SURVEY AND EXCAVATION IN WADI AL-ḤASA: A PRELIMINARY REPORT OF THE 1993 FIELD SEASON

by
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Introduction

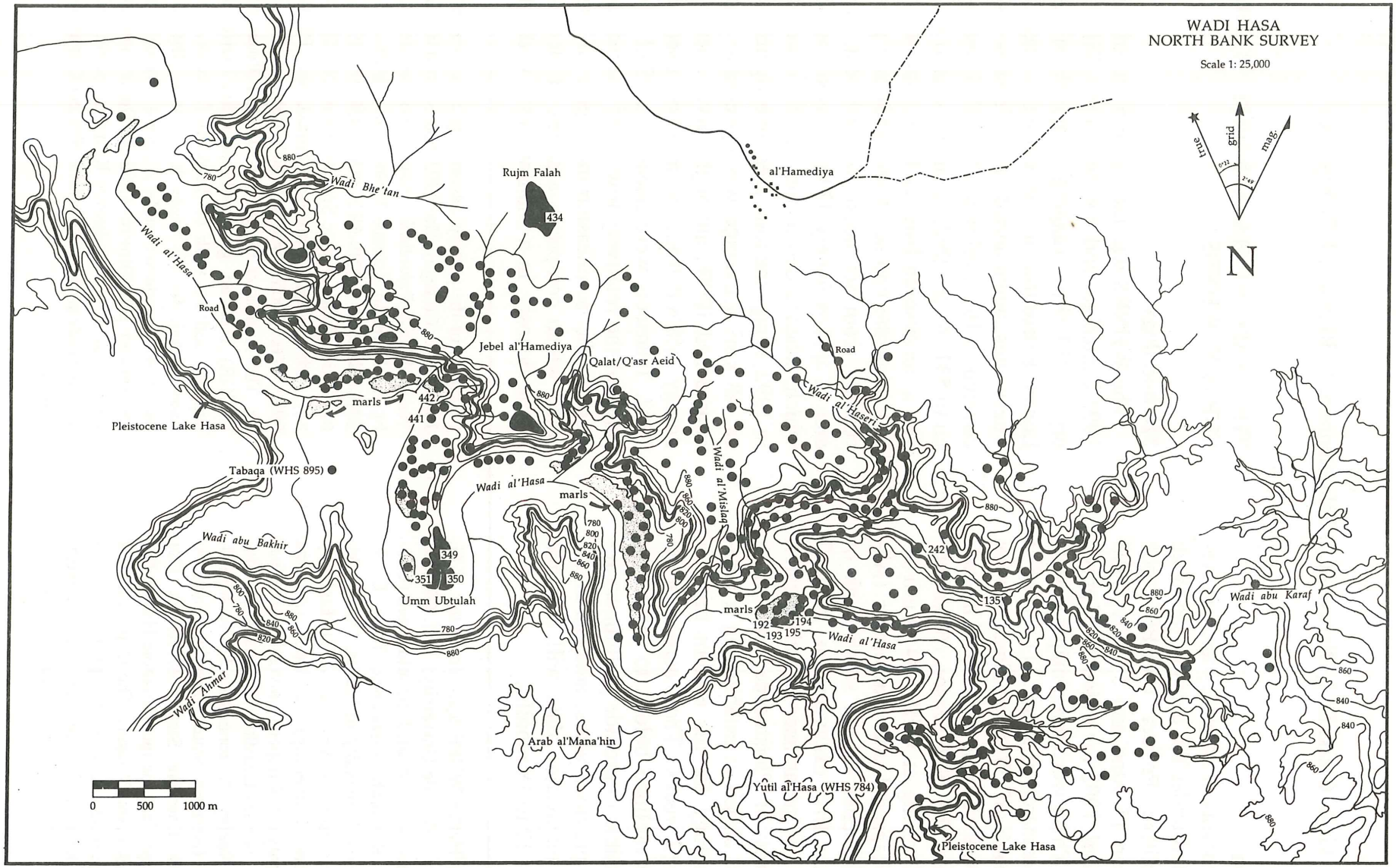
The fourth season of survey and excavation conducted under the aegis of the Wadi Hasa Paleolithic Project (WHPP) took place between 15 June and 31 July, 1993 (see Clark *et al.* 1992 for a résumé of previous work).[1] There were three major aspects to the 1993 research program: (1) survey of the north bank of Wadi al-Ḥasa; survey continued, with variable degrees of intensity, throughout the field season (6 weeks); (2) renewed testing at WHS 784 (Yutil al-Ḥasa), a collapsed Upper Paleolithic (Ahmarian) rockshelter on the south bank of Wadi al-Ḥasa first excavated in 1984 (2 weeks), and (3) geoarchaeological research in the vicinity of Pleistocene Lake Hasa (Clark 1984) aimed at establishing a landscape chronology for the eastern third of the drainage (2 weeks). These aspects of the research are outlined below, to the extent that it is possible to provide preliminary results. As in previous years, analysis of the survey and excavation data will continue over the next 12 to 18 months.

THE WADI AL-ḤASA NORTH BANK SURVEY (WHNBS)

Methodology

The WHNBS was the major focus of the 1993 campaign, and resulted in the discovery of 453 sites ranging in age from the Lower Paleolithic to the Ottoman period. These sites, when added to the 78 sites discovered in 1992, bring the WHNBS site total to 531. As in 1992, the intent was to survey a north/south band at least 2 km wide following the course of the wadi and proceeding from southeast to northwest. An area of approximately 32 km^2 was surveyed which, when added to the 16 km^2 covered in 1992, brings the total area investigated to ca. 48 km^2. Coverage was systematic and approached 100%, although survey methodology differed from the transects used in 1992. Transects were feasible in 1992 because of the relatively low relief characteristic of the southeasternmost part of the wadi, which comprises a series of fluviolimnic deposits in a shallow basin without

1. The 1993 WHNBS/WHPP team consisted of G. A. Clark (Arizona State University), D. I. Olszewski (University of Arizona), J. Schuldenrein (Geoarchaeology Research Associates, Inc.), C. P. (Molly) Davies (University of Maine, Orono), M. Stevens (University of Arizona), J. D. Eighmey (Arizona State University), R. Beck (Arizona State University), J. Cooper (University of Nevada, Reno), J. (Chaz) Czastka (University of London), M. P. Neeley (Arizona State University), J. D. Peterson (Arizona State University) and A. Smith (North Carolina State University). Our cook, as always, was the incomparable Hassan Salim Adawi (aka Abu Yousef). The Department of Antiquities representative for the project was, as in 1992, our friend and colleague, Jihad Darwish. Nazmieh Rida (Department of Antiquities) identified most of the pottery, assisted by Jack Lee (St. John Fisher College). The 1993 field season of the Wadi al-Ḥasa Paleolithic Project was supported by the National Science Foundation (Grant Nos. BNS-8405601, BNS-8921863, BNS-9013972), the National Geographic Society (Grant No. 2914-84), Arizona State University (Grant Nos. DNT-9995, WH5-1005), and the Chase Bank of Arizona. The American Center for Oriental Research (ACOR), Amman, graciously provided logistical support, and we wish to thank its Director, Dr. Pierre Bikai, for his many kindnesses. The research was conducted under a permit awarded by Dr. Safwan Tell, Director General, Department of Antiquities of the Hashemite Kingdom of Jordan. This is Wadi al-Ḥasa Paleolithic Project Contribution No. 23.



1. Sites recorded by the Wadi al-Ḥasa North Bank Survey (WHNBS), 1993. Only sites discussed in the text are numbered. Wadi al-Ḥasa Survey (WHS) Site 784X (Yutil al-Ḥasa), on the south bank, has been redesignated WHS 784. The discovery of Epipaleolithic deposits there during the 1993 excavations makes it clear that this is the same rockshelter identified by the WHS team in 1982 (MacDonald 1988). Source map is the al-Ḥamediya sheet, Royal Geographic Society, 1989 Series (scale 1:25,000, contour interval 20 m).

much incision. As one moves northwest, however, the wadi rapidly becomes deeply entrenched, and is flanked on the north by deeply incised tributaries, chief amongst which is Wadi Abu Karaf (Fig. 1). This vertical relief, with its steep slope gradients, required us to stratify the survey universe into (1) upland plateaux, cuesta ridges, spurs, saddles and isolated hills; (2) fluvial terraces and marl deposits (the marls abut the Middle Terrace of the Ḥasa system at an elevation of ca. 815 m asl— they appear to post-date the Middle Terrace), and (3) the valley floors and Low Terrace (4-6 m above the present wadi bed), of Holocene age. Although the rugged topography precluded the intensive coverage achieved in 1992, we were able to systematically record sites in the 2-4 m diameter range, suggesting that we did not miss very much. Thus it is argued that, other things being equal, survey results from the 1992 and 1993 seasons are directly comparable.

Paleolithic, Epipaleolithic and Prepottery Neolithic Sites

Probably owing to distinctive topographic settings and depositional regimens (i.e., deeply incised valleys flanked by deflated upland plateaux vs fluvio-limnic marls in a shallow basin), the 1993 WHNBS sample differs from its 1992 counterpart in site densities, range of temporal/cultural periods represented and in factors of preservation. Whereas in 1992 the lithic period sites accounted for 77% of the total (60 of 78 sites), in 1993 they make up a mere 20% (90 of 453 sites; 18.9% of the identified total), dominated by deflated Lower and Middle Paleolithic scatters found on Jabal al-Ḥamediya and Jabal Bhetan. Lithic site densities averaged 3.75 sites/km^2 in 1992 and 2.81 sites/km^2 in 1993, suggesting somewhat higher concentrations around the lake margins to the southeast of the 1993 survey area. The lake shores, which typically have marls preserved adjacent to them, are also characterized by numerous tufas, the remains of fossil springs. It has been suggested elsewhere that the presence of these freshwater springs at intervals during the Upper Pleistocene might have attracted humans to the area, since the lake itself was apparently alkaline during much of its existence (Clark 1992).

All lithic period sites were assigned to one of six temporal/stratigraphic periods (Tables 1 and 2). Undifferentiated Lower/

Table 1: Archaeological periods and dates.

Lower Paleolithic (ca. 500,000 - 90,000 BP)
Middle Paleolithic (ca. 150,000 - 45,000 BP)
Upper Paleolithic (ca. 45,000 - 20,000 BP)
Epipaleolithic (ca. 20,000 - 10,000 BP)
Prepottery Neolithic (ca. 10,000 - 7000 BP)
Pottery Neolithic (ca. 7000 - 6250 BP)
Early Chalcolithic (ca. 6250 - 5750 BP)
Late Chalcolithic (ca. 5750 - 5300 BP)
Early Bronze (ca. 3300 - 1950 B.C.)
Middle Bronze (ca. 1950 - 1550 B.C.)
Late Bronze (ca. 1550 - 1200 B.C.)
Iron I (1200 - 918 B.C.)
Iron II(918 - 539 B.C.)
Persian (539 - 332 B.C.)
Early Hellenistic (332 - 198 B.C.)
Late Hellenistic (198 - 63 B.C.)
Early Roman and Nabataean (63 B.C. - 135 A.D.)
Late Roman and Nabataean (135 - 324 A.D.)
Early Byzantine (324 - 491 A.D.)
Late Byzantine (491 - 640 A.D.)
Umayyad (640 - 750 A.D.)
Abbasid (750 - 969 A.D.)
Fatimid (969 - 1171 A.D.)
Crusader (1099 - 1171 A.D.)
Ayyubid (1174 - 1263 A.D.)
Mamluk (1250 - 1516 A.D.)
Ottoman (1516 -1918 A.D.)

Table 2: Wadi Ḥasa North Bank Survey 1993: Summary of sites recorded by period.

Period	*Number*	*Percent*
Lower Paleolithic	7	7.7
Lower/Middle Paleolithic (undifferentiated)	36	40.0
Middle Paleolithic	17	18.9
Upper Paleolithic	19	21.1
Epipaleolithic	3	3.3
Prepottery Neolithic	8	8.9
Lithic Period Total: 90 sites, 18.9% of identified total		
Pottery Neolithic	2	0.5
Chalcolithic ?	20	5.2
Chalcolithic	9	2.3
Early Bronze	11	2.8
Early Bronze 1	4	1.04
Middle Bronze	6	1.55
Late Bronze	1	0.25
Bronze Age (no temporal subdivision indicated)	1	0.25
Iron Age 1	12	3.1
Iron Age 2	97	25.1
Iron Age (no temporal subdivision indicated)	24	6.2
Persian	--	-
Hellenistic	20	5.2
Nabataean	10	2.6
Roman	68	17.6
Byzantine	37	9.6
Umayyad	28	7.25
Abbasid	7	1.8
Fatimid	2	0.5
Ayyubid/Mamluk	12	3.1
Ottoman?	6	1.55
Ottoman	9	2.5
Ceramic Period Total: 386 sites, 81.1% of identified total		
Unknown (architecture, but no lithic or ceramic diagnostics): 146 sites		

Middle Paleolithic sites are most common (36 sites, 40% of the lithic site total), followed by those of the Middle Paleolithic (17, 18.9%). Although most of the Middle Paleolithic sites come from deflated contexts, there is one "fresh" MP site with some fauna and rootcasts eroding out of the Ḥasa marls (No. 441). "Pure" Lower Paleolithic sites are represented by four isolated handaxe finds generally attributed to the

Acheulean, and by massive, wind-abraded and/or rolled flakes and blades lacking platform preparation (7, 7.7%). Upper Paleolithic sites number 19 (21.1%), and include Nos. 135 and 242, rockshelters with some stratified deposits in Wadi Abu Karaf. There are also relatively pristine UP open sites in the Wadi Ḥasa marls (Nos. 192-195). Epipaleolithic sites are quite rare (3, 3.3%), as are those assigned to the Prepottery Neolithic (8, 8.9%), although there is one PPN site (No. 442), located on the north bank of the Ḥasa about one kilometer due east of its confluence with Wadi Aḥmar, that preserves some architecture and midden deposits (and a possible Epipaleolithic component). Epipaleolithic and PPN sites were about twice as common in the 1992 survey area associated with the lake (10 sites, 11%; 14 sites, 15%). The 1992 and 1993 lithic component site frequencies are compared in Table 3.

Epipaleolithic and Prepottery Neolithic differences aside, the higher incidence of undifferentiated Lower/Middle Paleolithic sites in the 1993 sample probably reflects the fact that a larger proportion of the 1993 survey area is comprised by deflated upland plateaux upon which these early artifacts tend to accumulate. Although some of these sites appear to exhibit some compositional integrity (esp. those assigned to the Middle Paleolithic), most of them represent depositional composites which, although ancient, were derived from many different points in time and space during the half-million years conventionally assigned to the Middle and Upper Pleistocene. In the vast majority of cases, no traces remain of the land surfaces upon which these artifacts were originally made and used. The only exceptions to this generalization are rockshelters like WHS 634 ('Ain Difla), in Wadi 'Ali, and WHNBS 441, an MP site stratified in paludal marls in Wadi al-Ḥasa.

Neolithic, Chalcolithic, and Bronze Age Sites

Ceramic-period components are found on 386 (85.2%) of the 453 sites recorded in the 1993 survey. They account for 81.1% of the combined (lithic + ceramic) identified component total of 476 . Many sites, both large and small, are multicomponent so far as their ceramic inventories are concerned, whereas this tendency is much less marked in respect of exclusively lithic scatters (i.e., lithic sites tend to be more readily assignable to one or several periods).

As was the case in 1992, Pottery Neolithic (PN) sites are scarcely represented in the survey area, with only two possible ex-

Table 3: Wadi Ḥasa North Bank Survey: Lithic period sites. The 1992 and 1993 surveys compared.

	1992		1993	
	No.	Percent	No.	Percent
Lower Paleolithic	6.4	7	7	7.7
Lower/Middle Paleolithic	8.6	36	8	40.0
Middle Paleolithic	29.0	17	27	18.9
Upper Paleolithic	27.0	19	25	21.1
Epipaleolithic	11.0	3	10	3.3
Prepottery Neolithic	15.0	8	14	8.9
Unknown	3.0	-	3	-

Table 4: Wadi Hasa North Bank Survey: Ceramic period sites. The 1992 and 1993 surveys compared.

	1992		1993	
	No.	Percent	No.	Percent
Pottery Neolithic	-	-	2	0.5
Chalcolithic	-	-	29	7.8
Bronze Age	-	-	23	5.9
Iron Age	-	-	133	34.4
Persian	-	-	-	-
Hellenistic	-	-	20	5.2
Nabataean	1	5.0	10	2.6
Roman	2	11.0	68	17.6
Byzantine (combined with Early Islamic in 1992)			37	9.6
Early Islamic	7	39.0	35	9.0
Late Islamic	5	28.0	14	3.6
Ottoman	3	17.0	15	3.8

amples recorded (0.5% of the ceramic total, Table 4). Better documented are Chalcolithic remains, identified as such on the basis of the distinctive tabular scrapers as well as on ceramic criteria (29 sites, 7.5% of the ceramic total). Since they yielded no pottery, we were unable to assign 146 architectural sites to a temporal period (Table 2). A substantial number of these were small domestic clusters (farmsteads) comprising a few roughly circular "houses", sometimes associated with what were probably corrals. It was generally assumed that the presence of architecture indicated a site in the ceramic time range, although this clearly does not hold true for the late Epipaleolithic (e.g., some Natufian sites) and the aceramic Neolithic (e.g., Beiḍa, 'Ain Ghazal). Nevertheless, these "early" (pre-Bronze Age) ceramic-period sites often have little or no pottery, at least in the eastern Ḥasa, which was probably at, or near, the physiographic and climatic limits of rainfall agriculture. It is only in the Iron Age that the eastern Ḥasa experienced the effective implementation of domestication economies (see Neeley and Clark, in press, for a discussion of this process on a regional scale).

Sites with Bronze Age pottery number 23, and account for a relatively meagre 5.9% of the ceramic total. Of the various Bronze Age temporal divisions, EB sites are best represented (15, 3.8%). There is only a single LB site, suggesting virtual abandonment, or at least a sharp drop in population, during the 1500-1200 B.C. interval. The Early Bronze Age would appear to mark the shift to village food producing economies elsewhere in Jordan (see, e.g., Bienkowski 1991).

The Iron Age

The apparent decline in Late Bronze Age population is gradually reversed during the early Iron Age. Iron Age I sites are poorly represented, however (12 sites, 3.1% of ceramic total), although they may be more common than they appear to be since 24 Iron Age sites (6.2%) could not be assigned to a temporal subdivision. It is with Iron Age II (918-539 B.C.) that a virtual "population explosion" takes place in the eastern Ḥasa, with 97 sites (25.1% of the ceramic total) yielding Iron Age II pottery. Most of the Iron Age II sites are modest farmsteads, however, with little in the way of public architecture. There is a significant Iron II component at WHNBS Site No. 349, an

enormous (80,000 m^2) complex of ruins covering the south end of a cuesta ridge about a kilometer east of the Ḥasa's confluence with Wadi Aḥmar. If much of the architecture at No. 349', and at adjacent WHNBS Site No. 350, pertains to the Iron Age occupation, this would be the most important Iron Age settlement in the eastern part of the drainage. However, the site complex (Umm Ubtulah in MacDonald 1988: 292-294) was occupied intermittently over a long period of time, since Middle Bronze, Roman, Byzantine and Islamic period pottery was also recovered there. According to conventional wisdom, the north bank of the Ḥasa would have been within the Iron Age Kingdom of Moab, although the eastern boundary of that sociopolitical entity has never been determined. If Site Nos. 349 and 350 were indeed part of Moab (whose capital was at Dhiban, some 60 kms to the northwest), they would have been on its extreme southeastern frontier, since the Ḥasa was the boundary between Moab and the Kingdom of Edom, to the south. It is of some interest to note that there are no massive enclosure walls at Nos. 349 and 350, such as might be expected in a defended frontier settlement. Dhiban was a defended site during this period (Bienkowski 1991).

The later Iron Age would seem to have been a period of relative prosperity and population growth, perhaps fostered by the growing importance of trade (gold, spices, gemstones) with Arabia. A major trade route essentially paralleled the Desert Highway, which lies 11 kms due east of Site Nos. 349 and 350, and which extended north through Amman and Damascus into northern Syria and southern Anatolia. In terms of sociopolitical complexity, this period saw the appearance of the first multi-community polities, essentially small kingdoms like Edom, Moab and Ammon, with fortified "capitals" that functioned as administrative, market and possibly religious centers. Sites usually considered to be "watchtowers" (circular stone structures of various sizes) guarded the approaches to all three kingdoms. The 1993 survey recorded a considerable number of these, typically distributed along ridgelines with unobstructed views of the wadi beds, and associated, at least in some cases, with routes leading into and out of the wadis. Some (many?) of these watchtowers might date to the Iron Age. However, in default of the diagnostic ceramics and some clearing of surface rubble (which would give us a better idea of the architecture), it is difficult to date them.

The Classical Periods

The regional kingdoms of Jordan and Palestine came under the control of a Persian satrap with subordinate governors after ca. 500 B.C. The survey, however, produced no archaeological evidence of Persian domination, the only period not represented at all in the WHNBS data base. It seems likely that Persian control over the eastern Ḥasa (indeed, over most of Palestine) was sporadic and ephemeral at best. The two centuries of Persian rule were marked by internal dissension and civil strife, and apparently, by economic decline (Bienkowski 1991).

Persian rule came to an end when Palestine was conquered by Alexander (332 B.C.) and shortly thereafter came under the control of dynasties founded by his generals – first the Ptolemies from Egypt (ca. 301-198 B.C.) and later the Seleucids from Syria (ca. 198-63 B.C.). It was incorporated into the Roman Empire when the Roman general Pompey conquered Syria in 63 B.C. There is some evidence of the Hellenistic presence in the survey area (20 sites, 5.2% of the ceramic total), but the second major "blip" in the population curve clearly coincides with the Roman and Nabataean periods (78 sites, 20.2%), followed by something of a decline during the Byzantine era (37 sites, 9.6%). All three periods are repre-

sented on sites that appear, in many instances, to have been Iron Age foundations, and which seem to have been depopulated or abandoned altogether during the Persian and Hellenistic occupations. Although isolated farmsteads and hamlets again constitute the major site functional categories, there are larger and more complex aggregates, including WHNBS Site No. 434 (Rujm Falaḥ), where 18 loci have produced pottery ranging from the Early Bronze Age through the Late Islamic periods. This resurgence in population can probably be attributed to the political stability engendered by Roman domination, and the re-establishment of secure commercial ties with Arabia and points to the north of Palestine.

Despite the relative proximity of the Nabataean capital at Petra, some 75 kms to the southwest, and the long-established trade route some 10 kms due east of the survey area, Nabataean pottery was found on only 10 sites (2.6%). Originally nomadic herdsmen from the Arabian peninsula, the Nabataeans were, in this period, traders *par excellence* and controlled the major trade routes between Arabia and Damascus, dealing in textiles, copper, iron, incense, sugar, animals, medicines, perfumes and ivory, in addition to the gold and spices exchanged by earlier itinerant merchants. They were also known to be skilled hydraulic engineers, and it may be that many of the numerous water impoundment and control devices recorded by the survey, which typically do not have associated pottery, in fact date to the Nabataean period (63 B.C.-A.D. 106). Long under pressure from Rome, Nabataean autonomy came to an end with the peaceful annexation of the kingdom by the Emperor Trajan in A.D. 106 .

Although the Byzantine Era (A.D. 324-640) is represented by prosperity and population growth throughout most of western Jordan, Byzantine population in the survey area appears to have declined somewhat vis à vis the Nabataean-Roman period (37 sites, 9.6%). No reason for this comes readily to mind, since the consensus view is essentially one of continuity with the preceding Roman period. The marginal geographical position of the survey area, on the edge of the Eastern Desert, should be kept in mind, however, as well as the proximity of the trade routes. It could be that patterns (and/or intensity) of exchange shifted somewhat to the west during Byzantine times, thus accounting for its reduced importance in the eastern Ḥasa. The Byzantine period marked the widespread appearance of Christianity in Jordan, and the building of numerous churches, but so far, at least, not a single Christian structure or artifact has been recorded in the survey area. The last century of Byzantine rule was characterized by depopulation, civil disorder, a major plague (A.D. 542) and a brief occupation by the Sassanians (A.D. 614-629). Perhaps these factors, combined with the location of the survey on the peripheries of the Byzantine world, account for the apparently decreased importance of the Byzantine presence in the region.

The Islamic Dynasties and the Ottoman Empire

Civil disorder, depopulation and the collapse of trade also characterize the transition to Islam. Of the six Islamic dynasties (including the Ottomans), the earliest, Umayyad, is best represented in the eastern Ḥasa (28 sites, 7.25% of the ceramic total), followed by the latest, the Ottoman (15 sites, 3.85%). Ayyubid/Mamluk sites number 12 (3.1%), there are seven sites with Abbasid pottery (1.8%) and two Fatimid period sites (0.5%) (Table 2). It is difficult to escape the impression that the eastern Ḥasa had become something of a 'provincial backwater' during the Islamic periods, when the region was governed by dynasties in Damascus, Baghdad, Cairo, and Istanbul. The area was fortified late in the Ottoman

period, when a fort was constructed (Qal'at al-Ḥasa - WHS 1074), and a road, bridge and a railway built (the last between 1907 and 1914), as part of the Ottoman effort to make the *Ḥajj* road secure from Bedouin raids and less arduous for the pilgrims. This probably accounts for the occurrence of late Ottoman artifacts in both the 1992 and 1993 surveys, although the area probably never sustained more than a small Turkish garrison and their families.

Summary and Conclusions

Whereas the 1992 survey was dominated by lithic period sites, found at low elevations and associated with Pleistocene Lake Hasa, the 1993 survey produced large numbers of ceramic period sites "downstream", at high elevations, in ridge crest, spur, saddle and plateau contexts (Table 4). Particularly striking is the high incidence of Iron Age sites in the 1993 survey, and their complete absence in the 1992 sample. The latter produced no evidence at all of early ceramic period sites. Also noteworthy in the 1993 sample is the episodic reuse/reoccupation of particular loci in the landscape over very long periods of time. WHNBS Site No. 434 (Rujm Falaḥ), for example, is an enormous site with ceramics assigned to the Early and Middle Bronze Age, Iron Age, Hellenistic, Roman, Byzantine, and three Islamic periods. Although its function undoubtedly changed over time (there is a Roman fort there), it is located on a high promontory (1054 m asl), with unobstructed vistas in all directions. It probably was a convenient spot for human aggregation over literally tens of thousands of years, since there is also a dense Paleolithic scatter surrounding the rujm.

There were apparently two episodes of relatively sharp population increase corresponding to the Iron Age, followed by a decline, and the Roman/Byzantine/Early Islamic periods, with most of the latter increase dated to the interval of Roman control or suzerainty. In functional terms, most of the sites are isolated farmsteads and small domestic clusters comprising a few households with their corrals. This basic community plan appears to exhibit remarkable temporal stability since it cross-cuts sites dated, on the basis of the pottery, to the Chalcolithic, the Bronze and Iron Ages, the Nabataean/Roman and Byzantine eras, and the Islamic periods. One hundred forty-six sites could not be classified to a temporal period. Many of these are water control devices of various kinds, and circular structures of various dimensions and constructions which were considered to be the remains of house foundations, corrals, towers and graves. Most of the architectural sites were sketched and measured in the field and we hope, in the future, to subject these data to multivariate statistical pattern searches in order to refine our typology of site types.

It is worth remarking that the Wadi al-Ḥasa floodplain, and its Holocene terrace, are being heavily farmed today using water drawn by pumps from strong springs in the wadi bed. Melons, tomatoes, sunflowers, squash and other cucurbits, and some maize are being grown in tractor-ploughed, irrigated fields. This intensive agriculture is a very recent phenomenon; there was no trace of it in 1984 when we first began research in the area. It is very likely that this modern episode of agricultural intensification is only the most recent in a series of such efforts that date back to the Iron Age. Without some form of fairly intensive agriculture, and an efficient system of water impoundment and distribution, it is difficult to see how the high population densities of the Iron Age II and the Roman/Byzantine/Early Islamic eras could have been sustained.

EXCAVATIONS AT YUTIL AL-ḤASA (WHS 784)

Yutil al-Ḥasa (WHS 784) was located in 1982 and first tested during the 1984 season of the Wadi Ḥasa Paleolithic Project (WHPP). Although the site had been described as dated to the Epipaleolithic period by the Wadi Hasa Survey of the southern bank of the drainage (MacDonald 1988), the 1984 test pits (Units A, B) both yielded Upper Paleolithic Ahmarian assemblages (Clark *et al.* 1988; Olszewski *et al.* 1990). The 1993 field season provided an opportunity to pursue further testing at Yutil al-Ḥasa. Three 1 m^2 units (C, D, and E) were excavated. These units are located upslope and to the west of the 1984 Units A and B. All three of the 1993 units produced Epipaleolithic assemblages. Units C and E yielded lithic materials that resemble the Madamaghan (Henry 1986; 1989; Kirkbride 1958). Unit D produced an early Natufian assemblage (Garrod 1932). A total of 8472 lithic artifacts, as well as bone, shell and fossil shark teeth, were recovered.

Unit C

Thirteen arbitrary levels were excavated by the end of the field season; all except Level 1 were 10 cm thick. Level 1 was 1 cm thick and consisted of loose surface sediment. Bedrock was not encountered in this unit, which reached a maximum depth of 120 cm below the modern ground surface. Some levels appeared to be sulphur-stained, and suggest the former presence of a sulphur-charged spring or seep. Other levels were manganese-stained with mineralized organics, indicating standing water. Levels 2-9 yielded lithic materials that appear to date to the Madamaghan Epipaleolithic. These include true microburins, narrow arched-backed, pointed microliths, and possibly a few La Mouillah points. Levels 10-13 differ from the upper levels by virtue of larger debitage and few microburins. However, the majority of the formal tools are still narrow backed bladelets. It is possible that Levels 10-13 represent a change in the lithic industry either to an earlier Epipaleolithic tradition, or to Upper Paleolithic assemblage. Future work in this area of the site will undoubtedly help resolve this question.

Unit D

Unit D was excavated until a solid rock accumulation filled the square, making further digging impossible. It is unclear whether these rocks represent bedrock, or roof fall accumulated downslope from an upper rockshelter at the site. A total of nine arbitrary and natural levels were excavated; most were approximately 10 cm thick. As in Unit C, the Level 1 loose top sediment in Unit D was 1 cm thick. The maximum below-surface depth attained was 72 cm in the northeast corner of the unit, while the minimum depth was 42 cm in the southeast corner. Levels 2-5 yielded early Natufian materials, primarily Helwan lunates and Helwan bladelets (pieces backed with bi-directional retouch), as well as true microburins. The lithics from this occupation were all heavily patinated. Levels 2-3 provide the best context, since Levels 4-5 appeared to be disturbed by rodent activity. While Levels 6-9 yielded a small number of artifacts, these were unremarkable and generally not temporally diagnostic.

Unit E

Unit E is located on a considerable slope – 14° from north to south, and 21° from west to east. Thus, the maximum depth below ground surface was reached in the northwest corner of the unit, at 88 cm, while that attained in the southeast corner was only 25 cm. Six arbitrary and natural levels were excavated to bedrock. This bedrock comprises the ledge that runs above Unit C, and it probably represents the original roof of the lower rockshelter at the site.

Level 1 is the loose 1 cm thick top sediment. Levels 2-4 represent downslope detrital sediments derived from a number of temporally disparate periods; they include patinated and unpatinated lithics, and ceramics. Levels 4b and 4c are a thick downslope accumulation of limestone rubble derived from the roof of the shelter. The artifacts in these levels come mainly from the contact with the cultural occupation in Levels 4a and 5. The cultural materials appear to resemble those from Unit C, Levels 2-9, and are also probably assignable to the Madamaghan Epipaleolithic. Levels 4a and 5 were confined to a 1-5 cm thick deposit that rests directly on top of the bedrock shelf in the southeast half of the unit. The northeast half of the unit produced a sandy deposit with a distinct sulphuric odor. This also rested directly on top of the bedrock ledge and was probably a sulphur-charged spring or seep.

Summary

The 1993 field season at Yutil al-Ḥasa successfully located an Epipaleolithic occupation at the site. We now know that, in combination with the information derived from the 1984 campaign (Olszewski *et al.* 1990), the Yutil al-Ḥasa witnessed three distinct episodes of use/occupation. The first of these was during the late Upper Paleolithic Ahmarian, ca. 19 kyr BP, just prior to the draining of the Pleistocene Lake Hasa. During this interval, a number of springs existed in the vicinity of the site (evidenced by tufa deposits outcropping in the nearby marls), as well as at the site itself (since Unit A produced sulphur-stained deposits). In addition, an arm of the lake may have extended into this part of the Ḥasa drainage. The situation at Yutil al-Ḥasa was probably very similar to the late Ahmarian occupation at 'Ain al-Buḥira (WHS 618), some 4 kms to the south (Coinman 1990; in press).

Climate, situational and settlement pattern changes appear to have left the Yutil al-Ḥasa unoccupied in the period between ca. 19 kyr BP and 13.3 kyr BP. After about 13.3 kyr BP, a probable series of Madamaghan occupations is documented, dated in north Jordan (in Wadi Jilat, Azraq Basin) to the 13.3-12.6 kyr BP interval (Henry 1986: 18). There is evidence for springs or seeps at the site itself, while other springs probably existed nearby across the Ḥasa drainage. It appears unlikely that Pleistocene Lake Hasa was still present in this part of the drainage during the Madamaghan occupation. A total of 5785 lithic artifacts can be assigned with confidence to this temporal unit. Preliminary analysis of the retouched pieces suggests that Yutil al-Ḥasa functioned as a very specialized limited activity station since 91% of the tools are backed microliths.

Immediately following the Madamaghan period, in the interval between ca. 12.5 and 11 kyr BP (Henry 1986: 19), an early Natufian Epipaleolithic occupation occurred at the site. In the area excavated, no evidence for a spring or seep was found, but it is quite probable that these existed elsewhere at the site, or in the vicinity. Although the lithic sample is relatively small, with 729 artifacts that can be assigned confidently to this analytical unit, the character of the assemblage resembles the earlier Madamaghan occupation in one important respect: the early Natufian at Yutil al-Ḥasa is also dominated by backed and retouched microliths, which make up no less than 95% of the retouched tool component. This might suggest that the specialized functional role of the site continued into the early Natufian period. The onset of the arid Younger Dryas interval at ca. 11 kyr BP (Moore and Hillman 1992) probably resulted in the abandonment of Yutil al-Ḥasa after the early Natufian.

Further excavation of the Ahmarian, Madamaghan, and Natufian occupations at Yutil al-Ḥasa will be pursued over the next

few years. In conjunction with this, test excavations are also planned for three probable Upper Paleolithic rockshelters located by the WHNBS in 1992 and 1993.

GEOARCHAEOLOGICAL INVESTIGATIONS IN WADI AL-ḤASA

Objectives

Geoarchaeological studies were undertaken in Wadi al-Ḥasa between July 18 and 30, 1993. The objectives of this third field season included:

(1) Establishment of a preliminary landscape chronology and site stratigraphy for WHS 784 (Yutil al-Ḥasa).
(2) Resolution of the Pleistocene lake and lake edge stratigraphy across central portions of the drainage, specifically the sectors parallel to the WHNBS.
(3) Refinement of the Holocene alluvial sequence of the Ḥasa Terrace, the dominant landform overlooking the contemporary channel.

Field work proceeded for a total of ten days and consisted of description and profiling of key stratigraphic exposures, mapping of landform relations, sampling of diagnostic soil and sedimentary units, and procurement of radiometric samples. The latter task was critical for reconstructing the complex cycles of lake transgressions, retreats, and subsequent erosional and fluviatile episodes since Upper Pleistocene times. Methods and strategies applied for each of the objectives are addressed in turn.

WHS 784 (Yutil al-Ḥasa)

Archaeological excavations at WHS 784 proceeded during the second half of the field season. Initial geoarchaeological assessments were geared toward identifying the landscape chronology that explained the occurrence of discrete later Paleolithic components at select elevations above the lake basin. A generalized topo-stratigraphic construct suggests that the key feature in the contemporary erosional landscape is a remnant tufa preserved opposite the wadi (to the east) and at the precise elevation of the Ahmarian occupational "bench" of the rockshelter. Preliminary indications are that this tufa correlates with an altimetrically equivalent tufa outcrop 2 km upstream, at Ahmarian site WHS 618. Both outcrops represent a band of former spring deposits, paralleling the ancient lakeshore. These signalled the end of lacustrine conditions and the onset of paludal environments in the central Wadi Ḥasa between 23-20 kyr BP (Schuldenrein and Clark, in press). A sample of the tufa was taken for a Th/U radiometric determination. Additionally, bracketing sediments were sampled to determine the mineral signature of the spring waters. Preliminary indications from the diagenetic composition of the sediments suggest that they were sulphur, manganese, and iron enriched, implicating fresh water discharge and the creation of marsh environments.

Above the Ahmarian levels, progressively younger occupations occurred at increasingly higher surface elevations of the rockshelter. Inspections of the slope morphology and blockfall configurations along the talus and ledges demonstrate that the most extensive surface along the rockshelter face was the strath bench sustaining the Ahmarian occupation. Upper sediments, those preserving Epipaleolithic (Madamaghan, Natufian) assemblages, represented limited colluvial episodes that mobilized only finer fractions of spall and angular rubble. The principal entrainment matrices were silts and sands washed down during episodes of slope sediment mobilization. Effectively, the effects of a series of minor slope collapses were exacerbated by more protracted periods of hillslope erosion. Sediment displacements were probably initiated as the steeper slope faces were destabilized.

Inspections of the individual excavation units disclosed complex microstratigra-

phies. The most intricate stratification was preserved in Unit C, where a series of slope collapses interdigitated with slope wash and weakly structured (i.e., discontinuously cemented and calcified) cave breccias and travertines. The most striking feature of Unit C was the presence of extensive iron and sulphur streaks throughout the laminar sediment facies. The sediment geochemistry and water-laid bedding are indicators of water discharge through the bedrock and raised water tables at the time the lake existed. They may also signify the persistence of at least cyclical flows during later Pleniglacial times. Soil-sediment samples were taken from all micro-strata to document the changes in deposition and weathering penecontemporaneous with the occupations.

Lake Edge Marls and Fluvio-limnics

Investigations of the lake edge marls began with a comprehensive survey of landform systems along the principal tributaries to the trunk (Ḥasa) drainage. A series of 15 diagnostic landform and/or stratigraphic sequences were examined to assess landscape variability along a downstream gradient. The key tributary examined was Wadi Abu Karaf. Mapping of exposures disclosed a series of graded terraces whose gradients diverge significantly from channel floor slopes. Accordingly, terrace elevations range from +7 to +30 m; near the confluence of the Wadi al-Ḥasa tributary terrace, complexes are variously eroded and slope worn, suggesting either a series of erosional surfaces produced by cut and fill cycles, or protracted slope wearing associated with the currently incisional topography. These relationships remain to be resolved in subsequent analysis. It is apparent, however, that tributary alluvial sequences mirror the larger scale climatic and sedimentary cycles of the Ḥasa lake basin. Typically, the tributary fills are comprised of poorly sorted alluvial silts and clays that appear to be related to base level fluctuations in the Hasa. At the mouths of three tributary junctures with the Ḥasa, complex "hanging fan" and fluvial terrace configurations indicate the emergence of paludal environments at the margins of the highest marl accumulations.

Steep marl escarpments were identified within the primary Ḥasa drainage. The sediment suite begins with a "pure" gray to olivine, detrital marl facies, generally to a basal depth of 15 m. It is capped by a series of pinker fluvio-limnic silts and clays. The latter are invariably associated with the tributary terraces and "hanging fans". It is possible that the fluvio-limnics register the lake edge micro-environments contemporaneous with Epipaleolithic (Kebaran) occupations already documented for the eastern Ḥasa at WHS 1065 (Clark *et al.* 1987; Schuldenrein and Clark, in press).

The age of the gray marls and overlying pink fluvio-limnics was a key focus of the present study, since the exposures identified in this portion of the drainage preserved the center of the former lake basin. Accordingly, a series of ten radiocarbon samples was taken from organic sediment matrices from both facies. Additionally, a well-preserved tufa bench, laterally continuous with the upper "gray marl" facies, was sampled for a Th/U determination. It may correlate events in the well-preserved central basin with dated events upstream and downstream, thereby bridging the history of lake basin development for all segments of the drainage.

The Ḥasa Terrace

One of the primary gaps in the history of the Ḥasa basin centers on the final period of Pleistocene erosion, the initiation of the "Neolithic wet phase" (after ca. 10 kyr BP), and the establishment of the contemporary hydrography. The 4-6 m Ḥasa Terrace defines the present alluvial terrace plain (T-1) surface; its uppermost horizons have been dated to approximately 1 kyr BP (Schuldenrein and Clark, in press). A major lacuna in the sequence is the base of the deposition,

marking the onset of terrace aggradation.

To resolve this stratigraphic gap, the geoarchaeological team investigated the base of the T-1 in the vicinity of the reference profile that was sampled sedimentologically and radiometrically in 1984. Within 150 m of the original profile a series of laminar sediments preserved an organic silt that produced sufficient humic material for a sample at a depth of 3.6 m below the top of the T-1. It should now be possible to calibrate sedimentation rates for Holocene alluviation and to identify the events marking the Pleistocene-Holocene transition for this critical portion of the Ḥasa sequence.

Conclusions

The 1993 field work will be followed up by a battery of sedimentological, geochemical, and radiometric tests integrating the late Quaternary histories of the Ḥasa lake basin, alluvial plain, and tributary sequences. Systematic sampling of key rockshelter micro-stratigraphic units will link the WHS 784 occupations with the environmental context of lake basin developments. Additionally, it will furnish guidelines for subsequent research on site formation process. These tasks will be addressed during the upcoming analytical studies.

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References

Bienkowski, P.
1991 Jordan: Crossroads of the Near East. Pp. 1-30 in P. Bienkowski, (ed.), *The Art of Jordan*. Merseyside: National Museums and Galleries.

Clark, G. A.
1984 The Negev Model for Paleoclimatic Change and Human Adaptation in the Levant and Its Relevance for the Paleolithic of the Wadi el Hasa (West-Central Jordan). *ADAJ* 28: 225-248.
1992 Wadi al-Ḥasa Palaeolithic Settlement Patterns: Negeb and South Jordan models compared. Pp. 89-98 in *Studies in the History and Archaeology of Jordan, IV.* Amman: Department of Antiquities.

Clark, G. A., Lindly, J. H., Donaldson, M., Garrard, A., Coinman, N., Schuldenrein, J., Fish, S. and Olszewski, D.
1987 Paleolithic Archaeology in the Southern Levant: A Preliminary Report of the Excavations at Middle, Upper and Epipaleolithic Sites in Wadi el-Hasa, West-Central Jordan. *ADAJ* 31: 19-78.
1988 Excavations at Middle, Upper and Epipaleolithic sites in the Wadi Hasa, West-Central Jordan. Pp. 209-285 in A. Garrard and H.-G. Gebel (eds.) *Prehistory of Jordan: The State of Research in 1986.* oxford: BAR. International Series 396.

Clark, G. A., Neeley, M. P., MacDonald, B., Schuldenrein, J. and 'Amr, K.
1992 Wadi al-Ḥasa Paleolithic Project – 1992: Preliminary Report. *ADAJ* 36: 13-23.

Coinman, N. R.
1990 *Refiguring the Levantine Upper Paleolithic: A Comparative Examination of Lithic Assemblages from the Southern Levant.* Ph.D. Dissertation, Arizona State University. Ann Arbor: University Microfilms.
In press Ain el-Buhira (WHS 618): An Upper Paleolithic Site in the Wadi Hasa, West-Central Jordan. *Paléorient* 19(2).

Garrod, D. A. E.
1932 A New Mesolithic Industry: The Natufian of Palestine. *Journal of the Royal Anthropological Society* 62: 257-269.

Henry, D. O.
1986 The Prehistory and Paleoenvironments of Jordan: An Overview. *Paléorient* 12: 5-26.
1989 *From Foraging to Agriculture.* Philadelphia: University of Pennsylvania Press.

Kirkbride, D.
1958 A Kebaran Rockshelter in the Wadi Madamagh, Near Petra, Jordan. *Man* 63: 55-58.

MacDonald, B. (ed.)
1988 *The Wadi el-Hasa Archaeological Survey, 1979-1983, West-Central Jordan.* Waterloo, Ontario: Wilfrid Laurier University Press.

Moore, A. and Hillman, II.G.
1992 The Pleistocene to Holocene Transition and Human Economy in Southwest Asia: The Impact of the Younger Dryas. *American Antiquity* 57(3): 482-494.

Neeley, M., and G. A. Clark
In press Measuring Long-Term Change in the Human Food Niche: A Levantine Example. In *Studies in the History and Archaeology of Jordan,V.* Amman: Department of Antiquities.

Olszewski, D.*et al.*
1990 WHS 784X (Yutil al-Hasa): A Late Ahmarian Site in the Wadi Hasa, West-Central Jordan. *Proceedings of the Prehistoric Society* 56: 33-49.

Schuldenrein, J. and Clark, G. A.
In press Landscape and Prehistoric Chronology of West-Central Jordan. *Geoarchaeology* 9 (1).