



EDUU Project

Work Package 1 - Archaeological, Cultural and Environmental Research

Action Plan – updated on 24/07/2017



Project funded by the European Union

WP1 SUMMARY

AIMs:
Oc: Increased knowledge of the pre-Islamic societies in Iraq through archaeological and environmental fieldwork in the areas of Al-Qadisiyah, Wasit and Najaf.
Op 1: 1.1 Increased skills of Iraqi researchers; 1.2 New scientific data on the ancient societies and identities of Iraq; 1.3 Raised awareness on the rich Iraqi cultural heritage in the Iraqi academic community and youths.

ACTIVITIES:
Fieldwork: Two archaeological fieldwork seasons in AL-QADISIYAH and one in the WASIT governorates. <i>An ethno-archaeological survey will be carried out in Najaf – in the planning</i>
Papers & Conferences Academic publication of fieldwork results; Organization of 3 conferences in the 3 partner universities in order to share the results of fieldwork with students and staff.
Trainings Field Training for SBAH personals, community leaders, Iraqi students and researchers.

TARGETS:
<u>Indicators foreseen in the project proposal:</u> 40 newly mapped sites in Qadisiyah and Wasit; 6 fieldwork reports sent to SBAH; 50 SBAH operators learn EU best practices on the field; 12 academic papers in which 10 Iraqi researchers have collaborated read by 1500 students and 200 scholars, cited 20 times 1 conference in each Iraqi partner University (300 students total attendance) 1 conference in Kufa (January 2018) for disseminating more widely the results of WP 1 activities

Additional indicators foreseen:

45 community leaders trained in the field in best practices for managing and safeguarding the archaeological heritage

12 university students will be involved in fieldwork and trained on best practices applied to the archaeological research by working with the EU teams and with Iraqi colleagues.

TIMELINE:

UNIBO team will be in the field (Qadisiyah) in October 2017, 08/10-31/10 and in January 2018 for 2 weeks.

Fieldwork in Wasit will be carried out by UNITO from September 15th to November 15th 2017.

An ethno-archaeological survey will be carried out in Najaf in October 2017 – in the planning

Academic conferences will be organized in the 3 partner universities in January/February 2018, as the general dissemination in Kufa

From February/March 2018 work on putting together papers for academic publication and SBAH reports

RESEARCH FRAMEWORK

EDUU partners have built collaborative research groups formed by EU and Iraqi researchers, scholars, and operators that are closely collaborating in order to share best practices and improve local expertise.

University of Bologna	Prof. Nicolò Marchetti Dr. Federico Zaina
University of Turin	Prof. Carlo Lippolis
University of Baghdad	Prof. Bahaa Mahmood
University of Kufa	<i>In the planning</i>
University of Qadisiyah	Prof. Abbas al-Hussainy Dr. Jafaar Jotheri
SBAH	Qais Rasheed, Basim Jabbar

The research group has identified 3 theme areas that have been slightly modified from the project proposal:

- Reconstructing pre-Islamic societies and identities;
- Ancient landscapes and management of present natural resources;
- The role of rural communities in preserving heritage sites in South Iraq.

These three interrelated themes will be tackled by building a multi-tiered research framework encompassing archaeological excavations, innovative technologies for surveying, remote sensing, geo-archaeological and environmental analyses, restoration works and anthropological and ethno-archaeological surveys.

The timeframe that will be targeted by fieldwork is mostly comprised between the 3rd and the 1st millennia B.C., corresponding to the Bronze and Iron Ages. Within this long timespan, different pre-Islamic civilizations occupied the study areas, Sumerians, Akkadians, Babylonians, Kassites, Assyrians, et.. All these societies left distinctive traces on the ground and distinctive material cultures.

The EDUU project aims at increasing the knowledge of these pre-Islamic societies in Iraq through two archaeological surveys in Al-Qadisiyah, one archaeological excavation in Wasit and one anthropological and ethno-archeological survey in Najaf (this last one currently in the planning stage).

These fieldworks, carried out by EU and Iraqi researchers, will create new scientific data on the ancient societies and identities of Iraq, at the same time increasing the skills of the Iraqi researchers who will be also supported in publishing their findings. EDUU will target both English and Arabic scientific journals raising the awareness of both the international and national community of the importance of the rich Iraqi Pre-Islamic cultural heritage.

These solid academic findings will be the base of the work that the EDUU team will carry out in WP3 and WP4 with secondary schools, museum and cultural heritage associations that will become the repository of this new knowledge with the mandate of disseminating it to the society at large to contribute to the debate of the Iraqi national multicultural identity.

EDUU FIELDWORK IN AL-QADISIYAH

The fieldwork in Al-Qadisiyah will be carried over two campaigns: in October 2017, 08/10-3/10 and in January 2018 for 14 days. The team will be based in the town of Afak, located east of Diwaniyah (Al-Qadisiyah governorate). This location has been chosen because Afak is located inside the survey area and it makes easier to coordinate the logistics of fieldwork campaigns.

These fieldwork activities build upon previous experiences by the University of Bologna in the Governorate of Al-Qadisiyah, where UNIBO started a joint field project in 2015 in synergy with the State Board of Antiquities and Heritage (SBAH) and the University of Qadisiyah.

The UNIBO fieldwork team will be composed of the project coordinator, Nicolò Marchetti, of one researcher (Dr. Federico Zaina), and of four external experts: 2 topographers and 2 ceramologists. The UoQ fieldwork team will be coordinated by Prof. Prof. Abbas al-Hussainy. The team will also include members of the local branch of the SBAH (8-10 individuals) that will be also trained on the field.

Regional setting and background work

The Governorate of Al-Qadisiyah is a fertile alluvial plain located in southern Iraq and is one of the most important archaeological areas of the country and one subjected to intense cultivation. Early archaeological explorations focused on the sites of Fara – the ancient city of Shuruppak – and Bismaya – ancient Adab (1900s-1930s). Then, in recent years, the sites of Isin (Ishan Bahriyat) and Puzrish-Dagan (Tell Drehem) were also subjected to systematic excavations by foreign and local teams. The State Board of Antiquities and Heritage carried out several regular or emergency excavations at the sites of Tell Dhuhaiya, Bismaya/Adab, Tell Mirza, Tell Ruejeh and Tell Delmej 1-2 in the Delmej Basin, Tell al-Akhader, Tell Abu Edan, Tell el-'Arris and Tell Drehem/Puzrish-Dagan. On the other hand, surface explorations lagged behind and the only systematic surveys carried out were the ones completed by Robert Adams in the 1960s-1970s.

Altogether, these explorations indicate that the area was a major urban core during most of the 3rd and the 2nd millennia BC, with an extended network of cities, villages and ramified waterways connected to herringbone cultivated fields. In particular, most site present significant Early Dynastic (2900-2300 BC) and Ur III occupations (2100-2000 BC), with some significant Isin-Larsa (2000-1900 BC) and Old Babylonian ones (1800-1600 BC). Of particular importance is the network of sites and waterways that can be dated to the Ur III period, when the dynasty that ruled Sumer from Ur (Tell al-Muqayyar in the Dhi Qar Governorate) built the new administrative capital in this area – Puzrish-Dagan – on the site of modern Tell Drehem, and the place in which the Ur III kings were buried – Tummal (perhaps the site of Tell Dlehim).

This being said, previous work carried out by the UNIBO and QU team in the area involved a preliminary survey of the area in order to check the validity of surveys carried out in the past (1960s) and to assess the potential of the area in order to build a multi-tiered fieldwork strategy that takes into account not only settlement patterns, but also environmental and landscape changes. The other aim of this effort was to assess the damage done in the last decades by looters and by construction activities. The result is that looting occurred mostly in the years after 1991

and, more intensely, between 2003 and 2007. After 2007, the looting activities seemingly stopped altogether. Some sites were also affected by the construction of agricultural infrastructures, especially the ones dispersed among cultivations. Notably, looting was more intense in depopulated areas: the heritage/archaeological sites located in proximity to populated and/or cultivated areas were protected by their neighbors and almost not looted. This is an important point that needs to be stressed when dealing with issues related to the protection of archaeological sites in Iraq.

Main Aims and Goals

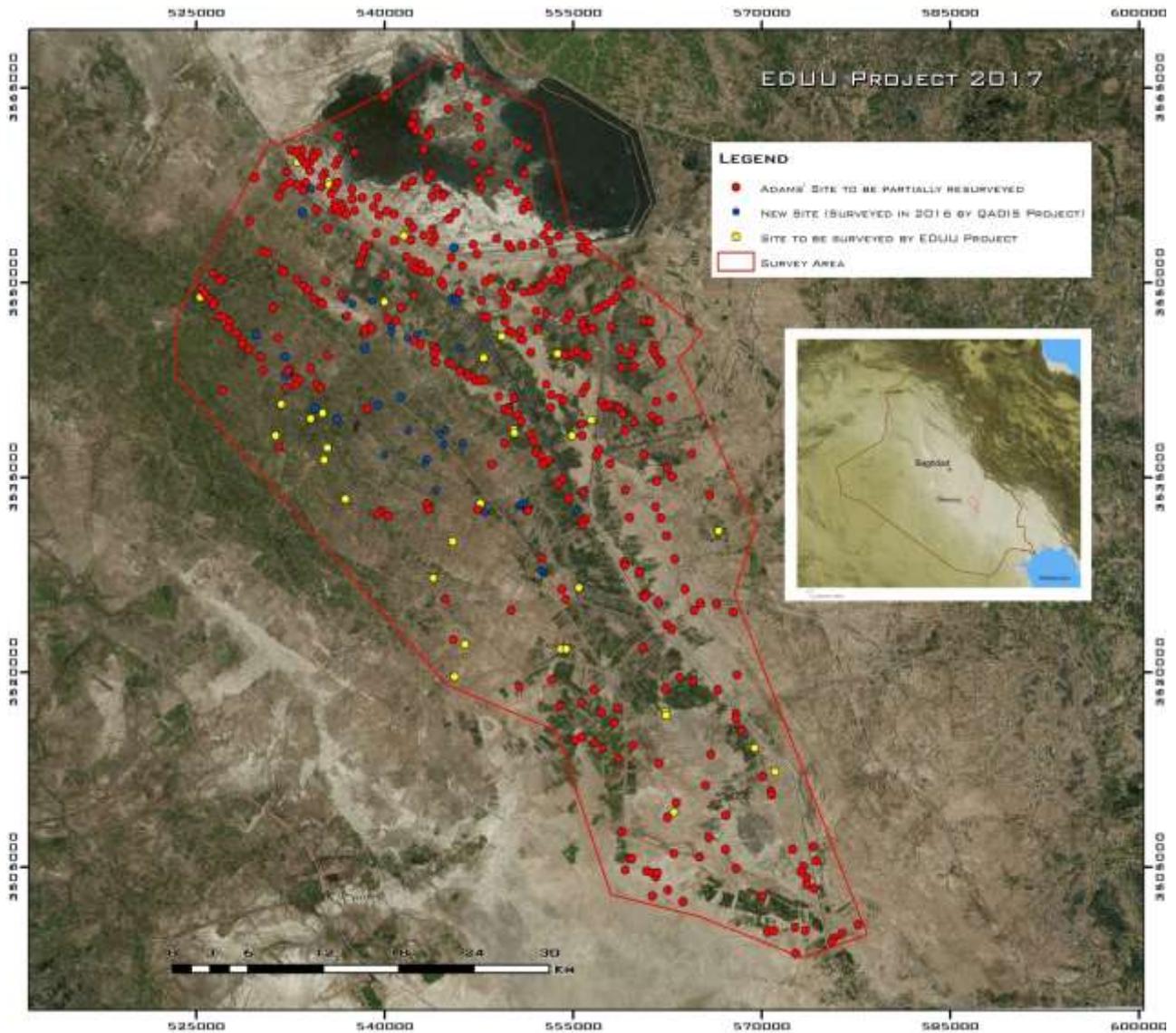
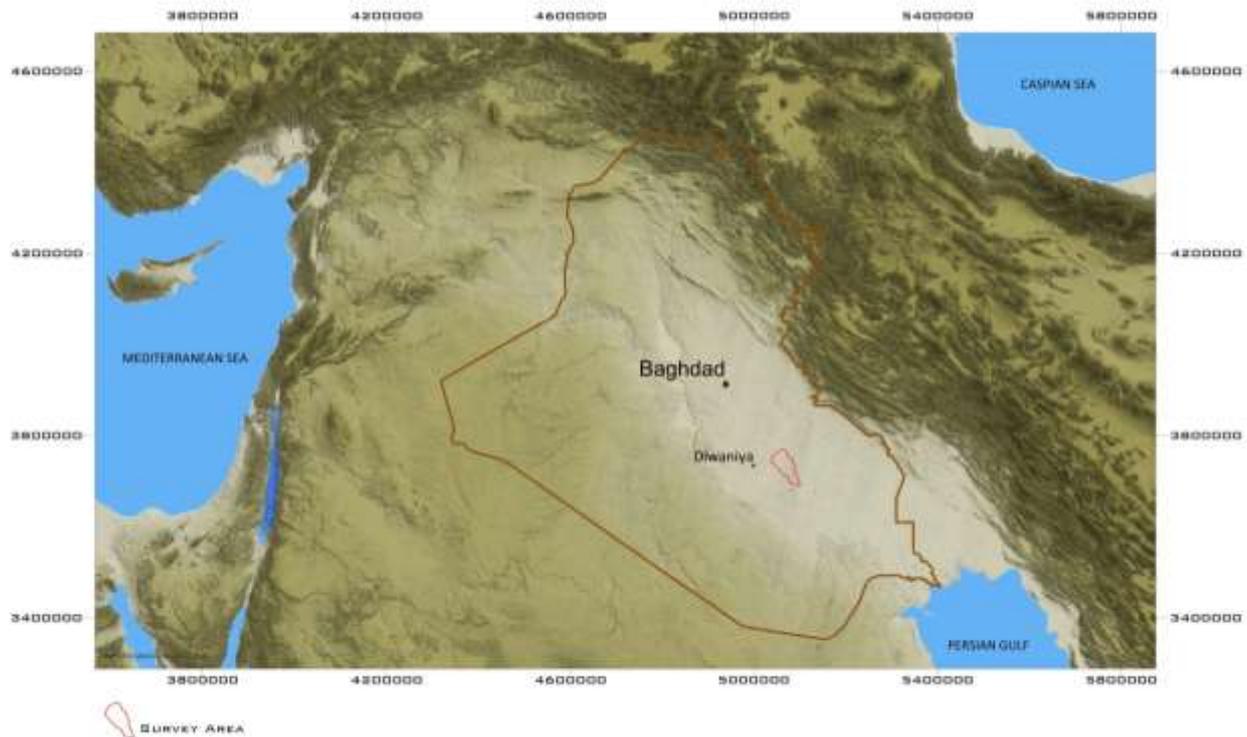


Photo showing the survey area within the Governorate of Al-Qadisiyah with main archaeological sites to be surveyed by the EDUU project.



Map showing the survey area within the Governorate of Al-Qadisiyah

The main aims of this fieldwork activity are to produce a new understanding of a multi-layered historical landscape through cutting-edge documentation techniques. The methodological framework consists of an integrated approach including ancient settlements and paleochannels reconnaissance through historical satellite imagery and free-access online platforms, high resolution photos of selected case studies taken with drones. The end-point of this work is that of reconstructing the relationship between human communities and their environment through time in the study region. The EDUU team will explore the phenomena of urban and state-formation in the study area also thought these new ground techniques. Major underpinnings of these phenomena are the rise of large urban centers (4th – 3rd millennia BC), the formation of territorial states (second half of 3rd millennium BC) and empires (late 3rd millennium). These social and political phenomena contributed to shape the environment via changing settlement patterns and the construction of progressively elaborated water infrastructures. The EDUU fieldwork aims at investigating the impact of these phenomena through the traces left on the ground and through material culture recovered from archaeological exploration.

To do so, the EDUU fieldwork will survey with modern techniques the settlements located in a core area for the development of Mesopotamian civilizations. In particular, during these campaigns the research team will target 40 sites that have never been surveyed before, identified thanks to satellite photos, that will be labelled as “EDUU Sites”. In addition, ancient channels, waterways and agricultural infrastructures will be surveyed with an array of ground and airborne techniques, in order to reconstruct land-use patterns through time. The landscape analysis has never been attempted before in the area with ground techniques since the 1960s survey were mainly based on satellite photos.

Also, one particularly important site, Tell Abu Hatab - ancient Kisurra, a major urban center during the 3rd and 2nd millennia BC – will be targeted by an intensive surface collection in order to ascertain its main occupational phases. The site of Kisurra was only briefly investigated by German archaeologists in the early 1900s. In addition to Kisurra, select study cases, such as sites with well-visible urban quarters or imposing architectural remains will be targeted by small-scale excavations in order to ascertain their chronology.



Drone photo of the site of Tell Dlehim, a site dating from the second half of the 3rd millennium BC. The low knoll in the left corner consist of the remains of the main sanctuary of the city, most probably a terrace-temple or ziqqurat.

Task-groups

To pursue the objective of these two campaigns, five task-groups will be created:

Task-group 1

Group 1 will be tasked with the excavation of small soundings in the sites of Bismaya – ancient Sumerian city of Adab, a very important urban center during the 3rd and 2nd millennia BC, briefly investigated during the early 1900s – and Tell Jidr – possibly to be identified with the ancient city of Karkara, an important cultic center, never subjected to investigations. The group will be composed of two UNIBO archaeologists, some members of the SBAH, university students and some community leaders.

Task-group 2

This group will be tasked with the intensive survey on the major site of Tell Abu Hatab – ancient city of Kisurra – and the random survey of previously not recognized archaeological sites that have been recently identified on the basis of satellite photos of the area under scrutiny. The components of this group will be one UNIBO archaeologist, some members of the SBAH and university students.

Task-group 3

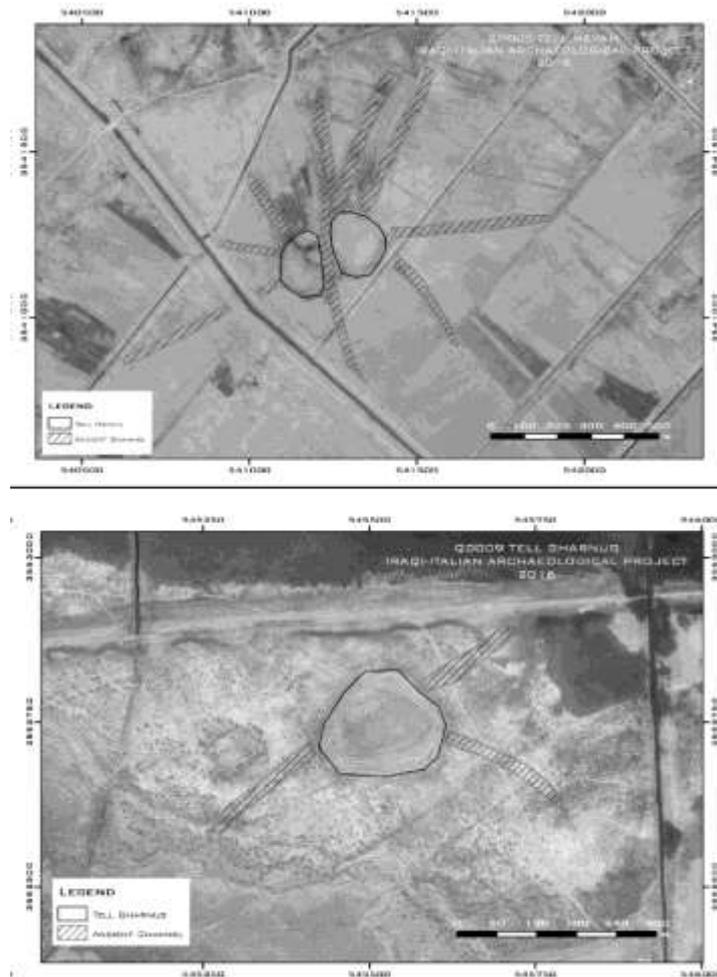
This group will be tasked with the processing of archaeological materials collected during surveys and small-scale excavations. The materials will be collected and transported at the excavation house in Afak to be processed and studied. This group will be composed of 2 Italian and one Iraqi ceramic experts, some members of the SBAH and university students.

Task-group 4

This group will be tasked with topographic work on the sites subjected to survey and on the sites subjected to stratigraphic testing. This group will be composed by 2 Italian and one Iraqi topographers, SBAH representatives and Iraqi students.

Task-group 5

This group will be tasked with geoarchaeological work, consisting of coring of ancient channels located near some important sites within the survey areas – such as Adab/Bismaya, Tell Dlehim/Tummal, Umm al-Fugas, the latter never subjected to archaeological investigations – with the aim of dating with more certainty the network of channels that surrounded these ancient settlements and that provided transportation and water for irrigation. The group will be composed by 2 Italian researchers, one professor from the University of Qadisiyah (Jafaar Jotheri, specialized in geoarchaeology), some members of the SBAH and university students.



Images showing the networks of ancient channels related to some settlements located within the survey area.

Methods and Techniques

Task-group 1 will carry out its activities by means of small-scale stratigraphic soundings in a select number of cases (see above) in order to test the nature of the site occupation, namely the date of the main occupation phases of the sites. This will be achieved by comparing the results from surface collection of pottery sherds with the results from these stratigraphic tests.

Task-group 2 will collect surface materials in random way while on a select number of sites (see above), intensely dividing the survey area in a grid composed of squares of 50x50 and 100x100 m.

Task-group 3 will focus on processing, documenting and studying archaeological materials. Once collected in bags, the materials are brought to the excavation house, where they are cleaned, selected (in case of pottery sherds), digitally cataloged, marked with catalogue numbers, photographed and drawn.

Task-group 4 will carry out the topographic survey of archaeological sites using drones (of the brand Phantom 3 and 4). The surveys made with drones are mainly aimed at recognizing and documenting the traces of structures on the surfaces of ancient sites (see fig. 3 below) and the traces of ancient waterways and agricultural infrastructures. Then, total stations and GPSs will be used to plot structures and features visible on the sites and to document the features brought to light via small-scale excavations.



The excavation of a small trench in order to test the results of surface collection.

Task-group 5 will be using geo-archaeological techniques, such as coring, for collecting buried sediments connected to fossil waterways, paleochannels and ancient irrigation infrastructures. The analysis of the collected sediments will be used to date more precisely the development of artificial waterways and irrigation features in the study areas.



Example of identification of architectural traces on the surface of an ancient site surveyed with drones. Black lines denote possible walls, violet lines denote possible streets and alleyways.

Data Post-processing Program

The data gathered via surveys and material culture analysis will be organized by means of a digital database. Drone and total station surveys will generate an array of high-resolution maps and plans of the surveyed features and sites. GPS data will be used to create a GIS system in order to put on map newly plotted settlements and paleochannels. All the resulting digital platforms containing raw data will be made available on the web, while field report will be prepared on the basis of the obtained datasets, and starting January 2018, the EDUU Iraqi-EU teams will be working jointly on publishing the results of their fieldwork.

The data resulting from this work will provide the means to reconstruct how ancient Mesopotamians shaped their communities and the environment they inhabited over the millennia. Of particular importance for the project are the dynamics between communities organized in towns, villages and the agricultural countryside they cultivated, in order to create a direct link between ancient and modern lifeways. As a matter of fact, the people that inhabited the Iraqi plain managed to create highly sustainable environment, even if almost completely artificial and in need of perennial renovation. It is therefore one of the main goals of this work that of documenting and studying a landscape that is constantly evolving, but at the same time remains very similar due to the nature of its very fabric: water, clay and people. The data gathered from this fieldwork will provide a major means for understanding one of the main economic underpinning of Mesopotamian – and modern Iraqi – societies, the development of agricultural techniques over the millennia and the resulting process of modification of the natural environment, started in the proto-historic period (4th millennium BC) to accommodate growing communities and still continues today.

At the end of fieldwork the EDUU team will have gathered substantial data on ancient urban entities, their agricultural and pastoral strategies, the impact of states on economy and environment, religious and social identities.

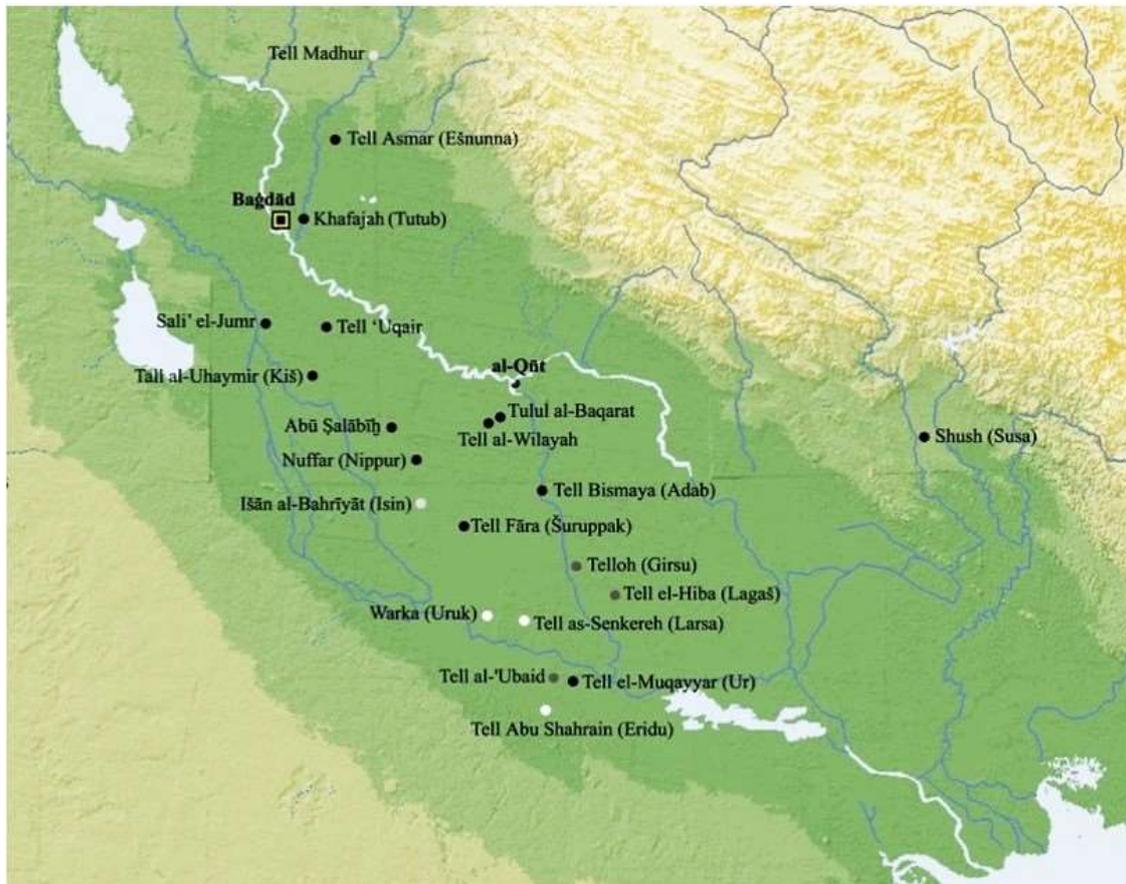
EDUU FIELDWORK IN WASIT

EDUU fieldwork in Wasit (precisely in the site of Tulul al Baqarat) will be carried out under the supervision of University of Turin (UNITO) between September 15th and November 15th 2017. UNITO will work in close collaboration with the University of Baghdad.

The team will be based in a building in the town of Kut (28 km to the N of the site), or alternatively (we are still considering the local logistic conditions) in the smaller town of Noumaniya (about 35 km to the NW of the site). From the logistical point of view, this project will of course require adequate accommodation for trainees (an expedition house able to accommodate more than 15 people should be selected and prepared) and other means of transportation in order, every day, to reach the site.

The expedition team will consist of 6 Italians from University of Turin (2 archaeologists, 1 ceramist, 1 topographer, 2 archeology students), 4 members from the Iraqi side (SBAH representatives) and 4 students from the University of Baghdad. To these ones they will be added SBAH trainees from Baghdad and Kut, and local community leaders who will participate in training activities on the site.

The site of Tulul al Baqarat



Map showing the position of Tulul al-Baqarat in relation to the main archaeological sites in southern Iraq.

The modern toponym 'Tulul al Baqarat' indicates a series of tells of different size and chronology scattered on an area around 5 km wide. Apart from the nearby Iraqi excavations at Tell al-Wilaya (located about 7 kilometers to the south-west) the area is still little known from the archaeological point of view. Baqarat is located (but not reported) on the far northeast edge of the survey maps drawn up by Robert McC. Adams in his seminal 1981 report *Heartland of Cities*. The main tell of the Baqarat area was partially excavated by the State Board of Antiquities and Heritage in 2008-2011, in order to stop illicit excavations that seriously damaged the site. The results of these excavations, unfortunately still unpublished, were significant and revealed the presence of a religious complex on the top of the hill, dated to the Neo-Babylonian period (626-539 BC) in its latest phase but with levels that reach the Early Dynastic period (ca. 2900-2300 BC) if not earlier phases.



Architectural remains belonging to the temple precinct excavated by the SBAH between 2008 and 2010.

Aims and Goals of EDUU archaeological work at Tulul al-Baqarat

The EDUU archaeological work on the site and in the area around Tulul al-Baqarat will focus on two main sets of operations: extensive excavation activities, and a regional survey around the site. Excavation activities will focus on two main areas of the site where previous investigations produced evidence of a major cultic area – in use between the 3rd and the 1st millennia BC – and one which is seemingly occupied by a small-scale settlement, perhaps a village, dating to the late 4th millennium BC. These areas will be investigated through stratigraphic excavations and documented through ground and airborne topographic techniques. Furthermore, a regional survey will be carried out in the area around the site to better understand the settlement patterns in the region. These operations will be combined with study of material culture, cataloging and consolidation of mud-brick architecture.

The end-point of these activities is that of understanding the process of formation of the settlement of Baqarat – possibly to be identified with the ancient city of Kesh, a powerful city-state during the 3rd millennium BC – and its changes over time, also in relation to the environmental and occupational changes of the surrounding region.

Program

The work program foresees several interventions. First of all, excavations will be concentrated on the two main mounds of the area (TB1 and TB7), that due to previous small-scale investigations

produced evidence respectively dating to the 3rd – 1st millennia and 4th millennium BC. Of particular interest for EDUU project is the presence of architectural remains on TB 7 that may be interpreted as part of a farm located inside a small settlement, possibly a village, dating from the late 4th millennium BC.

A second set of activities will be the documentation and study of archaeological materials, also the ones accumulated during the previous SBAH excavations and still not processed. The documentation will include drawing, cataloging and processing the collected diagnostic fragments.

A third field activity will be a regional survey focusing on the sites located in the immediate surroundings of Tulul al Baqarat (within a radius of about 10-15 km). The aim is to collect chronological and archeological data for the study and reconstruction of the settlement patterns in the area, especially between the 4th the 1st millennium BC, and to study the relationship between the main urban site – Baqarat – and its surrounding territory through time.

Finally, topographic surveys of the two mounds under excavation completed. For mound TB1, total stations and GPSs will be used to in combination with laser scanning of the entire mound to obtain a complete topographic record of the mound. On mound TB7, where late 4th and early 3rd millennium architectural remains have been previously brought to light, total stations and drones will be used to obtain a high-resolution ortophotographic record.



Excavations activities on mound TB 7.

All these works will be carried out together with the on-site training courses. The latter will take place both on the site and in the camp of the expedition (with lessons, practical exercises, seminars), so that participants can follow the different phases of archaeological activity, from the excavation to the documentation and the post-processing.

The post-processing of excavation data will be started in Iraq towards the end of the excavation campaign. In particular, our expedition had already elaborated a digital database for pottery, US forms, small finds, graves, etc., that will be used to record the excavation process and the finds.

Data from topography and the survey will require a longer and more accurate post-processing, to be completed once back in Italy. Preliminary reports, produced on the basis of the data gathered will be sent to the SBAH and preliminary articles are expected to be produced and published during second half of 2018.

The data gathered through fieldwork at Baqarat will provide the means to reconstruct the history of the human communities that inhabited the area in the millennia before the Islamic period. Main underpinnings of this data collection are the reconstruction of economic systems and religious identities in connection to the process of state and urban formation (late 4th – 3rd millennia BC) in a core area of southern Mesopotamia.

ON-THE-FIELD TRAINING ACTIVITIES

As part of the WP 2 training activities, the EDUU project plans to organize field training initiatives addressed to: SBAH operators, university students and community leaders. As to community leaders, originally, we deemed appropriate to involve them in the learning activities to be organized for SBAH member and cultural heritage operators. However, given the importance of the role of community leaders for the protection of the archaeological sites dispersed in the countryside, and the logistical constraints involved in organizing the transport of community leaders from their villages to the seats of the training activities (Baghdad, Qadisiyah, Kufa), we concluded that it is best to involve them in training activities carried out while in the field, so closer to their places of residence. This will also allow us to show them directly how to recognize archaeological features and sites in the countryside, to monitor the preservation state of the remains, to detect emergencies and eventual damages to the heritage in case of construction projects and the construction of agricultural infrastructures, etc.

Both Wasit and Qadisiyah fieldwork teams will elaborate and carry out an intensive training program in order to engage these individuals in activities that will raise their expertise in core archaeological field operations: stratigraphic excavation, topographic surveying, processing and cataloging material culture. The first two activities will be carried out while on the archaeological sites, while the third one in part at the excavation base / excavation house.

Trainees will learn: 1) how to excavate following a strict stratigraphic protocol, 2) how to record the excavated features (by using both paper and digital recording devices); 3) how to use total stations, GPSs and drone for surveying archaeological and landscape features; 4) how to collect, catalog, process and document material culture from archaeological excavations and surface collections (pottery, small finds, etc.) through photos and drawings.

We plan to carry out these training initiatives during the month of October 2018. Wasit team will engage as trainees 4 advanced students from Baghdad University. 3 of them will work at Baqarat for 10 days and 1, selected according to his/her level of expertise, will stay with the team for one month. In addition, 10 SBAH operators and 15 community leaders will be trained alongside students. As for SBAH operators, 3 of them will be a stable part of the team, according to SBAH regulations for archaeological expeditions, and 7 additional members will join the team for 10 days. Community leader also will be trained for 10 days.

The same applies for Qadisiyah team, that will organize 10 days of training during October 2017 engaging 4 students respectively from Kufa and Qadisiyah universities, 10 SBAH representatives (some of which attached to the team for the whole period) and community leaders.



On-site training activities involving Italian researchers, SBAH representatives, local workers and community leaders.

It is important to stress that the field training activities will have a three-fold impact on local operators: 1) SBAH members will be better prepared for their safeguarding duties and they will further their abilities to excavate and to handle archaeological materials; 2) students will experience international working standard and will acquaint themselves with methods and technologies that are considered state-of-the-art; 3) community leaders will experience first-hand how to recognize archaeological sites and materials, how to handle them and to create synergies with cultural heritage operators and groups.

The involvement of university students and SBAH operators is also of critical importance because their work will be instrumental for the preparation of papers, reports and articles that will be delivered to the government and to academic editors for publication in specialized journals.

ACADEMIC OUTPUTS

The results of fieldwork activities will be packaged into publications and reports and disseminated to the scholarly community via conferences. The involvement of Iraqi researchers and students in fieldwork and training initiatives will also result in the creation of joint-teams for the preparation of reports and papers that will be delivered to the SBAH and submitted to international editorials boards for publication in academic journals.

The aim of this operation is twofold: on the one hand, we aim at involving Iraqi researchers and students in all the phases of academic research, from fieldwork to publication; on the other hand, we aim at encouraging Iraqi researchers to participate in producing academic contents (in English and Arabic language) that will be accessible to the international academic community. To do so, 10 Iraqi researchers will work alongside European researchers for drafting academic papers documenting the results of fieldwork activities, that will be submitted to the editorial boards of scientific journals in the field of archaeology and cultural heritage (like Sumer in English and Al-Qadisiyah Journal, Al-Qadisiyah Journal for Humanities Sciences, Al-Qadisiyah Journal in Arts and Educational Sciences in Arabic). We aim at producing 12 papers that will be published, made available online, and eventually read by 1500 students and 200 scholars in Iraq and internationally by the end of the project.

In addition, the results of fieldwork activities will be packaged into reports that will be sent to the SBAH. Also in this case, joint European and Iraqi teams will collaborate in drafting the reports.

As to academic conferences, we will organize 3 conferences in January 2018, one in each partner university, where the joint-teams that carried out fieldwork activities will be presenting the results of fieldwork to students and local researchers. We plan to reach as much as 300 attendants with these initiatives. Furthermore, a final general conference will be organized in Kufa (January 2018) in order to disseminate more widely the results of fieldwork. The paper presented at the conferences will be published as proceedings volume by the end of the project and made available online in open access.