THE DRUZE MARSH PALEOLITHIC PROJECT, NORTH AZRAQ JORDAN STRATIGRAPHIC SEQUENCES FROM THE 2008 AND 2009 SEASONS

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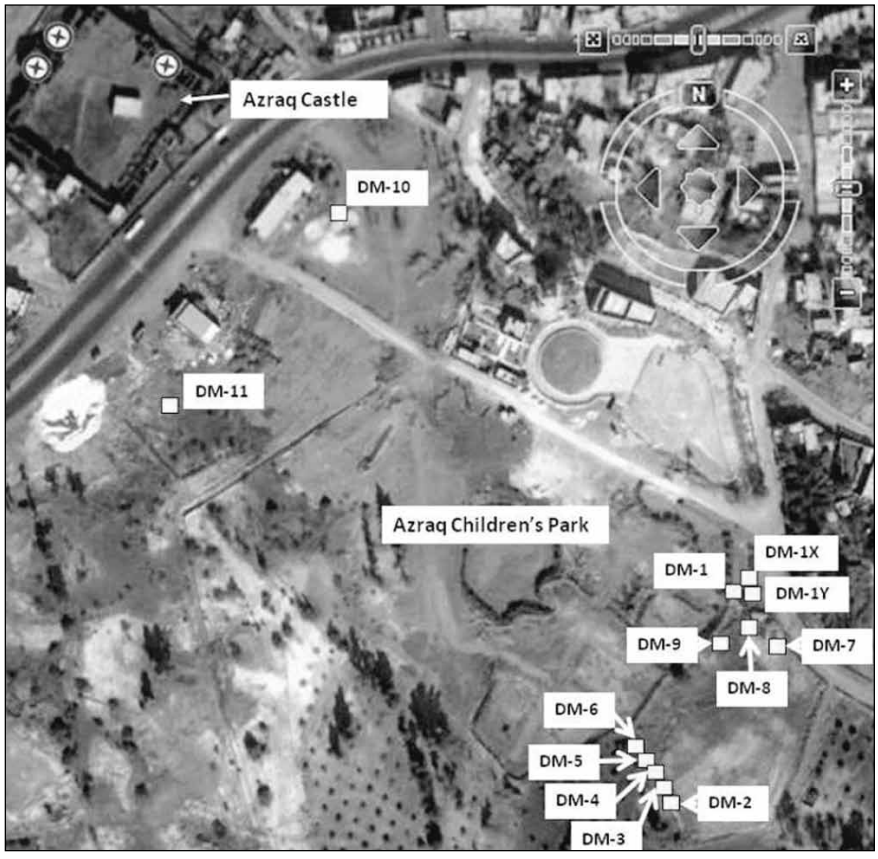
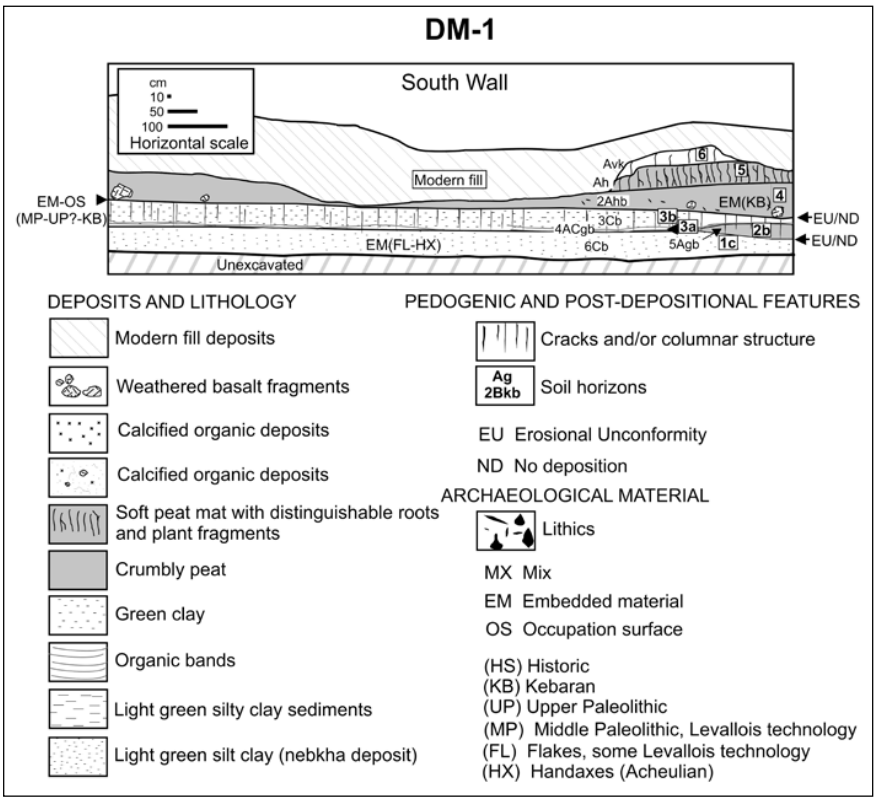
Introduction

The sites that form part of this study are located in the former bed of the Druze marsh at north Azraq (**Fig. 1**). The drying of the marsh occurred in the late 1980s as water was pumped for use elsewhere in Jordan. Previously, no sites had been reported in the area of the marsh since the area was underwater and the water table was too close to the surface. With the water table now several meters below the ground, recent trenching for construction, ditches, and wells revealed a wealth of lithic material. In June 2008 our team obtained a permit to investigate the sites in the Druze marsh.

The construction of the Children's Park (**Fig. 1**) in 2007 and early 2008 exposed deep stratigraphy and buried occupation deposits. Our team initiated a salvage archaeological project within the trenches opened for the construction of toilet facilities, a septic tank and water storage. These locations were named DM-1, DM-1X and DM-1Y. Owing to the rapid pace of construction, we were only able to document DM-1 (**Fig. 2**).

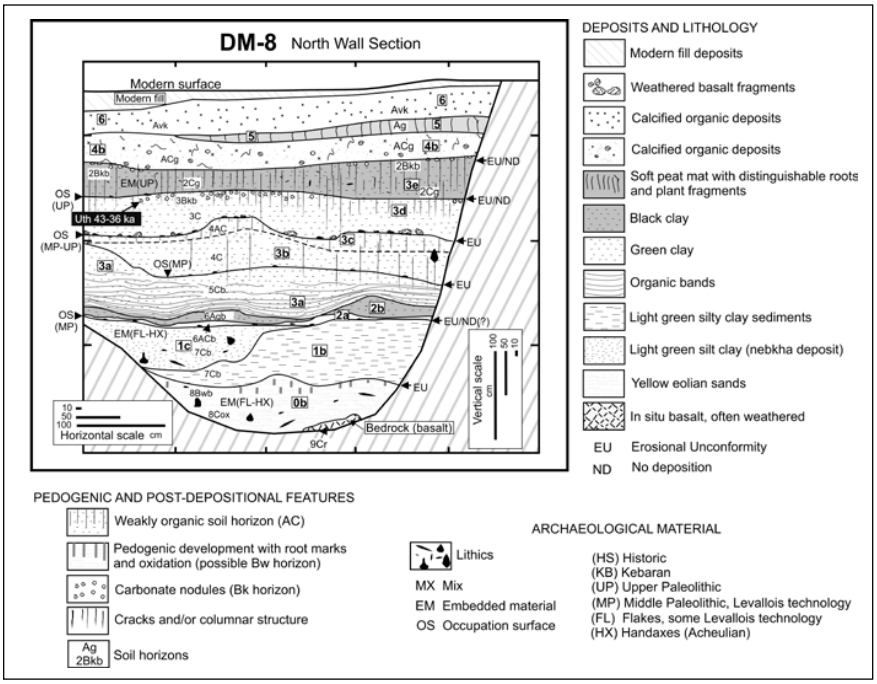


1. Aerial view of the Druze marsh sites; the photograph pre-dates the construction of the Children's Park.



2. DM-1, north section stratigraphy.

We also obtained permission to dig three 3 by 1.5m trenches, DM-7, DM-8 and DM9, on adjacent land (**Fig. 1**). Along a ditch on the same land, we excavated five 1 m. square test pits (DM-2 to DM-6). During our second season, in May 2009, two more stratigraphic sections were documented, in a modern trash pit (DM-10) and backhoe trench (DM-11). In May 2009, we re-excavated a unit adjacent to trench DM-8 (**Fig. 3**) in order to obtain more detailed infor-



3. DM-8 long north section, 2008.

mation on the distribution of layers and lithics, and to collect biological and chemical samples for paleoenvironmental and paleoclimatic reconstruction. The excavation of DM-8 provided more detail on the stratigraphy and occupation surfaces (**Fig. 4**).

This report presents a description and discussion of the stratigraphy thus far examined in the Druze marsh. The first U / Th dates and distribution of stratigraphic layers allow for a tentative reconstruction of the marsh and hypotheses on the development of the sedimentary deposits and occupations. In this report we provide a brief description of the stratigraphic units, pedogenic units and associated materials for sections DM-1, DM-8 and DM-11.

Stratigraphy

Section DM-1

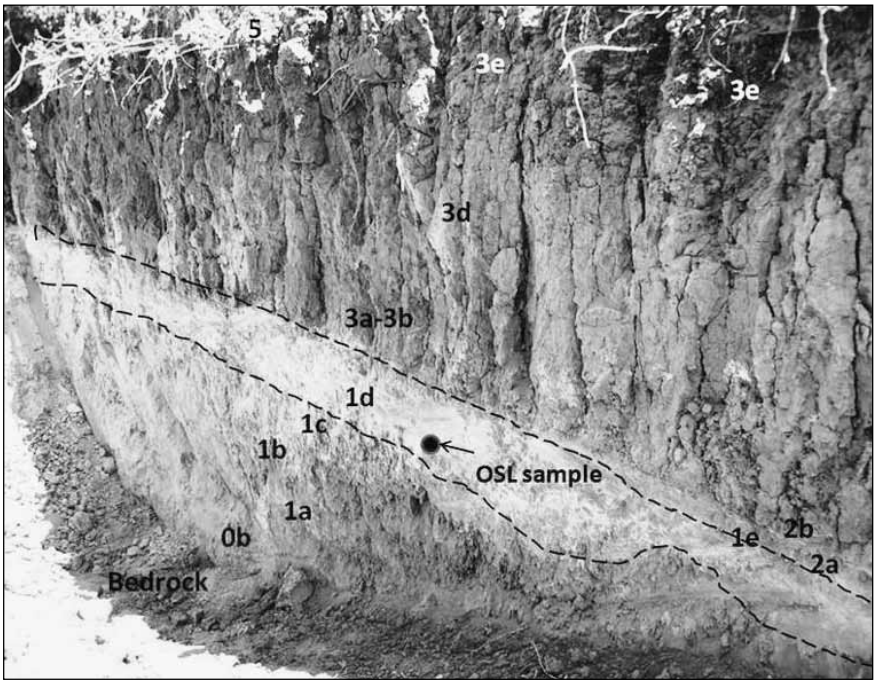
Modern trash deposits cap almost all stratigraphic units of this section (**Fig. 2**). Unit 6 is a calcified deposit associated with evaporation of the historic marsh. Unit 5 is an organic soil that was permanently saturated with water, which is believed to be the permanently waterlogged organic sediment of the historic marsh. Unit 4 is a layer of crumbly peat capped with basalt stones. The peat deposit lies on the erosional unconformity of the layer below. Abundant Kebaran lithics were recovered from Unit 4. In addition to DM-1, DM-1X, and DM-1Y, this unit is also found in DM-10. It is absent, however, in all other sections investigated in the Druze marsh.

Units 3a and 3b are green clays with strong columnar structure and seem to represent lacustrine facies. Although both units are similar, Unit 3a is characterized by alternating green and dark bands; Unit 3b has only green clays. Unit 2b is a dark deposit of organic sediment of loamy consistency. It is found only on the southern side of the trench. Unit 2a is a thin (2-4cm) deposit of sand, also visible in a few parts of the section. Unit 1c is a deposit of green clays with sugary consistency and lack of structure.

Section DM-8

The section exposed in 2008 (**Fig. 3**) formed the basis of the 2009 excavations. The top 3 units (6, 5 and 4b) are late Holocene. They contain a mixture of Neolithic and Epipaleolithic lithic material and Byzantine pottery. Units 6 and 5 are similar to their equivalents in DM-1. Unit 4b is a channel fill, probably laid by mudflow caused by torrential rain.

Unit 3e consists of a black clay deposit. The environment that produced this sediment seems to have been an organic-rich lake. Carbonates are present in the top of this unit, indicating that



4. DM-11 trench, north section.

after the lake dried out the deposit was exposed to dry conditions for a period of unknown duration.

Layer 3d consists of green clays capped by nodular carbonates. In 2008, a sample for U / Th dating was collected. The date obtained was between 43 - 36 k.a. B.P., which correlates well with the lithic material recovered in this season's excavation. The sedimentary and pedogenic characteristics of Unit 3d indicate that this is a lacustrine deposit that dried out for short periods, allowing temporary occupations. The pedogenic carbonates suggest that these drying episodes may have been of reasonably long duration.

Units 3c and 3b should be considered a single unit; their separation is based on the slightly darker color of Unit 3c. The top boundary of Unit 3c is an erosional unconformity with predominantly Upper Paleolithic (UP) and a few Middle Paleolithic (MP) lithic artifacts. Unit 3c is a dark green clay deposit that grades into a lighter green, compact clay deposit (Unit 3b). A clear lower boundary separates 3b from 3a. Unit 3a is a dark green clay deposit with moderately firm consistency. Units 3c, 3b and 3a are suggestive of lacustrine deposition, with short periods of dryness during which lithic materials were deposited. Unit 3a, however, is for the most part sterile.

Unit 2b consists of an organic clay loam deposit and a sandy deposit of variable thickness, but never thicker than 5cm. Unit 2a is a layer of aeolian sand and silt no thicker than 2cm. The interpretation of these two layers is that 2a was a surface with hominid occupation that was eventually covered by aeolian silt and sand. Subsequently, water levels rose, flooding this surface with an organic body of water that resulted in the deposition of Unit 2b. The importance of this unit lies in the climatic and human character of the events. The context is that of a transition from arid to moist conditions. The age of this layer has not yet been determined, but we hypothesize that it could relate to the moist MIS 5e interglacial, or one of the two warm and wet interstadials that ensued (e.g. MIS 5c or MIS 5b).

Unit 1c is a deposit of light green clay with a very sugary consistency. It is possible that this is a deposit of aeolian clay, clay dune or nebkha. However, further micromorphological studies will confirm or deny this assumption. Unit 1b is a light green clay deposit of lacustrine origin. Handaxes and flakes are the main cultural material found here. Unit 1a is a deposit with characteristics similar to 1c, but with orange stains. It is also a transitional deposit to Unit 0b, the basal deposit consisting of yellow sand. The orange mottles in it are the result of oxidation produced by the weathering of the underlying basalt.

Section DM-11

This section has a stratigraphic sequence similar to DM-8, as well as DM-7 and DM-9 (not discussed here). However, Units 1d and 1e, respectively identified as aeolian sand and intradunal pond deposits, have only been documented in DM-11. Unit 1d contained some artifacts, all of which are non-diagnostic. Unit 1c appears to be absent in DM-11, although traces of it are found in the north section (**Fig. 4**).

In DM-11, Unit 6 is absent but Unit 5 is present, suggesting that this area was underwater for most of the year when the historic marsh existed. This is confirmed by 1926 and 1927 aerial photographs of the area (Kennedy and Riley 1990). We hypothesized that Unit 5 is the area covered by water all year round, and Unit 6 is the higher ground that would have been covered by water during the winter, but dried out in summer.

Despite having been covered by the historic Druze marsh, the sequence in DM-11 lacks Unit 4 (Kebaran peat). Unit 3c is not clear in the stratigraphy and Units 3a and 3b appear as a single unit, here named Unit 3a-b. These variations with respect to the north and north-western parts of the marsh (e.g. section DM-10, plus DM-1, DM-1X, DM-1Y and DM-8) seem to be related to topographical changes through time, a topic that will be studied in future 4D reconstructions of the Druze marsh stratigraphy.

Other Stratigraphic Units with Limited Distribution

Unit 0a was identified in DM-1X as being a sandy deposit with bedding typical of beach deposits. Unfortunately, the contractor did not permit us to document it. Unit 1b in section DM-2 is capped by a layer of carbonates. The U / Th date provided by the carbonates was 141 - 150 k.a. B.P., which indicates a dry period, probably associated with the glaciations of MIS 6.

However, handaxes and other cultural material found in Unit 1b seem to be much older. The U / Th date on the carbonates is the minimum age of the deposit, which may post-date the deposition of Unit 1b by several tens of thousands of years.

DM-8 Artifacts

The following description summarizes the archaeological materials recovered from DM-8. **Table 1** summarizes the cultural inventory from all units excavated in this section. Units 6, 5 and 4b produced a mixture of Epipaleolithic and Early Neolithic material, mixed with glass and pottery dated to the Roman - Byzantine period.

Unit 3e - Upper Paleolithic

This unit produced 187 artifacts, including one core and three formal tools. Some artifacts in this unit were only slightly patinated (brown), but many were heavily patinated, partially desilicified and heat damaged, suggesting a harsh depositional environment including strongly acidic ground water. The clay deposits themselves were formed in relatively deep water; human occupation of this stratigraphic unit could therefore only have occurred during brief periods when the lake receded. Artifacts were dispersed in this layer, with no evidence of distinct occupation horizons. The formal tools from this layer included an atypical burin, a denticulated large blade and a borer on a large blade. The only core was a normal blade core. Among the technological elements, blades and blade fragments outnumbered bladelet fragments 27 to 21. Striking platforms were always either plain or cortical.

Unit 3d - Upper Paleolithic

Unit 3d extends from ca. 95 to 160cm below the surface and is a layer of green lacustrine clay, topped by a dense horizon of pedogenic carbonates. Much of this layer is archaeologically sterile with only a few widely dispersed artifacts, but there were two horizons where artifacts were common. In one, extending from 110 to 125cm below surface, lithics were only slightly patinated (brown and white); in the other, from ca. 150 to 160cm below surface, lithics bore a distinctive black and white patination. These horizons represent occasional occupations of the lake shore during brief periods when the deep water receded.

This unit yielded a total of 861 artifacts including 13 cores and 9 retouched tools (**Fig. 5** left). The retouched tools include 4 end-scrapers (including a large end-scraper on a retouched flake fragment found in the upper horizon), one borer on a blade and three double-backed bladelets. The cores include informal cores (6), blade cores (4) and bladelet cores (3). In the debitage, blades and blade fragments (147) outnumber bladelets and bladelet fragments (108). One noteworthy characteristic of the blade debitage is the presence of 'twisted' forms. 14 of the 27 whole blades, and all 6 of the whole bladelets, had twisted profiles. This unit also produced one Middle Paleolithic retouched Levallois point. This was wind abraded, in contrast to the Upper Paleolithic specimens, 93% of which were 'fresh', and was certainly not in its original depositional context.

Units 3a to 3c - Middle Paleolithic

The boundary between Units 3c and 3d is an erosional unconformity marked by heavily weathered basalt pebbles and cobbles. Units 3c, 3b and 3a were archaeologically almost sterile, yielding a total of only 14 artifacts of which 3 were formal tools. These included a Levallois point, a multiple tool (scraper / denticulate) on a Levallois flake and a triangular MP biface situated on the contact between Units 3a and 2a; this may have been derived from the rich MP layer immediately below (**Fig. 5** right).

Unit 2a - Middle Paleolithic

Unit 2a contained a single horizon of Middle Paleolithic artifacts that was, by volume, the richest deposit of archaeological material in the excavation (**Fig. 5** right). The assemblage included 44 point-located artifacts as well as abundant (562 pieces) small chipping debris. Much of this material was concentrated in the eastern half of excavation Unit B, and many artifacts were lying horizontally, suggesting that this layer represents an intact land surface. This layer also contained abundant small rounded basalt pebbles and gravel, suggestive of deposition on a beach. Over 85 % of artifacts were fresh or only slightly damaged; most of the damage was heat-fracturing (10 %). Heat-damaged speci-

Table 1: Artifact Inventory, DM-8; "L" after level number denotes artifacts over 2.5 cm. maximum dimension, "S" denotes smaller pieces. Flk = Flake, FlF = Flake Fragment, Bld = Blade, BldF = Blade Fragment, Bldt = Bladelet, BltF = Bladelet Fragment, Ang = Angular Fragment, Core = Core or Core Fragment, Tool = Formal Tool, Pot = Potsherd.

Level	Flk	Fl.F	Bld	BldF	Bldt	BltF	Ang	Core	Tool	Pot	Total
6 (L)	1			1							2
6 (S)	1						1				2
Subtotal											4
5 (L)	7	2		3							12
5 (S)	7	33		3		8	10		1	3	65
Subtotal											77
4b (L)	2			1				1	1		5
4b (S)	13	195		4		32	14			29	287
Subtotal											292
3e (L)	4	107		17		21	11				160
3e (S)	8	3	3	7			2	1	3		27
Subtotal											187
3d (L)	31	417		65		93	59				665
3e (S)	35	28	31	51	6	9	14	13	9		196
Subtotal											861
3c (L)			1	1					2		4
3c (S)		3									3
Subtotal											7
3a-b (L)									1		1
3a-b (S)	1	5									6
Subtotal											7
2a (L)	18	8	3	7			3	3	8		50
2a (S)	26	321		11			28				386
Subtotal											436
1c (L)	25	34		8			11	6	6		90
1c (S)	21	630		3			43				697
Subtotal											787
1a - 0b (L)	6	9		1			5		3		24
1a - 0b (S)	6	69					17				92
Subtotal											116
Total											2,774

mens were concentrated in the eastern third of the excavation, suggesting that one or more hearths may have been located nearby. The artifacts in this layer included retouched flake tools (notch, denticulate and scraper), two points (Levallois and elongated Mousterian) and a Levallois point core. Given the presence of both cores and formal tools, this assemblage may represent one or more brief episodes of hominin occupation during which both tool manufacture and hunting /

5. Lithics from the DM-8 excavation. (Left) Upper Paleolithic, Unit 3d; top row, left to right: endscraper, endscraper, complete double-backed bladelet, double-backed bladelet fragment; bottom row, left to right: blade, twisted blade, twisted bladelet, bladelet core. (Right): Middle Paleolithic, Unit 2a; top row, left to right: elongated Mousterian point, elongated Levallois point, Levallois point (Unit 3a), Levallois flake core; bottom row, left to right: Levallois point core, elongated triangular biface, convergent scraper (Unit 3b).

butchering activities were taking place.

Unit 1c - Lower Paleolithic

This layer contained dispersed Upper Acheulian artifacts, with most specimens occurring in the top 20cm of this stratigraphic unit (**Fig. 6**). These sediments, which included small amounts of flint gravel, represent silt dunes adjacent to a water source. Land surfaces during the deposition of this unit may have either been stable for long periods or, because nearly a quarter of the artifacts have damaged or rolled edges, may have undergone repeated cycles of erosion and deposition. Artifact densities in the top 20cm of this unit were relatively high. A total of 697 specimens were recovered, including 90 pieces over 2.5cm.

Artifacts in Unit 1c included an equal mixture of flake and core tools. These included a backed blade, a notch and a denticulate, as well as three bifaces. The bifaces were ovate, a crude sub-cordiform and a small bifacial cleaver. Two poorly executed Levallois flake cores ('proto-Levallois') as well as a discoid core and three core fragments were also found. Technological elements were primarily normal flakes, but the collection also included small numbers of Levallois flakes and blades. There was also one 'tranchet flake' from the production of a bifacial cleaver. The large Levallois points and minimally retouched scrapers on blades that were encountered last year in Unit 1c during geological trenching and inspection of the Children's Park foundation trenches were not found *in situ*

6. DM-8, Lower Paleolithic, Unit 1c; top row, left to right: partial cordiform biface, heat-damaged amygdaloid biface, discoid biface, small bifacial cleaver; middle row, left to right: cleaver tranchet flake, retouched Levallois point, déjeté scraper on a Kombewa flake, scraper-denticulate; bottom row, left to right: Levallois core.

in the DM-8 excavations.

Units 1a and 0b - Lower Paleolithic

The sandy clay deposits of Unit 1a extend from ca. 2.35 to 3.10m below the surface. Artifact densities were lower in this stratigraphic unit, and over 55 % of specimens were moderately to heavily damaged or rolled. Combined with the presence of numerous small rounded flint and basalt gravels, this suggests that beach lines repeatedly transgressed across this location during the deposition of this layer. A total of 116 artifacts were found, almost all from Unit 1a. The formal tools were a retouched Levallois point, a rabot (push-plane) and the tip of a large lanceolate biface that was broken in manufacture. This biface fragment was located in the Unit 1a - 0b contact horizon and was the deepest artifact found. Most technological elements were flakes, with only one blade fragment.

DM-11 artifacts

A total of *in situ* 137 artifacts were collected from the sections of DM-11 (**Fig. 4**). An additional 9 bifaces were collected, but lack archaeological context. The upper levels of this trench were almost entirely sterile, with most specimens coming from Units 1c and 1b. The lacustrine clays of Units 3d and 3a-b yielded only 12 artifacts, a sample that is too small to warrant description. The samples from Units 2a and 1d are also too small to be able to say anything definitive. **Table 2** summarizes the artifacts recovered from this trench.

Units 1c and 1b - Lower Paleolithic

The 50 pieces from Unit 1c included only one retouched tool, a thick, steep edge-angled déjeté scraper on a Kombewa flake. More formal tools were found among the 69 specimens from Unit 1b. These were a utilized Levallois flake, a denticulate, 4 complete bifaces and two biface fragments. The biface forms were ovate, discoid, amygdaloid and lanceolate. Among the 6 cores from this unit were one informal core, two Levallois flake cores, two informal cores on flakes and a Levallois blade core made from the recycled proximal end of a biface.

Concluding Remarks and Future Research

The excavation of trench DM-8 and the opening of trench DM-11 broadened the visibility of the stratigraphy, revealing additional information regarding the vertical and horizontal extent of the stratigraphic units and lithic materials within them. Of particular interest is the fact that the Kebaran peat (Unit 4) seems restricted to the northern margin of the Druze marsh area. It was also learned that the lacustrine deposits corresponding to Unit 3e date to somewhere between 36 to 20 k.a., and that the period represented by this unit ended with a dry episode, evidenced by carbonate formation on top. The excavation of DM-8 also provided information relating to the boundary between the MP and UP. The MP seems to be restricted to a progressively dry to wet phase (Units 2a, 2b and 3a - 3b), of as yet unknown date. An MP occupation surface was uncovered in Unit 2a.

Fieldwork in future seasons will include detailed excavation of DM-11 to expand our sample of the Acheulian levels, and excavation in the area of DM-10 for a better understanding of the Kebaran marsh, particularly its extent and correlations with similar occupations documented in south Azraq by Richter *et al*. (2007). Coring of the entire Druze marsh area will be implemented in order to create a 4D model of the lacustrine, palustrine and aeolian deposition and erosion processes, which will be supplemented by a detailed survey and dating of paleoshore benches and occupations on the surrounding basalt slopes.

Potential correlations with the sections in the south Azraq wetland and springs described by Rollefson *et al*. (1998), Richter *et al*. (2007) and Cordova *et al*. (2008) will also be examined in order to understand the extent of the paleolakes.

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Table 2: Artifact Inventory, DM-11; "L" after level number denotes artifacts over 2.5 cm. maximum dimension, "S" denotes smaller pieces. Flk = Flake, FlF = Flake Fragment, Bld = Blade, BldF = Blade Fragment, Bldt = Bladelet, BltF = Bladelet Fragment, Ang = Angular Fragment, Core = Core or Core Fragment, Tool = Formal Tool, Pot = Potsherd.

Level	Flk	FlF	Bld	BldF	Bldt	BltF	Ang	Core	Tool	Pot	Total
3e	1								2		3
Subtotal											3
3d	1			1							2
Subtotal											2
3a-b (L)	1	1		1				1			4
3a-b (S)		3									3
Subtotal											7
2a				1							1
Subtotal											1
1d (L)	1	2						1			4
1d (S)	1										1
Subtotal											5
1c (L)	1	2		1			1	2	1		8
1c (S)	2	37					3				42
Subtotal											50
1b (L)	19	8					3	6	7		43
1b (S)	2	17		3			4				26
Subtotal											69
NC									9		9
Subtotal											9
Total											146

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