Settlement in the Heartland of Napatan Kush: Preliminary Results of Magnetic Gradiometry at El-Kurru, Jebel Barkal and Sanam

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Ancient Kush was one of the major powers of the ancient world with a dynamic, often equal, relationship with Egypt, its northern neighbor. Centered on the Nile in what is now northern Sudan, Kush was first named in Egyptian texts after 2000 BC. Kush was conquered by the armies of the Egyptian New Kingdom after 1500 BC and re-emerged after 800 BC, ruling an expanding area for more than 1000 years until its collapse after AD 300. Its contacts with the broader ancient world – Egypt in particular, but also Assyria, Persia, Greece, and Rome, variously encompassed trade and military conflict.

Kush was, however, culturally distinct from its better-known northern neighbors, perhaps in part because of its environmental context – narrow agricultural areas along the Nile surrounded by desert, and distant from the connections facilitated by the Mediterranean – but also because of its distinctive historical and cultural trajectory (Edwards 1998; Emberling 2014) that included a significant component of mobility. In particular, the role of settlements as locations in which wealth and political power were concentrated is little understood, in part because with a few exceptions, archaeologists working in Kush have not focused on comprehensive studies of urban sites.

The exceptions to this general rule are significant. The first capital of Kush, known by the name of the nearby modern town as Kerma, has been investigated since 1973 by extensive excavation and has produced the most complete plan of an early African town (Bonnet 2014). A recent project at Amara West, a colonial Egyptian settlement within Kush, has produced a remarkably complete town plan using magnetic gradiometry combined with ongoing excavation (Spencer and Hay 2013). Excavation at the later Kushite town of Hamadab has also recovered a complete town plan (Wolf 2015). While other important ancient centers of Kush have been the focus of archaeological projects (e.g., Knudstad and Frey 1998; Vincentelli 2011; Welsby 2014b), we do not yet – for a variety of reasons – have comprehensive plans of the important Kushite sites of Kawa, Napata, Sanam, Meroe, or Naqa.

Ancient city plans have the potential to reveal a great deal about the cultures in which they were formed. Their spatial organization constructed social divisions and connections including the nature of political authority and the extent of its association with temples; the degree of difference in wealth between elites and non-elites; the possible existence of internal, horizontal social group divisions; and broad affiliations with varied cultural traditions of architecture.

Understanding the development of urban settlements is important to having an adequate account of the operation of ancient societies. Cities themselves have the potential to accelerate processes of technological innovation and accumulation of wealth, for example (Algaze 2008; Emberling 2015).

For all these reasons, it would be highly desirable to understand more about the ancient cities of Kush and the nature of activities conducted within them. As a first step toward that goal, a preliminary season of geophysical prospection was undertaken in 2016 at three sites in the heartland of Kush: el-Kurru, Sanam Abu Dom, and Jebel Barkal (Figure 1).[1]

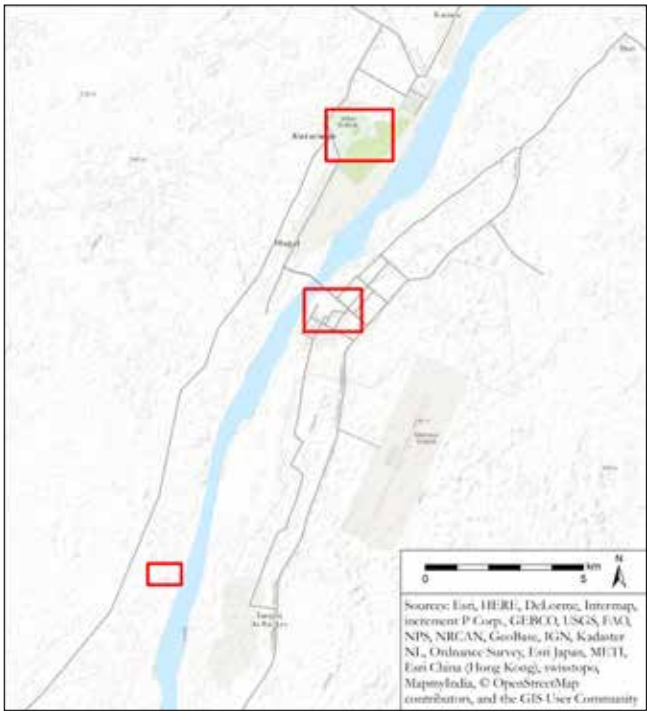

Figure 1. 2016 geophysical survey sites, outlined in red. The southernmost is el-Kurru, the central one is Sanam, and the northernmost is Jebel Barkal.

The two methods tested were magnetic gradiometry (sometimes informally termed "magnetometry") and electromagnetic conductivity. These surveys were conducted with a Bartington Grad 601 fluxgate gradiometer and a Geonics EM38-MK2 electromagnetic conductivity meter, respectively. The initial results of the magnetic gradiometry were extremely promising at Jebel Barkal and Sanam, as

[1] The research was funded by the Waitt Grant program of the National Geographic Society and was carried out with the active support and interest of licensees for the concessions (Timothy Kendall, El-Hassan Ahmed Mohammed, and Emanuele Ciampini for Jebel Barkal; Irene Vincentelli for Sanam) as well as the National Corporation for Antiquities and Museums, in particular Murtada Bushara Mohammed, Director of Antiquities for Northern State. Thanks also to colleagues who discussed aspects of Meroitic architecture: Derek Welsby, Bruce Williams and Pawel Wolf.

described below. The short test at el-Kurru confirmed what previous prospection efforts (Mohamed-Ali 2013) had suggested: that archaeological features are not clearly visible in the area surrounding the recent excavations (Plates 1 and 2*)*.

Plate 1. 2016 magnetic gradiometry areas at el-Kurru outlined in red, overlaid on Worldview-2 satellite imagery.

Plate 2. 2016 magnetic gradiometry results at el-Kurru (greyscale plot), overlaid on Worldview-2 satellite imagery.

It is now apparent that this is due to the depth and nature of the settlement deposits which are covered by 500-700mm of *wadi* or Nile flood deposits in areas in which bedrock is not exposed. While some of the anomalies visible in the results may correspond to archaeological features, further excavation or more intensive prospection would be necessary to facilitate their accurate interpretation (Plate 2).

The Region of Ancient Napata

The ancient city of Napata gives its name to the Napatan period (*c.* 800-300 BC), during which kings of Kush also ruled Egypt as its 25th Dynasty, *c.* 732-663 BC. The precise referent of the term "Napata" is uncertain (see recent discussion in Pope 2014, 35), but it seems most likely to refer to a town of some kind at the base of Jebel Barkal, the "Pure Mountain" in which the god Amun was thought to have been born in traditions developed first in Egyptian and later in Kushite theology. Investigation of Jebel Barkal over nearly the past 200 years (see the very useful website constructed by Timothy Kendall, www.jebelbarkal.org) has focused on the complex of stone-built temples centering on the massive Amun temple, with more recent work of the Italian team directed successively by Sergio Donadoni, Alessandro Roccati, and now Emanuele Ciampini focusing on the palaces of the Meroitic period (300 BC – AD 300) including particularly the palace of Natakamani.

While it is possible that "Napata" referred exclusively to the district of temples and palaces at the foot of the *jebel*, it has also been thought likely that a larger settlement must have been located somewhere in the vicinity of the monumental area. Earlier magnetic gradiometry in the area of the temples at Jebel Barkal had been carried out by geophysicist Margaret S. Watters in 2000 and geophysicists Thomas Goldman, Ronny Wutzler and Mohamed Abdelwahab Ali in 2006 and 2007 under the direction of Timothy Kendall and Pawel Wolf (some results published in Kendall 2014; also Kendall and Mohammed 2016).[2] This earlier work showed that, while the method worked well to identify mud brick and sandstone architectural remains, the area at the foot of the *jebel* was not a dense urban settlement. Certainly Meroitic structures have been excavated within the modern town of Kareima, most recently by Montserrat Díaz de Cerio (2007), but there is as yet no evidence of a dense settlement there. More recent excava-

[2] See www.jebelbarkal.org > Current Archaeological Teams (Season Summaries: 2000, 2006, 2007).

tions by archaeologists at the University of Dongola at Kareima, as yet unpublished, have shown settlement remains to the east of the Palace of Natakamani (Mohammed Fathi, pers. comm.). These results amplify the findings of the Italian mission (Donadoni and Bosticco 1982), which had found in the 1970s remains of two temples to the east of the *jebel*, immediately against the limit of the modern palm trees. It is also notable that no cemetery of the non-elite has yet been found in the immediate vicinity.

Jebel Barkal

With this background, the present project conducted magnetic survey for six days in winter 2016 around Jebel Barkal. Four areas were laid out around the great Amun Temple (B 500) and along its axis and processional way toward the Nile to the east (Plates 3 and 4*)*.

The first area, immediately south of B 500, provided initial confirmation that the equipment would pick up mud brick after comparison with prior excavation results and visual inspection on the surface. These results confirmed that anomalies visible in the southern corner of the area matched known archaeological structures, although very little construction is visible there, or elsewhere in this survey area (Plate 5).

Another area confirmed the existence of an as-yet unexcavated temple to the south of the processional way, located by previous magnetic survey and aligned with the structures excavated in the past two years at Jebel Barkal (Plate 6; designated B 560 and B 561 – see Kendall and Mohamed 2016). Although the form of this structure is not clear in detail, similarly to the mud brick identified in the first area discussed, its irregular magnetic signature matches that of B 560 and B 561 from the prior surveys. An area further along the processional way across the modern track to the east was essentially devoid of archaeological features, with few anomalies apart from modern field boundaries which can be identified also in the satellite imagery (Plates 6 and 7). The absence of ancient features and the position of this survey area along the agricultural region next to the palm line suggest that a portion of this area may have been an ancient Nile channel, perhaps active at the time of the settlement of Napata (a proposition we hope will be tested in future seasons of work).

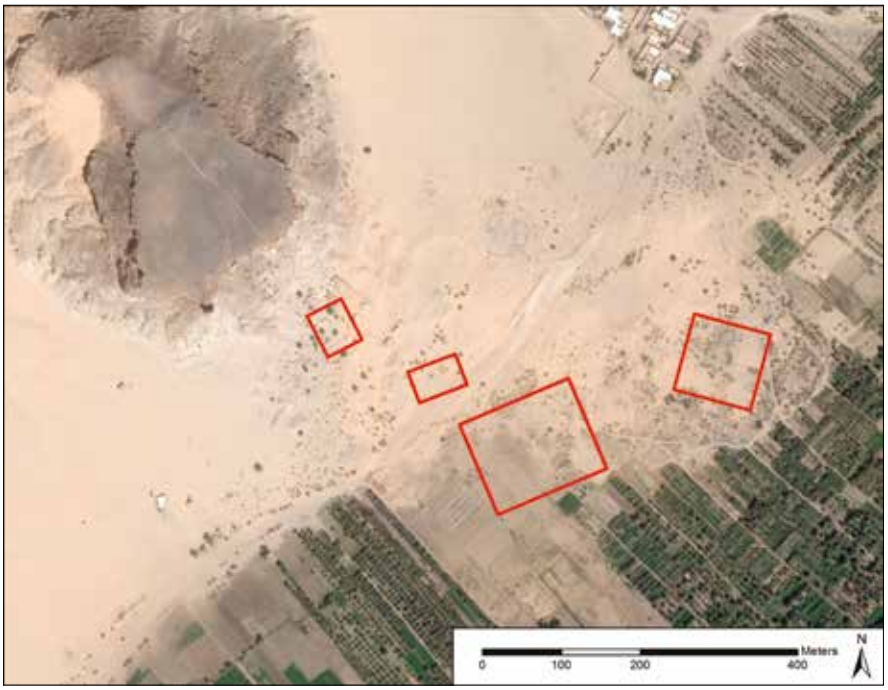

Plate 3. 2016 magnetic gradiometry areas at Jebel Barkal outlined in red, overlaid on Worldview-2 satellite imagery.

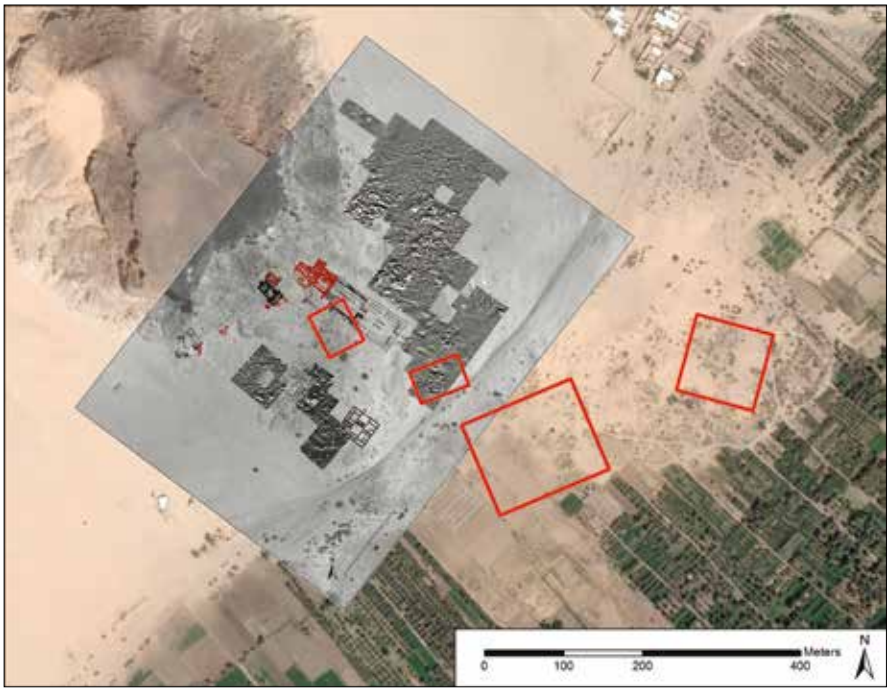

Plate 4. 2016 magnetic gradiometry areas at Jebel Barkal outlined in red, overlaid on a plan of prior magnetic survey work (courtesy Timothy Kendall) and Worldview-2 satellite imagery.

However, the most interesting results came from the area of the Meroitic temples excavated in the 1970s by Donadoni and his team, and currently within the concrete site boundary markers. Upon closer inspection, this area is a mound standing approximately 2m above the surrounding plain and covering perhaps 10ha or more in area. Two days of survey in this area showed clear plans of several structures, including a large rectilinear building approximately 20 x 40m in size (and likely larger), multiple rounded structures to the east, and several other rectilinear features on a slightly different orientation

Plate 5. 2016 magnetic gradiometry results at Jebel Barkal (greyscale plot), overlaid on Worldview-2 satellite imagery. Note that B 500 is visible in the satellite imagery to the north of the surveyed area and that the area outlined in red coincides with a known mud-brick feature confirming the efficacy of the magnetic survey at Jebel Barkal.

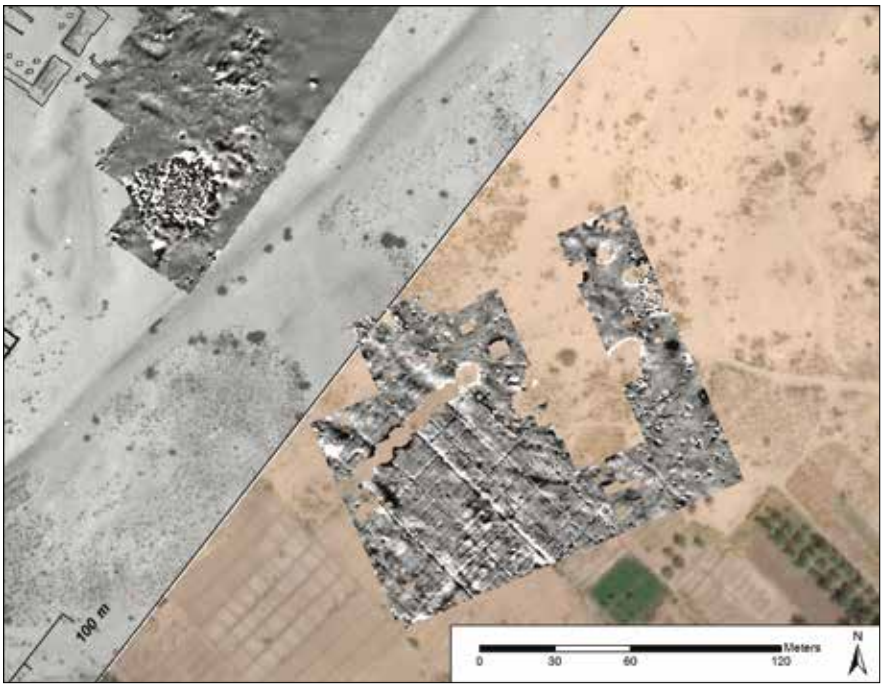

Plate 6. 2016 magnetic gradiometry results at Jebel Barkal (greyscale plot), overlaid on a plan of prior magnetic survey work and Worldview-2 satellite imagery. Note that the small area to the north west had been surveyed previously and was re-surveyed to confirm that the 2016 survey was producing similarly high-quality results.

from the large building (Plate 8). The large structure is not similar in plan to the square Meroitic palaces known at Jebel Barkal and at other sites of the Meroitic period (see Maillot 2014). Among currently known Meroitic structures, it is perhaps closest in plan to Palace M 750 at Meroe (Török 1997, 181ff.; Grzymski and Grzymska 2008).

Sanam

Across the Nile from Jebel Barkal is the urban site of Sanam, covering perhaps 45ha. Excavations in 1912-13 recovered a portion of a large building with stone column bases known as the Treasury (Griffith 1922), a temple built during the reign of the Napatan king Taharqo (Griffith 1922; see Pope 2014, 58ff.), and a cemetery of about 1550 burials (Griffith 1923; now Lohwasser 2010). Our knowledge of local burial practices has recently been expanded by the excavation of elite tombs at the site of Eltameer, 1km north east of the site (Mohammed 2014).

Since 2001, Irene Vincentelli has worked on the settlement site, around which Sudanese antiquities authorities have also built a protective fence. She has re-examined the Treasury building and excavated new structures designated SA. C 400, SA. K 200, and SA. K 300 (Vincentelli 2011). Like the Treasury, these structures are distinguished by extensive use of stone column bases in rooms and courtyards. All are marked by evidence of craft manufacture using exotic stones and ivory, perhaps under royal control as suggested by preserved royal seal impressions (Vincentelli 2006-07).

At Sanam, we began our test of geophysical methods to the west of SA. K 200 and SA. K 300, targeting a large rectangular area after consultation with the Sanam team (Plate 9). Three days of work also confirm the significant potential of magnetic gradiometry at Sanam, where there are no overlying modern structures. Magnetic gradiometry identified two areas of small parallel features that could be tree pits lining roads (cf. at Meroe: Török 1997, 193; at Kawa: Welsby 2009, 76; 2014a, 6), or perhaps porticos or colonnades, as well as a rectilinear structure in the north, smaller structures in the center, and a strong and large rectilinear anomaly in the south east of the surveyed area, likely another structure (Plates 10 and 11).

Confirmation that the small features are either remains of columns or of tree pits may only be possible through excavation, or with the aid of other geophysical survey techniques. In support of the idea that they could be

Plate 7. 2016 magnetic gradiometry results at Jebel Barkal (greyscale plot), overlaid on Worldview-2 satellite imagery. Highlighted in red are the area which matched prior survey results in the north west and the clear modern agricultural field features in the central portion of the image.

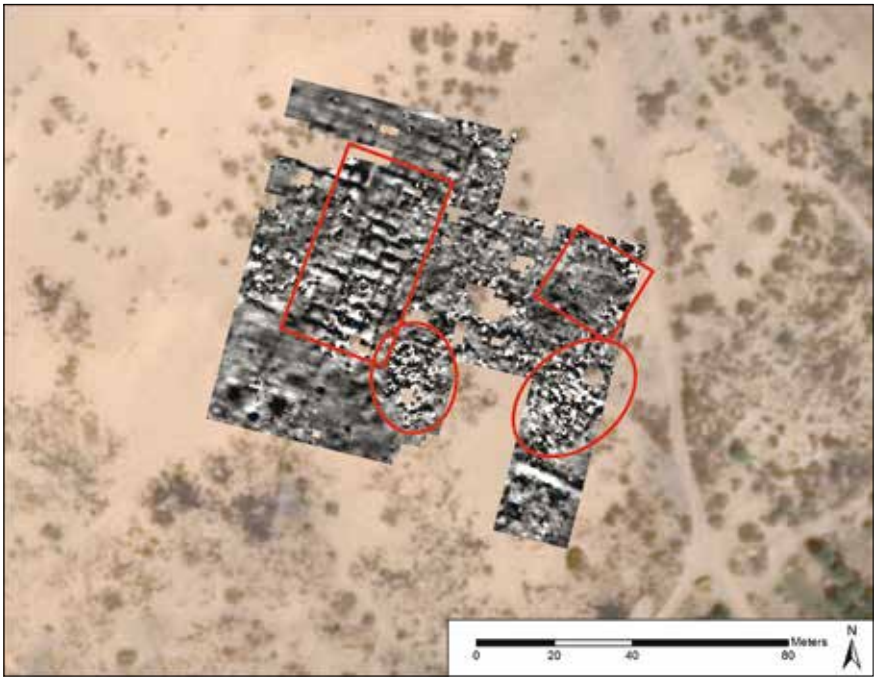

Plate 8. 2016 magnetic gradiometry results east of Jebel Barkal (greyscale plot), overlaid on Worldview-2 satellite imagery. The large rectilinear feature is highlighted in a red box on the western portion of the results, with two of the circular features and one of the other rectilinear features also highlighted.

column bases, we would note the nearby architectural features at Sanam, namely the column bases excavated in the Treasury building and the presence of other column bases visible on the surface of the site, while comparanda from other sites would support their interpretation as tree pits. It is clear that there are no structures directly associated with these features, at least as revealed by the magnetic survey, but this does not exclude the possibility that they could be marking a road, whether tree pits or column bases; however, the fact that the features are in relatively short segments that are not directly aligned suggests that these features are not marking major roads.

Conclusion

The results from the 2016 survey at the heart of Napatan Kush have proven successful in identifying a significant number of features of interest at Jebel Barkal and Sanam. These features are at times similar in form and scale to known structures at these sites, but others, such as the large rectilinear feature at Jebel Barkal, have a form previously not known from these sites. The presence of these dissimilar features may reflect architectural traditions which we can identify from comparison with other Kushite sites. This short season of geophysical prospection has provided significant positive results and suggests great potential for future survey at Jebel Barkal and Sanam to define settlement plans for both of these sites. Further defining the form of these sites will contribute greatly to our understanding of the people who lived, worked, and worshipped there, complementing the current research programs at these significant centers of Kushite power.

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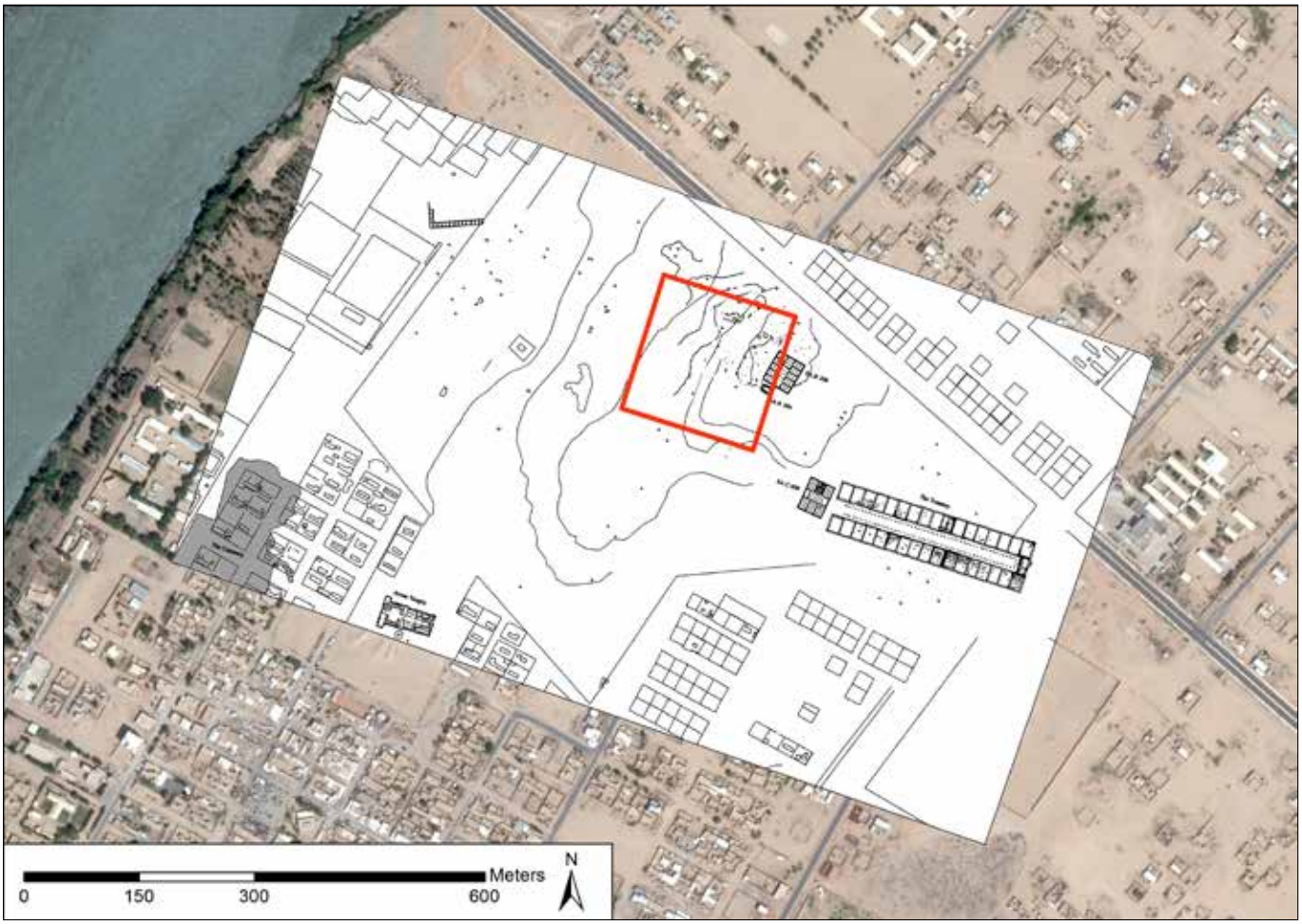

Plate 9. 2016 magnetic gradiometry area at Sanam, overlaid on a general site plan (courtesy I. Vincentelli) and Worldview-2 satellite imagery. The red rectangle indicates the limits of our survey area.

Plate 10. 2016 magnetic gradiometry results at Sanam (greyscale plot), overlaid on Worldview-2 satellite imagery. Highlighted are some of the features discussed in the text, including the two rows of roughly parallel small circular features visible in the southern and eastern portions of the area surveyed; large rectilinear features in the south west and north west; and smaller features in the center.

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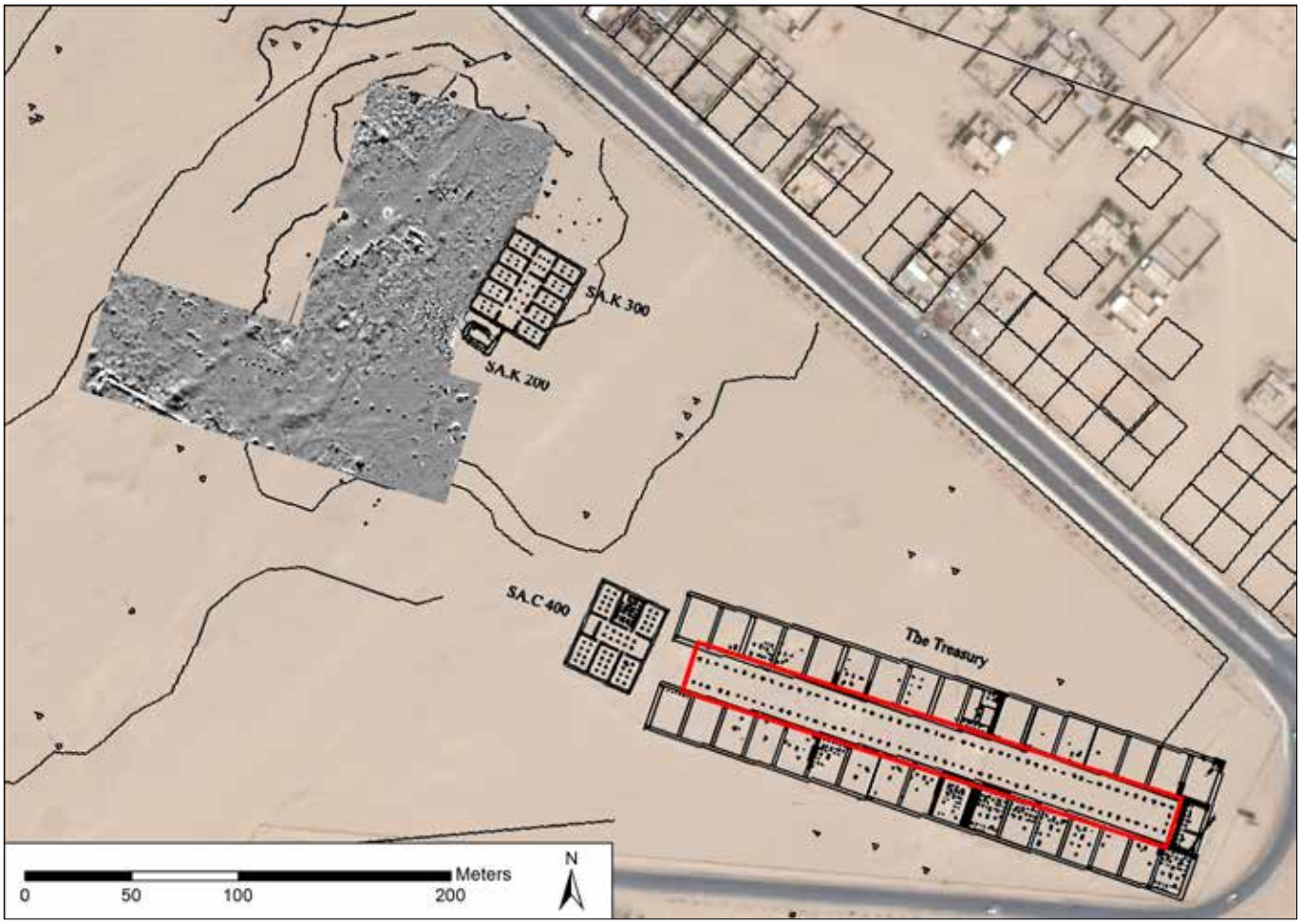

Plate 11. 2016 magnetic gradiometry results at Sanam (greyscale plot), overlaid on a general site plan. The colonnade of the Treasury is highlighted in the lower right portion of the image.

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