

Urban Archaeology

The Challenges and Opportunities of Archeological Rescue Excavation in the Region of Molavi, Tehran¹

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Abstract: Some cultural works and material related to the Islamic era were discovered in the fall of 2014 while doing pipe-laying operations in a city sewer line located in the historical context of south of Tehran between Ghiam and Molavi squares. A Tehranian citizen who is an archaeologist and second author of this paper informed the experts of the cultural heritage office about findings in the sewage drilling and archaeological rescue excavations were started in six trenches within the mentioned area. The found objects are of Neolithic, Chalcolithic and Islamic periods (Safavid, Qajar, Pahlavi and contemporary) in the terms of chronology. The results of laboratory studies performed by using thermoluminescence technique on clay fragments date back to the fifth millennium B.C. In addition to initial report of exploration, this paper also considers challenges and opportunities created by the excavations and its reflection among people, city officials and mass media.

Keywords: Tehran, rescue excavations of Molavi, Neolithic / Chalcolithic period.

Introduction

Urban archaeology is very important in countries such as Iran. Iran is a country with a very ancient history that has numerous archaeological sites from Palaeolithic period to the late Islamic period. Urbanization and population growth have led to many archaeological sites located in the cities, on the other hand, many cities have been built on the remains of more ancient settlements, so the urban archaeologists should apply specific rescue methods to carry out archaeological activities in these areas. The First World Conference on Rescue Archaeology was held in Ecuador in May 1981. The conference was held in response to the increased destruction of archaeological relics with industrialization, urbanization and illegal sale of antiquities. In fact, there are always construction projects and therefore the rescue archaeology is the only way to collect information from areas where native structures will be destroyed. The rescue archaeology can be considered as an exception in the view of cultural heritage management. As mentioned before, the works obtained by Molavi rescue excavations are culturally related to the Neolithic/Chalcolithic period in Tehran. The history of the settlement in Tehran goes back to the fifth millennium BC with this unique discovery, although more traces

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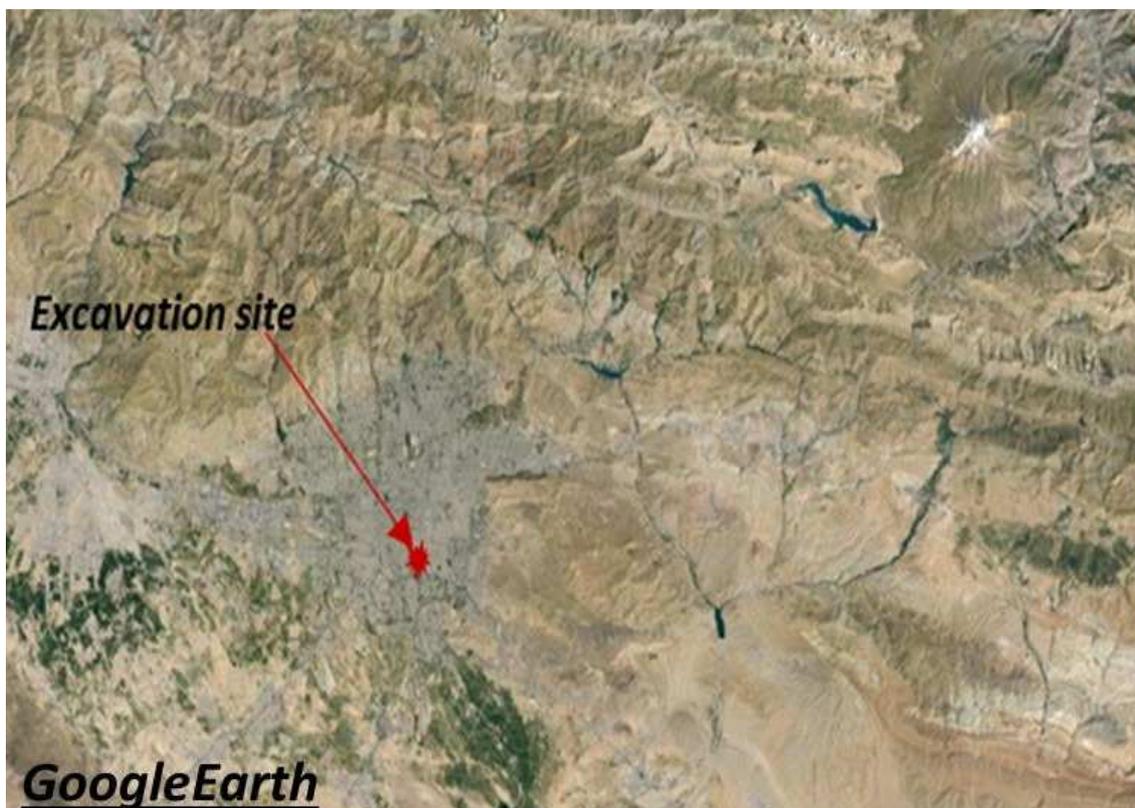
and evidences of prehistoric culture are achievable by developing and continuing archaeological explorations in Tehran . Three methods were used to collect information in this paper, documentary studies, field studies and interdisciplinary studies. Islamic written texts and other relevant documents were used in the first method, the archaeology excavations were performed in six trenches and necessary documentations in the field studies, the interdisciplinary studies such as geology, archaeology, parasitology, thermos-luminescence, three-dimensional optical scanning, genetic studies of ancient bones, anthropology and so on were done in the third method which some of them have been identified and some of them are doing.

Geography and archaeological studies in Tehran

In terms of archaeological geography, Tehran Plain is a part of the central plateau of Iran and is one of the most prone areas containing the oldest rural communities of the Middle East. Archaeological investigation of the Central Iranian Plateau was started by Cheshmeh Ali exploration by De Morgan in 1912 and then in 1924 by the Diet, the Charge d'affaires of the Embassy of France (Vandenberghe 1959 p.121). The archaeological studies entered into a new phase by re-excavation of Fazeli in Cheshmeh Ali and archaeological investigation of Tehran Plain. A new excavation of Cheshmeh Ali was obtained in addition to achieve the absolute chronometers, deposition of three Neolithic, transitional Chalcolithic and old Chalcolithic (FAZELI 2004 pp. 17,16). Cheshmeh Ali was the closest and oldest place to Tehran before the Molavi rescue excavations, to indicate the history of human presence in Rey. The remains obtained by Molavi rescue excavation works indicate human presence in the fifth millennium BC, or even a little earlier in Tehran. Before this, the oldest evidence of Tehran was during the first millennium B.C. including Qeytariyeh cemetery and some areas such as Kahrizak, Daros, Pishvaye Varamin, Qolhak, Saltanatabad and Fifth Bustan of Pasdaran (KAMBAKHSH FARD 2005). (Maps 1, 2)



Map 1 – Aerial view of Tehran /Iran (Copyright: Google 3D Earth)



Map 2 – Aerial view of Tehran city (Copyright: Google Earth)

The outcomes of archaeological rescue excavations in Molavi streets

Archaeological explorations were performed in the sewage area of Ghiam to Molavi squares in the fall of 2014 in Tehran. Six trenches along the constructed sewage pipeline have been identified in the map. Due to obtained findings, two trenches (VI, I) are the most important. The excavation of trench I continued to the depth of 560 cm by ensuring the virgin soil texture. Two periods were determined in trench I: Prehistoric and Islamic. The Islamic era was divided into the late (Pahlavi, Qajar) and medieval (Safavid, Timurid), and based on evidence, Prehistoric period dates back to the fifth millennium B.C. A human burial from the Chalcolithic period with a painted pottery vessel was among the important pre-historic findings. There were remains of residential floor and a possible thermal structure /oven with cultural materials including parts of stone chips, pieces of animal bones and charcoal besides the grave and the top of it. Digging was layered to the depth of 560 cm to identify the lower layers of the northwest corner of the trench, and considering to the uniform texture and the absence of any cultural material, it can be said that the trenches are in virgin soil. In this section after about a meter of material deposits, the subterranean corridor of Islamic era was obtained at the height of about one meter. Trench II which is at a distance of 6 meters from west of trench I was explored and works related to the construction of the Islamic era graves were found, also trench III with a depth of 500 cm was excavated and 13 trenches were recorded in the locus and 309 the accumulation of soil with fine sand were obtained inside this layer of clay fragments dating back to prehistoric times. Results of thermo-luminescence laboratory studies on a piece of pottery in these deposits show the late fourth millennium B.C. Trench IV, 100 meter west of trench III was opened and some ceramics of Islamic period and few pottery of the first millennium B.C. were found. Trench V was opened to study the layers of prehistoric pottery from 309 locus of trench III, and created at a distance of 2 meters north of trench III and unfold the municipal utilities, especially through municipal drinking water transmission mains practically to continue exploring the left spaces and exploration in the same trench IV was stopped. Exploration of the trench VI was continued to the depth of 885 cm, three important cultural periods were identified. The first period is related to the evidence of a contemporary street and a human burial which is attributed to the late Qajar to the Pahlavi era, the second period at a depth of about 4 meters including cultural signs is attributed to the sedimentary material of third millennium B.C. According to thermos-luminescence tests conducted on a sample of pottery, the second period history is dated 4970 ± 240 years before present (BAHROLOLOUMI et al. 2014). The third period began after this layer, more than two meters deposition without cultural signs. This period began from the depth of 640 cm with a thick layer of brown soil. The layer contains carbon grains, scattered pieces of bone and stone tools of the type of blade, small blade and bed-rock. In one case stone tools clinging to pieces of animal bone were found. (Fig. 1) The layer continued to the depth of 670 cm. The relative chronology of the layer, in terms of cultural materials is attributed to Sialk I and even before it; that means the end of the pre Neolithic -without pottery.



Fig. 1 – Stone tools were found clinging to pieces of animal bone. (Copyright: Authors)

Human skeleton

Human skeletal remains are rotten and fragile because of the passage of time and exposure to wet and damp bed; they have poor strength in different parts of the skeleton, including the skull thickness, papillae mastoid temporal bone, jaw size, type and characteristics of the occipital bone, the curve of the chin on the lower jaw, small size teeth, light bumps and bumps slightly above the eyebrows, chin and sciatica status in the hip groove. This groove is more open in female skeletons than in male ones and provides favourable conditions for pregnancy and childbirth. In the sample studied and it is therefore very likely the skeleton belonged to a female. In addition to gender diagnosis it is given that all joints have been completely connected to the trunk bone and all bones of the central and upper organs and lower organs as well as all teeth have been grown, and if someone loses his teeth during life for any reason, the holes of lack of teeth in the jaw bone has been filled over time, such a situation can be stated for the second and third molars in the lower jaw. The particular situation with complete connections in the arms and thigh bones and also the attrition rate in the crown remained in the lower jaw molars shows that the skeleton's growth has reached its final size at the time of death. In conclusion, the skeleton is that of an adult female (Fig. 2).



Fig. 2 – Skeleton stabilization operations with materials specific lab. (Copyright: Authors)



Fig. 3a – Digital reconstruction of the skeleton of Molavi. (Copyright: M.R.Rokni)



Fig. 4b – General view of trench I and human burial. (Copyright: Authors)

3D optical scanning and reconstructing of the seven thousand-year-old lady of Tehran

In order to prohibit gradual erosion of the skeleton after excavation, it was necessary to use optical scanning for the pick-up and documentation. Research and pathology are made possible through this method using three-dimensional optical scanning without access to skeleton all over the world. An accuracy of 0.04 mm is another property of this method. In the past, the human face was reconstructed by the knowledge of human body anatomy and by materials common in sculpturing. But nowadays modelling has been made very easy, quick, and accurate using computer software. For creating a three-dimensional model of the discovery, photo-scanning was used and about 200 images of the skeleton were referred to. These images were taken around the skeleton, teeth, cheeks, eye sockets and body members such as hands, legs, spine, ribs, pelvic skeleton, and evident parts of the skull. Placing each image based on its focal length, the angle of taking the photo, and the location of imaging, a model of the skeleton, in the form of a cloud-point, was achieved which was based on the pixels in the image. This is the photogrammetry-by-photo-scanning-method (Fig. 5). This still raw model needed information processing. In the next stage, a model was achieved by entering the data collected from the cloud-point modelling of the skeleton into a GIS system. The resulted model went into cover-mode (MESH), through triangulation between the points, which then becomes three-dimensional. This leads from a cloud-point to a three-dimensional model with full volume (Fig. 6). The three-dimensional version of the artifact was entered into *Blender's* three-dimensional software. Troubleshooting and sample modification was carried out by images, with high definition details, taken of the bones and members of the skeleton. Modelling of the complete skeleton based on funerary model was the next step. (Fig. 7) Correspondence of the reconstructed sample with the data is provided by photogrammetry. (Fig. 8) The existent faults had to be corrected. (Fig. 9) The likely location of eye muscles, lips, cheeks, and nasal cartilage was located by the anatomy model of

human body. Next steps were modelling of muscle tissue (Fig. 10), troubleshooting using the algorithm of the members of face (Fig. 11), modelling of the hair texture (Fig. 12) to come to the final model (Fig. 13).

[Written by Mr. Rokni]



Fig. 5 – photogrammetry-by-photo-scanning-method

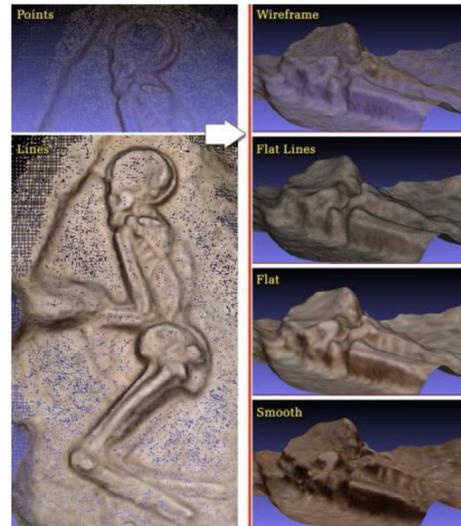


Fig. 6 – three-dimensional model with full volume

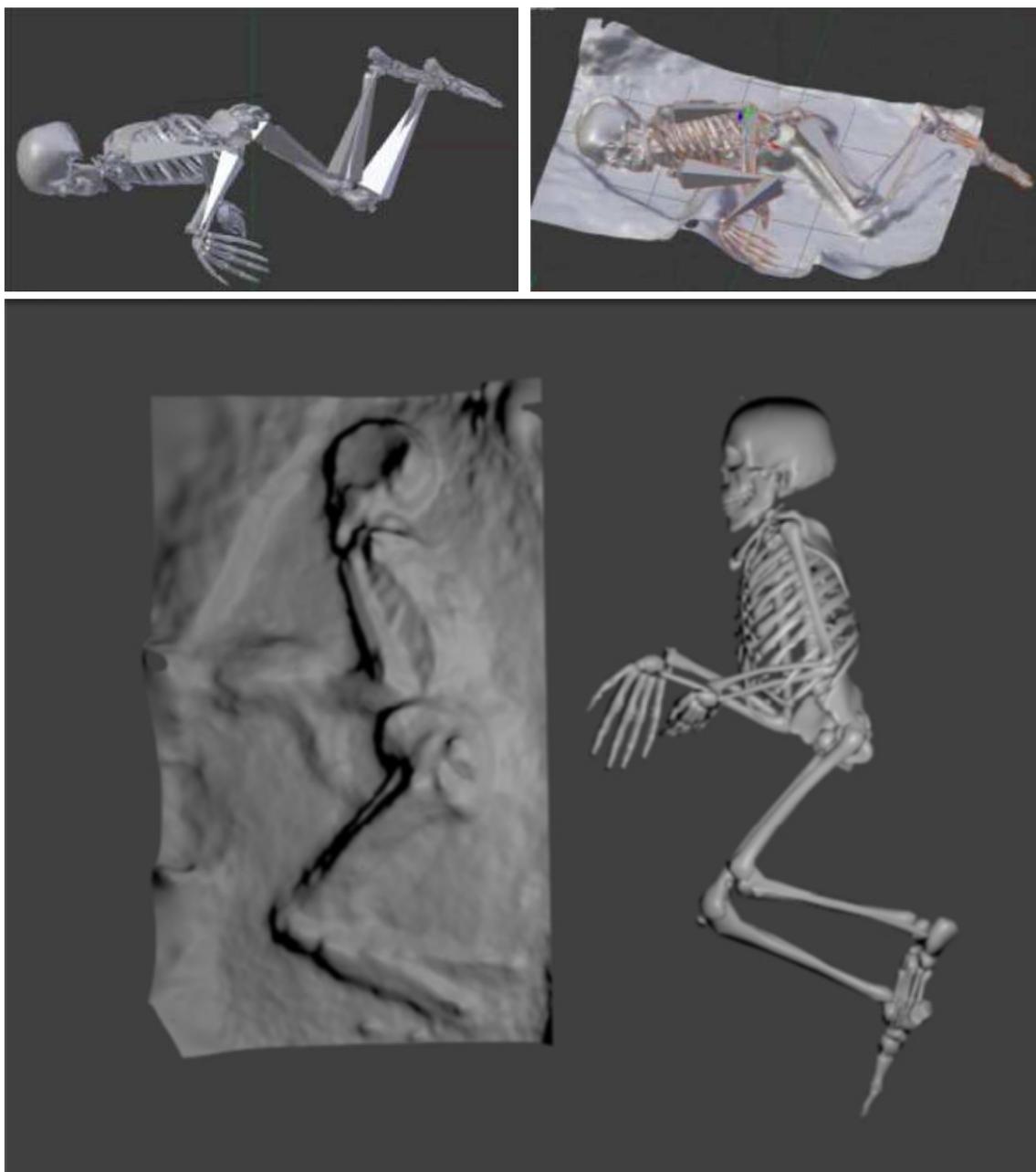


Fig. 7 (upper left) – Modelling of the complete skeleton, Fig. 8 (upper right) – Correspondence of the reconstructed sample with the data provided by photogrammetry, Fig. 9 (lower) – Correcting the existent faults

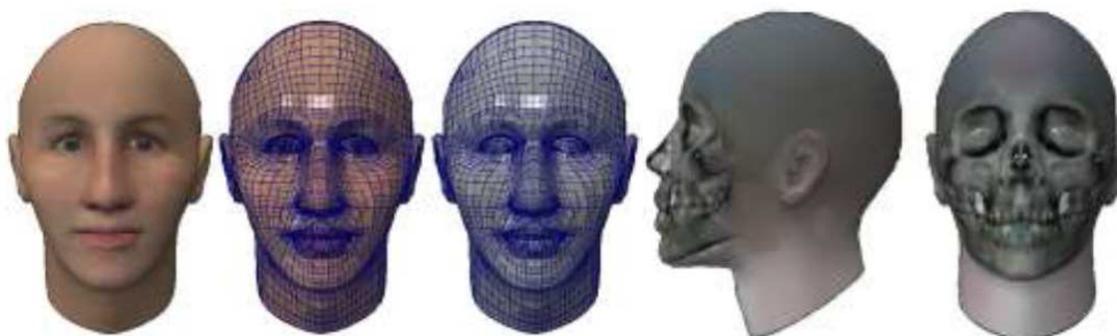


Fig. 11 – troubleshooting using the algorithm of the members of face Fig. 10 – modelling of muscle tissue



Fig. 12 – modelling of the hair texture



Fig. 13 – final model

Grave structure and burial method of Chalcolithic period in Molavi

For burial, the body has been placed in a shallow hole - about 40 cm depth in most parts- in the context of sand, it started from the depth 362 cm from BM and finished in the depth of 400 cm. The overall shape of the hole is an oval and the body has been buried in northeast-southwest direction that is about 160 cm long and 110 cm wide for the nearest part. Human burial has been approximately in the centre of the pit (Fig.14) on virgin soil. The custom of the placing of dead person is in the form of the southwest - northeast, head is placed in the west and face to the south east, burial placed on the shoulder and right side, the total length of nearly burialthe buried body in a bent state is 150 cm, the only object beside the skeleton was a painted pot dish was placed upside down just above the body (Fig.15).



Fig.14 – Burial hole. (Copyright: Authors)



Fig.15 – The human body was buried with a pottery dish on its head. (Copyright: Authors)

Thermal structure / Oven

The evidence of ash heated soil and compressed pieces like the edge of a oven was obtained in front of the left wrist and attached to it with a height difference of about 40 cm above the burial site, which was probably a thermal structure /oven. The structure is almost circular and is approximately 60 cm in current state. (Fig.16). The depth of this structure started from 320 cm of BM and its end depth is unknown due to its position along the trench walls. Some components of small and heated lumps, pottery, a few pieces of stone chips, bone and coal were obtained in the context of the structure. Based on the obtained evidence, the structure can be considered as a thermal structure or structurally related to fire. This issue provides better understanding of the spatial conditions of the traditional burial under architectural spaces in this period.

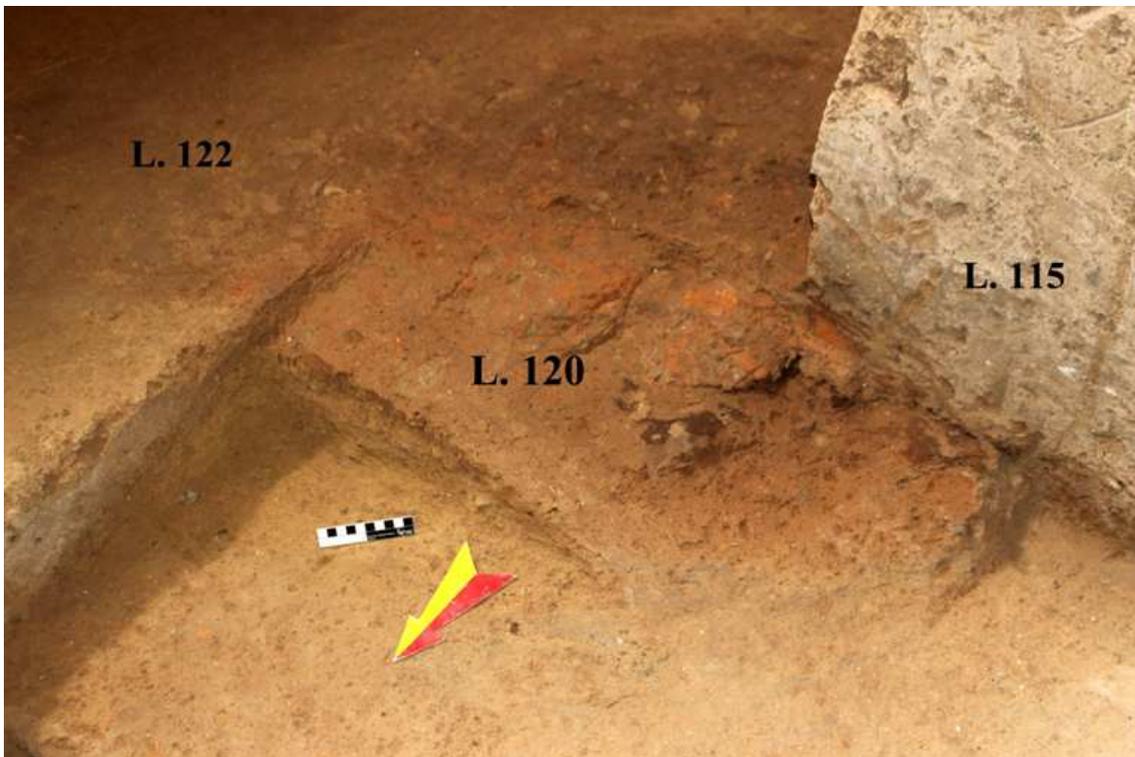


Fig.16 – Thermal Structures Locus 120 / Residential floor the locus 122(Copyright: Authors)

Pottery

The result shows that the history of ceramics of Cheshmeh Ali is variable in the late sixth millennium to the middle of the fifth millennium BC. The pottery of Cheshmeh Ali is one of the earthen species obtained from trench I in trenches in layers of prehistoric layers which thermoluminescence test was conducted on some of them. The result of experiments conducted on four samples of pottery approved seven thousand years old history of Tehran. Tests carried out on two samples of pottery of trench I that was related to the skeleton burial showed the date of 6950 ± 280 and 6870 ± 300 years ago and two other samples related to the trench 3 and 6 dated at 4970 ± 240 years were found (BAHROLOLOUMI et al. 2014). This date proved the presence of multi-period area in Molavi region.



Fig. 17 – Prehistoric pottery in trench I. (Copyright: Authors)

Stone artifacts

The excavated stone artifacts are obtained from trench I, the additional findings of trench I and trench VI can be identified as a scraper (Fig.18) retouching chip, milling chip , blade and tiny blade . Something that is striking among the findings of artificial stone is that a piece of cartridge bed-rock at the size of 35 * 25 * 17 mm was obtained from trench VI. (Fig.19).



Fig. 18 – Scraper from the trench I. (Copyright: Authors)



Fig. 19 – The stone artifacts obtained from trenches VI. (Copyright: Authors)

Opportunities and challenges



Fig. 20 – The locations of trenches II and III. (Copyright: Authors)

Each archaeological excavation with any way, shape or manner and considering to the specific time and place has its own challenges and opportunities that the right management provides the possibility to achieve good

result; however, perhaps the rescue archaeology excavation in a city can be considered as a kind of more challenges and opportunities. In this section we consider the challenges and opportunities arising during the rescue archaeology excavation in one of the most busiest regions of Tehran.

The presence of urban infrastructure and lack of relevant documentation

The presence of urban infrastructure such as gas pipelines, water, electricity, telephone and sewage disposal pipes are the main challenges in the archaeological excavation in Molavi Street. The lack of a facilities infrastructure map is a major problem, causing a waste of the time and cost on the excavation board. This led to stop trenches IV, V at the beginning of the excavation, despite obtaining evidence from historic and pre-historic era.

Opportunity: If there are any maps of facility / utility infrastructure of the city, the right placing of trenches can be done with more accuracy, more speed and less cost.

Residents, shopkeepers and passers of excavation region

First, the excavation was performed by informing the shopkeepers, their support and accompany, even before the installation of workshop. Later on, this issue became a serious challenge for the group due to prolongation of exploration and the lack of officials promises in creating the museum site.

Opportunity: Archaeological studies will be facing the resistance of people living in dig areas, including local residents, merchants and shopkeepers, passers-by and social offenders in addition to the governmental opponents, such as municipalities. In this section, the correct information, a program with suitable schedule, satisfaction of traders, shopkeepers and passers-by can provide the appropriate opportunity to raise the public awareness of cultural heritage.

Cultural identification for Tehran residents

Opportunity: The result of research conducted on the comments of people as well as on interviews conducted shown that cultural identification with the history of seven thousand years is one of the main discussions about this excavation among people and even the experts.

Challenge: Announced dates led to many objections by experts.

The role of mass media in optimal control and guidance of cultural heritage

Challenge: The lack of proper information for the public and expert reports which sometimes contained news interferences in experts texts and comments are the main challenges of exploration board. It creates a false information transfer to the public.

Opportunity: the news was evaluated for ten months to analyse news related to rescue excavation in Molavi . The news generated in the first period was 17% and then reached to 45% in February 2015. Due to the mass media pressure, the positive context was provided to expand the excavation. The skeletal remains as well as additional archaeological evidence were obtained by this action. on the other hand , the media pressure led to the chronological studies out of turn of the cultural heritage lab that re-announcement of the news was widely reflected by mass media. In fact, the mass media opportunity in Molavi excavation makes it necessary to carry

out interdisciplinary studies and appropriate context of it. The results of this media wave were found in physical anthropology studies to determine the age and gender, site museum at the site, the documentation and the optical three-dimensional scan of the skeleton artifacts, ancient genetic sampling, expand exploration to completion Information settlement in place, testing dating thermoluminescence method, Tehran meeting of experts from outside the group members were excavated seven thousand years, each of these cases are opportunities that authors sought to explore and reflect media in Tehran or it finally finished without any difficulties.

The frequency of works obtained by rescue excavation of Molavi region, an opportunity for tourism and museum purposes

Opportunity: The results of this excavation led to a significant number of objects that provided a good opportunity for researchers and the public visit.

Challenge: the lack of appropriate credit allocation and necessary cost to study the volume of works and related difficulties to them in establishing appropriate information banks.

Creating of the necessary context for the planning, designing and establishing site museums within the exploration

Opportunity: The value and importance of Molavi excavation works caused to presence of the city's cultural authorities in Tehran, especially the Tehran Municipality, and relevant organizations also cultural heritage authorities at the project site. Despite the initial idea to transfer the buried woman obtained by Molavi exploration to the National Museum of Iran, this led to the idea of museum site establishment was recommended by custodians and was considered well by the public .

Challenge: the problem of credit allocation, the lack of coordination of executive authorities, profit-minded design of museum by removal if the experts from project at the design stage, cultural and economic problems to economic position in the heart of Tehran. New monuments and discovered sites impose an additional burden on the program's cultural heritage protection and keeping all the monuments at risk is very difficult at the same time.

The establishment of cooperation with organizations, academic institutions and providing technical support for aspects of archaeological excavations

Opportunity: International scientific collaboration offered by archeology experts. The cooperation with other organizations of planning and urban beautification introduces date and providing technical support for archaeological aspects. Using the mentioned organizations capabilities for the protection, conservation and presentation of obtained works.

Challenge: The lack of coordination between the related authorities particularly losing the opportunity to not form some parts of national and international projects. Drilling is always itself involved the demolition of what is a rescue or a conventional probe.



Fig. 21 – Location trench I. (Copyright: Authors)

Solution

1. Today, new methods have come to help many archaeologists so that they can be used without any degradation, extensive information can be obtained from sites by methods such as infrared radiation satellite imaging, geo magnets methods, geo-electrical methods, ground penetrating radars and so on as well as some information such as the location of architectural spaces, the location of wells, the buildings plans and so on. The geophysical exploration should be used as a standard tool before any rescue excavation of archaeological research (IMMO 2007 p.17).
2. In order to prohibit gradual erosion of the skeleton after excavation, it was necessary to use optical scanning for the pick-up and documentation. Research and pathology are made possible through this method using three- dimensional volume and without access to skeleton all over the world. 0.04 mm accuracy is another property of this method. In the past, human's face was reconstructed by the knowledge of human body anatomy and by materials common in sculpturing. But nowadays modelling has been made very easy, quick, and accurate using computer software.
3. Archaeological assessments and evaluation of the necessary research and project design alternatives and proposing the effective solutions in an area of the city before carrying out rescue excavations.
4. The least collision will be caused by creating a balance between urban development and protection of cultural heritage programs.

5. Comprehensive protection measures for cultural heritage elements in the excavation site and the estimation of rescue archaeological exploration and other rescue measures cost.
6. Rescue archaeologists interference in the civil projects and creates significant changes. In some cases, small deviations from civil projects of archaeological projects can protect the historical monuments under demolition.
7. Archaeologists are aware of the initial planning stages of the project to find that the projects to what extent impact on archaeological works.
8. The training of all levels, formal archaeological courses and the exhibition to provide the good understanding of cultural heritage should be included in the programs.
9. The development of academic archaeology courses with the practical training purposes of rescue archaeology and cultural resources management.
10. The correct understanding of archaeology purposes, methods and techniques and training architects, engineers, planners and other professional activities have direct and indirect effects on cultural heritage.
11. Organizing the archaeological museums and exhibitions to encourage heritage protection as a matter of an urgent necessity and creating cultural and educational designed programs to inform the public about the objectives and results of rescue archaeology.
12. If necessary, enacting laws to protect archaeological remains, or considering regulations issue and specific provisions on rescue archaeology.
13. Close international cooperation in the field of rescue archaeology to be launched.

Conclusion

The city is an appropriate research field, not only as a historical and archaeological reality, but also as a modern reality to perform the anthropological and archaeological studies. The urban archeology is to study the relationship between cultural materials and material culture, human behavior and recognition in urban context (STASKI 1982 p.97). Urban context means a fixed place where the distribution of human settlements in the amount of energy per unit of land used is significantly more than the surrounding areas. When we talk about urban archaeology, we mean not only metropolis but all the major population centers (ANFINSON 1990 p.3). Iran as one of the oldest areas of the world civilization where has been governed as the city-states is the great treasure of resources for urban studies. People flooded from the highlands to the plains and several settlements were created in the right spots and along the rivers because of suitable environmental conditions, Iran was created by the first villages of the central plateau. Alborz Mountains in the North and East of Tehran would create North-South and East-West steep lands. Thus, Tehran naturally has been placed into the bowl surrounded by mountains in north, east and south (MOUSAVI, 1988 p.6). This geographical feature created conditions that makes Tehran plain the attractive place for countless human groups, the witness of claim is the identification of about 123 sites from the pre-historic to the Islamic period in Tehran plain (FAZLI et.al , 2004 p.31). The obtained works and evidences including the burial site of the skeleton (under the oven), burial type with clay dishes (burial gift) and clays and stone artifacts showed that the area culturally belonged to the central Iranian plateau in Chalcolithic period. Scattered fragments of animal bones with fine blades around the oven in two trenches (I and VI) that are located far from each other show the evidence of early settlements of

Chalcolithic period under Molavi region. Current evidence suggests that we don't face the compound settlements that had been used in a long time and there is no sign of daily and continued activities in the excavation area. Only available evidence indicates a very small-scale activity around the oven that is sign of cooking and food preparation according to the animal bone fragments, charcoal, plant material, the stone chips, interpretation of the camp area is consistent with the fine evidence of archaeology, continuing and expanding archaeological excavations will help to clarify the nature of the important areas. The works obtained from trench VI is attributable to fifth millennium B.C. or even earlier, means the Pre-Pottery Neolithic period. Conducted tests on two samples of trenches I potteries that were related to the burial of skeleton showed the date of 6950 ± 280 and 6870 ± 300 years ago and another example is related to the trench III dated of the third millennium B.C. The grey clay was found from trench IV belonged to the first millennium B.C. According to this date, multi-period area under Molavi region is discovered. Nevertheless, the establishment and change of settlement patterns from the fifth millennium to the first millennium B.C. and then to the Islamic period can be studied by developing the excavations. The study about whether this is single-burial or is belonged to a part of burial set of fifth millennium B.C., needed to more exploration and achieving more works.

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