

GEOPHYSICAL SURVEY, 2004

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Geophysical prospection on settlement sites in northeastern Syria, carried out since the early 1990s, has demonstrated the usefulness of the magnetic method in registering remains of ancient mud-brick architecture invisible on the surface.¹ It has proved especially purposeful in the case of large sites where regular archaeological excavations, slow by nature, take dozens of years to establish a settlement plan. Assuming favorable conditions, a geophysical survey can determine the extent of an endangered site, determining the area in need of protection.

Both aspects were instrumental in planning a prospection of Tell Arbid: the site covers c. 38 ha and lies near a modern village, the inhabitants of which have dug for clay in the ancient ruins in order to manufacture bricks and still use part of the site as a cemetery.

The objective of the prospection carried out on Tell Arbid in 2004² was to test the usability of the method in recording archaeological features in different parts of the site. Five areas were chosen: at the foot of the tell on its eastern, western and northern sides, and in selected areas also on the lower slopes of the tell.

METHOD AND EQUIPMENT

The magnetic method was employed, using Geoscan Research FM36 fluxgate gradiometers. The measurement grid was 0.25 m by 0.50 m with measurements taken in parallel mode (gradiometer moving always in one direction) every 0.25 m along lines spaced 0.50 m within

rectangular areas 20 by 10 m. The magnetic survey results were processed using Geoplot 3.0 software for preliminary measurement processing and Surfer 8 for map analysis and printing. The results were presented as maps of changing magnetic-field values.

- 1 H.S. Giese, A. Grubert, Ch. Hubner, "Geomagnetic mapping on the Early and Middle Bronze Age settlement of Mount Tell Mozan (Urkesch), Northeast Syria," *Archaeologia Polona* 41 (2003), 178-180; C. Meyer, B. Ullrich, "Tell prospection: experiences collected in Northern Syria", *Archaeologia Polona* 41 (2003), 233-236.
- 2 Fieldwork, organized within the framework of a cooperation agreement with the Polish Centre of Mediterranean Archaeology of Warsaw University, was carried out on August 18-28, 2004, by Mr. Tomasz Herbich (Institute of Archaeology and Ethnology, Polish Academy of Sciences), assisted by Mr. Pawel Gan. One of the instruments used in the research was provided by the Programa de Estudios de Egiptología (Consejo Nacional de Investigaciones Científicas y Técnicas) in Buenos Aires, in fulfillment of a cooperation agreement with the Polish Centre.

SURVEY RESULTS

The survey was carried out in five areas [Fig. 1]:

Area a – on the western side of the tell, partly in cultivated fields (not explored

archaeologically) and on a small mound (sector "A", where settlement remains had been confirmed in excavation) removed from under cultivation;

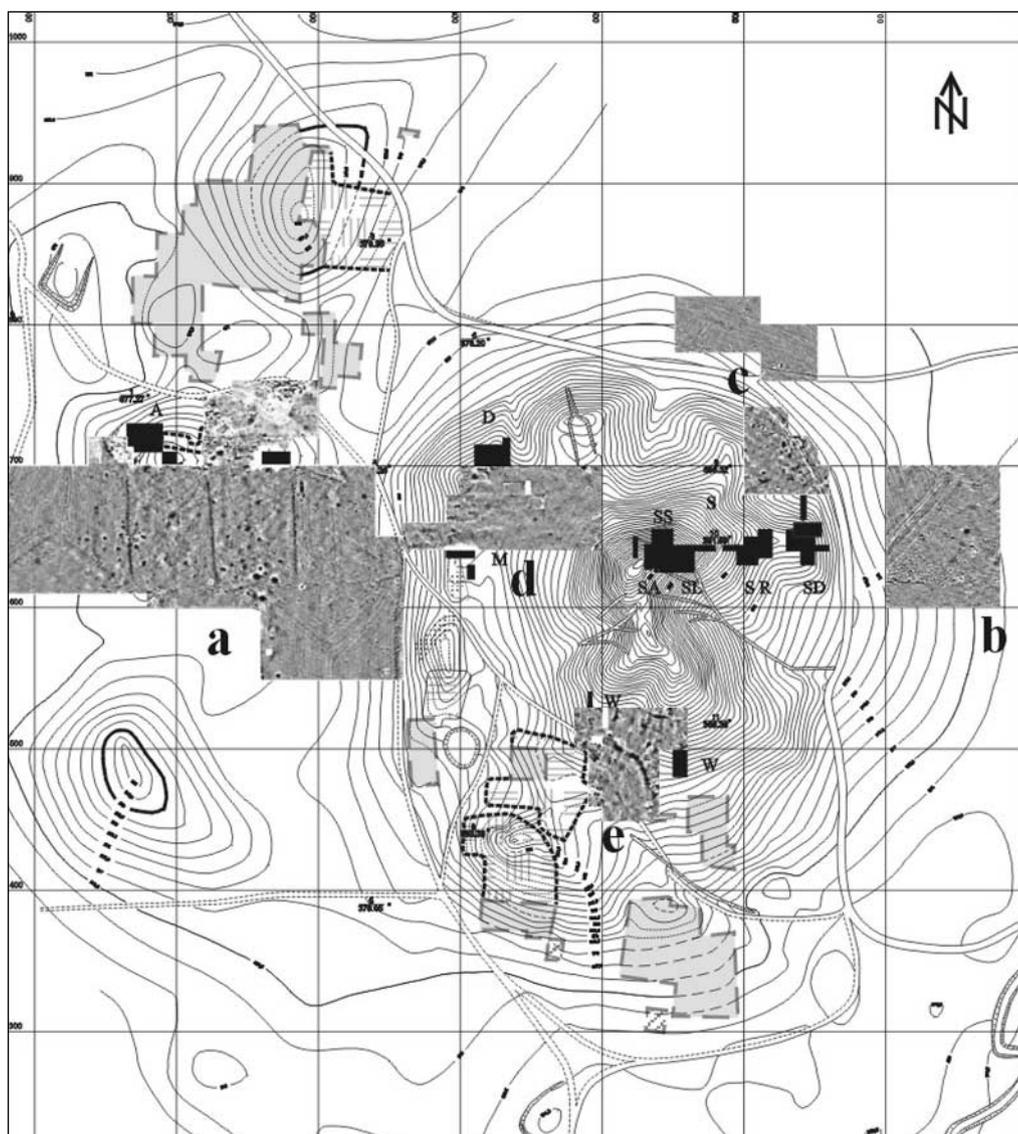


Fig. 1. Surveyed areas located on a contour map of the site (Map M. Wagner; magnetic map processing T. Herbich)

Area b – situated in cultivated fields on the eastern side of the tell (not yet excavated);

Area c – in the lower part of the north-eastern slope of the tell (north of sector "S") and in cultivated fields to the northeast of the tell (area under cultivation – not excavated as yet);

Area d – on the western slope of the tell (adjoining the earlier excavated sections in sectors "D" and "M");

Area e – on the southern slope of the tell, between the trenches in sector "W".
The total area covered by the survey measured 6 ha.

AREA A

Excavations in 1996-1997 and in 2002 revealed the remains of Hellenistic-period architecture, superimposed on earlier layers reaching back to the 2nd (Mitannian settlement) and perhaps even 3rd millennium BC.³ Ruins of buildings were noted around the summit of the mound in sector "A", especially on the southern and southwestern side. The prospection was thus planned to cover an area of 3.50 ha on the southern slope, reaching the foot of the main tell ("citadel") on the west. The objective was to establish the extent of occupational remains.

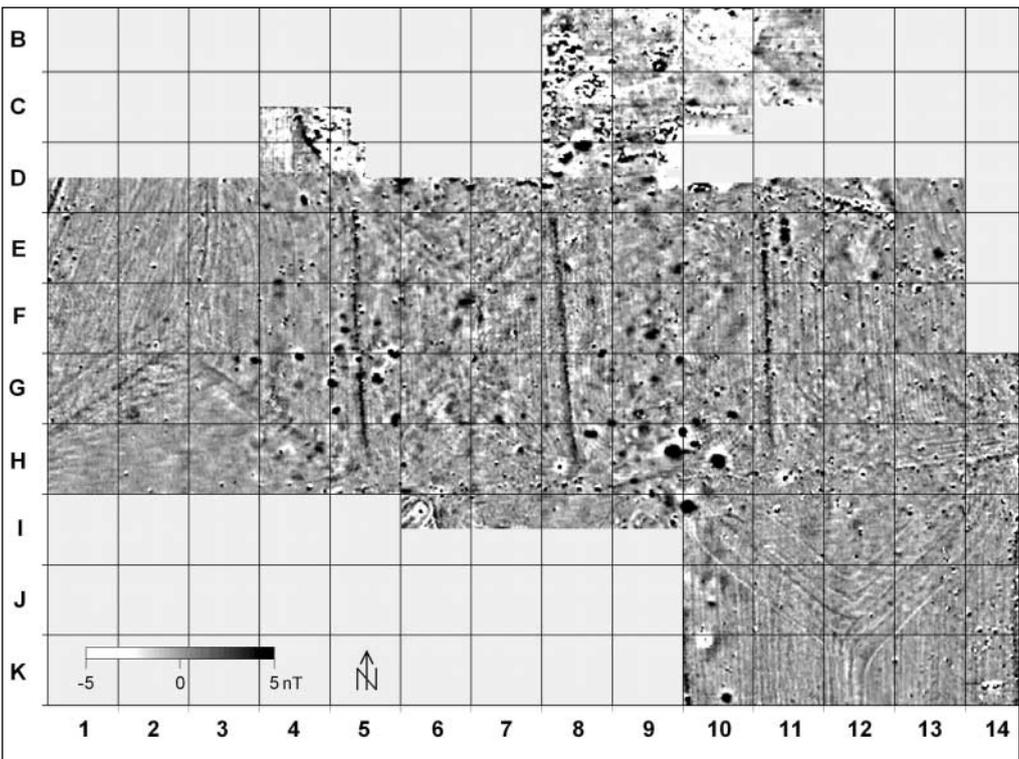


Fig. 2. Area a. Magnetic map, grid lines every 20 m.

3 Cf. P. Bieliński, *PAM VIII, Reports 1996* (1997), 206-207; id., *PAM IX, Reports 1997* (1998), 213-215; id., *PAM XIV, Reports 2002* (2003), 302-312.

In the central part of the area, the survey registered a number of oval-shaped anomalies with diameters ranging from 1.50 to 5.00 m and amplitudes from – 5 to 30 nT [*Fig. 2*]. The biggest density was observed in squares F5 and G5 and in H9 and H10. Such anomalies could be related to pits with ash-dominated filling and while there was nothing on the surface to support this interpretation, the discovery of numerous pits of the kind in nearby sector "A" provided a useful hint. These pits were found at different depths and were dated to Hellenistic times. Similar anomalies, if somewhat less distinct in outline, were also recorded in the center of the prospected area. They could correspond to deeper-lying pits of this kind.

The above-described anomalies, interpreted as pits, were the only relatively indisputable archaeological features seen on the map. They could be connected with the extent of the settlement in Hellenistic times. The remaining anomalies were largely a reflection of agricultural activities: narrow lines oriented N-S, found all over the map, corresponded to deep-plowing furrows, while three linear anomalies, also oriented N-S, extending between squares E5-H5, E8-H8 and E11-H11, corresponded to field boundaries (observed as slightly rising ground). Lines at an angle to the plow lines, discernible over much of the southeastern part of the area (between squares I10, J12 and I14) and in its western part (between G1-H1, F2 and H4), should also be understood as the outcome of changes in surface relief, presumably caused by the use of heavy equipment (caterpillar tractor?).

The interpretation of the northern part of the map (the survey was carried out im-

mediately next to trenches in sector "A") was impeded by disturbances caused by the presence of metal waste presumably discarded by the inhabitants of the nearby village. Even so, the magnetic map reveals possible building remains – linear anomalies intersecting at right angles in square C9.

AREA B

The prospection in search of evidence for the existence of a settlement on the western slope of the tell covered 0.8 ha. Mainly agricultural activities in the form of plow marks and heavy-equipment use were reflected on the magnetic map. In the southern part of the area, a series of anomalies appears to have been generated by the presence of metal objects. The only anomalies not in connection with surface relief were one oval anomaly possibly corresponding to a pit in the central part of the area and elongated anomalies with indistinct edges recorded in the southern part of the area.

AREA C

Measurements covered 0.68 ha of ground in two parts, separated by the road. The survey on the slope (in the southern part of the area) was meant to test the method in registering remains of architecture where it evidently exists, as confirmed by excavations in the area immediately to the south (sectors "SD"⁴ and "SR",⁵ where 3rd-millennium BC architecture was discovered).

South of the road, a series of anomalies of more or less rectangular shape, best visible in square F5 (less distinct in squares G5-G6), could not be explained by anything observed on the ground. It could be interpreted as remains of architecture [*Fig. 3*]. Linear anomalies running parallel

4 See P. Bieliński, *PAM X, Reports 1998* (1999), 213; id., *PAM XI, Reports 1999* (2000), 281-284; id., *PAM XV, Reports 2003* (2004), 338-345.

5 Bieliński, *PAM X*, op. cit., 211-212; id., *PAM XI*, op. cit., 284; id., *PAM XIII, Reports 2001* (2002), 290-291.

to the northeastern edge of the prospected area (between squares E4 and G6) corresponded to the run of the slope and the road running adjacent to the slope.

North of the road, where the prospection aimed at demonstrating the extent of settlement on the plateau north of the tell, nothing but plow marks and a road were reflected on the magnetic map.

AREA D

Measurements covered 0.7 ha. The eastern part was partly on the tell slope, the middle part on a plateau that falls away to the west. Prospection in this area was meant to register the potential remains of a 2nd-millennium defense system surrounding the main tell, as suggested by Mallowan.⁶ Excavations in Sector "M" had not con-

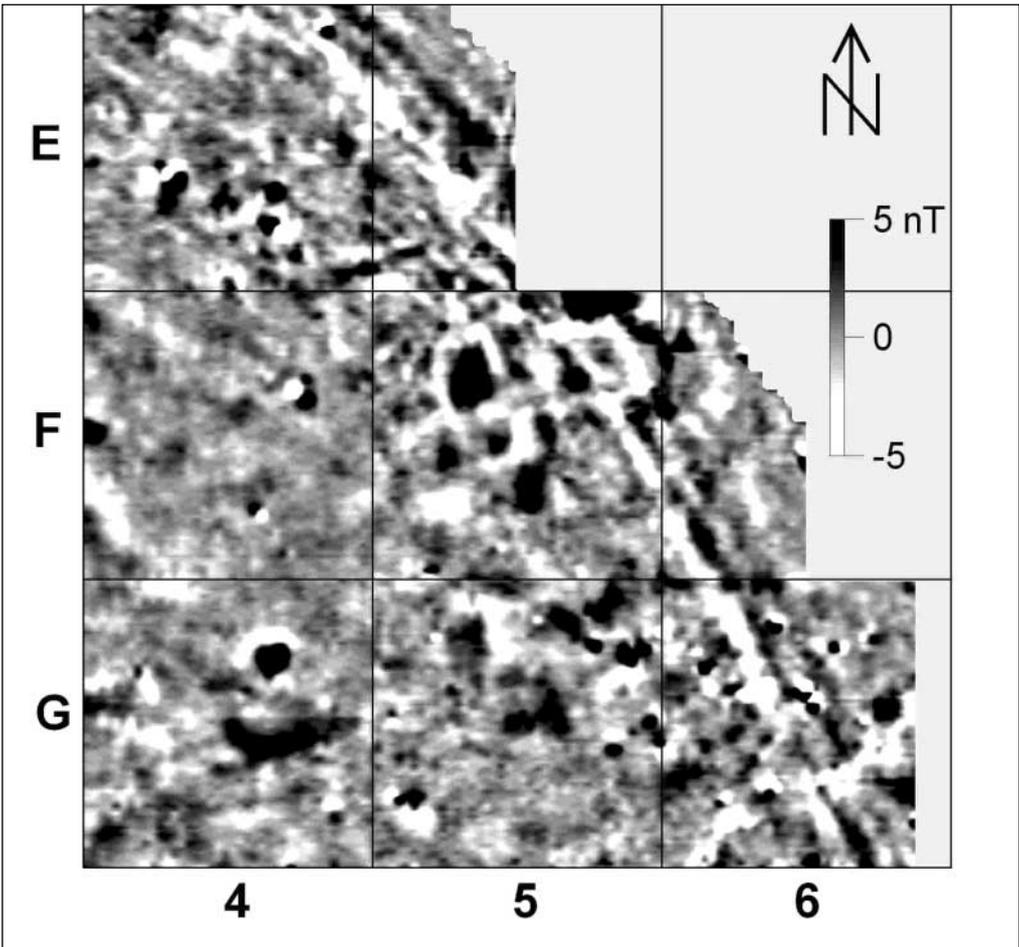


Fig. 3. Area c. Magnetic map of the southern part of the area. Grid lines every 20 m

6 M.E.L. Mallowan, "The excavations at Tell Chagar Bazar and an archaeological survey of the Habur Region. Second campaign, 1936," *Iraq* 4 (1937), 91-177.

firmed the presence of these fortifications, at least not in the form proposed by Malloyan.⁷

The changes observed in the western and central sections of the magnetic map did not form any image recognizable as architecture (although the presence of structures is more than likely in this area, as indicated by the excavations in Sectors

"M" and "D").⁸ Linear anomalies (NE-SW) in the southeastern part of the prospected area corresponded to the run of the slope, but the two linear anomalies in the southeastern corner of the area, both about 2 m wide and spaced c. 20 m apart, distinctly paralleling map contour lines, were not to be explained by anything in the ground relief.

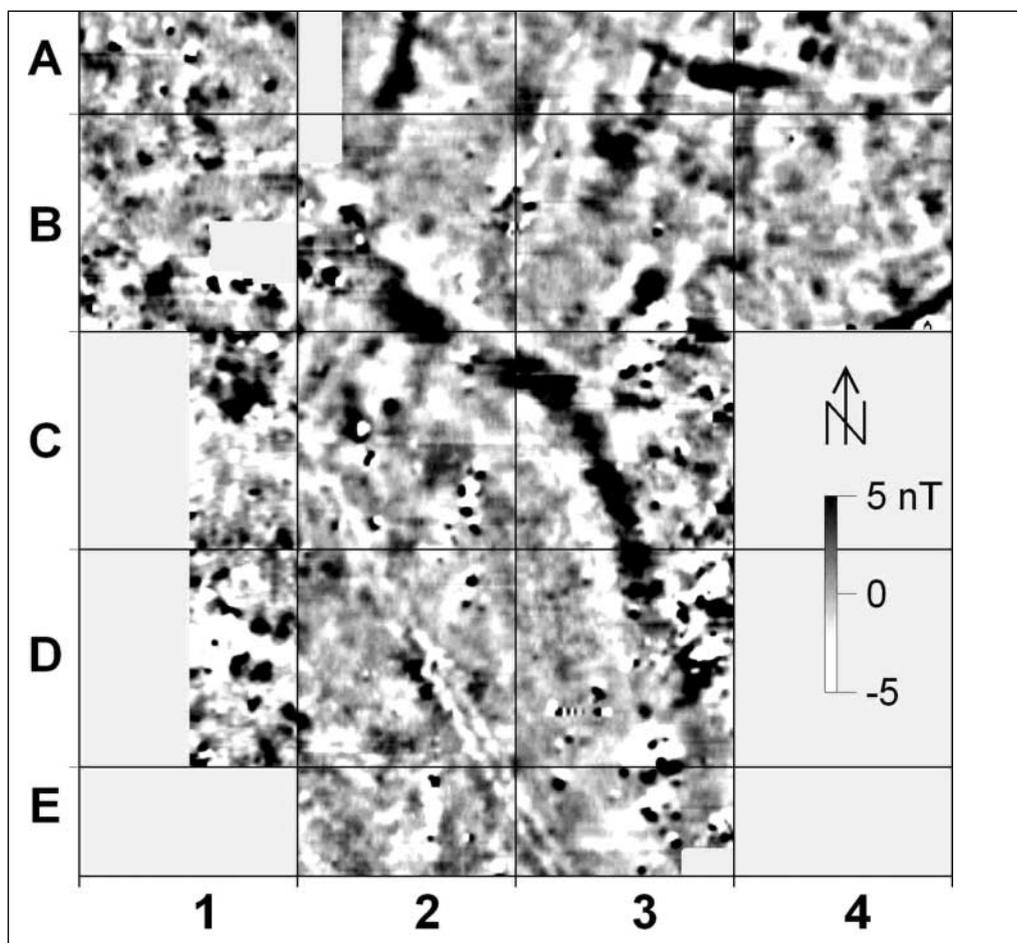


Fig. 4. Area e. Magnetic map, grid lines every 20 m

7 Bieliński, *PAM IX*, op. cit., 215.

8 *PAM IX*, op. cit., 215-217, *PAM XI*, op. cit., 284; *PAM XIII*, op. cit., 289-190; *PAM XIV*, op. cit., 312.

AREA E

Prospection covered an area of 0.48 ha. The map appeared to reflect architecture, the presence of which in the area had already been confirmed by excavations. The anomaly in the central part of the map, between squares B2 and C3, turning to the south in D3 and terminating in E3 on the south, could correspond to a wall (reaching 4 m in width) [Fig. 4]. There is nothing in the ground topography to explain it. The arrangement of

anomalies in squares B2 and C1-C2 could suggest the presence of buildings adjoining the structure described above on the south. Another anomaly, possibly reflecting architecture to judge by the shape, is the one at the edges of squares A3-A4, B3-B4. Again, the ground surface reveals nothing to explain the presence of the anomaly, similarly as in the case of the anomaly recorded in square A2. A narrow anomaly running between squares C1-E2 reflects a path.

CONCLUSIONS

The prospection reported on here is undoubtedly a test of the method in the specific conditions of Tell Arbid. Proper map interpretation requires a key that only archaeological verification of selected anomalies can provide. Thanks to earlier excavations, it was possible to attribute the oval-shaped anomalies (in area a) to pits. Nothing else, however, seems to have been registered anywhere in the prospected area at the foot of the tell, which, if the pottery scattered on the surface is any indication, must have been at least partly inhabited in antiquity.

The cause of anomalies observed in areas c and e will have to be determined through excavations. Should these anomalies be confirmed as reflecting architecture, then further magnetic prospection on the tell slopes would be justified. Furthermore, there is no cultivation on the slopes of the mound, thus the magnetic map is not burdened by disturbances related to changes of surface relief and soil density in near-surface layers caused by deep plowing and heavy-equipment use.