GEOPHYSICAL SURVEY 2007 AT TELL EL-DABᶜA

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1. Magnetometer survey

The survey was undertaken in May 2007 at the ideal time of year for such an endeavour in the Egyptian Nile Delta.[1] As in former years,[2] two different configurations of magnetometers were used: a Fluxgate Magnetometer operated by Tomasz Herbich and a Caesium Magnetometer operated by Christian Schweitzer. Due to the fact that the Tell el-Dabᶜa survey is now evolving from the purely prospective to the investigative stage, the two magnetometers were applied complementary to a higher extent than before. Most areas were investigated with both methods in order to benefit from their respective advantages.

The following parts have been investigated (for an over-all map see Forstner-Müller 2007, fig.1):

1. The area between the palace of the 18th Dynasty and the modern village of Khataᶜna
2. In area A/II especially the precinct of the Temple of Sutech
3. The area to the immediate west of the modern Didamun Canal in the North of ᶜEzbet Helmi.

Khataᶜna North (Fig. 1)

The area investigated this season is positioned south of the huge Tuthmoside palace district.[3]

Modern features include: in the eastern part, large pits where soil was retrieved (most probably to be used as building material), power poles (both the electromagnetic field emitted by the power line and the metal of the pole itself heavily interfering with the measurement), low ridges and small channels marking the field borders (clearly depicted in the geophysical map and thus obscuring older features deeper in the ground) and finally subterranean constructions belonging to a 100 years-old drainage system.

This old water supply system (tambur), still connected to the Pelusiac branch of the Nile, was replaced by the main Samaᶜna-Didamun canal by the end of the 19th century.[4] It is already depicted on the maps of the Survey of Egypt dating to 1904.[5]

These modern remains of the mostly silted up Pelusiac branch of the Nile are now known as Moses Canal, Faqus Canal or the Old Canal among the local population. The orientation of the excavated and prospected structures indicates that the original course of the river-branch differed significantly from these remains. Just like at Memphis, a shift of the river bed to the east may have destroyed the old topography and any archaeology connected to it.[6]

Between the southern limit of the Tuthmoside Palace district and the above mentioned modern track a densely settled part of a settlement emerges. The major orientation of the buildings is north-east – south-west; they are therefore not aligned along the main river but along a small canal (Canal 1) which runs from the Pelusiac branch to the southwest in a north-easterly direction probably to the palace found in Area F/II (see fn. 22). This area is significantly disturbed by the modern Didamun canal and farming activity.

An assumed second canal (Canal 2), partly obscured by the modern feature of a path, would also run from the Pelusiac branch of the Nile in a north-west to south-easterly direction. Both canals existed for a long time because no buildings were

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[1] The magnetometer work was done by Christian Schweitzer and Tomasz Herbich, the surveying and mapping by Anne-Catherine Escher, Astrid Hassler and especially Michael Weissl who not only supervised the survey but also provided us – as usual in his meticulous way – with digital maps. For preparing the figures I would like to thank Nicola Math.

[2] Forstner-Müller *et al.* 2004; Forstner-Müller/Müller 2006.

[3] Recently Bietak/Forstner-Müller 2005.

[4] Habachi 2001, 73.

[5] Personal communication M. Bietak.

[6] Jeffreys/Malek 1988, 23.

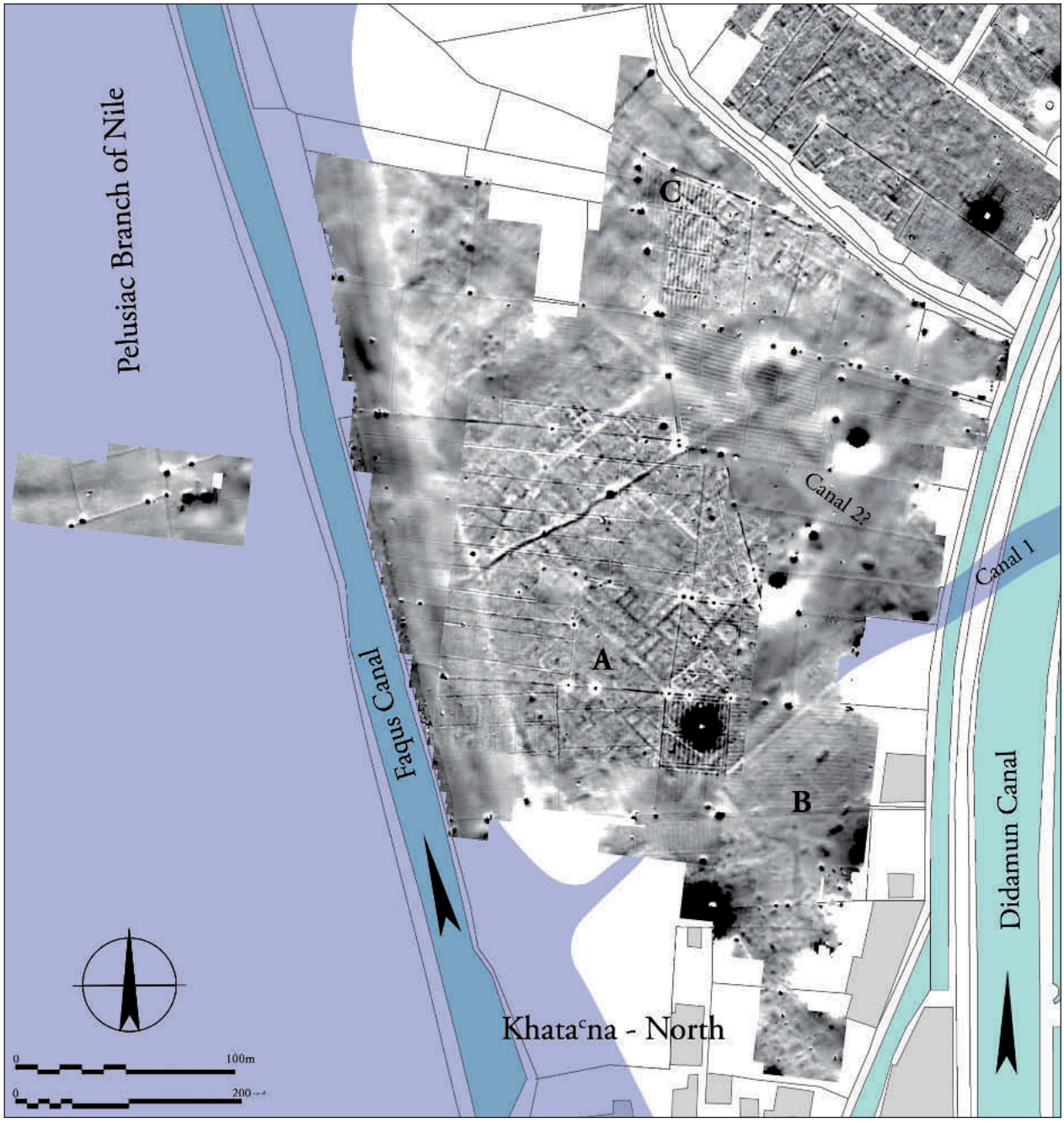


Fig. 1 Khataᶜna North, combined measurements with Fluxgate Magnetometer and Caesium Magnetometer (plan M. Weissl, drawing N. Math)

erected on top of them in other prospected areas, like ᶜEzbet Rushdi South.[7]

The settlement was organized according to these topographical features and the ensuing development of the whole urban area.[8] Due to the excellent quality of the geophysical maps produced by the teams, architectural features of the buildings can be studied in great detail.

Among the buildings, two large complexes are of special interest:

Part A

This large anomaly, covering the central part of the measured area, presumably consists of several buildings, at least two, built on top of each other. The major drawback of the method, name-

[7] Forstner-Müller *et al.* 2004, fig. 5.

[8] This is very typical for a non-planned settlement s. also Piramesse, Pusch/Becker/Fassbender 1999, figs. 1 and 2.

ly that no information concerning the depth of detected structures is given, makes it impossible to analyse the exact chronological sequence of these buildings. Suffice it to say that human (building-) activity took place over a very long time span. A difference in building materials may give some additional hints as the clearly depicted building in the northernmost part of the area shows a whitish anomaly, indicating the use of low-magnetic building materials (sandy mud-bricks), often of an earlier date than the highly magnetic mud-bricks used for the presumably later phases of the complex.

Part B

The size of this complex is at least 52 × 72 metres. Its eastern and southern limits were destroyed by modern agriculture and the Didamun Canal. An approximately 4 m wide enclosure wall separates the precinct from the rest of the town. Its light colour again points to sandy mud-bricks used as building material. As to the inner organization of the complex, several narrow walls divide the space into more or less regular squares. Without intrusive archaeological methods it is impossible to decide whether they resemble courtyards or just large rooms.

Part C Kilns

In the northwestern part of this year's survey a group of at least 10 circular anomalies of equal size (2,5 m in diameter) was detected. Similar features appearing on the geophysical map produced by Tomasz Herbich in Buto were excavated and found to be caused by pottery kilns.[9] If the same interpretation is feasible for Tell el-Dabᶜa, it would not be unreasonable to assume that the industrial area was situated to the south of the official government district. Due to the predominant wind direction (North), at least the most prestigious parts of the city had clean air and were still within a reasonable distance to important production centres.

Conclusion

In Khataᶜna-North, a new part of the town, probably an administrative quarter of Avaris, was investigated. The large multi-phase buildings with industrial installations nearby, the vicinity of the palaces in areas H and F and the topographical situation next to the main transportation routes are good reasons for such an interpretation. The key question is whether this settlement belongs to the New Kingdom Palace district or is part of the Hyksos town.

Fig. 2 Trench H/VI-bb/22, settlement layers of the late Second Intermediate Period

The northern sector of the surveyed area was excavated in 2007.[10] (Figs. 2, 3) In a small trench (H/VI-bb/22) the first intact layers produced comprised pits containing Late Period material followed by debris dating to the New Kingdom (fecundity figurines, scarabs). The first discernible architecture encountered, however, were houses with burials, a living quarter which can be dated to the later Second Intermediate Period. After the abandonment of the settlement, the walls of the houses stood erect for some time in ruins. In spite of the fact that the result of this excavation might imply that the structures in the

[9] Hartung/Herbich 2004, 17; Ballet 2004.

[10] Spring season 2007, Bietak/Forstner-Müller 2007, 38, figs. 3–6.

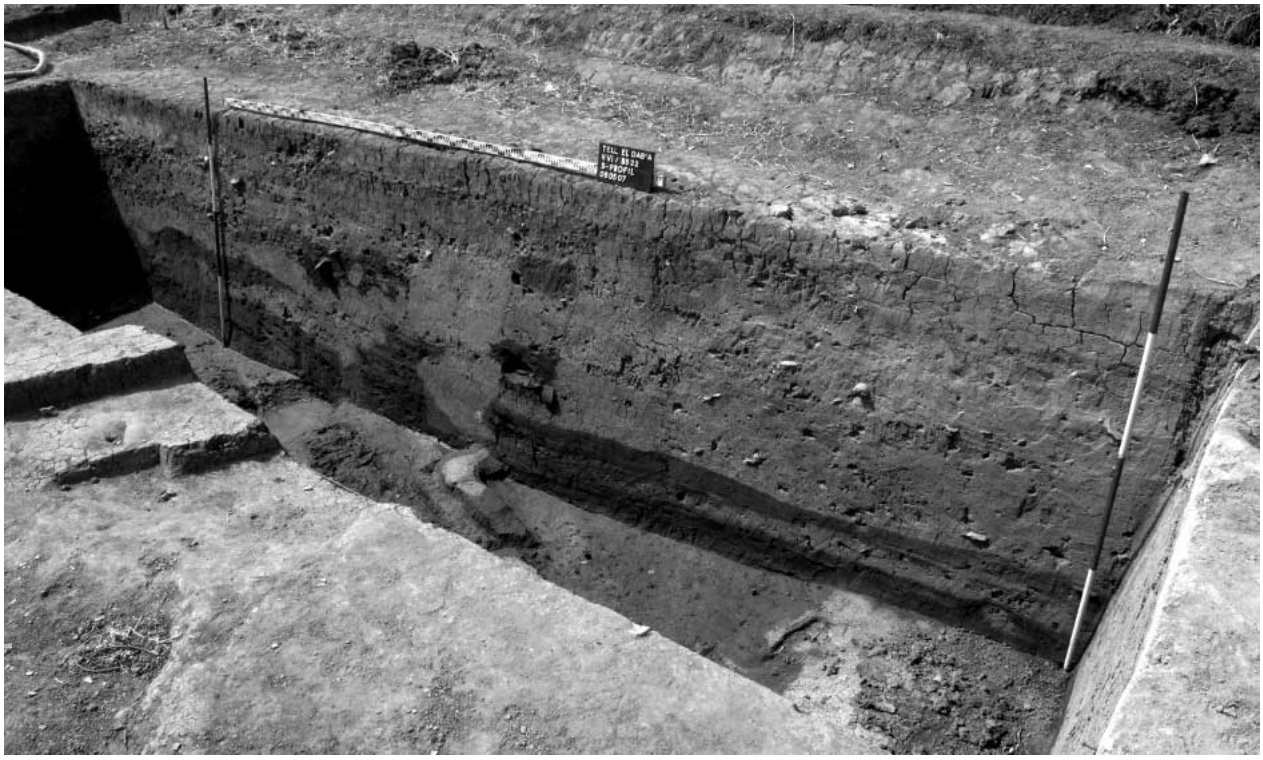


Fig. 3 Southern section of trench H/VI-bb/22

geophysical map are part of the Second Intermediate Period-town, intrusive archaeological methods have yet to be applied in Khataᶜna-North itself in order to verify this hypothesis.

The settlement pattern changes in the immediate vicinity of the village of Khataᶜna and further to the south. Limited excavations, conducted in 1979, documented burials and small houses, presumably living quarters of the non-elite. The associated material was dated to Dynasty 13.[11] Any potentially later layers had been destroyed by various human activity.

A/II (Fig. 4)

Area A is the only part of the site where at least remains of the original Tell still exist. In the 19th century, the elevated area was much more extensive:[12] the visitor could walk on the Tell from modern Tell el-Dabᶜa to Qantir. The north-south extension of the ruin-field measured at least 2 km.[13]

Due to heavy – mostly anthropogenic – erosion only in area A younger layers, dug off elsewhere, are to be expected.

The prominent feature of A/II is the temple precinct of the god Sutech, one of the main temples of the city of Avaris and Piramesse.[14] Along this *temenos* the buildings found on the geophysical map of the area are aligned[15], at least the enclosure wall, probably as a ruin, and still standing. The orientation of the structures is more or less east-west or north-south. Dimensions of these buildings vary from 38 × 24 m to 14 × 11 m. The smaller ones are almost square. Mud-bricks (darker grey) as well as sandy mud-bricks (lighter grey) were used as building material. Similar structures are known from Buto.[16]

Late period remains have been discovered all over Tell el-Dabᶜa: in area A/II architectural remains,[17] in ᶜEzbet Helmi a pipeline made of clay[18] and several storage pits in ᶜEzbet Helmi[19] and F/II.[20] This surprisingly intensive building-activity, long after the abandonment of Piramesse

[11] Personal communication M. Bietak.
[12] Habachi 2001, 73.
[13] Griffith 1888.
[14] See Bietak/Forstner-Müller in prep.
[15] S. also Forstner-Müller/Müller 2006, 79, fig. 2.
[16] Hartung/Herbich 2004, especially p. 16.
[17] Bietak 1979, 271, fig. 18. Then the buildings outside of the Sutech temple precinct were erroneously attributed to the Ramesside Period.
[18] Bietak/Dorner/Janosi 2001, 103–104, fig. 54a–c.
[19] Unpublished.
[20] Bietak/Forstner-Müller 2006.

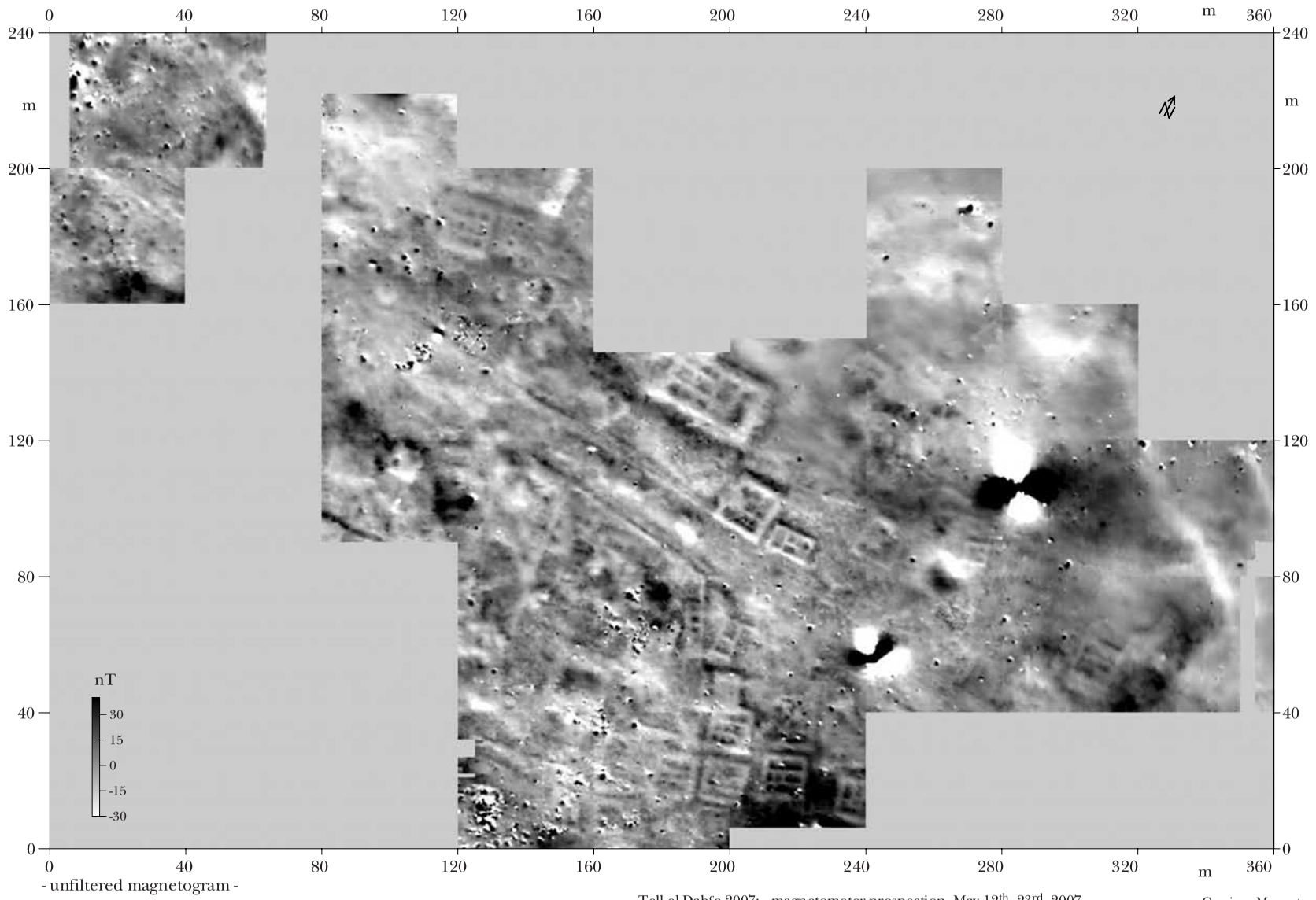
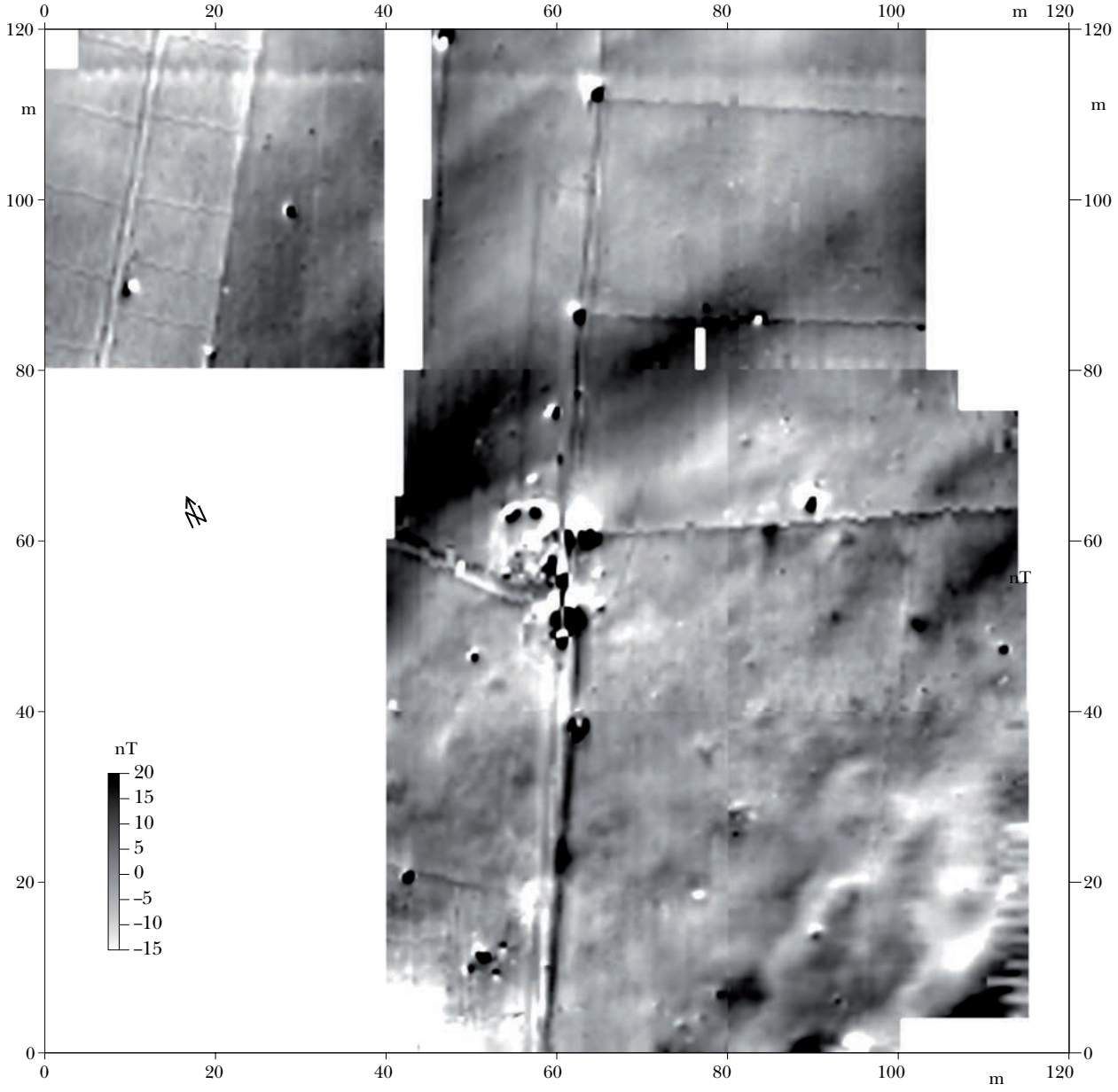


Fig. 4 Late Period buildings in area A, Caesium Magnetometer image



Tell el-Dab^{c}a 2007: ^{c}Ezbet Helmi Northeast - unfiltered magnetogram -

Tell el-Dab^{c}a 2007: magnetometer prospection, May 12th–23rd 2007
Irene Forstner-Müller, Astrid Hassler,Tomash Herbich; Anne-Catherine Escher, Christian Schweitzer, Michael Weissl, Michal Kurzyk, David Swiech
Caesium Magnetometer: Mohammed Mutwalli

Caesium Magnetometer
SM-4/4G-'special'
'Duo-Sensor' arrangement
Schweitzer-GPI, May 2007 measured area in 2007: 0,98 ha

Fig. 5 Helmi North, eastern shore of the Pelusiac Branch of the Nile, caesium magnetometer image

and the displacement of the capital to other cities like Tanis, Sais or Mendes, is still rather enigmatic and has to be studied in more detail.

^{c}Ezbet Helmi North East (Fig. 5)

Another investigation was done to the north-east of ^{c}Ezbet Helmi where the course of the Pelusiac branch of the Nile was already detected by a geomorphological survey.[21] The magnetometry survey confirmed this analysis. The river bank is clearly visible, followed to the east by an area between river and settlement without discernible anthropogenic anomalies that was temporarily flooded during the inundation period.

[21] Dorner 1999, map 1.

Fig. 6 GPR measurement in area A/II, Erol Bayirli (right) and Ibrahim Mohamed (left) (photo: S. Seren)

2. Ground Penetrating Radar

During the spring season 2007 (May 8th–13th 2007) Ground Penetrating Radar measurements were undertaken in cooperation with the Central Institute for Meteorology and Geodynamics in Vienna (S. Sirri Seren, assisted by Erol Bayirli). This method of geophysical survey had hitherto not been applied in Tell el-Dab'a. The device, a „PulseEkko PRO", produced by „Sensors and Software" was used with 500 and 250 MHz antennae. The equipment was pulled on a slide (Fig. 6).

Five areas were investigated (Fig. 7):

AB: on the Tell area A/II

CD: within the palace of the 15. Dynasty (F/II)[22]

EF: in the Second Intermediate Period-town

GH: in the temple precinct of Sutech

I: along the huge feature, most probably a city wall which separates the Middle Kingdom town of ᶜEzbet Rushdi from the Second Intermediate Period settlement.

All these areas had already been investigated by geomagnetry. It was hoped that GPR would provide information concerning the depth of the archaeological features and detect special non magnetic materials like limestone. For the areas AB and GH, both in the vicinity of or in the temple precinct itself, the aim was to detect any limestone blocks still *in situ*. Area EF and I are densely settled urban quarters of the town, the images which had been given by magnetometry were confusing as many layers were positioned on top of each other. The hope was that this complicated stratigraphy could be better understood by GPR.

The results were unconvincing (Fig. 8) and mostly of a (also important) negative nature as since almost no stone structures were detected. GPR is not an ideal prospecting method in the area of Tell el-Dabᶜa. The radar was hardly able to penetrate the soil, most probably because of its humidity, the images produced were nondistinctive.

[22] For this palace s. Bietak/Forstner-Müller 2006; Bietak/Forstner-Müller/Herbich 2006.

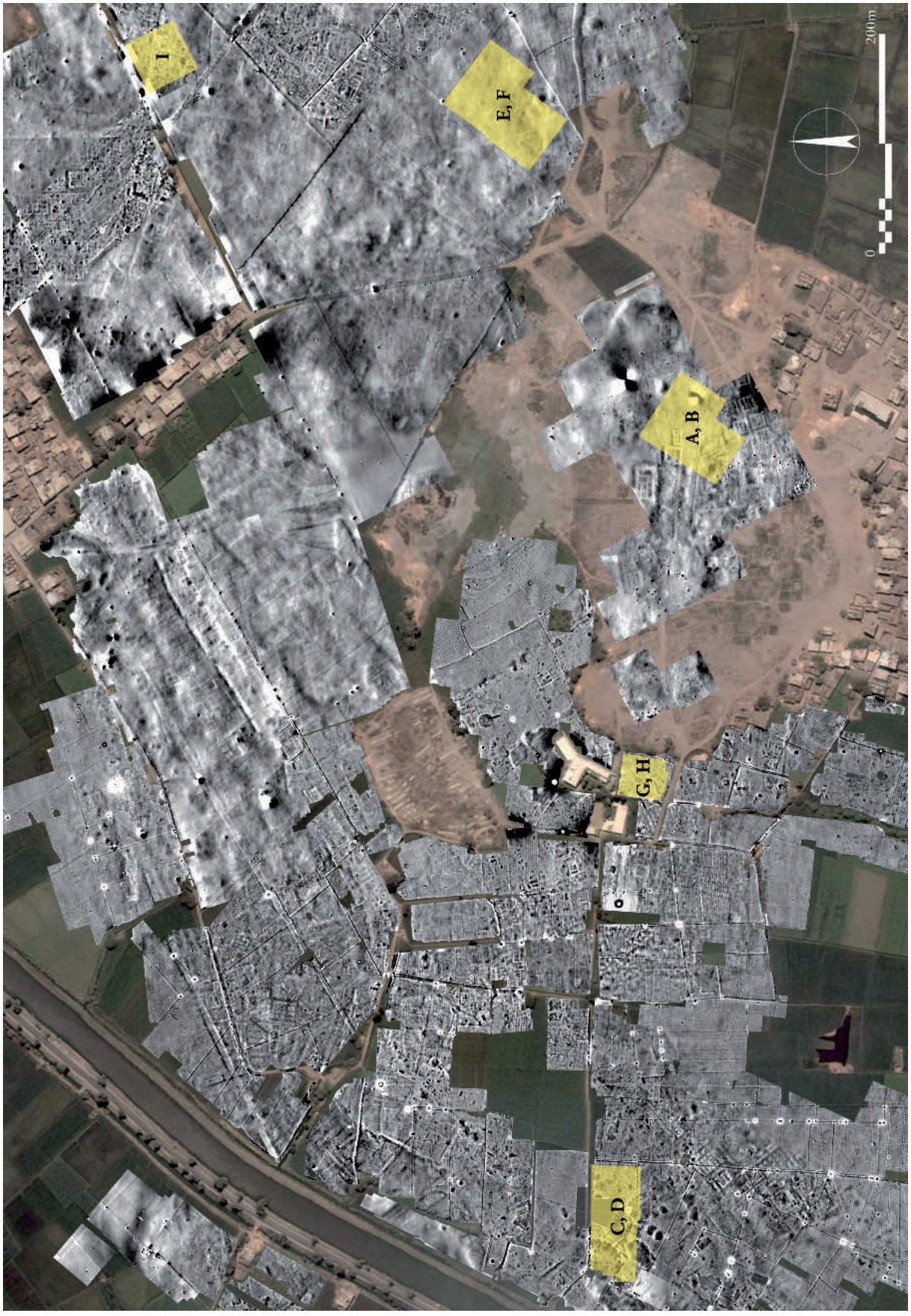


Fig. 7 Areas of Tell el-Dabʿa measured with GPR (plan M. Weissl, drawing N. Math)

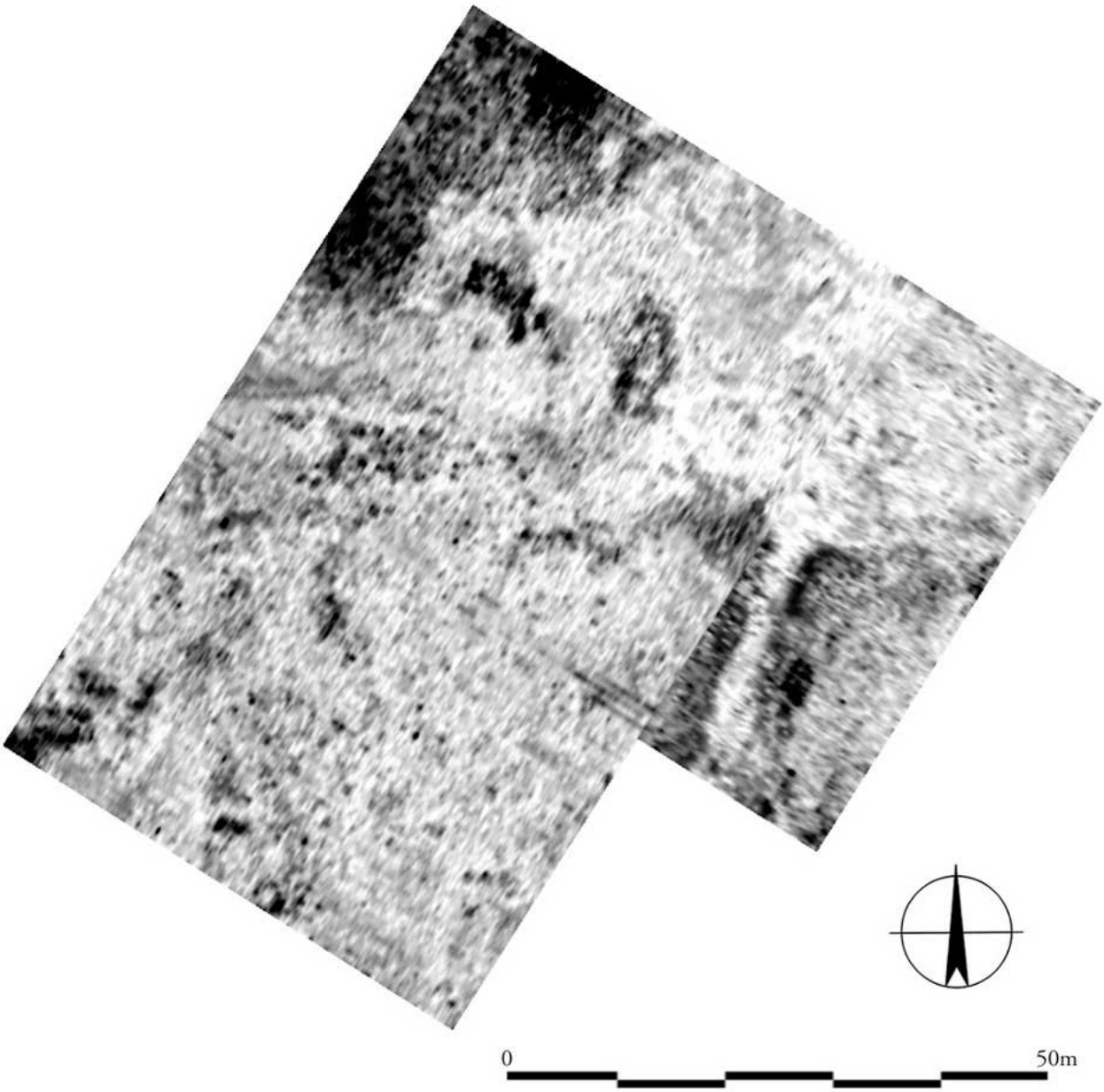


Fig. 8 Area AB, GPR measurement (levels 50–60 cm beneath the surface)

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Bibliography

Ballet, P.

2004 The Graecoroman Pottery Workshops of Buto, *Egyptian Archaeology 24*, 18–19.

Bietak, M.

1979 *Avaris and Piramesse: Archaeological Exploration in the Eastern Nile Delta*, Proceedings of the British Academy 65, London.

Bietak, M., Dorner, J., and Jánosi, P.

2001 Ausgrabungen in dem Palastbezirk von Avaris, Vorbericht Tell el-Dabᶜa/ᶜEzbet Helmi 1993–2000, mit einem Beitrag von A. von den Driesch, *E&L* 11, 27–129.

Bietak, M., and Forstner-Müller, I.

2005 Ausgrabung eines Palastbezirkes der Tuthmosidenzeit bei ᶜEzbet Helmi/Tell el-Dabᶜa, Vorbericht für Herbst 2004 und Frühjahr 2005, *E&L* 15, 65–100.

2006 Eine palatiale Anlage der frühen Hyksoszeit (Areal F/II). Vorläufige Ergebnisse der Grabungskampagne 2006 in Tell el-Dabᶜa, *E&L* 16, 63–78.

2007 Ausgrabung eines Palastbezirkes der Tuthmosidenzeit bei ᶜEzbet Helmi/Tell el-Dabᶜa, Vorbericht für das Frühjahr 2007, *Ä&L* 17, 33–58.

in prep. The Topography of Avaris and Pi-Ramesse in the Ramesside Period, in: S. Snape *et al.* (eds.), in preparation.

Bietak, M., Forstner-Müller, I., Schweitzer, Ch., and Herbich, T.

2006 Discovery of a New Palatial Complex in Tell el-Dabᶜa in the Delta: Geophysical Survey and Preliminary Archaeological Verification, 119–126, in: Z. Hawass, J. Richards, (eds.) *The Archaeology and Art of Ancient Egypt, essays in Honor of David B. O'Connor*, Cairo.

Dorner, J.

1999 Die Topographie von Piramesse, *E&L* 9, 77–83.

Forstner-Müller, I.

2007 The Colonization/Urbanization of the Tell Area A/II at Tell el-Dabᶜa and its chronological implications, *E&L* 17, 83–95.

Forstner-Müller, I., Müller, W., Schweitzer, Ch., and Weissl, M.

2004 Preliminary Report on the Geophysical Survey at ᶜEzbet Rushdi/ Tell el- Dabᶜa in spring 2004, *E&L* 14, 101–109.

Forstner-Müller, I., and Müller, W.

2006 Neueste Ergebnisse des Magnetometersurveys während der Frühjahrskampagne 2006 in Tell el-Dabᶜa/Qantir, *Ä&L* 16, 79–82.

Griffith, F.LL.

1888 *VI. Gemaiyemi, in Nebeshe (Am) and Defenneh (Tahpanes)*, EEF Excavation Memoirs 4, London.

Habachi, L.

2001 *Tell el-Dabᶜa I. Tell el-Dabᶜa and Qantir. The site and its connection with Avaris and Piramesse.* Aus dem Nachlaß herausgegeben von E.-M. Engel, unter der Mitarbeit von P. Jánosi, und C. Mlinar, UZK 2, Vienna.

Hartung, U. and Herbich, T.

2004 Geophysical Investigations at Buto (Tell el-Farain), *Egyptian Archaeology* 24, 14–17.

Jeffreys, D., and Malek, J.

1988 Memphis 1986, 1987, *JEA* 74, 15–29.

Pusch, E.B., Becker, H., and Fassbinder, J.

1999 Wohnen und Leben oder: weitere Schritte zu einem Stadtplan der Ramses-Stadt? *E&L* 9, 155–170.