

PRELIMINARY REPORT ON FIELDWORK AT NEOLITHIC AL KHAYRĀN IN WĀDĪ ‘ASSĀL, WEST-CENTRAL JORDAN

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Introduction

The early Neolithic (**Table 1**) site of Al KHayrān is found in the west-central Jordanian Highlands. It is located along the upper reaches of the southern ridge of Wādī ‘Assāl (also spelled ‘Asal, ‘Isal, Issal, or Easal) in an area known locally as Ar Ruṣays (**Fig. 1**). Al KHayrān was first identified for the international archaeological community by the Wādī ‘Assāl Survey, which recorded a mix of early Neolithic and Chalcolithic/Bronze Age artifacts at the site (Jacobs 1983). The ‘Assāl-DHirā’ Archaeological Project investigated the early Neolithic component of the site through systematic surface collection, systematic sub-surface testing, and extensive horizontal excavations. This work identified a single structure, constructed and reconstructed in two phases, and associated refuse, dating to the Pre-Pottery Neolithic B (PPNB).

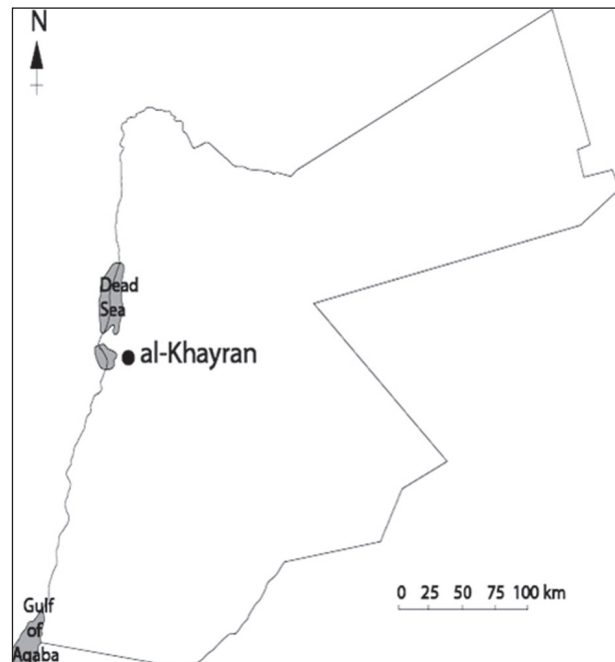
Table 1. Chronology for the Early Neolithic of the Southern Levant (Birkenfeld *et al.* 2024).

Period	Dates cal. BC
Pre-Pottery Neolithic A (PPNA)	9750-8500
Early Pre-Pottery Neolithic B (EPPNB)	8500-8250
Middle Pre-Pottery Neolithic B (MPPNB)	8250-7500
Late Pre-Pottery Neolithic B (LPPNB)	7500-7000
Final Pre-Pottery Neolithic B/Pre- Pottery Neolithic C (FPPNB/PPNC)	7000-6400

Methods

Surface Collection

A program of systematic surface collection was conducted at the site to identify not only the spatial extent of surface archaeological remains, but also the structure of these remains. Based on the information provided by Jacob’s in her (1983) publication, the site of Al KHayrān was relocated and the spatial extent of the site was determined through field walking. Following this, surface collection samples were made across the areal extent of the site using ten



1. Map of Jordan showing the location of Al KHayrān (Drawing: M. Kroot; ‘Assāl-DHirā’ Archaeological Project).

square meter “dog” leash units, spaced at 15m. First, a series of 40 collection units were laid onto the site in two lines running north-south and east-west. The ends of the collection lines were determined to be when three units in a row returned no artifacts.

Non-collection methods were used at Al KHayrān. Within each collection unit, analysts would gather all visible archaeological materials and then sort these materials by both artifact class and typology. For example, knapped stone materials were sorted into hammer stones, cores, flakes, blades, chips, chunks, and formal tools. All lithics were examined for evidence of retouch and use-wear. Formal tools and cores were sorted into specific chronologically and technologically diagnostic types. Ceramics were sorted based on paste, temper, thickness, and decorative elements, again with attention to chronologically diagnostic indicators. Once sorted by detailed type, all artifacts were placed on a contrasting background with a scale bar and photographed on two or more sides with a DSLR in order to capture potential relevant metrical, technological, and unrecorded details, which would allow for further analysis after the completion of fieldwork. A unique number was assigned to each unit, and types, counts, and photo numbers were recorded. Artifacts were then returned to the surface of the collection unit.

Initial results identified a lack of ceramics and a substantial number of bidirectional cores and blades (Quintero and Wilke 1995) and multiple formal point types (Gopher 1994) typical of the PPNB in the north-east quadrant of the collection units. Jacobs (1983) also identified this same portion of the site as the source of the early Neolithic knapped stone artifacts recovered during survey. In order to define the extent of the PPNB surface scatter at Al KHayrān, a further 64 dog-leash collection units were made in the north-eastern part of the site. They were spaced at 15m in a triangulated pattern and used the same non-collection sampling method described above. The extension of collection units was terminated in any given direction when two consecutive samples returned no archaeological materials. Surface collection results identified early Neolithic materials, characterized by the

above-mentioned bidirectional cores, blades, and point types typical of the PPNB, over an area of approximately 0.38ha.

Site Mapping

Once the full areal extent of the site was determined, detailed spatial data from Al KHayrān was generated by Jamal Safi of the Department of Antiquities of Jordan. This included site topography and archaeological features and structures visible on the surface, as well as natural resource locations. A datum of rebar and concrete was placed at the highest point on the site, and its exact three-dimensional location was identified using a Trimble differential GPS system. A total station was placed directly above the datum from which individual points used for the topographical points and resource locations were shot. For the topographic map, starting on the northern edge of the site, an individual with a prism walked east-west transects, stopping every five meters for another datum point. Once each transect was finished, the individual would move five meters south and walk another set of transects until the entire surface area of the site was mapped.

In order to outline all architectural remains and resource locales visible on the surface of the site, individual points were shot in sequences at key spots to form polygons that represented the two-dimensional forms of these resources overlaid on the three-dimensional surface map of the site. A similar technique was used for spatially extensive natural resources, such as a flint source 100m southeast of the site, while other, smaller resource locales, such as a seep 100m south of the site, were recorded with a single point.

Test Excavations

In order to determine the sub-surface extent of archaeological remains, a series of test excavations were made. Preliminarily, three 2×1m test excavation units were dug into the site based on the results of the surface collection. One unit was located at the center of the early Neolithic surface scatter, one in the south-west (upslope) corner of the collection units returning early Neolithic remains, and one within the Chalcolithic / Early Bronze Age returns from the site. The first was intended to

determine if the center of the surface scatter was truly the center of the remains, given the fact that Al KHayrān is located on a hill slope running downhill to the north-northeast. The second unit was intended to determine how far up the hillside the site extended. The third unit was intended to determine if possible early Neolithic remains were buried below the much more substantial Chalcolithic/Bronze Age materials at the site.

Each of the test units was dug in 1×1m squares, with excavations following depositional stratigraphy. Before excavations commenced, a unit datum to be used to locate materials in three dimensions with line levels and tape measures was shot in using a total station. The units were strung, and the surface of each unit was scraped with the tips of square-bladed shovels. All surface materials and, later, excavated deposits were screened using 2mm mesh. All knapped stone, ground stone, ceramics, animal bone, and other small finds were collected for analysis.

Individual *locus* numbers were assigned for each discrete deposit, and each *locus* was drawn within each 1×1m unit at the commencement of excavation and the termination of *locus* excavation, as well as in 0.1m levels when *loci* had depths greater than 10cm. These drawings included soil characteristics (e.g. color as determined with a Munsell chart, grain size, friability, inclusions), deposit morphology (planview shape and upper and lower deposit elevations), and larger inclusions, such as stones or plaster. Each *locus* and the excavation procedures used in the field were summarized in a form that accompanied the drawing and included the starting and ending elevations for each corner of the 1×1m unit. All architectural features and *in situ* artifacts were drawn in place and their top and bottom elevations were recorded. Before the removal of architecture, a plan view that recorded the entirety of the removed construction was done as a single drawing. The terminus of each excavation unit was determined to be when 0.2m of deposits had been excavated without yielding any further archaeological materials. Upon the termination of excavation, all four walls of each trench were drawn in profile, which included deposit descriptions and assigned *locus* numbers.

The test excavation in the center of the surface scatter identified up to 0.1m of a archaeological deposits. Materials were almost exclusively knapped flints and included significant number of diagnostic early Neolithic artifacts, primarily in the form of bidirectional blades. Both of the other test units, on the southern edge of the Neolithic surface scatter and within the Chalcolithic/Bronze Age scatter, yielded no subsurface early Neolithic remains, although the latter did return substantial amounts of Chalcolithic/Bronze Age ceramics and, notably, both meat-bearing and non-meat-bearing ovicaprid bones.

Given that subsurface early Neolithic remains were identified only in a single 2×1m unit, it was decided that further and more systematic test excavations were needed. First, a 100m east-to-west and 60m north-to-south grid was laid over the entire area in which early Neolithic remains were identified during surface collections. Within this grid, three rows of 1m north-to-south and 2m east-to-west excavation units were dug at 20m intervals, starting in the southwest corner of the grid and moving north and east. The original test unit that yielded subsurface remains was included as one of the units in this pattern. The same procedures as used for the first three units were followed in this second phase of testing. A total of 14 additional units were excavated, with none yielding subsurface remains.

Extensive Excavations

It was decided that the sole test unit to yield subsurface early Neolithic remains would be the anchor for extensive excavations at the site. These excavations were intended to produce a broad horizontal picture of the site in order to understand the behavior of the site's occupants during the early Neolithic. The 2×1m test unit was used as the southwest corner of a 5×5m unit. Excavation procedures identical to those used for the test excavations were followed for the larger units. This included shooting in unit data, surface scraping before excavation, sieving of all deposits in 2mm mesh, the recovery of all knapped stone, ground stone, animal bone, and other small finds, excavation in depositional stratigraphic layers, the three-dimensional contextualization of architectural features and

in situ artifacts, the drawing of *loci* before, during, and after excavation, and termination of excavation once 0.2m of deposits devoid of artifacts had been encountered.

Additional 5×5m units were subsequently laid out to the north, south, east, and west of this trench, leaving the northern and eastern most 1m rows of each unit as balks. This produced an excavation grid of 4×4m units with 1m balks. Units of 1×1m were dug in all directions until two consecutive squares devoid of any subsurface archaeological materials were excavated in any given cardinal direction. In this manner, it is possible to be confident that excavations recovered materials and architecture that characterized the full areal extent of the site. In total, 146m² of subsurface deposits were identified, 73m² of which were excavated fully.

These units were the first to encounter Neolithic architecture at Al KHayrān. Once coherent deposits and architectural remains were encountered, additional excavation procedures were implemented. When structures and constructed surfaces were identified, these remains were left in place. Structure interiors were treated as separate units, regardless of location within the site grid, and were solely excavated using hand trowels. When constructed surfaces were encountered, 0.05m of deposits above the surface were excavated—again, solely with hand trowels—as a separate layer, regardless of whether a stratigraphic change was identifiable. Once architectural features were completely uncovered, drawn, and photographed, and their three-dimensional extent was recorded, some were removed to allow for further investigations below. For all stone features removed, their bottom depths were also recorded using a datum. Again, any items identified *in situ* were left in place and point-provenienced in three dimensions before removal.

Laboratory Analysis of Artifacts

All collected knapped stone, ground stone, fauna, and small finds were loaned to the author by the Department of Antiquities of Jordan for analysis. Preliminary analyses of these materials and the development of further analytic strategies were done within the

laboratories of the American Center of Research and the Council for British Research in the Levant. Additional analysis of these materials was done at the University of Michigan Museum of Anthropological Archaeology. Methods included technological, typological, metrical, and macroscopic use-wear analyses of knapped stone materials, typological, metrical, and macroscopic use-wear analyses of ground stone materials and small finds, and metrical and taxonomic analyses using the comparative collections of the Center for British Research in the Levant and the University of Michigan, Museum of Anthropological Archaeology, as well as aging, sexing, and element determination for fauna.

Results

Stratigraphy and Architecture

Most of the archaeological remains at Al KHayrān were affected by ploughing that has recently occurred over the entirety of the site. This has resulted in materials on the exterior of the structure becoming mixed within a single stratigraphic layer. It is only within the interior of the structure that the stratigraphic integrity of the original depositional processes was preserved in any identifiable way. The structure was constructed and reconstructed in two phases, with layers of collapse and anthropogenic fill in between the prepared floors of the earlier and later phase.

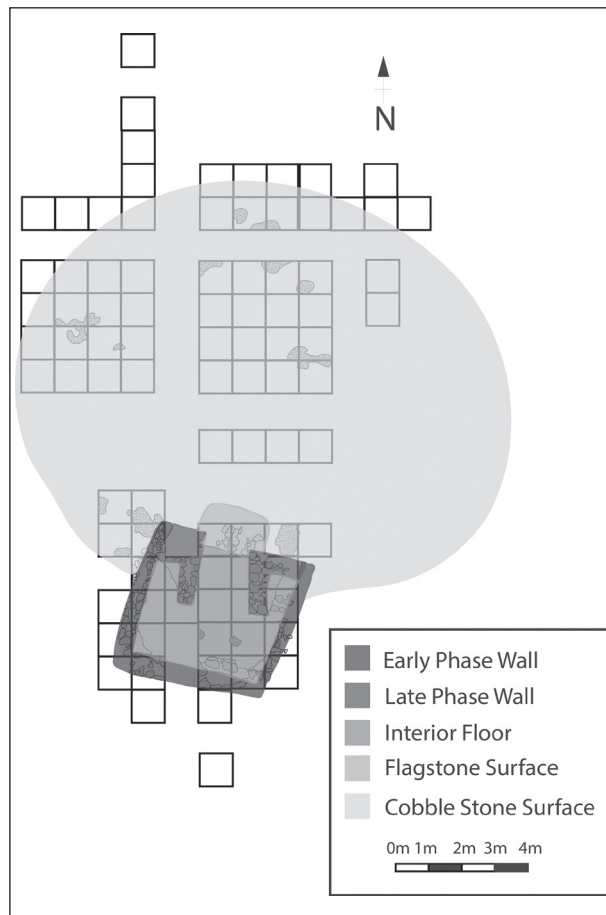
The interior floor of the earlier phase included a sandstone saddle quern and a flat sandstone slab with striations set into the floor. At the end of the use-life of the earlier phase, the structure partially collapsed. When the occupants of the site reconstructed the structure in the later phase, they utilized un-collapsed wall sections, as well as newly constructed walls. The floor of the later phase was constructed out of lime plaster and was poorly preserved due to its proximity to the present-day surface. Two different forms of exterior surfaces, one built of flagstone and the other of cobble stones, were associated with the later phase (**Fig. 2**).

In both the earlier and later phases, the structure consisted of stacked limestone block walls with prepared interior surfaces. In both phases, the walls of the structure are built in a square approximately 5×5m from exterior edge

to exterior edge of the walls, with the interior space of the structure measuring approximately 4×4m. The form and size of the structure are typical for the PPNB of the southern Levant (Banning 2003; Banning and Byrd 1989). The use of plaster for the floor of the later phase of the structure is typical of the PPNB as well (Clarke 2012). The structure was partially dug into the hillside to ensure that the floor was flat, as was the flagstone exterior surface. However, the cobble stone surface followed the natural slope of the Neolithic ground level.

Knapped Stone

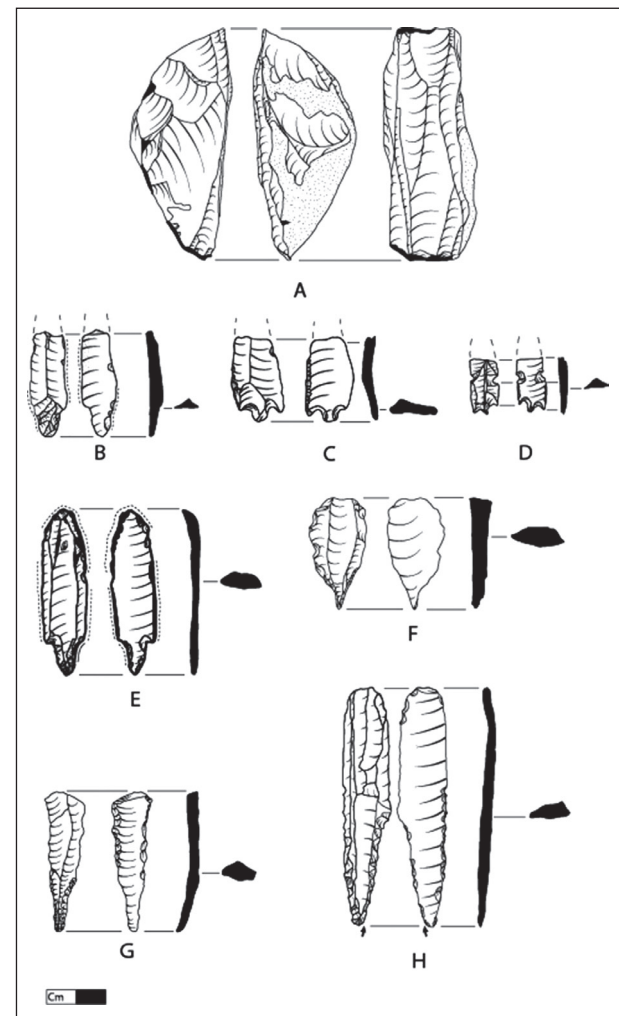
6,957 knapped stone and hammer stone artifacts were recovered from Al KHayrān during excavations, all were made using flint. There is a wide variety of colors (gray, black, brown, green, white, yellow, and red), grain sizes (small to medium), and lusters (dull to lustrous), all of which can be found at the closest



2. Schematic reconstruction of the architectural layout of the architecture at Al KHayrān, overlaid onto the planview drawing of the structure (Drawing: M. Kroot and E. Wallace; 'Assāl-DHirā' Archaeological Project).

flint source 0.1km southeast of the structure. The assemblage attests to core preparation and reduction, as well as tool production occurring at Al KHayrān. Excavations returned twenty bidirectional cores and 10 hammer stones. Production waste includes significant quantities of flakes and blades, core, pressure flakes, shatter, burinations, and platform and façade production and maintenance debitage. The formal and informal tools show that many of the know types associated with the PPNB were utilized at Al KHayrān, including points and perforators (awls, drills, borers, *etc.*) (Gopher 1994; Shea 2013). All formal tools were made on blade blanks (Fig. 3).

As noted above, the technological and typological analysis of the knapped stone



3. Example knapped stone materials: (A) Bidirectional (naviform) core; (B) Byblos point; (C) Jericho point; (D) Helwan point; (E) Tanged bidirectional blade with use-wear; (F) Drill; (G) Perforator; (H) Burin (Drawings: M. Kroot and S. M. Brazeal; 'Assāl-DHirā' Archaeological Project).

assemblage fits broadly with the dating of Al KHayrān to the PPNB. Eighteen formal knapped stone tools derived from subsurface deposits are of types that are typically seen as chronologically diagnostic within the codified typology of the PPNB. These include elongated knives (Byblos, Jericho, Nahal Hemar, and related types) and projectile points (Byblos, Jericho, Helwan, and related types) (Shea 2013). Additionally, all excavated cores were the product of bidirectional reduction techniques, which is dated to the PPNB within the southern Levant (Quintero and Wilke 1995).

Ground Stone

Ten ground- stone objects were identified at the site. Those deriving from refuse deposits include fragments of two pestles, a shaft straightener, and a quern. A broken double hand stone was incorporated into the wall of the later phase of the structure. A sandstone pillow-shaped piece (Hermansen and Gebel 1996) was found lying flat on the floor of the later phase in a cache alongside two hammer stones. A cache associated with the early phase floor included a flat sandstone disk (Gebel 2010; Gebel *et al.* 1997; Rosenberg *et al.* 2008), a mass of ground red ochre, and dozens of bidirectional blades and blade-based tools. A complete single hand stone was found lying directly on the floor of the earlier phase. As noted above, two ground stone features were also incorporated into the floor of the earlier phase of the structure.

Small Finds

Three shell beads, one made of a bivalve, one from a conical shell, and one from mother of pearl, were recovered from refuse deposits. The bivalve shell was ground smooth and pierced at the umbo. The conical shell was ground smooth and pierced at the apex. The mother- of- pearl ornament is a disc bead, pierced in the center. Additionally, the above-mentioned rounded mass of ground ochre was recovered from the floor of the earlier phase. It was likely originally held within a container, which subsequently disintegrated.

Discussion and Future Directions

The preceding has been primarily a description of the methods of and preliminary results

from investigations at the early Neolithic site of Al KHayrān. However, some discussion of results is warranted due to the potentially unique nature of the site. The remains from Al KHayrān attest to a number of different behaviors by the site's Neolithic inhabitants. There is evidence of subsistence production, on-site knapped stone production, and significant investment in residential architecture. All of these practices are among the most common identified at early Neolithic settlements throughout the southern Levant. However, there are some unique aspects to Al KHayrān, the most obvious being that only a single, yet substantially built, structure has been identified at the site. This is despite an intensive program of surface collection, test excavations, and broad horizontal excavation trenches. This makes understanding the behavioral dimensions of the occupation at the site potentially quite informative for its interpretation.

Future analyses will focus on understanding the broader regional context of Al KHayrān in relation to other early Neolithic settlements and natural resources. They will also be directed towards further investigation of the details of stone- knapping and subsistence production behavior on- site, as well as the spatial and temporal dimensions associated with the habitation of the site. Not only is the structure of Al KHayrān potentially unique, but so is the way that the residential and economic practices enacted at the site integrated within the broader settlement systems in which they were embedded.

Acknowledgements

Thank you to the al-Garaleh family of Kathrabā and 'Ayy, including Abdul, Riad, Mahmoud, Basheer, Fadi, Khalid, and Noor, as well as Rami Freihat, Phil Graham, Jamal Safi, Khaled Tarawneh, Eliza Wallace, Chantel White, and Joshua Wright for all their hard work in the field. Bill Finlayson, Kent Flannery, Ian Kuijt, Cheryl Makarewicz, Joyce Marcus, Leslie Quintero, Ashraf Rawashdeh, Phil Wilke, Henry Wright, Mindy Zeder, and the staffs of the Council for British Research in the Levant, the American Center of Research, and the Department of Antiquities of Jordan, all of whom were instrumental in their support. Thank

you to former Directors Dr. Ziad al-Saad and Dr. Fawwaz al-Khraysheh of the Department of Antiquities of Jordan for permission to conduct this research and to H.E. Dr. Fadi Bala'awi for the opportunity to publish on it. This work was funded by the National Geographic Society, the Wenner-Gren Foundation, the American Center of Research, and the University of Michigan's Department of Anthropology, International Institute, and Rackham Graduate School. Fieldwork was conducted under the auspices of the Department of Antiquities of Jordan, permit numbers 2007/38 and 2010/17.

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Bibliography

- Banning, E.B.
2003 Housing Neolithic Farmers. *Near Eastern Archaeology* 66: 4–21.
- Banning, E.B. and Byrd, B.F.
1989 Alternative Approaches for Exploring Levantine Neolithic Architecture. *Paléorient* 15: 154–160.
- Birkenfeld, M.; Borrell, F.; Purschwitz, C. and Rokkitta-Krumnow, D.
2024 To Be or Not to Be; An Introduction of the Origins, Nature and Chronology of the EPPNB in the Southern Levant. *Paléorient* 49(2): 1–4.
- Clarke, J.
2012 Decorating the Neolithic: An Evaluation of the Use of Plaster in the Enhancement of Daily Life in the Middle Pre-Pottery Neolithic B of the Southern Levant. *Cambridge Archaeological Journal* 22: 177–186.
- Gebel, H.G.K.
2010 Commodification and the Formation of Early Neolithic Social Identity. The Issues as Seen from the Southern Jordanian Highlands. Pp. 35–80 in M. Benz (ed.), *The Principle of Sharing*. Berlin: ex oriente.
- Gebel, H.G.K.; Bienert, H.D.; Kramer, T.; Muller-Neuhof, B.; Neef, R.; Timm, J. and Wright, K.I.
1997 Ba'ja Hidden in the Petra Mountains. Preliminary Report on the 1997 Excavations. Pp. 221–262 in H.G.K. Gebel, Z.A. Kafafi, and G.O. Rollefson (eds.), *The Prehistory of Jordan, II*. Berlin: ex oriente.
- Gopher, A.
1994 *Arrowheads of the Neolithic Levant*. Winona Lake: Eisenbrauns.
- Hermansen, B.D. and Gebel, H.G.K.
1996 More “Pillow-Shaped Pieces” from LPPNB Basta. *Neo-Lithics*: 11–12.
- Jacobs, L.K.
1983 Survey of the South Ridge of the Wadi Isal, 1981. *ADAJ* 27: 245–274.
- Quintero, L.A. and Wilke, P.
1995 Evolution and Economic Significance of Naviform Core-and-Blade Technology in the Southern Levant. *Paleorient* 21: 17–33.
- Rosenberg, D.; Assaf, A., Getzov, N. and Gopher, A.
2008 Flaked Stone Discs of the Neolithic and Chalcolithic Periods in the Southern Levant. *Paleorient* 34: 137–151.
- Shea, J.J.
2013 *Stone Tools in the Paleolithic and Neolithic Near East: A guide*. New York: Cambridge University Press.