Spying on the Past: Declassified Intelligence Satellite Photographs and Near Eastern Landscapes

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Jason Ur

Near Eastern archaeology has its origins in the scramble for great objects, as the great imperial powers of the nineteenth century filled their national museums. Since that time, the questions that archaeologists seek to answer have diversified. We are no longer interested only in the lives of kings; we are more concerned with society generally. Our questions now demand a perspective beyond the excavation trench; we have to consider entire landscapes if we want to know about the rise of urbanism, human land use and environmental impacts, and the demographic impacts of states and empires, for example. This broadening of research horizons was behind the growth of archaeological survey as a field method in the later twentieth century.

Regional-scale research demands a regional-scale viewpoint, and Near Eastern archaeologists were some of the earliest to recognize the power of a vertical perspective. Pioneers of aerial archaeology such as O. G. S. Crawford, Antoine Poidebard, and Aurel Stein all studied Near Eastern landscapes as part of their foundational research. These early studies were all conducted in the context of the dissolution of the Ottoman Empire, World War I, and the mandate period that followed it. With the emergence of new nationalist governments in the later twentieth century, easy access to aerial photographs and national airspace has been sharply curtailed, with a few exceptions (e.g., Jordan). Unfortunately, this new restrictive phase corresponded with the rise of archaeological survey as a field method. Just at the time that archaeologists were most in need of a vertical perspective, it became nearly impossible to obtain one.

Archaeologists, and nearly everyone else, were unaware that thousands of photographs of Near Eastern sites and landscapes were indeed being taken at this time—by the first generation of U.S. intelligence satellites under the code name CORONA. It would be almost four decades before these photographs became known to anyone outside of the intelligence community, but since their declassification there has been a revolution in Near Eastern landscape archaeology.

Spying from Space during the Cold War

By the middle of the 1950s, the U.S. intelligence community had experienced a series of dramatic failures. The Japanese attack on Pearl Harbor, for example, was completely unforeseen. Two more recent Soviet triumphs were especially alarm-

ing: the detonations of their first atomic bomb in 1949 and the first hydrogen bomb in 1953. Both events came as complete surprises and were instrumental in the start of the CORONA program under the impetus of President Eisenhower (Day, Logsdon, and Latell 1998).

CORONA consisted of six increasingly sophisticated cameras and included 145 launches from 1959 to 1972. At the same time, a "spotter" program code-named GAMBIT could return high-resolution photographs of sites and features initially recognized by CORONA. After some early failures, CORONA and GAMBIT returned a wealth of imagery on America's Cold War adversaries. Their cameras revealed all Soviet intercontinental ballistic missiles sites, antiballistic missile sites, warship bases, submarine bases, and many previously unknown military complexes. It confirmed the existence of the feared "missile gap" but demonstrated that it was dramatically in favor of the United States, and in this sense the program was instrumental in preventing the nuclear proliferation that might have led to war. It was a stunning intelligence triumph, but most Americans remain completely unaware of CORONA's existence.

Unlike the Soviet tests, CORONA predicted a nuclear China (fig. 1). An initial CORONA mission spotted a strange circular anomaly in the northwestern deserts in 1961, and the site was closely monitored by repeated CORONA visits (i.e., on August 8, 1964). A GAMBIT program satellite took a high-resolution image on September 25 that convinced US interpreters that an atomic test was about to occur. The test occurred on October 16, and a CORONA satellite confirmed it four days later. The U.S. Secretary of State had, however, made

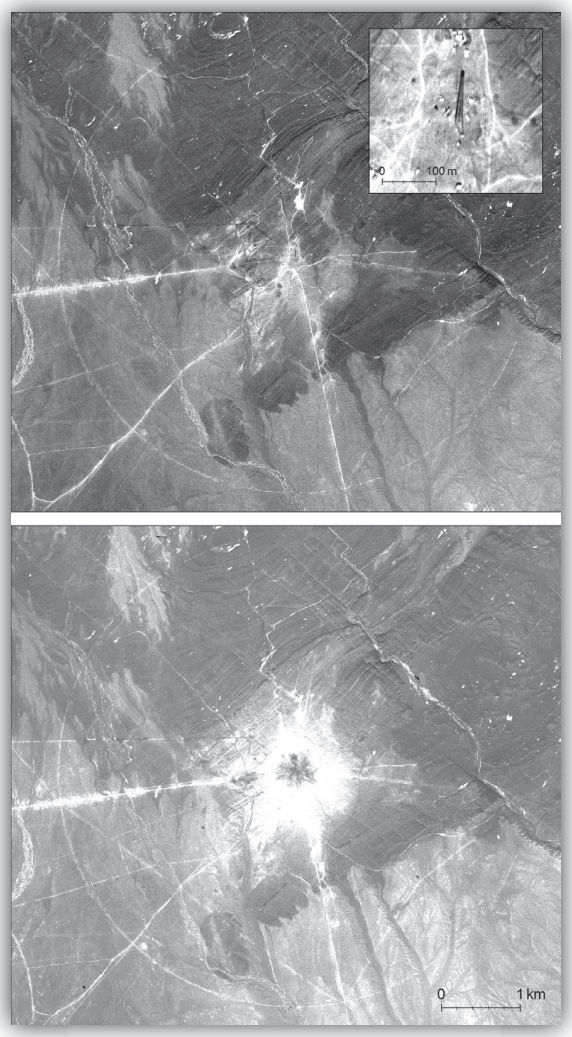


Figure 1. The first Chinese atomic test at Lop Nor, China. Top: GAMBIT shows the circular test area, including a detailed image of the tower that held the bomb (Mission 4011, 25 September 1964). Bottom: The test site four days after the detonation (CORONA Mission 1012, 20 October 1964).

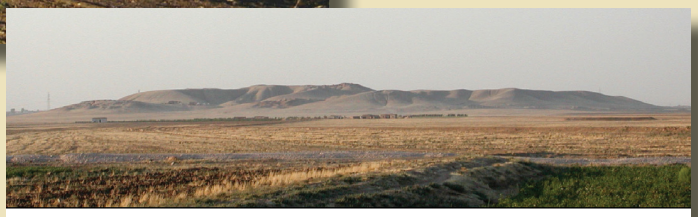
Figure 2 (below). Figure 2. GAMBIT photograph of subterranean ICBM silos at Baikonur, Kazakhstan (Mission 4033, 13 October 1966). The three silos at center have domed covers that slid on rails to the left before launch.

it clear that the he anticipated the test and was able both to blunt its propaganda effects and to reassure Asian allies that the U.S. was aware of Chinese capacities and would stand by them.

Fortunately for world stability, many of the strategic sites photographed have become archaeological sites themselves. CORONA kept a close eye on the Baikonur Cosmodrome, a facility today found in Kazakhstan and most famous for Sputnik and Yuri Gagarin. Its primary role, however, was as a test facility for Soviet intercontinental ballistic missiles. One area of the facility had three below-ground silos with domed covers on rails (fig. 2). It was surrounded by a group of support structures within several layers of fencing. By 2003, however, this site had been decommissioned: the fencing and many structures had been dismantled, and the silos lay open and empty.

Satellite imagery for intelligence purposes is only useful if it is current, and the imagery from CORONA and GAMBIT has long ceased to be useful for its original purpose. In the interests of providing a "new" resource to scientists and historians, the imagery from CORONA was declassified in 1995 and made available to the public in 1998; GAMBIT imagery was declassified in 2002. In total, approximately 850,000 images can be previewed and ordered via the U.S. Geological Survey. Almost immediately, archaeologists seized upon this new resource, and since 1998 there have been dozens of

Figure 3 (left). View across a 1-m deep hollow way near the Early Bronze Age city of Hamoukar, Syria.



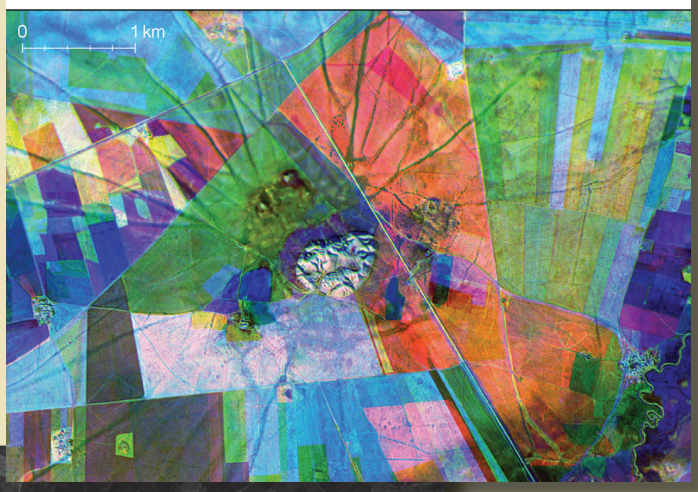
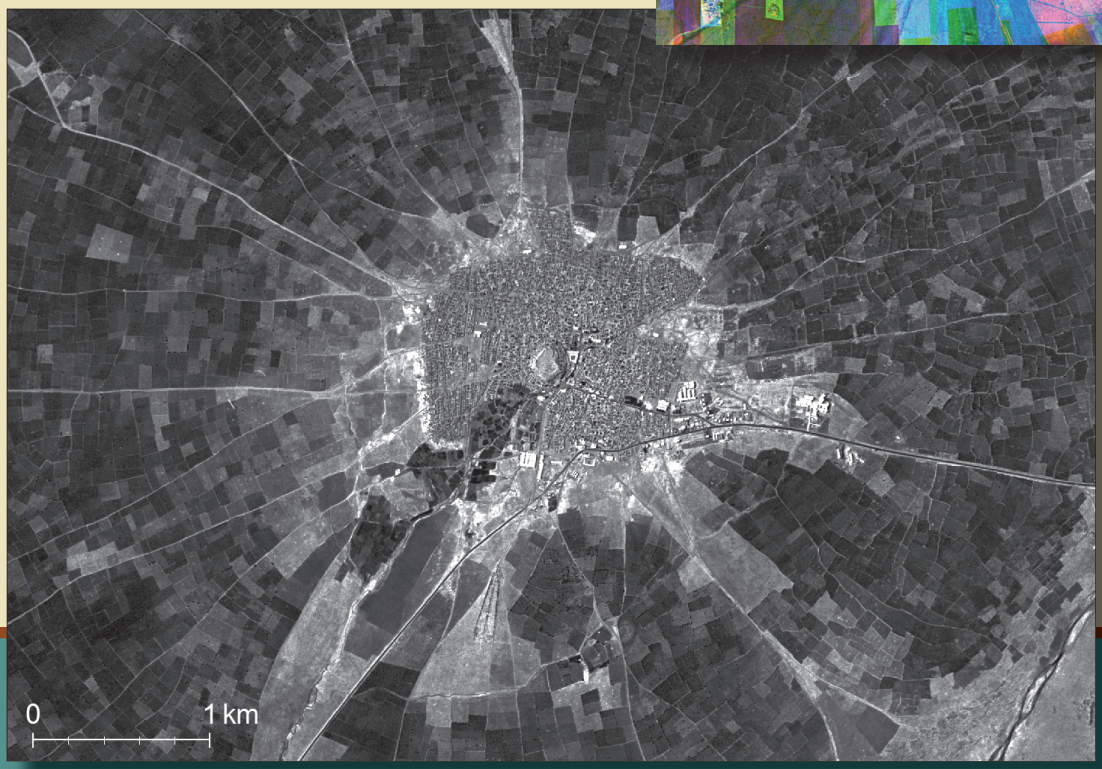


Figure 4 (right). Top: the mound at Tell Brak from the south (September 2005). Bottom: composite image of trackways radiating outward from the Early Bronze Age city at Tell Brak, Syria (Missions 1102, 1108, and 1117).

Figure 5 (below). The town of Siverek in southeastern Turkey (Mission 1107, 1 August 1969). The radial pattern of tracks through the fields is identical to the Early Bronze Age pattern in Figure 4.



new studies based on CORONA (see recent reviews in Fowler 2013, Ur 2013) and an online interface for the public (the CORONA Atlas of the Middle East: http://corona.cast.uark.edu). In addition to identifying ancient sites, these images have been especially powerful for what they can tell us about the spaces *between* the sites—the landscape beyond the village or outside the city wall. In this manner, archaeologists can approach the texture of daily life in a way that is impossible using only the tools of excavation. This article will review several hidden landscapes revealed by CORONA: ancient paths of movement, irrigation schemes, and the ephemeral landscapes of pastoral nomads. These case studies will take us to Syria, Iraq, and Iran.

Ancient Movement in Early Bronze Age Northern Mesopotamia

People in the past left their settlements and moved out into the countryside for a variety of reasons, yet archaeological maps frequently depict sites as isolated dots, like islands in the sea. This circumstance results from the great challenges of identifying any physical traces of that movement; for the most part, they have been wiped clean by later activities. Most commonly the culprit is agriculture: a beaten-earth track might have been used as an artery between major cities for centuries, but a few years' plowing will cause it to vanish completely. In the face of modern agriculture, with its tractors and steel plow blades, the survival of ancient trackways is unlikely.

In at least one case a complex landscape of ancient movement survives in CORONA photographs. The later Early Bronze Age (ca. 2600–2000 B.C.E.) was a time of great urbanization throughout Mesopotamia. On the northern plains, in what today falls mostly in northeastern Syria, great cities emerged, some with populations as high as ten to fifteen thousand persons. They had enormous walls, large palace-temple complexes on high citadels, and densely packed residential neighborhoods with narrow streets. The countryside contained a small number of towns and small villages, but generally this was a time when people lived within cities (Stein 2004; Ur 2010; Matney 2012).

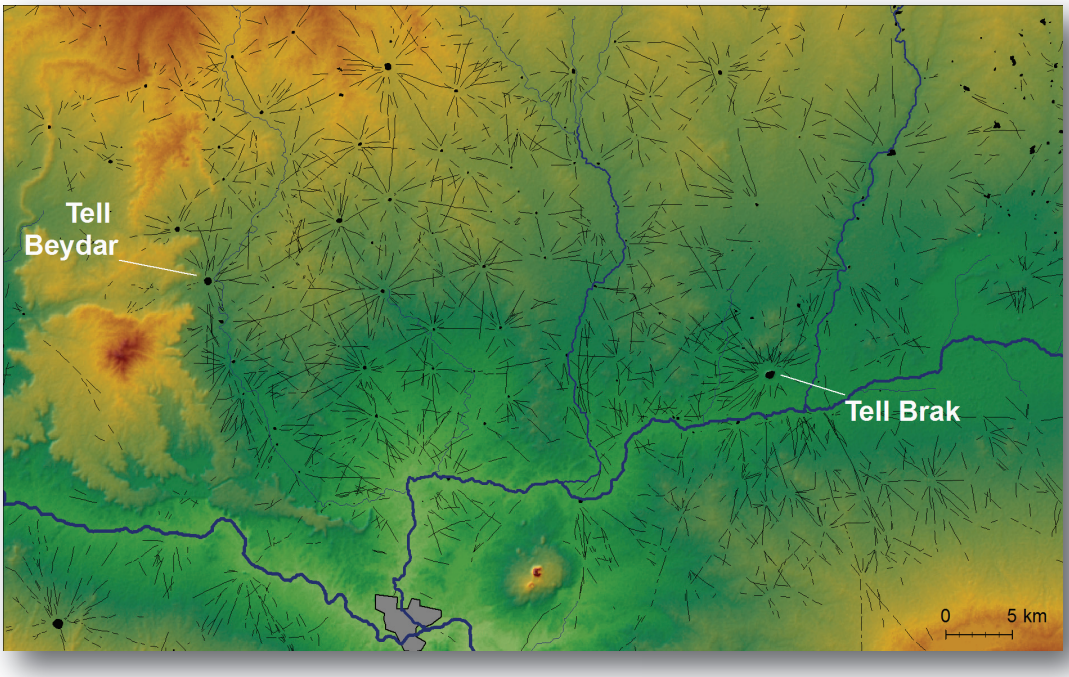
Landscape fieldwork, both on the ground and using CORONA photographs, has uncovered broad and shallow linear trackways that are often referred to as "hollow ways" (Wilkinson 2003, 111–17). These features can be as wide as 100 m and up to 2 m deep. They are difficult to identify on the ground (fig. 3), although under favorable lighting conditions their topographic depression is more pronounced. Because they collect moisture, vegetation often grows disproportionately within them. In the dry season, they promote weed growth, which is often the only way to recognize them. Under rainy conditions, some features can even accumulate standing water.

In the view from the CORONA satellites, on the other hand, hollow ways are vivid and abundant across the landscape. Because they are wetter and contain more vegetation, they appear as dark lines on the photographs (Ur 2003).

Most commonly, hollow ways extend out 3–5 km from an Early Bronze Age site and then simply fade out. This pattern occurs around major cities, such as Tell Brak (fig. 4) but also around villages of 5 ha (12.3 acres) or less. "Roads to nowhere" might seem odd, but this pattern can be confidently interpreted by analogy with recent agricultural towns in the Near East. For example, roads and tracks around the Turkish town of Siverek describe an identical pattern (fig. 5). This pattern, both ancient and modern, results from the daily movement of farmers to their fields and shepherds and their animals out to pasture. It may seem prosaic, but these quotidian activities were the economic bedrock upon which early cities were built.

In total, over 6,000 km of trackways have been mapped in northeastern Syria and northern Iraq (fig. 6). Often it is possible to link the radial systems together in a web of intra-settlement movement that blanketed the plain over four millennia ago. These tracks are just as important for where they did not go: the land between them was being cultivated at an intensity not seen again until the mid-twentieth century C.E.

Figure 6. Hollow ways in the Upper Khabur basin, northeastern Syria, mapped from CORONA photographs.



Planned Cities and Landscapes in the Core of the Assyrian Empire

The Neo-Assyrian Empire (ca. 900–600 B.C.E.) controlled vast territories throughout the Middle East, corresponding to large parts of Iraq, Syria, Iran, Turkey, Palestine, and even briefly Egypt. The imperial core straddled the Tigris River, including the ancestral capital at Ashur and subsequent capitals at Nimrud, Khorsabad, and Nineveh (Radner 2011; Pedde 2012). The plains east of the Tigris hosted important provincial cities such as Erbil and Kilizu. As important as these places were, their archaeological investigation has been uneven. Archaeological pioneers such as Austen Henry Layard, Hormuzd Rassam, and Paul-Émile Botta recovered thousands of cuneiform tablets and miles of marble reliefs from the cities' palaces, but by the twentieth century C.E. most of the great discoveries had been made and the pace of excavation diminished. Furthermore, hostilities between the Arab governments of Iraq and the Kurds of the northern provinces made parts of the region unsafe.

Nonetheless, we know that the imperial core was carefully planned by its kings and their engineers, in several respects. Most obvious are the great capitals themselves. The ancestral city of Ashur was over a thousand years old when King Ashurnasirpal ordered the construction of a new Assyrian capital at Nimrud, ancient Kalkhu (Oates and Oates 2001). Many of the monuments of the city's palace were brought back to London by Layard in the 1840s. For the structure of the city itself, we must turn to CORONA (fig. 7). The city wall, which still stands up above the surrounding farmland, is clear from the shadows it casts on its northern side. The citadel, the arsenal at the southeastern corner ("Fort Shalmaneser"), and the city wall have all been known since the time of Layard, but the fabric of the city was previously unknown. Broad avenues through the town appear as dark linear features; some of these processional ways were almost 20 m wide. The lighter areas are the remains of collapsed built structures—in some cases continuous areas that probably were densely packed neighborhoods, and in other cases as isolated features that might be isolated blocks, palaces, or temples (Ur forthcoming). All of these structures lay beneath the agricultural fields that today lie within the city walls, waiting for the shovels of future archaeologists.

One hundred and sixty years later, Sargon followed his predecessor in founding a new capital, this time to the north, at Khorsabad. It was planned according to a similar template: a citadel mound with palaces, an arsenal, and straight and powerful city walls, all of which are clear on CORONA photographs (fig. 8). Missing from this photograph, however, are the traces

Figure 7. The Assyrian imperial capital at Nimrud (Mission 1039, 28 February 1967).

Figure 8. The Assyrian King Sargon's capital at Khorsabad (Mission 1039, 28 February 1967).

of avenues and residential blocks that built up within the former capital at Nimrud. Shortly after the completion of his new city, Sargon died in battle, and his body was never recovered; his son and successor Sennacherib immediately transferred the capital to Nineveh. It remains an open question as to whether Khorsabad ever had an urban population, given its brief life as the imperial capital. The CORONA imagery seems to suggest a vacant city, an interpretation that must be confirmed by ground observations in the future.

Assyrian planning was not limited to cities. Several kings undertook great efforts to rework the natural hydrology of Assyria. Royal inscriptions describe ambitious systems of canals that tapped rivers and springs, and parts of canals have been identified and mapped on the ground. CORONA imagery, however, allows the near-complete reconstruction of the entire lengths of several monumental systems (Ur 2005), revealing the striking accomplishments of Assyrian engineers more than five centuries before the Romans.

Ashurnasirpal's capital at Nimrud was sustained by irrigated farmland. The water for the fields came not from the Tigris but from the Upper Zab River, a nearby Tigris tributary (Oates 1968, 42–49). The canal itself is clearly visible in CORONA imagery (fig. 9). The large main channel is 100 m wide and has been known since the time of Layard; CORONA allows a precise map of its course to be made. More important are the subtle new details revealed now for the first time by CORONA. For example, one can recognize several offtakes, places where water was taken out of the main canal to water local fields, in this case almost 10 km away from Nimrud.

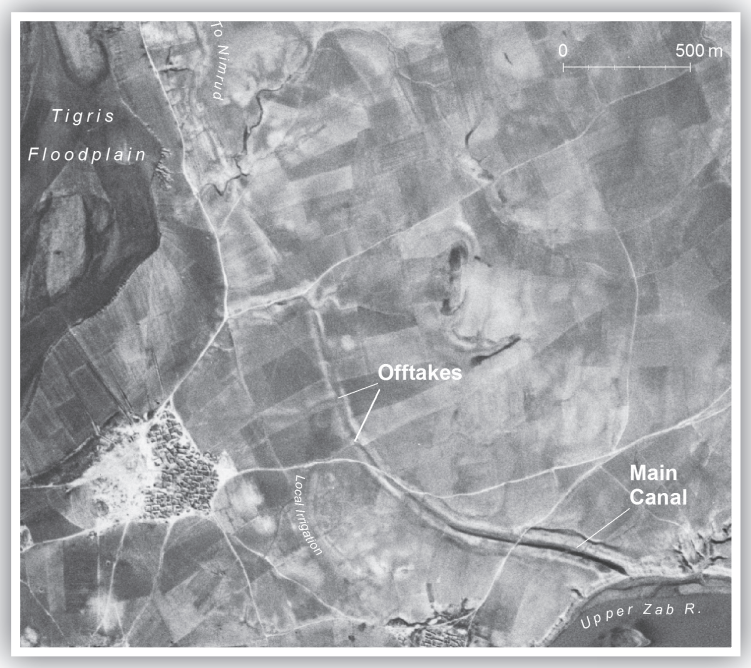


Figure 9. Ashurnasirpal's canal for Nimrud (Mission 1039, 28 February 1967).

A similar situation is found along one of the canals that fed the city of Nineveh, Sennacherib's capital. The canal originated in the foothills of the Zagros, where the dam was marked by monumental reliefs of Sennacherib standing before the god Ashur and his wife Mullissu. The canal can be traced 95 km from this point to the city wall of Nineveh itself. Along its course, it crossed one of the greatest feats of Assyrian engineering: the two-million block aqueduct at Jerwan (Jacobsen and Lloyd 1935). On account of their inscriptions and reliefs, the canal head and dam have received almost all of the attention from archaeologists, but with CORONA imagery we can reconstruct the course of the entire canal. Again, there are clear traces of offtakes that removed water from the system, this time over 40 km away from the canal's terminus (fig. 10).

Thus it is certain that Assyrian hydraulic engineering was intended to supply not only the great capitals with water but also irrigation of fields and gardens, in some cases several days' walk from the city. These landscape insights from CORONA beg the question: Who benefited? The Assyrian kings claimed to have filled these new cities and their hinterlands with the peoples of conquered lands (Oded 1979). The walls of Sennacherib's palace at Nineveh show the army leading the captive population of Lachish away and back to Assyria. Historical books in the Bible appear to support the royal accounts. Unfortunately, the nature of settlement in the Assyrian countryside is

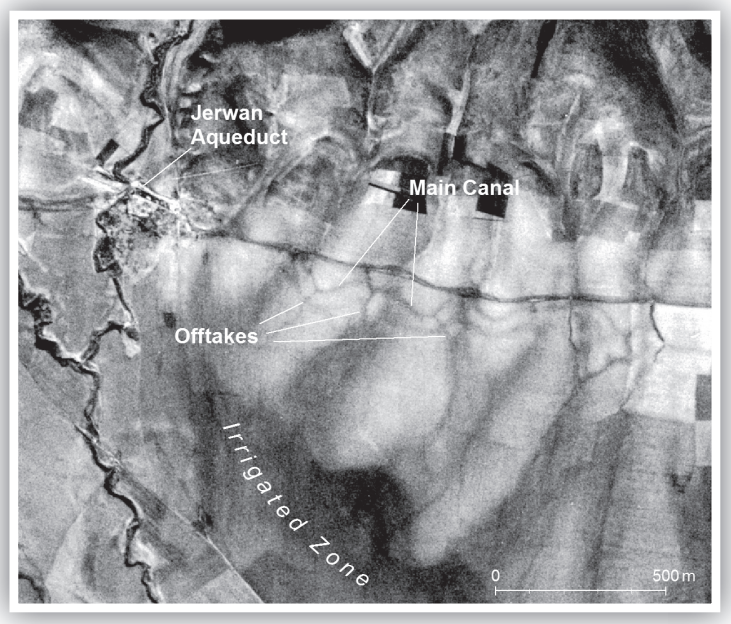


Figure 10. Offtakes for local irrigation near the Jerwan aqueduct, north of Nineveh (Mission 1039, 28 February 1967).

nearly unknown, pending first results from new archaeological surveys in the Kurdistan region of Iraq. It is tempting, however, to see the imperial investment in water systems in relation to the Assyrian policy of forced deportation: populations were brought to the countryside, settled, and given land and a reliable water supply (Wilkinson et al. 2005). In this manner, enormous cities such as Nimrud and Nineveh could be fed and sustained.

Pastoral Nomads in Northwestern Iran

Urban states and empires get most of the attention from archaeologists and historians, but less-centralized societies have had significant roles in the history of the Near East. Tribes and confederacies of pastoral nomads have been culturally and politically dominant at various times up to the twentieth century C.E.: Amorites, Arameans, Mongols, and Arabs, to name only a few. Archaeological projects have often disregarded them, under the assumption that their imprint on the landscape was too light to be detected.

Nomads do present a challenge to archaeology, but at least in some cases their landscape impacts remain captured on CORONA. The Shahsevan tribal confederacy took form at the start of the eighteenth century C.E. in northwestern Iran (Tapper 1979, 1997). Its tribes spent their summers high up on the slopes of Mount Sabalan and in winter brought their animals down to the Mughan Steppe, a broad plain on the edge of the Aras (Araxes) River, which today marks the frontier between Iran and the Republic of Azerbaijan. In the late nineteenth century, the Shahsevan comprised over twelve thousand tents with almost two million sheep. Mobility is almost always considered threatening by centralized states, and in the twentieth century the governments of the Soviet Union and Iran both pushed to contain and settle the Shahsevan. Today they are radically reduced in number and mostly settled on their former winter pasturelands in Mughan.

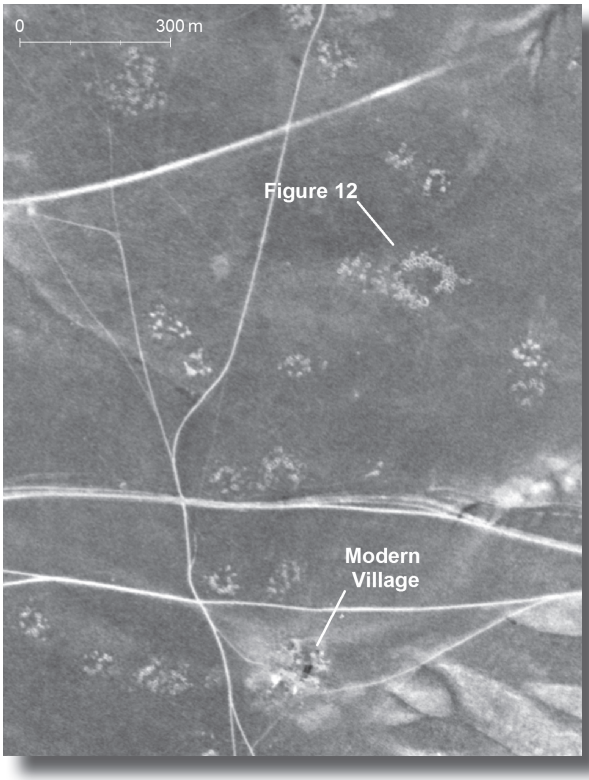


Figure 11. Abandoned and contemporary Shahsevan campsites on the Mughan Steppe (Mission 1110, 30 May 1970).

The extent and impact of Shahsevan occupation was discovered accidentally in the course of a project focused primarily on Sasanian (224–642 C.E.) fortifications and irrigation systems (Alizadeh and Ur 2007). One pattern recurred frequently on CORONA photographs: clusters of circular features at intervals across the high steppe and closer to the river, in the midst of the abandoned Sasanian field systems (fig. 11).

As is often the case with remote sensing, a combination of ground observation and ethnography provides the key to interpret this pattern. A visit to these places revealed them to be composed of shallow pits ringed by the upcast from their excavation (fig. 12). The pits collect water and vegetation and therefore appear dark. Their edges are slightly raised and devoid of any vegetation, hence their light appearance. An ethnography of the last remnants of the Shahsevan describes how

Figure 12. Abandoned Shahsevan campsite (January 2005).

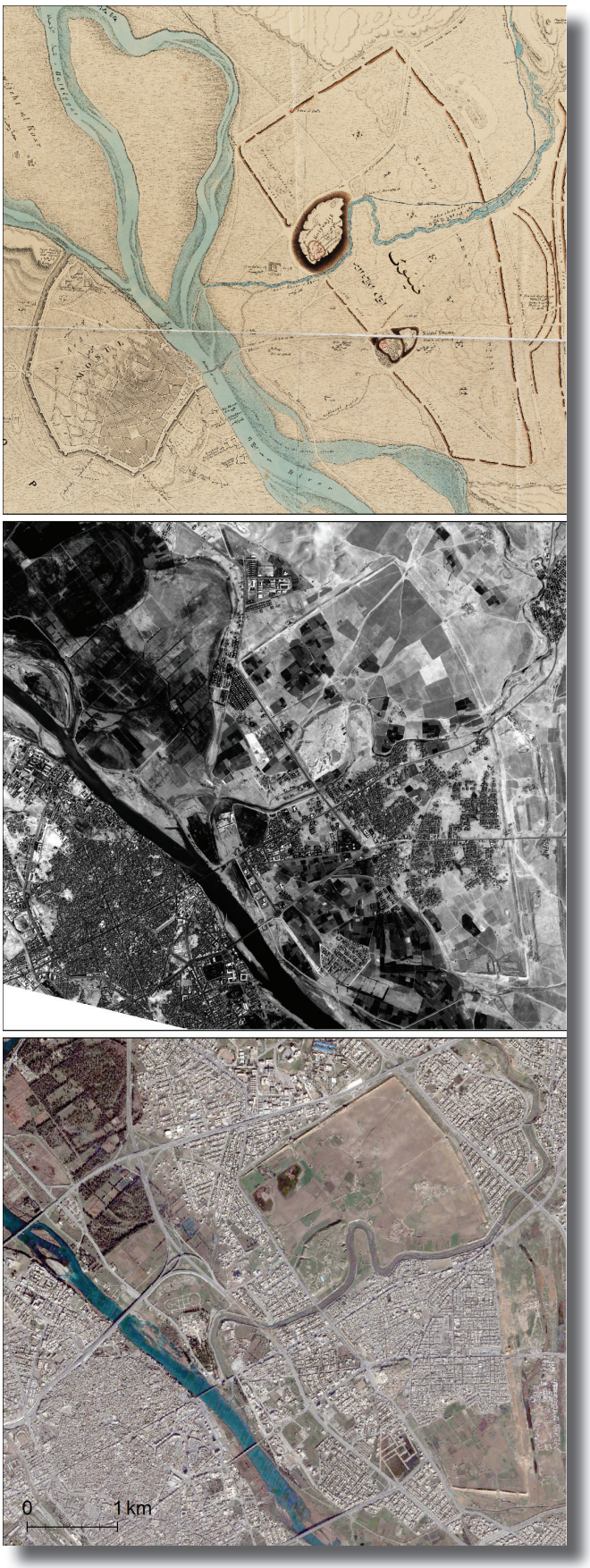


Figure 13. The evolution of the Mosul-Nineveh urban landscape. Top: Map of Felix Jones (1855); middle: GAMBIT photograph (Mission 4031, 20 September 1966); bottom: QuickBird image (28 December 2004)

they dug semisubterranean shelters for their animals in the centers of their campsites (Tapper 1979). Their tents, on the other hand, were circular framed structures that rested directly on the ground. CORONA is capturing the shelters of the Shahsevan's animals rather than the structures of the campsites' human members.

Armed with this interpretive ability, further examination of CORONA revealed several thousand campsites across the Mughan Steppe. Emerging from their patterning were clues to pastoral nomadic land use, campsite logic, and long-term pasture land tenure. Importantly, we can come to these conclusions by interpreting the activities of the Shahsevan themselves rather than relying on historical sources, which often derive from states governments that are hostile to nomadic communities.

CORONA and Endangered Near Eastern Landscapes

Landscapes are dynamic entities, as we have seen for the past, but never more so than in the present, and often to the detriment of cultural heritage. Various landscape elements are always being recycled by human communities, but such processes have never been as accelerated as they are today. Modern technologies and powerful state governments combine to transform landscapes to the point where they would be unrecognizable to their former inhabitants: new cities, enormous agricultural schemes, and hydroelectric dams can cover over, plow up, and inundate the past. The pace of population growth and economic development will only speed these processes in the twenty-first century.

For archaeologists, CORONA has emerged as an irreplaceable source for reconstructing ancient landscapes from a 1960s baseline. In the Middle East, CORONA photographs capture a time when modernization and rapid development were not yet underway or in their early stages. From the case studies described above, the most dramatic case is the Mughan Steppe, where CORONA images preserve the final moments of a vanishing way of life; they also capture early construction phases of an enormous canal irrigation system (completed in 1972) that has subsequently effaced many of these campsites.

Urban development is just as threatening. At the time of Layard, Mosul was a sleepy outpost in the Ottoman Empire on the right bank of the Tigris; the ancient city of Nineveh, on the left bank, hosted only a small village around the tomb of the prophet Jonah (Nebi Yunus). By 1966, Nebi Yunus was expanding within Nineveh, and Mosul was creeping around the Assyrian walls. Today Nineveh is completely enveloped within Mosul, and the lower town is increasingly disappearing beneath modern housing (fig. 13).

At the same time that more of the archaeological landscape is being damaged or disappearing, still more satellite photo-

graphs are becoming available. In 2012, the U.S. government declassified the technical details of the HEXAGON program (1971–1984), revealing that it was the highly successful successor to the CORONA program. At the time of writing, the imagery is scheduled to be declassified in the course of 2013. Archaeologists are eager to see what new hidden elements of Near Eastern landscapes will be revealed.

Acknowledgments

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References

Alizadeh, K., and J. A. Ur. 2007. Formation and Destruction of Pastoral and Irrigation Landscapes on the Mughan Steppe, North-Western Iran. *Antiquity* 81:148–60.

Day, D. A., J. M. Logsdon, and B. Latell, eds. 1998. *Eye in the Sky: The Story of the CORONA Spy Satellites*. Washington, D.C.: Smithsonian Institution Press.

Fowler, M. J. F. 2013. Declassified Intelligence Satellite Photographs. Pp. 47–66 in *Archaeology from Historical Aerial and Satellite Archives*, ed. W. S. Hanson and I. A. Oltean. New York: Springer.

Jacobsen, T., and S. Lloyd. 1935. *Sennacherib's Aqueduct at Jerwan*. Oriental Institute Publications 24. Chicago: University of Chicago Press.

Matney, T. 2012. Northern Mesopotamia. Pp. 556–74 in vol. 1 of *A Companion to the Archaeology of the Ancient Near East*, ed. D. T. Potts. 2 vols. Malden, Mass.: Wiley-Blackwell.

Oates, D. 1968. *Studies in the Ancient History of Northern Iraq*. London: British Academy.

Oates, J., and D. Oates. 2001. *Nimrud: An Assyrian Imperial City Revealed*. London: British School of Archaeology in Iraq.

Oded, B. 1979. *Mass Deportations and Deportees in the Neo-Assyrian Empire*. Wiesbaden: Reichert.

Pedde, F. 2012. The Assyrian Heartland. Pp. 851–66 in vol. 2 of *A Companion to the Archaeology of the Ancient Near East*, ed. D. T. Potts. 2 vols. Malden, Mass.: Wiley-Blackwell.

Radner, K. 2011. The Assur-Nineveh-Arbela Triangle: Central Assyria in the Neo-Assyrian Period. Pp. 321–29 in *Between the Cultures: The Central Tigris Region in Mesopotamia from the 3rd to the 1st Millennium BC*, ed. P. Miglus and S. Mühl. Heidelberger Studien zum Alten Orient 14. Heidelberg: Heidelberger Orientverlag.

Stein, G. J. 2004. Structural Parameters and Sociocultural Factors in the Economic Organization of North Mesopotamian Urbanism in the Third Millennium BC. Pp. 61–78 in *Archaeological Perspectives on Political Economies*, ed. G. M. Feinman and L. M. Nicholas. Salt Lake City: University of Utah Press.

Tapper, R. 1979. *Pasture and Politics: Economics, Conflict and Ritual among Shahsevan Nomads of Northwestern Iran*. London: Academic Press.

———. 1997. *Frontier Nomads of Iran*. Cambridge: Cambridge University Press.

Ur, J. A. 2003. CORONA Satellite Photography and Ancient Road Networks: A Northern Mesopotamian Case Study. *Antiquity* 77:102–15.

———. 2005. Sennacherib's Northern Assyrian Canals: New Insights from Satellite Imagery and Aerial Photography. *Iraq* 67:317–45.

———. 2010. Cycles of Civilization in Northern Mesopotamia, 4400–2000 BC. *Journal of Archaeological Research* 18:387–431.

———. 2013. CORONA Satellite Imagery and Ancient Near Eastern Landscapes. Pp. 19–29 in *Mapping Archaeological Landscapes from Space: In Observance of the 40th Anniversary of the World Heritage Convention*, ed. D. C. Comer and M. J. Harrower. New York: Springer.

———. Forthcoming. The Morphology of Neo-Assyrian Cities. *Subartu*.

Wilkinson, T. J. 2003. *Archaeological Landscapes of the Near East*. Tucson: University of Arizona Press.

Wilkinson, T. J., E. Wilkinson, J. A. Ur, and M. Altaweel. 2005. Landscape and Settlement in the Neo-Assyrian Empire. *Bulletin of the American Schools of Oriental Research* 340:23–56.

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