

New Agendas in Remote Sensing and Landscape Archaeology in the Near East

Studies in Honour of Tony J. Wilkinson

edited by

Dan Lawrence, Mark Altaweel and Graham Philip



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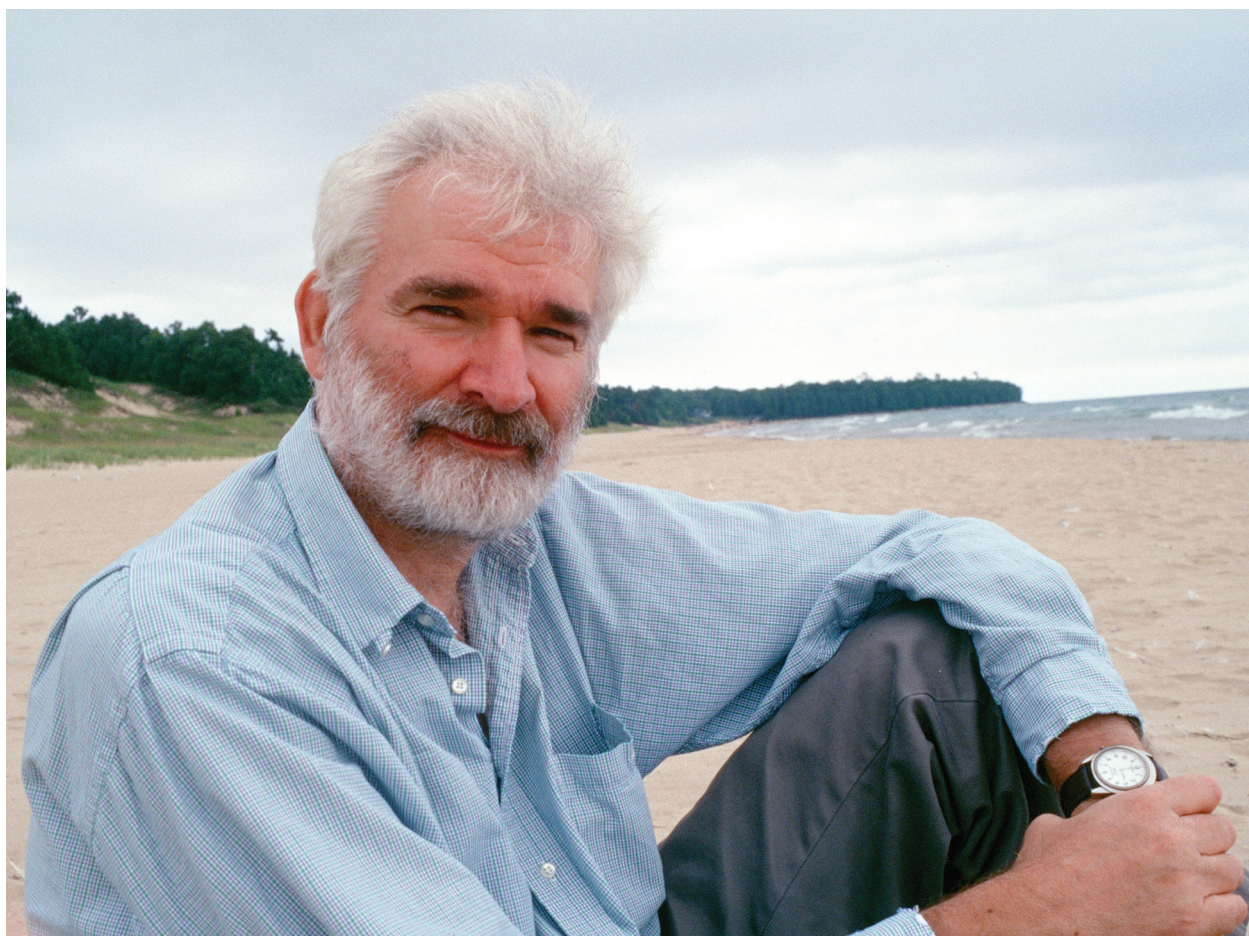
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Cover illustration: Palaeochannels and archaeological sites north of Nasiriya, Iraq. A. SRTM image
B. Landsat Image C. Features visible on SRTM D. Features visible on Landsat. For full explanation see
Chapter 18

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Tony J. Wilkinson
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List of Contributors

Badir Albadran, *Department of Geology, University of Basra*
Mark B. Allen, *Department of Earth Sciences, Durham University*
Mark Altaweel, *Institute of Archaeology, University College London*
Jennie Bradbury, *Department of Classical and Near Eastern Archaeology, Bryn Mawr College*
Michael Brown, *Institut für Ur- und Frühgeschichte und Vorderasiatische Archäologie, Heidelberg University*
Jesse Casana, *Department of Anthropology, Dartmouth*
Emma Cunliffe, *School of Arts and Cultures, Newcastle University*
Naghham Darweesh Al Hawi, *Department of Geology, University of Basra*
McGuire Gibson, *Department of Near Eastern Languages and Civilizations, University of Chicago*
Michelle de Gruchy, *Department of Archaeology, Durham University*
Kristen Hopper, *Department of Archaeology, Durham University*
Carrie Hritz, *SESYNC*
Marco Iamoni, *Department of Humanities and Cultural Heritage, University of Udine* as for Morandi Bonacossi above
Jaafar Jotheri, *Archaeology Department, University of Al-Qadisiyah, Al Diwaniya, Iraq and Earth Sciences Department, Durham University*
Eva Kaptijn, *BArEO-project, Royal Belgian Institute of Natural Sciences*
Dan Lawrence, *Department of Archaeology, Durham University*
Camille Lecompte, *CNRS-Université Paris 1*
Anke Marsh, *Institute of Archaeology, University College London*
Daniele Morandi Bonacossi, *Department of Humanities and Cultural Heritage, University of Udine*
Jebrael Nokandeh, *Director of the National Museum of Iran, Tehran and Research Fellow, Research Institute of Cultural Heritage and Tourism (RICHT)*
Hamid Omrani Rekavandi, *Iranian Cultural Heritage, Handicraft and Tourism Organization*
Graham Philip, *Department of Archaeology, Durham University*
Jennifer R. Pournelle, *School of Earth, Ocean, and Environment, University of South Carolina*
Rune Rattenborg, *Department of Linguistics and Philology, Uppsala University*
Louise Rayne, *EAMENA Project, University of Leicester*
Sébastien Rey, *Iraq Emergency Heritage Management Programme, British Museum*
Eberhard W. Sauer, *School of History, Classics and Archaeology, University of Edinburgh*
Stefan L. Smith, *Department of Archaeology, University of Ghent*
Elizabeth C. Stone, *Department of Anthropology, Stony Brook University*
Eleanor Barbanes Wilkinson, *University of California, Berkeley*

Preface

Eleanor Barbanes Wilkinson

This volume of collected papers has been produced in honour of Tony Wilkinson (T. J.), who was Professor of Archaeology at Durham University from 2006 until his death on 25 December 2014. Many of the papers in this book were presented at a workshop, organised by Mark Altaweel, Dan Lawrence and myself, at the annual conference of the British Association of Near Eastern Archaeologists (BANEA) at the University of Reading, held on January 10th, 2014. At that time, Tony had been active in archaeology for almost 45 years, and his career had included fieldwork in Britain as well as the Near East (see French 2014 for a summary of Tony's archaeological work in Britain). Tony's 65th birthday was fast approaching, and as we knew then that Reading would likely be his last BANEA conference that milestone provided a convenient focus for celebrating the enormous impact Tony had had upon Near Eastern archaeology. The dialogue initiated in the BANEA workshop is continued and enlarged in this publication. Though this volume is commemorative in concept, the workshop was intended to explore emerging agendas in remote sensing and the ways in which innovative tools, techniques and theoretical approaches can be applied to resolve challenges within the framework of landscape archaeology. Following the example set by Tony in his own career, the authors collectively demonstrate the importance of an interdisciplinary approach for understanding the impact of human activity on shaping the landscape and, conversely, the profound effect that landscape has on sociocultural development.

Tony was a true pioneer in remote sensing applications in archaeology, and the theme of this volume highlights that aspect of his research. Through his creation of the CAMEL (Centre for the Archaeology of the Middle East Landscape) lab at the Oriental Institute in Chicago during the 1990s and his subsequent establishment of Durham University's Informatics Lab, Tony built up a large cohort of researchers who are applying similar techniques of remote sensing to answer research questions in archaeology. Much of the research in this book emanates directly from ideas and techniques which were originally incubated under Tony's creative oversight in the collegial and democratic environments of those two remote sensing labs. Many of the authors in this volume have benefitted from time spent in one of these two research centres, or have utilised data generated within them. In general, contributions were invited from practitioners of regional survey who are

actively exploring archaeological issues in the Near East on a broad scale, addressing archaeological landscape contexts and issues beyond a single site, as did Tony himself.

In addition to papers from colleagues who were leading major research projects with Tony (Gibson, Philip, Sauer), the content in this volume includes work from a number of archaeologists who are establishing groundbreaking new trajectories in the field, whose work Tony followed with great interest (Iamoni, Kaptijn, Morandi, Pournelle, Rey, Stone). In the period leading up to the BANEA session, Tony held a leading role in five major projects, including the Fragile Crescent Project, Modelling Ancient Settlement Systems (MASS), Land of Carchemish, Persia and its Neighbours, and the Tripillya Project. Regionally, these projects encompass Iran, Iraq, Syria, the Levant, the Caucasus and Eastern Europe. For the sake of thematic cohesion, the regional parameters of this volume have been limited to projects within greater Mesopotamia, although this means Tony's significant work in Arabia (see Kennet 2015) and Tripillya Project have been omitted. A number of papers in this volume have been contributed by some of Tony's students at Durham University and the University of Edinburgh who were at the time approaching, or had recently completed, their PhDs (Bradbury, Brown, Cunliffe, de Gruchy, Hopper, Jotheri, Lawrence, Rattenborg, Rayne, Smith), as well as former University of Chicago students, now academics themselves, whose research is taking the field in new directions (Altaweel, Casana, Hritz). Certainly, one of the most enduring features of Tony's legacy will be the fact that he launched an impressive generation of scholars now forging unchartered intellectual pathways and exploring new agendas in regional survey through the application of geospatial technologies.

In many ways, Tony's entire approach to the landscape was shaped by his childhood in England, spent walking, fishing, and generally wandering happily within the green and open landscapes of Essex and Wiltshire. As a teenager, he would often ferry across to Ireland or hike up through the wilds of Scotland, spurred on by some particularly beguiling bit of landscape depicted on an ordinance survey map. His undergraduate thesis dealt with the sequential development of the upper Thames River system, revealing an early awareness of the need to integrate water and climate into any reckoning of the archaeological landscape. In the UK, where public

right of access to the countryside remains a staunchly defended privilege for everyone, the close association between people and the landscape has deep historical resonance, and this constant engagement with the British countryside seems to have shaped Tony's personality as much as it did his career. In preparing for any trip, either across the globe or across town, he always began by looking at a map of the place, preferably one with topographic contours. He resisted using a GPS in our car; he was a superb navigator, and anyway he considered map reading to be a necessary skill, not to mention an enjoyable one.

As Mac Gibson mentions in his Introduction to this volume, to walk or drive through any landscape with Tony was truly wonderful. Whether in Iraq, Northumbria, or on the streets of Chicago, to share Tony's experience of any outdoor environment was to perceive the world in a way that was always thought provoking, but also frequently hilarious. He had a lovely sense of humour which, combined with his passion for unexplored places and an impressive indifference to the challenges of travelling in far-flung places, guaranteed us a life filled with adventure, friends and purpose. Those of us who were fortunate enough to have worked with Tony in the field know that his insights and observations, often delivered quite casually, were uniquely perceptive and often quite profound. He gave excellent advice. A good friend of Tony's once said of him that he wore his wisdom lightly, and it is true that it was almost impossible not to accept his side of any argument, since it was usually backed up by compelling evidence, and never delivered with arrogance or condescension. Tony achieved a tremendous amount in his brief life, and he has blazed a brilliant trail for others to follow. A student of his once observed that Tony's brilliance wasn't only that he taught archaeology well; it was that he taught people *how to be* as an archaeologist. No doubt everyone who knew Tony would agree with her.

As a mentor, Tony was a magnetic force. His students and colleagues relied upon his boundless enthusiasm and generosity, and he took real pleasure in others' success. He had a unique way of being both confident and self-deprecating at the same time, a quality which attracted many and endeared him to everyone he met. He was a rock of dependability, a perpetual optimist, and just a good soul. Tony and I were married in 1995, and it was my joy and privilege to walk beside him every day for almost 25 years. Though not a landscape specialist, I am an archaeologist and I worked with Tony in Syria, Turkey, Yemen, and Morocco. Writing both as Tony's wife and as his colleague, I can think of no archaeologist more worthy of emulation and no person in Near Eastern archaeology more deserving of the honour offered here by the eminent scholars who have joined together in this publication. This collection of new research opens up an exciting discourse in remote sensing and landscape archaeology, and it is a substantive and fitting commemoration of Tony's long and distinguished career.

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Introduction

McGuire Gibson

Tony Wilkinson transformed, in fundamental ways, our view of Near Eastern landscapes, and therefore of ancient society and economy. With his rare combination of a keen intellect, superior management skills, and an ability to find enjoyment not only in his work but also in good company, he was able to adapt to a great variety of situations. His archaeological fieldwork included innovative projects in Canada, Britain, Greece, Iraq, Syria, Yemen, Oman, Saudi Arabia, Lebanon, Turkey, Morocco, and Iran. This record is astonishing, given that survey can too easily be taken for espionage, and it is a mark of Tony's diplomatic skills, as well as the seriousness with which he was viewed by the authorities in those countries that he was able to accomplish so much. He had an ability to work with anyone, to truly collaborate with scholars in those countries and other foreign researchers working there, as well as training a generation of students to carry on the work. He was a model in publishing his results in a timely and comprehensible way, and was able to envisage new approaches to our field, such as agent-based modelling, and to fashion projects to address the issues involved.

But Tony would have been the first to say that, although he transformed the field of landscape study, he stood in a long line of innovators who made his work possible. For the Near East, the roots of landscape study are ancient, with some of the earliest attempts at mapping found on clay tablets, and with Greek and other ancient writers like Xenophon describing what they witnessed. Arab geographers (Le Strange 1895) added detail, often on the basis of second-hand accounts, which can be assessed for veracity only after you have made a study on the ground.¹

As early as the 17th Century, European travellers, passing through Syria and Iraq, often on their way to or from India, published valuable accounts. And diplomats and representatives of British or French trading companies resident in Aleppo, Damascus, Mosul, Baghdad and Basra often described the areas in which they lived. But the beginning of serious work on the Iraqi landscape has to be assigned to Claudius James Rich, who studied definitively located Babylon (Rich

¹ When doing my survey around Kish, I found that only Ibn Khordadbeh, among the five Arab geographers who described the area, had actually been there, as was made clear by details he gave of the Nil Canal, its settlements, and the offtakes from it.

1822) and made detailed maps of portions of Iraq and Iran in the early 1800s.

Although done for strategic and commercial purposes related to finding a quicker way to India, the attempt in 1835–37 by Francis R. Chesney (1850; 1868; Guest 1992) to prove the navigability of the Euphrates was a milestone in regional geography. Chesney transported two steamboats in pieces from England to the Levant coast and then to the Tigris, where they were assembled. One boat foundered, but the other made it with difficulty to Basra. His team included cartographers and naturalists, and one of the results was the detailed mapping of the area bordering both banks of the river.

The Bombay government sent British military officers to Iraq throughout the 1840s and 1850s, with the purpose of mapping as much of the country as possible. James Felix Jones created the first good plan of Nineveh and surveyed large parts of Assyria, as well as other areas along the Tigris. T. K. Lynch, W. B. Selby, W. Bewsher, and C. Collingwood mapped most of southern Iraq, but their results were not published until the German geographer, Heinrich Kiepert (1883) combined them with maps by French scholars, such as J. Oppert (1863), who were also beginning to do surveys. The Kiepert map is an invaluable depiction of the state of the landscape of southern Iraq, with its extensive deserts and marshes dotted with hundreds of tells and huge, dead Islamic canals.

In the early 1850s, A. H. Layard (1853) and W. K. Loftus (1857) made forays into the desert of the south, leaving accounts of conditions and the exploration of sites in the area. Much later, at the turn of the century, Koldewey and Andrae, as an adjunct to their excavations at Surghul (Nina) and Fara (Shuruppak), made a short survey locating major sites down to and including the Lagash area (Andrae 1902; Koldewey 1997). More systematic and larger was another German project in 1907–08, the mapping of Islamic canals and sites in Syria and Iraq, especially the mapping of the Nil Canal, by F. Sarre and P. T. Herzfeld (Sarre and Herzfeld 1911–20). This work was a major step in survey for archaeological/historical purposes.

Tied to survey is aerial observation and photography. Armies had used balloons to observe military operations

since the French began the practice at the Battle of Fleurus in 1794. Balloons came into widespread use in battle during the American Civil War of 1861 to 1865. Nader took the first photographs from a balloon over Paris in 1858, and kite photography was pioneered by E. D. Archibald in Britain in 1882, but it was with the introduction of the airplane during the First World War (1914–18) that aerial photography came into its own. Allenby, in 1918 in Palestine, is given credit for ordering the air wing to use photographs to correct maps of Turkish positions, but there are a good number of maps of Iraq, made with air photography, that date to about the same time. The British in the 1920s carried out ground surveys of the entire country of Iraq, and it is those maps that still served as the cartography of the country until the introduction of satellite imagery.²

Not far behind the military in the early use of aerial photography were the archaeologists and epigraphers. In the early 1920s, James Henry Breasted took photos of Egyptian sites from RAF planes shortly before the French Jesuit aviator, Antoine Poidebard, began his systematic recording of the remains of the Roman *limes* and dozens of sites across Syria (e.g. Poidebard 1934). Aurel Stein also used aerial photography in his research. But the most impressive aerial project is arguably Erich Schmidt's documenting of hundreds of sites in Iran during the 1930s (Schmidt 1940).

The first real systematic archaeological ground survey in the Near East was, as far as I can determine, that of Thorkild Jacobsen, who began to map and collect pottery on tells in the Diyala region around the four major sites being excavated by the Oriental Institute. His research aimed to create a history of settlement based on the notion that all sites had to be located along the rivers and canals in that area, and that the pottery found on the surface would date the occupations. In 1936, Robert J. Braidwood, as a graduate student on Chicago's Amuq expedition (Director, Calvin McEwan), carried out a systematic collection and mapping of sites in that area, resulting in his doctorate and a groundbreaking book. In Northern Iraq and Eastern Syria, British archaeologists, e.g. Max Mallowan and Seton Lloyd, and later David Oates, were conducting surveys of sites preparatory to, or as an adjunct to, major excavations.

The development of archaeological survey techniques in the Near East was stimulated by survey work in the Americas, most notably by A. L. Kroeber and others in Peru, beginning in the early 1920s. G. R. Willey's Viru Valley Project in the years immediately following

the 2nd World War (Willey 1953) brought a greater degree of rigor to the process that was emulated by archaeologists, most notably Robert McC. Adams in the Near East.

Adams, of course, is a key figure in settlement archaeology, with his work in Iraq, Iran,³ Saudi Arabia, and Mexico. His greatest contribution was made in southern Iraq, where, from 1957 to 1975, he put on the map more than 3000 sites. His initial work, while still a graduate student, was a survey of Akkad (Adams 1972), followed closely by the survey of the Diyala Region in 1957–58, which was part of a larger project led by T. Jacobsen and F. Safar (Jacobsen 1958; Jacobsen and Adams 1958; 1965). In that project, the multi-disciplinary team tested the hypothesis proposed by Jacobsen in his initial survey in 1933, with contributions from geomorphologists and other technical specialists. In the Diyala Project, for the first time, Adams had access to aerial photography, in the form of mosaics. Adams later carried out the Uruk Survey in the 1960s (Adams and Nissen 1972) and the Nippur Survey in the 1970s (Adams 1981). For these last two surveys, he had the use of air photographs, done on contract for the Iraqi government by KLM in 1957, in addition to maps. In 1966, when I was carrying out the Kish Area Survey (Gibson 1972), I was allowed to buy maps and air photos of the entire area from Baghdad to Nippur. Adams, at the same time, bought the same kind of coverage for the area from Nippur to Basra. I am not certain if Henry Wright, who was doing his Eridu Survey in the same year (Wright 1959; 1981), had access to air photographs. We were able to buy the maps and photos on the condition that we left the maps and photos in the offices of the Directorate General of Antiquities. In subsequent years, due to a shift in government and heightened security, it proved to be difficult to gain access to these materials, although not impossible. When the Iran-Iraq war began in 1980, security police removed them from the Antiquities office and we never recovered them.

The salvage operations in connection with the Tabqa Dam in Syria in the late 1960s forced scholars to take an interest in the assessment of major areas and not just sites. The dozens of excavations were important, especially the eye-opening Uruk settlements, but putting all sites in context was equally important, beginning with the surveys that were carried out as a preliminary step. The later salvage projects in the Khabur and the Tishrin areas of Syria in the 1980s added to the stress on entire areas. But most often, surveys up to that time were done from automobiles, stopping

² Later, Arabic versions were made of the maps, and in the 1930s, Germans created a set. Map collections in libraries around the world often cover Iraq with bits and pieces from all three sets. In the 1970s, a Polish team had a contract to re-survey the country and they set up new benchmarks in many places, but I have never seen any output from that project.

³ Adams' work in Iran was followed up by his students, Frank Hole, Kent Flannery, Henry Wright and Gregory Johnson, and later by their students, but there were other researchers doing survey in that country, especially those connected to Robert Dyson of the University of Pennsylvania and the French team centred on Susa.

where a site was obvious or marked on a map, or visible on an air photograph,

It was in this atmosphere, in which the Syrian Antiquities service encouraged survey, that Tony Wilkinson entered the picture and altered survey in a major way. He had already worked out his method, nicely illustrated for me in the 1980s in the North Jazira Project associated with the Tell al-Hawa excavations in the Eski Mosul Dam Salvage area. He also carried out survey around Abu Salabikh in the south. At that time he was the Assistant Director of the British School of Archaeology in Baghdad.

In the 1990s, when the Sanctions on Iraq made it impossible for the British School to continue functioning in Iraq, he took a research position at the Oriental Institute of the University of Chicago. In that position, he initiated, or participated in, numerous projects in Turkey, Syria, Yemen, and elsewhere. Sometimes as a side project of an excavation, Tony would enter an area and usually with a student or two, he would do a survey that did not just find sites, but laid out the ecological history of the area. His work in the Balikh Valley, around Tell Beydar, and Hamoukar has allowed the reconstruction not only of the settlement history, but also the communication routes over a vast area from the bend of the Euphrates to the vicinity of Mosul (see Ur 2010 for summary of results and bibliography).

Essential to all current landscape work by hundreds of archaeologists around the world is the availability of satellite imagery and GIS.⁴ By the early 1980s, large-scale images were available for broad-scale issues, for instance Adams' use of a Landsat image to derive a plan of ancient levees in southern Iraq (Adams 1981: fig. 6), and, in time, more detailed, multi-spectral images for smaller areas became available, but usually at some cost. A real breakthrough came with the release in the early 1990s of the CORONA images. These were cheap, easily bought, and would allow a comparison of landscapes as they were in the 1960s and 70s with the landscape visible in current images. For much of the Near East, these early images have proved invaluable because many of the areas have undergone massive change through agricultural, industrial, and urban development.⁵

⁴ See Hritz 2014 for an authoritative, detailed account of the evolution of landscape studies and the role of aerial photography, cartography, and GIS/satellite imagery.

⁵ It is not generally known, but Bob Adams had a key role in having the CORONA images declassified. While he was Secretary of the Smithsonian Institution, he was seated at a dinner next to James Woolsey, then head of the CIA. When asked about his research, Adams told Woolsey about his surveys, and said that he had come to a halt in interpreting ancient settlement patterns because he no longer had access to air photographs. Woolsey then told him about the CORONA images, which were so obsolete that they were useless to the military or intelligence agencies. He said he would see what he could do. Adams told me about this at the time, and when the CORONAs were

Under Wilkinson at Chicago, dozens of students were introduced to landscape analysis, and many have made major contributions to the field, including the use of images to locate ancient routes and water control devices in Assyria (Altaweel 2003; Ur 2005), and to map potential sites in areas where ground-truthing is not yet possible (Altaweel 2006; 2007; Hritz 2006). With satellite images, they were able to verify or correct the positions of sites located by triangulation in earlier surveys by Adams, Wright, and me in the south and by Iraqi archaeologists in the north. The addition of several thousand other probable sites, by Altaweel in the north and Hritz in the south, enabled us to create a database that was put on a 'no-strike' list during the war of 2003. This database continues to be monitored for signs of destruction from looting, military action, and industrial or agricultural incursion. Carrie Hritz and Katharyn Hanson, along with Emma Cunliffe and Michelle de Gruchy at Durham, are continuing to monitor Iraq while expanding the analysis to Syria.

Wilkinson's generosity to students has resulted in numerous dissertations at Chicago, Edinburgh, and Durham. But his influence is much more widely spread through his articles and his book on archaeological landscapes in the Near East (2003), and through CAMEL, the remote sensing lab he established at the Oriental Institute. Under the directorship of Scott Branting and Emily Hammer, CAMEL has expanded its holdings and has become an international resource as well as a training facility. Scholars who have not studied under Wilkinson have still been influenced by him, and have made major contributions by following his lead, e.g. Simone Mühl's dissertation/book (2013) on a huge survey in the Kurdish area of Iraq. But his influence continues to grow through his former students at Chicago and Edinburgh who are now teaching and graduating other landscape specialists, making landscape study one of the most productive sub-areas of archaeology. In addition, his students and former students from Durham have been activated to carry out a variety of projects, many springing from Wilkinson's Fragile Crescent Project.

Although the regions open to any kind of research have shrunk drastically in the past three years, analysis of images can still proceed. The current burst of archaeological activity in the Kurdish region of Iraq includes major surveys by Altaweel and Mühl near Sulaymaniya, by Ur around Erbil, by Şerifoğlu and Casana in the upper Diyala, and by other teams in other areas, all of which are just beginning to be reported in print.

made available, I phoned him to thank him. He was not aware that they had been declassified, but immediately began to put in orders.

Wilkinson's method has always centred on intensive, walking survey, examining sites in relation to the geology and geomorphology and to living and dead streams, and the collection of sherds not just on sites, but in the areas around them, to give an approximation of the agricultural sustaining area. His work on hollow ways is important. He brought a heightened level of observation, data collection, and new questions to ask of the material. His conclusions were so convincing that you wondered why we hadn't all seen them before. He never stood still, but instead went on to new questions and new methods, seeking answers to ancient demographic trends, local and interregional trade, development of complex societies, etc. It was his vision that saw the potential in creating an agent-based model for ancient Mesopotamia, and a great start was made toward that goal, as is reflected in the book that resulted (Wilkinson *et al.* 2013). His more recent research on the northeastern frontier of Iran and his involvement in documenting damage to archaeological sites in Syria reflect his commitment to intriguing and/or critical issues.

To walk or even drive through a landscape with Tony was a great experience, and I have done this in Iraq, Yemen, and Syria. We may think that we know a lot about an area, but Tony's training in the earth sciences gave him an ability to read a landscape the way most archeologists do not, seeing a Pleistocene terrace when we see only a rise or a ridge.

In Yemen, the intricate pattern of mountains and terraced slopes required different approaches to those used in Iraq or Syria. Even with very good quality air photographs and maps, it was not easy to see sites. After talking to local people and clambering up to the top of several mountains, he began to correlate what he saw with what was visible on the photos, and was able to recognise which would reward the climb and which would not. That particular field experience was punctuated by political events, and our initial survey season included one night in which, after we had gone to bed in the Potato Project in Dhamar, we were awakened by artillery shells passing over us in both directions. Initially, we thought it was just another wedding, but it became clear that the camp of northern soldiers to the north of the town and the camp of southern soldiers to the south were discussing the benefits of the unification of the country that had taken place a year or so before. The next morning, we prepared to leave for Sana'a, but our Yemeni co-director came in and said everything was fine, so we went out for the day's survey, passing the southern camp, where soldiers were coming out to buy bread from shops across the street. That night, we heard more gunfire, and thought the fighting had started up again, but that did turn out to be a wedding. A few days later, when we ended our season, we arrived

in Sana'a to find out that the civil war had broken out that morning, and that the first action had been in Dhamar, with the southern troops leaving their camp and moving around the town, blowing up the local power substation, and then heading east and south toward Aden. We returned a year later to continue the work.

In all the areas I have worked with Tony, I was struck by his quickness to discover the best place to look for a specific answer. I was confident, as a dig director who had to pay the bill for a backhoe, that the cuts we made would produce results because Tony had decided where to locate them. Tony was quick to seize any opportunity to examine dirt. In the 1980s, while at Nippur, I decided to take the crew to visit Umm al-Hafriyat, a site I had dug in 1977 out in the desert to the east. We found the desert much changed, with a huge berm around a newly revived Delmaj marsh, and a tremendous ditch, 7 metres deep and about 20 metres wide, running northwest to southeast for many kilometres. We also ran into an Antiquities team carrying out a salvage operation on a small site in the projected path of the ditch. No one had told us that any of this was happening. But it was obviously the realisation of a project to desalinate the alluvium, first proposed under the Ottomans by Willcocks (1917), and planned in detail by an American engineering firm in the 1950s. Only the northern part of the programme, the Mussayib Project, was finished by Dutch engineers before the Revolution of 1958, and through the next three decades nothing more was done; the Mussayib portion was being used only as an irrigated area, and was progressively salting up. In the 1970s, a Greek company began to cut the subsidiary drains that were meant to bring the salty water from the fields to the main drain, which was scheduled to be done but was not completed at that time.⁶ Having seen the cut for the main drain, I quickly went to Baghdad to see Tony and say that we had a fantastic opportunity to examine the alluvium in a way that had never previously been possible. He returned with me and for one day we drove north up the cut, stopping to observe the profiles, recording one site four metres down that yielded a C¹⁴ date and a couple of sherds that indicated a small Ubaid village, completely buried. Unlike Ras al-Amiya, which was discovered by the cutting of a drain in the Mussayib Project (Stronach 1961), this site had left no sign on the surface. We also ran over an ancient, sand filled river course that was located in the bottom metre of the trench, coming from one side of the cut to the other, and then back again. This did not appear to be as big a course as the one passing through Umm al-Hafriyat and Adab, as mapped from air photographs by Adams during his Nippur Survey (Adams 1981: fig. 21), but it must be related. When we were digging Umm al-

⁶ The Iran-Iraq War came, and the Third River was not cut until the 1990s, and even then most of the drains were not linked.

Hafriyat in 1977, we could easily see, north of the site, the meanders that Adams had mapped. They were easily visible, not as differences of soil on the surface, but as an extensive, meandering grove of tamarisk bushes that were sending down deep roots into the old riverbed. Stephen Lintner, a geomorphologist who worked with us, sank a pit in the middle of the tamarisks, but at six metres he had not hit the streambed and was forced to quit because it was becoming dangerous.

Everyone who has ever had the privilege of working with Tony has similar stories to tell. He made us think in ways we would not necessarily have done. Every project he cooperated on was improved, and his own projects were truly innovative. We have all appreciated his intelligence, his decisiveness, his calm assessment of a situation and his ability to cope with adversity. Administrators valued his grant-writing abilities, and his financial scrupulousness. We all enjoyed his good humour, and even his love of the Blues. Not many archaeologists can say that they have played harmonica with Buddy Guy.

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