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REVISITING THE SEALANDS: REPORT OF PRELIMINARY GROUND RECONNAISSANCE IN THE HAMMAR DISTRICT, DHI QAR AND BASRA GOVERNORATES, IRAQ[1]

By CARRIE HRITZ, JENNIFER POURNELLE *and* JENNIFER SMITH

The flourit of early Sumerian civilization in southern Iraq marked a degree of economic differentiation, socio-political complexity, and urbanization previously unseen in the ancient world. This article reports the results of recent geo-archaeological investigation of three complementary resources in southern Mesopotamia that are thought to have offered an ecological advantage, thus laying the economic foundations for these developments: (1) expansive irrigable plains; (2) vast pasture lands; and (3) the littoral resources of levee back swamps/deltaic marshes. Focusing on the area of the Hawr al-Hammar marshes, the authors conducted preliminary archaeological, geological and landscape investigation over the course of 18 days in the autumn of 2010, funded by a U.S. National Science Foundation High Risk Research in Physical Anthropology and Archaeology grant.

Introduction

While northern Mesopotamia had also begun to urbanise by the onset of the fourth millennium B.C., proto-Sumerian civilization in southern Iraq exhibited a degree of economic differentiation, socio-political complexity, and urbanization previously unseen anywhere in the ancient world. The processes that began at that time culminated a millennium later in the formation of a powerful, persistent city-state system across southern Mesopotamia. Based on latter third millennium B.C. texts and twentieth-century ethnographic analogy, scholarly discussions of the economic underpinnings of these events have long emphasized three complementary natural resource pillars: (1) expansive irrigable plains in the northern portion of the Tigris-Euphrates alluvium; (2) vast pasture lands within and beyond the alluvial margins, extending into the eastern mountain foothills of the Zagros; and (3) the littoral resources of levee back-swamps throughout the irrigable plains, persistent lakes and marshes formed within the inner delta of the Tigris, Euphrates, and Karkheh/Karun river systems, and the outer deltaic estuaries where those rivers debauch into the head of the Arabian-Persian Gulf (Adams and Nissen 1972; Adams 1978, 1981; Postgate 1994; Rowton 1973a and b). Throughout most of the twentieth century, however, scholarship focused primarily on investigating the first two pillars of this economy—the expansive and complex irrigated agricultural system, plus activities related to pastoralism.

Beginning in the 1960s, thirty years of archaeological survey, excavation, and textual analysis built up an image of a southern Mesopotamian landscape dominated by river and irrigation channels, presumably associated settlements, and nascent irrigated field systems (Liverani 1996). Partly due to assumptions about the primary role of irrigation agriculture and animal husbandry in the rise of complex societies, and partly due to sheer inaccessibility, until recently the third pillar of the economy—that of marsh, estuary, and marine resources—was left largely unexplored (Pournelle 2003; Algaze 2008; Eger 2011; Pournelle and Algaze 2012). However, over the past decade or so, the growing availability and utilization of increasingly high resolution, low cost satellite imagery (Hritz 2005, 2010; Kouchoukos 2001; Pournelle 2003a, 2006, 2007, 2012; Ur 2003); a new generation of Sumerological and Assyriological work on proto-cuneiform and cuneiform texts related to wetland resources like reeds, pigs, fish, fowl, and trees (Potts 1997: 106–15; Englund 1998;Boehmer 1999: 51–56, 66–67, 71–74, 90–104; Molina and Such-Gutiérrez 2004; Scharlach 2004;Wilcke 2007: 115–21; Widell 2009; Firth 2011; Heimpel 2011); and published archaeological investigations both

[1] Conducted September 11–22, 2010 under NSF-HRRPAA Award # 1045974, with permission from the Iraq State Board of Antiquities and Heritage (SBAH), and the Iraq Ministries of Culture, Interior, and Tourism. We are especially grateful to: SBAH Director Quais Hussein Rasheed and SBAH representatives from Dhi Qar and Nasiriya for their support; Sheikh 'Ali ibn Muhammed al-Ghizi and Dhaif Muhsen Al-Ghizi, Site Curator of Ur, for their hospitality, support, and guidance; and to the Iraq Ministry of the Interior for providing police escorts within each governorate and city district.

within Iraq and in adjoining areas of Iran and Kuwait (Huot 1999: 30; Pollock 1999: 83; Pournelle 2003b, tables 13–15; Carter and Crawford 2001; Gasche 2004, 2005, 2007; Carter 2006), have begun to fill this gap. They emphasize the existence, preservation, and importance of paleoenvironmental and archaeological evidence for this littoral third pillar, and the necessity of including these factors into models for the rise of urban complexity in ancient Mesopotamia (Pournelle and Algaze 2011). Following a twenty-year hiatus in foreign archaeological field work in Iraq, we present herein preliminary results of a U.S. National Science Foundation-funded geo-archaeological ground reconnaissance of the Mesopotamian delta, intended to launch explicit, rigorous investigation of the relative contributions of all three economic pillars to the genesis and long-term viability of the oldest and longest-lived urban heartland in the ancient world.

Models for urban hinterlands

Twentieth-century models attempting to explain the rise of social complexity and urbanization in southern Mesopotamia focused on integrating data sets derived from excavation and archaeological survey conducted within the alluvial plains lying between the present-day courses of the easternmost branches of the Euphrates River, and the westernmost branches of the Tigris River. During the decades of large-scale surface survey, conducted from the 1960s through the early 1980s, because of the impediments to ground visibility and travel imposed by crop cover, irrigation channels, and perennial wetlands, foreign surveyors excluded from scrutiny both the agricultural belts along and outside these boundaries, and the vast, southeastern system of interconnected marshlands and lakes known as the Awhar. Nevertheless, the data from this era, supplemented by a few, limited excavation exposures, covers approximately one-third of the alluvium (Adams 1967, 1981; Adams and Nissen 1967; Gibson 1972; Wright 1981) (Fig. 1).

This data has been used to model changes in settlement patterns, agricultural regimes, architectural forms, social complexity, and political economy from the earliest sixth millennium B.C. (Ubaid 0) farming settlements (Huot 1989) to the world systems inhabited by competing polities in the urbanized landscape of the fourth millennium B.C. (Algaze 1993, 2001, 2008; Pollock 2001). The earliest *visible* settlements on the alluvium appear to cluster in the extreme south, but this may well be an artefact of a combination of selective recording of excavated material, limited excavation to earliest occupation levels, survey methodology (conducted by driving from mound to mound across the paper-flat plain), and highly variable aeolian deflation (and therefore variable surface exposure of early materials) (Pournelle 2003b: 137–209). The known Ubaid 0–Ubaid 5 farming villages of the southern alluvium, which span approximately two millennia of occupation levels, are uniformly located atop Pleistocene-era turtlebacks, average less than 10 ha. in size, and are presumed to have supported relatively low permanent populations (Wright 1981; Huot 1989; Sanlaville 1989; Pournelle 2007).

Whether as an artifact of exposure or as an empirical reflection of change, the surveys indicated a significantly different settlement pattern beginning in the fourth millennium B.C. Rather than the isolated clusters atop turtlebacks characteristic of Ubaid period settlements, by the Early Uruk settlements were dispersed throughout the alluvium, and could be mapped in linear patterns along what were presumed to be relict branches of the Tigris and Euphrates Rivers (Pollock 2001: 191–92). More and larger sites were visible as surface scatters, some approaching genuinely urban scale (20 ha. and above). Notable among these was Eridu, at 40 ha. This transformation of settlement pattern is argued to be the result of a confluence of various political, social and economic factors, including new forms of labor control and organization, techno-ecological innovations in irrigation, the development of networks of hybrid, natural and artificial canal systems, and mass production of commodities, including ceramics (Adams 1981; Algaze 2008).

Evidence from excavation on the plain is patchy, given the deep burial of some relevant layers, and aeolian erosion of others. However, synthesis of extant excavated material suggests that the populations of what became ancient Sumer had a powerful ecological advantage over their northern neighbors (Algaze 2001, 2008; Pournelle and Algaze 2011). Unlike the farmers and pastoralists of the rain-fed northern plains, those of the southern alluvium drew substantial wealth and transportation advantages from their fluvial environment. First, they lived, not in a fragile steppe-land affected by a high degree of interannual variation in rainfall (characteristic of the northern

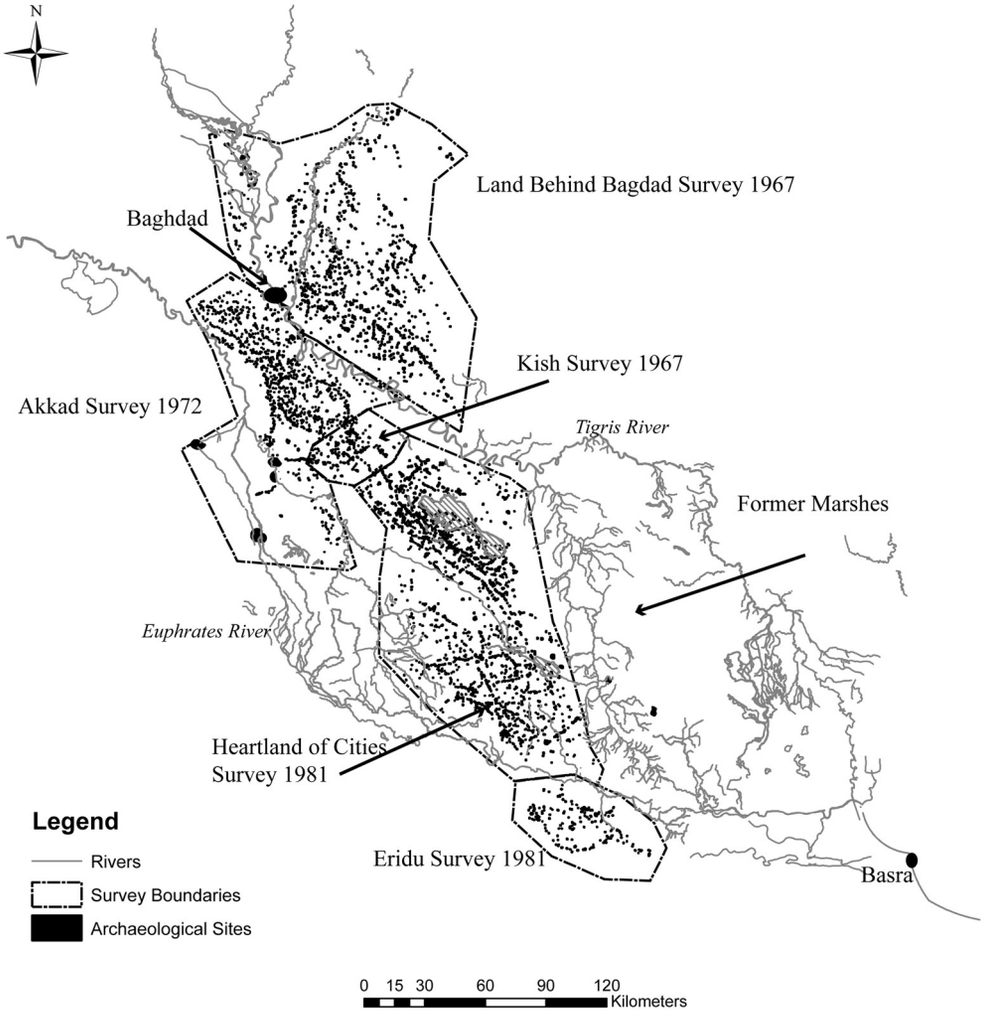

Fig.1 Archaeological sites surveyed 1950s–1980 (Adams 1981; Adams and Nissen 1972; Gibson 1972; Wright 1981).

Mesopotamian plains), but in a prograding deltaic system marked by branching river channels (Pournelle 2003a, 2003b). The advantage of this system, through cycles of climatic variation, was that it periodically renewed varied and abundant resources that the early urban dwellers of southern Mesopotamia were adept at exploiting. Second, it provided them with waterborne lines of communication that gave them an exponential advantage in the range and volume of goods they could transport, particularly in comparison to the overland transport costs of the north (Algaze 2008). Finally, the existence of a marsh environment just to the south of the arable plains afforded early inhabitants access to a wide range of subsistence resources such as fish, fowl, and diverse vegetation. Pournelle and Algaze (in press: 2013) argue that the ecological and transportational advantages offered by this ecotone played a key role in the rise and longevity of this urbanizing zone, by enabling inhabitants to exploit a wider, more reliable resource base, and thus consistently feed larger populations than their neighbors of the northern alluvium. From the mid-fourth millennium B.C., as the delta prograded south-eastward and regional climate became dryer (Table 1), through time urban centers such as Uruk, Girsu, Lagash and Larsa could continue to exist by investing in ever more managed hydrological control, including extending their agricultural irrigation networks along their expanding river levees (as described by Hritz 2010). Simultaneously, new settlements, connected by waterways, would have been founded further afield to exploit marshland resources at the tips of the prograding delta. This would suggest an ongoing cycle of urban centers first growing from settlements founded on minimally higher ground within inundated areas, then becoming

TABLE 1: Summary of paleoenvironmental context, by geographic relationship and period*

					Ubaid	***Uruk***	***Early Dynastic***	***Akkadian***
				Millennium BC:	*6th–5th*	*5th–4th*	*Early–mid 3rd*	*Late 3rd*
North		Girsu					Shoreline maximum	Marine retraction
	Uruk					Marsh Formation	Marsh Expansion	Delta Progradation
		Eridu			Persistent marsh	Persistent marsh	Persistent marsh	Aridification
			Ur				Delta Progradation	Aridification
				Hawr al-Hammar	Marine incursion	Marine	Delta Progradation	Marine retraction
				Basra	Marine incursion	Marine	Marine	Sabkha
South				Khor as-Zubayr	Marine incursion	Marine	Marine	Marine
	West	→		**East**				

*For a complete review of new, radiocarbon-dated evidence, see Hritz *et al.* 2012. For a summary of archaeological surveys as related to environmental context, see Pournelle in press.

proportionately more reliant on irrigated crops and pastoral exchange as those wetlands infilled with sediments, and finally waning as the transaction costs of maintaining those irrigation systems became too high and fields were permanently abandoned. If this model is correct, more early villages, including those whose descendants became early and long-lived urban centers, should be located in the former Awhar of southern Iraq.

History of archaeological work in the Awhar

At its greatest modern extent, the Awhar encompassed an area of approximately 20,000 km^2 south and east of the Shatt al-Gharraf (CIMI 2008; UNEP 2006). The marshes spanned three governorates (Maysan, Dhi Qar, and Basra), and comprised dozens of interlinked, named wetlands grouped broadly into three sub-zones: al-Hawiza, straddling the Iranian border east of the Tigris; the Central Marshes, west of the Tigris and north of the Euphrates; and the Hammar lake district, south of the Euphrates (Fig. 2). They have never been systematically surveyed by archaeologists, preventing a chronological reconstruction of the settlement history, and accounting for the appearance of an "empty" region on the archaeological maps of Mesopotamia.

Georges Roux conducted the first informal archaeological reconnaissance of this area in the late 1950s, venturing into the Hawr al-Hammar during his days off from work as a medical officer at the Basra Petroleum Company. Using maps and spotting mounds from overhead helicopter flights, he visited eight previously unknown archaeological tells made temporarily accessible by low lake levels (Hritz 2007:45–48). He described them as "littered with copious amounts of pottery (Roux 1960: 22)", and made a preliminary ceramic analysis providing evidence for long-term settlement there, from at least the third millennium B.C. into the Islamic period. Given that only the uppermost portions of these sites were then exposed above the waterline, and the large quantity of sediment deposited every flood season, Roux postulated that fuller exposure would surely reveal even earlier material.[2] Over the past decade, Iraqi archaeologist Abdul Amir Hamdani has conducted

[2] During the 1970s, based on indices previously compiled from published finds, augmented with additional locations reported to antiquities officers by various field operations, the Iraq SBAH (then Directorate of Antiquities) compiled a massive folio atlas of maps indicating archeological site locations, indexed by region. Where possible, SBAH inspectors were sent to verify findings, but coverage was extremely uneven. In the Hammar district, it simply reiterated Roux's report (Iraq 1976: 101–108; Al-Haik 1968).

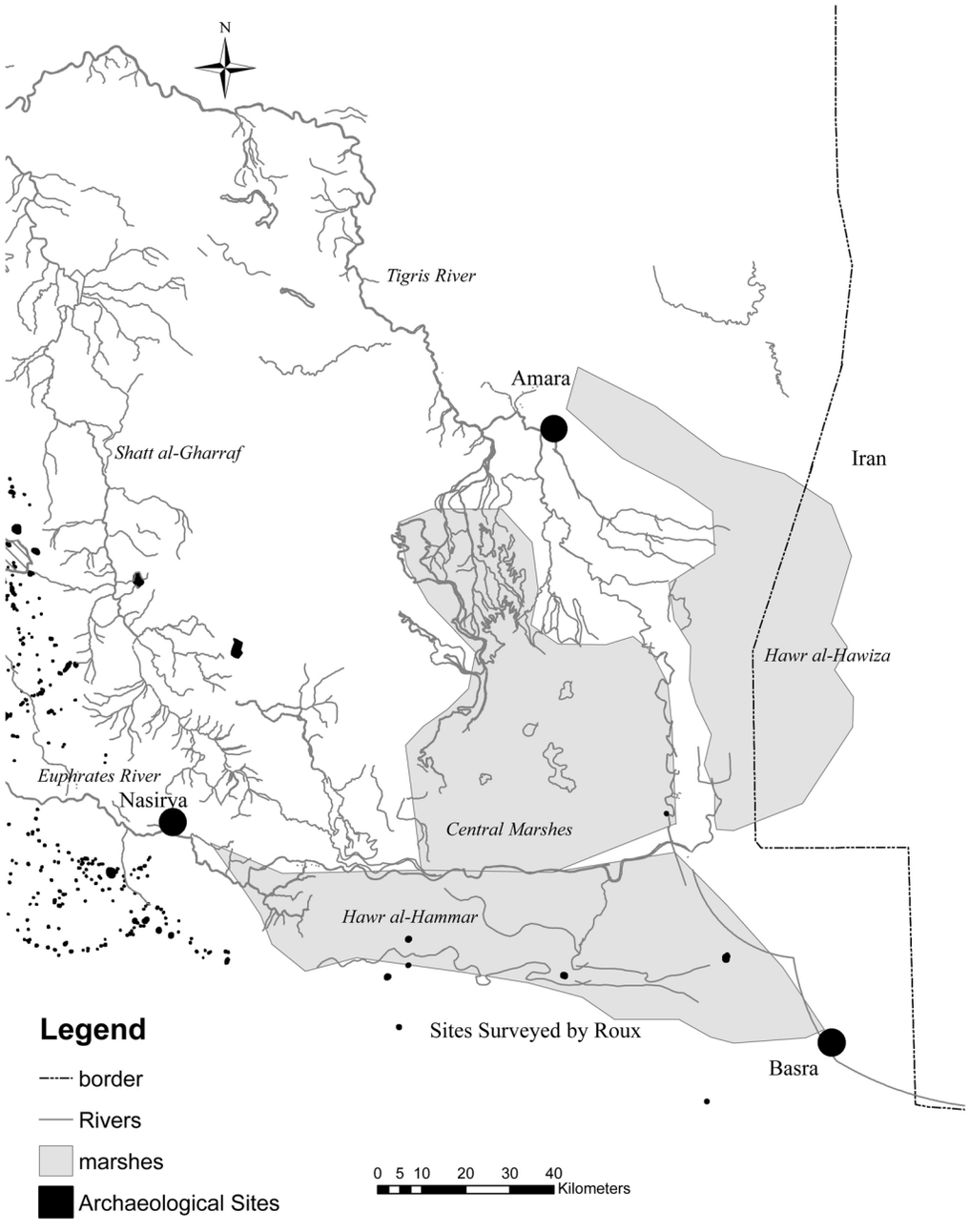

Fig.2 The former marshes, based on satellite imagery (Gasche 2005: 15), with Roux's surveyed sites in the Hawr-al Hammar.

archaeological surveys over broad stretches of the former Awhar, and we eagerly await the publication of his methodology and findings.[3]

Circumstances now place us in a unique position to investigate the archaeological record of this area. During the large-scale surveys of southern Iraq, including the timeframe when declassified

[3] Hamdani provided a preliminary summary of this work to a meeting of The American Archaeological Research Institute in Iraq (TAARII), held at the University of Pennsylvania on February 11, 2011. He reported that his survey began in the environs of Tell Shmit, proceeding to Umma, Bad Tabira, Larsa, Wasit, Lagash, and finally the former marshes. He claimed to have recorded about 640 new sites in total. Consistent with Wright 1981: figs. 21–24, he also reports that his findings during the 2008 season suggest that a relict Euphrates channel that exits at the eastern end of the Eridu basin, continuing on through the Hammar district beneath the former lake, connects Old Babylonian–Kassite period sites, with some earlier third millenum B.C. material also evident. East-south-east of Eridu itself, Amar-Sin (Ur III) bricks and several new prehistoric sites were noted (Wright 2011).

satellite photography (such as Corona) was filmed during the 1960s–1970s, this area was under water—rendering it inaccessible, and Corona imagery unhelpful. Wholesale marshland drainage since 1997, followed by upstream damming and persistent drought, has left (possibly ancient) settlements and (possibly associated) relict land use systems visible in the now-desiccated landscape (Fig. 3). After integrating Roux's survey data, published paleoenvironmental analyses, the newer data from recent geo-archaeological investigations in Khuzestan, and analyses of post-drainage and freely available satellite imagery at multiple scales, recognizing the limitations of image analysis, the authors applied for and received a U.S. National Science Foundation High Risk Research award to conduct a brief, preliminary ground reconnaissance.

During September 2010, we visited major archaeological sites throughout southern Iraq; previously unreported, remotely sensed landscape features in the Hammar district and along the Khor as-Zubayr south of Basra, and the massive salt dome near the Kuwait border known as Jebel Sinam. We were accompanied by SBAH representatives to all archaeological sites. For geoarchaeological investigations in Basra governorate, we first consulted with specialist faculty in geology and marine sciences at the University of Basra, and were accompanied by Badir Albadran, Professor of Sedimentology and Chair, Department of Geology. The purpose of this reconnaissance was to: (1) gain a ground-level perspective of physical geography and site locations; (2) attempt to verify and ground-truth remotely sensed features, such as possible archaeological sites, canals, and relict field systems, toward the ultimate aim of reconstructing settlement and land use patterns; and (3) assess the feasibility of commencing or re-commencing archaeological work, select locations for future archaeological, paleo-environmental, and geomorphological

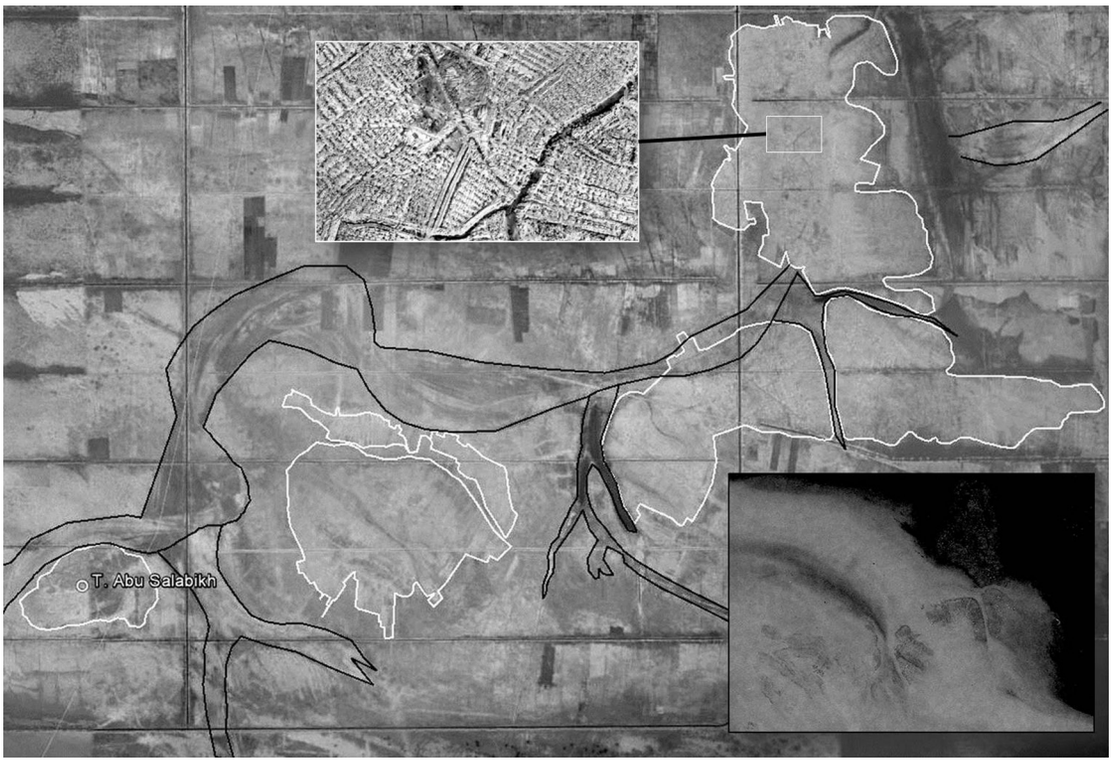

Fig.3 "Old Town." G. Roux visited the top of Tell Abu Salabikh by boat in 1958. The entire area lay under Lake Hammar as late as 1968 (Inset, bottom right. Black is deep water; grey is sediment-rich flood water). Drying of the lake since 1991 has revealed relict river meander and splay scars (black borders), and approx. 4,000 ha. of abandoned, undated, mixed residential-agricultural zones (white borders). Vegetation, extremely sensitive to slight variations in salinity and soil moisture, maps these zones in exquisite detail (Inset, top.) Base, top inset: Digital Globe images ©2011, re-rendered as grey-scale. Original full colour, full-scale images available via Google Earth. Bottom inset: CORONA, May 1968.

data collection, and begin formulating a five-year plan for cooperative data collection and analysis with Iraqi colleagues.

Archaeological sites visited

While a number of known archaeological sites at the edges of the marshes were visited, the site of Eridu (Safar and Lloyd 1981; Wright 1981) shows high promise as a location for future geo-archaeological coring and investigation to collect evidence for the western extent of Mid-Holocene Gulf incursion and marsh formation (Fig. 4). Archaeological survey conducted in the 1960s in the area around this fifth millennium B.C. site had already demonstrated that it sits in a topographic

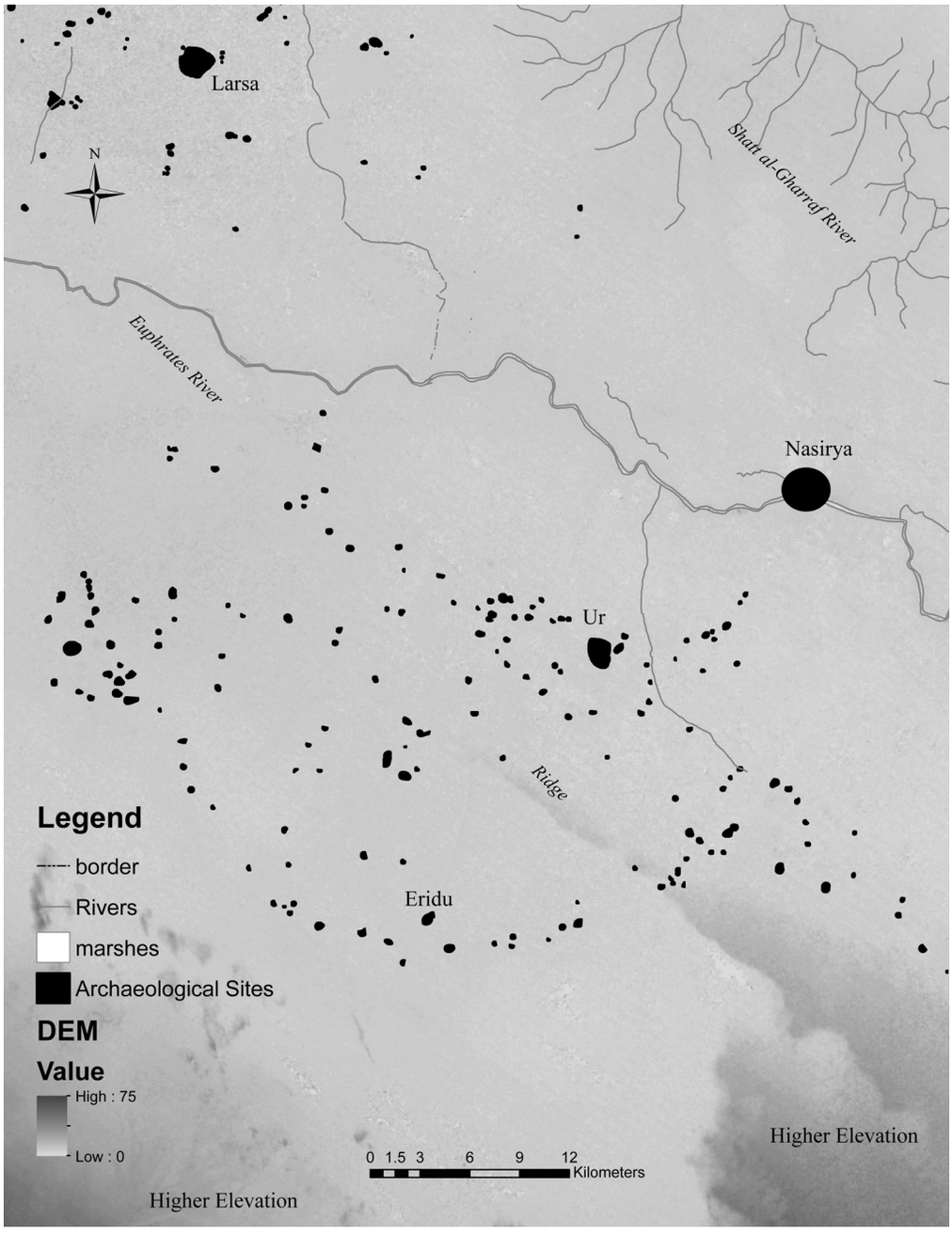

Fig.4 Topography of the Eridu basin, indicating sites recorded in Wright 1981.

depression separating it from the rest of the alluvium by a sandy ridge known as the Hazim (Wright 1981). Excavation reports describe markers of a swampy environment (Safar and Lloyd 1981), but no samples of flora and only a small faunal sample were collected and analyzed (Flannery and Wright 1966). Both the excavators at the site and the surveyor of its hinterland interpreted local topography as indicating that the site was once located along a beach ridge of the Early-Mid Holocene Persian Gulf shoreline. While a comprehensive coring program will be required to define the boundaries and extent of fresh marshes, salt marshes, and estuaries,[4] the direction of water flow, in conjunction with the natural boundaries reinforced by the accumulation of substantial south-east-trending levees, probably resulted in a belt much like the late-twentieth-century Hammar district having formed in the Eridu basin, with tidal flushing as far inland as Uruk itself. The very few dated samples of fossil shell and organic-rich sediments that we do have from the Awhar support this assessment (Aqrawi and Evans 1994; Aqrawi 1997, 2001; Al-Baidhany, Darmoian and Albadran 2002; Brückner 2003; Aqrawi, Domas and Jassim 2006;Heyvaert and Baeteman 2008).

At Eridu itself, we noted that fossil aquatic shell not only covers the top and base of the tell, but is visible embedded in and eroding from the mud bricks of remaining structures (Fig. 5). The predominant species, *Melanoides tuberculata,* is an aquatic gastropod mollusc common throughout Eurasia and North Africa. While usually classified as a freshwater snail (e.g. Leng *et al.* 1999), this cosmopolitan species is known to prosper in brackish, estuarine water with salinity up to 30 ppm (Abell and Hoelzmann 2000). It is thus adapted to the wide and variant range of conditions typical of a marsh environment. In southern Iraq, the *Melanoides*-dominated multi-species assemblage

Fig.5 Denuded mud brick at the summit of Eridu.
Photo J. Pournelle 2010.

[4] We have no direct geophysical data to verify the northern limit of transgression, presumed to coincide with the Awhar scour basin visible on imagery. The relevant portions of the exposed walls of the gridded drainage canal cuts though this area are under water.

collected at Eridu is typical of calm, freshwater lacustrine and marsh bottoms (Plaziat and Younis 2005: 6). Recent flooding could have resulted in shell deposits at lower elevations, but the dispersal of the shell throughout the visible buildings and preserved mudbrick, well above the flood zone, more likely indicates the presence of a persistent marshy environment prior to or at the time of construction. Mud for the bricks is likely to have been locally collected from extraction pits in the environs of the site (Wilkinson and Tucker 1995:15), and AMS datings of four samples of fossil shell collected from denuded mud brick at three locations on the Eridu mound range in age from 5770 cal.B.C. near the base, to 2291 cal.B.C. at the top of the mound (Hritz, Pournelle and Smith 2012).

Relict agricultural landscapes

With the drying of the former Hawr al-Hammar marshes, subsequent clearing of modern architecture, and concomitant depopulation, entire relict landscapes have appeared, preserved in detail on the ground surface. High-resolution satellite imagery reveals a complex schema of previously submerged field systems, settlements, and canals covering nearly 4000 ha. east of the site of Tell Abu Salabikh, the oldest of the sites surveyed by Roux in the 1960s. At that time the area was submerged beneath water, rendering it invisible to Roux.

Situated within a bend of a relict Euphrates River levee, the relative association of these relict features indicates that the landscape is unlikely to be recent. Further, the area has been under water for over a century, and neither the layout nor extent bears any resemblance to towns known to have been abandoned in recent decades. Based on its visible connection to the relict third–second millennium B.C. Euphrates channel mapped exiting the Eridu basin (Wright 1981: figs. 21–24), it could be much older. It may even represent the agricultural hinterland of nearby Tell Abu Salabikh, or another incipient city. Based on inscriptions from the site, Roux suggested that Abu Salabikh was *Bīt-Iakīn*—seat of the historical figure Merodach-Baladan (Marduk-apla-iddina II), and central city of the marsh realm between Sumer and Elam known as "The Sealands" or "*māt tâmti*" during the second millennium B.C. (Roux 1960: 27–28).

Using the imagery and Roux's survey as a guide, we visited the area with a local guide and conducted informal reconnaissance (Fig. 6). The area itself was accessible by vehicle, but due to recent rain, land access to Tell Abu Salabikh was not possible. Both the visibility of relict anthropogenic features and the utter lack of any cultural material of any period on the surface was striking. The centimeter-thick crust of grey, clayey silt mixed with high densities of shell and reed casts on the surface suggests that any cultural material associated with surface features has been capped by a thick, water-laid deposit. Whatever its age, this area shows high potential for excellent preservation in the former marsh zone, and presents a unique locale for diachronic study of the cultural ecology of deltaic colonization and urbanization. Working with the Department of Geology and the Marine Sciences Centre at the University of Basra, we intend to combine seismological survey, cleaning and examination of existing canal cuts, and systematic collection of new cores. This will enable us to determine basic stratigraphic relationships among observed surface features in order to reconstruct the environmental history of the marshes, and to collect cultural material in order to contextualize sites and relict landscape features in this area.

Beach ridges

Beginning in 1999, archaeological excavations at H3/Tell as-Sabiyah in northern Kuwait provided evidence of an early Ubaid settlement in this area (Carter and Crawford 2001; Carter 2006). The site is located adjacent to a relict beach ridge representing the shoreline of the ancient Persian Gulf. On high-resolution GeoEye® and Digital Globe® imagery freely available via Google Earth, this ridge is visible continuing northwards along the Khor az-Zubayr—a relict mouth of the Euphrates—toward the city of Basra (Fig. 7). Guided by our colleagues from the University of Basra, we visited an area we had identified as a fossil beach ridge on the imagery. While evidence of the ridge was not visible on the ground despite its appearance on imagery—a common phenomenon when analyzing features of an ancient landscape (Ur 2003)—our colleagues informed us that unpublished geological cores from this area detected the landform at a depth of five meters below present land surface. In the past, this area would have been subject to individual and/or conjoined outflow of the Euphrates, Tigris, and Karkheh/Karun rivers, resulting in continual and heavy sedimentation

Fig.6 Ground-level view of Old Town.

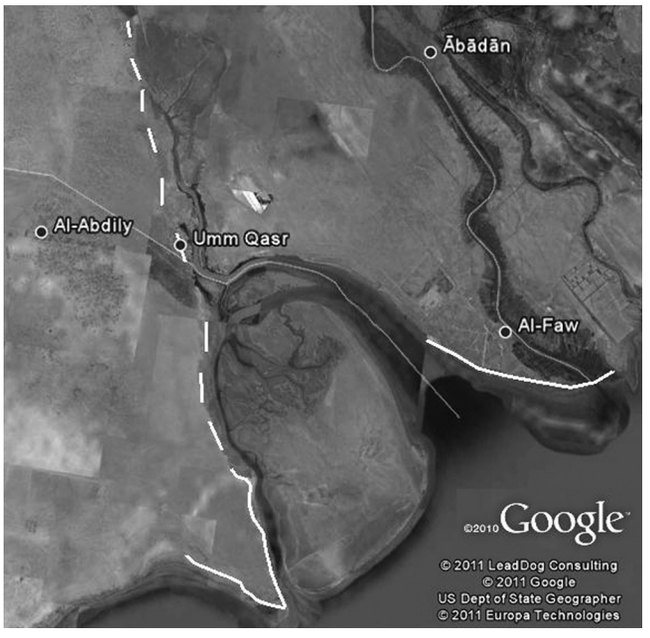

Fig.7 Exposed beach ridges in Kuwait and Fao (al-Faw), with potential connections to surface and subsurface features in Iraq indicated as dashed lines.

masking the ridge itself, as well as any associated archaeological features. By integrating the existing Basra University core data and with that obtained from new cores, we hope to reconstruct the environmental history of the area, including the location of the beach ridge through time, gain

information on rates of sedimentation, and model outflow of channels, thereby improving our understanding of the timing of sedimentation and regional landscape transformation.

Conclusions

Integrating remote sensing/GIS, ground visitation, and sampled material, we have begun to address the ecological contributions of marsh and coastal landscapes to the development of cities in southern Mesopotamia. Building on image interpretation and published past survey data, locations throughout the former marshes were visited in autumn 2010. This trip demonstrated the feasibility of collecting new, targeted samples to address long-standing questions about the physical processes and landscape transformations associated with urbanization.

Our satellite and ground observations demonstrate the potential, where conditions permit, to connect paleoclimatic to settlement data in marshland contexts (such as in the former Hawr al-Hammar). Our observations at Eridu, in the former Hawr al-Hammar marshes, and along the Khor as-Zubayr vividly illustrate the spatial and temporal heterogeneity of southern Iraq's wetlands. These visits confirmed irregular processes of sedimentation and erosion across the delta, rendering surface exposure of cultural material extremely uneven, even for modern settlements known to have been recently abandoned. Sources of paleoenvironmental data (including foraminifera, ostracods, molluscs, pollen, and reed casts) appear to be readily available from sedimentary archives, but investigating local-scale taphonomy—specifically the competing processes of aggradation and deflation—will be a particularly important consideration in this landscape. Therefore under a new award,[5] we are now planning to execute a three-year programme of investigation aimed at specific local and regional paleoenvironmental and paleogeographic reconstruction, in order to situate the marshes of southern Iraq within Mesopotamia's long-term settlement and land use systems in this ever-changing delta. This work will test the hypothesis that, in southern Iraq, rather than being a fundamental aspect of urban genesis, irrigation was its after-effect: an adaptive response to the relentless, progressive, south-eastward migration of life-giving marshes. By elucidating variations in resource potential across the southern Iraqi landscape, and illuminating changing subsistence options through time, we hope to shed further light on essential aspects of sustainability and resilience during critical intervals of urban development.

Bibliography

Abell, P. I. and P. Hoelzmann. 2000. Holocene Palaeoclimates in Northwestern Sudan; Stable Isotope Studies on Molluscs. *Global and Planetary Change* 64: 1–12.

Adams, R. McC. 1978. Strategies of Maximization, Stability, and Resilience in Mesopotamian Society, Settlement, and Agriculture. *Proceedings of the American Philosophical Society* 122:329–35.

Adams, R. McC. 1981. *Heartland of Cities: Surveys of Ancient Settlement and Land Use on the Central Floodplain of the Euphrates*. Chicago and London: University of Chicago Press.

Adams, R. McC. and H. J. Nissen. 1972. *The Uruk Countryside: The Natural Setting of Urban Societies*. Chicago and London: University of Chicago Press.

Al-Baidhany, A., S. Darmoian and B. Albadran. 2002. Evolution of Holocene Sedimentary Environments of the Southern Part of Iraq. *Basrah Journal of Science* B 20(1):73–86.

Algaze, G. 1993. *The Uruk World System: The Dynamics of Expansion in Early Mesopotamian Civilization*. Chicago: University of Chicago Press.

Algaze, G. 2001. The Prehistory of Imperialism: The Case of Uruk Period Mesopotamia. In. M. Rothman (ed.), *Uruk Mesopotamia and its Neighbors: Cross-Cultural Interactions in the Era of State Formation.* Santa Fe: SAR Press. pp. 29–84.

Algaze, G. 2008. *Ancient Mesopotamia at the Dawn of Civilization: The Evolution of an Urban Landscape*. Chicago and London: The University of Chicago Press.

Aqrawi, A. A. M. 1997. The Nature and Preservation of Organic Matter in Holocene Lacustrine/Deltaic Sediments of Lower Mesopotamia, SE Iraq. *Journal of Petroleum Geology* 20(1):69–90.

Aqrawi, A. A. M. 2001. Stratigraphic Signatures of Climatic Change During the Holocene Evolution of the Tigris-Euphrates Delta, Lower Mesopotamia. *Global and Planetary Change* 28(1–4):267–83.

Aqrawi, A. A. M. and G. Evans. 1994. Sedimentation in the Lakes and Marshes (Awhar) of the Tigris-Euphrates Delta, Southern Mesopotamia. *Sedimentology* 41: 755–76.

Aqrawi, A. A. M., J. Domas and S. Z. Jassim. 2006. Quaternary Deposits. In S. Z. Jassim and J. C. Goff (eds.), *Geology of Iraq*. pp. 185–96. Praque: Dolin.

[5] "Deltaic Resilience and the Genesis of Mesopotamian Cities (Iraq)." United States National Science Foundation Archaeology Award #1227784.

Brückner, H. 2003. Uruk—A Geographic and Paleo-archaeologic Perspective on a Famous Ancient City in Iraq. *Geo-Öko* 24: 229–48. Bensheim: Georg-August University.
Carter, R. 2006. Boat Remains and Maritime Trade in the Persian Gulf During the Sixth and Fifth Millenia BCE. *Antiquity* 80(307): 52–63.
Carter, R. and H. Crawford. 2001. The Kuwait-British Archaeological Expedition to as-Sabiyah: Report on the Second Season's Work. *Iraq* 63: 1–20.
Canada–Iraq Marshlands Initiative (CIMI). 2008. Southern Iraq Marsh Extent 1973 + 2008. http://www.iraqimarshlands.org/maps/
Eger, A. 2011. The Swamps of Home: Marsh Formation and Settlement in the Early Medieval Near East. *Journal of Near Eastern Studies* 70(1): 55–79.
Firth, R. 2011. A Discussion of the Use of im-babbar$_2$ by the Craft Workers of Ancient Mesopotamia. *Cuneiform Digital Library Journal* 2011(2): 6.2.3–6.2.5. http://cdli.ucla.edu/pubs/cdlj/2011/cdlj2011_002.html.
Flannery, K. and H. Wright. 1966. Faunal Remains from the 'Hut Sounding' at Eridu. *Sumer* 22:61–4.
Gasche, H. (ed.). 2004. The Persian Gulf Shorelines and the Karkheh, Karun, and Jarrahi Rivers: A Geo-Archaeological Approach. A Joint Belgo-Iranian Project. First Progress Report. In *Akkadica* 125(2): 141–215.
Gasche, H. (ed.). 2005. The Persian Gulf Shorelines and the Karkheh, Karun, and Jarrahi Rivers: A Geo-Archaeological Approach. A Joint Belgo-Iranian Project. First Progress Report Part 2. In *Akkadica* 126(1): 1–44.
Gasche, H. (ed.). 2007. The Persian Gulf Shorelines and the Karkheh, Karun, and Jarrahi Rivers: A Geo-Archaeological Approach. A Joint Belgo-Iranian Project. First Progress Report Part 3. In *Akkadica* 128(1–2): 1–72.
Gibson, M. 1972. *The City and Area of Kish*. Coconut Grove, Florida: Field Research Projects.
Heyvaert, V. and C. Baeteman. 2008. A Middle to Late Holocene Avulsion History of the Euphrates River: A Case Study from Tell ed-Dēr, Iraq, Lower Mesopotamia. *Quaternary Science Reviews* 27: 2401–10.
Heimpel, W. 2011. Twenty Eight Trees Growing in Sumer. In D. I. Owen (ed.), *Garšana Studies*. Cornell University Studies in Assyriology and Sumerology 6. Bethesda: CDL Press.
Hout, J.-L. 1989. Ubaidian Village of Lower Mesopotamia: Permanence and Evolution from 'Ubaid 0 to 'Ubaid 4 as seem from Tell Oueili. In I. Thuesen (ed.), *Upon this Foundation: Ubaid Mesopotamia*. Copenhagen:Carsten Niebuhr Institute Publications no. 10. pp. 19–42.
Hritz, C. 2005. *Landscape and Settlement in Southern Mesopotamia: A Geo-archaeological Analysis.* Ph.D. dissertation, Department of Near Eastern Languages and Civilizations, University of Chicago.
Hritz, C. 2007. Appendix III: Remote Sensing of Sites in and around the Hawr al-Hammar and Hawr al-Hawiza. *Akkadica* 128: 45–49.
Hritz, C. 2010. Tracing Settlement Pattern and Channel Systems in Southern Mesopotamia Using Remote Sensing. *Journal of Field Archaeology* 35:2.
Hritz, C., J. R. Pournelle and J. Smith. 2012. Mid-Holocene Dates for Organic-Rich Sediment, Palustrine Shell, and Charcoal, Southern Iraq. *Radiocarbon* 54(1): 65–79.
Iraq, Kingdom of, Directorate of Antiquities 1976. *Atlas al-Mawaqi' al-athariyah fi al-'Iraq* (Atlas of the Archaeological Sites in Iraq). Baghdad: Ministry of Culture.
Kouchoukos, N. 2001. Satellite Imagery and Near Eastern Landscapes. *Near Eastern Archaeology* 64(1/2): 80–91.
Leng, M. J., A. L. Lamb, H. F. Lamb and R. J. Telford. 1999. Palaeoclimatic Implications of Isotopic Data from Modern and Early Holocene Shells of the Freshwater Snail Melanoides Tuberculata from Lakes in the Ethiopian Rift Valley. *Journal of Paleolimnology* 21: 97–106.
Liverani, M. 1996. Reconstructing the Rural Landscape of the Ancient Near East. *Journal of the Economic and Social History of the Orient* 39(1): 1–41. *http://www.jstor.org/stable/3632524*.
Molina, M. and M. Such-Gutiérrez. DATE On Terms for Cutting Plants and Noses in Ancient Sumer. *Journal of Near Eastern Studies* 63(1): 1–16.
Plaziat J. C. and W. R. Younis. 2005. The Modern Environments of Molluscs in Southern Mesopotamia, Iraq: A Guide to Paleogeographical Reconstructions of Quaternary Fluvial, Palustrine and Marine Deposits. *Carnets de Géologie/Notebooks on Geology*, Brest, Article 2005/01 (CG2005_A01).
Pollock, S. 2001. The Uruk Period in Mesopotamia. In M. Rothman (ed.), *Uruk Mesopotamia and its Neighbors: Cross-Cultural Interactions in the Era of State Formation.* Santa Fe; SAR Press. pp. 181–232.
Postgate, J. N. 1994. *Early Mesopotamia: Society and Economy at the Dawn of History*. Routledge. London.
Pournelle, J. R. 2003a. The Littoral Foundations of the Uruk State: Using Satellite Photography Toward a New Understanding of 5th/4th Millennium BCE Landscapes in the Warka Survey Area, Iraq. In Dragos Gheorghiu (ed.), *Chalcolithic and early Bronze Age hydrostrategies*. BAR International Series 1123. Oxford: Archaeopress. pp. 5–23.
Pournelle, J. R. 2003b. *Marshland of Cities: Deltaic Landscapes and the Evolution of Early Mesopotamian Civilization.* Ph.D. dissertation, Department of Anthropology, University of California, San Diego.
Pournelle, J. R. 2006–2011. Traces on the 'Ubaidian Shore: Mid-Holocene Eustasis, Marine Transgression, and Urbanization in the Mesopotamian Delta (Iraq). Presented at: International Conference on the 'Ubaid. University of Durham, UK, April 2006; American School of Oriental Research Annual Meeting 2010—Space, Place, and Landscape in the Old and New Worlds, Atlanta, GA, 17

November 2010 (updated); American Geophysical Union Annual Conference—The Evolution of River Systems since the Last Glacial Maximum and their Interactions with Human Societies, December 2011 (updated).
Pournelle, J. R. 2007. KLM to Corona: A Bird's-Eye View of Cultural Ecology and Early Mesopotamian Civilization. In E. C. Stone (ed.), *Settlement and Society: Essays Dedicated to Robert McCormick Adams*. Los Angeles: UCLA Cotsen Institute of Archaeology and Chicago: Oriental Institute. pp. 29–62.
Pournelle, J. R. 2012. Physical Geography. In H. Crawford (ed.), *The Sumerian World*. London: Routledge.
Pournelle, J. R. and G. Algaze. In press (2013). Travels in Edin: Deltaic Resilience and Early *Urbanism* in Greater Mesopotamia. In H. Crawford, A. McMahon and J. N. Postgate (eds.), *Preludes to Urbanism: Studies in the Late Chalcolithic of Mesopotamia in Honour of Joan Oates*. Cambridge: MacDonald Institute for Archaeology.
Roux, G. 1960. Recently Discovered Ancient Sites in the Hammar Lake District (Southern Iraq). *Sumer* 16:20–31.
Rowton, M. 1973a. Urban Autonomy in a Nomadic Environment. *Journal of Near Eastern Studies* 32(1/2): 201–15.
Rowton, M. 1973b. Autonomy and Nomadism in Western Asia. *Orientalia* 42:247–58.
Safar, F., M. A. Mustafa, and S. Lloyd. 1981. *Eridu*. Baghdad: Ministry of Culture and Information, State Organization of Antiquities and Heritage.
Sanlaville, P. 1989. Considerations sur l'evolution de la Basse Mesopotamie au cours des derniers millenaires. *Paléorient* 15(2):5–27.
Sharlach, T. M. 2004. *Provincial Taxation and the Ur III State*. Cuneiform Monographs 26. Leiden-Boston: Brill-Styx.
Ur, J. A. 2003. CORONA Satellite Photography and Ancient Road Networks: A Northern Mesopotamian Case Study. *Antiquity* 77(295): 103–15.
United Nations Environmental Programme (UNEP). 2006. *Iraqi Marshlands Observation System UNEP Technical Report*, ed. by H. Partow. Nairobi: UNEP/DEWA. http://imos.grid.unep.ch/modules/wfdownloads2/visit.php?cid=3&lid=25
Widell, M. 2009. Two Ur III Texts from Umma: Observations on Archival Practices and Household Management. *Cuneiform Digital Library Journal* 2009 (6). http://cdli.ucla.edu/pubs/cdlj/2009/cdlj2009_006.html
Wilcke, C. 2007. Markt und Arbeit im Alten Orient am Ende des 3. Jahrtausends v. Chr. In W. Reinhard and J. Stagl (eds.), *Menschen und Märkte: Studien zur historischen Wirtschaftsanthropologie* (=Institut für historische Anthropologie 9). Vienna: Böhlau Verlag. pp. 71–132.
Wilkinson, T. J. and D. J. Tucker. 1995. *Settlement and Development in the North Jazira, Iraq: A Study of the Archaeological Landscape.* Iraq Archaeological Reports 3. Baghdad:British School of Archaeology in Iraq.
Wright, H. T. 1981. The Southern Margins of Sumer: Archaeological Survey of the Area of Eridu and Ur, in R. McC. Adams (ed.), *Heartland of Cities: Surveys of Ancient Settlement and Land Use on the Central Floodplain of the Euphrates*. Chicago and London: University of Chicago Press. pp. 295–338.
Wright, H. T. 2011. Minutes of the Meeting "The State of Archaeological Fieldwork in Iraq," The American Archaeological Research Institute in Iraq, University of Pennsylvania, February 2011. Unpublished.

Dr. Carrie Hritz
Assistant Professor of Archaeological Anthropology
Department of Anthropology
The Pennsylvania State University
516 Carpenter Building
University Park, PA 16802-3405
cah52@psu.edu

Dr. Jennifer Pournelle
Director, MEERM-AWNES
University of South Carolina
Environment and Sustainability Program
School of Earth, Ocean, and Environment
Byrnes Building, Suite 430 A
901 Sumter Street
Columbia, SC 29208
jpournelle@environ.sc.edu

Dr. Jennifer Smith
Associate Professor
Department of Earth and Planetary Sciences
Washington University in St. Louis
Campus Box 1169
1 Brookings Drive
St. Louis, MO. 63130
jensmith@wustl.edu