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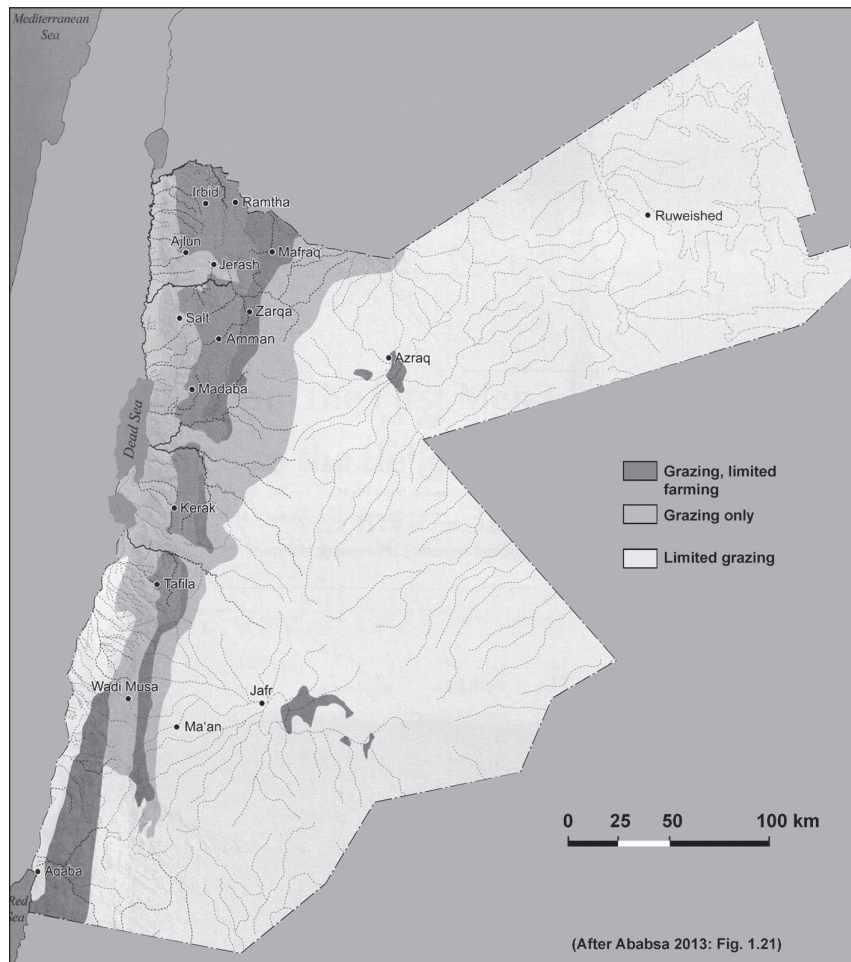
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Walk on the Wild Side: Prehistoric Archaeology in the Deserts of Jordan

Introduction

There is little doubt that when the phrase “Archaeology in Jordan” is uttered, the first thing to enter the mind is Petra; following behind this marvelous site would be (in no particular order) Umm Qays /Gadara, Jarash, Pella, Hisbān, numerous tell sites in the Jordan Valley or in the Jordanian highlands, and the several Crusader fortresses. One of the common factors of all these sites is their geographic location: the western part of the kingdom where farming is possible through adequate rainfall or irrigation. Jordan’s climate, topography, and hydrology have always been strong factors in how people were distributed throughout the kingdom. For the last 4,000 years or more, 90% of the country’s population has been confined to only 15% of the territorial boundaries since 85% of the landscape is not suitable for dry farming or irrigation agriculture (Ababsa 2013: 64-65, 2013: Fig. I.21). Local population sizes and densities are highest where agricultural production is highest and where surplus food production can provide the foundation for labor specialization outside of the agricultural sphere (FIG. 1). Where farming is not dependable,

population can’t be concentrated for long periods of time under the climatic conditions of the last four millennia, and as a consequence, herding groups that convert steppe and desert vegetation to caprine meat, dairy, and wool/hair are small and mobile, leaving little trace of their presence. Under these conditions, the estimate of 15% for the steppe/desert dwellers might be exaggeratedly high, at least from time to time. The regions of Jordan that are not agriculturally dependable are called the *bādiyah*, and this territory is mostly comprised of a semiarid to hyperarid limestone plateau (the *ḥammād*), but in the northeastern part of Jordan the *bādiyah* is covered with basalt fields, called the *ḥarra*. The *bādiyah* has always played an important role in Jordan’s past, which stretches back at least a million years. Stone Age hunter-gatherers moved along north-south and east-west transects following wild animals on their migrations. As early as 15,000 BC there is evidence of connections in the eastern *bādiyah* with both the Mediterranean and Red Seas in the form of marine shells that were used for adornment. Obsidian from eastern Anatolia shows up early in the Neolithic period, and flint tools from southern



1. Land-use patterns in Jordan (after Ababsa 2013: Fig. 1).

Jordan are thought to have been exported to Egypt at least 5,000 years ago if not even earlier. During the proto-historic periods there were important trade routes among Bronze and Iron Age towns and cities that crossed the *bādiyah* to Mesopotamia and to the Nile Valley. In order to understand the emergence of complex societies in the agricultural part (the 15%) of Jordan, one must examine the other 85% of the territory that supported and connected the settled areas of the Levant. But this requires that archaeological projects spend considerable time and effort in exploring landscapes that are isolated, often entirely barren, and in conditions where water and electricity are in short supply; in some circumstances, projects are limited to the summer months, when temperatures exceed 40°. Tent camps are frequently the only living accommodations, and contact with the “outside world” is

limited and infrequent. Life for archaeologists in the *bādiyah* is usually not under the comfortable and pleasant conditions that a project in an urban area might afford. Instead, life in the *bādiyah* is often to experience the wild side of archaeology. What follows is a brief survey of prehistoric archaeological research in Jordan’s *bādiyah*.

The Wild Side

It is tempting to equate the intensity of archaeological research in Jordan with the intensity of agricultural production – that is, that 85% of the archaeology of Jordan has focused on the 15% of the land that supports farming, and that archaeology in the *bādiyah* accounts for only 15% of the time, labor, and funds expended in the entire country. That characterization may have been true for the 19th and first

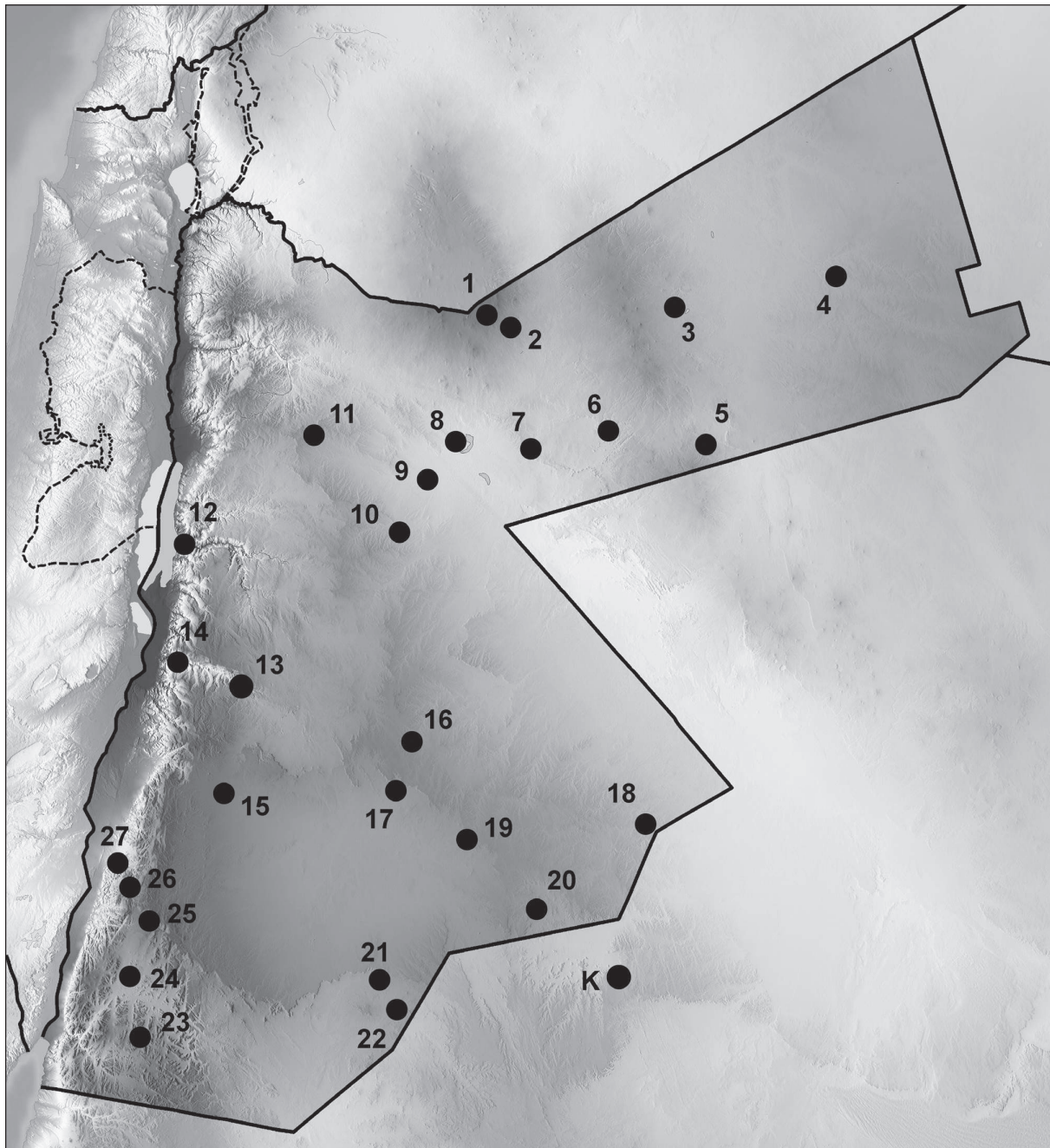
two-thirds of the 20th centuries, but since the 1970s that ratio has probably changed considerably. The earliest prehistoric research in Jordan is probably the survey undertaken by Henry Field in 1925 (Field 1960), when he drove the length of the panhandle of Jordan to Baghdad. His survey was not systematic, however: Field selectively stopped when something looked intriguing, or when a tire had to be changed, the car radiator had to be cooled, or a gazelle shot for the evening meal. Another early project involved the excavation of early Neolithic settlements in the Wādī Jilāt (FIG. 2:10) in 1938 by Waechter and Seton-Williams (1938)¹. At about the same time a survey and excavation of sites in the Kilwa area (“K” in the lower right corner of (FIG. 2), which until 1964 was still located within the borders of the kingdom²) was undertaken (Rhotert 1938). In the 1940s a brief survey at Chalcolithic/Early Bronze Age Qulbān Banī Murra (FIG. 2:20) was reported by A. Kirkbride and G.L. Harding (1944) and Stekelis (1945). It was in the late 1950s that a prolonged program of excavations was begun at early Neolithic Bayḍa (FIG. 2:26), just a few kilometers north of Petra (Kirkbride 1966; 1984). There was a sea change in prehistoric archaeology in the 1970s, and much of the increased intensity took place in the *bādiyah*. Henry undertook a multi-season survey and excavation project in the Wādī Ḥismā (FIGS. 2:24; 3a) that spanned the Paleolithic (especially the Middle to Epipaleolithic), Neolithic, and Chalcolithic periods (Henry 1995). Rollefson made artifact collections at the northern rim of the Jafr Basin (Rollefson 1980), a region (FIGS. 2:17, 4) that would become a full-blown, multi-season investigation by L. Quintero and P. Wilke in the 1990s and later (Quintero and Wilke 2014; Quintero *et al.* 2002) that covered a time period from the Middle Acheulian (*ca.* 700,000 years ago) through the Chalcolithic/Early Bronze Age. Other projects that arose in the 1970s included

the survey and excavations by S. Helms at the walled Early Bronze Age town at Jāwā (FIG. 2:1) (Helms 1981). A. Garrard began a long-term project in the greater al-Azraq Basin (FIG. 2:8) in the Wādī Jilāt and al-Azraq town area (Garrard and Stanley Price 1975; Garrard and Byrd 2013). Betts also began a twenty-year program of survey and excavations in the Black Desert from al-Azraq to Burqu’ (FIG. 2:3) that principally dealt with Neolithic camps (Betts 1998, 2013). The results of the work by Garrard and Betts determined that the earliest pastoral exploitation of the *bādiyah* began in the Late Neolithic around 6,500 BC. The 1980s witnessed a continuation of intensifying interest in the prehistory of the *bādiyah*. L. Copeland and F. Hours led a team that expanded the investigation of Garrard’s survey to the west and north of al-Azraq (Copeland and Hours 1989; *cf.* Rollefson 1983), greatly increasing the known distribution of Lower Paleolithic sites in addition to later periods of prehistory. B. MacDonald carried out a survey of the south bank of the Wādī al-Ḥasā (FIG. 2:13) from 1979-1983 (MacDonald 1988) that spawned numerous follow-up excavation projects (*e.g.* Clark *et al.* 1987; Coinman 1998) that continued into the current decade (Olszewski and al-Nahar 2011a, 2014). On the north bank of Wādī al-Ḥasā, Makarewicz has excavated at al-Ḥimmah, a Neolithic site that spans the PPNA through the PPNC and into the Pottery Neolithic (*cf.* Makarewicz and Austin 2006). In recent years a 10th millennium PPNA “mortuary house” with numerous sub-floor burial pits has been exposed at al-Ḥimmah (Makarewicz and Rose 2011).

In the lower Wādī al-Ḥasā, not far from its mouth above aṣ-Ṣāfi (FIG. 2:14), a MPPNB hamlet about a half hectare in area was investigated at Ḥamarāsh (Sampson 2011, 2014); the area is of very difficult access, which might explain its small size. Some distance away is the PPNA site of Sharāra, where excavations have

1. There appears to have been some geographic confusion at the time: the authors placed the site in the Wādī Dhubay).

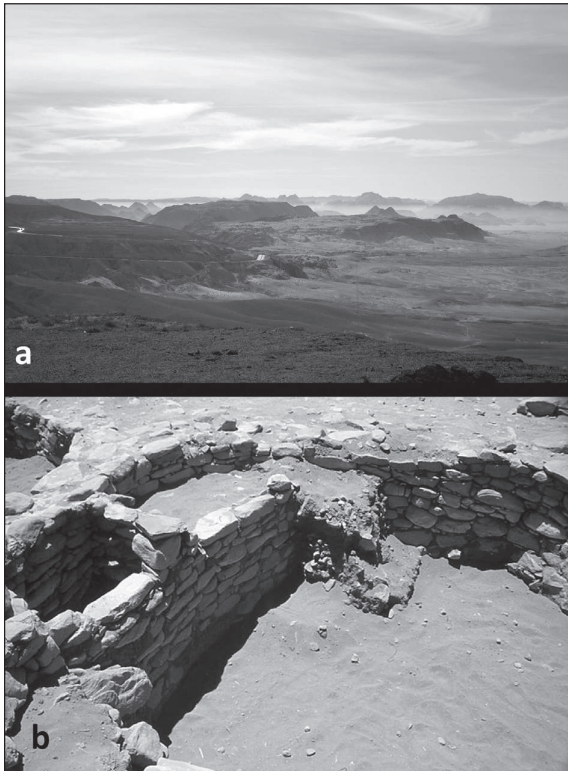
2. There was a land swap between Saudi Arabia and Jordan, when Jordan increased the amount of sea front at ‘Aqaba in exchange for the Wādī Tbayq region, where Kilwa was located



2. Location of steppe-desert sites areas in Jordan. 1. Jāwā; 2. ash-Shubayka; 3. Burqu', Tulūl al-Ghuṣayn, Khirbat Abū al-Ḥuṣayn; 4. Wādī ar-Ruwayshid flint mines; 5. Wisād Pools; 6. Wādī al-Qattāfi; 7. Jabal Qurma; 8. al-Azraq; 9. al-Kharrānah IV; 10. Wādī Jīlāt; 11. Wādī Mushāsh; 12. Dhirā', Dhahrat adh-Dhirā' 2; 13. Upper Wādī al-Ḥasā sites; 14. Hamarāsh, Sharara; 15. Jabal Juhayra; 16. Bāyir; 17. 'Uyūn Qadīm, northern Jafr sites; 18. Wādī Ḥudruj; 19. Jabal al-Khashabiyyah; 20. Qulbān Banī Murra, Wadis as-Sahāb and al-Asmar; 21. ath-Thalīthuwāt; 22. al-'Awja; 23. 'Ayn Abū Nukhayla, Ṭurayf al-Marāgh; 24. Wādī Ḥismā sites; 25. 'Ayn Jammām; 26. Baydā, Ba'jah, Shukarat al-Masa'id; 27. Wādī Faynān, Fīdān, Ghuwayr, Tall Wādī Faynān; K: Kilwah.

just recently been initiated (Finlayson and Makarewicz, personal communication). A survey project in the *ḥammād* southwest of al-Azraq by M. Muheisen located a wealth of prehistoric

camp in the steppe and led to an excavation of the relatively enormous Epipaleolithic site of al-Kharrānah IV (FIG. 2:9; Muheisen 1983, 1988). Excavations have recently been resumed



3. a. The Wādī Ḥismā viewed from Rās an-Naqab. b. One of the Middle PPNB dwellings at ‘Ayn Abū Nukhayla in Wādī Ramm (Photos by G. Rollefson).

at al-Kharrānah IV (Maher *et al.* 2012) and are revealing unexpected social complexity 20,000 years ago. In the 1990s and mid 2000s three new factors greatly improved prehistoric research in Jordan’s desert. In 1993 NASA finished the establishment of 24 stationary satellites to provide a Global Positioning System (GPS) that fixed the location of sites on the earth’s surface (NASA 2012). While the use of GPS probably wasn’t used by research teams until the late 1990s in Jordan, the devices vastly improved the mapping of survey data that, especially in topographically redundant areas, eliminated errors in plotting sites on maps, “preserving” the location for later follow-up research. Also in the 1990s, David Kennedy began his decades-long aerial photography project throughout the kingdom, the archives of which were made available to all researchers (APAAME *n.d.*). Kennedy and his team were especially important for recording features in difficult terrain, especially in the Black Desert (FIG. 5; *cf.* Kennedy and



4. a. Cortical flake cores of the Jafr Industry along the northern rim of the Jafr Basin. b. a large Lower Paleolithic bifacial cleaver from site J92 in the Jafr Basin (Photos by G. Rollefson).

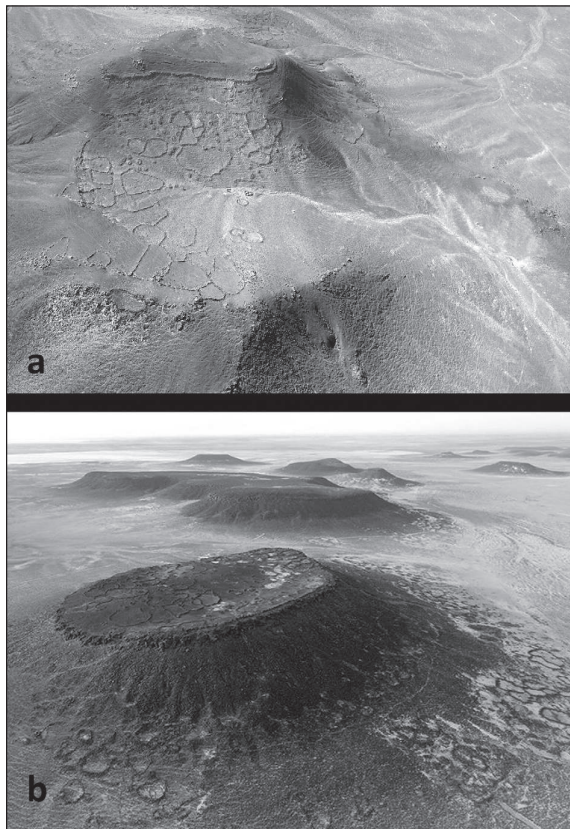


5. aṣ-Ṣafāwī Kite 104 near aṣ-Ṣafāwī, northeastern Jordan. (Photo: APAAME_20090928_DLK-57 by D. Kennedy; by permission).

Banks 2015; Kennedy *et al.* 2014), where earlier photography by Royal Air Force pilots first recorded the “Works of the Old Men” in the

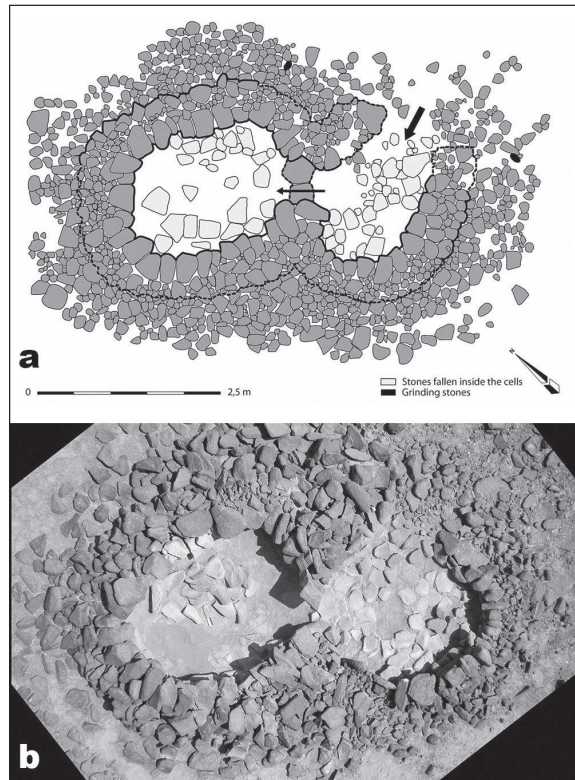
basalt fields that were virtually indistinguishable when looked at from the ground (Maitland 1927; Rees 1929). Finally, Google Earth emerged in 2005 (Anon. *n.d.*), providing satellite coverage of the entire planet that, again, was especially useful for regions such as deserts that were difficult to travel through.

All three of these “new” research tools have been especially vital for research in the volcanic fields of the Black Desert in Jordan’s panhandle. Recent survey in this region by Müller-Neuhof (FIG. 2:1, 2:3 and 2:4) has altered our fundamental understanding of the Early Bronze Age in the northern basalt country. A major flint-mining industry in the Wādī ar-Ruwayshid (Müller-Neuhof 2012) has been located that rivals the Jafr Basin region (Quintero *et al.* 2002). His resumption of Helms’s research at Jāwā (FIG. 2:1) has greatly improved our



6. a. Walled garden plots in the caldera of the volcano of Tulūl al-Ghuṣayn. (Photo by B. Müller-Neuhof, by permission). b. Walled garden plots atop the summit of Mesa 4 (“Maitland’s Mesa”) in the Wādī al-Qaṭṭāfi (Photo by A.C. Hill).

understanding of the agricultural base of that settlement (Müller-Neuhof 2017), and excavations at Tulūl al-Ghuṣayn, Khirbat Abū al-Ḥuṣayn, and Khirbat al-Ja‘bariyyah (between FIG. 2:3 and 2:5) have confirmed three more agriculturally-based permanent or semipermanent fortified settlements of the Early Bronze Age as well (Müller-Neuhof 2014; Müller-Neuhof and Abu-Azizeh 2016; Müller-Neuhof *et al.* 2013). The configurations of the garden plots atop the three basalt prominences as well as domestic architecture are identical to the summit of Mesa 4 (“Maitland’s Mesa”) in the Wādī al-Qaṭṭāfi (FIGS. 2:6; 6 and 7), indicating that although Mesa 4 was not fortified, it too supported an agricultural system for a permanent or semipermanent population. Since 2008 the Eastern Badia Archaeological Project has been investigating Late Prehistoric sites in the Wādī al-Qaṭṭāfi (FIG. 2:6) on the southwestern edge of the Black Desert (*e.g.* Rollefson *et al.*



7. a. “Ghawr al-Ḥūt” from the summit of Tulūl al-Ghuṣayn (Illustration by B. Müller-Neuhof, by permission). b. “Ghawr al-Ḥūt” a top Mesa 4 in the Wādī al-Qaṭṭāfi (Photo by Y. Rowan).

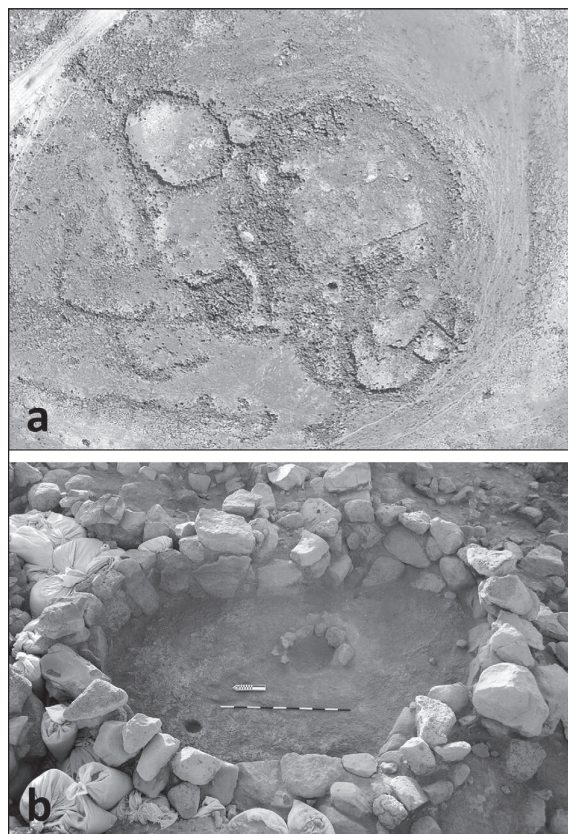
2016) and at Wisād Pools (FIG. 2:5), 60km farther east on the opposite edge of the basalt desert (e.g. Rowan *et al.* 2015).

Hundreds of structures are located in both site areas, and thus far five structures have been excavated, all dating to the Late Neolithic period (ca. 6,500-5,000 BC). The density of occupation is surprising (Rollefson *et al.* 2014b) considering the hyper-aridity of the desert in these two areas, but recent analysis of charcoal and pollen has revealed that the region enjoyed much higher rainfall during the Late Prehistoric period; identified species such as bulrush/cattails and duckweed indicate marshy conditions at Wisād Pools, and Tabor oak charcoal and pollen reflect higher precipitation, as do charred fig remains from Mesa 7 in the Wādī al-Qaṭṭāfi (Rollefson *et al. n.d.*). Adjacent to the west of the Wādī al-Qaṭṭāfi is the research area of the “Landscapes of Survival” project (FIG. 2:7, Akkermans *et al.* 2014).

Surveys and excavations anchored in the area around Jabal Qurma have revealed large Late Prehistoric semipermanent settlements as well as extensive and intensive distributions of rock art and contemporary Safaitic inscriptions, similar in many respects to the information from the Eastern Badia Archaeological Project. The Eastern Badia Archaeological Project is a successor to the Wādī as-Sarḥān Project begun in 2002 in the Black Desert (Wasse and Rollefson 2005, 2006). The survey recovered evidence of relatively intensive use of the hyperarid desert as early as the Lower Paleolithic. Small hunting camps dating to the Middle and Late PPNB were numerous around Qā‘ 001 at Jabal adh-Dhurwa, and small clusters of seasonal hunter-herding groups from the Late Neolithic also appeared on the landscape. Small-scale cortical flake/fan scraper production during the Chalco/Early Bronze periods was undertaken by small pastoral groups throughout the area. The Shubayqa Archaeological Project has investigated the area around Qā‘ ash-Shubayka, 22km north of aṣ-Ṣafāwī, since 2012 (FIG. 2:2). The Qā‘

has a large number of structures around its edge ranging in age from the Late Epipaleolithic (Natufian) to the Pre-Pottery Neolithic A (PPNA) and into the Chalco/Early Bronze Age periods. The project is unique in that it appears to reflect the transition from the final hunter-gatherer to the first agricultural subsistence economies in today’s arid desert (Richter *et al.* 2014, 2016, *n.d.*). The well preserved animal bones include many migrating birds, indicating at least seasonally marshy conditions, and charcoal from riparian tree species confirm moister conditions in the region after the Younger Dryas period (FIG. 8).

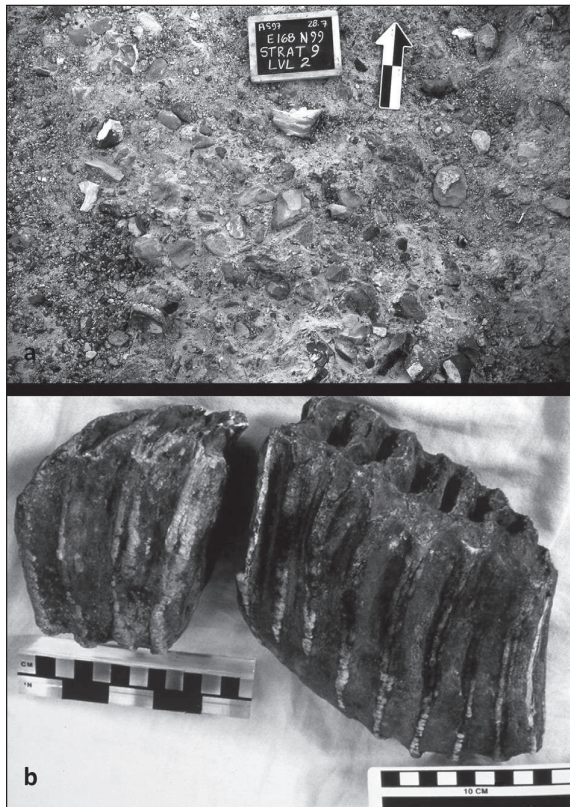
Farther to the west near Qaṣr al-Mushāsh, one of the celebrated “Desert Castles”, is a newly discovered permanent PPNA settlement called Mushāsh 163 (FIG. 2:11), although the current weather pattern would make it unlikely that farming could be relied on today (Bartl *et al.*



8. a. Chalco/Early Bronze compound at the ash-Shubayka Qā‘. b. Pre-Pottery Neolithic A house with interior fireplace at Shubayka 6. (Photos by T. Richter, by permission).

2013; Tvetmarken *et al.* 2015). Prior to the work undertaken at ash-Shubayka and al-Mushāsh, no PPNA sites were known in these presently arid areas of the kingdom. Investigations in the al-Azraq Oasis (FIG. 2:8) continued in the 1990s and into 2015. Lower and Middle Paleolithic excavations were undertaken in North Azraq (“Azraq ad-Durūz”) (*e.g.* Cordova *et al.* 2009) and in South Azraq (*cf.* Rollefson *et al.* 1997). Remains of an extinct elephant species (FIG. 9) in addition to rhinoceros, wild cattle, an equid, and possibly lion were recovered, verified as food resources for the hominins by protein residue on the stone tools that were recovered (Nowell *et al.* 2016). A Pre-Pottery Neolithic B hunting camp that relied heavily on migrating birds was excavated at Bawwābit al-Ghazāl in the southern Azraq wetlands (Rollefson *et al.* 2014a). Three seasons of survey and excavations from 2004 to 2009 in the region east

of Bāyir Wells (FIG. 2:16) recorded numerous pastoral camps, cairns, and animal enclosures that dated to the Late Neolithic and Chalcolithic periods, mostly along wadis and especially at the edges of *qī‘ān* (Tarawneh and Abudanah 2011). Similar results were obtained by a multi-season effort in the ath-Thalīthuwāt area (FIGS. 2:21 and 10b) farther south (Abu-Azizeh 2010). It was logical that the project directors team up in continued research as the Southern Badiya Archaeological Project, which located and excavated the first kite hunting trap outside of the basalt desert at Jabal al-Khashshābiyyah; excavation revealed how the trap was constructed and used during the Late Neolithic period (Abu-Azizeh and Tarawneh 2015; Abu-Azizeh *et al. n.d.*), and this will enormously aid in the interpretation of kites, which are much more prevalent in the *ḥarra*. Intensive excavation and survey at Qulbān Banī Murra and in

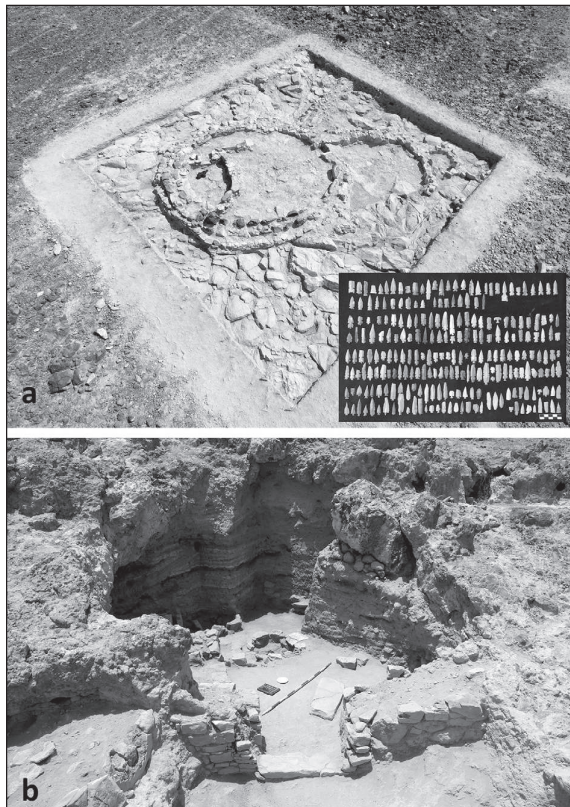


9. a. Dense scatter of *in situ* Late Acheulian bifaces and other stone tools at ‘Ayn Sawāda (Photo by G. Rollefson). b. Molars of an extinct elephant from Lower Paleolithic layers at ‘Ayn Sawāda.



10. a. One of the long rows of tombs at Qulbān Banī Murra (photo by H.G.K. Gebel, with permission). b. The escarpment above ath-Thalīthuwāt (photo: G. Rollefson).

the Wādī as-Sahāb and Wādī al-Asmar (FIGS. 2:20 and 10a) greatly increased our appreciation of Chalco/Early Bronze Age pastoral societies (e.g. Gebel and Mahasneh 2010; Gebel *et al.* 2011) when hydraulic systems of access to subterranean water sources became developed and led to hypotheses of the importance of oasis locations in pastoral life (Gebel 2015). Fujii's prehistoric field research in Jordan has concentrated in the southern and southeastern parts of the kingdom. His work at the northwestern edge of the Jafr Basin at Qā' Abū Ṭalayḥa (FIG. 2:17) demonstrated the presence of sophisticated water control in the LPPNB (second half of the 8th millennium BC; Fujii 2014). Closer to Jurf ad-Darāwīsh, excavations have exposed a well-documented site complex (FIG. 11) with cultural stratification from the Early PPNB (EPPNB) through the Late Neolithic (*cf.* Fujii 2015, Personal Communication). In the

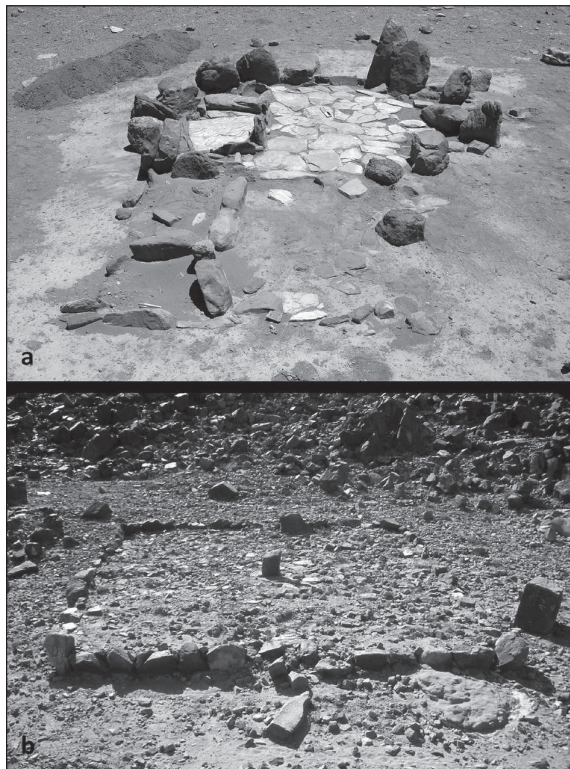


11. a. Early PPNB house and projectile points from Jabal al-Juhayra (photo by S. Fujii, with permission).
b. Late PPNB structure in a rockshelter at Jabal al-Juhayra (photo by S. Fujii, with permission).

far southeastern part of Jordan (FIG. 2:22) at the site of 'Awja-1, Fujii has exposed a series of animal figurines – possibly cheetahs – near open-air sanctuaries (FIG. 12) that he thinks might date to the Late Neolithic in the 6th millennium BC (Fujii *et al.* 2013: 355). Archaeological attention was focused on Wādī Ramm (FIG. 2:23) at least 70 years ago (Kirkbride and Harding 1947), but renewed interest was resumed in the later years of the 1990s (Farès 2013; Farès-Drappeau and Zayadine 2004) that focused on Late Neolithic structures and subsequent periods of occupation. Henry turned to 'Ayn Abū Nukhayla (Henry and Beaver 2014) about four decades after Diana Kirkbride tested the MPPNB settlement (Kirkbride 1960) to note that the site was recurrently occupied by opportunistic farmers and herders. Enigmatic structures of unknown function and date (FIG. 13) were examined at Ṭurayf al-Marāgh across the *wadi* from 'Ayn Abū Nukhayla by Rollefson in 2007-2008 (Rollefson 2013). A Cultural Resource Management team surveying the route for the renewed Desert Highway discovered a Late PPNB megasite at 'Ayn Jammām (FIG. 2:25), just beneath Rās an-Naqab (Waheeb and Fino 1997). The complex architecture (FIG. 14) recalled the two-story buildings at other megasites of the second half of the 8th millennium in Jordan along with numerous arrowheads that are more reminiscent of the Negev/Naqab Desert region than areas to the north (Rollefson 2005; *cf.* Goring-Morris 1993: fig. 5). The greater Petra area (FIG. 2:26) has witnessed



12. Animal (cheetah?) outlines in stone slabs at the site of 'Awja 1 (photo by S. Fujii, with permission).



13. a. Paved circular structure of possible ritual nature in Wādī Ramm (photo by G. Rollefson). b. One of more than 200 rectangular open-air sanctuaries in Wādī Ramm (photo by G. Rollefson; cf. Farès-Drappeau and Zayadine 2004).

considerable prehistoric research since the 1980s. Surveys in the Wādī Ṣabrah have identified the entire Paleolithic sequence from the Lower Paleolithic through the Epipaleolithic and into the Neolithic periods; later Holocene sites have also been located (Schyle and Richter 2012). New excavations were conducted at the early Epipaleolithic site at Wādī al-Madāmigh (Olszewski and al-Nahar 2011b), a site originally tested by D. Kirkbride (Kirkbride 1958). Work at Baydā was renewed in the present decade to investigate a large circular MPPNB communal building (Finlayson and Makarewicz, personal communication). The curiously isolated (almost “fortified”) LPPNB settlement at Ba‘jah, a few kilometers north of Baydā, was the scene of extensive excavations during the 1990s and into the following decade (e.g. Gebel and Kinzel 2007); a new season of excavations was initiated in 2016 (Gebel, personal



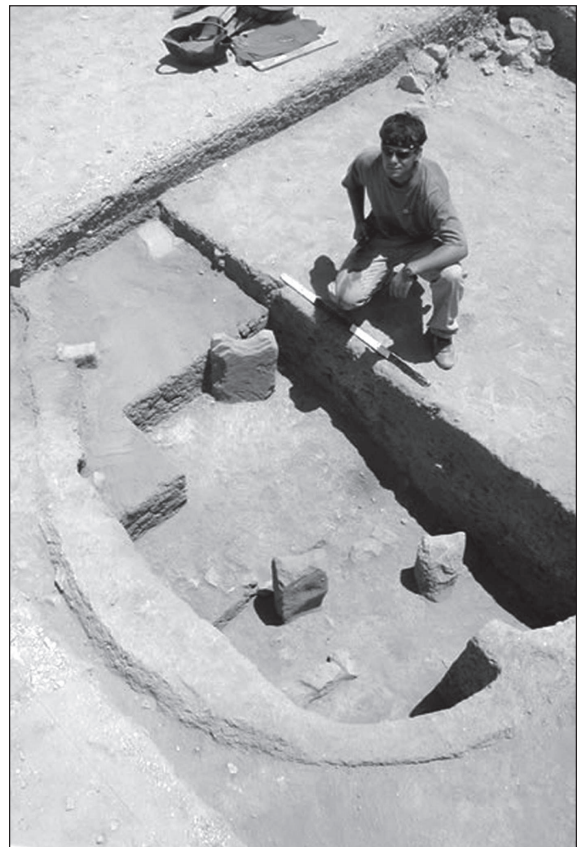
14. a. Niches in the east wall of a room in a two-story residence at ‘Ayn Jammām (photo: G. Rollefson). b. View towards the west in the same building showing a doorway leading to another room (photo: G. Rollefson).

communication). The MPPNB site of Shukarat al-Masa‘īd, about 16km north of Wādī Mūsā, was first excavated in 1999, and work has continued episodically since. The site is a compact village of circular semi-subterranean houses constructed in a honeycomb fashion; Building F is intriguing in view of its obvious ritual nature based on the concentration of human burials there (Kinzel *et al.* 2015). The drainages leading from the ash-Sharāh Mountains westward to the Wādī ‘Arabah are rich in archaeological sites, especially those that date to the Neolithic period. al-Ghuwayr (FIG. 2:27), a small but densely occupied Middle and Late PPNB village, is located at the mouth of the Wādī al-Ghuwayr (Simmons and Najjar 1998). Just a kilometer farther downstream in the Wādī Faynān, WF16 is an important PPNA settlement

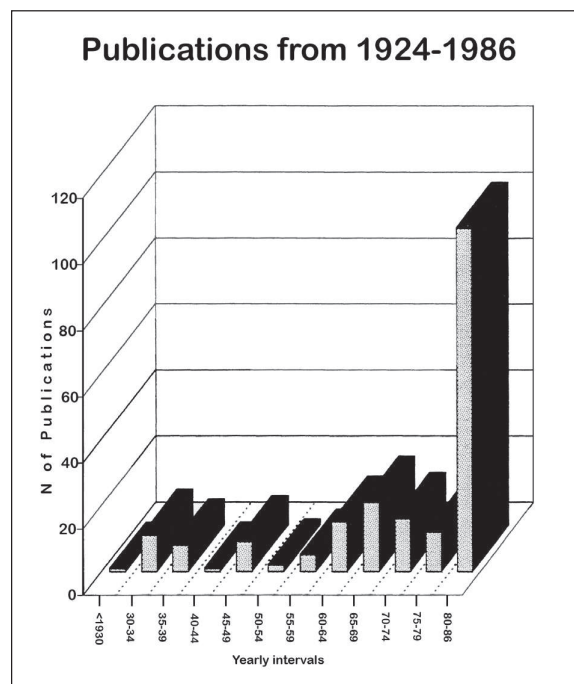
with a huge communal building that certainly was constructed using communal labor under someone's direction (*cf.* Finlayson and Mithen 2007). And a couple of kilometers farther west is a Pottery Neolithic village called Tall Wādī Faynān; whether the pottery from this site is closely allied with the Yarmukian or the Jericho IX traditions (or something else altogether), is not certain (Najjar 1992). Finally, two PPNA sites downstream from the Wādī adh-Dhirā' (just over a kilometer south of the mouth of Wādī al-Karak) excavated at the beginning of the 21st century reflect considerable differences in terms of architecture and stone tools. Dhirā' (*e.g.* Finlayson *et al.* 2003) and Dhahrat adh-Dhirā'-2 (Edwards *et al.* 2002) are separated by only a couple of kilometers and are virtually contemporaneous, yet the buildings at Dhirā' are circular or oval, while those at Dhahrat adh-Dhirā' are "C-shaped" with a wide opening on one side. One semi-subterranean structure at adh-Dhirā' appears to have been a communal storage facility (Kuijt and Finlayson 2009) set on joists supported by notched stone pillars (FIG. 15). Arrowheads at adh-Dhirā' typologically account for around 40% of the formal tool inventory (*cf.* Goodale and Smith 2001: Table 2), whereas at Dhahrat adh-Dhirā' they make up less than 1% (Sayej 2004: Table 3.3); the reasons for such disparities remain conjectural.

Concluding Remarks

(FIG. 16) shows a major increase in publications that treat Jordan's prehistory beginning in the 1980s, an illustration that is already more than 30 years old and obsolete. Although not all prehistoric archaeology was undertaken in arid zones, it is likely that the publication record up to 2017 reflects a major enthusiasm for investigating those parts of the kingdom that today are incapable of sustaining agriculture and consequently of supporting major population concentrations. This supposition has a major implication: Although today only 15% of the territory of Jordan supports 90% of the



15. Subfloor grooved/notched stones that supported joists of the floor of a communal storage building at adh-Dhirā' (photo by G. Rollefson).



16. Growth in publications on Jordanian prehistory from 1924-1986 (after Henry 1998: Fig. 1).

country's population, several thousand years ago that was not the case. Neolithic villages in the Wādī Jīlāt, Wādī Faynān, Wādī Mūsā, and Wādī al-Ḥasā provided support for populations much higher than is the case in those regions today. And even in the *ḥarra* of the eastern *bādiyah* and the *ḥammād* of southeastern Jordan, increased rainfall in various periods of the past provided rich pasturage for herds of caprines or heavily vegetated landscapes that provided the food for herds of wild animals 'harvested' by hunting groups.

The fortified Early Bronze Age settlements such as Jāwā, with the local reliance on gardens of planted food, made inter-regional economic and political transactions with Mesopotamia more reliable and productive. The collapse of various cultural entities during the long prehistoric period had important effects on the evolving social groups that replaced them, altering relationships between humans and the environment and the relationships among different human groups. To a great degree the prehistoric collapses of social organizations were due to the vicissitudes of climatic change and its influences on environmental resources. In many cases during and after the Neolithic period, environmental degradation was exacerbated by cultural demands and practices such as deforestation and pastoral exploitation, but environmental resurrection was expectable when climatic regimes returned to favorable circumstances. This appears to have been the case in the *ḥarra*, for example. Variability in local occupation seems to have had a cyclical nature of recurring drought that may have lasted for a century or more followed by periods of increased precipitation that generated vegetation for resumption of resource exploitation through hunter-herder subsistence economies. But the sinusoidal climatic variability and population decline and increase in the Black Desert, the greater Petra area, and elsewhere in Jordan may have come to a "final" end when persistent increases in the size of caprine herds and their effects on grass cover and soil

conservation coincided with a drastic decrease in rainfall, perhaps around the Early Bronze and Middle Bronze Age transition (Rollefson *et al. n.d.*), from which the region never recovered.

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