The *Badia* from Above
Successes, Limitations, and Potential

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A "kite" (Wisad Kite 24), so-named by the RAF pilots in the 1920s because of the shape and the walls (the "strings" of the kite). With origins in the Neolithic these are likely hunting sites for gazelle and oryx. Many such kites are damaged, often from bulldozing. Photograph: Karen Henderson, APAAME_20091004_KRH-0037, courtesy of APAAME.

The Aerial Archaeology in Jordan project (AAJ) has conducted an annual programme of aerial reconnaissance in Jordan, including the badia *region, since 1997 (Kennedy and Bewley 2004). This project was inspired by and built on the ground-breaking but isolated aerial surveys conducted by Antoine Poidebard and Sir Aurel Stein in the region half a century prior, and the stunning photographs captured by the Royal Air Force that inspired the "'father" of aerial archaeology, O. G. S. Crawford. It took many more years for the significance of these discoveries to become apparent, and even now we are only beginning to understand the depth and breadth of the archaeology of this region (see Kennedy 2011 and Kennedy, Banks, and Houghton 2014). The annual programme of photography has gradually captured a record of a landscape crowded with features from multiple periods. As aerial archaeologists we see and record many more landscapes and sites than we could ever hope to follow up by field visits or excavations. Therefore our work, by its very nature, is collaborative, and anything we record is shared (responsibly) for others to use. This article highlights not only the achievements of aerial reconnaissance in understanding the complex and concentrated archaeology of the* badia*, but also the importance of collaboration with other archaeologists. Moreover, access to information through resources such as the Aerial Photographic Archive for the Archaeology of the Middle East (APAAME) website (www.apaame.org), is imperative in making sure the importance of these landscapes and what is captured through the camera, survey or research, is not lost, overlooked, or forgotten.*

The archaeological importance of the *badia* first came to light through the observations and photographs of RAF pilots in the 1920s who, with the help of O. G. S. Crawford (founder and editor of the journal *Antiquity*), were able to publish their discoveries (Maitland 1927; Rees 1929; see also Crawford 1929). In those early British Mandate years in Transjordan, there was a need to improve communications, especially between Cairo and

Figure 1. Safawi Kite 118, a well-preserved example of a kite, but in an area under increasing threat. Photograph: Robert Bewley, APAAME_20090928_RHB-0461, courtesy of APAAME.

Baghdad. It was in creating the Air Mail Route between these two cities (Hill 1929; Andrews 2000; Kennedy, Banks, and Houghton 2014: 5) that many of the pilots with an interest in archaeology, saw and photographed sites. Some impressions of the *badia* were less than favorable as vividly described by Wing Commander Roderic Hill: "Its barrenness, its utter loneliness seems to embody something sinister" (1928: 401). But as Insall noted (1929: 175): "A little knowledge of the possibilities of archaeology from the air can add interest to those long flights over familiar country when flying becomes monotonous."

Many of the sites popularly photographed by the RAF were of a familiar archaeological form: built structures such as forts or palaces, or archaeological mounds (such as featured in Crawford 1929). But in the *badia* the most common features were those the pilots went on to name "kite-sites" (figs. 1, 2) and "hillforts" based on their knowledge of such stone-built structures in Britain, as well as "walls," "enclosures," and "circles" (fig. 3; Hill 1929: 10–11; Insall 1929; Maitland 1927; Rees 1929; see also Field 1929: 39–40). At least one pilot, Rees, enthusiastically followed up his observations on the ground and aided archaeologists Henry Field and O. G. S. Crawford during their visits to the Middle East (Kennedy 2012a: 483).

Much of the early aerial photography in the *badia* has survived in several collections, but two primarily. Crawford toured the Middle East in 1928 collecting existing aerial photographs taken by the RAF for the purpose of establishing a national reference collection of archaeological sites at The British Museum (Crawford 1929; now archived at the UCL Institute of Archaeology Special Collections). Here, for example, the mosaic "Walls and Fort in Basalt Country" (a kite) first published by Maitland (1927: pl. iii) can be found as AP1022-1025, and "'Tell A', Nearanding-ground E" (*sic*) first published by Rees (1929: pl. ix) can be found as AP1032-1034, 1040-1041. The full collection is in the process of digitization in cooperation with UCL Institute of Archaeology Special Collections, and the itemized geo-located digital images will be made available for previewing through the APAAME website in the near future.

"Flying over the *badia* there is rarely a moment to catch one's breath, as the concentration of sites is so dense in so many areas. To a prehistorian, this is an archaeological paradise not just because of the number or density of the sites but also because of their variety."

Sir Aurel Stein used the aerial photography expertise of the RAF in 1938 (Iraq) and 1939 (Iraq and Transjordan) in order to survey the British Mandate territories for traces of the Roman *Limes* (Gregory and Kennedy 1985). He followed the example of Antoine Poidebard (1934) in the French Syrian Mandate. Heavily biased towards finding traces of the Roman frontier, such as the forts of Qasr Burqu (ASA/3/418–423), Aseikhim (ASA/3/465-468), Uweinid (ASA/3/470–472, 480–487), and Azraq (ASA/3/459-460, 463), he nevertheless recorded

Figure 2. Sibhi Kite 29, first photographed and published by an RAF pilot (Insall 1929). The bull-dozed track through the head of the kite is sadly a common form of damage to sites in the *badia*. The track across the tail in the right background of the image is present in the RAF image and probably associated with the creation of the airmail route. Photograph: Andrea Zerbini, APAAME_20160925_AZ-0274, courtesy of APAAME.

snapshots of several other sites including a pendant or tailed cairn burial (ASA/3/424-425), landscape near the Wadi el-Abd (ASA/3/426-427), and structures near Safawi (ASA/3/428-429) and Jawa (ASA/3/439-440). Moreover, his notes and manuscript give early reference to other sites in the *badia*, visited on foot, such as enclosures in the "Rijm Khalib" area (Gregory and Kennedy 1985: 247–48), a cluster of Safaitic inscriptions (Gregory and Kennedy 1985: 248–49), wells near Tell Ghusein (probably Biyar el Ghusein; Gregory and Kennedy 1985: 249), and a visit to Jibal umm Kusheisha (Gregory and Kennedy 1985: 278–79). Stein's collection from his *Limes* survey is held primarily between four institutions: The Bodleian Library, The British Academy, The British Library, and the aforementioned collection

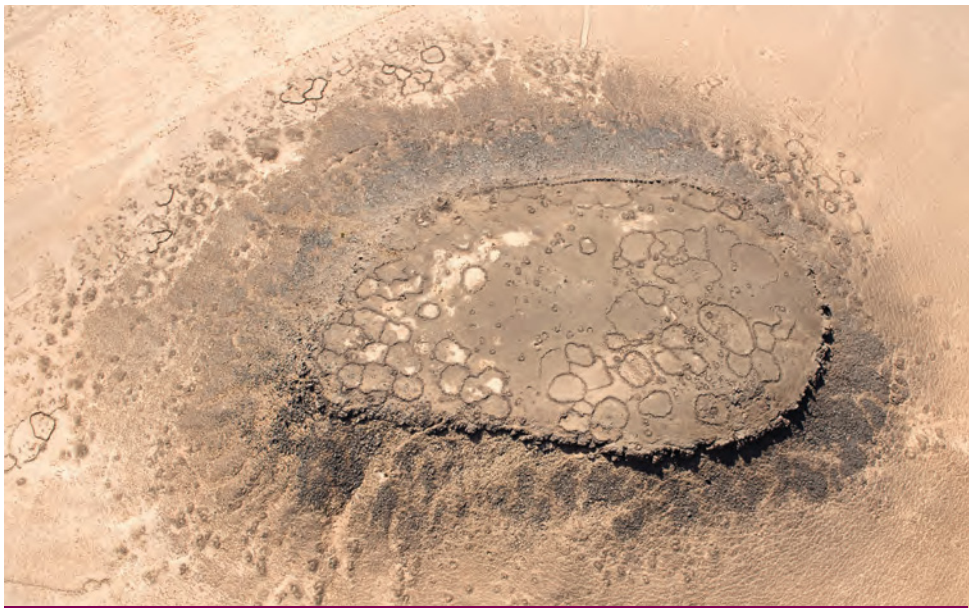

Figure 3. Qattafi Mesa 4. Originally named "Maitland's Fort" as the enclosures and burials on this mesa were originally thought to be part of a defended "fort" by Flt Lt Maitland (Maitland 1927, see. pl. 2), but there are no defensive walls and the slopes are clustered with celled dwellings (Rollefson, Rowan, and Wasse 2014). Photograph: David Kennedy, APAAME_20080909_DLK-0280, courtesy of APAAME.

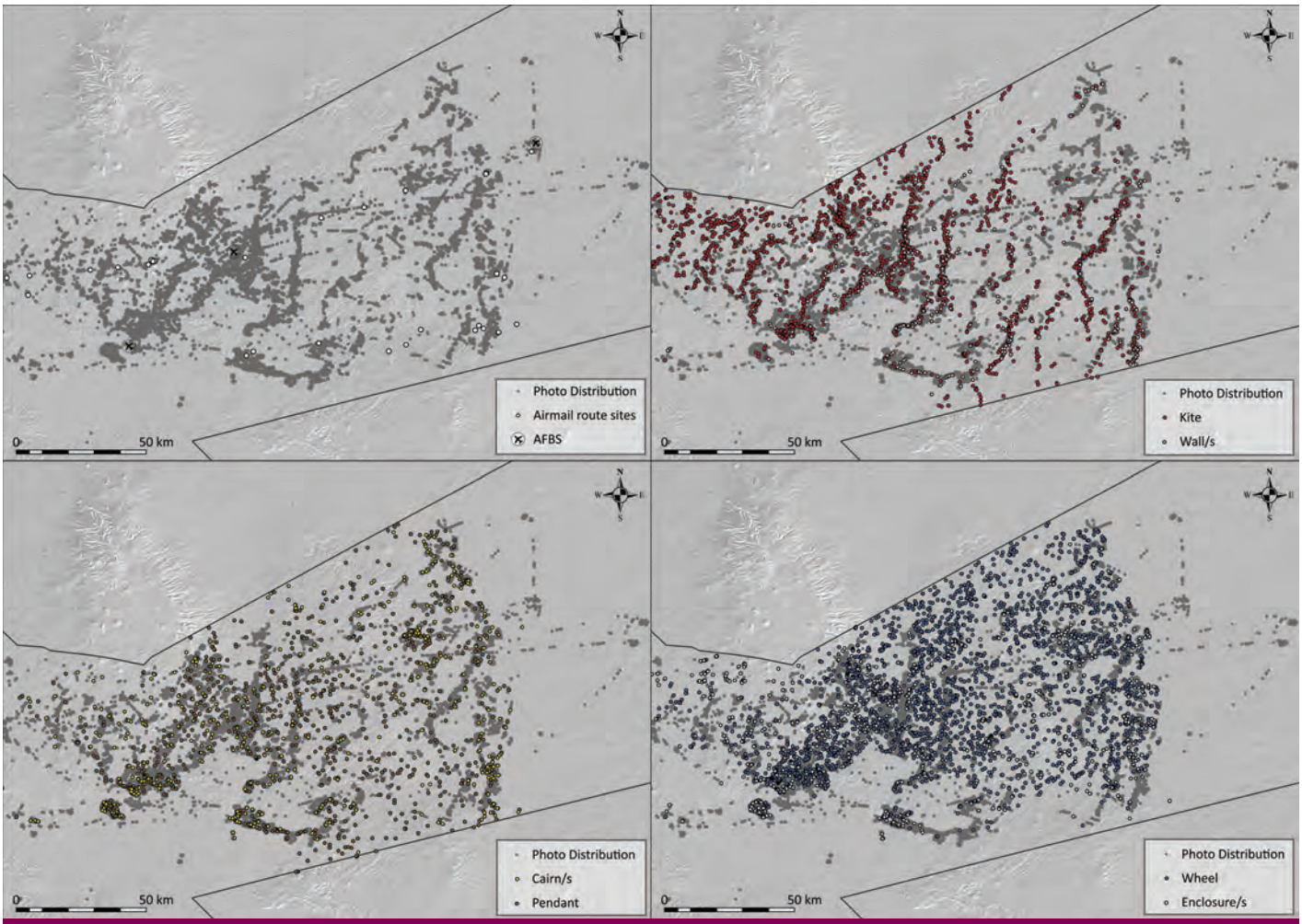

Figure 4. Distributions of aerial photographs taken by the Aerial Archaeology in Jordan project between 1997 and 2016 in the *badia* overlain on the known distribution of primary site types referenced in this article (from left to right, top to bottom): the airmail route, kites, cairns and pendants, and wheels and enclosures. It is interesting to note the more linear (north–south) arrangement of the kites than any other site type. Map by Rebecca Repper.

of Air Surveys at UCL Institute of Archaeology, but the Jordan aerial photographic material is only held by The British Academy (Kennedy 2000; see also Wang and Perkins 2008). This material can be browsed through on the APAAME website, and accessed through The British Academy Library and Archive.

The research potential of these early collections was demonstrated through the work of Kennedy and Riley (1990), but also underscores the case for a programme of aerial reconnaissance in the region first articulated in 1979. In 1979 the Aerial Photographic Archive for Archaeology in the Middle East (APAAME) was established with a few hundred aerial photographs (Kennedy 1980: 58). Examination of the 1953 Hunting Aerial Surveys photographs, sourced by APAAME from the Royal Jordanian Geographic Centre (Kennedy and Bewley 2012: 236–39), which cover part of the *badia* around Azraq revealed thousands of sites and from all the previous research it was clear that aerial reconnaissance in this region, and Jordan especially, had huge potential. In 1997 the Aerial Archaeology in Jordan project was born, with Kennedy's first flight—including the Azraq Basin—and it has continued ever since, completing over 400 hours in the air with approximately 130 of these over the *badia*. The archive now contains over 110,000 digital aerial photographs as well as maps, and the majority are of Jordan with a large number explicitly for the *badia* (fig. 4). It is an active, growing archive freely accessible online at www.apaame.org, and is the only programme of aerial reconnaissance for archaeology anywhere outside Europe.

The first initial flight of 1997 was followed up by an intensive season of ten flights in 1998, going as far east into the *badia* as Qasr Burqu (fig. 5). Photographing the isolated Qasr Burqu is an example of the limitations of aerial reconnaissance. Using helicopters provided by the Royal Jordanian Air Force has been a huge success over the past twenty years, but, as with any survey, there are constraints. In this case it is the two-hour fuel range of the aircraft (helicopters). This has an impact on the practicalities and cost-effectiveness of flying in some parts of the country, and the eastern *badia* where Qasr Burqu is located is one of those, given its distance from the airfields of Safawi and Ruwayshid. It is no coincidence then that we have only been to Qasr Burqu on three occasions (in 1998, 2010, and 2011). The southern *badia* in Jordan, which we do not discuss in this article, is even more

Figure 5. The site of Qasr Burqu. A late Roman tower surrounded by a later Islamic residence, it lies 205 km northeast of Amman, and overlooks a lake created by a dam. Photograph: David Kennedy, APAAME_20111024_DLK-0088, courtesy of APAAME.

Figure 6. Ruwayshid trench mines. Opencast flint mines/quarries, Wadi Ruwayshid, outcrops of chert layers on slopes in limestone areas, used as the source material for cortical scrapers, discovered by Müller-Neuhof. Photograph: Bernd Müller-Neuhof, APAAME_20130409_BMN-0148, courtesy of APAAME.

Figure 7. Ruwayshid trench mines. Detail of one of the mines in Wadi Ruwayshid; the lighter areas are the outcrops of the chert. Photograph: Robert Bewley, APAAME_20130409_RHB-0096, courtesy of APAAME.

difficult to survey by aerial archaeology for these reasons, with the only refuelling between Amman and Aqaba available at Al-Jafr. Structures are more difficult to identify in this landscape as they are more often built of material of the same hue as their landscape, whereas the basalt of the eastern *badia* is striking against the sands. There are of course other constraints on any flying programme, such as the weather and also the proximity of national borders. In the *badia*, Jordan is bounded by Syria to the north, Iraq to the east, and Saudi Arabia to the south. Flying is restricted to within 5 nautical miles (nm) from any border, but depending on the sensitivities of any year, at times flying has been restricted to 7.5 nm and even 10 nm if the situation demands it.

The aerial perspective is only one of the techniques available to us as archaeologists, and, even though it has its limitations, it has been immensely successful in recording not only a huge number of sites but also a wide variety in the *badia*. As one can see from the distribution of aerial photographs taken by the AAJ project (fig. 4) compared to that of the major groups of identified sites, we have been able to supplement the recording of sites beyond our aerial-reconnaissance survey. This is possible through the ease of access to satellite imagery in free platforms such as Google Earth and Bing Maps. The limitations of both of these modes of "remote sensing," of course, have to be taken into account when analyzing the representative nature of the resulting survey and photography. It reinforces the point that all archaeological surveys are samples, and there is no such thing as a comprehensive archaeological survey. Given how long it takes to journey to Burqu by car, let alone visit the entire surface area of the *badia*, visiting this region from the air is still very cost effective and is still providing us with important new information regarding sites and their locations, as well as monitoring a vast archaeological landscape.

We have been very fortunate in being able to collaborate with other archaeologists working in this important and much-neglected region. At its most basic, the collaboration involves a discussion between field archaeologist and the AAJ team; exchanging information about the number and nature of sites and landscapes being requested for aerial photography. Our collaborations within the *badia* have perhaps been some of our longest and most fruitful, such as with the Eastern Badia Project directed by Gary Rollefson, Yorke Rowan, and Alex Wasse regarding the sites around Wisad Pools and the basalt mesas of Wadi al-Qattafi; The Jebel Qurma project, directed by

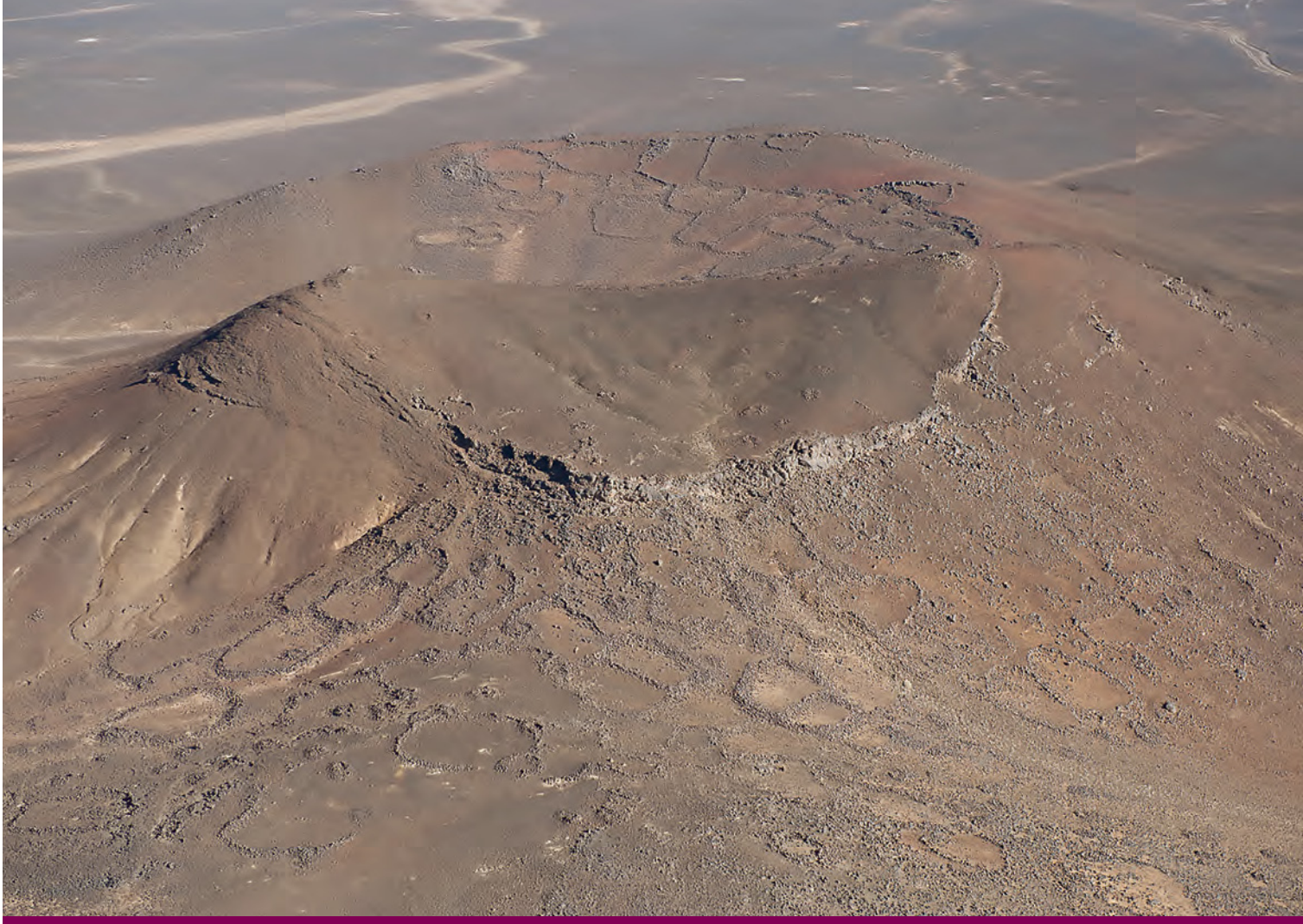

Figure 8. Tulul al-Ghusayn. Bronze Age settlements and terraced garden enclosures on a former volcano. Photograph: David Kennedy, APAAME_20130409_DLK-0041, courtesy of APAAME.

Peter M. M. G. Akkermans; and the northern Badia project and the "Arid habitats in the fifth to the early third millennium B.C." project, directed by Bernd Müller-Neuhof. We tend to operate in the spring and autumn to take advantage of the best weather and also the better light; we require as much shadow-forming light as possible and the summer light (June to August) is too harsh for too much of the day. We have been able to expand the collaboration by having field archaeologists in the helicopter with us, in particular Bernd Müller-Neuhof, who has joined us on several days since 2011. This has proved immensely successful and mutually beneficial because the more the aerial photographer knows of the landscape being photographed below, the better the results (Müller-Neuhof and Abu-Azizeh 2016).

The example of opencast flint mines/quarries (figs. 6 and 7) in the Wadi Ruwayshid region on the western slope of the Risha plateau is a very good case in point (Müller-Neuhof 2014a: fig. 1). With Müller-Neuhof in the helicopter with us, we were able successfully to record the whole range of the sites he and his team had identified in the field; if we had been left to our own devices the "targets" may have been missed or inadequately recorded, because of the nature of the quarry sites. The outcrops are geological formations (chert layers on slopes in limestone areas) and thus not what we would normally expect to see and photograph from the air. These flint mines are very significant for the late Chalcolithic and Early Bronze Age (EB1) period (4500 to 3000 B.C.E.), because the flint raw material was processed into cortical scrapers in the direct vicinity of the extraction sites (Müller-Neuhof 2012 and 2013; Quintero, Wilke, and Rollefson 2002). Under Müller-Neuhof's direction, we were able to locate and record the sites. This also gave the opportunity for Mueller-Neuhof to explore a wider landscape, from the air, than would have been possible from ground survey alone.

The collaboration can also work in reverse. In 2011 the site of Talul al Ghusayn (fig. 8) was first photographed after being initially located on satellite imagery (by Kennedy). By sharing the data of the initial sortie, Müller-Neuhof identified the site as one of particular importance, and his team was able to visit it on the ground in 2013, and begin to understand this remarkable, prehistoric garden landscape. The exchange of information has been ongoing and, since then, a large possible network of sites, such as at the similar site to the south, Khirbet Abu al-Husayn (Müller-Neuhof 2014a: figs. 1, 8, 10), has been identified and targeted for aerial reconnaissance and ground investigation. This includes the site of al-Qseir Ghadir located on the eastern edge of the *badia*, first photographed by Sir Aurel Stein (ASA/3/431-436) and positively located by APAAME in 2015 during the digitization of The British Academy material.

However, the *badia* is not solely about ancient sites. The Cairo-Baghdad Air Mail Route that first revealed the concentration of archaeological sites to us has also left its physical remains, which

Figure 9. Airmail route marker no. 23 near Hibabiya. These markers helped to guide the pilots on the Cairo–Baghdad airmail route in the 1920s. Photograph: Robert Bewley, APAAME_20020929_RHB-0272, courtesy of APAAME.

Figure 10. A landing ground for the aircraft using the Cairo-Baghdad Air Mail Route—this one called "KENSINGTON" 17—the mudpans were clear of stones and good for landing and essential for aircraft refuelling en route, as well as repair stations for replacing engines, repairing propellers and tires. Photograph: Robert Bewley, APAAME_20141015_RHB-0441, courtesy of APAAME.

Figure 11. Remnants of stone buildings of Al-Risha, an abandoned early Islamic town or village, partially buried by sand. Photograph: Rebecca Banks, APAAME_20111024_REB-0102, courtesy of APAAME.

are visible from the air. It is rare, though not unparalleled, to find archaeological remains of an aeronautical navigational route.

Although the development of aircraft and radio navigation and communication was rapid in the early years of the twentieth century, in some areas the use, development, and speed of air travel outstripped that of radio navigation. Without the guidance provided by railway lines, roads, and towns to assist navigation for parts of the Air Mail route, ground markers were required. Initially between Amman and Baghdad this was a ploughed furrow (still visible today) that passed frequent mudpans that were used as makeshift landing grounds and identified alphabetically in Transjordan, then numerically in Iraq (Andrews 2000: 5–10). As time progressed and the route shifted northwards (roughly corresponding to the modern road to Iraq) there was a series of numerical markers (fig. 9) created to assist the pilots to know where they were (especially if they needed to land because of an engine failure, a frequent occurrence; Hill 1929; see also Kennedy 2012). We see the identifiers of the landing grounds, still, carved or marked with stones on the smoother mudflats. Large, flat mudpans acted as makeshift runways and landmarks for the pilots, some bear names—such as "Yarmouk" and "Kensington" (fig. 10)—though some of these may relate to the later "Syria-Lebanon Campaign" against Vichy Syria during World War II.

These remains from the twentieth century emphasize the huge chronological range of the sites in the *badia*, but also highlight the gaps in our knowledge and periods of time when very little changed in the landscape. Apart from the construction of oil pipelines, roads, and modern airfields in the twentieth century, we have to go back to the early Islamic period (seventh to ninth centuries C.E.) for evidence of a change in use of the landscape. The site of Al Risha, not far from Ruwayshid (an important oasis and now home to an airfield) has been interpreted as an Early Islamic town or village (fig. 11). This was an experiment in attempting to occupy this part of the desert, but it did not last long, as the site is clearly of a single period and the evidence suggests it was not in use very long before it was abandoned (Whitcomb 2001; Helms 1990; see also Kennedy 2014: 99–100). More survey work is clearly needed, such as that by Dr. Karin Bartl investigating water management in desert regions during the Islamic period (Bartl 2016).

Continuing our journey back in time, there is the evidence of the Roman occupation (first century B.C.E. to fourth century C.E.)—the forts

Figure 12. Ghusein Pendant 19. One of the pendant burials. Not all have the bullseye-type cairn like that shown here. Photograph: Matt Dalton. APAAME_20111024_MND-0519.dng, courtesy of APAAME.

clustered near the oasis at Azraq, and the settlements and forts in the fertile southern Hauran, first captured in Jordan, as we have mentioned, by the RAF and Sir Aurel Stein, but it is in the prehistoric period that the *badia* really comes into its own. Flying over the *badia* there is rarely a moment to catch one's breath, as the concentration of sites is so dense in so many areas. To a prehistorian, this is an archaeological paradise not just because of the number or density of the sites but also because of their variety. It is our role as archaeologists to begin to untangle this extensive network that covers both space and time; as yet we are at the very beginning of this process. The results reveal much larger human populations than would previously have been thought possible; recent work by a number of teams has begun to return promising data for dating. Gary Rollefson and his team, as a result of their excavations, have shown that there is every likelihood that the Late Neolithic population (7000–5000 cal B.C.E.) was much greater in the southern areas (Wisad Pools and Qattafi), but that there is still much more investigation to do to understand this complex landscape (Rollefson, Rowan, and Wasse 2014). Research is still in its early days, and we are only beginning to understand, through the combination of aerial survey, mapping, and fieldwork just how difficult it is to untangle these stone-built structures that took thousands of years to build. The distribution of site types (fig. 4) for kites and wheels, especially in the Azraq area, suggests that the wheels occur in clusters and that when one type of site was in use, the other was not (Athanassas et al. 2015: fig. 8; Rollefson et al. 2016: 949 and Kennedy 2012b: 80–81, fig. 4). The aerial view is a key component in this research because these sites are notoriously difficult to see on the ground, and it is only once in the air that their size and shape become apparent.

We know that some of the stone-built structures are settlements, burials, and hunting enclosures (kites); the date and function of the wheels however has remained a mystery until recent research has shown they were built over a long period of time; we can be confident of a date range from the Late Neolithic to the Bronze Age, that is, the eighth to third millennia B.C.E. (Athanassas et al. 2015; Rollefson et al. 2016; Kennedy 2012b; see Kennedy 2011: 3189). As to the possible function of the wheels, it has been suggested either that they are settlements, fortified or not, with garden plots, or, given their association with cairns, that they are ritual sites—the internal dividing walls perhaps defining separate burials (Rollefson et al. 2016: 949). However, given the variety of the shapes and complexity of the wheels, it is probably best to conclude that they may well have had multiple functions (Rollefson et al. 2016: fig. 10; see also Kennedy 2012b: fig. 3). Recent work (Akkermans et al. 2014) suggests there are Late Neolithic settlement sites (seventh to fourth millennia cal B.C.E.) in the Jebel Qurma area (east of Azraq), with possible hiatuses in occupation, and then abandonment in the Bronze Age. There is a diversity in site layout (lithic scatters as well as areas, up to 8 ha in size, of stone built structures) that suggests a long period of occupation, and shifts in habitation patterns.

This evidence means we have to reevaluate the nature of human occupation in the Neolithic and Chalcolithic periods. For burial sites and cairns we know so little too (see Kennedy 2012c); some of the burials date from the nineteenth century C.E. and

Figure 13. Ausaji Chain 22. A most unusual arrangement of stone-built structures, resembling chains, a site-type needing much more research. Photograph: Robert Bewley, APAAME_20160526_RHB-0479.jpg.

some from the Neolithic; the morphological variation does not necessarily mean a chronological difference (fig. 12; Bradbury pers. comm.; see Abu Azizeh et al. 2014). Finally there are many sites that need to be recorded, but we struggle to know what they represent, and the "chains" are one such example (fig. 13; see Kennedy 2011: 3190).

All of the tools available to archaeologists will be needed to continue to unlock the patterns of sites, their function, form, and date. Aerial reconnaissance should be a continuing part of this and it has already made a significant contribution to transforming our understanding of this important landscape. Collaboration and sharing of knowledge has been, and continues to be, integral in revealing the complexity of this fascinating archaeological landscape.

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