CHAPTER 7

THE UMMA-LAGASH BORDER CONFLICT: A VIEW FROM ABOVE

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INTRODUCTION

Archaeologists routinely employ multivariate and multiscalar datasets to reconstruct broad patterns of past cultural behavior. Specifically, they rely on understanding the spatial relationship between a number of diverse artifacts and ecofacts to infer sequences of social, political, and economic change through time. In historic periods, ancient written records have the potential to further correlate with archaeological evidence, refining and testing archaeologically based hypotheses, and make a substantial contribution to holistic reconstructions of ancient history. Yet, despite the potential that integrated datasets can have in the production of robust historical narratives, emphasis on the systematic synthesis of archaeological material and textual records has been a relatively recent methodological advance and, in the past, analyses were restricted by research methods that treated material separately. For example, in the late nineteenth and early twentieth centuries, large-scale excavations in Iraq, or ancient Mesopotamia, routinely treated cuneiform records as separate objects. In this context, information from texts was analyzed by language specialists with limited input or interest from archaeologists, and with little or no reference to findspots or archaeological context, hindering their use by both archaeologists and historians in broad reconstructions of site and regional histories. Recognizing these limits, the Diyala excavations by the Oriental Institute of the University of Chicago in the late 1930s represent one of the first projects to systematically integrate textual and archaeological datasets with the aim of producing a synthetic and spatially informed chronological and functional analysis of site occupation (Reichel 2001; Frankfort, Lloyd, and Jacobsen 1940).

Building on this project and moving beyond the scale of the individual site, subsequent projects in southern Mesopotamia began to explore the potential of integrating variable quality textual and archaeological data from site and intrasite contexts to make important contributions to the long-term socioeconomic history of the region at multiple scales.[1] McGuire Gibson's topographic study of the city and environs of the powerful Early Bronze Age city of Kish stands out from the others in his integration of texts with excavation and survey data, and his effort to spatially broaden this analysis with an emphasis on the city's ancient landscape (Gibson 1972a, 1972b). Methodologically, he merged reanalysis of past excavation records, reconstructing findspots of texts when possible, and the results of targeted surface surveys of the numerous mounds that collectively comprise Kish and the cultural landscape around them. Drawing from these uneven datasets, he demonstrated cycles of functional change at the mounds and shed light on the complex relationship between settlements and channel systems by identifying the shifting courses of the Euphrates river channels and its branches in the area. Still, even Gibson's emphasis on the landscape context of the city, reconstructed from the union of variable-quality datasets, was limited by traditional spatial boundaries imposed by surface survey and restricted by uneven access to aerial photographs.

With burgeoning geospatial technologies and increasingly available multiscalar datasets, the incorporation of heterogeneous data is now possible, enabling ever-more synthetic reconstructions of trajectories of change in ancient societies. These datasets, such as high-resolution satellite imagery and photography, allow

[1] Charpin 1986; Pedersen 1985; Reichel 2001, 1994; Stone 1987; Zettler 1992.

a multiscalar landscape analysis that transcends traditional geographic boundaries imposed by the practical limitations and the scale of on-the-ground fieldwork. This chapter applies an integrative landscape approach to the overall geography and hydrology of the Sumerian landscape east of the Shatt al-Gharraf River to reveal new insights into the historic Umma-Lagash border dispute (ca. 2500–2350 BC). While this marsh and deltaic environment area was home to many ancient cities that became powerful centers of Sumerian city-based polities in the early third millennium BC, the hydrology and settlement landscape south of the Shatt al-Gharraf is poorly understood. The Umma-Lagash border dispute, located in this area and one of the earliest documented examples of tension over water rights in the ancient world, has the potential to contextualize the role of political ecology in the emergence of the Sumerian polity. However, a lack of systematic study of this landscape, and difficulties in reconciling textual and archaeological information, have left open important questions about the nature of the conflict and its geography, and its part in shaping the Sumerian geopolitical landscape in terms of the expansion and consolidation of royal power in this period.[2] Complementary reanalysis of this material and its historical significance is possible by combining increasingly available remote sensing datasets, such as high resolution satellite imagery and digital elevation models, and information digitized from the archaeological *Atlas of Iraq* (1976) with past survey, excavation, and textual interpretations.

Employing geospatial tools and a landscape-oriented framework, it is possible to shed new light on this episode and begin to address broader questions of the role of political ecology in the emergence of Sumerian society. The fluvial landscape east of the Shatt al-Gharraf river was dominated by large leveed branches of the Tigris River, entering the area from the north and west, with a primary in the area preserved and reused by the modern Shatt al-Gharraf River (de Vaumas 1965). As this levee aggraded, it created a physical boundary between Umma and Lagash, and isolated Lagash from polities to the north. North of the site of Girsu, these branches mixed with Euphrates river channels, accounting for the written descriptions of Euphrates channels in the area. The scale of this channel, mapped by Adams (1981) and Pournelle (2003), indicates that it was a joint channel of the Tigris and Euphrates river and may have conducted a large volume of water, accounting for the emphasis on canal maintenance in the written documents recounting the border tensions, and the presence of the unparalleled features for water management at Girsu (Parrot 1948; Barrelet 1965; de Vaumas 1965).

The landscape east of the Shatt al-Gharraf River experienced a distinct fluvial setting, different than the landscape context for Sumerian polities on the plains to the north. These ecological conditions, their instability, and their potential for rich resources are reflected in the border dispute. Cities like Girsu, highlighted in the dispute, lay on the edge between the two areas and in a zone that was well placed to control water and tap into good agricultural land, insulating it from perturbations in the fluvial system and overall climate that might be catastrophic for other Sumerian cities. Taken together, the data suggest that this dispute may represent an extreme case of intercity conflict due to the unique environmental conditions experienced by cities along the edges of the marshes and alluvial plains. While the data shed light on overall political and social history, they also have the potential to shed light on the relationship between emerging state level societies and changing environmental conditions.

HISTORICAL CONTEXT AND PHYSICAL GEOGRAPHY

In southern Mesopotamia, the early third millennium BC or Early Dynastic period[3] (2900–2350 BC) is marked by the appearance of a network of semiautonomous, city-based territorial polities, many of which were located at the southern edges of the alluvial plains in an area termed ancient Sumer, for its shared language and cultural identity(Westenholz 2002; Yoffee 2005). The geography of Sumer, covering an area of roughly 51,000 sq km, can be described as bounded by the site of Kish in the north, the foothills of the Zagros Mountains in the east, the western desert in the west, and the shoreline of the gulf in the south (fig. 7.1).[4] Five thousand

[2] Foster 1984; Cioffi-Revilla 1999; McMahon, Sołtysiak, and Weber 2011.

[3] This period has three generally accepted subdivisions: ED I, 2900–2800 BC; ED II, 2800–2600 BC; ED III, 2600–2300 BC.

[4] The location of the shoreline in this period is unclear.

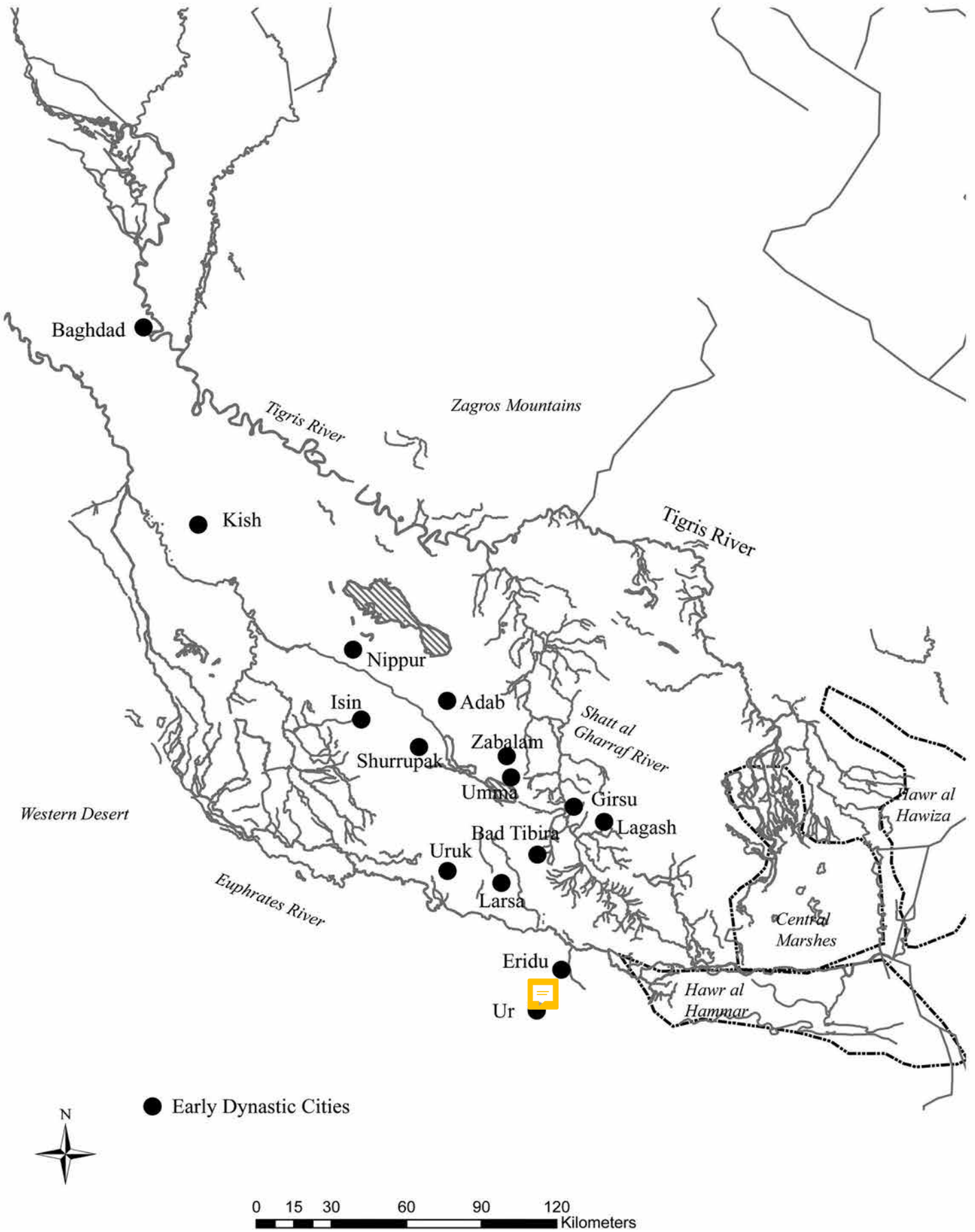

FIGURE 7.1. Area of Sumer; cities and landforms mentioned in text.

years ago, this landscape would have included a number of diverse and interspersed ecological niches,[5] such as tidal swamps associated with the shoreline and the debouchment of the Tigris and Euphrates rivers and their channels, and coastal mudflats. In this landscape, a broad spectrum of resources would have been locally available, including fish, fowl, cultivation via irrigation from naturally branching channels of the rivers, and marginal grazing land for animals.[6] The small-scale territorial polities that marked the Bronze Age landscape are traditionally described as Sumerian city-states, borrowing from the classical Greek polis model. Yet, unlike the relatively homogenous Greek city-states, Sumerian polities exhibited variation in composition, expressions of hegemony, and economic organization (Yoffee 1995, pp. 45–52; Westenholz 2002, p. 23). For example, while many of the individual polities had one primary urban center after which the city-state was named, several, such as Lagash and Umma, had multiple urban centers. Some city-states seem to have had a relatively confined local influence with fixed borders while others, such as Kish, exercised hegemony over cities geographically distant (Cooper 1983, pp. 22–25). Despite individualizing differences, these cities were linked by similarities in overarching social, political, and religious institutions, and the organizational structures that developed in this period continued to characterize Mesopotamian society for millennia to come.

There are three primary sources that provide multiscalar information on these emerging polities: archaeological surveys, excavation, and information interpreted from ancient texts. Synthesis of these datasets reveals some general characteristics of Sumerian society. First, the extensive surveys of Iraq in the 1960s–80s demonstrate that in the third millennium BC the center of gravity, in terms of dense urban settlements, shifted from northwest to southeast of the alluvium. This settlement distribution begins to take a pronounced linear form along several key branches of the Euphrates River, which has been described as a pearls-on-a-chain pattern (Adams 1957, 1981). Multiproxy environmental records contextualize these shifts and indicate that the third millennium BC saw the onset of increasingly arid conditions across the Middle East.[7] For riverine environments, consequences included a decrease in overall flow in the rivers, and for anastomosing and leveed rivers such as the Euphrates River, this could precipitate the consolidation of flow into fewer, but larger, channels, and initiate morphological changes along individual river channels (Brown 1997, pp. 25–30). At the same time, the distinctly linear settlement distribution reflected the necessary movement of settlements following the river channels (Adams 1981). Based on visible relict levees, Adams (1981) and others (Cole and Gasche 1998; Gibson 1972b; Jacobsen 1960) have reconstructed three large channels, and their branches, that dominated the alluvial plains in the third millennium BC and acted as the loci of settlement (fig. 7.2). They are Euphrates channels, with lines through Adab, Shurrupak, and Uruk, and an easternmost channel whose source is less clear and which may be a primary branch of the Tigris River (Hritz 2010). The synthesis of the survey data provides a general geography of channels and settlements on the alluvial plains of central Mesopotamia and outlines the dynamics of the relationship between settlements and channels, but it does not extend to the southeastern portions of Sumer where centers such as Umma and Lagash were located, leaving a lacuna in the overall reconstruction of the Sumerian riverine and settlement landscape.

Second, relatively rare but detailed on-site surface surveys and excavations demonstrate that incipient fourth-millennium BC cities such as Uruk, Ur, Kish, Nippur, and Lagash grew exponentially larger and more spatially differentiated in the Early Dynastic period (3100–2900 BC). From excavated contexts, it is possible to generalize the outcomes of this demographic shift in the internal organization of Sumerian cities. Temples and palaces, as well as other institutional architecture, dominated the urban landscape (Stone 2013; Van De Mieroop 1997; Yoffee 1995). Aggregated excavation data reveal that the third-millennium BC city contained a walled core—the mounded area—of administrative buildings, temples, residences, and production areas. Space was divided by canals, and harbors have been identified at several cities (Van De Mieroop 1992).

Outside the city walls were, presumably, the suburbs of domestic houses, fields, and orchards (Postgate 1992; Van De Mieroop 1997). These growing urban centers came at the expense of settlements in the countryside, which began to decrease in number, reflecting a shift of rural populations into the cities (Adams 1981). From these datasets, it can be inferred that changing resource availability, specifically the shifting hydraulic

5 Pournelle 2013; Sanlaville 1989; Verhoeven 1998; Wilkinson 2013.

6 Algaze 2008; Hritz, Pournelle, and Smith 2012; Pournelle and Algaze in press.

7 Nissen 1988; Wilkinson 2003, pp. 19–22; Roberts 1998, pp. 121–73.

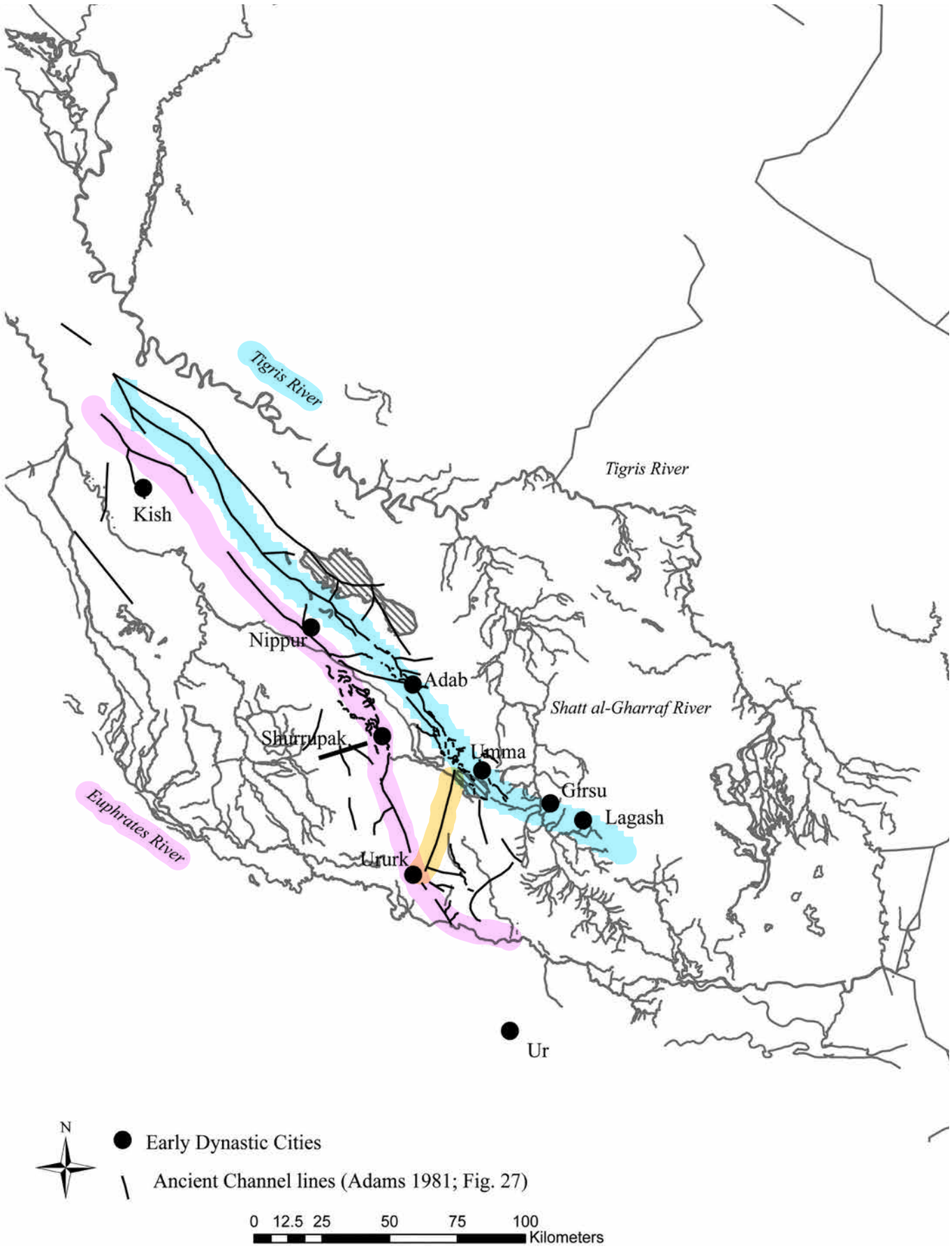

FIGURE 7.2. Primary Early Dynastic period channel lines reconstructed by Adams (1981).

landscape, played a role in these population movements. For example, the regular spacing of urban centers in the early third millennium BC, some 40–50 km apart, along dominant channels of the rivers (after Adams 1981, pp. 159–61), may reflect the process of settlement along primary stable channels, and the progressive loss of the hinterland may be related to the disappearance of small scale channels that fed the rural hinterlands. Yet understanding of the processes by which these large cities gradually became capitals of territorial polities that extended influence and control over the economically and socially adjacent hinterland is unclear because textual and archaeological datasets can present differing pictures. For example, the survey of the area around the site of Umma revealed sixteen contemporary settlements and two to three channels (Adams 1981, pp. 35–36; 2008). However, analysis of the textual sources indicate perhaps as many as 185 hinterland settlements in a varied rural landscape, accompanied by a number of water channels and canals (Steinkeller 2007). The surveyor, R. McC. Adams, attributes this discrepancy to a combination of artificial survey boundaries and low visibility, with smaller sites buried under the alluvium (Adams 1981, 2008).

Finally, specific written and iconographic data provide insight into the development and variation of the Sumerian geopolitical landscape and political history. Several key datasets, contemporary and later, are relevant for contextualizing these new political forms. The general historical outline has been reconstructed from the nineteenth century Sumerian King list (Jacobsen 1939). While some scholars point out that the text is idiosyncratic (Finkelstein 1979, pp 60–63; Michalowski 1983), neglecting some otherwise attested dynasties such as Lagash and Isin (Cooper 1983; Michalowski 1983), it provides a framework for both early chronology and understanding the movements of power and authority among emerging Sumerian polities. When taken with iconography and inscriptions from early third-millennium BC city-seals, the evidence indicates a developing framework of political and economic relationships between cities, rooted in budding competition over resources and attempts at hegemony, if remaining unclear on the nature of interactions and the organization of developing alliances.[8]

After ca. 2700 BC, groups of contemporary texts recovered at several capital cities provide a limited but tantalizing range of information.[9] While largely regulated to economic and administrative activities (Postgate 1992), the texts paint a picture of increasingly complicated political ecology with shifting alliances between neighboring cities, extensive and upward scaling of networks of artificial irrigation canals, and extending trade routes. These territorial polities had delineated and explicit geographic boundaries, administrative and governing institutions that communicated and formed alliances to deal with the conflicts and tensions of burgeoning populations, and circumscribed resources (Nissen 1988, p. 145; Adams 1981). Internally, the texts indicate that city-states were governed by powerful public and religious administrative institutions whose ideological roots lie in a system of patron gods for each city (Nissen 1988; Postgate 1992). These social institutions harnessed their power and authority to organize military activities and govern aspects of production and consumption. For example, a combination of lexical texts (Postgate 1992, pp. 223–25) and documents that record administrative activities reveal a complex hierarchy of groups and individuals whose professions range from chief temple administrator and temple personnel to specialized craftsmen, farmers, and scribes.

One of the most robust written collections used to reconstruct political history, social order, and intercity warfare in this period comes primarily from excavated and looted contexts at the site of ancient Girsu (Telloh), and concerns an on-going border conflict between the neighboring polities of Umma and Lagash (fig. 7.3; see also Cooper 1983). Referred to in the scholarly literature as the Umma-Lagash border dispute, the disagreements described in royal inscriptions and displayed in iconographic material pertain to claims over land and a canal along a shared border, providing unique insight into the relationship between water, power, and politics (Cooper 1983; Winter 1985). The sources used to reconstruct the conflict, and its evolution over a period of 150 years, recount the tensions from the perspective of the Lagash polity.

In brief, the earliest inscriptions relate the establishment of the border in a previous period by the King of Kish, Meslim (ca. 2500 BC), accomplished under the direction of the chief god of the Sumerian pantheon, Enlil (Cooper 1983, p. 22). Over time, the texts chronicle increasing tensions over cultivated land along this border called Gu'edena (translated as "edge of plains," Cooper 1983, p. 23). This was territory claimed by both

[8] Matthews 1993; Nissen 1988; Postgate 1992, pp. 32–34; Steinkeller 2002; Winter 1985; Wright 1969.

[9] Alberti and Pomponio 1986; Alster 1991–93; Biggs 1974; Kuhrt 1995; Martin 1988.

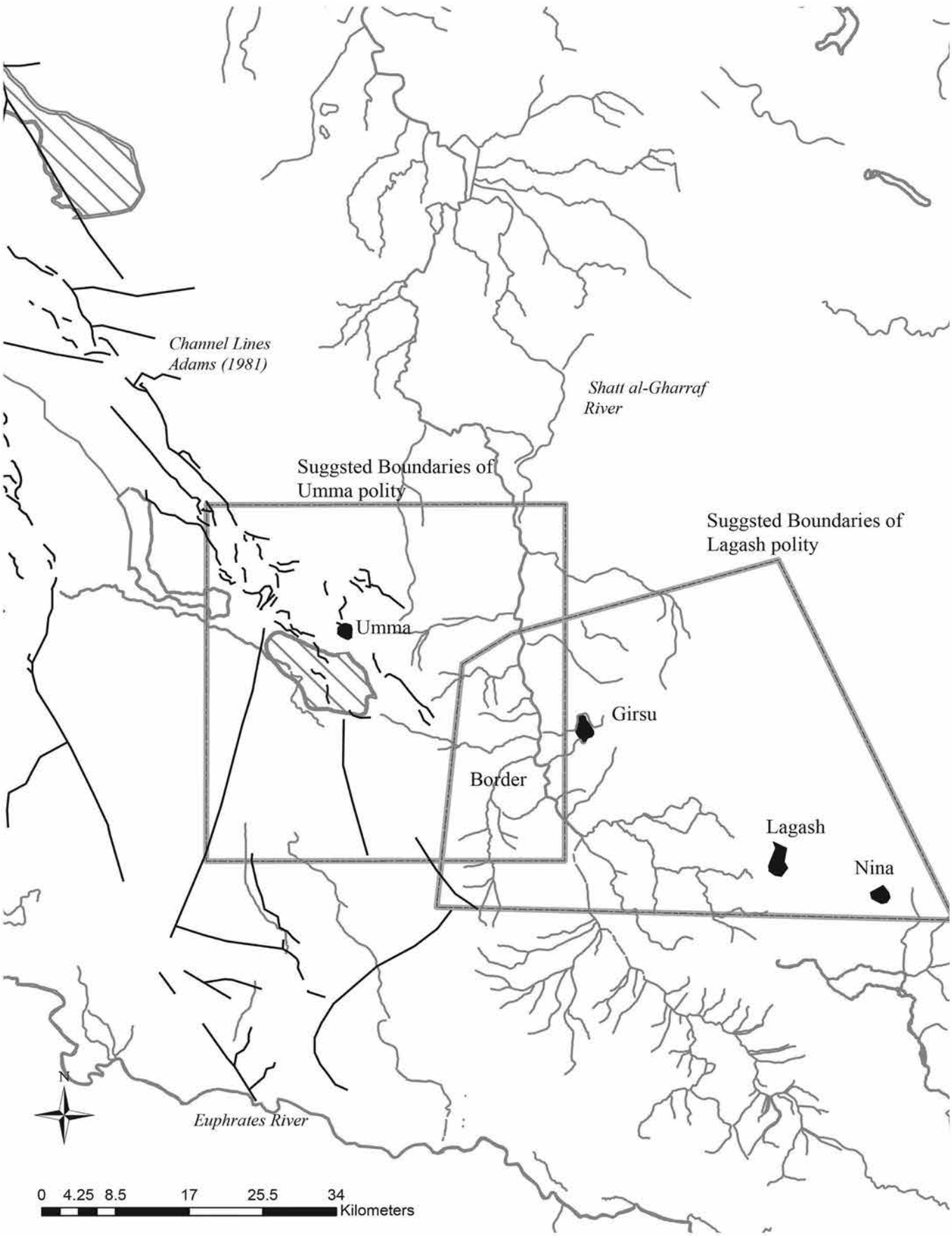

FIGURE 7.3. Boundaries of the Umma and Lagash polities in the third millennium BC. (Compiled from Steinkeller [2007] and Jacobsen)

polities and, according to the inscriptions, cultivation was allowed by both with the following constraint: Umma paid in grain yields to lease fields in this area. By the reign of Enantum I (ca. 2450 BC), it is clear that the heart of the developing dispute lay in three related conditions: (1) Umma's failure to make payments; (2) improper use of the shared irrigation canals, i.e., Umma is charged with theft for attempting to divert water from shared canals into canals that only fed Umma's fields; and (3) Umma's extension of fields across the border canal and into land allotted for Lagash cultivation. In some cases, these transgressions are described as immediately leading to warfare, but in others it seems to take some time for action to occur, and the texts may be relating incidents that merely provoked a warning (Cioffi-Revilla 1999; Rasler and Thompson 2006). Chronologically, the latest inscriptions suggest the conflict was not resolved and recount Girsu playing a more prominent role in the dispute (Cooper 1983, pp. 36–37).

Cooper's (1983) exhaustive analysis of the inscribed material demonstrates that this conflict probably reflected broader struggles for hegemony over southern Babylonia and the development of enduring political alliances, which ultimately left the Lagash polity isolated. Yet he points out the geographical, chronological, and philological limits to understanding the political ecology of this conflict. For example, the written documents refer to numerous place names and canals, but few have been securely identified and located. Jacobsen's (1969) short survey of the area proposed a location for the border canal and several settlements mentioned in the texts, but the survey reported difficulty in reconstructing channel patterns due to low visibility during ground survey and lack of available aerial photographic coverage over the area, rendering conclusions tentative. As it stands, the conflict appears as a spatially "floating" set of events that are difficult to correlate in terms of archaeological material and environmental and geographical setting.

DATA AND METHODS

The primary datasets, archaeological surveys, excavations, and textual records illustrated by the Umma-Lagash case study paint a picture of an evolving urban landscape and the shifting relationships between humans and their environment in the context of newly emerging polities and social hierarchies. For example, climate shift, with the onset of increasingly arid conditions, would have created a greater demand for artificial landscape management to both maintain and expand resources. The depopulation of the countryside and demographic movements into walled cities may in part reflect an initial response to unstable rural conditions. Relationships between communities once regulated on the local level would have required increasingly complex institutions to manage and negotiate new resources and access, such as shared water source rights and land use.

Yet, while informative, each of these datasets is hampered by spatio-temporal limitations. For example, the extensive surface surveys covered primarily the northern and western portions of the Sumerian heartland, because the southern and eastern areas were located in the Central, Hawr al-Hammar, and Hawr al-Hawiza Marshes. In these wet conditions, visibility was low, rendering surface survey impractical, and access was hindered by lack of passable roads (Adams 1981, 1972; Adams and Nissen 1972). While there may be as many as fifty capitals of polities in this period (Westenholz 2002), excavations in the late nineteenth and early twentieth centuries focused on a handful of the most prominent of these sites. Methodologically, the goals of these excavations were heavily weighted toward the collection of museum quality material and the articulation of temples and monumental structures, revealing an incomplete snapshot of material. Finally, the textual corpus is comprised of groups of texts from different centers and is uneven, both chronologically weighted toward the latter end of the third millennium BC (2600–2100 BC) and restricted by the varied scope of topics at different sites (Kuhrt 1995, pp. 28–29).

One promising method for moving beyond these data limitations is to integrate previously excavated textual and archaeological data with remote sensing data in a geospatial framework. Numerous recent studies have demonstrated the utility of remote sensing datasets and GIS tools to act as a bridge for fragmentary archaeological and textual datasets and address long-standing historical questions (for summaries see Hritz 2014; Parcak 2009). With changing ground conditions both permitting new fieldwork and revealing relict features on satellite imagery (Hritz, Pournelle, and Smith 2012), landscape studies in southern Mesopotamia,

in particular, have benefited from an integrative geospatial research design that permits the synthesis of previously collected data with variable collection and recording methods and new available datasets to enhance past historic models.[10]

Building on recent integrative geospatial approaches,[11] this study employed a combination of multiperiod and multiseasonal historic Corona satellite photography;[12] recent submeter resolution Digital Globe satellite imagery;[13] 90 m SRTM DEMs;[14] 30 m ASTER DEMs (Altaweel 2005; Harrower 2010); maps from past excavations of the site of Girsu (Huh 2008); four maps from the *Atlas of Iraq* (1976); and information from ancient texts that covered the reconstructed territory of Lagash (based on Jacobsen 1969, fig. 1).

The draining and drying of the marshes over the last twenty to thirty years has made landscapes visible on the surface and on high-resolution satellite imagery (Hritz, Pournelle, and Smith 2012). Studies of looting patterns in southern Iraq have demonstrated the utility of expensive high-resolution datasets such as Quickbird or Geo-eye images (Stone 2008) over small areas. But these datasets can be cost prohibitive when dealing with large areas rather than specific sites. For example, the former Hawr al-Hammar marshes, about 1/3 of the entire area, at its greatest recent extent covered 20,000 sq km. At roughly USD $14 per sq km, images of the area would cost USD $280,000. An alternative is to clip images from Google Earth Pro. The program allows the user to clip images and save them at resolutions as high as 4800 dpi. For this area, 162 images were clipped and the preserved ground resolution was ca. 2 m. Digital globe images from 2006 and 2012 were also integrated covering smaller areas around Girsu and Lagash. Recently available DEMs from the SRTM and ASTER satellite missions provide a broad view of the riverine landscape. These terrain models emphasize the more long-lived and enduring landforms such as relict channel levees, and eliminate small and more ephemeral features (Hritz and Wilkinson 2006; Hritz 2010).

Methodologically, each of these datasets was digitized and integrated into a GIS for comparison and spatial analysis. Using survey data from the alluvial plains as a guide, archaeological sites and relict channels within the boundaries of the Lagash city-state and along the presumed border area between the city-states of Umma and Lagash were identified. Channel and canal lines were identified by topographic signature first and, when possible, verified visually on satellite imagery. Archaeological sites were identified by a set of visual criteria (Hritz 2012, 2010; Ur 2003; Wilkinson 2003) including looting holes, and verified on multiple datasets. Integrating these datasets, it was possible to present a preliminary reconstruction of the Sumerian settlement system—channels and archaeological tell sites—and take a detailed look at the geography and ancient landscape of the border.

VIEW FROM ABOVE: THE ANALYSIS (FIG. 7.4)

Despite recent archaeological forays into the marshes and delta of the rivers[15] that demonstrated the visibility of archaeological tell sites during periods of low water, the complexity of channel systems (Wilkinson 2013, fig. 2.3) and difficulty in dating archaeological occupations have prevented systematic reconstruction of the ancient landscape southeast of the modern Shatt al-Gharraf river. Previously, the physical geography of this area, including topography, settlement patterns, and ancient channel systems, had been reconstructed for small areas immediately around archaeological sites. Two principal studies that focused on the area immediately east of the river, considered to be part of the historic Lagash territory, combined information from the written sources and a brief archaeological survey. First, in 1969, as a follow-up to the survey of central Sumer and his reconstructions of the ancient channels of the Euphrates River, Thorkild Jacobsen made a brief survey of the area around the sites of Girsu and Lagash. Given the historical importance of the Lagash territory, his

[10] Hritz, Pournelle, and Smith 2012; Hritz 2010; Hritz and Wilkinson 2006; Pournelle 2003, 2007; Stone 2003, 2008.

[11] Hritz 2010, 2012, 2013; Hritz and Wilkinson 2006; Pournelle 2003; Ur 2003.

[12] Casana and Cothren 2008; Hritz 2010, 2012; Ur 2003, 2011.

[13] Lasaponara and Masini 2006; Parcak 2009; Hritz 2008; Stone 2008.

[14] Menze and Ur 2012; Menze, Ur, and Sherratt 2006; Hritz and Wilkinson 2006; Sherrat 2004.

[15] Hamdani, pers. comm.; Hritz 2014; Roux 1960. Archaeological surveys have been conducted in this area by State Board of Antiqutites and Heritage representative Abdul Amir Hamdani and continue.

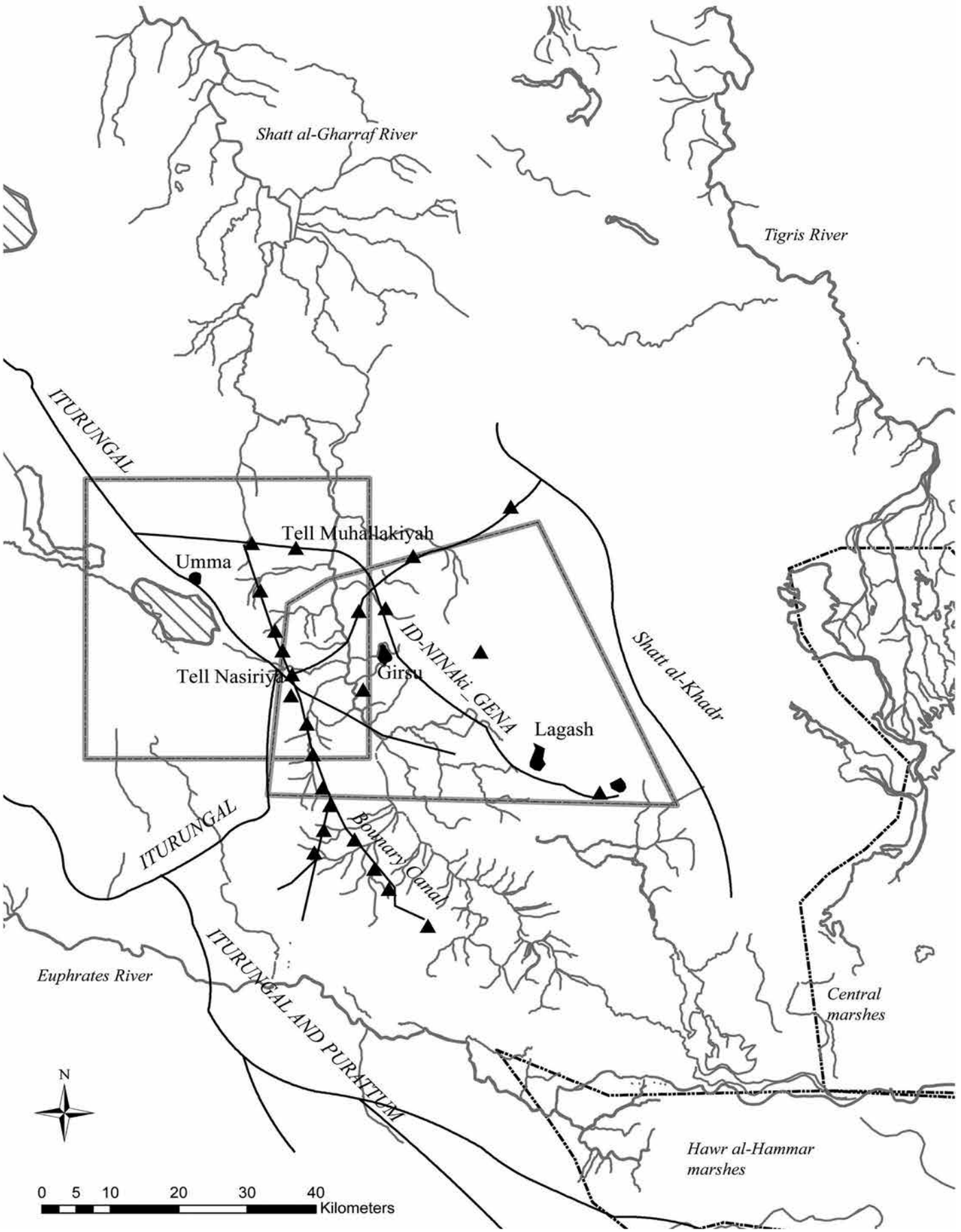

FIGURE 7.4. Jacobsen's reconstructed channel lines and surveyed sites on the modern river channels.

goals were to (1) trace the boundary canal described in the texts that was the primary source of tension between Umma and Lagash, and (2) determine the location of the Tigris River feeder canal, and by proxy the location of the main branch of the Tigris River in this period, as described in the inscriptions of Entemena.

Using methods from the Survey of Central Sumer project (Jacobsen 1960), he conducted surface surveys and dated forty-two tells in the area around the cities of Girsu and Lagash (Adams 1958). Integrating his ground observations with information from ancient texts, he sketched out the boundaries of the Lagash polity (Jacobsen 1960; 1969, fig. 1). He visited sites aligned north–south, and located west of but parallel to the modern Shatt al-Gharraf River. During his survey, he did not observe a relict channel levee, but reasoned that the alignment of sites marked the line of a relict canal. He concluded that this marked the boundary canal, called ID-NINA^{KI}-GENA in the ancient texts. Locating the feeder canal of Entemena, which would have directed water to Lagash's fields, proved more difficult because it relied first on determining the location of the Tigris River in this period.

Based on his interpretation of the Entemena cone inscriptions, and his reconstruction of the location of the boundary canal, he suggested that in the third millennium BC, the Tigris River could have been located in its Islamic period bed, the Shatt al-Khadr, east of the modern Shatt la-Gharraf. From this channel, a feeder canal could have run southwest to Tell Nasiriya, and crossed the ID-NINA^{KI}-GENA that fed Girsu (Jacobsen 1969, pp. 104–05). Such a set of canals would have mixed the water of both rivers. The Euphrates River would have watered the northern reaches of the ID-NINA^{KI}-GENA canal via the Iturungal River while the Tigris would have contributed flow via a channel running southwest from the Shatt al-Khadr emptying into the ID-NINA^{KI}-GENA north of Girsu near Tell Muhallakiyah (Jacobsen 1969, fig. 1). He concluded that this joint channel and secondary canals would have emptied into marshes to the southwest of Lagash and Girsu. Further, he noted that without the large and recent levee of the Shatt al-Gharraf, these marshes could have extended ever further north and east. Jacobsen points out a key constraint for this reconstruction of the Tigris River and the feeder canals: all sites visited along the proposed course date to the Parthian, Sasanian and Islamic period with no visible evidence for earlier occupation, despite previous information from previous surveys of the area (Jacobsen 1960, p. 175).

The second study was conducted by E. de Vaumas (1965) based on the study of topographic maps and analysis of the same texts used by Jacobsen. His reconstruction of the hydrology focused on topography and presents a different reconstruction of the fluvial landscape. Specifically, de Vaumas (1965, pp. 87–90) suggests that the third-millennium BC Tigris River followed the same course as the present Shatt al-Gharraf River, based partly on topography and partly on the large size of the Shatt al-Gharraf river levee, which is indicative of its long use. Further, he deduced that if the bed of the Shatt al-Gharraf river conducted the flow of the main body of the Tigris River in antiquity, then its levee would have presented a topographic barrier, separating the low-lying wetlands from the arable plains to the north (de Vaumas 1965, p. 88). In de Vaumas's reconstruction, Jacobsen's border canal, identified by the line of sites, would have been located at the edge of the topographic basin, and for water to reach Girsu from this canal, it would have to flow upslope. This renders the boundary canal reconstructed by Jacobsen topographically impossible. De Vaumas proposes, rather, that the channels that fed Girsu may be preserved in the more recent easterly channels of the Shatt al-Gharraf River (Wilkinson [2013, p. 41, fig. 2.3] shows this complex set of channels). This reuse makes the identification of individual canals and channels difficult to identify, and he did not suggest the location of the boundary or feeder canal described in inscriptions. Instead, he proposed that this canal must have been located north of Girsu. Until recent imagery became available, this work has been the only systematic archaeological exploration of this channel system.

Overlaying the DEM on the recent and historic high-resolution satellite imagery, it was possible to address the nature and morphology of the Shatt al-Gharraf River, and enhance the hydrologic picture produced by Jacobsen and De Vaumas. Both Jacobsen's and De Vaumas's reconstructions of the physical geography and hydrology were hampered by the narrow geographic view resulting from a short survey and limited scope of available topographic maps. In a fluvial environment, riverine systems act as an integrated whole and changes to a part effect the whole.[16] Therefore, to understand the natural and anthropogenic hydraulic

[16] E.g., Cushing, Cummins, and Minshall 2006; Molner, Burlando, and Ruf 2002.

landscape of the Umma-Lagash border dispute, it is necessary to take a broad spatial perspective. Viewing the modern course of the Shatt al-Gharraf river as a whole, from the Euphrates in the south to the modern Tigris in the north, several relict channel levees that are visible as topography on the DEMs can shed light on the local hydrology of the Girsu/Lagash area (fig. 7.5). For example, a significant point of avulsions occurred near the modern city of al-Hay. In this area, three channels splay out to the southwest and southeast. The westernmost channel (1) represents the current course of the Shatt-Gharraf River. The middle channel (2), represented by its relict topographic levee and faint soil discoloration on the high-resolution satellite imagery, runs parallel and 18 km to the east of the modern Gharraf. It rejoins the main river branch at Qalat Sakur, where the Gharraf splays out into numerous secondary branches running to the southeast. 20 km further to the east, the easternmost channel (3) follows a parallel path until Qalat Sakur, where it also avulses into at least five secondary branches, one of which may be the bed of the Shatt al-Khadr mapped by Jacobsen (1969). In this area just south of Qalat Sukkar, the DEM records a drop in elevation that would encourage the transition from a meandering river, at the northern reaches of the Gharraf, to an anastomosing river system visible in the relict levees of the secondary branches, and set the conditions for channels to avulse. In this area, a number of channels branch and rejoin, revealing the complexity of this channel system.

The relict middle channel levee (2) may shed light on the specific hydrology of the disputed border area, and aid in reconciling the different reconstructions of Jacobsen and de Vaumas. 16 km south of Qalat Sukkar, this levee is intersected by an ancient Euphrates levee, identified as the ID-NINA^{KI}-GENA, coming from Zabalam (Adams 1981; Jacobsen 1969). It is here, just north and east of Girsu, that waters of the two rivers began to intermingle. This Tigris/Euphrates channel splays into several secondary lines toward the southeast, past Girsu and toward the city of Lagash. These secondary channels are finger-like branches that flowed out and, presumably, deposited water from the Gharraf levee downslope to the lower elevation areas of the southeast and the marshes. Three of these channels are preserved in part as modern Shatt al-Gharraf eastern branches and in part as relict topographic ridges on the DEMs, feeding the territory surrounding the cities of Girsu and Lagash. The first channel carrying the water of the Tigris and Euphrates rivers would have come from Zabalam, run northeast of Girsu and Lagash, and fed a number of contemporary small sites noted in the *Atlas of Iraq* (1976). The second channel came from the area of Umma, intersected the Gharraf bed, and ran directly past Girsu and down to Lagash and Nina. Finally, a third canal is visible to the southeast and would have fed some of Jacobsen's north–south aligned sites on the western side of the Shatt al-Gharraf.

From this landscape reconstruction, it is clear that the Tigris River played a prominent role in the hydrology of southern Sumer, particularly in the area of the Lagash polity. For example, the Gharraf itself, like so many other channels in southern Mesopotamia, is reusing older channel lines of the Tigris River, and this may account for the massive levee of the river channel and its similarity to the reused Nahrwan canal in the Diyala region (Hritz 2010). The morphology of the three channel lines visible on the DEMs reveals that the Tigris River may have experienced variable morphology along its course resulting from even slight elevation changes southeast of the alluvial plains. As an anastomosing and leveed river, its multiple branches correlate with de Vaumas's reconstruction of the Tigris line along the Shatt al-Gharraf and Jacobsen's Tigris branch in the Shatt al-Khadr bed. Essentially, the Lagash polity would have been surrounded on all sides by large branches of the Tigris River.

Further, the DEMs reveal that the cities of Umma, Lagash, and Girsu would have been located on channels that were fed by waters from both the Tigris and Euphrates rivers. The presence of both rivers in this area and the modification of their channels by millennia of irrigation agriculture have contributed to the complex hydraulic landscape preserved today, and the burial of ancient features under alluviation. In these conditions, the efforts to pinpoint an individual feeder canal of the rivers may not be possible because the disputed feeder canal could be preserved in part or whole by any of the canals preserved along the eastern edge of the modern Shatt al-Gharraf, the boundary area between the two polities, or totally buried under the aggrading levee of the Gharraf. Further, the remote sensing data demonstrates that mapping of the boundary canal may not be necessary to understand the hydrological context of the water dispute and its broader historical implications.

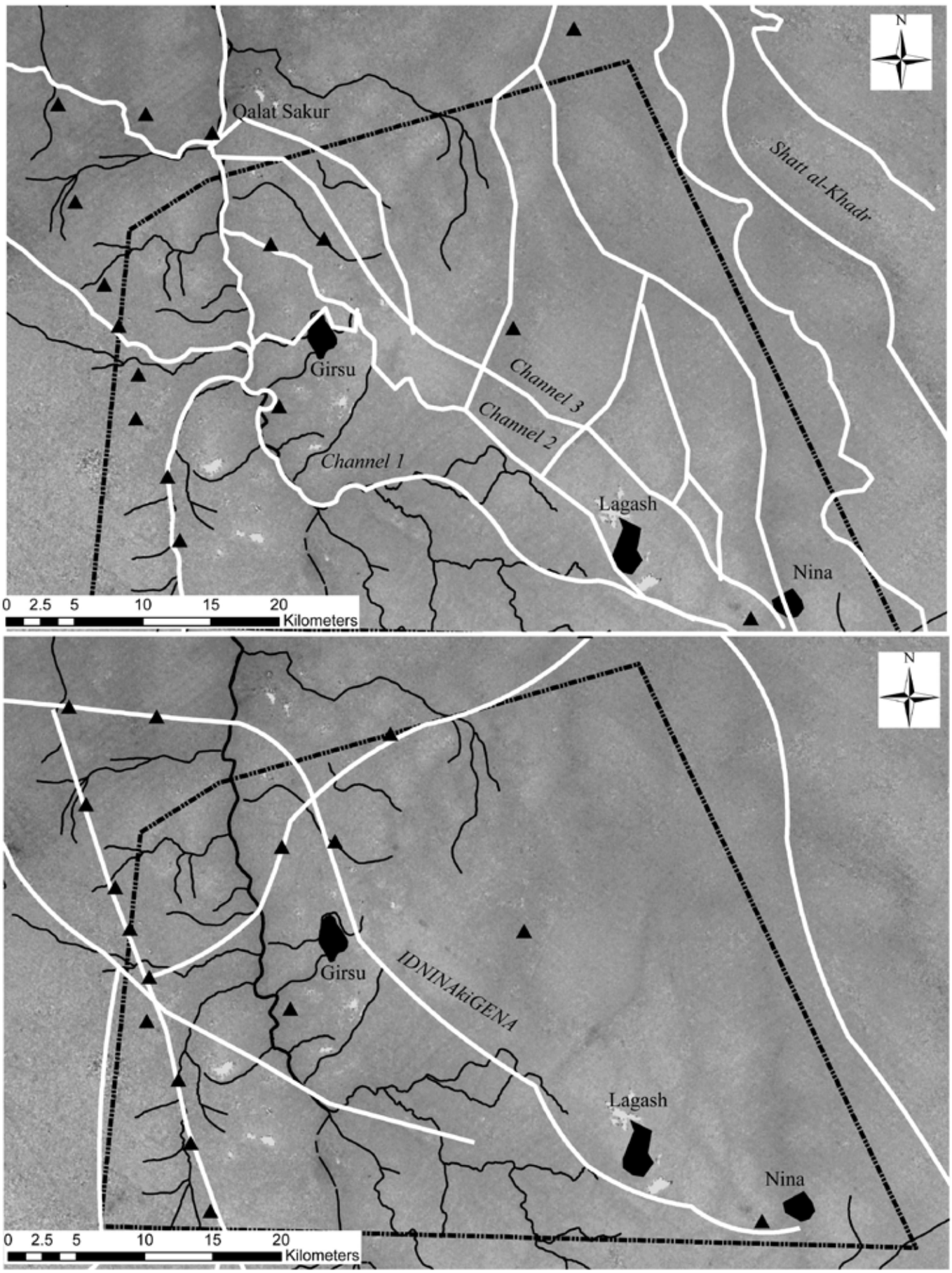

FIGURE 7.5. SRTM as background, channels traced by Jacobsen at bottom, channels digitized from topographic data at top.

CITIES AND THE SETTLEMENT LANDSCAPE (FIG. 7.5)

Remote sensing datasets and maps from the *Atlas of Iraq* (1976) can also facilitate a preliminary outline of site distributions in this area (fig. 7.6). Using the common keys for the signature of an archaeological tell site on a satellite image, such as tonal differences and characteristic shape, 583 sites were visible on the Digital Globe clips throughout the entire area. In general, the sites are dispersed throughout the area east of the Shatt al-Gharraf. Possible sites of all sizes are clustered along relict channels of the Tigris River, and empty spaces off the relict river levees have been heavily modified for on-going agriculture, presumably masking smaller settlements. While dating must await future fieldwork, it is clear that this was a heavily occupied ancient landscape, with some possible sites with mounded areas reaching over 100 ha.

Zooming in on the immediate area east and west along the Shatt al-Gharraf river, the presumed border between Umma and Lagash, and the territory of Lagash (roughly 1,816 sq km), the *Atlas of Iraq* (1976) and Jacobsen's survey provide a base outline of visible settlement distributions (fig. 7.7). Many of the sites Jacobsen mapped are not visible on the recent high-resolution satellite imagery and historic Corona satellite photography. This may be a reflection of progressive loss of the ancient landscape as a result of several combined taphonomic processes such as burial or destruction due to intensive irrigation agricultural and canalization from the Shatt al-Gharraf river on its western side in the period since his mound survey. On the eastern side of the Shatt al-Gharraf and in the landscape between Girsu, Lagash, and the site of Nina, the *Atlas of Iraq* notes sixty-eight archaeological sites. These sites show three distinct clusters, on the levee of the Shatt al-Gharraf (the border with Umma), along two large channels that run from Girsu toward Lagash, and along channels to the northeast of Lagash. While sites in each area range in date, according to the *Atlas*, many of those along the levee of the Shatt al-Gharraf and the two large channels are dated to the early third millennium BC. Integrating high-resolution satellite imagery, there are an additional 108 possible archaeological sites in this area, clustered in the three primary areas and filling in the rural landscape. The majority of sites are small with visible mounded areas ranging between 0 and 5 ha, revealing the overall density of the rural landscape in this area.

While dating must await future ground visitation, a few individual mounds can be described, and references to textual sources suggested (fig. 7.8). The largest site in the Lagash territory, excepting Girsu and Lagash, has 78 ha of visible mounded area and is located at 10 km north of Girsu on the Tigris/Euphrates river channel that comes from Zabalam in the northwest. The site is crisscrossed by modern roads and canals. Looter holes are visible on its southern edges on Quickbird imagery. In this area, distinct tonal differences on the imagery reveal the possible traces of two large square buildings, perhaps measuring 125 × 15 m. While the site has not been surveyed or dated, it may have represented a significant town on the border area between Umma and Lagash. The texts describe an important northern sanctuary of Ningirsu—Antasurra and the palace of Tirash—in the Gu'edin that was affected by the conflict over water between Umma and Lagash. Jacobsen suggested it was located at or near the site of Imrebi'a (Jacobsen 1969, p. 104). Imrebi'a is located further to the east, a smaller settlement and surrounded by small-mounded sites. Reasoning that this is the largest town in the area and located along the contested channel line, it is possible to suggest that this site may have contained the sanctuary or palace rather than Imrebi'a.

The second large site is located 3 km north of Girsu. This 22 ha tell has been dated to the Achaemenid and Parthian periods by the Atlas survey. Given its proximity to a series of Early Dynastic sites dated by Jacobsen (1969) and along the same river channel, it may have had an earlier occupation. It is located along the reconstructed Tigris/Euphrates channel that fed Girsu and may have played a role in water management to the site. At the southwestern edge of the Lagash territory, west of the modern Shatt al-Gharraf River, are three large sites covering 24, 53, and 43 ha of mounded area. They are located on the remains of a large levee that has been cut by the third river drain. The *Atlas* (1976) identified them as Tell Madinah-Bad-Tibira, Tulul al-Madyna, and Abu al-Sakhair. Tell Madinah-Bad-Tabira and Abu al-Sakhiar date to the Early Dynastic–Ur III periods while Tulul al-Madyna dates to the Sasanian–Islamic periods. It is possible these sites represent a shifting occupation along the levee as the Tigris channels adjusted over time. All are located along major visible channels that lead from Umma territory into Lagash and areas further southeast. The overall pattern which emerges is one of large and evenly spaced cities, most clustered at the edge between the alluvial

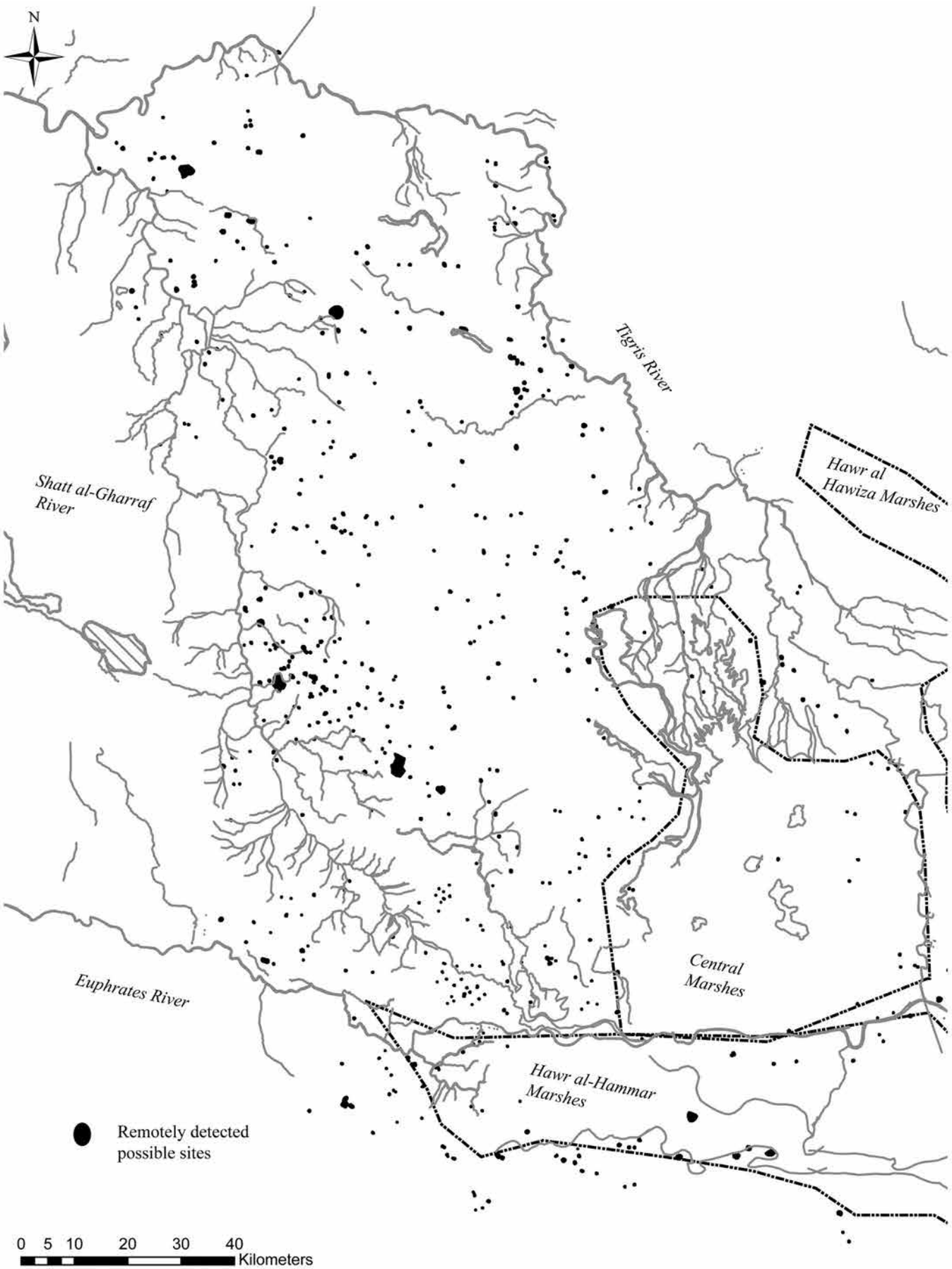

FIGURE 7.6. Remotely detected possible archaeological sites east of the Shatt al-Gharraf River.

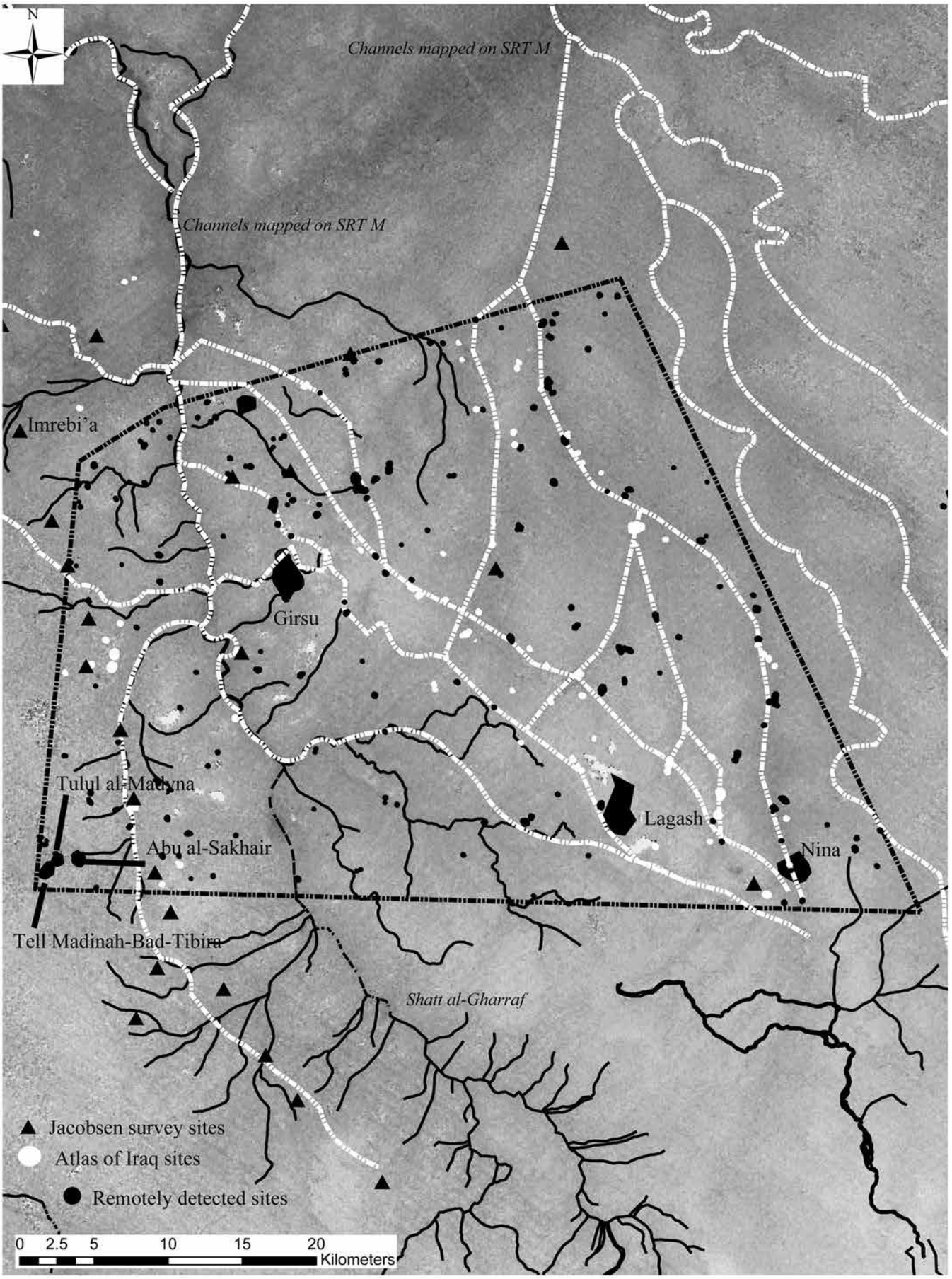

FIGURE 7.7. Sites mapped by Jacobsen (1969), the Atlas of Iraq (1976), and remotely detected in the reconstructed Lagash territory.

FIGURE 7.8. Sites in the border area.

plains and the marshes further south, and along the fertile levees of river channels. These sites could have functioned as gateway sites between the resources of the marshes and the plains with the smaller and rural sites further south in the marshes. Sites in this area would have played a key role in border disputes and should be the focus of future fieldwork in the area.

With the levee of the Shatt al-Gharraf acting as a barrier between plains and marshes, and the ensuing diversity of ecological conditions in this period, it is not surprising that settlement distributions are varied throughout the Lagash territory. In general, the picture which emerges is one of a populated rural landscape around several primary urban centers, with the spatial boundaries between cities and the countryside fluid. Girsu itself was well located to access both rivers and their channels, and the immediate environs around the site would have included a mosaic of ecological conditions, including marshes and irrigable plains interspersed between canals and channels. The ability to tap into a diversity of resources and access primary river channels to move goods over distances may have contributed to its long-term stability and the importance placed on this area. At the same time, channel consolidation occurring in this period may have resulted in increased strain on water and fertile land, setting the stage for the conflict.

CONCLUSIONS

The integration of the remotely sensed datasets and the past surveys, excavations, and textual sources highlights the importance of geography and hydrology in the emergence of Sumerian cities. In the context of prolonged conflict over resources between Umma and Lagash, these landscape conditions, dissimilar to those on the alluvial plains or areas further west, set the stage for an extreme case of intercity conflict and the politicization of resources. Physically, the riverine landscape east of the Shatt al-Gharraf river was one that was marked by an abundance of water in antiquity, and heavy sedimentation and alluviation. Locating a specific "boundary" may not be possible in this landscape, where channels have been used and reused over millennia and sediment and intensive field cultivation have buried features that were visible as recently as forty-five years ago during Jacobsen's survey. Yet, reconstructing the general natural and cultural landscape can provide historical context and illustrate some conditions, including opposing conditions of resource abundance and scarcity (Le Billion 2001, p. 564), that contributed to the conflict.

The confluence of both rivers in this area, traced on the DEMs and high-resolution imagery, contributed to the development of interspersed marshes and swamps alongside levee-based irrigation agriculture. The dominance of a number of leveed Tigris River branches in this area, particularly an ancient course which has been adopted by the Shatt al-Gharraf river, presented opportunities for expansive agricultural landscapes, reflected in the dispersed settlements along the levees and at the edges of the marshes, and contextualizing the large numbers of fields referenced in inscriptions from throughout the third millennium BC. But these opportunities must have come at the price of resource vulnerability, increasing management of once-natural canals and channels as water from the rivers became unstable from a combination of modifications upstream and a gradually changing climate. The border dispute must have occurred in the context of fluctuating conditions that would require inhabitants to make increasing investments in management and maintenance, perhaps reflecting shifts in the Euphrates channels serving this area. If that was the case, it would have required Umma's inhabitants to draw more irrigation water from Tigris channels and extend field systems laterally across the large levees, resulting in boundary transgressions.

Beyond the physical geography of the area, these multiple large levees acted to isolate the Lagash polity. Surrounded by large levees and fertile land, Lagash would have been spatially separated from polities to the north such as Umma and to the south and east such as Uruk and Ur. One could envision the Lagash territory as a relatively self-sufficient and diverse ecological mosaic, insulating it from any resource constriction felt elsewhere in the alluvium and also making it an attractive landscape to surrounding polities. This spatial landscape may account for Lagash's isolation in the alliances that develop in the mid–late third millennium BC and Girsu's longevity. Image interpretation reveals the presence and preservation of several sites, particularly a 78 ha settlement north of Girsu, whose future exploration could contribute to a broader understanding of the settlement landscape.

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