādī al-Qaṭṭāfī are preserved to nearly 3m height, with basal diameters around 8m (cf. Rowan *et al*. 2011). Rosen's research in the Negev Desert has demonstrated that some tower tombs are probably Late Neolithic in age,



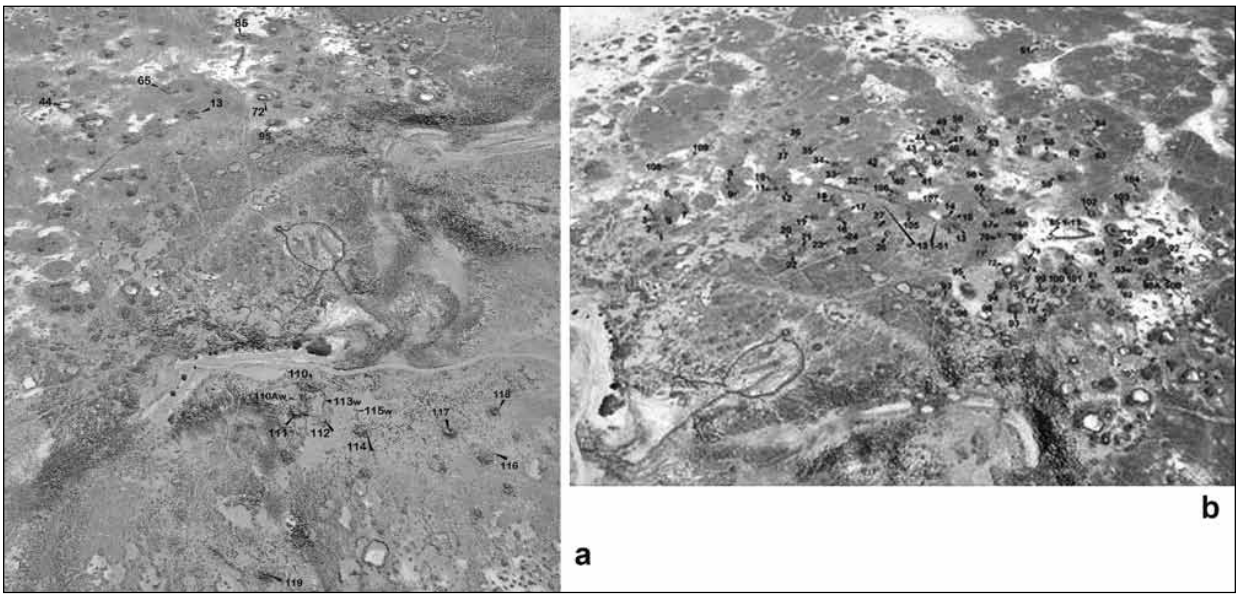
11. Cortical scraper fragments from al-Wisād Pools (Photo: G. Rollefson).



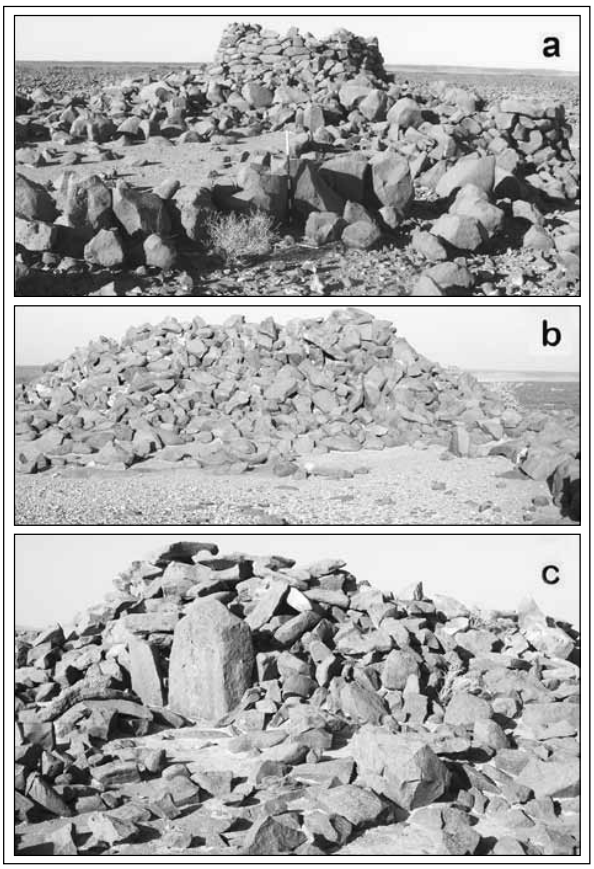
12. Map of architecture located by GPS devices in the core and periphery areas of al-Wisād Pools (after K. Harrington, n.d.).

dating to around 5,000 cal BC (Rosen *et al*. 2007: 19-22). At al-Wisād, scattered artifacts inside and immediately outside the tombs include beads and tool fragments that are consistent with a Late Neolithic date (**Fig. 15**). It should be noted that *nawāmīs* (*bedouin* term for tower tombs; sing. *nāmūs*) in the Sinai were dated to the Chalcolithic / Early Bronze Age (Bar Yosef *et al*. 1986: 163-185), and two large *nawāmīs* necropolises in Yemen have been dated to the Early Bronze Age (Braemer *et al*. 2001; McCorriston *et al*. 2011).

Within this type there is some degree of variability. Most tower tombs are set in isolation, but one tower tomb at al-Wisād ('Wisad Structure' 110, i.e. WS 110), for example, was surrounded by a 'courtyard' cleared in the basalt cover, using the boulders and smaller stones to create a massive wall (**Fig. 14a**). Others have small semi-circular paved areas separated from their surroundings by small basalt slabs set on edge to the west and east of the central structure (e.g., WS 80). Two tower tombs at al-Wisād have a large upright stone at the base on the eastern



13. Mapped structures at al-Wisād Pools as of the end of the 2009 season (Photos by D. Kennedy; images by G. Rollefson).

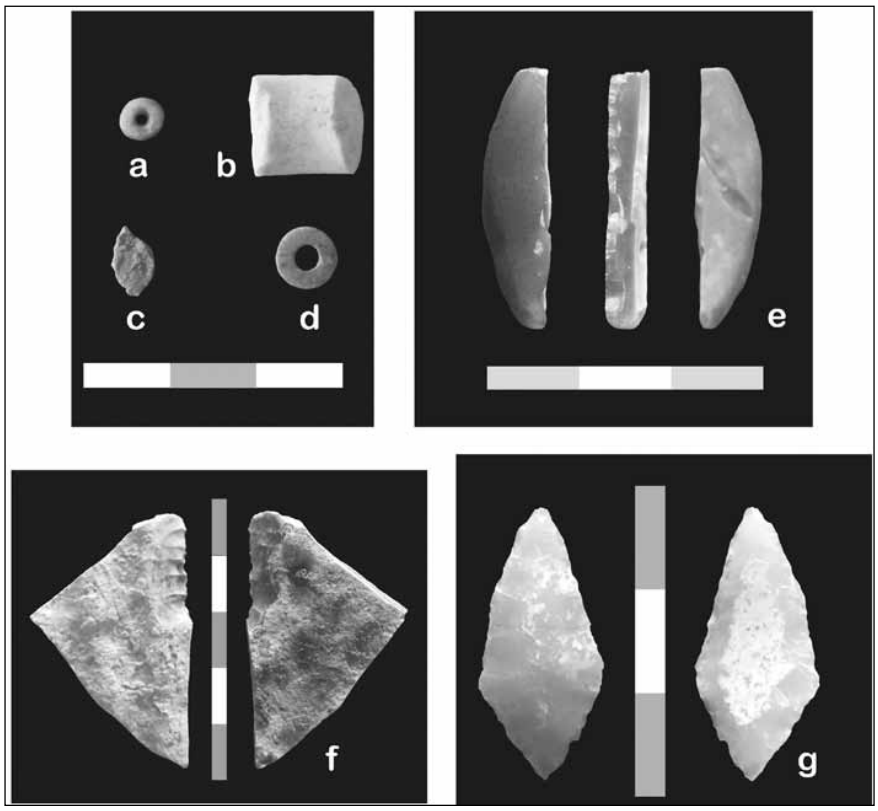


14. Some of the structural variability at al-Wisād Pools; a: WS 110 with a large western courtyard surrounded by a massive wall of basalt boulders; b: WS 72, a large circular 'namus-like' structure; c: WS 7, a long (10m) chain of rectangular chambers oriented north - south. (Photos: G. Rollefson).

edge of the structure (**Fig. 14c**); although it can not be demonstrated conclusively that this is associated with sunrises, it is a tempting interpretation. In terms of distribution, tower tombs are found all over the core area.

Type 1b

This sub-type is essentially a tower tomb but with added elements. The most striking feature is a 'tail' (a term coined by Rees in his description of structures in the eastern Bādiya, 1929: 391), or chain, of chambers measuring *ca*. 2 x 1.5m each. WS 13, for instance, has 44 chambers trailing towards the west in a long arc of *ca*. 120m (**Fig. 16**), although several others had shorter tails of from six to 14 chambers, with the tails oriented in several directions on the compass. Tailed tower tombs (called 'pendants' by Kennedy; cf. Kennedy and Bishop 2011) are common in the eastern Bādiya, especially on top of the basalt-capped mesas that are numerous in the south-western part of the basalt desert. The tower tomb on top of Maitland's Mesa has a tail of 55 chambers along the southern edge of the mesa (Rowan *et al*. 2011). The size of the towers is essentially the same as those without tails. To our knowledge, these have not been reported from the Negev or Sinai, but excellent examples are known from a site west of Riyadh, Saudi Arabia (Zarins *et al*. 1981: Plate 37c) and from central Yemen (Braemer *et al*. 2001).



15. Artifacts from inside tower tomb WS 118; a - e: ornaments; f: fragment of a tile knife; g: LN arrowhead (Photos: G. Rollefson).

There are several points of variability within this sub-type. First, the tower tomb could be isolated except for the attendant tail. Second, the tower tomb itself might be in the center of a circular platform walled all around (e.g. WS 85); another variation is a walled oval compound (e.g. WS 66). WS 13, on the other hand, added two more features: first, it was separated from its tail by a rectangular, low-walled, paved platform that included several small circular and sub-rectangular areas walled off from the rest of the platform by narrow standing stones about 60-75cm high; second, the tower was rectangular in plan, not circular (**Fig. 16**), and there might be more than one chamber inside the tower.

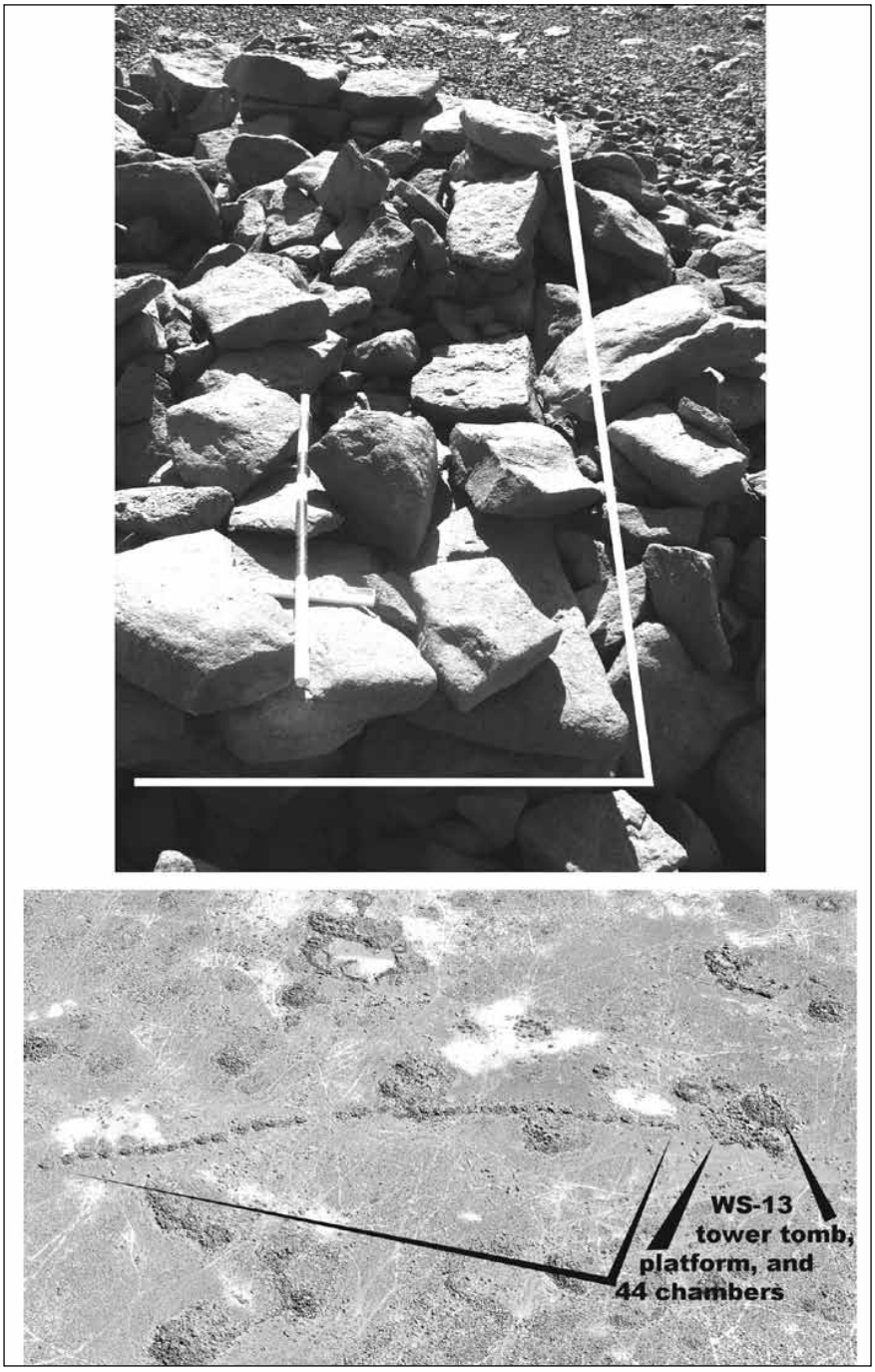
Dating this form of ritual monument is problematic at the moment, but the fundamental similarities of the tower tomb element with Type 1a suggest these might be somewhat later, perhaps Chalcolithic or Early Bronze Age.

Type 2

The second major structural form is the large circular or sub-rectangular mound of basalt blocks, with diameters often exceeding 10m and with preserved heights of up to a meter or more. While some appear to remain intact, many others have been severely damaged due to looting, but this action has also exposed interior features (**Fig. 20**). Type 2 cairns appear to be multi-chambered tumuli, ranging from two to as many as eight or more chambers. We estimate that these multi-chambered tumuli make up roughly a quarter of the major structures at al-Wisād. Regarding dating, at the moment we can only suggest that they probably are Late Neolithic, or perhaps slightly later. Abu Azizeh's research in the Thulaythuwāt area of southern Jordan has circular cairns that have been dated to 5,300-4,700 cal BC (Abu Azizeh 2010: 368).

Type 3

Rectangular linear structures unassociated with tower tombs or large circular tumuli occur less frequently at al-Wisād. WS 7, for example, is a 10m chain of four or five rectangular chambers approximately 1.5 x 1.0m and *ca*. 75cm high (**Fig. 17a**); one of the chambers has been thoroughly destroyed by looters, although the others appear to be intact. Were such chambers associated with burials? Or could they have been sturdy storage features to



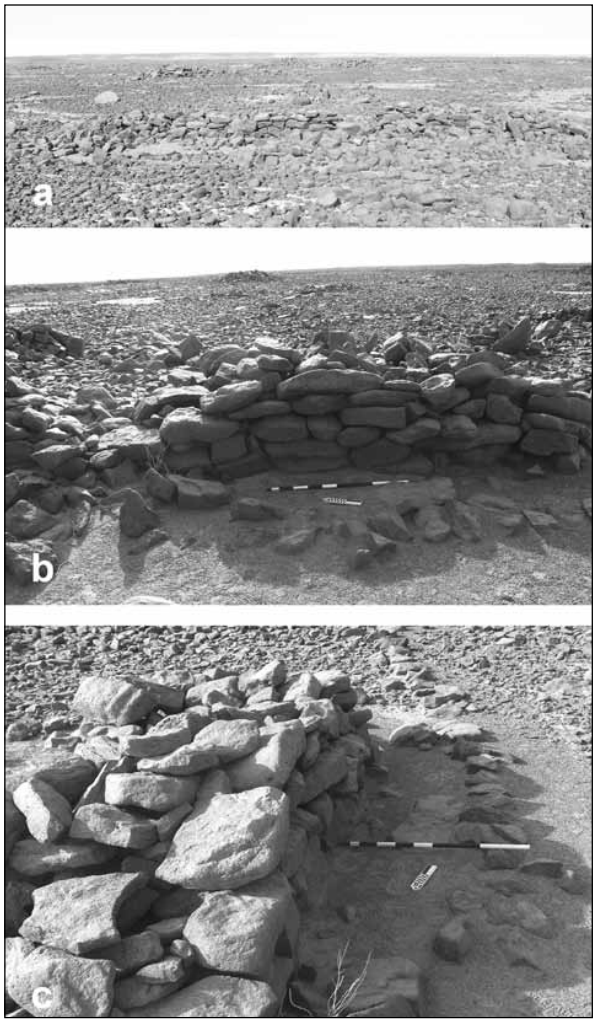
16. Type 1b tailed tower tomb WS 13; a: the white lines emphasize the rare rectilinear arrangement of the walls of this large tower tomb; b: the tower tomb at right is separated from a 'tail' of 44 chambers by a paved platform about 5 x 6m in extent (Aerial photo by D. Kennedy; other imaging by G. Rollefson).

hold equipment pending frequent returns to the same location?

Another example is WS 65, where a chain of five rectangular chambers constitutes the western 'wall' of a broader, almost square paved area that includes a slightly raised platform (**Fig. 17b-c**) and a lower paved courtyard with a pathway leading through it, set off by thin basalt slabs placed on edge.

Type 4

There are several examples of large circular enclosures (8-10m diameter) built of massive basalt slabs that have survived to a height of more than a meter. These we have termed '*nāmūs*-like', although they are evidently a third to two thirds larger than the Sinai originals (cf. Bar-Yosef *et al*. 1986: 125-126). Some of these structures (e.g. WS 72, **Fig. 18**) have a paved



17. Type 3 structures; a: WS 7, linear arrangement of enclosed chambers (north to left); b: WS 65, similar to WS 7, one of whose chambers is visibly empty; c: WS 65, view to south, with a curb of stones leading towards a ring-walled tower tomb (WS 66) (Photos: G. Rollefson).

courtyard as large as the building to the east, set off from the surrounding area by a wall of high, thin basalt slabs (*ca*. 60-75cm). The mass of the walls, their height and the paved courtyards argue against a simple residential construction (and are certainly unnecessarily complex for animal pens), so it appears these might have ritual associations. Type 4 structures constitute a small proportion of the al-Wisād structures, although they were prevalent at the southern foot of Maitland's Mesa (Rowan *et al*. 2011).

Type 5

Ritual 'complexes' add to the diversity of architecture at al-Wisād, and some of this com-

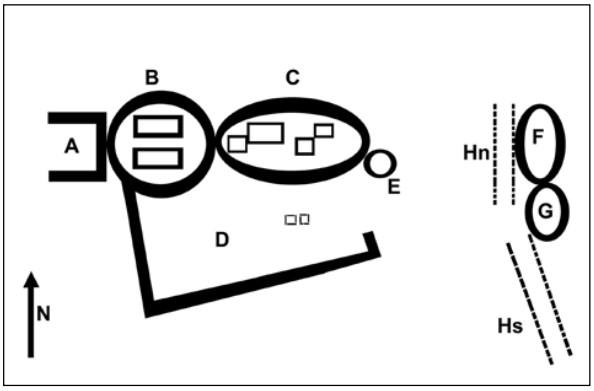
18. Type 4 structure WS 72, a 'nāmūs-like' structure; a: view of massive wall construction; b: view of interior of WS 72, showing abundant fallen wall stones, implying the walls were probably once more than a meter high; c: relationship of WS 72 to tailed tower tombs WS 13 and WS 85 (Aerial photo by D. Kennedy; other imaging by G. Rollefson).

plexity may reflect an evolutionary sequence of alterations to original, simpler ritual elements. While most of the buildings at al-Wisād might individually represent changes over time (including much of the variability in Types 1 - 4 described above), these accumulated develop-

ments appear to have been effected within only a few generations. But other examples might argue for extended alterations over longer periods of time. One of the most extreme examples of complexity is WS 58 (**Fig. 19**).

WS 58 (see **Fig. 19** for features A - H below) may have begun life as an isolated tower tomb, similar in all respects to Type 1a above (though there are clearly two interior chambers in WS 58). This would certainly be the case if tower tomb B existed in isolation. However, over time, additions were made to the basic tower tomb, although the sequence of changes has not yet been worked out. U-shaped element A abuts tower tomb B, as does an elliptical multi-chambered tomb C. When these appeared relative to walled courtyard D (which includes two tiny square cubicles) can not be determined, nor is it at all clear when circular feature E (which is only one slab high) was created in relation to features A - D. Smaller single-chamber tumuli F and G seem to be contemporary in a general sense, but this can not be correlated in any way with features A - E. Finally, there is 'curbed' pathway H (Hn and Hs in **Fig. 19**), outlined by small (25-40cm) slabs lying flat on the ground that separate tumuli F and G from the rest of the complex.

How WS 58 can be interpreted requires much more information than we have at the present time. There are several other large complexes with apparently multifaceted sequences, but they also defy definitive interpretation at this time. The complexity of all of them indicates something that is non-linear in development, but how that can be determined remains elusive.



19. Type 5 complex; sketch diagram of WS 58 in the central part of the core area. A is a u-shaped feature at the western edge, abutting tower tomb B, which has two internal chambers. Abutting this to the east is oval mound C that contains four interior chambers. D is a partially walled courtyard containing two small cubicles (interior dimension ca 30-40 cm maximum). E is a circle of stones. F and G are two oval mounds each with a single chamber. Between C / E and F / G are curbed 'paths' H, leading north (Hn) and south-east (Hs). Not to scale; orientation approximate. The diameter of B is approximately 3m (Sketch by G. Rollefson).

Type 6

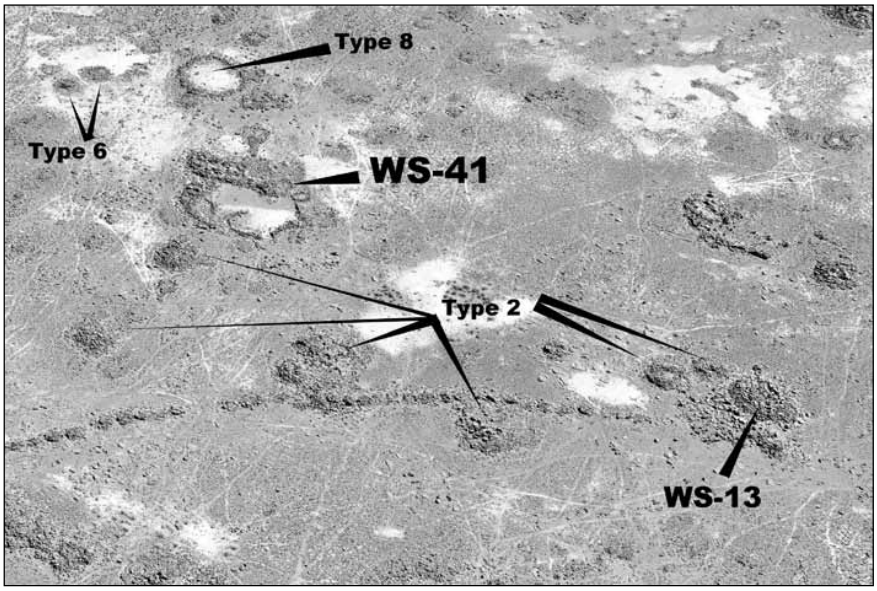
There are numerous low basalt cairns (*ca*. 2 x 1m, height 20cm) that are usually at odds with orientations that are normally indicative of Islamic burials. At the sites on the periphery of al-Wisād, south-east / north-west orientations, which allowed faces to be directed towards Makkah, were frequent. We have interpreted these as ritual, perhaps being late prehistoric burials of individuals of lower status than those buried in the larger tumuli. An appreciable number of them have standing stones in association, sometimes at both ends of the elliptical cairn. Dating – as ever – is a problem, but it is worth considering the possibility that these burial mounds might be associated with the largely invisible pastoral communities that are known to have inhabited the region during the later Bronze Age, Iron Age and Classical periods (**Fig. 20**).

Type 7

Some of the arrangements of stone walls and apparent clusters of alignments suggest that at times there were residential complexes atop the Wisad plateau. These are relatively scarce in comparison with other structure types, but stand out in terms of what might be arrangements of nuclear or even extended family walled compounds. WS 41, for example, was a walled compound of *ca*. 15 x 20m (**Fig. 20**). Inside the compound, with a spacious area for sheep or goats, were several smaller enclosures that might have been stone foundations for tents / huts and for storage features. The quantity of heavy basalt slabs necessary to construct this complex indicates that it was a compound that was repeatedly reoccupied.

Type 8

Walled clearings constitute the most numerous kind of construction at al-Wisād. Typically they are 10m or more in diameter and have low walls erected simply by clearing large spaces in which to camp and for animals to be protected.



20. Type 7, WS 41, a possible walled residential complex with animal pen, hut and storage rooms. This complex is close to tailed tower tomb WS 13; tumuli of types 2 and 6 are in the near vicinity, as is a type 8 animal pen (Aerial photo: D. Kennedy; other imaging by G. Rollefson).

In clearings where there were enormous, partially buried basalt boulders, we can assume these were animal pens (**Fig. 20**). Such clearings were probably repeatedly re-used. The variability in the color of the cleared surfaces likely reflects a seriation of clearance and use.

Type 9

There is a plethora of ephemeral but noticeable animal tracks across the necropolis that resulted from traffic as animals – herded and wild – passed to and from the pools at al-Wisād. But there are also some intentionally created paths of variable lengths that link up some of the Type 8 clearings. Usually the stones removed during the path creation were simply tossed aside, but there are also instances where the stones were kept beside the path, forming a curb (cf. **Fig. 19**: Hn and Hs).

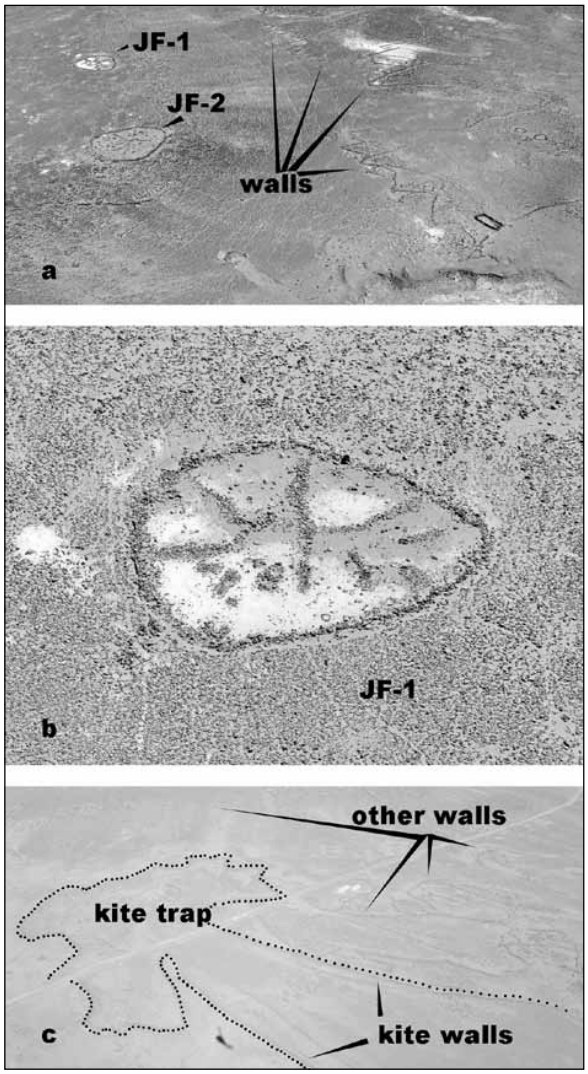
Type 10

Type 10 units are generally off-site constructions that may or may not be related to the visits to the al-Wisād necropolis. 'Kites' are hunting traps first identified by Rees (1929: 395), and there are several very large ones in the immediate vicinity of al-Wisād Pools. While some kites have walls kilometers in length at times, the quaint kite on the site itself, just east of Pool 1, is a miniature version (**Fig. 13**). The trap of the kite is slightly more than 60m in diameter and the length of the southern wall just over 100m. The circular part of the kite stands to a preserved height of more than a meter. The temporal relationship of this feature with any of the other structures at al-Wisād remains enigmatic, but it is possible that this was mostly used as a pen for sheep and goats that were taken to and from Pool 1 for watering.

There are 'real' kites of much larger dimensions in the vicinity of al-Wisād Pools, with traps of *ca*. 250m diameter and walls of undetermined length but reaching a kilometer or more; the diameter of the trap in **Fig. 21c** is more than 250m, taking the width of the truck track running through the kite as *ca*. 4m. There are also two 'jellyfish' (Kennedy refers to them as 'wheel houses') a couple of kilometers to the south of the site periphery (**Fig. 21a-b**). Along the eastern, southern, and south-western edges of the necropolis are enigmatic zigzag wall alignments (**Fig. 22**). The long walls may be analogous to the "*murets-barrières*" noted by Abu Azizeh in the Thulaythuwat region, interpreted as part of the pastoral system to control animal herds (Abu Azizeh 2010: 308-322).

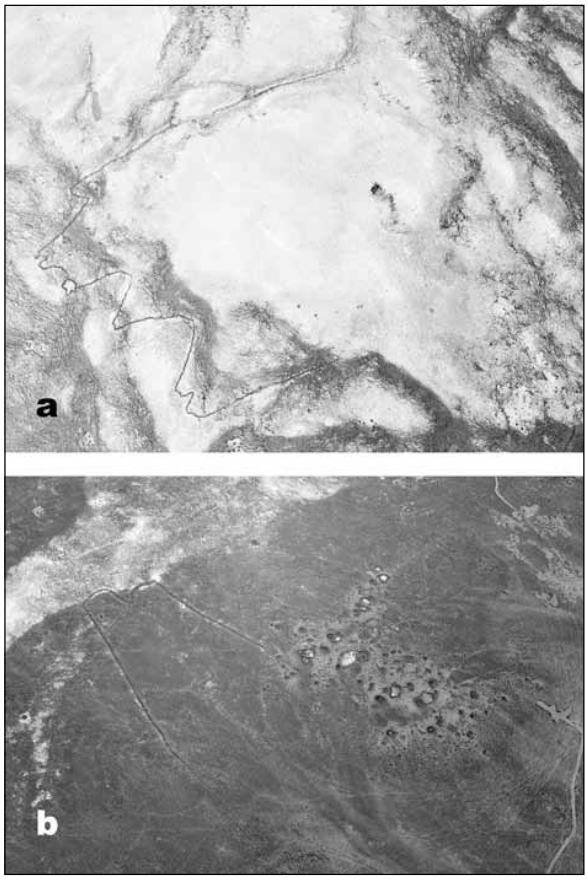
Discussion

Population pressure combined with climatic deterioration was a catastrophic combination for Neolithic residents of the mega-sites of Jordan at the turn of the seventh millennium BC. One response to the difficulties of staying alive under these circumstances would have been



21. Type 10 structures in the near vicinity of Wisad Pools; a: two small 'jellyfish' (JF) and some zigzag walls of unknown date and function approximately 4 km south of the pools in the necropolis; b: close-up of JF 1; c: a kite approximately 5 km south-east of al-Wisād, the walls and trap of which are enhanced by dotted lines. Diameter of the trap is over 250m (Aerial photos: D. Kennedy, additional imaging by G. Rollefson).

to look towards the arid lands of the eastern Bādiya, relying on the ability of sheep and goats to convert the otherwise unusable vegetation of the arid landscape into food and other goods to trade with people who remained behind to coax cereals and other crops from the hard-pressed soils of the agricultural areas. The foundations of today's *bedouin* societies were taking form, and by the Late Neolithic of the latter half of the seventh millennium full-scale herding societies had emerged.



22. Walls of unknown function and date; a: at the edge of the kite at the north-east edge of the necropolis; b: long walls that parallel a shallow wadi at the south-western edge of the necropolis periphery (Aerial photos: D. Kennedy; additional imaging by G. Rollefson).

But if life was taxing for farmers, it was not necessarily easy for the early herding families either. Rainfall necessary to provide seasonal vegetation in the badlands was also scarce in the sixth millennium, so the beginnings of the pastoral lifestyle were probably tenuous. But in the second half of the sixth millennium, when rainfall began to return to modern conditions, winter and spring pastures grew more and more lush, herds increased in size – as did the numbers of herding families – and wealth grew simultaneously. As tribal groups increased in size, social organization became more complex. Possibly through processes similar to those of 'big man' developments (Sahlins 1963; Hayden 2001), responsibilities for ensuring tribal welfare may have been accompanied by unequal access to wealth (especially animals); the emergence of the ancestors of today's sheikhs was well estab-

lished by the end of the fifth millennium. The death of these important tribal individuals was announced to the rest of the desert dwellers in the form of imposing mortuary architecture in places where visitors or passers-by could hardly ignore them.

Al-Wisād Pools would have quickly assumed a special place in the lives of herding societies in the late sixth and fifth millennia. Just as agricultural land and other assets had become increasingly commodified as 'restricted property' in the ninth and eight millennia BC among the farming societies in arable territories (Gebel 2010a), so did sources of predictably abundant water and pastureland become defended as tribal territories. Monumental mortuary structures would have demonstrated the depth of time of such restricted access. The pools at al-Wisād began as natural reservoirs, but over time additional barrage dams were constructed across the narrow Wādī al-Wisād to increase conservation of water by preventing its loss on to the broad plain at the mouth of the wadi. In a sense, then, we see at al-Wisād the development of a form of desert water management that would eventually culminate in what Gebel has called "Pastoral Well Cultures" leading to Arabia's "Oasis Economies" (Gebel 2010b; Gebel and Mahasneh n.d.) that would continue elaboration until modern times.

Despite earlier visits to the site by hunting groups, al-Wisād's primary occupational history was probably concentrated from the late sixth through the mid-third millennia, although the vagaries of rainfall - even during the mid-Holocene climatic optimum (cf. **Fig. 4**) - probably caused significant interruptions during that long span of time. As a consequence, at least some (if not most) of the variability that can be seen in the mortuary and ritual structures likely reflects an evolution of style over time. Furthermore, although the last groups who buried important personages there may have claimed some sort of ancestral link with the earlier inhabitants of the other tombs at the necropolis, they may actually have had little direct historic and genetic connection with the earlier groups.

For the moment, there are major problems concerning the use of al-Wisād Pools that require resolution before a minimal understanding of this remarkable place can be achieved. Everything we have at present comes from the surface, which is clearly unsatisfactory. From what we could tell in a brief assessment, almost all of the physically more impressive tombs have been looted, and this is another blow to a social and physical reclamation of the people who were buried there. At the moment, there are also no samples that can provide direct absolute dating for any of the structures and their contents. But this set of hurdles is about to be removed in future fieldwork at al-Wisād.

At least three more seasons will be devoted to mapping the structures, but in addition we will also have teams to recoup as much information as is possible from the tombs, looted or not. Commonly, looters both ancient and modern have shown an exclusive interest in artifacts from the graves, but they have left behind the mortal remains of their inhabitants. Although no longer in pristine location, the bone material (which is generally of good preservation) can be recovered so that we can obtain bone apatite radiocarbon dates, as well as provide at least minimal demographic information over the time span represented at the site. Furthermore, other teams will excavate samples of the non-mortuary architecture, including animal pens, residential buildings, and ritual structures, taking OSL samples for general dating when radiocarbon samples can not be recovered.

Research into the development of desert-dwelling peoples in Jordan and elsewhere in the Near East has been sporadic until the past few decades, but as new generations of archaeologists expand their research in the greater Arabian Peninsula, a more comprehensive picture of what seems to be an exotic, even romantic lifestyle will come into clearer focus.

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