FROM THREAT TO OPPORTUNITY: THE CASE OF BAM, IRAN

Eskandar Mokhtari Taleghani, Rasool Vatandoust, Glavije Amirjamshidi

Theme 2: World Heritage Earthen-Architectural Sites, Natural Disasters and Climate Change
Keywords: Hazard, earthen heritage, Bam

Abstract

The earthquake of December 2003 in Bam should be considered the worst hazard to befall one of the oldest standing earthen structures of the world. The disaster severely affected its historical and cultural landscape and destroyed a significant amount of national heritage. This heritage was comprised of religious, residential and public buildings, as well as the ancient city of Bam. The tragedy not only ruined the character of the buildings from their core, but also made earthen resources a distrusted category of building materials in people's minds. Subsequently, the culture of building with earthen architecture lost its good traditional reputation with the risk of tragedy in an earthquake. Six years of hard work after the earthquake, which began with the creation of the Recovery Project of Bam's Cultural Heritage (RPBCH), along with the help of other national and international partners, made it possible for conservators, engineers and architects to rebuild the lost trust in the public mind.

In the aftermath of the earthquake, some major opportunities for meaningful progress in conservation presented themselves. The development of new guidelines for crisis management in cultural heritage, valuable identification of Bam's heritage, recognition of different aspects of the existing earthen architecture, assessment of new technology for conserving earthen monuments and learning the techniques to use them in other historic earthen heritage were among the results of capitalization of these opportunities. In addition to these achievements, educating and training the elderly craftsmen, and the combination of scientific methods with traditional methods also helped to gain the trust of residents. This paper reviews these activities and presents the results within a research framework; it identifies good practices in using the opportunities and proposes new ideas to tackle potential future challenges.

1. INTRODUCTION

The earthquake of the 26th of December 2003 in Bam, Iran seemed like an irreversible tragedy and the destruction of one of the biggest earthen monuments of the world. The six years spent after the earthquake from 2003 to 2009 marked a crucial era for conservators of earthen architecture to improve their knowledge on conservation of earthen architecture.

This paper evaluates the damage and opportunities at the World Heritage Site of Bam and its cultural heritage. The opportunities resulting from the earthquake were not only important for conservation and reconstruction of Bam, but also critical for other similar sites. In conclusion to this evaluation, it is important to mention that the knowledge gained was a significant step forward in the conservation of earthen heritage.

2. DAMAGE

The damage to the architectural heritage of Bam can be classified into two main categories: the first category includes the damage to the body and structure of the heritage in the Bam citadel and the structures near the citadel; the second category is the loss of credibility and reliability of earthen architecture in the mind of citizens of Bam, as well as the rest of the country.

2.1 Damage to the structure

The damage to the structure can be grouped into two categories:

- The first category is comprised of the damage to the architectural heritage inside the city of Bam. The earthen houses, the bazaars, mosques, sacred buildings, Ab Anbars (cisterns), and other communal buildings outside the citadel and in the city of Bam are in this group. The percentage of damage differed in various parts of the city, because the earthquake intensity varied in different parts of the city. For example, the intensity was higher around the citadel, whereas in the south of the city, less damage was seen in earthen structures. Some earthen buildings, like the Arsham School, the henna factory, the Ameri house, the Vakil bath, the Vakil mosque, the Haj Abbas bath, parts of the Zoroastrian complex, and parts of the old hospital of the city were heavily damaged in the earthquake, but were still stable. These buildings were well protected during the conservation phases of the recovery project, but did not have the chance to be fully conserved.
- The second category consists of the damage to the citadel of Bam and the buildings inside. The Bam citadel is an ancient city that was fully inhabited until 200 years ago, when the residents of the citadel started migrating to the nearby orchards. The abandonment of the citadel by ordinary people from the early Qajar era in 1785 until the 1940s made the citadel a fortress monument with a military presence as its sole inhabitant. It was during this period that the Bam citadel was listed on the national heritage list of Iran and was, therefore, protected from further manmade damage. The citadel of Bam is a good example of an untouched pre-Islamic Iranian city that stands today. The fortress, the moat, the huge entrance, the bazaar, the residential quarters, the governor's quarters, the surrounding walls and the watchtower were all fully standing before the earthquake of 2003.

At first assessment, the earthquake damage was estimated to be well over 80%. The Bam citadel appeared to be a mass of ruins; however, subsequent analyses and surveys, revealed otherwise. These surveys were based on the comparison of the volume of the earthen structures before and after the earthquake. For example, the volume of the standing outer-boundary wall of the citadel before the earthquake was 168,570 cubic meters. This volume decreased to 151,319 cubic meters after the earthquake. Thus, the volume of destruction was 17,250 cubic meters, or in other words, 10.33% of the wall. This can also be calculated holistically based on the volume of the entire citadel as a complex (the boundary wall, the important buildings described in the pilot projects, government's quarter and residential areas). In this case, around 195,935 cubic meters were destroyed; this amounts to about 23.7% of the entire volume of the buildings (Keramatfar, 2008).

Despite these higher evaluations, it is imperative to note that the remaining structures were not entirely stable and many different varying levels of stability existed. As a result, the rescue plans were prioritized to emergency conservation of the least stable structures and short-, mid- and long-term actions.

2.2 The loss of credibility of earthen architecture

After the tragedy in Bam, the reliability of earthen architecture seemed questionable, both to the ordinary population of Bam, who were used to seeing the citadel as an unmovable background in their daily lives, and to the professional team assembled on site after the earthquake. Some of the published literature states that the majority of the buildings in the old citadel of Bam, which were earthen buildings, were completely destroyed (Mirzai, Farzanegan, Majedi Arkani, and Nasrollahzadeh, 2003, p. 15). It was also stated that rural earthen houses located in central Iran are relatively vulnerable in massive earthquakes of over 5.5 Ms (Moghaddam, 2003, p. 8). In addition, it is important to note that from the public's point of view, earthen structures were considered to be the cause of death and destruction.

There are no accurate records of the number of earthen structures in the city of Bam before the earthquake, but the total number of adobe structures with vaulted roofs, fired-brick structures with flat roofs, steel structures and concrete structures were estimated to have been around 20,000. In the earthquake, these buildings were damaged with destruction rates between 80 and 100 percent (Papoli Yazdi, 2010, p.56). In

Fig.1 The Bam citadel in 2004 after the 2003 earthquake (credits: RPBCH, 2011)

Fig.2 The city of Bam after the earthquake (credits: G. Amirjamshidi, 2004)

Fig.3 The first international workshop in Bam after the earthquake (credits: RPBCH, 2011)

the process of identifying the buildings that were worth listing in the city of Bam, surveys and field studies were carried out. Sixty-four eligible buildings were discovered as the result of these studies. Most of these buildings were public buildings, such as bazaars, hospitals, schools, mosques, Imamzadehs, baths, etc., while historical houses formed only a small percentage (Ekhlaspour, 2005, p. 213).

Only a small percentage of the city of Bam's 100,000 inhabitants were living in earthen houses at the time of the earthquake. Perhaps surprisingly, the wealthy families of the city were all in this minority. These families lived in earthen mansions surrounded by gardens that substantially contributed to the perceived image of the city.

A survey after the earthquake showed that most people in Bam preferred conserving the heritage using pre-earthquake methods. In this survey, while 85% of the population of Bam expressed their interest in rebuilding the city with its pre-earthquake character and identity, there was an overwhelming desire for adding equipment and enhancing the resistance of the buildings against earthquakes. The opposing minority believed that the earthen architecture was not strong enough against earthquakes (Golpaygani and Einifar, nd, p. 76).

This trend of opposition against living in non-reinforced earthen buildings went beyond the public and the engineering society. Governmental organizations regulating the building and construction work in Iran, with the Iranian Construction Engineering Organization at their lead, adopted more stringent guidelines in assessing the habitability of earthen buildings. This was mainly due to the weakness of earthen structures against earthquakes, and thus the earthquake in Bam ultimately resulted in a decrease in the credibility of earthen architecture in the public's opinion.

3. OPPORTUNITIES FOR IMPROVEMENTS IN THE CONSERVATION OF EARTHEN ARCHITECTURAL HERITAGE

Although the earthquake in Bam caused severe physical damage to the tangible heritage, as well as significant damage to the credibility of the intangible cultural assets of the area, it provided unique opportunities for practitioners to enhance conservation techniques used in earthen architectural heritage. These opportunities include:

3.1 Crisis management for cultural heritage

The importance of the city and citadel of Bam for Iranians was such that an hour after the earthquake, the Iranian Cultural Heritage Organization, which was legally responsible for the support and preservation of historical heritage, formed a crisis headquarters. These headquarters were active for four months and helped to appoint the new management team for the site, clarify duties, and develop an emergency-work program. The crisis headquarters was comprised of seven work committees. Among these, the international-relations committee was responsible for coordination of the international-relief effort and actions undertaken by global organizations and international institutions.

The efforts of this committee resulted in an international workshop that was held on 17 April 2004 for four days. In this workshop, 38 international experts collaborated with 23 Iranian experts, 31 members from the Iranian Cultural Heritage Organization and representatives from national and international organizations from countries like Canada, France, Germany, Italy, Peru, Spain, UK and the USA took part. Representatives from UNESCO and ICOMOS also attended the workshop. The final convention resulting from the workshop contained short-term, mid-term and long-term conservation plans that significantly supported the rescue effort that was orchestrated as a joint international collaboration. It is noteworthy that these efforts formed the first experience for this kind of rescue activity and crisis management in the history of conservation in Iran, and can be considered as good practice in heritage rescue efforts in the world (Mokhtari, 2005; 2008; Momenzadeh, 2005).

3.2 Rediscovery of the Bam cultural landscape

Before the earthquake, Bam was culturally recognized for its glorious citadel only. It is as if the rest of the cultural heritage in the region was completely overshadowed by this magnificent building. Sir Aurel Stein, for example, ignored many of the treasures surrounding Bam as if blind (Stein and Hobson, 1937) (1).

Archaeological studies that were carried out from the first day after the earthquake started to reveal thousands of hectares of valuable historical landscape with numerous sites, some as near as just one kilometer from the citadel. The archaeological artifacts around Bam had remained undiscovered for millennia

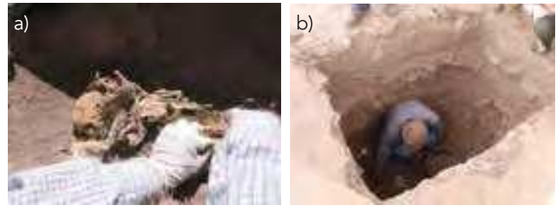

Fig.4 (a) Excavation at the Bam citadel (credits: RPBCH, 2011)
(b) Excavation of roads at the citadel (credits: G. Amirjamshidi, 2004)

and the site only started to attract its deserved attention when the area was inscribed as World Heritage (Adle, 2006).

The archaeological data generated from the activities after the earthquake, revolutionized the knowledge about the history of Bam. This data indicated that the citadel of Bam is only one of the ancient cities in the region, and numerous large cities dating from the Achaemenids to the pre-Islam dynasties existed nearby. In addition, the largest qanat (2) was discovered in the Bam fault (Zareh, 2008). Tools built by Neolithic humans were discovered in and around the citadel as well as in Tal-e-Aatashi 30 kilometers east of Bam. This showed that Bam was populated as long ago as 7000 BCE. Undoubtedly, the studies of the 280,000 pieces of pottery discovered in the debris in Bam will further enhance the knowledge about the history of the southwestern Iran and its culture in the pre-Islamic era. These discoveries resulted, indirectly, from the earthquake in 2003.

Similar studies were also carried out in fields such as archaeological ethnology, anthropology and geology resulting in a wealth of information and rediscovery of the Bam cultural landscape.

3.3. Enhanced awareness of the values in earthen architecture

The Bam earthquake and the subsequent rescue effort, which was conducted in an atmosphere of national and industrial collaboration, raised awareness for the many aspects of earthen-architecture conservation for practitioners and interested parties.

Most importantly, the attention of the international conservation community was drawn to the fact that the majority of the Iranian architectural heritage is built from earth. As Iran is located entirely in a seismically active area, more vigilance and prudence is necessary in the conservation of the built monuments. The importance of this awareness becomes more prominent when attention is paid to the fact that Iranian earthen architecture guards the bulk of the historical data and archaeological documents in the country. This invaluable archaeological evidence was found after the earthquake, during the excavations (Shidrang, 2005; Sajjadi, 2007). The only way to preserve, study and rediscover this historical data is to conserve the earthen buildings that contain and embody this knowledge. Bam has been an integral example in this process

Alignment of earthen architecture with human nature, limiting the waste of energy in heating and cooling of buildings, local sourcing of building materials in earthen architecture, and the economy of construction in earthen buildings are among the other values that were reconsidered as a result of enhanced awareness at Bam.

3.4 Technological discoveries in conservation of earthen heritage

Many of the conservation approaches that were adopted in the six years' worth of rescue activities after the earthquake in Bam were being tried for the first time.

The majority of these approaches relied on the basis of introducing construction-engineering knowledge into the conservation effort. Before the experience in Bam, the conservation approaches for preservation of earthen architecture was based on traditional methods of the past. These traditional methods included the elimination of damaged elements and adding new adobe structures. In Bam, it was no longer acceptable to remove original materials or to replace unstable elements with newly constructed artifacts, as this would severely affect the authenticity of the heritage. Therefore, new methods for stabilizing the remaining structures were needed. These methods included introducing engineering practice into earthen structures.

The first step was the establishment of the earthen material-studies laboratory in the site with the support of CRAterre. This laboratory analyzed the building materials, including the adobes used to construct the citadel. In addition, the laboratory performed mechanical tests on the materials to ascertain their properties. The efforts undertaken in the laboratory resulted in the development and building of authenticity-based adobe with maximum tensile strength (Hadian 2005; Ejrai, Esrafily, and Rasekh, 2005; Esrafily, Ejrai, Farahbakhsh, Asadollahi, Rasekh, and Hadian, 2005; Ahmadi, 2005; Esrafily, Ejrai, Rasekh, & Hadian, nd; Amirjamshidi, Fodde, & D'ayala, 2012) provide an overview of materials used before and after the earthquake in the conservation of Bam's citadel.

The next steps concerned with reinforcing standing earthen structures after the earthquake. Three activities were undertaken in parallel:

- Collaboration was sought from international institutes with expertise in the subject of adobe structural strength. The interested parties were each assigned a project: Dresden University of Technology undertook work in conservation of the Sistani house; the Italian Ministry of Cultural Heritage and Activities commenced work on Tower 1; CRAterre in France assumed responsibility for the second gate; and Politecnico di Milano and the University of Padua from Italy became jointly responsible for the Mirza Naim house conservation. These projects were envisioned as pilot projects.
- Soil Engineering Services (SES), consulting engineers,

were invited to perform studies on injection grouts. National universities with relevant expertise were also invited, to assume the responsibility for pilot projects. Among these, only Isfahan University, which had previous experience in reinforcing historical buildings, was charged with the conservation of Tower 32.

- A national engineering group was formed at the site from structural and civil engineers with experience in analysis of seismic areas. The Payambar Mosque, the warehouse adjoining the Sistani house, and the Tekkiye (3) were chosen as pilot projects for this group.

These steps were taken to gain experience and develop the necessary technology to reinforce and stabilize the standing adobe structures and to control the lateral forces in these structures to eliminate the weaknesses.

The collaborations between the international community and the young Iranian experts resulted in the following:

- Development of techniques for reinforcing materials and structures of earthen architecture.
- Design and construction of the necessary tools for implementation of the above techniques (e.g. grout-injection tools, levers for moving structures, etc.).
- Study of materials and additives required for reinforcing earthen buildings at the foundations, load-bearing elements and coatings.
- Education and training of experts and craftsmen.
- Use of local materials to reinforce earthen structures.
- Study of the use of structural-modeling software for application in conservation of earthen architecture.

Consequently, useful expertise in reinforcement and stabilization of adobe structures was generated as a result of the rescue efforts in conservation of the Bam cultural heritage. This expertise is not only useful in the continuation of the conservation work at Bam, but is also good practice applicable to other similar sites around the world.

3.5 Attempts to revive the culture of earthen architecture

In a conference after the Bam earthquake, Dr. Ghalibafan, a major structural engineering figure in Iran, said, “Engineering in Iran has abandoned earthen architecture”. Bam’s earthquake greatly affected people’s faith in earthen architecture and its benefits; the majority of the population thought of earthen architecture as the main reason that the death rate had been so high in the earthquake, even though buildings made from other materials were also destroyed. At the time, the society of engineers in Iran were of the opinion that buildings using modern materials could have been designed to better withstand the earthquake but, in their mind, earthen buildings would never have been able to resist earthquakes of such magnitudes.

This lack of attention by engineers could have had devastating effects on the future of earthen architecture

Fig.5 World Heritage logo at the entrance of the citadel (credits: G. Amirjamshidi, 2011)

in the country, and hence there was a need for some effort in reuniting the engineering disciplines with earth as a building material. The path towards this reunion has been precarious, but lessons learned from the conservation of Bam after the earthquake has created new hope. The efforts in building more earthquake-resistant earthen structures and reviving the culture of building with earth have given rise to a new horizon for these buildings in Iran and throughout the world. In the six years after the earthquake, the following activities where undertaken in Bam in this regard.

3.5.1 Education and training of craftsmen

The recovery effort after the earthquake created a unique opportunity for earthen-building techniques to be taught to a new generation of young professionals. A number of expert professionals in the field, who had been in Bam at the time of the earthquake, had unfortunately perished in the disaster, and thus the number of experts had dwindled. During the six years of the project, the remaining professionals were heavily encouraged to mentor new students, and as a result of this program, newly trained young professionals learned the techniques to use and pass on to future generations. For example, in the production of khesht (adobe), the project started with a single professional. He was originally placed in a group with two assistants, who later became experts in their own respective groups. In 2009, there were six groups active in khesht production, each with one expert and two apprentices, and thus the number of professionals in this trade, traditionally called kheshtmal, had risen from one to 18 in six years.

3.5.2 Educating students

Aside from professionals who were working full-time or temporarily in different parts of the Bam project, university students interested in khesht and earthen architecture were involved through many student projects during the six years. In addition to the students from the Universities of Bam, Kerman, and other Iranian cities, some projects were completed with students from Italy, Germany, and France. All of these projects were aimed at reviving earthen-architectural culture.

3.5.3 Involvement in other earthen architectural projects

During the tim that the post-earthquake reconstruction efforts were being carried out, two other earthen architectural-construction projects were completed. The first was the construction of a sample earthen structure by CRAterre in the Iranian Housing Foundation (Bonyad-e-Maskan) exhibition. The second project was the building of two sample projects by the Nader Khalili Foundation in the city of Baravat. In a period of time where earthen architecture was mistrusted by the public, perhaps undeservedly as a result of the Bam earthquake, the Bam Recovery Project Office had the responsibility, as the guardians of this ancient method of construction, to utilize every opportunity to maintain the core competences required for gradual recovery of the practice. The office, therefore, participated in both of these projects by supplying the craftsmen, labor, and, in the case of the CRAterre project, the required materials. This participation was in line with the goal of reviving the culture of earthen architecture in Bam.

3.5.4 Construction of an earthquake-resistant earthen-architecture unit

Investigating methods for retrofitting earthen buildings in villages around Bam was another useful step in preserving the culture of earthen architecture in Iran. Consequently, the Bam Recovery Project carried out a joint effort with a postgraduate researcher from the University of Kassel, Germany to build a sample earthquake-resistant khesht building. The resulting structure was reinforced with organic fibers and resins, and was finished in 2007 (Nejati, 2008).

3.5.5 Other attempts

Other attempts to revive the culture of earthen architecture included: publishing reports, participating in related seminars, and organizing meetings with Bam’s City Council and culturalheritage enthusiasts.

3.6 Establishing the heritage zones of Bam and its cultural landscape

Prior to the earthquake, many houses were built in the vicinity of the ancient city of Bam and the citadel without appropriate consideration for heritage. The destruction resulting from the earthquake gave rise to a unique opportunity to put in place boundaries and limits for construction. In the city of Bam,

Fig.6 New students learning from the professionals (credits: RPBCH, 2011)

a maximum height of 10.5 meters was set for all building construction to protect the cultural landscape. Many properties had been occupied based on dubious legal foundations around the citadel. After the earthquake, the conservators could put in place rules to disallow the same thing from happening again. Another example is the street to the south of the citadel and the surrounding gardens and orchards, which had been put in the care of the municipality of Bam before the earthquake. The responsibility for these areas were given to the Bam Recovery Project as a result of the zoning for inclusion in the World Heritage listing; this opportunity allowed significant steps to be taken towards the conservation of the cultural landscape in Bam.

4. CONCLUSION

Natural disasters, such as earthquakes, result in irreplaceable damage to earthen architecture. The experience in Bam showed that despite the devastation that is left in the wake of such events, many unique opportunities for radical rethinking of conservation approaches can also appear. Exploitation of these opportunities could allow some good to come out of an otherwise horrendous event and provide some degree of consolation. The six years of conservation after the earthquake in Bam are a good example of such capitalization of opportunities with the support of the national and international communities. During this period, Bam was not only a reconstruction site and a historical heritage-conservation project, but also a leading world-research facility for developing and testing new ideas in preservation of the earthen-architectural heritage.

Notes

(1) Stein stayed for three days in Bam, from 20 to 23 April 1932, but did not manage to see any of the archaeological sites that he intended to visit.
(2) Wells connected with underground tunnels, a popular method of irrigation in arid areas of the Middle East.
(3) A stage for traditional religious theater.

References

Adle, C. (2006). Qanats of Bam, archaeological point of view. *Third Congress of the History of Iranian Architecture and Urbanism*. Vol. 5.

Ahmadi, M. (2005). A report on the discovery of clay mine in Bam plain. *Annual Report of Arg-e-Bam Research Foundation*. Vol. 1, pp. 158-166. Bam, Iran: Archive of RPBCH (Recovery Project of Bam's Cultural Heritage). In Persian.

Amirjamshidi, G., Fodde, E., & D'ayala, D. (2012). An investigation into the materials used for the conservation of Bam. In Terra 2012 CD-rom. Lima, Peru: Pontificia Universidad Catolica del Perú.

Ejrai, S., Esrafily, A., & Rasekh, N. (2005). Soil mechanic laboratory: Methods and techniques. *Annual Report of Arg-e-Bam Research Foundation*. Vol. 1, pp. 101-116. Bam, Iran: Archive of RPBCH. In Persian.

Ekhlaspour, A. (2005). Relics and limits of the Bam city: Restoration of the old bazaars (markets). A*nnual Report of Arg-e-Bam Research Foundation*. Vol. 2, pp. 213-218. Bam, Iran: Archive of RPBCH. In Persian.

Esrafily, A., Ejrai, S., Rasekh, N., & Hadian, M. (nd). *Documentation of Mud Brick Laboratory in Bam: Tower 1*. Archive of RPBCH (Recovery project of Bam's cultural heritage) Bam. In Persian.

Esrafily, A., Ejrai, S., Farahbakhsh, M., Asadollahi, M., Rasekh, N., & Hadian, M. (2005). *Annual Report of Arg-e-Bam Research Foundation*. Vol. 1, pp. 123-140. Bam, Iran: Archive of RPBCH. In Persian.

Golpaygani, A. & Einifar, A. (nd). *Guide and Typology of Building in Bam*. Tehran, Iran: Ministry of Housing and Urban Development. In Persian.

Hadian, M. (2005). A glance over laboratory achievements of the Arg-e-Bam Urgent Recovery Project. *Annual Report of Arg-e-Bam Research Foundation*. Vol. 1, pp. 98-100. Bam, Iran: Archive of RPBCH. In Persian.

Keramatfar, M. (2008). Account of damage to Arg-e-Bam cause of earthquake (December 2003). *Annual Report of Arg-e-Bam Research Foundation*. Vol. 2, pp. 93-104. Bam, Iran: Archive of RPBCH. In Persian.

Mirzai, H., Farzanegan, E., Majedi Arkani, M., & Nasrollahzadeh, K. (2003). Specifications of the earthquake of Bam and its damages. *Abadi*. Vol. 40 and 41. In Persian.

Moghaddam, H. (2003). Earthquake of Bam, destruction of 2700 years in 7 seconds. *Abadi*. Vol. 40 and 41. In Persian.

Mokhtari, E. (2005). A glance over post-earthquake activities of the Arg-e-Bam Urgent Recovery Project. *Annual Report of Arg-e-Bam Research Foundation*. Vol. 1, pp. 12-21. Bam, Iran: Archive of RPBCH. In Persian.

Mokhtari, E. (2008). Preface. *Annual Report of Arg-e-Bam Research Foundation*. Vol. 2, pp. 8-18. Bam, Iran: Archive of RPBCH. In Persian.

Momenzadeh, M. (2005). ICHTO international activities after earthquake of 26 December 2003 in Bam. *Annual Report of Arg-e-Bam Research Foundation*. Vol. 1., pp. 12-21. Bam, Iran: Archive of RPBCH. In Persian.

Nejati, M. (2008). Report of engineering-technical activities in urgent recovery project of cultural heritage of Bam. *Annual Report of Arg-e-Bam Research Foundation*. Vol. 2, pp. 19-38. Bam, Iran: Archive of RPBCH. In Persian

Papoli Yazdi, L. (2010). Bam, an ethnoarchaeological study, tragedy, theory and goal. Existence or nonexistence. *Papoli*. In Persian.

Recovery Project Of Bam's Cultural Heritage (RPBCH) Office. (2011). Photographs of Bam. RPBCH archive.

Sajjadi, L. (2007). *Introduction and documentation of excavations of the school in west of Arg*. Bam, Iran: Archive of RPBCH. In Persian.

Shidrang, S. (2005). An examination on Tell Atashi stone artefacts. *Annual Report of Arg-e-Bam Research Foundation*. Vol. 1, pp. 93-95. Bam, Iran: Archive of RPBCH. In Persian.

Stein, M.A. & Hobson, R.L. (1937). Archaeological Reconnaissances in North-Western India and South-Eastern Iran. Teheran, Iran: Macmillan Publishing. In Persian.

Zareh, S. (2008). Archaeological studies in Afraz-fault of Bam, *Annual Report of Arg-e-Bam Research Foundation*. Vol. 2, pp. 75-80. Bam, Iran: Archive of RPBCH. In Persian.

DOCUMENTING EARTHEN-ARCHAEOLOGICAL SITES – THE ISCEAH GLOSSARY OF DETERIORATION PATTERNS

Louise Cooke, Enrico Fodde (†), Sandeep Sikka, Julio Vargas-Neumann

Theme 3: Documentation, Conservation and Management of Archaeological Sites
Keywords: Damage, decay, earthen sites, terminology

Abstract

Traditional and contemporary earthen construction can be identified in most European countries. The ecological and sustainable advantages associated with European earthen-building traditions make it a relevant material for construction nowadays. However, despite recent technology, earthen heritage remains fragile and threatened. This is why the protection of this unique heritage and the diffusion of contemporary earthen architecture in Europe deserve to be further acknowledged and supported.

In that aim, a European project was implemented in 2006-2007 making a state of the art of earthen architecture in Europe, particularly in France, Italy, Spain and Portugal. In order to complement these results at the scale of the European Union and to ensure a widest dissemination, a new project "Terra InCognita – Earthen Architecture in Europe" was launched in November 2009 for a period of two years. The aims of the research project were challenging: a scientific publication gathering the contributions of authors from the 27 European Union countries; an updated European cartography concerning traditional earthen techniques; a scientific exposition and a photography exhibition, a European label, as well as a comprehensive website (www.culture-terra-incognita.org). The research project also initiated the launch of a European network during a symposium held in Marseille (4-6 May 2011).

This paper presents the results of the Terra InCognita project, as well as a reflection concerning the relevancy of these kinds of initiatives, as they can contribute for the advancement of knowledge regarding earthen heritage, as well as the establishment of strategies to protect earthen heritage.

1. INTRODUCTION

1.1 The need for a glossary of deterioration patterns

The need to document earthen architecture and its deterioration has been an issue since the development of the scientific approaches to conservation. The start date for earthen architecture is often considered to be 1966 with the establishment of ICCROM's scientific program through a partnership between the University Museum, Philadelphia and the Italian Archaeological Institute in Baghdad and Turin (Carter and Pagliero, 1966). Documentation has been an issue highlighted at many of the Terra conferences, since their initiation in 1972 (Hughes, 2002; Matero and Cancino, 2002; Cooke, 2010a).

ICOMOS-ISCEAH International Scientific Committee for Earthen Architectural Heritage supported the compilation of the document, as consolidating both vocabulary and terminology would be of great help for practitioners and academics. At present, there is no similar tool that deals with earth, as a building material. As such, the current initiative is the response to a growing need for a standardized approach for documentation of deterioration patterns, particularly in light of the growing interest in the conservation of archaeological sites. There is also recognition of needs for both research-led documentation of earth structures alongside more rapid documentation of earthen architecture, given the assumed complexities of its environmental susceptibility and given the likely impacts of climate and climate change.

Moreover, the professionalism of 'documentation' as a discrete technical discipline allied to, but not necessarily undertaken by, archaeologists, conservators or earth building specialists – and particularly the one undertaken by technicians