Geophysical applications for ITA 2008 : the example of the Selimpaşa Höyük

Volker Heyd (Bristol), Şengül Aydıngün (Kocaeli) & Emre Güldoğan (Istanbul)
with contributions by Maxime Brami (London), Mehmet Karauçak (Istanbul), Hakan Öniz (Famagusta), Matthias Rummer (Dresden), Christoph Skowranek (Halle) & Çağlar Yalçiner (Strazburg)

1. Introduction

Geophysical applications were an important component in our survey work for the summer 2008 campaign of our ITA-project (see Aydıngün et al. in press). Two geophysical systems were used: on the one hand a gradiometer producing horizontal plans of the magnetometric field, on the other hand a portable ground-penetrating Radar (GPR) producing vertical sections. The ability to combine the results produced by the two techniques, hence maximising the information, makes this methodology very successful.

These two systems were applied on different sites during the summer campaign of the ITA project. Beside 'Kücükçekmece A6', which has yielded a flint assemblage with interesting links to the late Pre-Pottery Neolithic B in Central Anatolia (for a description of the site and flints, see Ş. Aydıngün 2007, 2008, 2009), and a classical harbour site at the tip of a peninsula reaching into the Lake of Kücükçekmece (provisionally called 'Bathonea'; see for example H. Aydıngün in National Geographic Türkiye, November 2008), our efforts concentrated for about seven days on the Selimpaşa Höyük.

Selimpaşa Höyük is the only large prehistoric settlement mound (Höyük) that remains on the northeastern coast of the Sea of Marmara (Harmankaya &. Erdogu 2002). In that region, comparable sites on the coast or further away from the sea, such as Kanallı (Kınalı) Köprü (Silivri; Istanbul province), Sereflı Çiftlik (Marmaraereğlisi; Tekirdağ province), Temenye (Pendik; Istanbul province), and particularly Toptepe (Marmaraereğlisi; Tekirdağ province), have

all been destroyed either by continuous agricultural ploughing or construction in the last two decades, mostly without any archaeological investigation. However, Selimpaşa Höyük is now also threatened with destruction, because of the everlasting expansion of the modern town and the increase in the number and size of holiday homes in its immediate vicinity.

The primary aim of this paper is therefore to raise awareness on the current state of preservation of this key site – first discovered, recorded and published in the Anatolian Studies by D. French in the mid 1960s (French 1965); then visited several times by M. Özdoğan during his surveys in Thrace (e.g. Özdoğan 1993). We would also like to give an account of the current state of research at Selimpaşa, and by so we hope to demonstrate its research potential for further study. Finally, the present article seeks to show how targeted geophysical and survey work, here also including the topographical measurement of the site, can enhance our knowledge of an important single site and therefore help to prepare further imminent fieldwork.

2. Location and Situation

The Höyük of Selimpaşa (exactly located at: N 41° 03' 31-37" ; E 28° 20' 24-32") is nowadays a seafront site (**Fig. 1**); it lies immediately behind the sandy beach, c. 50 meters from the sea, on a slight natural lime/sandstone elevation at the western end of a small bay on the northeastern shores of the Sea of Marmara, some 3 km west of the modern town centre of Selimpaşa. Administratively, Selimpaşa belongs to the Silivri District, in the westernmost part of the Istanbul Province. The distance to Istanbul's old city centre (Eminönü) is about 55 km as the crow flies.

Two small water currents, the Kavakli Dere and the Kocadere, spill into this c. 800 meters long bay, securing year-round water supply for nearby settlements. The Höyük itself stands next to the Kavakli Dere stream banks, just west of its mouth. Here, a low lime/sandstone outcrop creates the natural foundation for the Höyük. On the seafront side, this rocky elevation has become partly visible due to erosion, and its summit rises up to c. 9 meters above current sea level.

Figure 1: The Selimpaşa Höyük, as seen from the Sea of Marmara (from the South).

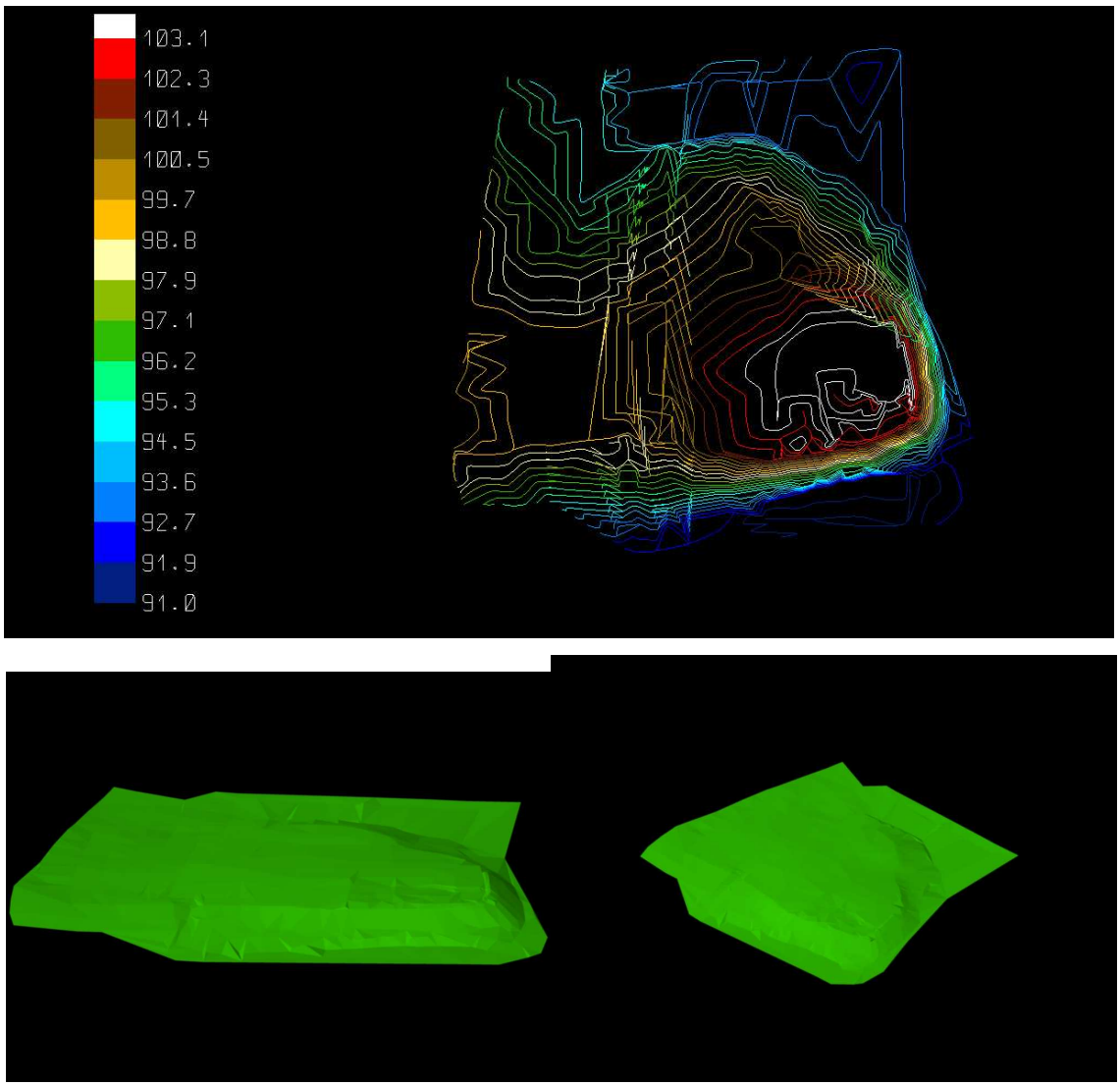
Further to the west, a more hilly landscape of the same lime/sandstone formation continues, now completely built over by holiday houses. To the East, however, there is the flat sedimentation plain irrigated by the two currents, likely a wet area in the recent past, or perhaps covered partly with sand dunes. In Prehistory, the bay likely extended further inland; the sea shore itself was further away due to a lower sea level. Today, the waters in the bay are shallow, partly covered with sandy banks, and the beaches are in place 100 meters wide and fine sandy. In the last decade, this whole area, as well as the nearby lime/sandstone hills some 800 meters further to the east, has been converted to a holiday resort area, which resulted in the construction of hundreds of holiday homes in parallel lines in the whole 300 meters wide strip behind the beaches and shores. Towards the north, the flat coastal hinterland continues deep into the inland. On the horizon, at a distance of c. 5-6 km, hills are visible.

The situation of Selimpaşa Höyük, at the sandy beach on a small bay, with a little adjacent current providing year-round water supply, and with a flat fertile hinterland attached to it, is suggestive of a major settlement site, probably the long-term centre of a wider catchment area. Unsurprisingly, we know of no other settlement mound within a radius of 10 km. The location of the site just at the beach in the bay provides the ideal setting for a prehistoric, in particular Bronze Age, harbour town visited by sea merchants wishing to enter the Black Sea. One thinks of the site as the last secure shelter before entering the Bosporus. All this makes Selimpaşa Höyük a key site for our understanding of the transmission of social and technological innovations and achievements from Asia to Europe, and from the Aegean to the Black Sea (and the other way round!), and therefore for the emergence of complex societies in Southeast Europe.

3. The Höyük

The Höyük itself has a somewhat circular or oval shape, with a well pronounced and steep sloping Southern seafront and Eastern riverside, and more gently descending Western and Northern (hinterland) sides (**Figs. 2-4**). This makes it difficult to estimate the exact extent of the Höyük; however, taking into account all the evidence that we have at our disposal, it seems likely that the mound was c. 150 meters along the East-West axis, and from c. 110 to 140 meters in the North-South axis. Given its overall dimensions, Selimpaşa Höyük is one of the largest settlement mounds on the northern coast of the Sea of Marmara, including the Gelibolu peninsula.

Nowadays, the top of the Höyük rises c. 15 meters above sea-level. The configuration of the mound, and in particular its elevation, probably changed a good deal since prehistoric times, because of sedimentation processes, changes in sea-level and perhaps tectonic movements. As mentioned above, the Höyük possesses two steep sides towards the East (the riverside) and the South (the seafront side). Elevation is here at its maximum. In particular, the eastern side ends abruptly in a very steep slope rising c. 13 meters above the



Figures 2-4: Topographical measurement of the Selimpaşa Höyük: 2 – view with iso-lines; well visible is here the flat plateau in the Southeast; 3-4 – two 3D-models of its shape.

modern track downhill. There can be no doubt that this side has been preserved in its original form and that erosion played only a marginal role here. This is further confirmed by the identification of a low wall c. 1.5 meters wide, still well visible today and flanking the top of the lateral side on a length of c. 40 meters (**Fig. 5**). The wall seems to be constructed of now weathered mudbricks on a stone socle. The Eastern side has thus preserved the somewhat typical, castle-like appearance of the Höyük. Unfortunately, the seafront side is different. Here, both topographical measurements and geophysical survey (s. below) indicate that heavy erosion has taken place over the last four millennia at least, so that a

Figure 5: Two photos of the little wall as it follows the edge of the abrupt eastern slope.

large surface (perhaps extending as much as 10 meters towards the sea) has been cut away. Nevertheless, together the eastern and southern sides are framing the highest part of the Höyük, hence creating a kind of relatively flat plateau c. 60 x 50 meters. If one adds the missing 10 meters or so, then the original plateau may have covered an area of c. 60 x 60 meters, ideally suited for a kind of acropolis. Important is the question of the thickness of the cultural deposit. Our estimations are based less on the results of the GPR (see below) than on the identification of actual outcrops of the bedrock on the heavily eroded seafront side of the Höyük. The uppermost exposure is c. 8-9 meters above sea level, which suggests that the cultural deposit may measure some 6-7 meters in height.

This description of Selimpaşa Höyük would be incomplete without reporting the various damages the site has suffered in the last decade, and especially in the last years, despite its officially protected status. Above all, and perhaps most striking, is the construction of a helicopter landing platform near the top of the mound overlooking the seaside. Although the Höyük is mostly flat at its summit, a bulldozer has been used to level the surface within a radius of 20 meters or so. In place, the bulldozer cut more than c. 50 cm of the deposit, and by doing so it destroyed largely untouched archaeological layers, as the many sherds on

the surface would suggest. In addition, part of the mound was cut off by a bulldozer at its Northeastern lateral side to widen the access of the track. Similar destructions need to be reported on the seafront side. Here, a bulldozer seems also to have been used to cut away the lower parts of the deposit, just next to the modern buildings the landowner erected behind his lavish bungalow. Moreover, hundreds of pits for planting trees were dug into the cultural layers at the seafront side, as does a North-South earthen track leading centrally over the Höyük and partially cutting into it.

There can be no doubt that these damages will continue; and they might even increase if nothing is done. Nevertheless, it is amazing that most of the Höyük remains intact: if one uses the *Google Earth* view (**Fig. 6**) on the situation along the coastline, one can see that the c. 200 x 200 meters (c. 4 ha) fenced Höyük area is one of only few spots free of houses for several kilometers on both sides.

Figure 6: The *Google Earth* view on the Selimpaşa Höyük

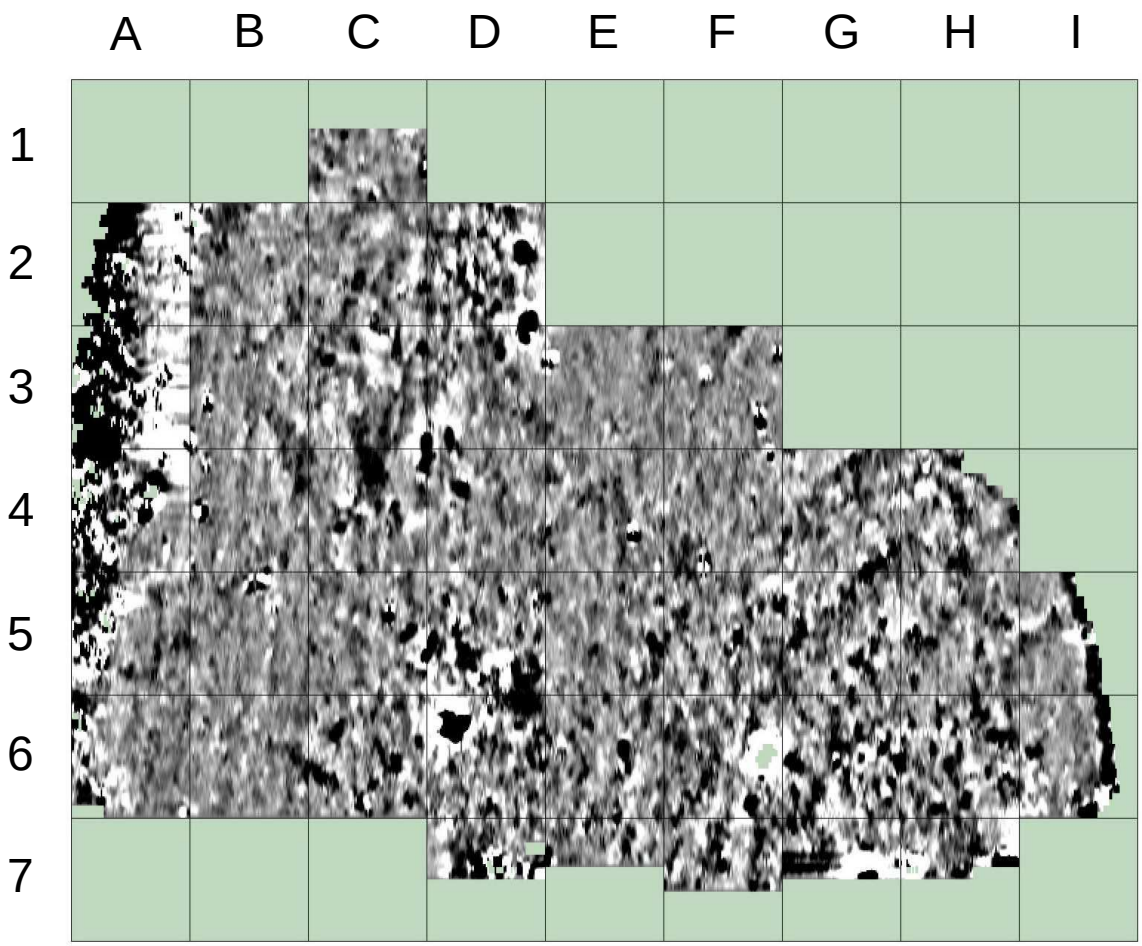
4. Survey and Prospection Work on the Höyuk

Survey and prospection work on the Höyük was organized in four different teams in order to maximize efficiency within the one week available for the task. Two teams were dealing with the geophysics, mainly C. Skowranek in charge with the gradiometer and the geomagnetic prospection, and Ç. Yalçiner conducting the GPR work. At the same time, a measurement grid system was laid out by M. Rummer and the whole Höyük was measured topographically in order to gain a 3D-model of its shape. Finally, pot sherds and other miscellaneous finds were collected all over the site by a team of students from Istanbul and Kocaeli Universities, coordinated by E. Guldoğan.

The geomagnetic prospection was conducted using a fluxgate gradiometer (Bartington 601-2), which is standard at the Department of Archaeology and Anthropology in Bristol. This device consists of two parallel switched probes in a distance of one metre from each other, both fixed on a plastic carrier harness. The measurement density on the site was set at 0,25 x 1,0 meters, during the processing of the data it was enhanced to 0,25 x 0,25 meters. The advantage of the device and this arrangement lies in the possibility to prospect areas in a hectare range within a relatively short time. This is particularly advantageous at geophysical surveys with restrictions in time and funding. On the downside, the resolution of the results is not always the highest possible, but the results showing the general layout of any archaeological remains in the survey area and it would be possible to re-survey any areas of particularly interest with a higher density or different survey methods (Caesium magnetometry, Resistivity).

The Prospection at Selimpaşa Höyük was conducted on the basis of a 20 x 20 meters grid system, whose corners and sides were simultaneously being built into the topographic plan by the other team. By doing so, c. 38 grids could be measured on the Selimpaşa Höyük. This equals the area of 15,200 m^2, ergo 1.5 hectares.

The results of the geophysical survey are difficult to interpret (**Fig. 7**), mainly because of the characteristic of the site being a multi-period Höyük. Some disturbances within the plot can be explained by modern structures around and


A B C D E F G H I
1
2
3
4
5
6
7

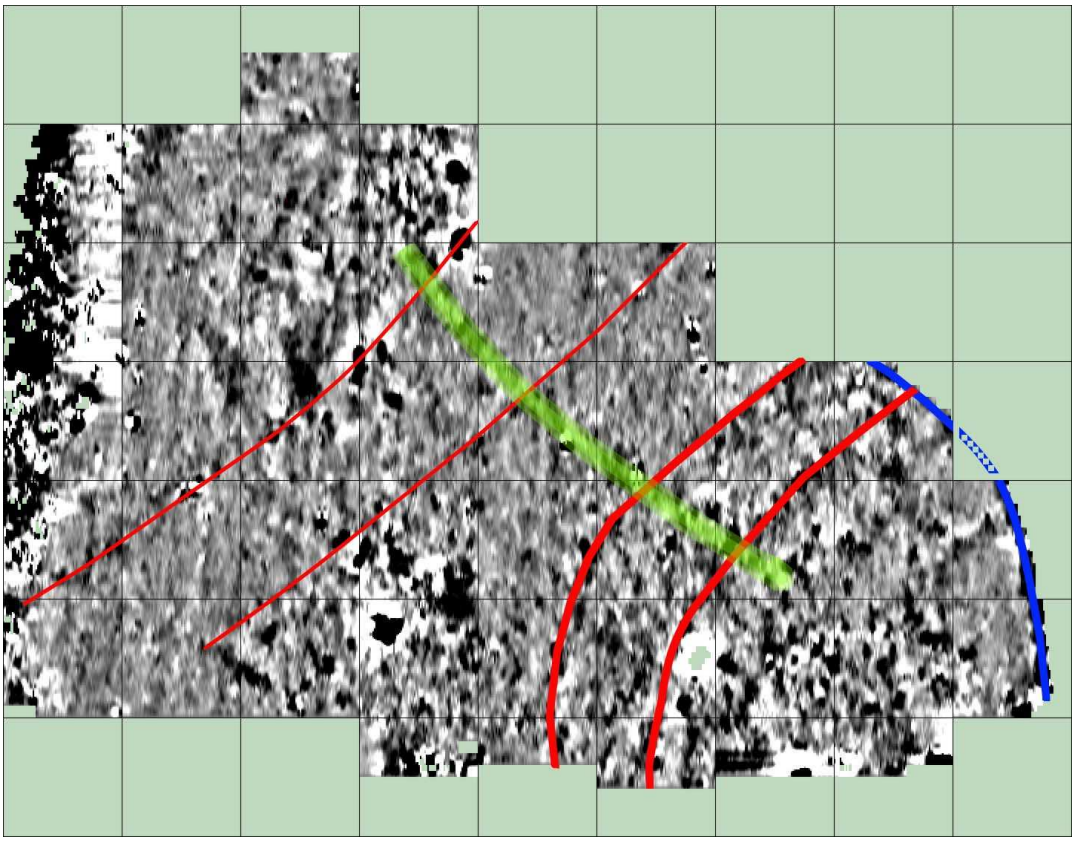


Figure 7a/b (opposite side): Results of the Gradiometer prospection of the Höyük; interpretation of the linear features found on the Höyük.

inside the survey area; for example, along the western side of the area runs a modern metallic fence and the big white ‘hole’ in grid F6 is caused by a big iron stand for instruments for measuring the direction and speed of the wind.

Most importantly, areas of heavy ‘activity’ just below the surface, which can be caused by large fire places, burnt-down houses or large pit clusters, created high anomalies in the magnetic field. This is likely the case in the grids D2, C/D 3/4 and D5-7. The upper platform in the Southeast of the Höyük is characterised by a high ‘noise’ in the magnetic field, likely coming from many different overlying archaeological features below the surface. The strong magnetic response in some areas indicates that some of these features may be burnt; but beside the linear features and some large pits no structural differentiation can be given by our results. Some linear features are discernable, lined around the highest area, the Southeastern part of the Höyük – probably in some sort of circular arrangement. It is possible to distinguish two lines within thies area of high magnetic activity. These lines seem to be in line with the topography (see Fig. 2), creating a barrier between the higher grounds of the Southeastern corner and the gentle slopes of the northern and western flanks of the Höyük. Another possible linear feature, visible as a slightly dark line, leading from Northwest to Southeast and meeting with the semi-circular lines approximately in grid F5. This line makes the impression of being an ancient access to the upper plateau possibly through the semi-circular lines. Two further linear features, in a different arrangement and orientation, are visible in the area outside the platform and its immediate Northern und Western slopes. Only slightly visible, they run through the western and northern parts (from grid A5 to D3 and from grid B2 to F3) of the Höyük. The area in between these two linear features seem to be very quiet, almost as soil is covering the surrounding archaeological layers or the archaeological layers in this area has been removed. Up until this point the interpretation remains, very diffuse.

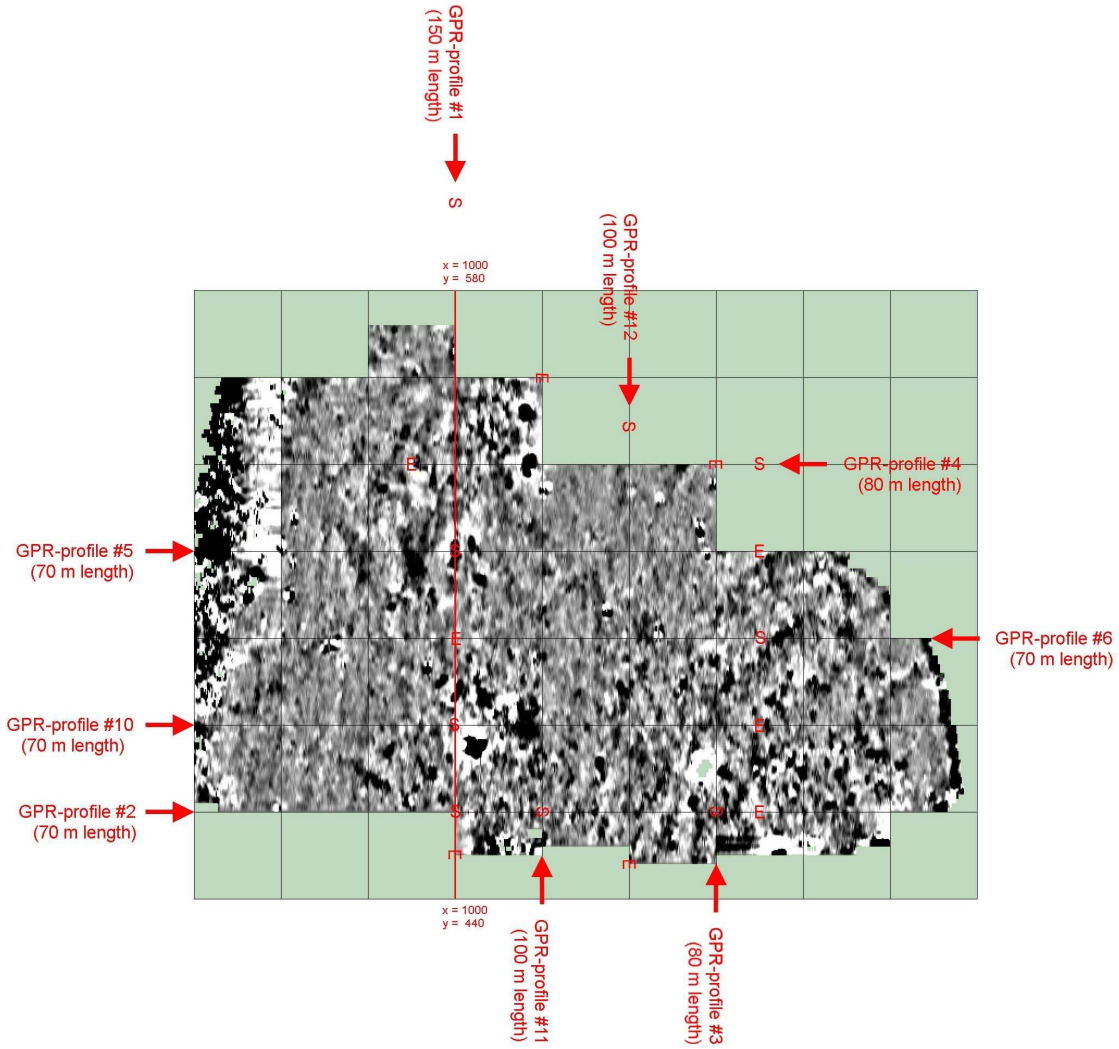


Figure 8: Position of the nine GPR sections relative to the results of the geomagnetic prospection.

Ground penetrating radar was used to set nine sections over the whole Hoyuk (**Fig. 8**). These sections were both orientated North-South as well as West-East. The longest of these sections (# 1) had a length of 150 meters, however the majority of them were about 80 meters long. Again, as such these results are difficult to interpret (**Fig. 9**). Clearly visible and discernable are layered structures, often with varying orientations, some mounting, others descending. Some of these structures, in particular in the upper parts of the profiles, seem to be of archaeological origin; they potentially demonstrate the layered accumulation of settlement debris on the mound. Other anomalies, particularly in the lower parts of the profiles reaching down to a maximum of about 20

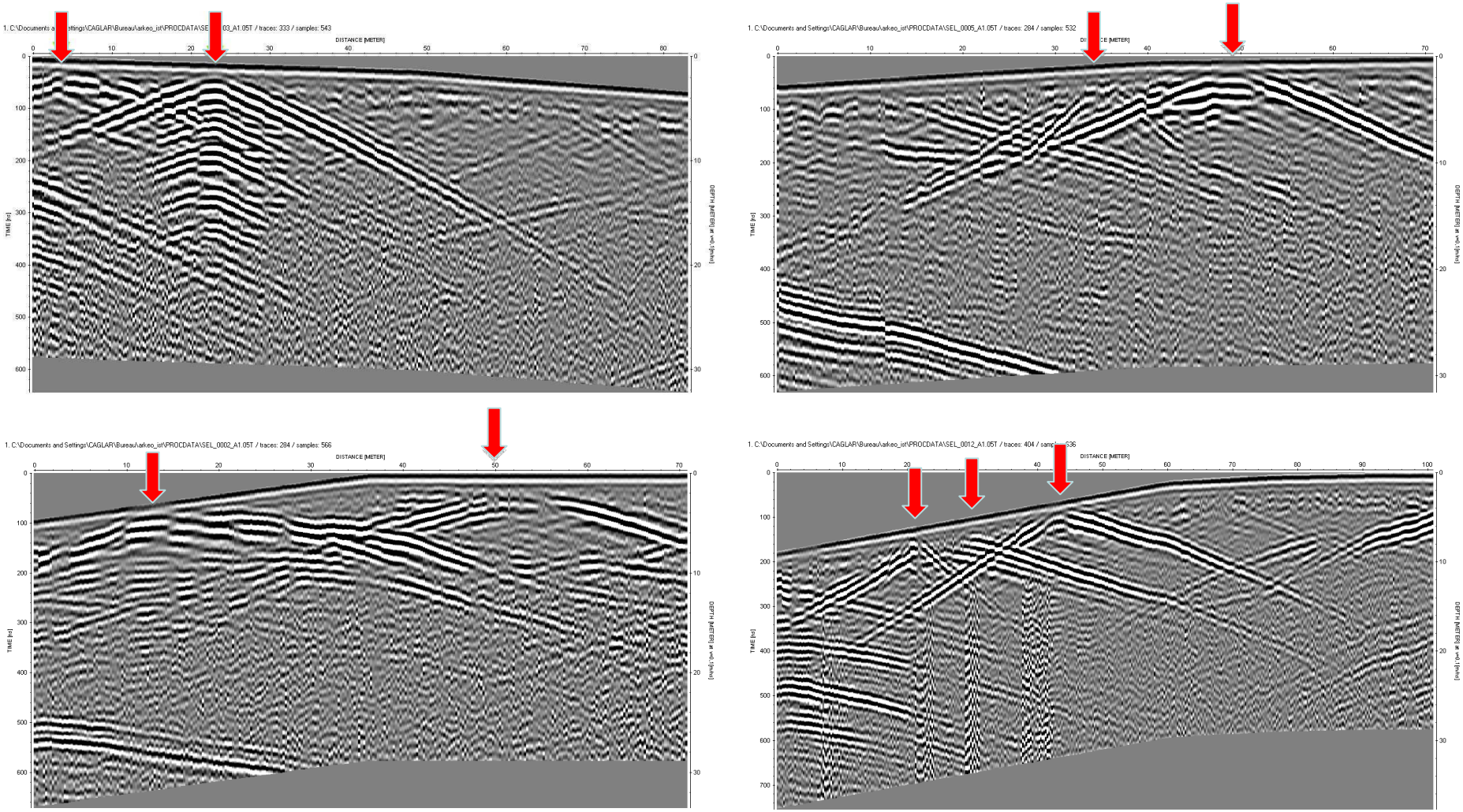


Figure 9: Four examples (clockwise from top left #3, 5, 12 & 2) of the nine sections gained by the GPR; the red arrows mark the position of reflexion of massive stone bodies near the surface, likely deriving from stone walls, ramparts other kind of fortifications.

meters, seem to be geological in nature and they display the natural patterning of the subsoil, here the sand/limestone rock. However, even when comparing all the profiles the underground rocky subsoil and the overlying cultural deposit cannot be clearly distinguished. Reflections in a sharp ‘V’-shape in the profile are nonetheless of a clear archaeological nature. These reflections derive from archaeological features and their down-reaching echo near the surface of the profiles. Good examples for these are at section #2 at 15 and 50 meters, section #3 at 25 meters, section #5 at 45 to 50 meters, and section #12 at 20, 30 and 45 meters. These ‘V’-shaped features can only be the reflections of massive structures in the deposit, likely some kinds of stone walls, perhaps

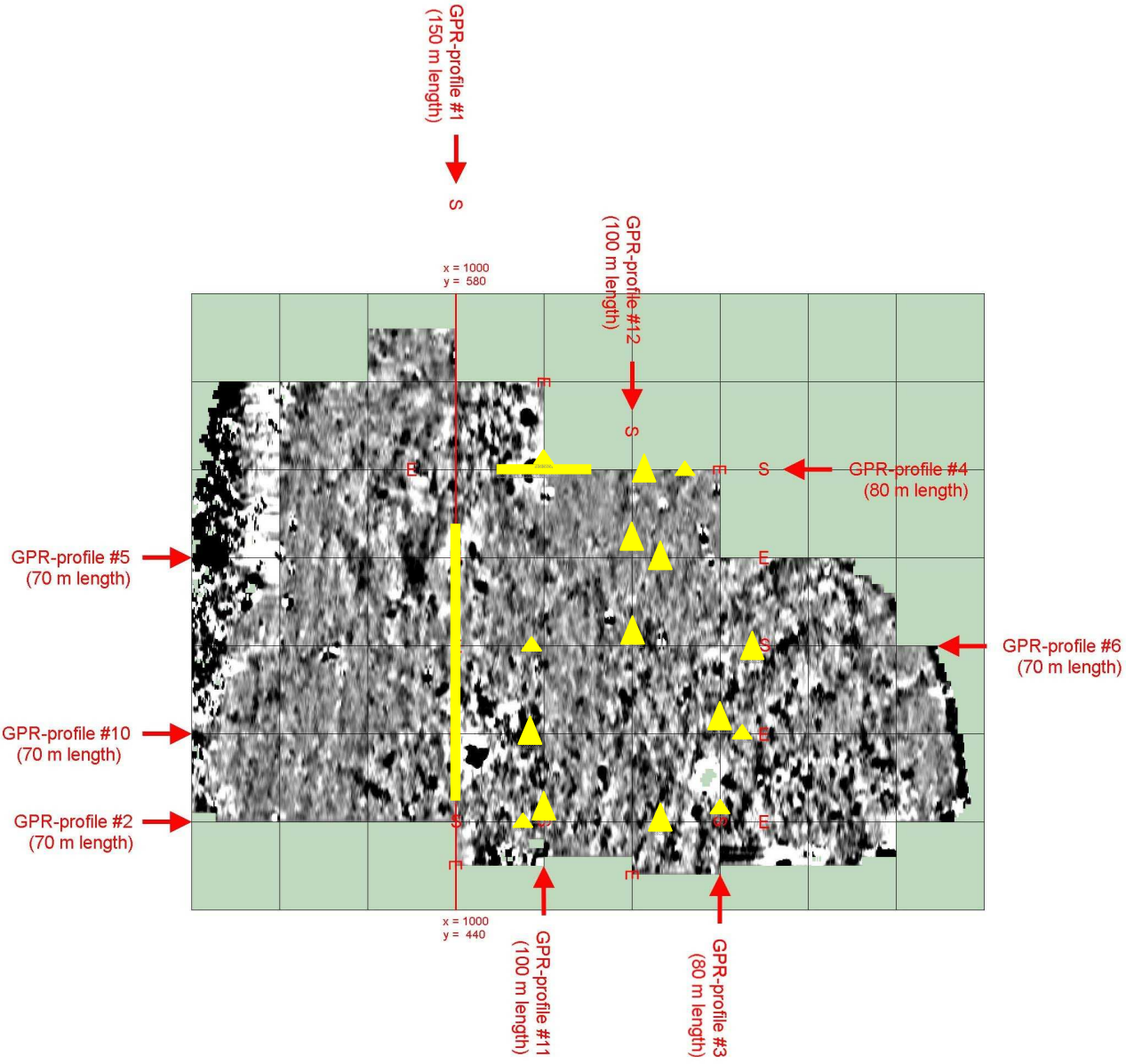


Figure 10: Combining geomagnetic prospection and GPR sections.

ramparts, or any other kind of stone fortifications. In those few cases where the signal continues for several meters, as for example section #4 at 30 to 55 meters (not shown as a figure but compare Fig. 10), the profile seems not to have crossed the reflection zone, but continued on top of it for a while.

The next step of our research consists in combining the results of the geomagnetic prospection with those of the GPR sections. This is given in Fig. 10. Here, the yellow triangles stand for the massive structures in the ground, likely stone walls, ramparts or any other kind of fortification. In particular around the Southeastern upper plateau with its semi-circular lines following the slope of the terrain, their position and coincidence makes it very likely that these are in fact the remains of at least two, perhaps three, lines of walls encircling the upper plateau. However, massive stone structures detected by the GPS are also found outside this encircling fortification lower in the slope. Here, they sometimes coincident with dark spots in the geomagnetic plot, however without giving clear evidence for what kind of construction lies in the ground. Sometimes they even don't match any anomaly at all.

5. Conclusion

To sum up, the combination of two different methods of geophysical prospection, the magnetometric gradiometer producing horizontal plans and the GPR producing vertical sections, has given us a much more detailed insight into the important site of the Selimpaşa Höyük. In particular the Southeastern upper plateau, framed on two sides by steep natural slopes, seems to have functioned in the past as a kind of acropolis with additional protection by two or three lines of encircling walls or fortifications at the more gentle Northern and Western slopes. Even the original access to this acropolis seems to have been detected in the squares D3, E4 and F5. On the other side, many other detected features, such as linear structures, obvious pit complexes, burnt places and massive stone bodies in the ground, are still awaiting clearer interpretation and contextualisation.

Here is not the place to discuss in full detail either the material culture of the Selimpaşa Höyük collected from the surface during the survey, nor to put this important site into the wider context of the northern Marmara Sea, Thrace and this most Southeastern part of Europe. However, in brief, most of the sherds recovered on the upper plateau, in particular at the point where a helicopter landing platform has been created by a bulldozer, are actually late Early Bronze Age in date. Among the sherds are several Anatolian/Trojan red-slip fine-wares, wheel-made plates and some pithoi fragments. The fact that they were collected at the surface without much intrusion by later materials makes it very likely that buried late Early Bronze Age building structures are just beneath surface. The consequence of this observation can only be to place the whole detected features here, i.e. the acropolis-like topographical situation, its ‘noise’ of settlement remains, the defensive semi-circular ring-system, and perhaps even the low preserved wall following the edge of the eastern slope, also in the Late Early Bronze Age. This would well position Selimpaşa Höyük in parallel to fortified sites such as Troy II/III, Küllüoba and Kırklareli-Kanlıgeçit to name only the most prominent examples currently under excavation.

Bibliography:

H. Aydıngün 2008 = H. Aydıngün, Istanbul'un Kayıp Şehri. *National Geographic Türkiye*, November 2008: 58-70.

Ş. Aydıngün 2007 = A new Prehistoric Settlement Near Küçükçekmece Lake in Istanbul:Avcılar- Firuzkoy, *Boletin De La Asociaon Esponala de Orientalistas* , XLII, 13-23, 2007

Ş.Aydıngün = İstanbul'da Neolitik Bir Yerleşme Avcılar-Firuzköy*, KOU Fen-Edebiyat Fakültesi Sosyal Bilimler Araştırma Dergisi*, 1, 93-100, 2008

Ş. Aydıngün 2009 = Ş. Aydingun, Early Neolithic discoveries at Istanbul. *Antiquity* Vol. 83, Issue 320, June 2009 (http://www.antiquity.ac.uk/projgall/aydingun/)

Aydıngün et al. in press = 2008 Yılı İstanbul Tarih Öncesi Çağlar Yüzey Araştırması

D. French, Recent Archaeological Research in Turkey – Surface Finds from Various Sites. *Anatolian Studies* 15, 1965c, 34-39.

S. Harmankaya & B. Erdoğu, Türkiye Arkeolojik Yerleşmeleri (TAY) 4b: Ilk Tunc (Istanbul 2002); Selimpasa 10/4/2002.

M. Özdoğan, Trakya'da Tarihöncesi Araştırmaların Bugünkü Durumu ve Bazı Sorunlar". *Güney-Doğu Avrupa Araştırmaları Dergisi* 10/11, 1983, 21-58.