

History in Depth: Surface Survey and Aerial Archaeology*

Introduction

Archaeology in Jordan has undergone a revolution in the past twenty years. It is a revolution which has occurred in other countries, too. It comes with its inevitable pain but also its excitement and measurable advances. The revolution is that brought about by a steep increase in knowledge; an increase which is not merely incremental but exponential. Our knowledge has been moved onto a new plane of activity and understanding. The dynamics of this change are to be traced primarily to the series of surface surveys undertaken in recent years. Between them they have permanently altered the way in which we view the human landscape of Jordan over several millennia and have forced a new perspective on how archaeology should proceed from here. Much has been achieved and more is in progress. It is the argument of this paper that there is the opportunity to develop these new advances further still through the systematic employment and integration of Aerial Archaeology as a parallel and complementary tool of surface survey.

The Explosion in Knowledge

The volume of archaeological work in Jordan and the numbers of publications arising has risen steeply in the past generation. The Annual of the Department of Antiquities (ADAJ) has doubled in size in twenty years; the six volumes arising from these conferences (SHAJ) have added several hundred more articles; and the number of books and articles overall relating to Jordan has increased markedly within a generation.

Considerable efforts have been expended on bringing some order to all this new material with the volumes of *The Archaeology of Jordan* and the important data base of sites, JADIS. A Cultural Resource Management plan has also been developed.

Surveys in Jordan

Surface survey is not new in Jordan although the term

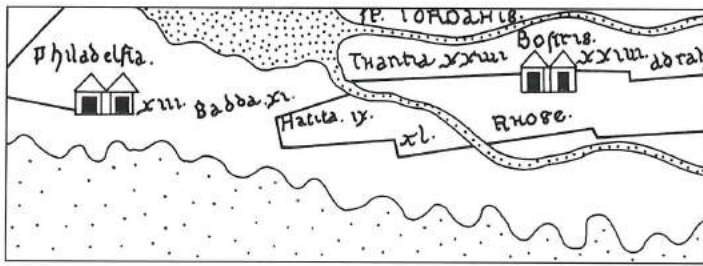
might be better reserved for the more recent approaches. Much of what went before was exploration, sometimes systematic but seldom intensive. The earliest modern explorers left vivid accounts of a landscape which was often virtually empty. For example, Robinson Lees in 1893 provides a typical example of the period, a man interested in ancient remains but who passes between 'Ammān and az-Zarqā', az-Zarqā' and al-Mafraq, then on to Buşra — and reports virtually nothing between these places (Lees 1895). The accounts of such travellers and explorers implied a landscape largely empty of human activity, present and past. The principal places of interest were known but travel between them was represented as if in a vacuum. It was a world curiously reminiscent of that which one encounters in the second century AD account of the Greek writer Pausanias. His report on the places of interest in Greece has been characterised recently in much the same terms as could be applied to the descriptions of most field-work in Jordan until a century ago.

"... for [Pausanias], the rural landscape is largely a kind of void that intervenes between each city or sanctuary and its nearest neighbour; a void crossed by the life-line of the road system ..., which enabled the traveler to pursue a linear course from starting point to destination, with little regard for the lateral and vertical dimensions" (Snodgrass 1992: 77).

The image is one seen, too, in the Peutinger Table, the late Roman map, with its scatter of place-names linked by the lines of roads but between which there seems to be nothing (FIG. 1).

The names of Musil, Conder and Kitchener, Brünnow and von Domaszewski, and Butler and his collaborators in the Princeton Expedition, mark the next stage. Their extensive publications remain landmarks transforming the brief and often superficial contributions of their swiftly moving predecessors. Between them these scholars added many new sites and a mass of detail. More importantly, they made a significant advance in "peopling" the land-

* I am grateful to Prof. David Mattingly for permission to reproduce FIGS. 3 and 5.



1. A section of the Peutinger Table for northern Jordan. Philadelphia ('Ammān) is on the left with Bostra (Bosra eski-Sham) in Syria in the centre and Adraha (Der'aa) on the right. In between, lines with distances marked, provide the only other information. In practise this is a landscape densely packed with sites of all periods, not least the Roman but only this handful of major places is recorded.

scape. Scholars could begin to see the growing evidence for a complex and varied settlement pattern in the landscape of the region. For the Roman period what articulated at least some of these sites was the presence of contemporary roads.

These great journeys of exploration looked both forward and back. They looked back to the work of De Vogüé, Waddington, Buckingham, Bankes, Merrill, Schumacher — dedicated and courageous explorers who had been principally concerned with the remains of Classical Antiquity. These earlier scholars had deliberately searched out the sites of the Roman period and given priority to comment on the great monuments of a civilisation with which they felt themselves familiar by education. The recording of Greek and Latin inscriptions was a priority. The new investigators of the turn of the century were able to explore more leisurely and if they, too, were primarily concerned with the remains of the Graeco-Roman past, they adopted a different approach. Sites were recorded systematically and there was a more sharply defined objective: Brünnow and von Domszewski were in search of the Roman frontier; the Princeton Expedition looked for the architectural remains which would enable them to place the Graeco-Roman, particularly early Christian, culture of the region in a wider context. But they were also forward-looking in their more systematic approach and willingness to record not just the inscriptions of the Classical past but those in native languages too - Nabataean, Safaitic and Arabic. More importantly, the fuller information produced more densely marked maps - sites were more numerous than supposed and hitherto blank areas on the map were now found to have been settled, too. After the appearance of the volumes of these turn-of-the-century scholars the human landscape of what was to become Jordan was irrevocably altered. And yet, these works, too, had much in common with Pausanias's

Guide to Greece. It was still the significant sites and overwhelmingly those of the Classical World which were being mapped. Butler and his colleagues make occasional reference to the rural landscape but between sites most comment is reserved for the natural features observed. The world they were revealing was one still largely of towns and forts and they themselves still travelled in many instances along the Roman roads which linked them. Where and how the mass of people lived was unknown and the chronological context of the Classical period not addressed. It seemed almost to exist in a vacuum.

The surveys of Nelson Glueck in 1932 and 1947 mark the next significant development. His method was essentially that of his predecessors — following the established routes of a region and exploration of what local informants had to report. Of course, Glueck added several hundred new sites to the existing corpus of data and he ranged widely across what had by then become Trans-jordan. More importantly, however, Glueck's interest went beyond the strikingly monumental and it went, too, to other periods. Suddenly the Roman period could be placed within a continuum which included flint sites, Bronze Age towns, Moabite hillforts, Nabataean rural sanctuaries, Islamic castles and Ottoman mills. Faced with often unremarkable architecture and few of the inscriptions so avidly sought by Classical archaeologists, Glueck worked instead with the identification of pottery and the surface artifacts of these cultures, and with the monumental architecture of hitherto neglected periods. Inevitably much of Glueck's work has come in for re-evaluation and revision but the major contribution from his survey will remain his multi-period research from which sprang his theories of development and change through the ages and the extent and nature of cultures as defined through their artifacts.

Glueck recorded more than a thousand sites, mostly unknown, a tremendous achievement, and preserving information often since lost or damaged by subsequent developments. Nevertheless, the total will today seem modest alongside the numbers recorded by archaeologists pursuing a new type of survey.

Archaeological Surface Survey since the 1970s

As is well-known, archaeological survey took on a new character in the 1970s, becoming less extensive in scope but more intensive and systematic.¹ In contrast to Glueck's survey of all what of he called "Eastern Palestine", the new generation of work has focussed on more limited areas. Sites of all kinds and periods are recorded. Where Glueck had devised an outline of settlement his-

¹ S. Thomas Parker's survey of Roman military sites from one end of Jordan to the other in 1976, motivated by a specific research question, is an interesting mixture: in the great tradition of Brünnow and von Domszewski, but intent on extracting dating evidence from

the mundane surface finds which had been of no interest to the German and American scholars 75 years before (Parker 1976). Contrast, my own survey of a very small area two years later (Kennedy 1982).

tory for Transjordan on the basis of 1000+ sites from across the entire country, the new surveys recorded as many sites in small parts of the country. A single example underscores the point: Burton MacDonald's Wādī al-Ḥasā Survey (1988) recorded 1074 sites in an area of c. 600 sq km; only 37 of those had been recorded by Glueck. Despite the inevitable bias which persists in the data — especially amongst the unsystematic surveys — interpretations based on the dramatic increase in quantity can be applied more confidently where the pattern reveals marked differences between periods and sub-divisions.

The systematic surveys by MacDonald both along the Wādī al-Ḥasā and now in the Southern Ghors/ Wādī 'Arabāh (1992) are especially noteworthy for their high quality and commendably rapid publication. There have, however, been numerous others in various parts of the country and more are in progress. It has become, in fact, one of the commonest forms of fieldwork in Jordan, putting it in the forefront of such work elsewhere in the eastern Mediterranean (Alcock 1994) — well ahead, for example, of Turkey², Syria and Egypt. A far cry from the claim made in 1983 that "... in many countries, especially the Near East and North Africa, excavation is archaeology" (Jones 1985: 1). For Jordan at least, archaeology is in fact now quite likely to be surface survey.

At this point it is appropriate to recollect the significance of archaeological surface survey and how it should, ideally, be conducted. According to a standard current undergraduate textbook:

"Surface survey has a vital place in archaeological work, and one that continues to grow in importance. In modern projects, however, it is usually supplemented (and often preceded) by reconnaissance from the air, one of the most important advances made by archaeology this century" (Renfrew and Bahn 1996: 75).

What is said to be "usual" is in reality *uncommon* outside a handful of countries. The recently published and highly important survey of the Molise Valley in Italy, for example, was carried out without air photographs much less a reconnaissance from the air (Barker 1995). Indeed, aerial archaeology in Italy hardly exists. Conversely, in Britain, where numerous part-time private and full-time professional aerial archaeologists operate, there have been few systematic surface surveys³. There the aerial discoveries have been employed instead to construct sophisticated and detailed maps peopling landscapes. In practise there are few countries where even *old* air photographs may be obtained; fewer still where a programme of dedicated reconnaissance may take place as a comple-

mentary component of surface survey. This is a misfortune.

Air Photo Interpretation

The role of aerial archaeology needs no detailed exposition. The *JADIS* volume, identifying sites known from various sources lists about 9000. At about the same time as *JADIS* was being compiled, systematic interpretation of 4000 vertical air photographs of western Jordan taken in 1953 identified some 25,000 sites (Kennedy 1997). Site density varies considerably with, unexpectedly perhaps but understandably, the highest concentrations in the more marginal areas of farming rather than in the central regions of human settlement. Archaeological interpretation of this mass of data is in progress (Kennedy 1997; in preparation). FIG. 2a and 2b illustrate the transformation this work can make by reference to one area.

It is too soon to provide detailed results. Analysis, however, is being guided by procedures adopted elsewhere. Once again, the long history of intensive aerial reconnaissance for archaeology in Britain points the way to what may be achieved. One of the best examples, from northern Britain 25 years ago, is highly instructive (Jones and Mattingly 1990: 255-63). The survey area in question is a quite small one — about 1500 sq km — but it overlaps the western end of Hadrian's Wall and one objective was to gauge what impact, if any, was made by the establishment of a Roman military zone cutting through the region. The survey found quite marked differences on either side of Hadrian's Wall, which are surely associated with the existence of the wall itself and different responses to and consequences of it (FIG. 3):

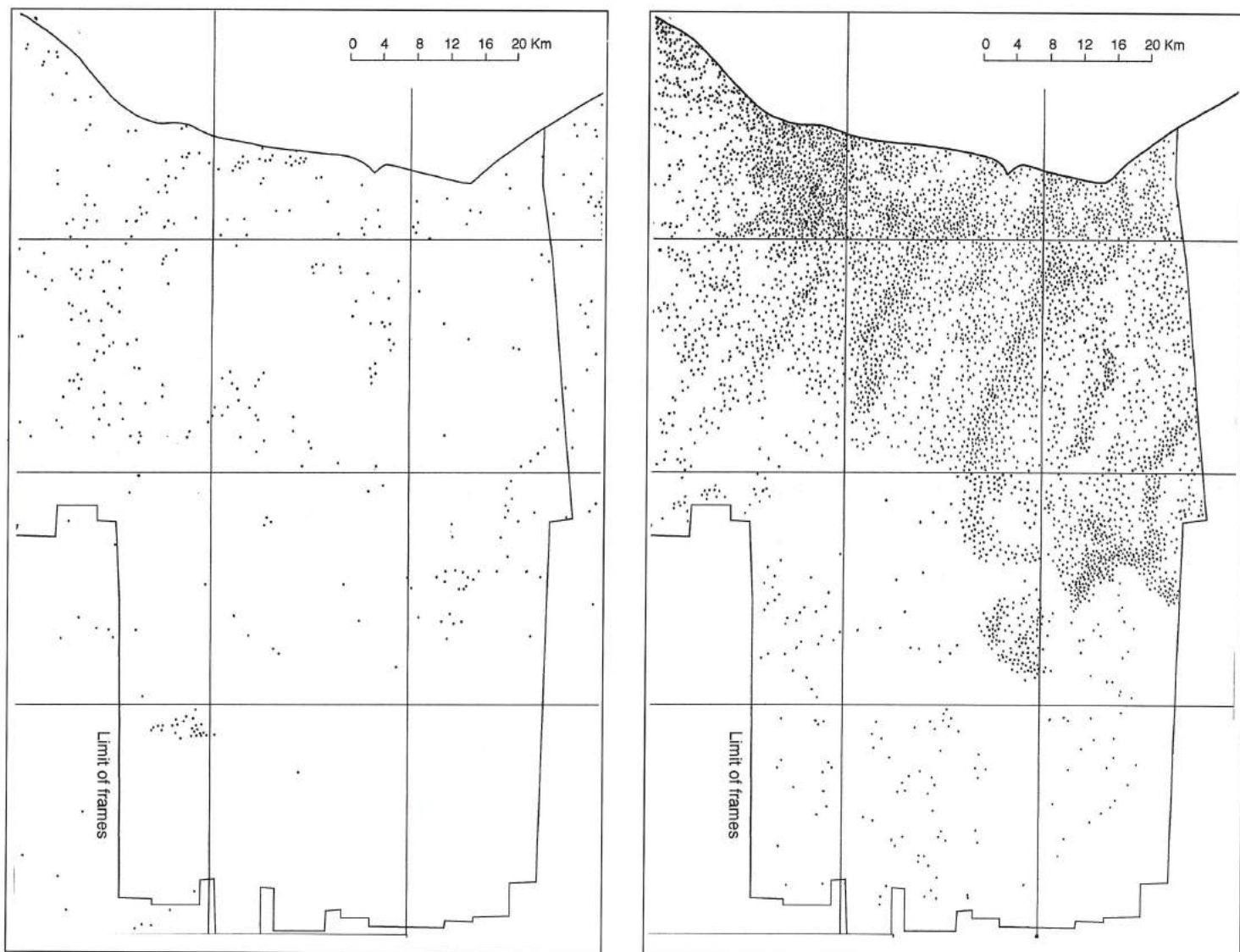
- * to the north, site density was 3.77 per sq km; to the south it was 9.7;
- * north of the wall none of the farmsteads identified had associated field systems implying stock-raising rather than cultivation; south of it farmsteads with field systems are common;
- * north of the wall, farmsteads are almost exclusively circular/ curvilinear; south of it rectangular/ rectilinear becomes the standard;
- * north of the wall 20% of farmsteads are set within defensive ditches; south of it only 3% are.

A start can now be made on similar interpretative research in Jordan. As detailed now in Bert de Vries' important first volume on Umm al-Jimāl, the archaeological interpretation of the sites identified on air photos for an area of c. 430 sq km around the town can be highly instructive. 1079 sites were identified, a density of 2.5 per

² The limited picture for Turkey has improved in recent years as a result of work done along the Euphrates, with systematic surveys within the northern part of the bend of the river around Tiris Höyük (Algaze *et al.* 1992; 1994a; 1995a; 1995b) and Kurban Höyük (Wilkinson 1990). Cf. the Tigris-Euphrates survey (Algaze *et al.* 1991;

1994b).

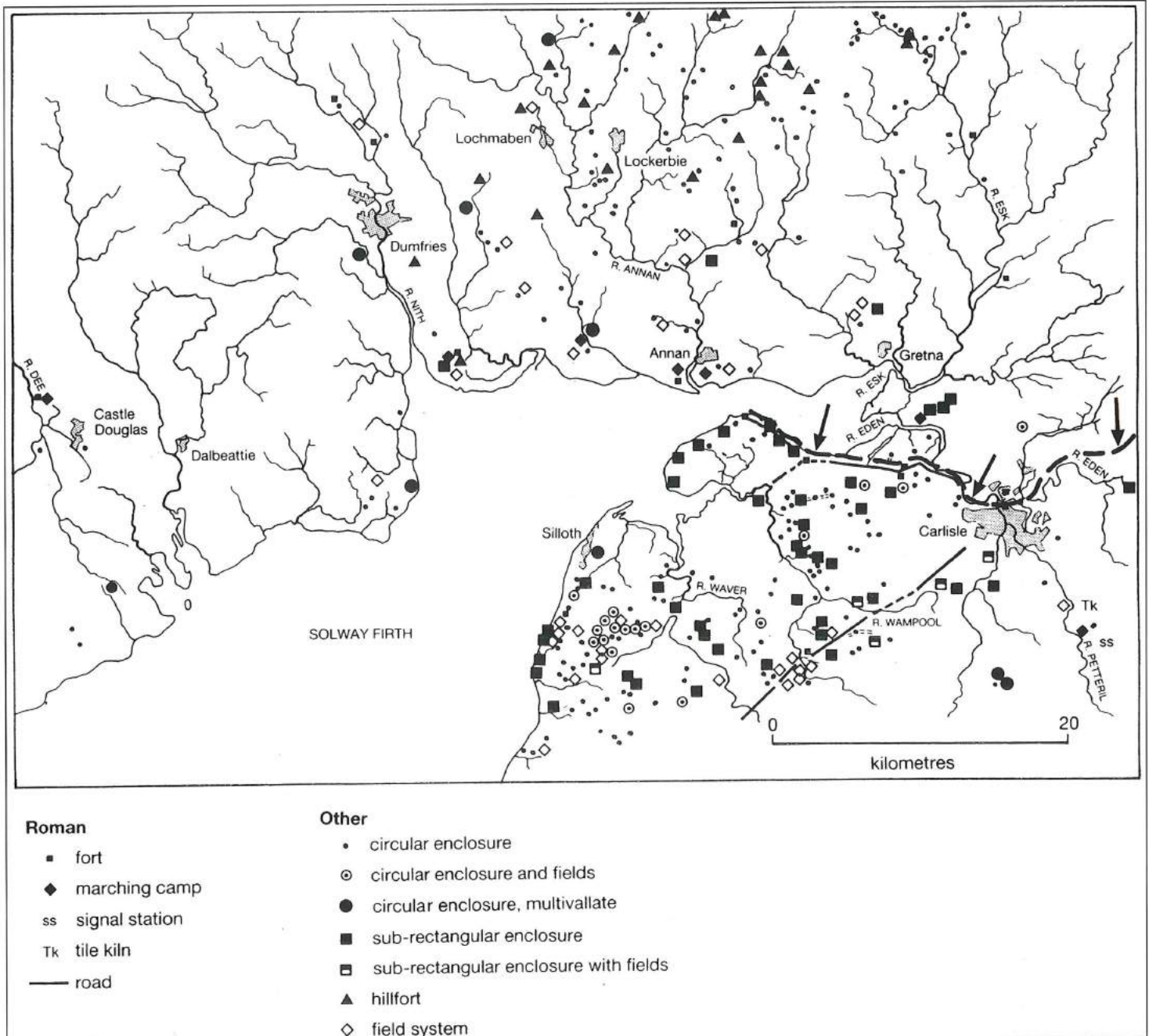
³ There have been numerous surveys but the concept of field-walking has only been applied systematically to intensive survey around one or a few specific sites.



2. Sketch maps of (a) the basalt desert and steppe of northern Jordan showing the number and distribution of sites as recorded in JADIS, (b) the same area with the data recovered through air photo interpretation of the 1953 Hunting Aerial Survey.

sq km (Kennedy 1998a: 51-55, at 54). Although the ground data from surface survey was not available, it was nevertheless possible to “people” the landscape around Jimāl and offer suggestions for how that landscape was employed and developed solely on the basis of the air photographs. Particularly interesting was the identification of over 100 farms — perhaps nearer 200 if less secure examples are included (Kennedy 1998a: 67-73). Surface examination at two of these found pottery of the Roman period. A great deal more work is necessary on the ground: excavation at one or more of these farm sites should be a priority and many should be surveyed on the ground and sherded. At a stroke, however, though still hazy and incomplete, our understanding of the rural context of the town of Umm al-Jimāl has been altered significantly (FIG. 4). Placed in a wider context, it is apparent that one of the characteristic features of these farmsteads — the

cross-wadi walls, are distinctive to this region around Jimāl (Kennedy 1998a: figs 31-33). Analysis of the air photographs for the regions to west, east and south found no such walls. Not even around the small town at Umm al-Quṭṭayn or the fort and settlement at Dayr al-Kahf. The distribution of these farms is markedly densest around the major settlements which in turn are mainly located on the lava. On the other hand they are thin in the immediate vicinity of the towns of Umm al-Jimāl and Umm as-Surab, implying, perhaps, that farming immediately outside the town was in the hands of people who lived in the town. That should be reflected in the character of at least some of the town houses which would have been in part at least working farms. The form of the farms is also distinctive: overwhelming they are curvilinear and derived from a native architectural tradition. A handful, however, generally larger in size, are rectilinear and located on prime sites



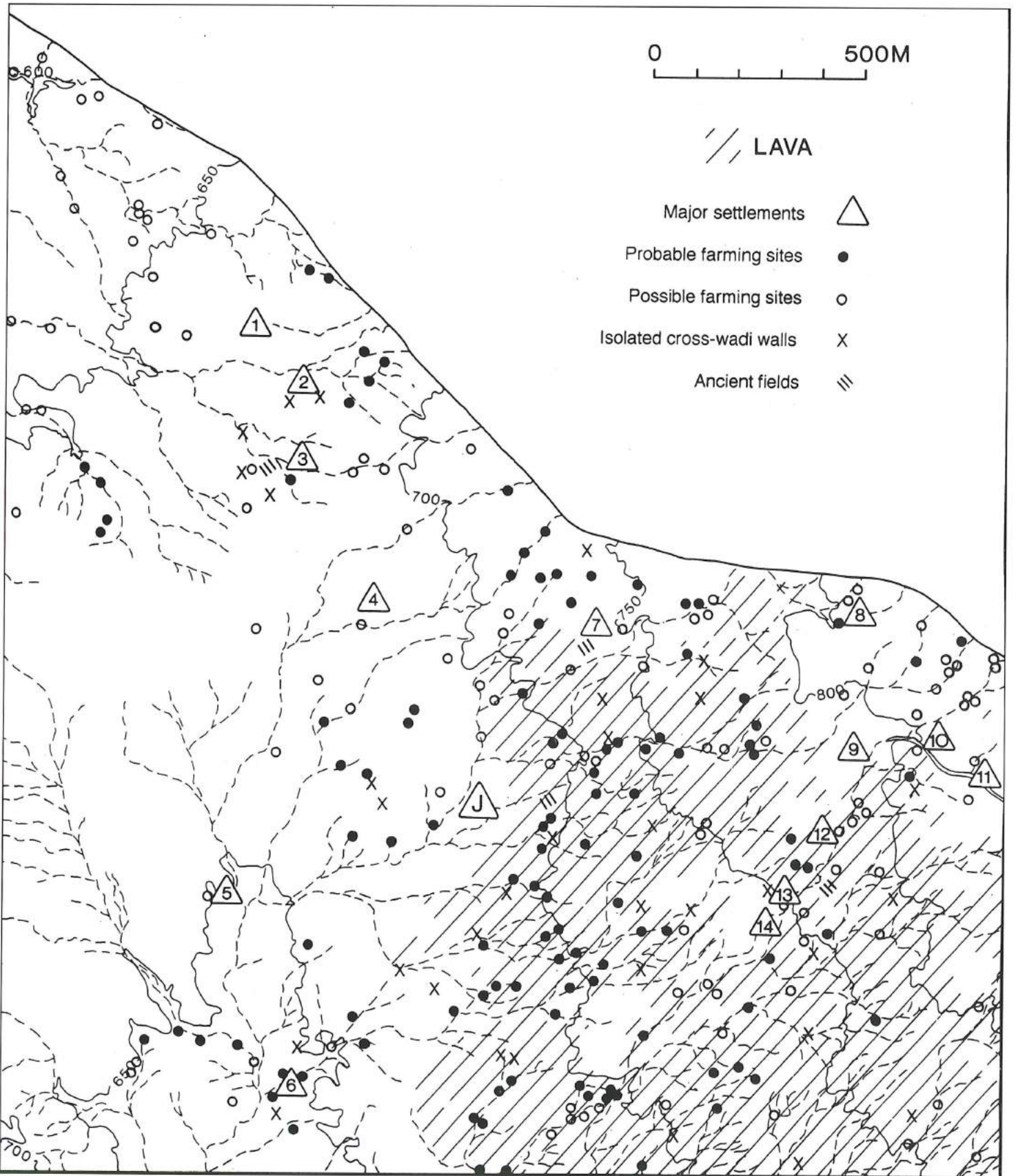
3. The morphology of sites around the Solway Firth in Britain as determined by aerial reconnaissance. The broken line (arrowed) marks the approximate alignment of Hadrian's Wall (commenced c. AD 122) (after Jones and Mattingly 1990: Map 7.25).

(Kennedy 1998a: 72 and 76, fig. 35). Dating evidence from both types of site may yield the explanation or it may be cultural, the work of outsiders with a different tradition of design.

Another site type around al-Jimāl is that of kites (Kennedy 1998a: 74-80; see now Fowden 1999). In contrast to some of the published 1: 50,000 maps for the region further east, the Umm al-Jimāl sheet recorded the traces of only 3. From scrutiny of the air photos, the number was raised to 58, all of them on the lava in the eastern part of the area (Kennedy 1998a: fig. 39). Plainly they had in fact

been a common structural type in the region. Closer inspection revealed certain differences from those already studied further east, in particular, there was far greater variety in orientation than in the east where it was rare not to be opening to the east. Around Umm al-Jimāl, 38%, the single largest group, were oriented to the north and two thirds were oriented north or north-east.

Finally, especially interesting was the recognition of how elements of ancient structures continued to influence current inhabitants. Field boundaries work around the curving "heads" of kites and elsewhere the long "tails"



4. Map illustrating the distribution of the major settlements and probable or possible farming sites. Major settlements mentioned in this article: 1. Khirbat Umm as-Surab; J. Umm al-Jimāl (from Kennedy 1998a).

continue to form field walls (Kennedy 1998a: fig. 41). And of course the selection of Umm al-Jimāl, as-Surab and the other larger ancient settlement sites for the principal modern villages was because these places offered not just good natural locations but building material and water storage facilities which could be repaired.

Scrutiny of the air photographs for the Umm al-Jimāl area was one of several such projects undertaken as part of the analysis and interpretation of all the 1953 air photographs. One of those currently in progress has also permitted some ground verification as a follow up. At Gharrandal in southern Jordan, excavation by Alan Walmsley on the town site itself will be complemented in future seasons by a surface survey of the vicinity. In 1997 the opportunity was taken first to interpret the relevant air photographs then pursue some of the sites on the ground. The results are instructive. Glueck had identified 5 sites in the area; the JADIS volume lists 14; interpretation of the air photographs identified 50 (Kennedy 1998b). Several of these could not be traced, apparently destroyed by recent quarrying; one proved to be a natural feature and yet another was discovered by accident where nothing had been noted on the air photograph. Most of the other sites were swiftly traced using the photographs as a map. Of those previously known, the photograph provided an immediate geographical context for the site, an indication of extent and some details of internal features. Little of this was known from Glueck's brief written account. As for the new sites, most would certainly have been noted by a surface survey but the air photograph provided an immediate location, context and details. And it did so swiftly and cheaply.

The Wādī al-Ḥasā Survey

The Wādī al-Ḥasā Survey (WHS) has allowed an exercise of a different kind. Here the survey has been completed and published a decade ago and parts of it involved intensive and systematic survey within a large area. The results of the surface survey may be tabulated as follows:

	Number of Sites	Undated Sites	Dated Sites
Western Universe (Transects and purposive)	214	68	146
Central Universe (Purposive)	338	169	169
Eastern Universe (Probabilistic transect, purposive)	522	283	239
TOTALS	1074	520	554

The air photographs were only examined after the survey was published and without reference to it until the interpretation had been completed. In the first full scrutiny of the air photos covering the Western Universe, 187 sites

were recorded. Contrasting what the WHS recorded and what was found by the photo interpretation is instructive:

- * 48 sites were common to both surveys.
- * Many of the sites identified by the WHS but not seen on the photos were either lithic/sherd scatters (26) or sites lacking any visible structure and for which only surface artifacts indicated human activity (eg 12 caves) or sites which were too small to pick up (eg 3 grinding facilities).
- * On the other hand, it is instructive that some sites on which the surface surveyors had found no dating evidence, had been identified on the photographs as definite sites.
- * In addition the air photo interpretation identified 139 other potential "sites" including 38 outside the transect areas. In some instances the explanation may be that these sites, visible in 1953, have now been destroyed; or they may have been visible but discounted by the WHS as modern; or they may be natural features misidentified by the photo interpreter. Here, a ground check of at least a few would be desirable to determine the explanation(s).

Similar results were obtained from the area of the Central Universe covered by the aṭ-Ṭafīla map (Sheet 3151 IV).

In light of these results it was decided to try an experiment with a run of 5 air photos dealing with the Central Universe on the 'Aina map (Sheet 3151 I). Previously the air survey had been self-denying including only those "sites" felt to be definite. It was now decided to include probable and possible "sites" as well. For this area WHS found 127 sites against 134 on the air photos. Of these, 73 were common to both (though in addition some of the air survey sites refer to more than one WHS site). Of note is our identification of 28 of the sites for which WHS had no dating evidence. It is debatable whether these results indicate that examination of the air photos should be much more inclusive or whether this merely increased identification of dubious sites to an unacceptable level. It should be noted, however, that this section of the study including preparation, interpretation and transcription occupied only 10 hours 20 minutes.

These case studies, each in their own way reveal much about the relative strengths of the surface and air photographic evidence. Much, too, about methodology. More importantly for the larger issues, they demonstrate the value of aerial survey and the way in which it can significantly complement and enhance surface survey. Renfrew and Bahn (above) may have been wrong in claiming aerial survey as a "usual" complement to ground work but the principle that it *should* be is valid. How that may be done is the subject of the final part of this paper.

Aerial Archaeology in the 21st Century

Air photographic interpretation of all the 1953 air photographs covering all but a small part of the entire western

side of Jordan and part of the basalt desert has now taken place (Kennedy 1997). At the very least, it is possible now for every survey undertaken in those parts of Jordan, to obtain a set of crude results of our interpretation of the photos for the area to be surveyed. Potential enquiries should provide a precise definition of the survey area on a photocopy of a scale 1: 50,000. The project from which these results were obtained must now be self-supporting, but preparation of copy photos, distribution maps, description of sites and recommendations by my research assistant are at cost price (see now the web page for details: <http://www.arts.uwa.edu.au/classics/archeology/apamea/>)

The next active stage of the project should be to carry through a detailed combined surface and air photographic survey of one or more areas. To some extent this has been done for the Southern Ḥawrān Survey and it might be done, retrospectively, for the Umm al-Jimāl area. More useful, would be a new survey area in which ground survey and interpretation of both the 1953 and more recent air photos could proceed in tandem and feed off one another.

More useful still, would be to bring in a programme of *active* Aerial Archaeology. That is now a possibility. Through the kind support of Prince el-Hassan and the Royal Jordanian Air Force, a season of new flying has just been carried out involving inspection and photography in every part of Jordan. One part of the project was to explore some relatively limited areas intensively. As is well-known, archaeological sites can be revealed from the air which are invisible or undetectable at ground level. To some extent that happens already with the old vertical air photographs. There is the potential, however, to increase the success rate considerably by a programme of dedicated flying in ideal conditions of light and season. Certainly modest sites should be detectable as shadow sites early or late in the day. Some noted on the vertical photographs but showing indistinctly because viewed in the middle of the day, should be clearer. In spring and autumn there is the potential for completely buried sites to be visible as vegetation marks. Almost half a century ago, in his classic study of Aerial Archaeology, John Bradford defined western Turkey as one region of the Middle East in which crop marks should be found. Nothing has been done there but it is possible now to illustrate the point by employing recently declassified satellite photographs of the 1960s taken in different seasons in eastern Turkey (Kennedy 1998b). Further south, in Syria, Poidebard in the 1920s and 1930s noted vegetation marks revealing sites (cf. Kennedy and Riley 1990: 65-7). There is no reason to doubt they may be equally instructive in Jordan in the appropriate places and conditions.

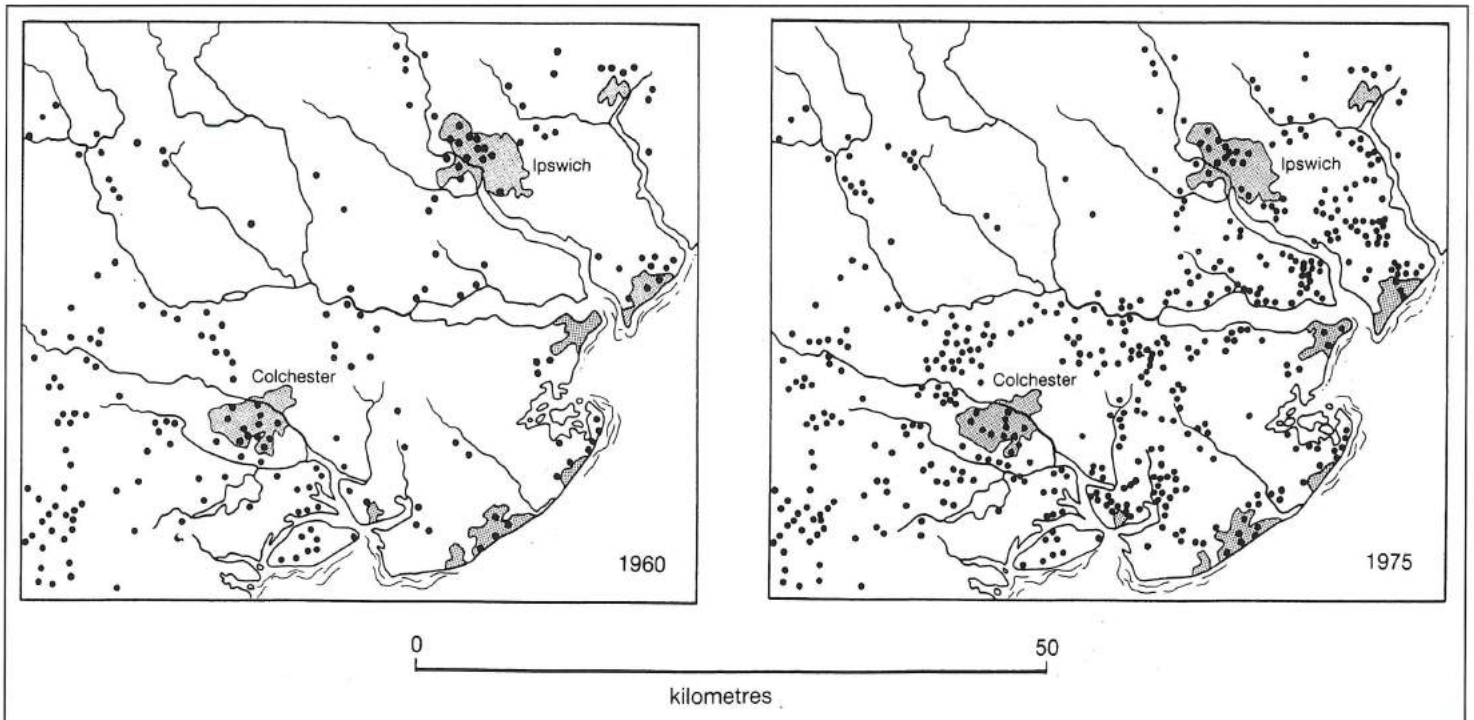
Vegetation marks may be sought profitably even in the desert and steppe areas to reveal, for example, the lines of ancient roads. Crop marks should be detectable in those

areas where cultivation has destroyed and hidden surface traces of sites, but the surviving buried remains may cause a differential growth above. Suitable would be much of the region from at-Ṭafila northwards. Especially useful might be a programme of flying over the Jarash Basin. The different types of farming from the uplands of ‘Ajlūn to the cereal cultivation towards al-Mafraq could be very revealing. In the longer term context of intensive field-work of all types at and around Jarash, the integration of a dedicated aerial survey with a parallel programme of systematic ground survey would be of great potential for a place of rare international cultural importance, a part of our common heritage.

Hopefully, this work will be continued in coming years and ideally it will involve the training of a Jordanian Aerial Archaeologist. Just how profitable such work can be, may be illustrated from an experiment in Britain. There, flying around Colchester as of 1960 had revealed numerous sites. Later, however, the same region was again examined but this time through systematic flying in appropriate conditions. Not only were many more sites discovered but the pattern of sites in the region was changed dramatically. No longer was the pattern related to the valleys — by 1975 there were numerous sites on the high ground as well (FIG. 5).

Epilogue

Like Archaeology in general, Aerial Archaeology must be seen to serve not just the interests of academics but of the wider present and future inhabitants of the countries in which it is conducted. In the present case, the recent flights were engaged in both narrowly academic pursuits and in the task of revealing and “selling” the cultural heritage of Jordan to a wider home and international audience. Jordan has a heritage of great breadth, depth and quality. Relatively little of it is well-known beyond the handful of well-familiar sites. It is undoubtedly necessary to develop Petra and Jarash but there is much more to the archaeology of Jordan. Not just the implications of c. 25,000 sites — or the many more in reality that figure implies — but the scores, hundreds of others of good preservation which should be part of the consciousness of everyone interested in the cultural heritage of Jordan. A step in that direction was taken in the recent flights with the photographing by myself and Dr Robert Bewley of the Air Photographic Unit of the RCAHME of some 200 sites. Sites were selected of every period, type and in every corner of the country, from prehistory to the glories of the Islamic centuries. The examples here are samples of those which will go to illustrate a profusely illustrated book, *Ancient Jordan from the Air*, which will provide air photo, interpretative diagram and short text. The book will be, at different levels, advertisement of Jordan’s archaeological treasures, guide book, tourist memento, and academic resource.



5. Maps illustrating the different patterns of site distribution around Colchester in Britain. (a) sites as known from random investigation; (b) the pattern following a period of intensive and systematic flying (from Jones and Mattingly 1990: Map 7.25).

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