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APPROACHES FOR THE CONSERVATION OF THE NINMAKH TEMPLE IN BABYLON, PRELIMINARY STUDIES AND PROJECT

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Abstract

This paper highlights the methodological approach used for the project of conservation, recovery, and reuse of the temple of Ninmakh in Babylon, a monumental building of significant importance dating back to the Neo-Babylonian period (626-539 BC), in which Babylon was the capital of one of the most powerful empires known at the time.

Babylon is the subject of a project called The Future of Babylon, funded by the U.S. government and conducted by World Monuments Fund (WMF) in collaboration with the Iraqi State Board of Antiquities and Heritage (SBAH). For WMF, Dr. Josephine D'Ilario, in collaboration with the co-authors of this contribution, drew up the project for the conservation and recovery of the temple, starting from previous mission reports carried out since 2005¹. The project provides for interventions to manage and preserve the archaeological site of Babylon.

Located 85 km south of Baghdad, the area includes the remains of the defensive walls and the famous Ishtar gate, palaces, and temples. These testify to Babylon's grandeur during imperial eras, which saw a succession of emperors, including Hammurabi and Nebuchadnezzar II. Babylon's fame and myth make it a significant site, which brought it to be included in the UNESCO list of World Heritage Sites in 2019.

This contribution covers the temple of Ninmakh, which has been, together with the Ishtar Gate, the subject of a meticulous and complex conservation and recovery project for more than 15 years. The complexity of the site derives not only from the nature of the archaeological remains built with earth but also from the reconstruction works that took place from the end of the '40s until the end of Saddam Hussein's regime in 2003.

Keywords: earthen archaeological heritage, conservation, management plan

¹ Mission reports and inspection results by John Curtis for UNESCO, 2005-2009, and initial assessment reports of the condition of various monuments in Babylon, including the Ishtar Gate by Mahmoud Bendakir (2010-2011).

1. Introduction

The site of Babylon covers about 10 hectares, of which only 85% has been excavated to date. The excavations, started in the mid-twentieth century by the Iraqi government, continued until the outbreak of the First World War by the German Robert Koldewey. At the time, important buildings had been unearthed, including the iconic Ishtar Gate, the processional way, the south palace and the north palace, the temples of Esagila, Nabu-sha-hare, Ishtar and Ninmakh, the ziggurat Etemenanki. [1]



Photo 1. View of the temple of Ninmakh to the right of the Ishtar Gate and the processional way. Credit: Ammar Al Tae

Most of the excavation works have been reconstructed in recent times, as part of the project "Archaeological Restoration of Babylon" commissioned by Saddam Hussein with the intention of cultivating the cult of his image. The bricks used for the reconstructions bear an inscription similar to that of his ancient predecessor Nebuchadnezzar: *"In the reign of the victorious Saddam Hussein, the president of the Republic, may God keep him the guardian of the great Iraq and the renovator of its renaissance and the builder of its great civilization, the rebuilding of the great city of Babylon was done in 1987."*

The reconstructions focused on the South Palace with 250 rooms, 5 large courtyards, and large entrance arches, a long stretch north of the processional route, the Ishtar gate, the temples of Nabu-sha-hare, Ishtar and Ninmakh, as well as the theater built by Alexander the Great.

The main reconstruction works, completed in 1987 and celebrated starting from the same year with the Babylon Festival, an annual event that brings thousands of visitors to the site, were carried out with materials and techniques that were not consistent with the remains found, and without a rigorous methodology. Of the whole process, which took place in a relatively short period, almost no technical documents or descriptive reports are available.

These operations have not only strongly undermined the authenticity of the site and the monuments brought to light, but also caused in many cases major structural alterations and instability.

The authenticity of the site is also threatened by the construction of other more recent constructions, dating back to the military occupations of the site during the Second Gulf War, to which are added the presence of waste, the lighting of fires and other environmental factors [2]. The conservation and recovery operations of individual monuments therefore require not only a careful study of the monument itself and its subsequent reconstructions, but also a critical reading of the environmental and social context around them.

2. The Ninmakh temple

The temple dedicated to the mother goddess Ninmakh was first unearthed during the excavations of Iraqi Hormuzd Rassam for the British Museum in 1880 and later in more depth by the German Robert Koldewey during his mission carried out in the period 1899-1917.

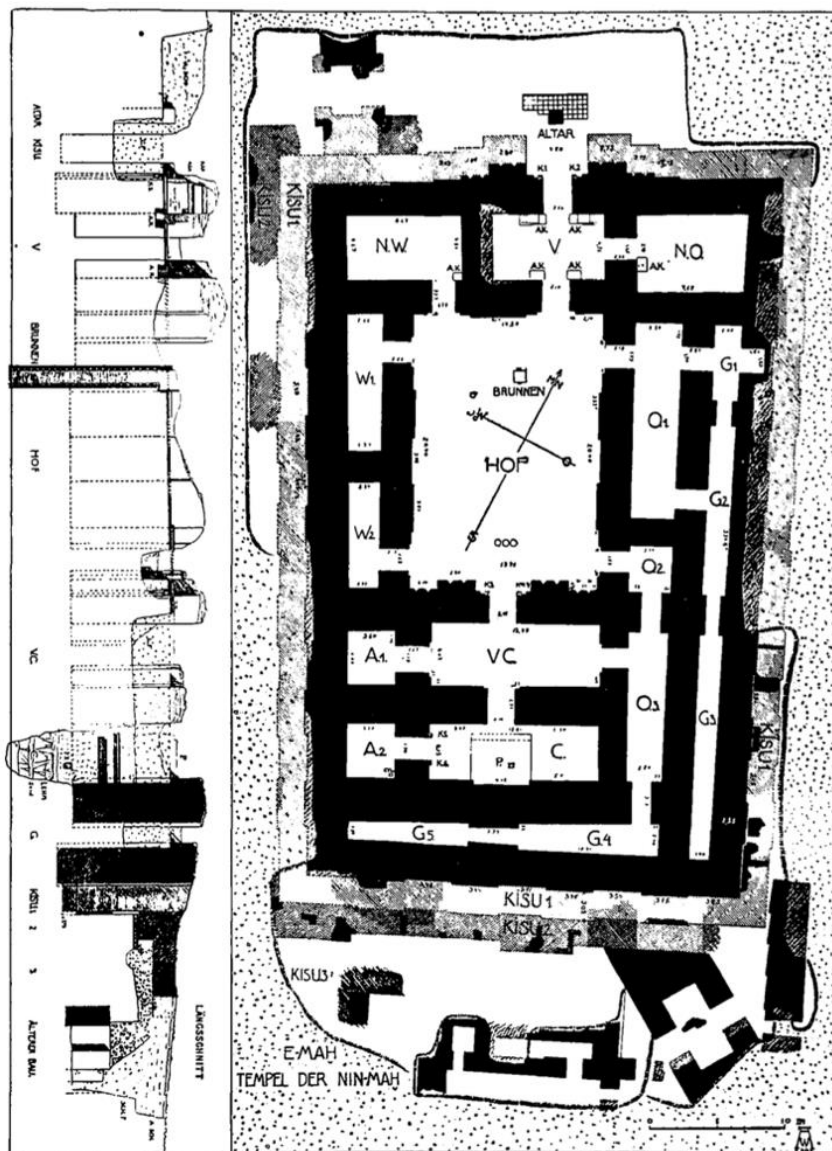


Photo 2. Temple plan by R. Koldewey

Excavations testify that the temple was rebuilt at least three times, one of which was certainly in the period of King Ashurbanipal (668-626 BC), as confirmed by the cylinder found inside the cella, at the foot of the foundation [3], and a second during the reign of Nebuchadnezzar II (604-562 BC), a period in which the city reached its most productive and extraordinary phase in architectural and urban development. In fact, the beautiful glazed ceramic decorations of the Ishtar gate and the processional route, icons of Mesopotamian culture, date back to this period [4] [5]. The quadrangular building covers an area of about 1500 square meters by 6 m. high, has a large internal courtyard of 278 square meters, and is mainly made of adobe of 33 X 33 X 12 cm and 16 X 33 X 12 cm.

The temple, as it appears today, is the result of the reconstruction carried out by the government since the 50s on the archaeological remains brought to light during the excavations of Robert Koldewey. As no information about the phases of this reconstruction is available, the definition of a correct intervention methodology has been particularly challenging. Very different materials ranging from earth to gypsum, from bitumen to lime, from brick to cement, make this building

a real test bed for its conservation and recovery. The ancient parts, until recently hidden by earth plaster, are not always easily distinguishable from the reconstructed portions, which, not having been carried out in a workmanlike manner and having not been in any way connected to the existing structures, in a short time have shown degradation of various kinds: crumbling, detachment, subsidence, detachment, and even collapses.

3. Preliminary investigations

In the pre-design phase, particular attention was given to preliminary investigations.

A series of detailed reports regarding the history of the building and its factory were written by Josephine D'Ilario and Olof Pedersén respectively. [6] [7]

The investigations carried out on the building, all of non-invasive type, included a metric and photogrammetric survey, the identification of the materials used, the survey of building pathologies, the analysis of structural instability, the surveys at the base of the external and internal walls, *in situ* investigations of the materials to verify their main characteristics. In addition, a substantial diagnostic apparatus has been put in place to know the entire structure in detail to allow a more scientific approach to the resolution of individual pathologies.

The metric and photogrammetric survey, carried out by architects Saba Sami Al Ali and Dima Zabar, allowed not only the restitution of the plans, elevations and sections of the building, but also the surveys of the construction details, the materials used and the evident pathologies of the individual construction elements.

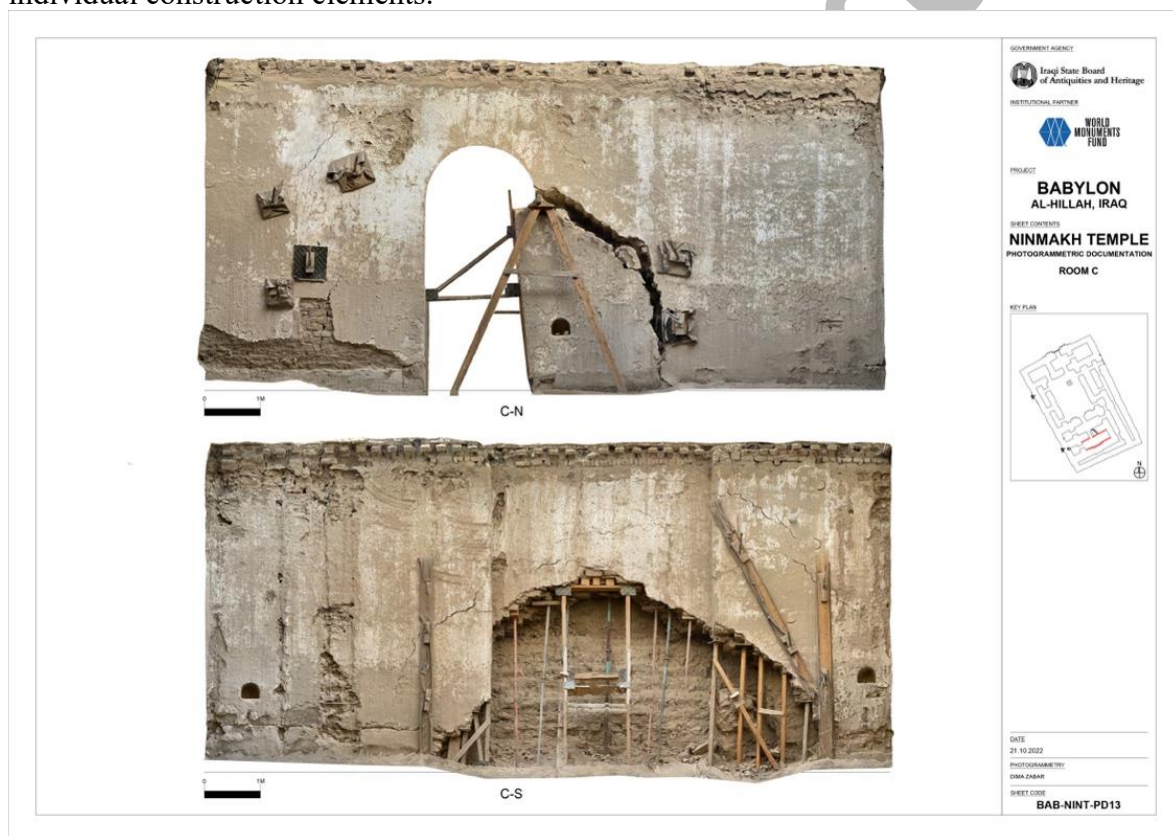


Photo 3. Photogrammetric documentation, WMF

Subsequently, a survey was carried out on the structural conditions of the building by the ZRS studio in Berlin, a group with long experience in the diagnosis and structural adaptation and recovery of important sites in Mesopotamia. This study resulted in the project for an initial safety of the structure and some of the recurring problems in the building were highlighted, mainly related to the walls rebuilt in recent times. [8]

Photographic Documentation

Assessment and Sampling (ASS)

Project-No.: 22020

Project: WMF Babylon



Photo no. ASS-11

Bricks used for the construction of the Kisu (Kisu brick 1), solid brick



Photo 4. Photographic documentation, WMF

During the same period, Josephine D'Ilario and co-author Ammar Al Taei, an archaeologist commissioned by the Iraqi State Board of Antiquities and Heritage in Babylon, conducted a series of interviews with local adobe makers to catalog local craft manufacturing processes and methodologies. [9] A set of "recipes" was collected and reproduced on site for an initial study useful for the start of a new production. This in-depth study was also particularly interesting for understanding the workmanship of the adobes of the original factory and was a great inspiration for the subsequent production of the almost 20,000 adobes used from 2021 to date for the renovation works.

4. Methodological approach

Although the authenticity and integrity of the ancient remains were severely compromised with the reconstruction interventions, the building preserved an important historical and interpretative value, as well as a good adequacy for adaptive reuse.

For this reason, the conservation project [10] focused on the preservation of the building in its current form, thus including the new reconstructions, but paying particular attention to the recovery of its historical material and the maintenance of its form as a general representation of a temple of the Neo-Babylonian era. The intervention process deliberately wanted to preserve traditional building materials and practices, which were essential to emphasize the oldest building practices used in Babylon and Mesopotamia. [11]

The proposed methodologies were based on the use of common and contemporary materials, methods and practices for the conservation of archaeological sites. Most of the choices were based on interventions that could be easily identified and possibly removed without damage during future maintenance operations. The proper preservation of all materials and elements from the different periods of the history of the Ninmakh Temple has been placed at the center of all actions but always giving priority to the oldest ones.

The conservation methodology of this intervention focused on overcoming some recurring errors made in past decades concerning the conservation of historical materials. In particular, the concrete blocks positioned at the base of all the walls were almost completely removed to counteract the effects of humidity rise by capillarity. The use of cement for the conservation of earthen archaeology is in fact completely discouraged due to the different physical behavior of the two materials, one elastic and permeable to air and humidity, the other rigid and sealing. The latter factor is the reason why, in the presence of moisture condensation, the weaker material disaggregates. In addition, its subsequent removal without damage to the underlying structure is practically impossible.



Photo 5. Cement blocks and degradation at the base of the wall. Credits: M. Achenza

The research and choice of suitable materials for the temple restoration was carried out to ensure the most appropriate protection of the original materials (adobe, bricks and earth or lime mortar) of different construction periods. It is believed that the diversified approach applied in point interventions can guarantee their durability, aesthetic appearance and ease of removal should further interventions become necessary in the future.

The interventions were carried out through the preventive performance of tests to define the most suitable mixture of earth for the production of new adobe and mortars based mainly on the use of natural and historical materials already successfully tested in the conservation of earthen archaeological sites. Lately, a methodology was defined to allow a non-invasive and coherent connection between the new structures and the pre-existing ones. Numerous prototypes were made of both adobe and bricks to obtain the most suitable blocks for the replacement of deteriorated parts.

Following the same logic, differentiated mortars were developed for the installation of the two different types of blocks (adobe and brick). Only when necessary, have natural additives been added to the mortars, such as lime, to improve their mechanical resistance and ensure good performance against humidity and rainwater.



Photo 6. Tests and samples for plasters and mortar. Credits: M. Achenza

5. Choice of soils and adobe production

The soils for the production of adobe and mortars used for the masonry, for the plasters and for the consolidating injections, have been carefully chosen from the soils available in the vicinity. In general, these are soils with a very fine grain size, less than 0.50 mm, very cohesive and difficult to manipulate. For this reason, it was necessary to mix them with percentages of aggregates, also of fine grain size (less than 4 mm). The adobe production process was carried out according to traditional local practices. Inside a pool made of earth, a quantity of material of about 17 cubic meters was hydrated for more than two weeks. Afterwards, the material was further mixed with straw (7 bags per tank, about 28 kg) and repeatedly mixed and "washed" with drinking water to eliminate the large quantities of salts. At the time of the production of the adobe, more straw was added to the mixture (2 bags, about 7 kg) and the material was further worked barefoot. Considered that production took place in the months from May to September, the drying times were very short: two weeks to turn the adobe over on the side and another two for complete drying.

The traditional method, with long hydration times, has proved to be significantly more effective than the systems currently used today. The effective soaking of the organic components contained in the soils seems to give the mixtures much better-quality characteristics and stability. The adobe produced in this way have a very regular appearance, rarely have cracks and, when present, they are of negligible size.

It was not possible to carry out tests in the laboratory, but the numerous compressive strength tests carried out on site during the various stages of production confirmed the good workmanship of the blocks, sometimes excellent.



Photo 7. Adobe production outside the temple. Credits: M. Achenza

Water resistance has also been tested with investigations aimed above all at verifying the ability to rise by capillarity. Again, the results proved to be appreciable.

Bedding mortars and plaster mortars are all earth-based, with earth/aggregate (sand) proportions varying depending on the application surface and with the addition of straw cut to about 2-3 cm. in length. Even the plasters applied to portions of external brick masonry are earth-based, added with lime to ensure watertightness.



*Photo 8. Compression tests on adobe and water resistance test on earth-lime plasters.
Credits: M. Achenza*

6. Restoration and consolidation of walls

During the works, numerous restoration and wall consolidation interventions were necessary, not initially planned. This is due to the fact that the damage inside the recently built masonry was not always visible. However, the detachment of the ancient structures from the new reconstructions is practically constant, which has made the entire structure very precarious in some places and the superficial lesions of no negligible extent. The interventions concerned almost all walls, both external and internal, which were treated with a stitching system to restore the cracked parts and subsequent filling with a slurry of earth.

Only in very few cases was it necessary to place additional reinforcements with fiberglass bars, fixed with natural hydraulic lime. This system, applied by engineers Christoph Ziegert and Tobias Bieger - ZRS büro Berlin, ensures good stability for the subsequent installation of the roofs.



Photo 9. Wall stitching and earth grouting. Credits: M. Achenza

7. Other completion interventions

Considering the general condition of the building, as reported at the time of the beginning of the restoration project, numerous additional actions aimed at the conservation of the temple of Ninmakh were necessary. These included not only reconstruction and restoration works of the deteriorated walls, but also the reconstruction of the large arch connecting the cella and the antecell, the total reconstruction of the roofs, an external drainage system, the conservation of the only portion of plaster dating back to the Neo-Babylonian period.

As the project is now in its final phase, we can confirm that the indispensable works of safety, reconstruction, and others aimed at the aesthetic improvement of the monument are about to be completed. We hope to be able to proceed with later interventions to adapt the structure so to accommodate not only activities related to cultural tourism, but also others related to the Babylon Festival, an significant annual event during which events such as temporary exhibitions and chamber concerts can be held inside the temple.

8. Capacity building

The conservation project included capacity building actions for the local community with the aim of restoring cultural knowledge about traditional construction lost over time. Over a period of four years, 12 masons were trained as technicians specialized in the recovery of ancient earth constructions.

In addition, an important project funded by the Autonomous Region of Sardinia has allowed the holding of two *hands-on workshops* aimed at students of Nahrain University in Baghdad and Karbala University. Two PhD students from the Faculty of Civil, Environmental and Architecture Engineering of Cagliari as well as two professors also participated in the workshops. The joint activities, developed over about two years, represented the premises for the stipulation between the Universities of Cagliari and Nahrain of a *Memorandum of Understanding* that will allow the two institutions to share research and dissemination activities and activate a mutual exchange of students and teachers.

9. Conclusions

The project for the conservation and recovery of the temple of Ninmakh in Babylon can be considered a pilot project within the archaeological heritage of Mesopotamia. Being the first project for the recovery of an earthen structure rebuilt in Babylon, it has addressed several challenging issues related to the peculiarity of previous interventions, which have caused a diversified series of structural problems and incompatibility between materials and elements.

The decision to preserve the monument in its entirety, with its historical stratifications, the use of different materials, represented a challenge for the conservators, archaeologists, historians, architects and structural engineers who participated in the work. The methodologies used included the exclusive use of local and natural materials, the implementation of reversible interventions, the application of artisanal and traditional local techniques, the enhancement of the portions of the ancient building and the training of specialized personnel.

In addition, the rich documentation (graphic, photographic, descriptive) produced during each phase of the intervention is made available by WMF to the local management authority, the Iraqi State Board of Antiquities for future maintenance.

The Ninmakh temple recovery project is therefore meant to become in the future a model for interventions on similar monuments, such as the nearby temples of Ishtar and Nabu-sha-hare, now in a state of severe degradation.

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