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CAA 2008

Computer Applications
and Quantitative Methods in Archaeology

On the Road to Reconstructing the Past

Proceedings of the 36th Annual Conference on Computer Applications and Quantitative Methods in Archaeology

CAA 2008 Budapest
April 2–6

Budapest, Hungary

Creation of a GIS Database for the Archaeological Investigation of a Major Administrative Centre in the Carpathian Basin: Solt–Tételhegy (County Bács-Kiskun, Hungary)

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Abstract

The Solt–Tételhegy site, lying in one of the most remarkable environments of the Great Hungarian Plain, has recently come into the focus of research. Situated in an excellent, well defensible strategic location by major routes, the settlement lay in the midst of a former marshland. The finds collected on the monadnock, the series of aerial photographs, and the finds and features brought to light during the excavations suggest that the site had functioned as a major administrative centre in the Carpathian Basin during several periods. Described here will be the construction of the GIS database for the Castrum Tetel Project and the preliminary findings of the first three excavation seasons (2005–2007).

Keywords

GIS, major administrative centre, Carpathian Basin

1. Theoretical issues of the construction of a GIS database for archaeological excavation

An archaeological GIS does not start with determining the trenches to be excavated and does not end with the printing of the summary drawings for the necessary reports. A GIS is an infinitely more complex system, and should not be much as simply a technical solution in documentation. In order to fully exploit the potentials of GIS, the system itself must be carefully planned in advance. GIS layers and databases can be linked to the planned research methods. The creation of these GIS layers and databases obviously calls for an assessment of the research strategies to be applied. Although the choice of the most suitable research techniques, which can either complement or, conversely, exclude each other, very often depends on the available funds, the various research options must also be considered in the light of the planned GIS.

The principal research technique is excavation (*Figs. 1–2*), which yields the highest amount of reliable data. Knowing that the excavation of a site is a costly, unrepeatable and irreversible process, it is vital to consider its effects on other, alternative research methods (*Fig. 3*).

The data provided by field surveys are indispensable for choosing the area to be excavated since they provide a general picture of the nature of the terrain. Surveys enable the exact identification of still visible remains, such as ruins. At the same time, determining the location of excavation trenches based on the artefacts scattered in a ploughed-up field might be highly misleading. The exact location of the various artefacts and remains identified during the surveys, as well as their reliability index can be entered into the GIS database, meaning that the degree of reliability can be placed into its proper context during the site's evaluation. The artefact count preceding the excavation must be adequately prepared both in the field and on the maps, calling for an assessment of the size of the area to be surveyed, as well as of the grid type to be used and of the planned sampling technique. If an artefact count is planned concurrently with the excavation, one must be aware of the fact that the earth moved during the course of the excavation will modify the scatter of artefacts both in the excavation trench(es) and the area of the dump, as well as in the area between the two.

Surface traces of various features can be noted on most archaeological sites. These traces should be recorded even in cases when an excavation is not planned since they are continuously eroded. An excavation irrevocably destroys all surface remains

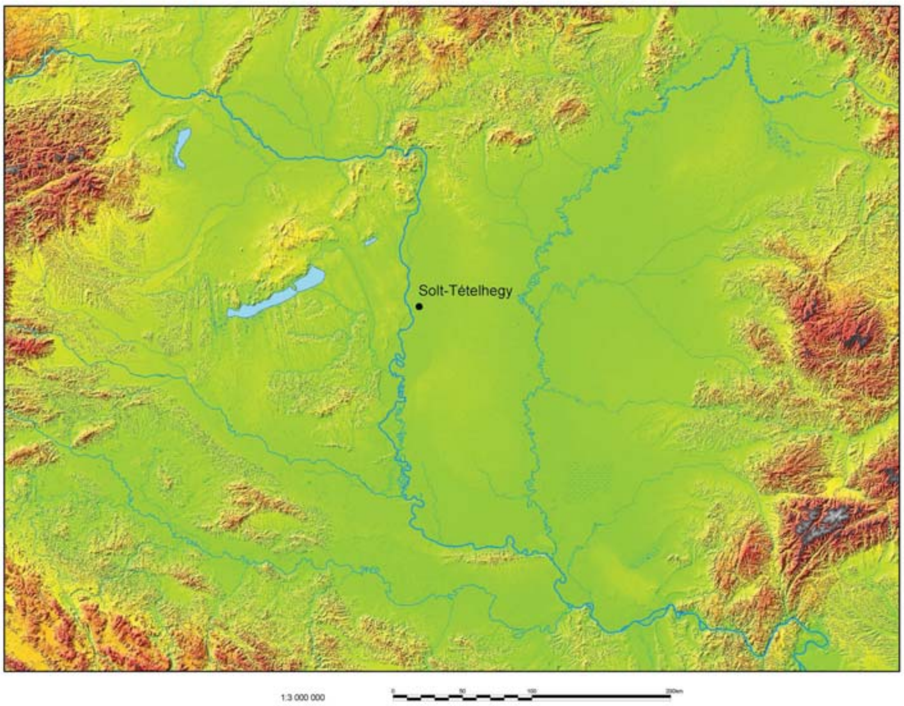

Fig. 1. Location of the Solt-Tételhegy site in the Carpathian Basin.

Fig. 2. The Tétel-halom mound (Tételhegy) on Mihály Ruttkay's map of the Kalocsai Sárköz region (1763).

and traces, not only in the excavation trenches, but also in the area of the dump and the area between the two. A survey of the area is therefore an important preliminary to any excavation, whose data must be entered into the GIS database. These data are necessary for planning the excavation and thus sufficient time must be left for their evaluation.

The layer sequence of a site can be determined without excavation by means of sub-surface borings, although several borings must be made along a transect in order to gain a meaningful set of data. Since it is rarely possible to survey the entire area of a site using this technique, suitable sampling locations must be chosen, which can generally be identified from aerial photographs and/or geophysical surveys. The sub-surface borings should therefore be scheduled after these surveys have been completed. The nature of the terrain also offers a wealth of archaeological information in this respect. Buried ditches can be explored with sub-surface borings; at the same time, stone structures, such as walls and ramparts, should not be investigated using these techniques because the bore head can easily get lodged between the remains. While sub-surface boring should definitely precede excavation, the trampling of the area around the boring points might destroy the vegetation for aerial photography. The boreholes can be later identified in lower-lying levels too and can thus serve as reference points during the excavation (*Fig. 4*).

The determination of the area to be geophysically surveyed raises a number of issues. Geophysical surveys can provide useful archaeological information if their results are tested by excavation. While an excavation provides considerably more data and also contributes to the interpretation of the geophysical findings, it ultimately destroys the layer sequence examined by the geophysical research, meaning that the geophysical influences on the various features uncovered during the excavation cannot be monitored after the excavation. The same holds true for the features lying along the edges of the excavation trenches or extending beyond the excavated area, and the edges of excavation trenches also tend to disturb the measurements. One possible solution is to conduct a geophysical survey of the entire site prior to the excavation, or at least of the area intended for excavation, in order to integrate the relevant survey data. We may say that the features lying in the excavated area can be immediately interpreted, while the data gained from areas beyond the excavation trenches can be placed in their meaningful context by the subsequent archaeological investigation. A GIS database is very useful if the area to be excavated is determined with the aid of geophysical surveys since the analysis generally involves different sets of data. Fortunately, most geophysical survey techniques can be fitted into other field surveys. For example, the laying out of the grid system for the geophysical surveys and the overall survey of the site can be performed simultaneously. The grid system can then be used for the artefact count too.

Fig. 3. The Tételhegy site before the commencement of the excavation in 2005 (aerial photograph by Civertan Bt., Budapest).

Fig. 4. Overview of the geophysical and geological investigations, 2007.

One of the major restraints of aerial photography is that scheduling is constrained by weather conditions. In order to gain information on a particular area, one must wait for suitable weather. There is not always sufficient time for gathering information using aerial reconnaissance and photography prior to the excavation of a site. The already available, older aerial photographs (*Fig. 5*) of an area made for purposes other than archaeological rarely include wholly adequate prints, even though they do provide a wealth of other information, such as the changes in cultivated plants and possible disturbances caused by construction and other activities (e.g. pits for planting trees,

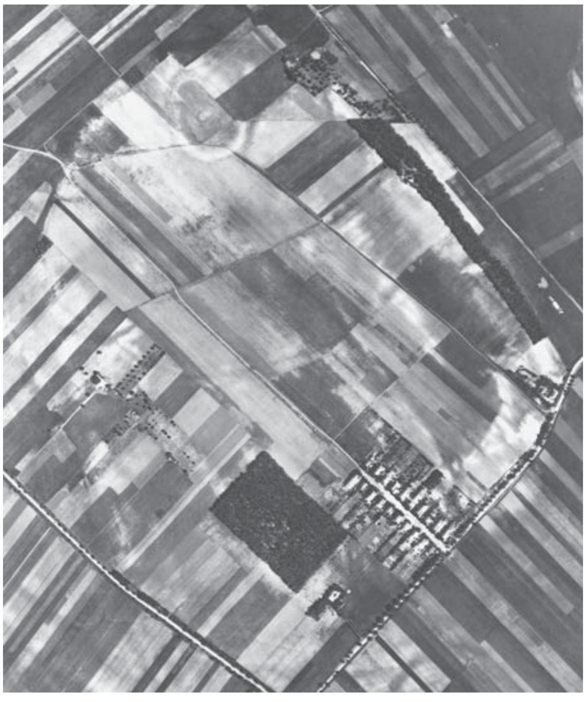

Fig. 5. Aerial photograph from 1954 (Map Archives of the Institute and Museum of Military History, Budapest, inv. no. L-34-39-C-a/1954-41071)

vine planting, house constructions). The location of these disturbances can be mapped using GIS and then projected onto the aerial photographs made for mapping purposes after performing the necessary orthocorrections. The evaluation of aerial photographs made for archaeological purposes is less simple and their integration into the GIS database can be problematic. Even the precise location of well definable features can pose problems in the lack of suitable reference points (*Fig. 6*).

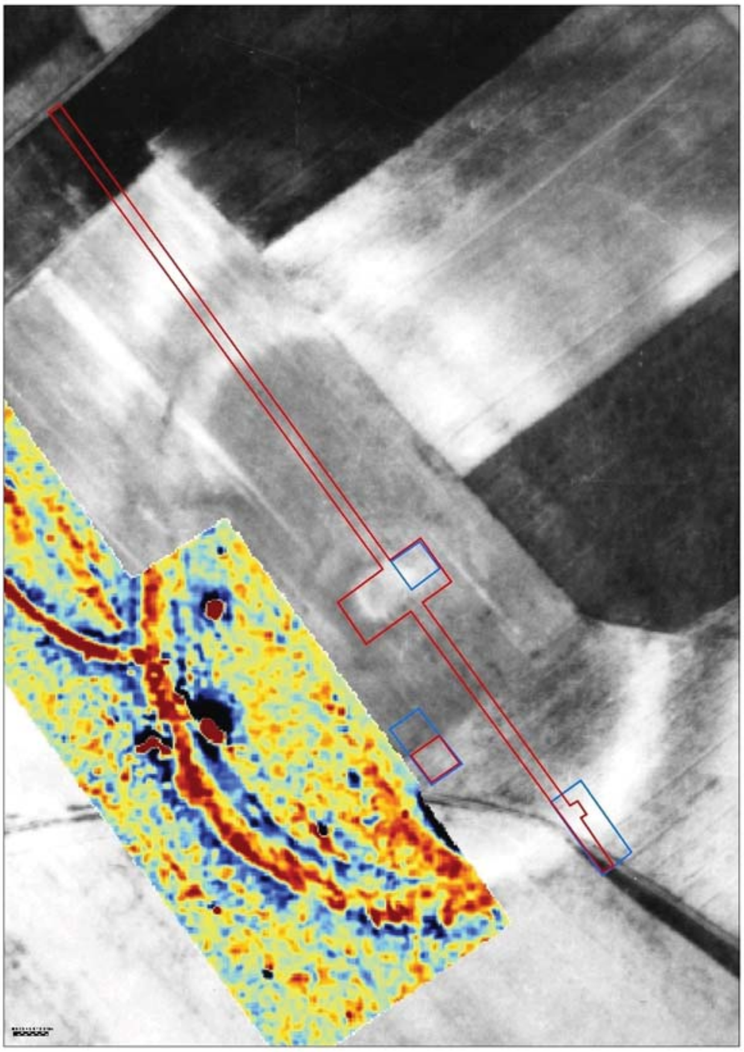

Fig. 6. Archaeological features identified during the geophysical investigations projected onto the aerial photograph from 1954.

GIS is useful for minimising damage caused to agricultural land by excavation if the database contains the relevant sets of data (which might otherwise fall beyond the scope of archaeological interest). A knowledge of the time interval between the growth of various cultivated species in the case of archaeological sites extending over several fields, for example, can be used for determining the period during which fieldwork can be performed without having to compensate for possible damages. An agricultural map of this type can be used for choosing the areas of field surveys, geophysical research, aerial photography, sub-surface probes, and excavation. In the case of extensive sites, scheduling according to these considerations can lead to substantial cost cutting.

Travelling and transportation can be a major cost in the case of long excavation seasons spanning several months. While logistic support of this type is not a GIS task *sensu stricto*, the maps plotted from the GIS database can be of aid in planning. The planning and creation of the shortest route to the site leading through neighbouring fields is well worth a consultation with field-owners and some financial investment.

Baulks are generally left for the later control of on-site observations in the case of planned excavations. These baulks are either randomly placed or they conform to a pre-designed system. In addition to concentrating on the identification of various features, the location of the baulks must also be planned during the preliminary investigation of a site.

The primary objective of an archaeological GIS is not the creation of a site's documentation, but the creation of a system suitable for long-term data collection, data storage, data retrieval and analysis must be carefully designed. As mentioned, the planning of the GIS database is also part of the preparations preceding the excavation. The analysis and evaluation of a professional excavation can last for several decades. In this case, the GIS should be designed with a view to long-term research, especially if in addition to being of aid in fieldwork from the very beginning, researchers plan to use the system during the evaluation of the finds and findings. This is an important consideration in terms of computer programmes and database structures.

It is most unlikely that the same softwares (or the same software versions) will be used for several decades and thus the database and its integration with other data sets must be designed in a manner to make them independent of platforms, data carriers and programmes. In addition to making provisions for archiving, a register of archive materials must also be created in the long run. Changes in project team members can also occur and thus the data of interest to each researcher must also be documented. The creation of a GIS is an integral part of a research project, inseparable from archaeological activity and from the archaeologists themselves. A system of this type can hardly be created by an individual not participating in the research project and neither can archaeologists make use of the data which are not gathered with their continuous participation.

2. Preliminary findings of the archaeological investigations at Solt–Tételhegy

The extensive site lying in the heartland of the Carpathian Basin provided an opportunity to put the above theoretical considerations into practice. We were aware of the fact that the long-term investigation of a major centre of this type meant a long-term research project. The systematic excavation of the site is not impeded by time constraints, providing an opportunity not only for meticulous archaeological work, but also for testing and developing new research techniques. We, therefore, made every effort to apply the most up-to-date techniques when we started the project, and we are also prepared to test new techniques appearing during the time of the project. Parallel to this experimentation we are also employing traditional techniques in order to ensure the fullness of the final documentation.

Our goal is to create a complex archaeological GIS database during the excavation of the Solt–Tételhegy site, extending over a hundred hectares (Szentpéteri and Rosta 2006; Szentpéteri 2007). We plan to use the most modern techniques, ranging from the determination of the excavation's fixed reference points using GPS to the digital analysis and evaluation of drawings and photographs, as well as various other technical innovations aiding complex analyses (*Fig. 7*).

During the first three excavation seasons at the site (2005–2007) we uncovered over a hundred burials of an 11th–12th century cemetery (*Fig. 8*), the sanctuary and sacristy of a Gothic church, and the burials around the church (*Fig. 9*). One notable result of the excavations was the cutting of a wide ditch, whose finds provided conclusive evidence that the stronghold enclosed within a multiple ditch and rampart system had its origins in prehistory and had been initially settled by an Urnfield community of the Late Bronze Age. The defence works destroyed during the centuries were repeatedly renewed during the Middle Ages. Various buildings were raised atop the one-time ramparts in the late 13th–early 14th century, which had become badly eroded by that time (*Fig. 10*).

The archaeological investigations to date have provided a fresh perspective on several historical issues, which have preoccupied scholars of early Hungarian history since the beginning of scientific historic studies, but have remained largely unresolved. These include the location of the 7th–8th century seat of the Avar Khaganate (*Regia Avarorum Hring*) and of the early administrative centre of the Árpád Dynasty between 895 and 970, the emergence of the Kalocsa archdiocese in the 11th century, and the emergence of the Solt district in Fejér County during

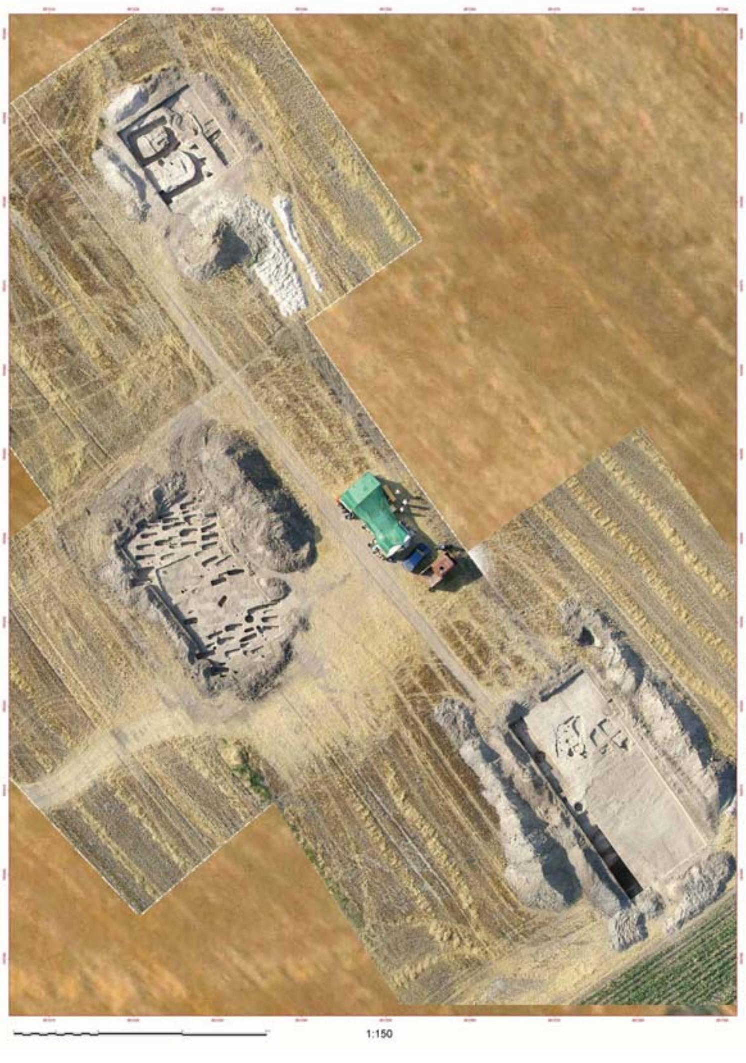

Fig. 7. Archaeological investigations at Solt–Tételhegy, 2005–2007

Fig. 8. Burials of the 11^{th}–12^{th} century cemetery.

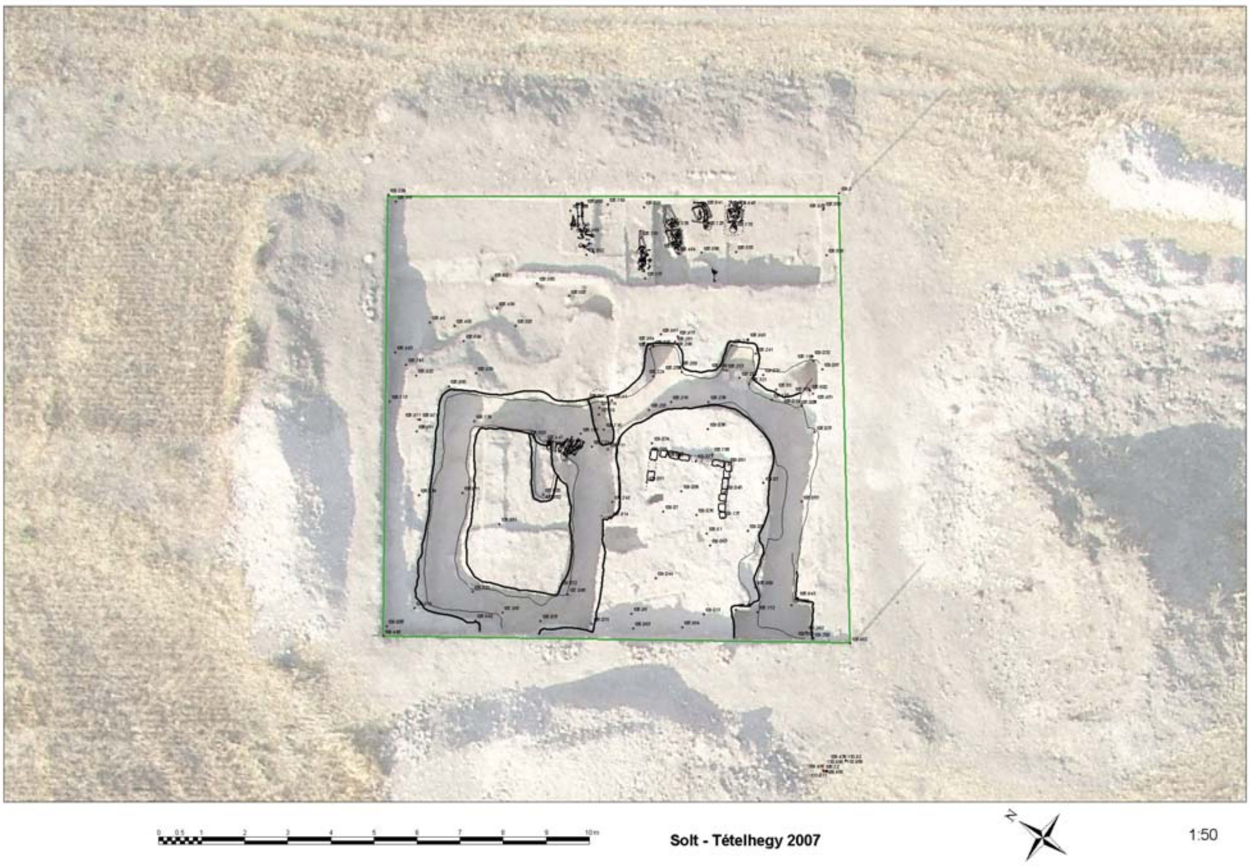

Fig. 9. The sanctuary and sacristy of the Gothic church from the 14^{th}–15^{th} century.

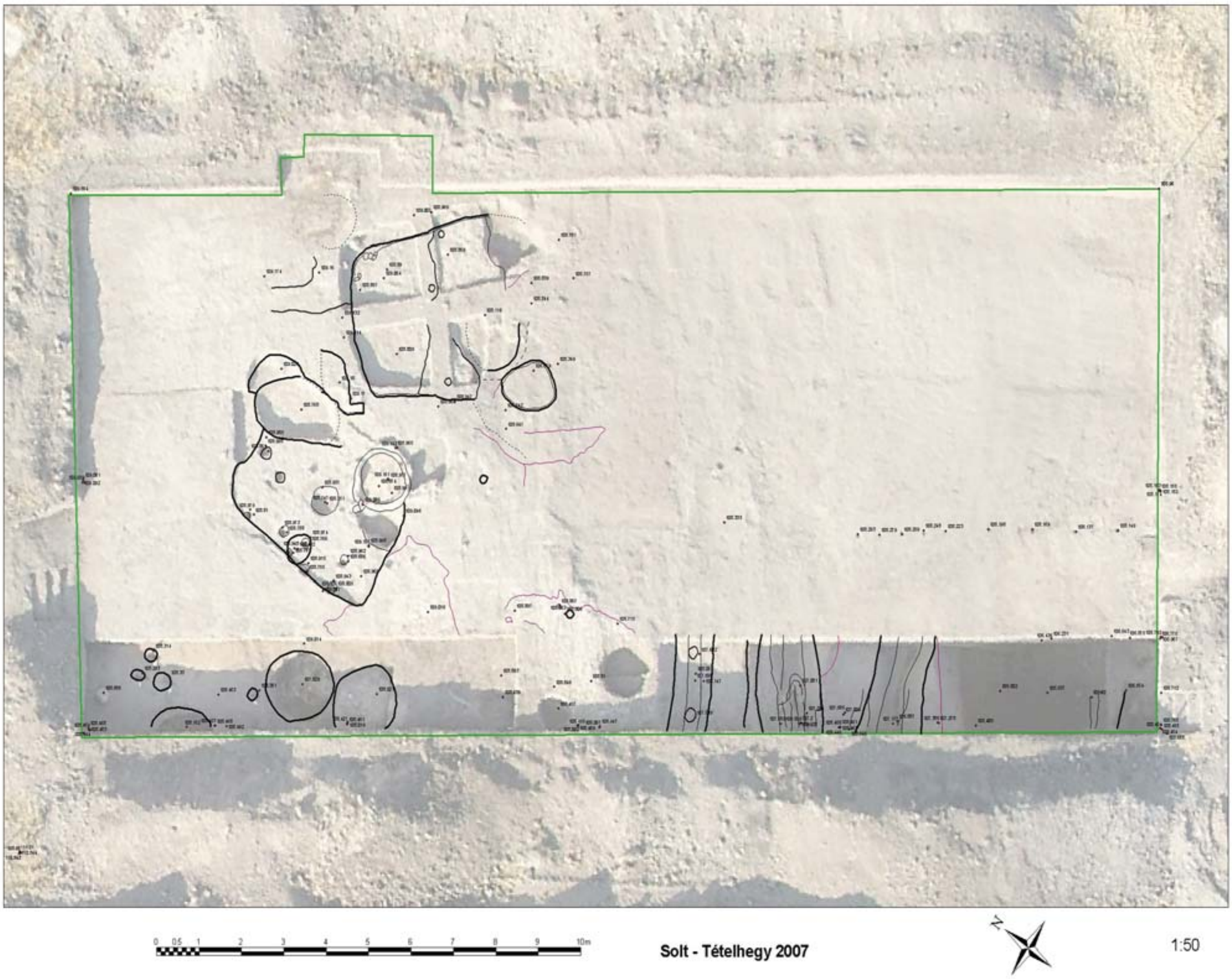

Fig. 10. Late Bronze Age ditch and rampart system (right), and settlement of the late 13th–early 14th century (left).

the Middle Ages. Being a period poor in written sources, even the preliminary findings can contribute to a better understanding of this period.

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