# THE 2011 SEASON AT WISĀD POOLS, BLACK DESERT: PRELIMINARY REPORT

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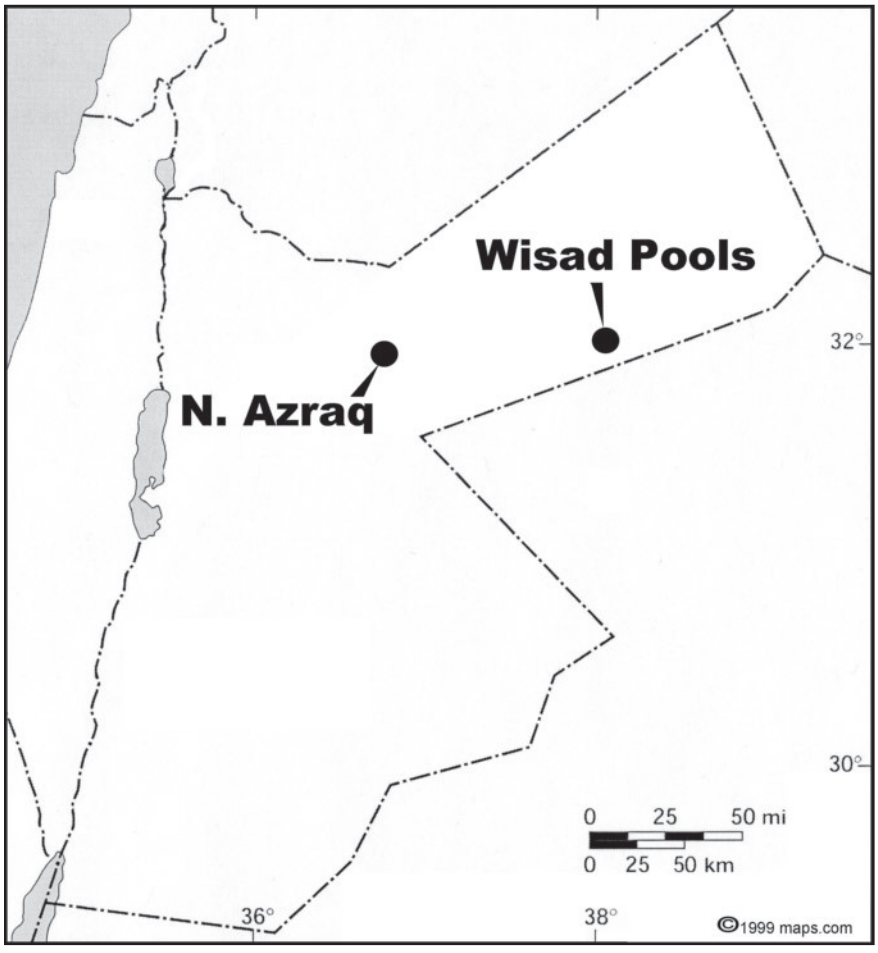
**Introduction**

Wisād Pools (**Fig. 1**) lie approximately 100km ESE of Azraq, consisting of a series of natural basins in a short (*ca.* 1km) *wadi* that leads from one plateau to another lying only 8-9m lower in altitude. Locally, the terrain includes low hills and numerous extensive *qī'ān* (Ar. "mudflats") that collect surface runoff when precipitation in the winter rainy season pelts the denuded, hard-packed silts and basalt blocks. Regionally, the landscape is characterized by a Late Miocene flood basalt cover (hence the name 'Black Desert') overlying undifferentiated (or at least unnamed) Middle to Late Eocene limestone formations and perhaps the Early Miocene Qirma calcareous Sandstone formation (Rabb'a 2000).

Although known to local *bedouin*, to Jordanian, Saudi and Syrian hunters, and to re-

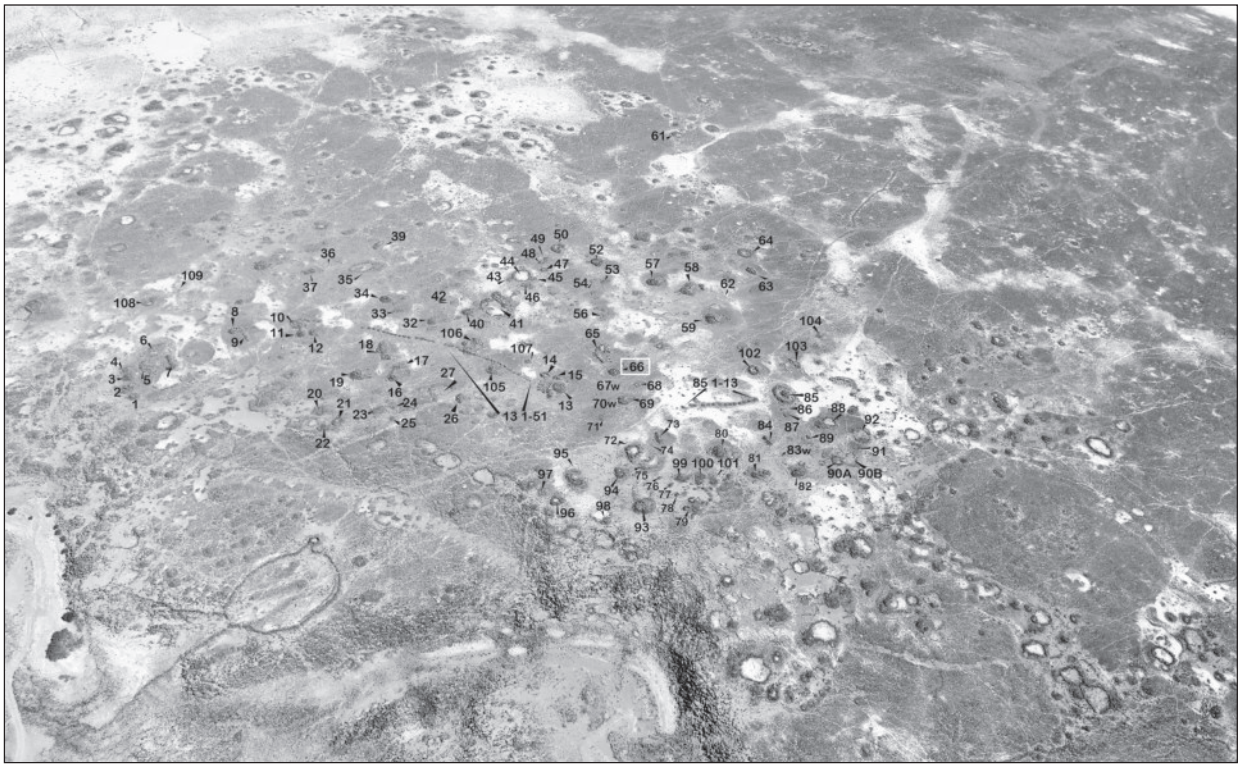



*1. Location of Wisād Pools in the Black Desert of eastern Jordan.*

searchers concerned with desert ecology for many years, the archaeological character of the Wisād Pools area was not acknowledged until 2002 when a survey included a stop at this concentration of prehistoric archaeological remains (Wasse and Rollefson 2005). Subsequent surveys and mapping followed in 2007, 2008 and 2009 (cf. Rollefson *et al*. n.d.a), and in 2011 we undertook continued mapping as well as limited excavation of structures that were densely distributed over an expanse of *ca.* 1.5x1.0km.

There are hundreds of structures (**Fig. 2**), all constructed of local, naturally rectangular, basalt slabs and more irregular blocks. The structures fall into several major types, including: (1) large multi-chambered tumuli (as evidenced by looting), (2) smaller, lower mounds that also appear to be mortuary in nature, (3) impressively massive towers, sometimes with attendant 'chains' or 'tails' of smaller (*ca.* 1x2x1m) chambers or basalt piles of various lengths, (4) what appear to be open-air buildings with interior features suggesting non-residential (ritual?) functions, (5) 'lanes' or pathways outlined by small basalt boulders that continue for tens of meters but do not have obvious origins or destinations, (6) small and large enclosures with walls of basalt boulders and slabs collected from the interiors of the enclosures, exposing floors of accumulated light-colored silts in the process, (7) probable residential compounds with interior structures that may represent dwellings, animal enclosures and storage facilities, (8) circular platforms (*ca.* 2-4m diameter) that perhaps represent either burials or work / storage areas, and (9) lines of adjacent rectilinear chambers (each *ca.* 2x1x1m, from four to eight in a line), which may have been storage features for pastoralists who visited the location on a regular basis. Overall, we interpreted the site as being an enormous necropolis with occasional visits by pastoral groups, which may have had no direct relationship to mortuary activity.

Surface artifacts are generally rare across most of the site, although the top of 'Late Neolithic Hill' includes dense distributions of Epipaleolithic cores, tools and debitage, as well as highly concentrated clusters of Late Neolithic chipped stone artifacts that overlap Epipaleolithic chipping areas. To the north, near the uppermost pool in Wādī Wisād, looters working in a couple




*2. Numbers refer to structures mapped in 2009; the W-66 complex is indicated by a white rectangle in the center of this aerial photo (photo by David Kennedy).*

of areas have dug through Middle / Late PPNB chipped stone material in relatively high quantities also. But for most of the expanses between structures there is a light dispersion of usually small-sized debitage characterized by steep, broad, single-facet platforms. There are rare fragments of tabular scrapers usually associated with a structure. Taken altogether, this 'background noise' of debitage could have dated to the Late Neolithic, Chalcolithic or Early Bronze Age (or all three periods).

**The 2011 Season at Wisād Pools**

The goals for the 2011 season at Wisād Pools were essentially twofold: first, to continue mapping the structures spread across the *ca.* 1.5km$^2$ extent of the site and, second, to investigate the contents of backdirt in disturbed tombs at the site. For the first objective, we would use kite photography in conjunction with GIS methods (see below), which would permit a rapid means of registering structure locations relative to 1:50,000 maps of the area. For the second aim, we would excavate inside and outside tombs that appeared to have been looted in the recent and more distant past.

The latter goal proved to be more urgent than we had originally thought. When we arrived at the site on 1 June, the *Bādiyah* Police informed us that a looter had been digging in one of the tower tombs during the week before we arrived, as was clear to us as we approached the campsite – fresh backdirt cascaded down the side of a tower tomb.

A more pleasant, welcoming sight involved the rain that had fallen in the area in mid May. Water was present in all but the shallowest of the pools, including Pool #1 at the northern end of the *wadi*, which we had measured in 2008 and calculated to hold more than 2,000m$^2$. It was nearly full after two weeks of evaporation (**Fig. 3**) and there was still a considerable amount of water left in the pool when we closed the season at the end of June.

**Kite Photography (WA-A)**

Several factors combine to make kite photography a particularly useful method for desert archaeology. The specific environment of the arid regions is one of those factors. The *ḥammād* or *ḥarrah* landscape generally offers a flat and smooth surface, upon which poor vegetation cover aids the visibility of archaeological structures from the air. Moreover, the typically shallow sedimentation on desert sites makes it easy to identify the structures. However, from ground level – amidst the stones scattered on the desert surface – it is often difficult to understand the shape and layout of these structures, which appear clearly from high in the air.

Kite photography has already demonstrated its worth in the context of desert archaeology. The method was tested during a survey project in southern Jordan on small, ephemeral pastoral

*3. View towards the north-east of Pool #1, still nearly full two weeks after May rainfall (photo by G. Rollefson).*

encampments dated to the Chalcolithic / Early Bronze Age in ath-Thulaythuwāt area (Abu-Azizeh 2010). At Wisād, however, the method was implemented on a wider scale, involving the use of specific methods.

*Methodology*

The layout of the site and its huge extent required multiple aerial views to be stitched together using GIS, in order to create a high resolution mosaic image of Wisād. The different steps of this procedure are briefly outlined below.

Defining Coverage Strategy and Primary Areas

Two variables depend on the vertical height of the camera above the ground surface: (1) the resolution of the images and (2) the surface area covered by the images. In order to optimize the stitching together of the images, it was first necessary to define a standard altitude. Trials at the beginning of fieldwork demonstrated that an altitude of 300m (the maximum attainable by the kite) was the best compromise between image resolution and sufficient surface coverage.

The aerial photography during the 2011 season focused on two main sectors (**Fig. 4**). The first was located in the central core area of the site and aimed to complete the mapping work started during previous fieldwork seasons. It was roughly square, measuring *ca.* 550x550m (*ca.* 30.25 ha). It was divided into three distinct areas located around the excavation camp, *viz*. 'East Camp', 'West Camp' and 'Late Neolithic Hill'.

The second sector was located approximately 1km south-east of the central core area. It was laid out in order to provide complete coverage of the 'Neolithic Village' and measured *ca.* 250x150m (*ca.* 3.7 ha).

Establishing a Grid of Ground Control Points

So that post-fieldwork orthorectification of the images and georeferencing into a GIS product could be achieved, ground control points were necessary. These needed to be visible both on the ground and on the images. Small white plastic plates (25cm diameter) were therefore staked to the ground surface at 50m intervals, using a grid oriented east-west / north-south. This grid was laid out using a decameter and a compass, and each point location was recorded using a hand-held GPS device and a total station (**Fig. 4**).

Taking Vertical Aerial Photographs

Numerous kite flights were necessary to complete the aerial photography of each sector. Once the standard altitude of 300m was reached, the camera – which was suspended pendulum-fashion below the kite – was swept back and forth across the area in an S-shaped pattern with pictures being automatically taken every 10 seconds. A ground assistant located directly below the camera gave directions using walkie-talkies to ensure that the kite passed over each white plate. In this manner, almost 5,000 aerial photographs were taken across the two sectors.

*Processing the Images Using GIS*

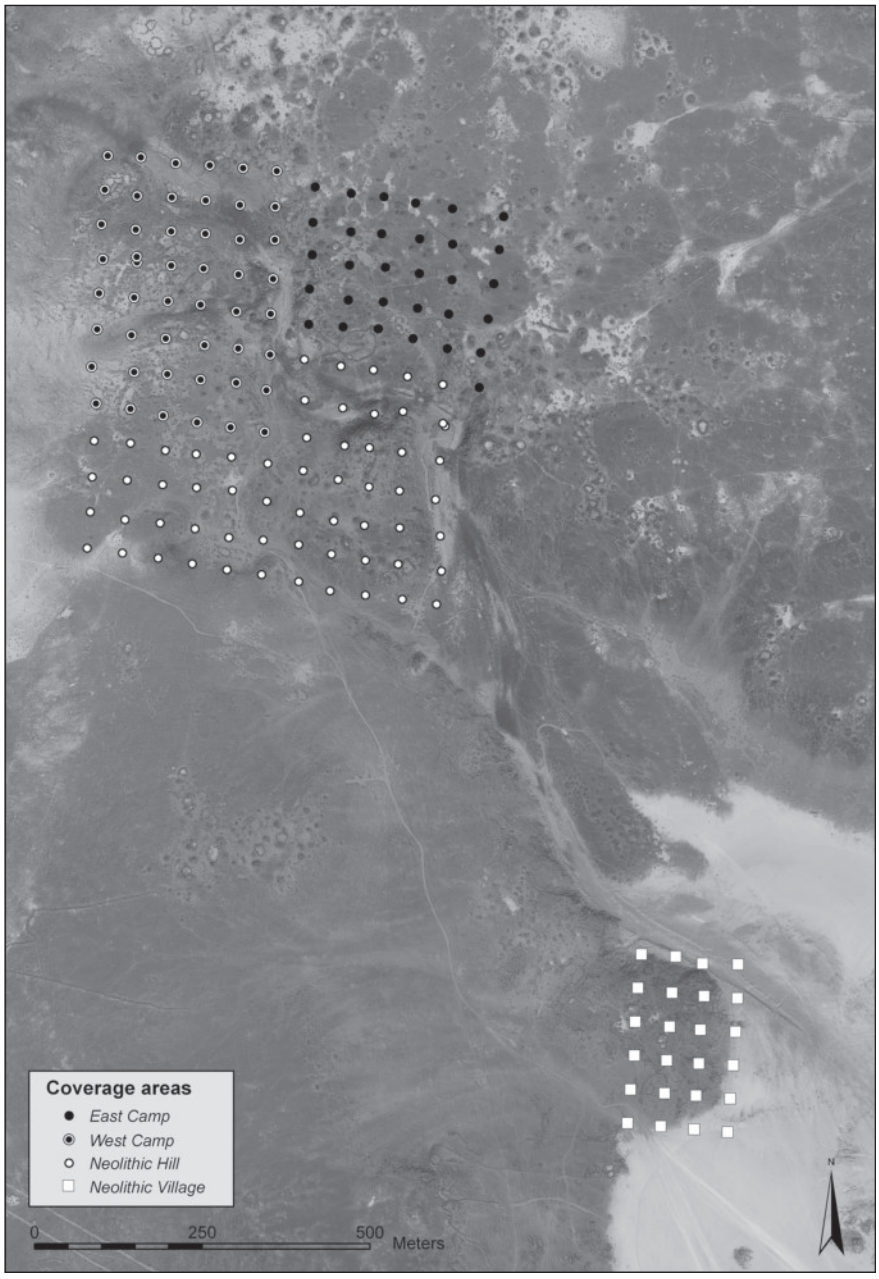
The first stage in the task of processing the aerial photographs, which is still in progress, involves careful selection of the best images from the huge quantity available. The quality of their assembly using GIS will depend on the verticality of the images, their resolution and their homogeneity. During this stage of the processing, the grid of ground control points will enable us to associate each plate visible on the images with its actual geographical location (using the Georeferencing Tool on ArcGIS software), thereby achieving primary georeferencing at an average accuracy of 3 to 4m. However, by using the QuickBird satellite imagery available on the project's GIS, the level of accuracy can be considerably improved to 2m, which is a very satisfactory result on a site as large as Wisād (**Fig. 5**). The ongoing processing work will eventually yield a high resolution, spatially accurate mosaic image which will aid in the documentation and mapping of the site.

**The Tower Tombs West of Wādī Wisād**

Although there are numerous structures west of Wādī Wisād, only 11 had been mapped prior to the start of the 2011 season (**Fig. 6**). All of the apparent mortuary constructions had been looted, and three of them – all tower tombs – were the focus of our investigations early in the season: W-110, W-117 and W-119 (marked in white at **Fig. 6**).

*W-110*

Although it was noted in earlier seasons that W-110 had been disturbed sometime in the past, it had been looted again the week before our ar-

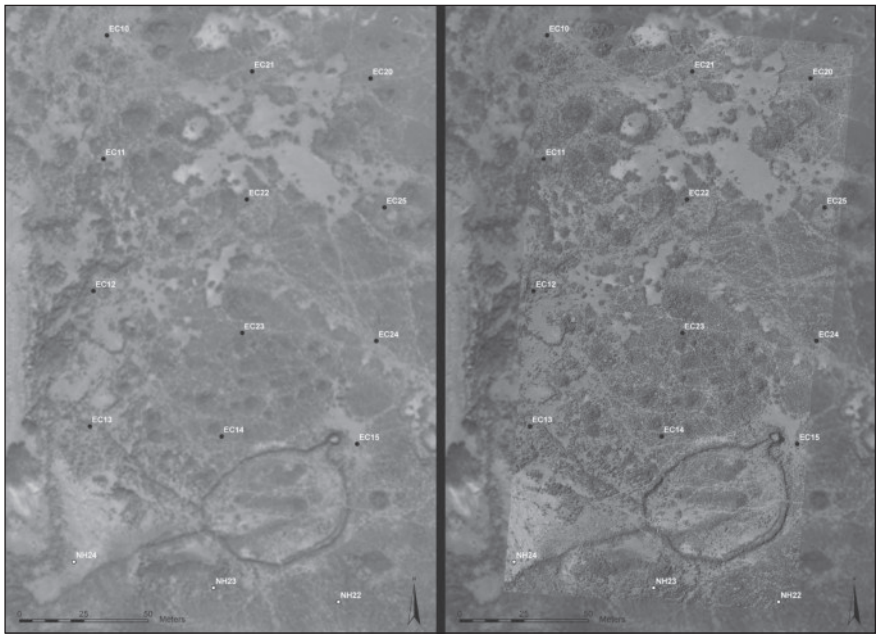



*4. General view of kite photography coverage at Wisād and ground control grids for selected areas (image by W. Abu-Azizeh).*

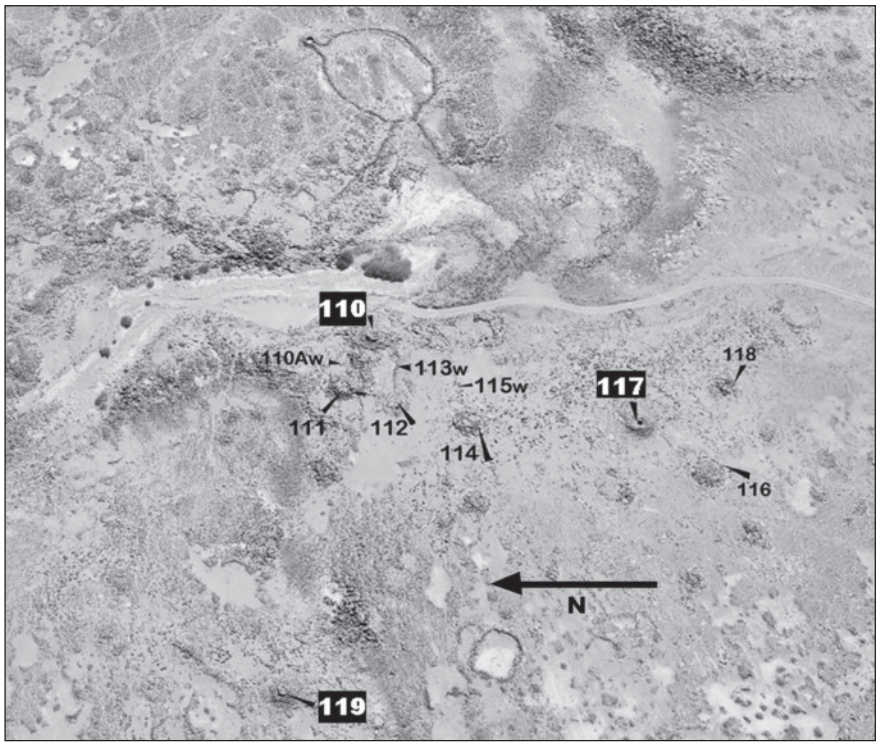
rival. The backdirt from this illegal operation was dispersed among the jagged blocks of basalt that had been thrown down from the top of the tomb, so it was not feasible to look through it to recover any bones or artifacts that may have been discarded by the looter. But there was still a considerable amount of disturbed and undisturbed aeolian sediment inside the tomb, so the decision was made to investigate some of the features of the tomb that had not been destroyed.

It was noted immediately that the looter was not interested in human remains, for on the rim of the tomb the looter had left a stack of bones, some still wrapped in ancient woven cloth. From the bones left by the tomb robber, at least three individuals were represented: two adults and a sub-adult.

The cylindrical tower was preserved to a height of approximately 1m (five courses of basalt blocks) with an exterior diameter of *ca.* 4.60m (**Fig. 7**). The tower was clearly constructed on an earlier platform or mound of basalt of undetermined age. Despite the confusion around the exterior of the tower caused by




*5. Kite photography georeferencing using ground control points and Quick Bird satellite imagery: (left) background QuickBird satellite image; (right) georeferenced aerial photography (images by W. Abu-Azizeh).*




*6. Location of the three tower tombs investigated west of Wādī Wisād (numbered in white) (illustration after photo by David Kennedy).*

tumbled blocks, it was evident that on the eastern side (facing 060-070˚, or ENE) there was an entrance chamber almost 2m long and just over 1m wide and high. The eastern end of the entrance chamber was blocked by a huge standing stone measuring 1.00x0.91x0.20m (with an estimated weight of 675 kg[1]). The chamber appears to be approximately 2m above the current ground surface west of W-110, suggesting that the chamber (and associated tower) are later additions to a previous construction, possibly a tumulus or stone platform that was, in turn, placed above a Late Neolithic dwelling (see below).

1.The density of a sample of basalt obtained from a nearby mesa was calculated to be 3.7gm / $cm^3$.

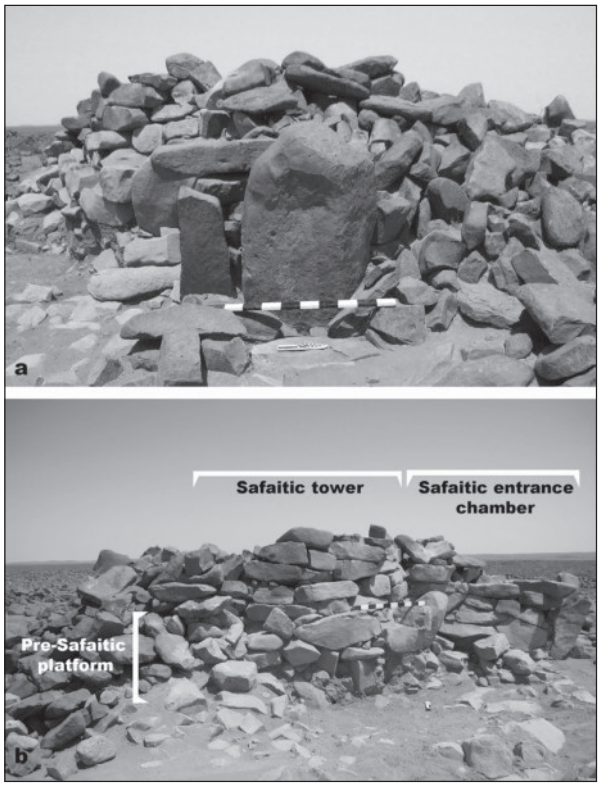

*7. Photo taken of W-110 in 2009 before damage caused by the 2011 looting; view to NNE (photo by G. Rollefson).*

Owing to disturbance by the looters, excavation of the interior followed arbitrary levels until an *in situ* deposit of very compact silt with ash lenses was reached. In this layer there were numerous animal bones as well as chipped stone debitage and tools that included Late Neolithic arrowheads, bifacial knives, truncation burins and drills on burin spalls. Conspicuous in the excavated sediments was a large basalt block measuring 1.15x0.54x0.33m (*ca.* 760kg); this was likely a pillar supporting a corbelled roof (**Fig. 8**; see W-66a below).

*W-117*

About 10m SSW of W-110 is another tower tomb, designated W-117; like W-110 it has a complex history. A circular tower preserved to a height of 1m (five courses of basalt blocks) was built atop a pre-existing stone mound or platform 1.20m high (also five courses in height). The tower had an exterior diameter of 4.60m and an interior diameter of 2.70m (**Fig. 9**). Abutting the eastern side of the tower and platform was an entrance gallery oriented precisely 090˚, or due

*8. View into the interior of W-110 showing the Late Neolithic surface at the bottom and the large standing stone above the north arrow (photo by M. Perry).*




*9. (a) View towards the west of the huge standing stone of basalt sealing the chamber into the tower at W-117; (b) view towards the north of the relationship between the entrance gallery, the tower and the earlier stone platform at W-117 (photos by G. Rollefson).*

east. The chamber was 2.30m long, 1.20m wide and 1.00m high (again five courses). The gallery was sealed at the eastern edge by a standing stone 1.28m high, 0.75m wide and 0.35m thick (*ca.* 1,240kg).

Again like W-110, W-117 had been looted at some time in the past, penetrating into the ground far below the surface on which the mound / platform was built. Unlike W-110, there was no evidence of a large pillar inside the excavation, nor were there any artifacts in the loose disturbed soil or backdirt that could be definitely associated with the Late Neolithic.

*W-119*

Approximately 90m WNW of W-110 are the remains of another two-phase tower tomb, designated W-119, with strong similarities to W-110 and W-117 (**Fig. 10**). The circular tower itself (*ca.* 3m diameter) was asymmetrically positioned on top of an earlier platform or mound. Another similarity at W-119 was an entrance chamber on


*10. View towards the north of W-119 showing the relationship between the tower and the earlier platform foundation (photo by G. Rollefson).*

the eastern edge of the tower and a sealing stone (albeit tumbled and partially covered by tumbled basalt).

As **Figs. 7**, **9** and **10** indicate, we have dated the towers at W-110, W-117 and W-119 to the Safaitic period (1st century BC to 4th century AD; MacDonald 1999). Our reasons for making this temporal ascription are manifold. First, the woven cloth associated with the bones left behind at W-110 is similar to textiles found with Safaitic burials (e.g. al-Salameen and Falahat 2009) and is in a state of preservation that is unlikely to be Late Neolithic, Chalcolithic or Early Bronze Age. Second, the presence of Safaitic inscriptions on some of the stones of the monuments at Wisād is confined to these three towers; no other tumuli or mounds appear to bear Safaitic writing, whether on the west or east banks of Wādī Wisād. Third, Safaitic inscriptions on other rocks are concentrated within the immediate vicinity of the western three tower tombs (13 inscriptions around W-110, 32 near W-117 and 44 within 15-20m of W-119). Fourth, rock art attributable to the Safaitic period is also clustered near the three towers in general association with the inscriptions. Exceptions to this evidence are two major rock art galleries opposite 'Late Neolithic Hill' on the northern and eastern edge of Wādī Wisād, although here Safaitic inscriptions are very rare. Fifth, additional clear evidence for reuse of earlier structures as foundations for tower tombs has been identified on mesas M-7 and M-9 in Wādī al-Qaṭṭāfī, as well as on mesas U-20 and U-22 in the Umm Nukhaylah chain of mesas. In these cases, Safaitic inscriptions and rock art are also restricted to the immediate area around the towers. Finally, none of the towers east of Wādī Wisād have Safaitic inscriptions on them, nor rock art nearby. Neither are any eastern entrance chambers sealed with a massive standing stone[2].

**The Late Neolithic House at Wisād Pools**

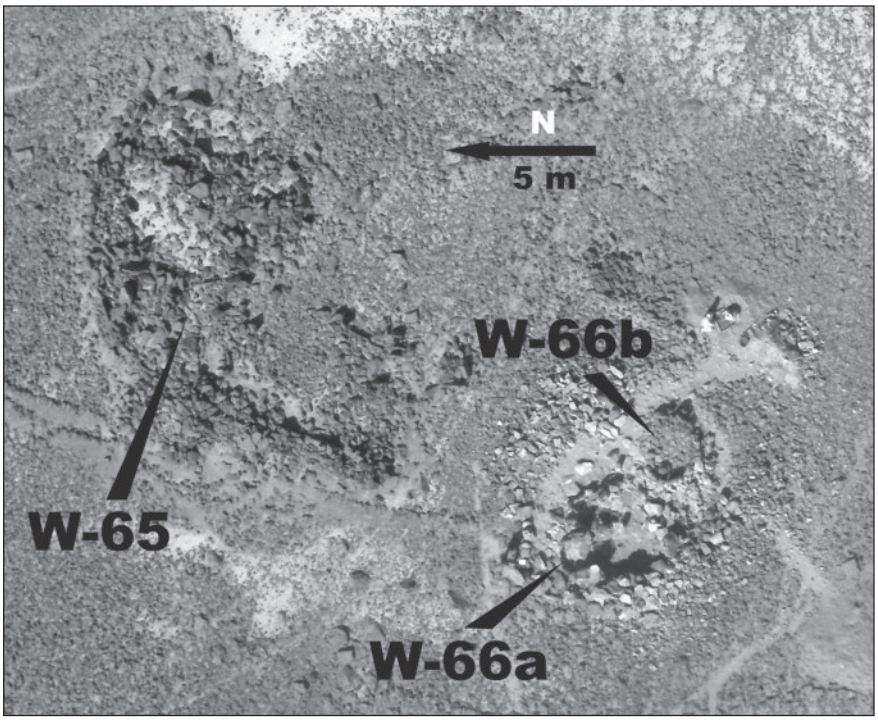
Based on research in other arid areas of the Levant and farther afield, much of the architecture seen at Wisād was deemed to reflect principally Late Chalcolithic or Early Bronze construction, especially the buildings that could be interpreted as mortuary structures (Steimer-Herbet 2004). There are certainly many points of similarity across much of the desert region (cf. Braemer *et al*. 2001, 2010). We selected several constructions we took to represent tombs that appeared to have been looted in the past. One of them turned out not to be associated with mortuary practices at all, and it was built much earlier than the Chalcolithic period.

W-66 was a building complex that seemed to all outward appearances to have been a low tower tomb whose ceiling had been disturbed by looters. The dimensions of the larger circular element (W-66a; **Fig. 11**) were difficult to assess owing to the collapse of many huge basalt blocks that were piled all around the virtually invisible exterior of the structure's wall. Adjacent to it on the eastern side was an even lower curvilinear platform (W-66b) paved with relatively small (*ca.* 30-35cm average maximum dimension) basalt blocks.

*W-66a*

The top of the complex was less than 2m above the present ground surface. Excavation of this unit revealed several phases of intensive occupation with intervening periods of little evident activity. The earliest phase represents a low circular or sub-circular one-room construction that incorporated a gypsum plaster floor, which lies 35cm below the modern ground surface to the west of the building (**Figs. 12 - 13**). The room measured *ca.* 4.25m from the western edge of the large basalt bedrock slab in the north-west part of the room to the south-east corner, although it may have been extended by almost a meter at a later time (see below). The floor included a plaster basin near the western side of the room. The

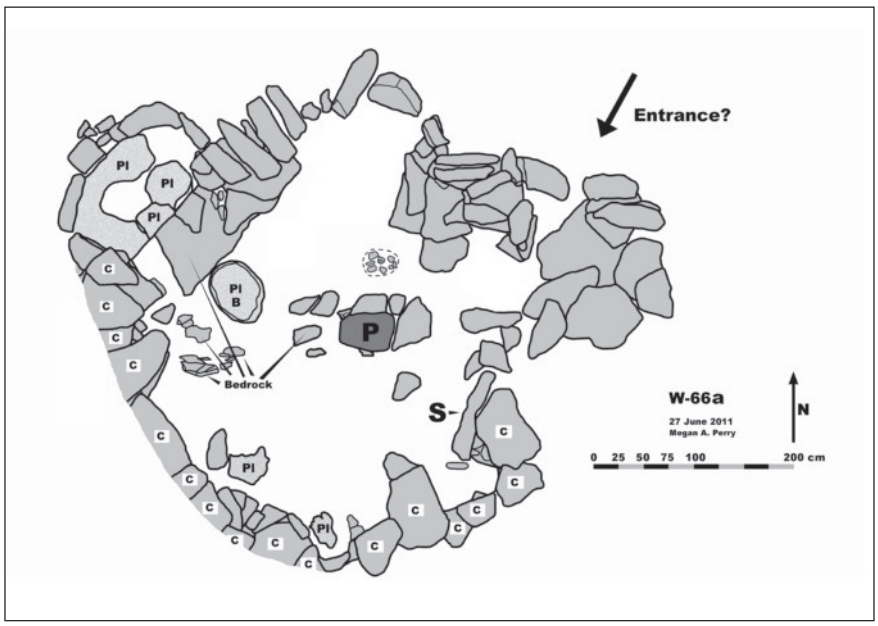
2.The eastern entrance gallery appears to be confined to the western part of Wisād Pools. To date, such features have not been seen anywhere else where Safaitic towers have been identified.




*11. Aerial view showing the relationship between W-66a and W-66b (photo by W. Abu-Aziezeh).*

basin was elliptical with a major axis of 58cm north-west / south-east and a minor axis of 44cm south-west / north-east. The plaster of the basin was about a centimeter thick, which matched the thickness of the floor plaster preserved in several patches near the southern wall of the room. The basin was probably simply a depression excavated about 5cm into the level floor surface and coated with plaster when the floor was laid.

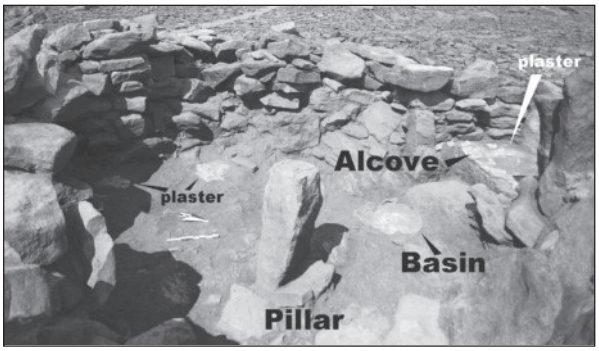
Dominating the center of the room was a large basalt pillar, measuring 1.02x0.44x0.30m, which weighed *ca.* 500kg. The western, southern and south-eastern walls show clearly that the construction here involved several straight wall segments consisting of stacked basalt slabs. Each segment was angled slightly in relation to its adjacent neighbors, so that the interior geometry (at least) was not curvilinear but polygonal. The height of the stacked slabs was approximately 0.50m, at which point the suc-




*12. Plan showing the initial use of W-66a: C = corbel stones; P = pillar; Pl = plaster; Pl B = plaster basin; S = anthropomorphic standing stone (drawing by M. Perry and G. Rollefson).*

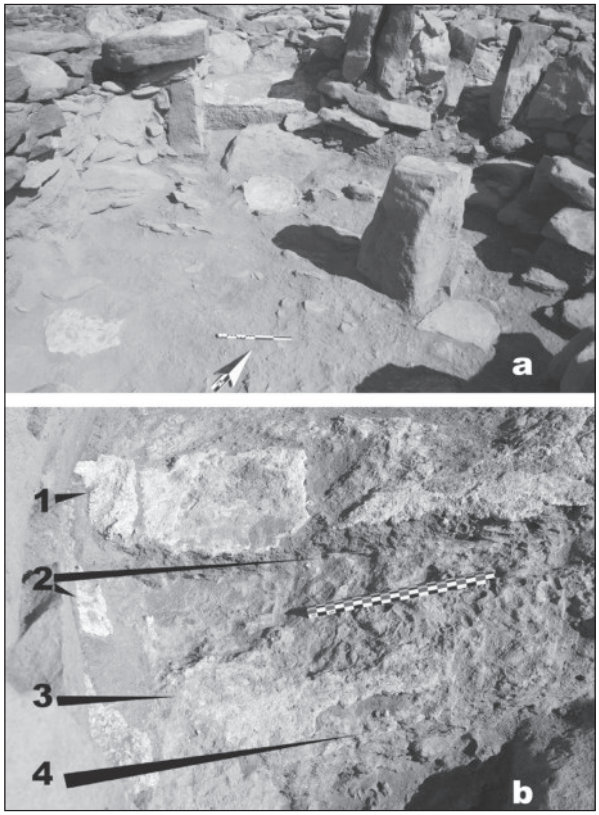
ceeding stones above were corbeled towards the center of the room, eventually reaching the central pillar that served as the primary support for the last corbeling stones. The corbelling stones were huge, measuring more than 1m in length in many instances, with widths that attained 0.80m; average thickness was 10-15cm, with estimated weights of up to a couple of hundred kilograms each (though some were much smaller). At the 'corners' of the segments of the polygonally arranged walls, there were occasional columns of smaller flat slabs stacked ostensibly in order to increase the stability of the corbeling (**Fig. 14**). The result of this design is that the inhabitants would have had to crawl about in the room, with a roof only 1m high at most, reduced to half that near the walls.

At the north-western edge of the room, and possibly added at a later time during the initial phase of occupation, there is an alcove measuring 1.5m south-west / north-east by 0.85cm north-west / south-east. Gypsum plaster was used to surface the floor of the alcove at least four times; the last plastering episode is 28-35cm higher than the floor level in the main room (**Fig. 15**). The alcove may have been an alteration to the original room during a later part of its first occupational phase. The alcove is set relatively far




*13. View to west of the interior of W-66a showing interior features including: (right) the plastered alcove, (left of the alcove) the plastered basin, (center) the pillar and remnants of plaster on the floor (photo by M. Perry).*

*14. Niche in the south-east part of W-66 showing the corbeled stones, the small supporting column and remnants of floor plaster (photo by M. Perry).*




*15. (a) View to the west of the plastered alcove (center top) (photo by M. Perry); (b) the four plastering episodes (photo by G. Rollefson).*


*16. View to the west of the pillar and anthropomorphic standing stone in W-66a (photo by G. Rollefson).*

from the pillar, adding a decidedly asymmetrical aspect to the structure.

On the opposite side of the room, there is a flat standing stone 0.93x0.90x0.10m (*ca.* 300 kg) standing against the eastern wall (**Fig. 16**). The top of this slab bears 'shoulders', although these are natural contours and not the result of intentional shaping. The stone now leans considerably to the west as a consequence of roof collapse; most likely the corbel leaning against the upper part of the standing stone in **Fig. 16** once rested on top of it. The base of the standing stone is at floor level, but it is possible this is a later addition to the room since it partially blocks access to the niche immediately behind it.

There was no dense accumulation of ash or fire-cracked rock inside the structure during this phase of occupation. However, there was a light concentration of charcoal and ash from a restricted area on a circular bed of cobbles just to the north of the pillar. If the occupation of the structure was seasonal, as one would predict if patterns of precipitation were anything like modern ones, the small hearth may have furnished some heat and light during the winter nights.

The end of the earliest phase of habitation is marked by the accumulation of sediments atop the floor, after which there is no longer any use of gypsum plaster. Layer 5, which is practically devoid of stones, may have been accumulating over the original floor before abandonment, but after about 20cm of sedimentation the structure appears to have begun to deteriorate. Layer 5 is characterized by dense concentrations of cemented beetle pupation chambers, suggesting a sustained interval of abandonment. Lithics and animal bone are relatively rare; only two ground stone objects were recovered from this layer. In Layers 4 and 3, cobbles and boulders of around 35cm maximum dimension appeared throughout the room, with handstones, grinding slabs and chipped stone tools densely dispersed throughout the layers. Moreover, in both layers there were frequent masses of caprine and equid-sized animal bone. Layer 2 yielded less bone and tools, although a cache of nine pestles of differing sizes, as well as a huge handstone, were placed in the upper reaches of the niche at the right in **Fig. 14**.

Layers 2 through 5 indicate that there were occasional uses of the shell of the structure of indeterminate duration. During these sojourns, the northern side of the building was probably altered considerably. The area to the north-east of the axis, from the standing stone at the eastern wall to the northern wall of the north alcove (**Fig. 12**), did not yield any evidence of the wall structures and corbel arrangements noted for the first phase(s) of use on the other half of the structure. In fact, many of the on-edge slabs at the periphery of the northern and eastern sides of the building suggest they may originally have been corbel slabs that were part of the initial occupational phase. The erect stones on this side of the structure are at least 35cm (and occasionally up to 60cm) above the original floor. What had originally been a well-built lodging had become a work area for tool manufacture, butchering and plant food processing.

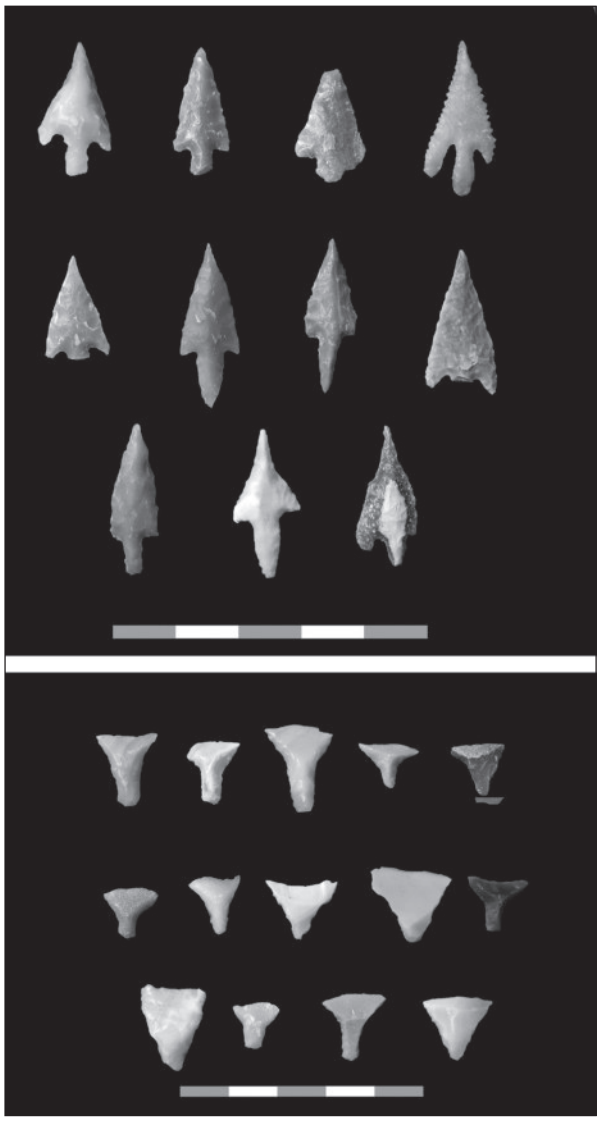
*W-66b*

Adjacent to and east of W-66a (we did not have time to determine the stratigraphic relationship between the two) is W-66b, a platform 3.25m in diameter and *ca.* 0.40m high, except for three larger standing stones (0.40-0.75m high, 0.40-0.70m wide and 0.10-0.20m thick) on both the eastern and western edges. The axis of the central stones of the two trios of stones was somewhat north of true east. The platform consisted of several layers of small (25x15x5cm) flat stones placed on top of each other. Removal of the northern and western sectors in arbitrary layers indicated that the platform was probably a work area (much debitage and many chipped stone tools, though rare animal bone), which may also have served to store goods above ground level during the rainy season.

During the removal of the layers of stones,

a large basalt slab (0.98x0.37x0.10m) was found lying horizontally in a north - south direction directly over a small triangular arrangement (sides *ca.* 0.60x0.75x0.80m) of small flat stones. Excavation within this delimited area encountered only sterile soil to a depth of 25cm.

As mentioned, the precise stratigraphic relationship of the platform with the larger W-66a structure has not been determined, but in view of the typological character of the artifacts (particularly arrowheads), W-66b at least overlaps the use of one or more of the phases of W-66a. There was no indication of the use of fire in any part of the platform.

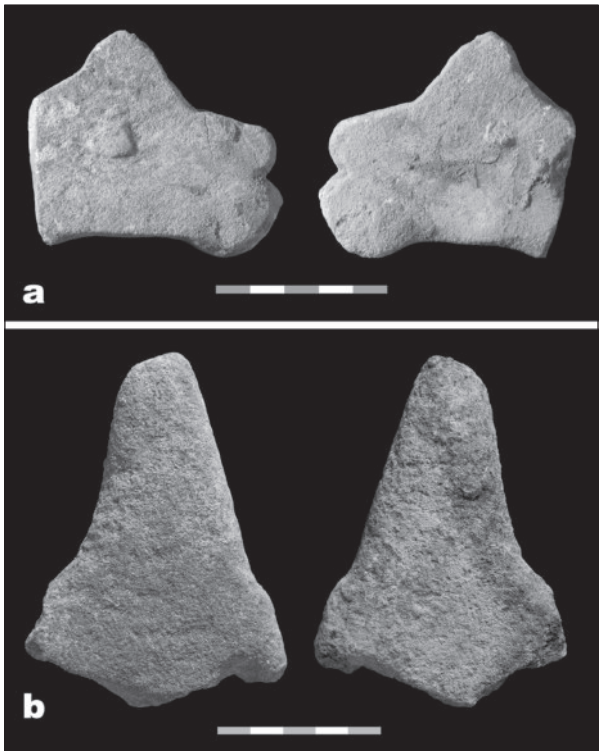


*17. Late Neolithic arrowheads from W-66a and W-66b: (above) Haparsa and Yarmoukian points; (below) transverse arrowheads (photos by G. Rollefson).*

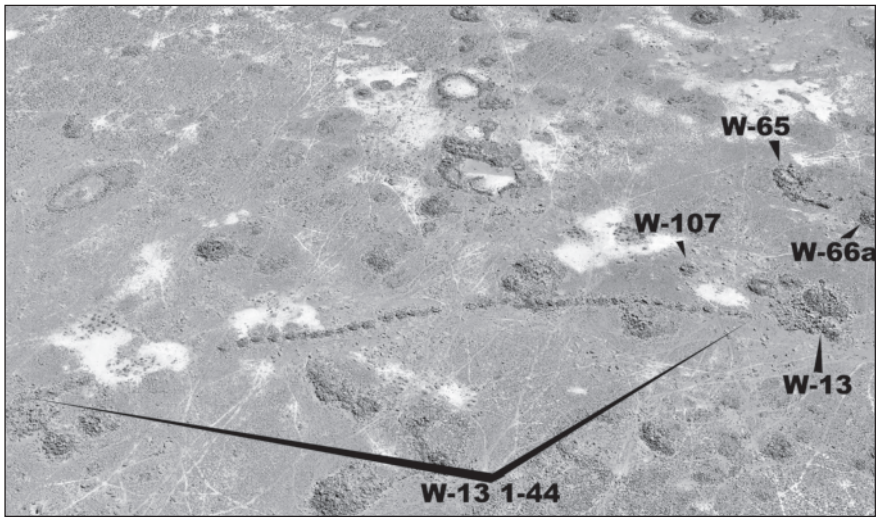
*Artifacts*

To date, there has been no opportunity to undertake intensive investigation of any of the chipped stone, ground stone, sherds, faunal remains or small finds from the W-66 complex. Nevertheless, from the recovered *in situ* artifacts, it is clear that we are dealing with an early part of the Late Neolithic.

In terms of ceramics, an excellent example of a Yarmoukian herring-bone incised and painted fragment that included a handle was found, virtually identical to one from ʻAyn Ghazāl (Kafafi 1990: fig. 10), though other sherds remain to be examined. We retrieved more than 40 *in situ* arrowheads from within W-66a and W-66b, all of them Haparsa, transverse or other Late Neolithic types (**Fig. 17**). Based on this information, one can conclude we are dealing with a period in the earlier part of the Late Neolithic, between 6,500-6,000 cal BC. Tens of thousands of pieces of debitage (including retouch flakes and debris) were recovered from the sieving of sediments through a 5mm mesh. There are also two figurines, one of an exotic fine-grained sandstone that might represent an ovicaprid or even a dog, and another of very fine-grained basalt not known in this re-




*18. Late Neolithic figurines from W-66a: (a) mammal; (b) anthropomorphic.*




*19. Location of W-13, W-65, W-66a and W-107 and their relationship with each other (after a photo by David Kennedy).*

gion that could be a stylized human (**Fig. 18**). Faunal remains became very abundant in Layers 3 and 4. Although we are awaiting detailed analysis, caprines, gazelle and equids all appear to be present (Dr A. Wasse, pers. comm.). Beads of both Dabba marble and malachite were also found throughout the structure, as was a broken bladelet of dark speckled obsidian notched bilaterally at the base, very similar to the proximal end of a Helwan point.

**Other Structures**

*W-13-8*

Structure W-13 is a tower composite of considerable complexity, involving a rectilinear tower, a platform to the west on which several features were built of upright stones, and a long 'chain' of at least 44 rectilinear chambers stretching generally towards the west in a long, shallow convex arc (**Fig. 19**). Chamber 8 (counting from W-13 to the west) measured 1.85x1.65m and was built of basalt slabs up to 0.83m long standing on end or on edge, unlike almost all the other chambers which were constructed by piling basalt slabs horizontally. The interior of the chamber had a shallow accumulation of aeolian sand and some rubble that lay on an original sandy, gravelly surface upon which there was a considerable amount of undiagnostic debitage. This surface overlay a sandy silt layer in which a small hearth was exposed, a feature that appeared to continue under the northern edge (and was thus earlier than) the chamber's north side. The function of the chamber(s) remains unclear, but its use as a tomb appears to be excluded, although it might conceivably have functioned as a cenotaph.

*W-65a and W65b*

About 15m north of W-66a is a complex architectural compound, designated W-65, that includes several paved 'rooms', a row of abutting rectilinear chambers (similar in size to those of the W-13 chain [and hollow as determined by looking through spaces left by looters]) and several small rectilinear features made of basalt slabs standing on end. The slabs of W-65a measured from 0.71x0.53x0.11m to 0.70x1.12x0.18m. W-65b is similar in construction and located 1.5m north of W-65a. Its slabs are 0.75x0.49x0.09m to 0.70x0.51x0.13m. Excavations to below the bases of the wall stones encountered only sterile sediments, so work ceased.

*W-107*

W-107 is an open, circular structure preserved to a height of four courses of stone slabs. The outer diameter is 3.50m and the inner diameter 2.77m. The entire interior was covered with basalt blocks, which were removed completely to expose the original surface. Sediments were excavated in the northern half to a depth of 1.01m, at which depth bedrock was reached and the structure abandoned.

*W-121*

Approximately 125m SSW of W-66 is a small, open oval ringed with relatively small stones set on end or on edge, with a prominent standing stone at the south-west end. The exterior of the feature measured 2.49m north-east / south-

west and 1.98m north-west / south-east; interior measurements were 2.03x1.50m. At 25cm below the modern ground surface and at the base of the standing stone there was a burned area *ca.* 5cm thick and 30cm in diameter. The rest of the fill within W-121 was culturally sterile to a depth of 35cm below the surface (and the base of the stone wall).

**Discussion**

The research undertaken so far at Wisād Pools has figuratively and literally barely scratched the surface of this enormous site. Nevertheless, a couple of important conclusions can already be drawn concerning patterns of use. First, not all of the structures at Wisād are prehistoric, at least not in the classic use of that term. The Safaitic tower tombs indicate that the seasonal rainfall and subsequent water storage in the pools at Wisād continued to attract visitors to the area well into the classical periods. (And numerous small tumuli with orientations suggesting Muslim burials indicate that this is true even into modern times).

The functions of the buildings at Wisād Pools (and in many other parts of the eastern *bādiyah*) are not intuitively obvious in many (perhaps most) cases. This is especially true for the smaller structures such as W65-a and b, W-107, W-121 and even the impressive 'chain' of chambers extending out in a single line from W-13 and other towers at the site. In these cases, the frequently expressed observation that pastoralists leave precious little material culture behind as clues to past activities holds true, and there may be little we can do to resolve the frustrating problem.

The most remarkable result of the 2011 season, however, was the exposure of the dwelling at W-66a. The four plaster episodes in the north-west alcove of W-66a indicate that there were repeated visits to the building in its earliest manifestation. The five or more centimeters of silt accumulation between the plaster layers suggest there may have been relatively extended periods of absence, perhaps coinciding with prolonged periods of decreased rainfall that would otherwise have fed into the pools of the *wadi* (cf. Rollefson *et al*. n.d.b). The use of gypsum plaster on the original floor and several times in the alcove is curious, since gypsum plaster has no waterproof qualities that might have been desirable during the rainy season. Perhaps it was simply an attempt to provide a brighter interior to an enclosed structure whose basalt-formed interior would have been dismal?

At this point in our analyses, the only reports of early use of corbeled roofing comes from the EB I site of Khirbat al-Umbashi (Braemer and Sorins 2011; Braemer *et al*. 2010) and the MB site of Abū Sunaysilah, near Saḥāb in Jordan (Lamprichs 1996). However, in these cases the buildings were long and narrow, and incorporated several pillars as corbel supports. Nevertheless, W-66 appears to be a model that dwellers of the Black Desert found to be effective shelters that would span several thousand years of use and modification.

Of particular interest is the simple fact that W-66a was not just a tent foundation or a simple hut, but a well-constructed, permanent (in the sense of durability) building for long-term use, even if that term was interrupted occasionally by climatic vagaries that made return to the specific location impossible during some periods in which precipitation was lacking. The collapse of the sturdy structure also raises the possibility that there may have been one or more tectonic events during the latter part of the 7th millennium, and that later visitors were content with using the shell of the southern part of the building as part of a more ephemeral shelter for tool-manufacturing and food-processing.

In any event, one must confront the climatic models that indicate a severe decrease in rainfall around the 8.2 kya 'event' (e.g. Weninger 2009 and references therein). These suggest that a sudden decrease in temperature and precipitation may have resulted in intercontinental deterioration of environmental conditions sufficient to cause widespread abandonment of Late Neolithic settlements from eastern Europe into the Levant. The information from W-66 does not, in itself, indicate sufficiently that the 8.2 kya 'event' didn't occur, but there is the possibility that the effects witnessed in the coastal regions of the Mediterranean may not have pertained to the same degree farther inland. The proxies used for paleoclimatic reconstructions come almost exclusively from the coastal / Mediterranean areas of the Levant, and we suggest they may not be entirely applicable to the interior areas. We agree whole-heartedly with Braemer and Échallier (2004) that the landscape we see today through-

out the Black Desert has been influenced by anthropogenic factors (especially overgrazing and fuel-collecting) rather than by climatic change alone. What we have recovered from W-66 indicates that the Late Neolithic residents had ample resources to support large-scale investments of labor to construct permanent dwellings, even if they would only be used on a discontinuous basis. The landscape we see today in the Black Desert is one of dismal and bleak expanses of basalt and sand, but this is not what our Neolithic ancestors enjoyed.

**Acknowledgements**

We are grateful to the Department of Antiquities for the opportunity to undertake the research and to Mr Wesam Talal, our departmental representative, who was of invaluable assistance. We also express our appreciation to Margaret Du Bray and Ian Kretzler, Whitman College students who were exemplary in the field. And finally, we express our gratitude to Dr Barbara Porter and the personnel of the American Center of Oriental Research in ʻAmmān for their invaluable support, as well as to visitors who helped to relieve the monotony of our meager diet during the season. Principal funding for the project came from Whitman College, the Oriental Institute of the University of Chicago and the co-authors.

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