

# The Importance of Maps at the Archaeological Excavations Works

**İbrahim Murat OZULU, Mustafa SÜEL, Fazlı Engin TOMBUŞ, Mustafa COŞAR and Murat ŞAHİN, Turkey**

**Key words:** Archaeology, measuring techniques, planning, excavation

## SUMMARY

Turkey has archaeologically phases which are coherent to each other and extending the depth of history to the present day. These lands have been host to many civilizations from the date of the oldest settlements to the present day. Therefore, all the archaeological researches are significant in terms of revealing both the facts of human history and Turkey.

This study has aimed at producing supporting solutions to works about determination of the archaeological remains, revealing the traces of the past and facts of the history of mankind. For this purpose, the excavations made in the archaeological residential areas in Çorum have been examined in terms of mapping activities. As a result of analysis, it has been emphasize that what the mapping activities should be according to the information obtained before the start of excavation. It has been tried to determine that measuring techniques, data base structure and technological infrastructures used in application environments for generated maps. In addition, how this process is applicable has been investigated in areas where the excavation works are going on.

## SUMMARY (Turkish)

Türkiye, arkeolojik anlamda tarihin derinliklerinden günümüze kadar uzanan iç içe girmiş evrelere sahiptir. Bu topraklar; en eski yerleşim tarihinden başlamak üzere günümüze kadar birçok büyük uygarlığa ev sahipliği yapmıştır. Bu nedenle yapılan tüm arkeolojik araştırmalar hem Türkiye'nin hem de insanlık tarihinin gerçeklerinin ortaya çıkarılması açısından önem taşımaktadır.

Bu çalışmada; arkeolojik kalıntıların belirlenmesi, geçmişe ait izlerin ve insanlık tarihi gerçeklerinin ortaya konulması için yapılan çalışmalara yardımcı çözümler üretilmesi amaçlanmıştır. Bu amaçla, Çorum İli sınırları içerisinde bulunan arkeolojik yerleşim yerlerinde yapılan kazılar haritacılık faaliyetleri yönünden incelenmiştir. İnceleme sonucunda elde edilen bilgiler doğrultusunda kazı çalışmalarına başlamadan önce yapılması gereken haritacılık faaliyetlerinin neler olması gerektiği üzerinde durulmuştur. Oluşturulacak haritalarda; ölçme tekniklerinin, veritabanı yapısının ve uygulama ortamlarında kullanılacak teknolojik altyapıların neler olabileceği belirlenmeye çalışılmıştır. Ayrıca kazı çalışmaları devam eden bölgelerde bu işlemin nasıl uygulanabilirliği araştırılmıştır.

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## 1. INTRODUCTION

The Anatolian peninsula, a settlement area which hosted to a number of civilizations throughout the ages, has archaeologically a deep cultural structure and wealthy cultural properties. The term “Culture” has expressed as the total of physical and moral values, which was created during the historical and social improvement, and the tools which were used to create and to transfer them to the following generations, and representing the measurement how human-being dominates to the nature and his environment. Every material cultural productions or artifacts which were discovered in a region are recognized as a cultural property.

The fact that Turkey has a huge wealth for the cultural properties and the importance of this wealth for the common history of mankind is undisputed. So each archaeological research in this region has a certain importance not only for cultural facts of Turkey, and also for the humankind.

The word “archaeology” is derived from the Greek words, *arkhaios* “old, ancient, or beginning” and *logos* “study”. On the contrary of supposititious, archaeology isn’t a field of history; it is a scientific field that tries to lighten the cultural history of mankind by researches and archaeological excavations, and gives valuable contributions to history of science. Archaeology is especially significant, since it allows to get information about the prehistoric and historic human-beings. A great deal of written documents from the ancient periods was discovered in the past. Most of them include information about taxes, laws, religious regulations and the rulers. It is not enough to reach a clear portrait of ancient human by examining these written sources. The archeologist as the masters of this discipline discover the ruins of private houses, palaces, graves, administrative buildings and temples, and examine the artifacts including tools, goods and remnants of buildings of ancient people, so they hold a view the life style of ancient mankind.

Archaeological excavation is a “digging” process which are full filed in a certain bordered place, that the topographic maps was charted, with a permission taking from authorized officers, by the special ones have scientific responsibility (Barker, 2005). In the definition of an excavation, it is underlined that an archaeological excavation doesn’t have to been performed without an official permission on an area which its borders didn’t define. Every artifact which was unearthed during the season of excavation must be classified and marked on the topographic maps of site (Burke *et al.*, 2004).

In this context, we point out the cartographic things to do before the excavation processes which are performed in order to put forward the facts of history of humanity and the ancient remains. Measurement techniques, structure of database, technologic substructures using in

the practice environment in the course of creating process of maps were defined in this study. Furthermore, it is examined the applicability of these operations in the areas where the excavations is carrying out.

## 2. STUDY AREA

Çorum is a province in Turkey, lying both inside the Middle Black Sea region and also inside Central Anatolian region. Land forms, climate and cultures between the Black Sea Region and Central Anatolia Region indicate transition characteristics. Its surface area is 12.820 km<sup>2</sup> and its attitude is 801 meters. The continental climate dominates in this province. The geographical location of Çorum is 40°32'56" N, 34°57'12" E (Fig. 1).

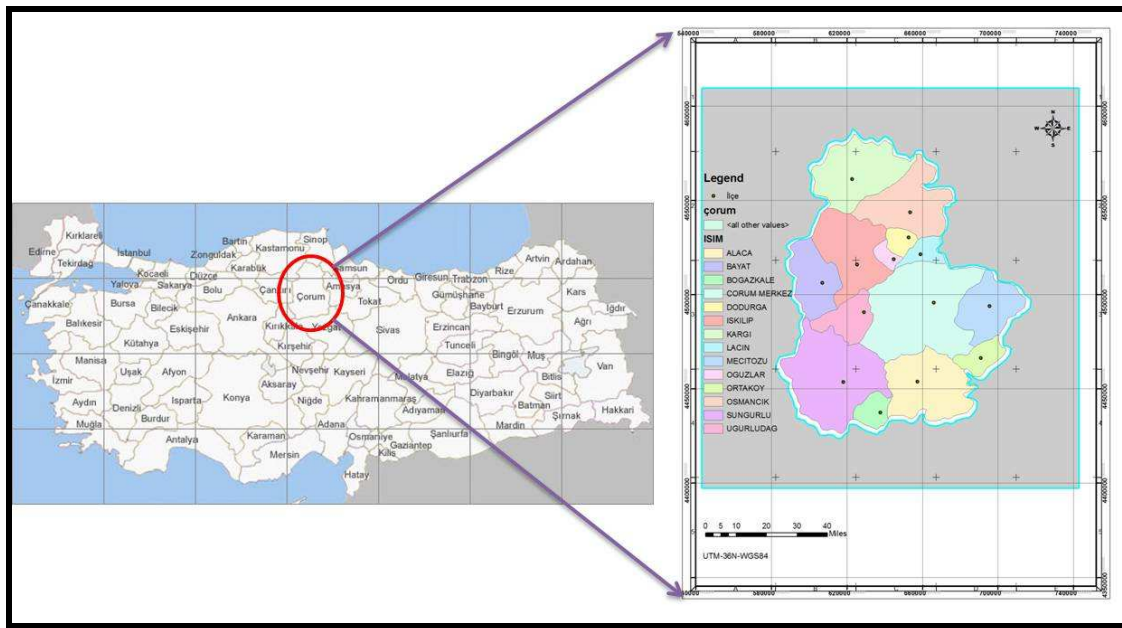


Figure 1: The study area

### 2.1 The Chronology of Researches and Excavations in Çorum

The opportunities, which the geographical position, geographical characteristics and the resources, especially the mines, of this city provide, ensure that Çorum has an outstanding cultural level which has improved throughout the history of humanity in Near East, and that the territory in question remains in contact with both eastern and western cultures. The researches related with the Anatolian peninsula were late with respect to its neighbors. By the contrast of huge cultural centers in Near East, Eastern Mediterranean region and even in Western Anatolian Territory, the wealthy ones in central Anatolia were left in the dark until the recent periods (URL 1).

In 1834, Charles Texier, archeologist and architecture, went on a discovery journey to Central Anatolia. Texier stayed in Çorum through 12 days beginning from 28<sup>th</sup> of July; he measured and took out the plans of remains of an ancient town here, and he also drew the gates

TS09C - Surveying and Cultural Heritage II, 5844

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Knowing to manage the territory, protect the environment, evaluate the cultural heritage  
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and the ramparts of this settlement. After Texier published his notes in 1839, a number of explorers and scientists visited Boğazköy in order to make some researches and investigations. William Hamilton came to Boğazköy in 1835-1836, and after his surveys, he announced that he discovered another ancient settlement, 34 km. far from Boğazköy. This ancient town is known as “Euyuk” i.e. Alacahöyük. After discoveries in question, the excavation teams took to the stage in the field, and they achieved to accelerate the archaeological researches towards the middle of 20<sup>th</sup> century in Çorum. In 1926, H.H. Von der Osten and then Kurt Bittel, the head of Boğazköy excavation, did comprehensive archaeological surveys in this region. In the following period, a number of excavations were started out respectively in Çorum: Alacahöyük in 1935, Pazarlı Örenyeri in 1937-38, Kaletepe in Büyük Güllücek Village near the center of Çorum province in 1947-49, Kuşsaray Village by Turkish History Society in 1966. In this period, the excavations in Alaca Eskiyaşar were also carried out under the directorship of Raci Temizer. Tahsin Özgüç also made a short-termed drilling in Demirciçeşme (Yeniköy) in 1946; P. Meriggi (1980), T. Özgüç and H. David French, who studied about the Roman roads and milestones, did researches in this region and they published the results of their observations afterwards. In recent period, Aygül Süel and Mustafa Süel carried out surveys in 1988-1990 and also Tunç Sipahi and Tayfun Yıldırım in 1996-2003 near Çorum. Then they began to excavations in consequence of their researches (URL 2).

However Boğazkale-Hattuşa has appeared in “UNESCO’s World Heritage List” since 1986 and the Boğazköy archives including cuneiform tablets also take place in the “UNESCO’s World Memory Registers” from 2001 (URL 3).

Table 1: Real Cultural and Natural assets registered in Çorum

Archaeological protected area	34
Urban Protected Area	3
Natural Protected Area	-
Historical Protected Area	-
Total	37
Cultural (in the scale of one structure) and Natural assets	165
Total	202

Table 2: The sites which the archaeological excavations have carried out in 2011

The Name of Archaeological Area	Beginning Date of Excavation	President of Excavation
Boğazköy- Hattuşa	1906	Dr. Andreas Schachner
Alacahöyük	1996 (1907)	Dr. Aykut Çınaroğlu
Ortaköy-Şapinuva	1992	Dr. Aygül Süel
Resuloğlu Cemetery-Settlement Area	2003 (1968-1983)	Dr. Tayfun Yıldırım
Eskiyaşar	2010	Dr. Tunç Sipahi

The dates into the brackets ( ) show the initial excavations in these settlements.

## 2.2 The phases of Archaeological Field Studies

The archaeological studies consist of preconfigured phases (Bilsbarrow, 2003 / Burke et al., 2004 / Banning, 2002/ Greene, 2003).

- Survey: It is one of the basic methods which are used to collect the archaeological evidence. Extensive areas can be searched by means of surveys. Survey is performed by a group of archeologists; as a rule, they walk on a defined area in a systematic way; they observe and record the evidence which is visible on the surface of earth
- Testing excavations: These are workings which are performed in a pre-defined area in order to recognize and to examine the layers of a settlement.
- Excavation: Excavation is a long-termed practice that is fulfilled according to the plans in the archaeological sites, which their borders were recognized by surveys and testing, by means of scientific methods, in order to recognize and to examine the layers of a settlement.
- Analyses and researches: These are performed to interpret archaeological artifacts and the evidence, which were discovered by surveys, testing and excavations, in a spatial and relational manner.
- Documentation, reporting: The practices are performed in order to explain the results and to record the archaeological evidence, which were arranged in spatial and attributive manner, in a certain format.
- Curation: This practice includes the storing and exhibiting phase of artifacts from the archaeological sites, after these artifacts were examined, analyzed and registered, in the museum or other places under the proper conservation conditions.

## 3. THE MAPS AND MAPPING IN ARCHAEOLOGICAL FIELD STUDIES

The basic function of maps is to inform about the topographic structure of its covered area and the spatial issues of its region such as geological and geomorphologic structure, climatic characteristics, traffic, underground sources, economical characteristics etc. .

In archaeological studies, the maps are used for different goals from the phase of planning the survey to the exhibition phase in every stage. The archaeological studies are stated out by gathering data, in order to define the exact localizations of artifacts above/under the earthen surface, in addition to natural and cultural characteristic of the site in question. These data are gathered as reports including the numerical and verbal information that appears on ancient studies and pre-produced maps. The reports comprising from the pre-studies and the topographic maps became an inseparable component of archaeological studies. In order to relating the archaeological materials with their natural environment, and to determine the characteristics of archaeological findings and the probable relationships between them, it is requires the mapping process during the excavations. Owing to new maps which were created by indicating the archaeological findings on the map, graphing the data relating to the

localizations and excavation area can be achieved. The visual mappings relating to the archaeological area will provide easy-comprehensible additional information to the decision makes, so it will ensure to keep on the archaeological studies in a systematic manner.

If the data acquiring from the archaeological excavations are treated with maps, or during the creation process of a new map or matching a number of maps each other, it will be required to use Geographic Information System (GIS). This computer supported system provides to bind the varied kinds of data to areas, contours and points on maps. What is more to the point, the process required to unify maps and to match them each other may provide opportunity to create new maps (DeMers, 2000). However, the practices of GIS mapping allow us to analyze the models of archaeological levels, to catalogue the artifacts from the archaeological site and to examine them in a quantitative manner. The tools of GIS are suitable to produce spatial models which enable to a good explanation and analytic analyses (URL 4). These tools are also used to prepare visual and textual reports.

#### **4. ANALYZING THE PROBLEMS IN THE ARCHAEOLOGICAL FIELD STUDIES AND SOME SUGGESTIONS TO RESOLVE THE PROBLEMS IN QUESTION**

The studies on archaeological sites also bring about a number of problems, such as climatic and topographical conditions of field, economical support, technical equipment, the experimental and performance proficiencies of staffs etc. It also seems that there are some differences about the usage of maps, mapping techniques and the technologies using in the mapping process. To not eliminate these problems causes to question the reliability of archaeological studies. In this context, the problems, which were experienced in archaeological excavations in Çorum, are tied to recognize by us. Then, we try to develop a mapping model that will provide valuable additions to solve these problems.

##### **4.1 Diagnosing the Problems**

The problems appearing in maps and their usage areas are gathered under the following headlines, as the result of examining the “reports on excavations and surveys”, which were prepared for the excavated sites in Çorum in every year, the web sites and the other publications (URL 5).

- Using the different coordinate (projection) systems.
- Producing final maps in different scales.
- The measurement errors due to using different measurement techniques.
- Using a symbol in legend in different meanings (deficiencies in standard illustration).
- Not including some information such as the creation date, publication date etc.
- Deficiencies for routing and informing.
- Not including the contour lines or the information about their intervals.
- Inconsistencies between the textual information about the area and illustration.
- Deficiencies about the updates.
- Deficiencies in 3D studies.
- The basic analyzes on the numerical maps can't perform, because of using printed maps.

The main reason of these problems is “to not use a common systematic map and mapping techniques in excavations”. As it seems, if the different excavation techniques in a region are performed in a coordinated and systematic manner, this is quite important for increasing the contributions of archaeological studies to the cultural accumulation of humanity.

## 4.2 Suggestions for the Solutions of Problems

Technological improvements, developments in software using in maps and mapping process cause to insert a number of practices as Remote Sensing (RS) and GIS into the current map usage. So, it is enable to relate each area in question on the maps with such practices as RS and GIS. In this context, RS and GIS are proper tools which can provide valuable contributions for the required consistency and coordination (DeMers, 2000). In this point, RS and GIS provide basic contributions as follows:

- From the statistical information, reports and final maps which are acquired by questioning, analyses and modeling practices performing by means of both attributive and graphic information of archaeological data in numerical environment, it will enable to reach new and different approaches.
- In order to get efficiency from the archaeology based projects, it is required a field administrator, it is important that the plan of field administration has feasibility and updateability characteristics.
- To create a plan of field administration, it required to evaluate a number of variables such as physical condition, threats and constrains.

For the areal planning, mapping is considered as an important technique. The mapping practice appears as a valuable source for both short-termed and also long-termed planning process. Map can provide the information requiring about the areal planning, improvements and relationships in an understandable manner. The information acquiring by calculating the regional values can assist to interpret the vital activities. That the map and photos are easy to read can be effective to overcome the lingual and cultural obstacles and to interpret them by providing easier analyses and communication.

The system for the archaeological areas has to express the topographic reality with a high sensitivity. This fact is especially important for the accuracy and genuineness of compiled data. The data must include areal and qualitative components. These elements allow to the GIS user to find the exact locations of his required things. There are a number of methods for data entry; each method has a specific effect on the data quality and data format. In GIS database, the data can be stored as raster and vector formats. The format of data can affect the data quality. So, by considering these points, the standards belonging to the data which will be used for modeling the archaeological sites must be assigned as well.

After the data gather, they enter into the GIS. So, GIS represents a model of real situation including different data levels. The system can be overlapped and unified in order to define the different information levels, geographical textures and connections. Sin the data are backed up in a database, it can be used for statistical and numerical analyses. Changing the data in GIS in anyway will affect negatively the data quality. Among the precarious conditions causing this kind of situation, it is found as changing the map projections,

changing the data measure, using the nonstandard data etc.

The results acquiring from GIS can be used to support the decision about an archaeological artifact from an excavation. The final decision, concerning that GIS outcomes affect the decisions in which mechanisms, belongs only to the decision-maker. Awareness of the fact that GIS provide the data in a proper manner in order to take a decision is so important. GIS can't take a decision with itself. By the decision, the decision cycle stops, because this decision affects the real situation. The cycle keeps on by adding the results acquiring from analyzing the variations about the real situation as new data to the system in a proper format.

The flowchart of GIS (Fig. 2) intended for the solutions of problems in question and that can be used during the archaeological excavations in Çorum and the details of working phrases are shown as follows (Table 3).

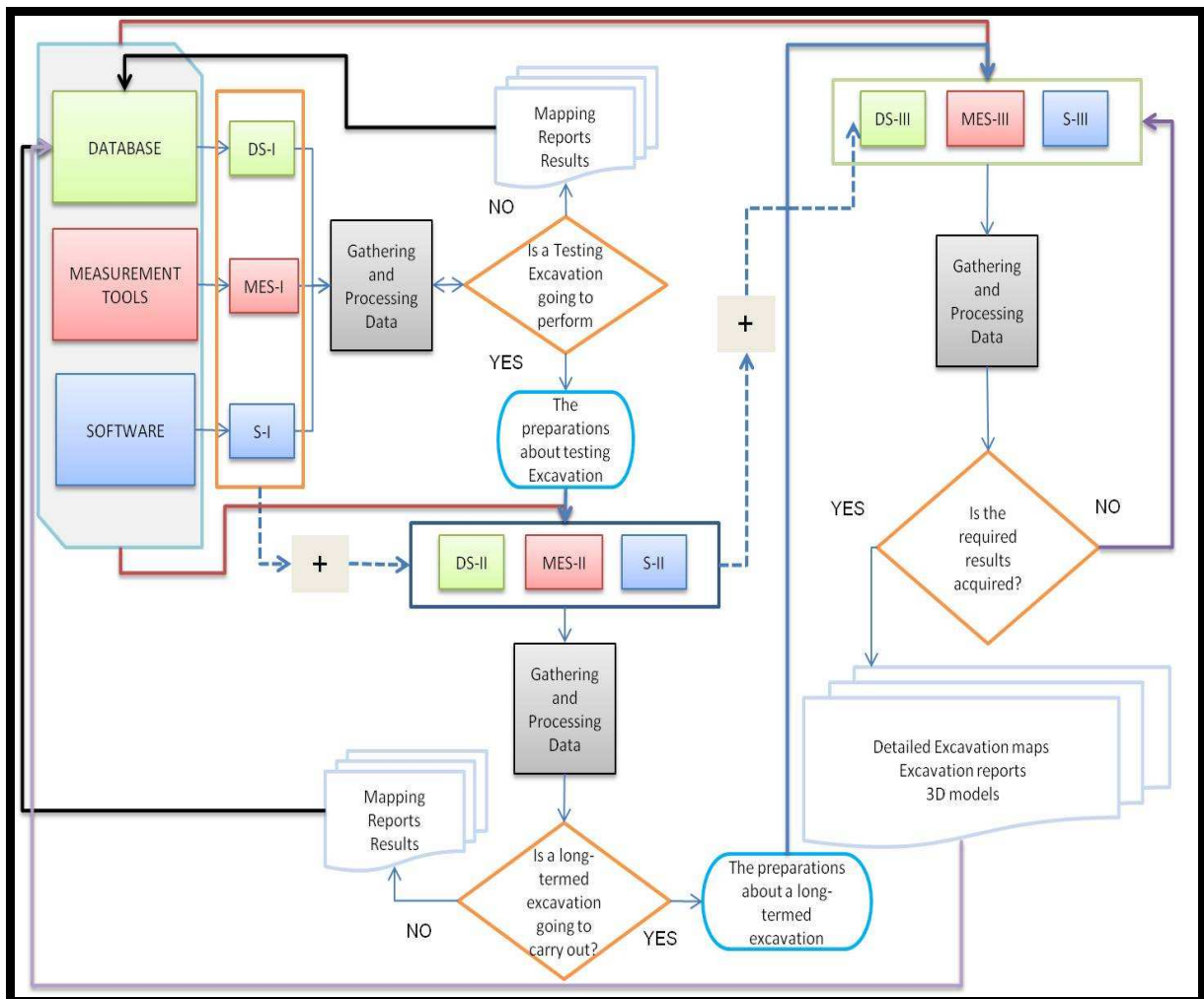


Figure 2: Flowchart of GIS



Table 3: The Phases of Study

	PHASE 1	PHASE 2	PHASE 3
	SURVEY	TESTING EXCAVATION	EXCAVATION
TARGET	Documenting the archaeological artifacts acquiring from the pre-defined area, registering them to the maps and marking on them.	Detecting the archaeological levels in a small area defining during the excavation or a survey and examining these levels.	Detecting archaeological levels in a pre-defined archaeological area by long-termed studies, and determining the probable relationships between these levels and neighboring settlements.
	Data Set I (DS-I)	Data Set II + (DS-I)	Data Set III + (DS-I) + (DS-II)
Data sets using before the Study	STH at scales of 1/25000 Cadastral map at scales of 1/5000 SYM/ DEM (Altitudes) Satellites images > 5m Aerial photos; Geologic maps The literature relating with the area.	Cadastral map at scales of 1/2000; Zoning sheet at scales of 1/1000; Satellites images > 5m Aerial photos LIDAR Survey maps.	Final maps about drillings; Topographic maps at scales of 1/1000; Aerial Photos (Balloon-Drones)
The Measurement Tools using in Field	Set I of Measurement Tools (MES-I)	Set II of Measurement Tools + (MES-I)	Set III of Measurement Tools + (MES-I) + (MES-II)
	GPS/ DGPS; Portable GIS record unit including digital records formats; Digital Photo cameras etc.	DGPS/RTK-GPS; GPR (Topographic radar); Nivo- Total Station; Detailed register forms.	Robotic Total Station Topographic Laser Scanner Balloon- Drones Video and audio recorder etc.
	Software Set I (S-I)	Software Set II + (S-I)	Software set III + (S-I) + (S-II)
Software	GPS, CAD and CBS software; Data Transfer Software; Image Processing Software; Office Programs.	GPR; Programs about cartography; 3D generating programs.	Programs about modeling an animation; Architectural programs; Laser scanning Software using to scan the topography; Image Processing software.
OPERATION	GATHERING AND PROCESSING PROCESSES OF DATA		
RESULT	Producing new data; Documentation; Registration; Producing data suited for standards; Survey Reports.	Creating detailed maps; Documentation; Registration; Producing data suited for standards; Drilling excavation reports.	Creating detailed maps of excavation area; Documentation; 3D Models; Producing outcomes suited for Standards. Regular Excavation reports.
DECISION	A decision about whether a testing excavation will perform, or not.	A decision about whether a long-termed excavation will perform, or not.	Planning the excavation – to determine the spatial relationships in other sites.
	The projection system must be indicated formerly. For the maps which will be included to the system, the transformation parameter has to be calculated. (The projection system suggested for Çorum is UTM ZONE 36N-WGS84)		

## 5. RESULTS

In a condition of establishing the system which we point out in this context, updating the data from the scientific researches in the archaeological sites, reaching to the information resources and sharing the data will be so quickly and safely. The practices about accessing the data, questioning and reporting the results can be performed safely and quickly apart from the time.

By using the sets of data, which we offer as a suggestion here, the measurement tools and software in the archaeological studies, we can produce maps which are suitable for the pre-defined standards. The maps in question will be equipped with a number of characteristics such as accuracy, relevance for the purpose, lucidity, comprehensibility, easy readability and aesthetic. The data which are required by users will be transferred in an accurate, qualified and reliable manner, according to a certain systematic.

As the accuracy and the quality of data from the working fields increase, the practices can be varied in this degree. Increasing practices in variety will contribute to produce solutions which assist to put forward the facts of history of humanity, to identify the remains both under the surface and above the earth which is the target of archaeological studies and to discover the ancient marks.

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- URL 3: UNESCO World Heritage List (<http://whc.unesco.org/en/list/377> )
- URL 4: CBS ve arkeoloji ( <http://www.gis.itu.edu.tr/content/arkeoloji> )
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## BIOGRAPHICAL NOTES

**İbrahim Murat Ozulu** is currently a Lecturer at the Vocational School Department of Technical Programs Map and Cadastre Department of the Hitit University in Turkey.

**Dr. Mustafa Süel** is archaeologist, retired academician, and vice president of Ortaköy-Şapinuva Excavation

**Fazlı Engin Tombuş** is currently a Lecturer at the Vocational School Department of Technical Programs Map and Cadastre Department of the Hitit University in Turkey.

**Mustafa Coşar** is currently a Lecturer at the Vocational School Department of Technical Programs Computer Programming Program of the Hitit University in Turkey.

**Murat Şahin** is currently a Lecturer at the Vocational School Department of Technical Programs Map and Cadastre Department of the Hitit University in Turkey.

## CONTACTS

İbrahim Murat OZULU  
Hitit University Vocational School  
Department of Technical Programs  
Map and Cadastre Program  
Samsun Cad. No : 99 Posta Kodu:19169  
Çorum  
TURKEY  
Tel. +90 364 2230800  
Fax + 90 364 2230804  
Email: [imozulu@gmail.com](mailto:imozulu@gmail.com) / [imuratozulu@hitit.edu.tr](mailto:imuratozulu@hitit.edu.tr)