Troia Roman Baths (Portugal) – Assessment of history of interventions

Ana Margarida Monteiro
Conservator-restorer, IPPAR, Lisbon, Portugal, mmonteiro@ippar.pt

Paulina Faria Rodrigues
PhD (civil eng.), Universidade Nova de Lisboa, Lisbon, Portugal, mpr@fct.unl.pt

SUMMARY: *This paper presents a study of one of the roman architectonic complexes from Troia archaeological site: the Roman Baths. The first archaeological excavations campaigns and the different Roman monuments that constitute the whole site are presented, as well as the historical past conservation and restoration interventions and the most important decay factors. The Roman Baths are one example of a complex that has been intervened in, at least, two different periods of time. An assessment was made in order to understand and document its actual state of conservation, to help planning a future coherent conservation operation.*

KEY-WORDS*: baths, masonry, mortars, interventions, conservation.*

I. INTRODUCTION

Portuguese archeological sites have been submitted to interventions since the decades of 50 to 70 of the last century. These interventions were developed without great care in terms of planning, coordination, materials and human skills.

The main purposes of these operations were to consolidate and protect the archeological structures, after excavation. They often used different mortar formulations, depending on their function, locally available materials and traditional techniques of workmanship.

After more than thirty years, the interaction between new mortars and the original substrates can be observed. Incompatibility is often observed by the occurrence of fissures, detachments and salts contamination.

The absence of preliminary studies and the lack of records and documentation about interventions held in the past do not facilitate their analysis, in order to obtain consistent survey. That information would be a precious tool, allowing the evaluation of those interventions.

Nowadays conservation interventions have a different approach. They begin by a first phase of study, documentation and diagnosis of the architectonic complex, which are the object of the intervention. These phase is often supported by a laboratorial campaign, with the aim of better knowing the materials composition, their possible interaction and eventual pathology identification, before any direct treatment.

The importance and applicability of this methodology is exemplified in a research work held over the archeological site of Troia - a Roman archeological site with an extended and diversified intervention history of conservation and protection.

II. TROIA ARCHAEOLOGICAL SITE

Troia archaeological site comprehends one of the most exceptional fish-salting industries of the Roman Empire. Built by the end of the century I b.C., it kept fully active until the middle of the century III a.D. By that time, it began a progressive and irreversible decadence until the century V a.D..

Ranging an extension of almost two kilometers, this fish processing industrial complex keeps a considerable dense set of Roman constructions. The fish processing factories includes specialized working areas namely tanks (*cetariae*), wells and fish preparation areas. Beside the extensive industrial structures, there is a Roman bath, three graveyards and a Basílica, covered in a large extension by Paleochristian mural paintings, and a residential area with buildings with two floors, some of them covered with *opus tesselatum*, indicating a probable splendor of the site.

The Roman constructions are built in stone masonry mainly made of stone from a Setúbal quarry (*opus incertum* and *opus quadratum*) and, in the later period (IV-V a.C.), also brick was used (*opus testaceum*, *opus mixtum*) in architectonic reformulations. Also different types of stones were used in the masonry, probably brought to Troia as successive ballast charges by the ships used to transport salt supplies.

The first archaeological surveys in Troia are not well known. The earlier reference dates back to 1502, in a privilege attribution document issued by *Ordem de Santiago*, granting to a couple, land and the use of a lagoon area to build tide mills. Gaspar Barreiro's *Chonographia* (century XVI) describes the existence of tanks for salting fish. A record from around 1700, written by a town councilor of Setúbal, mentions the finding of a building with columns and capitals, during the construction of houses in Troia - the so-called gentile temple was discovered. Excavations promoted later by Queen Maria I, who visited the ruins in 1842, where held. The *Lusitan Archaeological Society* was then officially created in 1851 with the purpose of accomplishing excavations in Troia [1] and carried out several survey campaigns, mostly in the residential area and over the area of the Basílica. José L. de Vasconcelos (1895) and A.I. Marques da Costa (1934), Prof. Manuel Heleno (1948), followed by Prof. D. Fernando d´Almeida (1969) with his team of University of Lisbon developed works on site. Dr. Cavaleiro Paixão (one of D. F. d´Almeida students) supervised the archaeological excavation studies until the present moment.

The sequence of conservation treatments developed in Troia archaeological site, closely follows its excavation history. Beside the first period of conservative operations made during Roman times, later interventions were developed after archaeological campaigns along the XX century. From later in the 1980's and until the present moment, conservative interventions were made by skilled restorers.

III. THE ROMAN BATHS

Located South one of the industrial plants, this thermal complex is developed from East to West along 36 meters (excluding the well that supplies it). With an average width of 8,5-11 meters (West) to 15-19,5 meters (East), it covers a total surface of 450 m^2.

What nowadays can be seen from the thermal complex correspond approximately to the last period of occupation of the Roman Empire. Although the good conservation conditions of some parts, it is not possible to identify the architectural design of previous periods.

According to Etienne *et al* [2], it is not possible to present a chronological development, but only describe this architectural complex, presenting the diverse transformations suffered from ancient times.

Figs. 1 and 2 – General view of the Roman Baths area

The Roman Baths architectonic complex was firstly mentioned in the XVI century, although its earliest published plan dates from the XIX century (1855/56), as a consequence of the archaeological campaigns performed by *Lusitan Archaeological Society* [3] presenting various thermal rooms with different functionalities: the vestibule, the cold, the tepid and hot sectors and the *praefurnium*, although some structures were not excavated, like the water reservoir (cistern).

References from the same period show that the thermal complex (or part of it) had already been discovered and that it showed architectural aspects of great sumptuousness. An episode that a floor with mosaic decoration has been stolen is referred.

Other references accuse the sumptuousness of this thermal complex: "*restos de óptimas thermas, que foram ornadas de colunas de mármore, de mosaicos, e as suas paredes interiores faceadas de mármore de várias cores, assim como o edifício embellezado de outras obras de arte*" (D.F. d'Almeida in Castelo-Branco, p.51 [4]).

The work continues in a later period by the National Museum of Archaeology and Ethnology's Director José Leite Vasconcellos [5] and University of Lisbon Prof. Manuel Heleno. In 1994 a marble lintel - an architectonic element of a great value – is described [2].

This thermal complex possesses a tank of water supply tied by a gutter pipe to a well. The biggest room of the thermal complex (*apodyterium*) still keeps the inferior part of two window-openings and a folding seat, all around the interior walls, which are typical of Roman thermal complexes. These walls were stucco plastered, painted with geometric drawings. They are mainly quadrangular panels with alternated color, predominantly white, yellow and red.

The following room, which would function as *frigidarium*, has its floor coated by *opus tesselatum* with simple drawings (braids and geometric figures). South there are two pools with steps that are covered in *opus sectile*, composed by Estremoz, Vila Viçosa and Pêro Pinheiro marble tiles.

The following rooms are quite destroyed, but it is possible to see some characteristics of *suspensurae*, *tepidarium*, *caldarium* and *praefurnium*, with successive architectonic alterations. It is possible to consider some connection with the adjacent *garum* industrial plant [2].

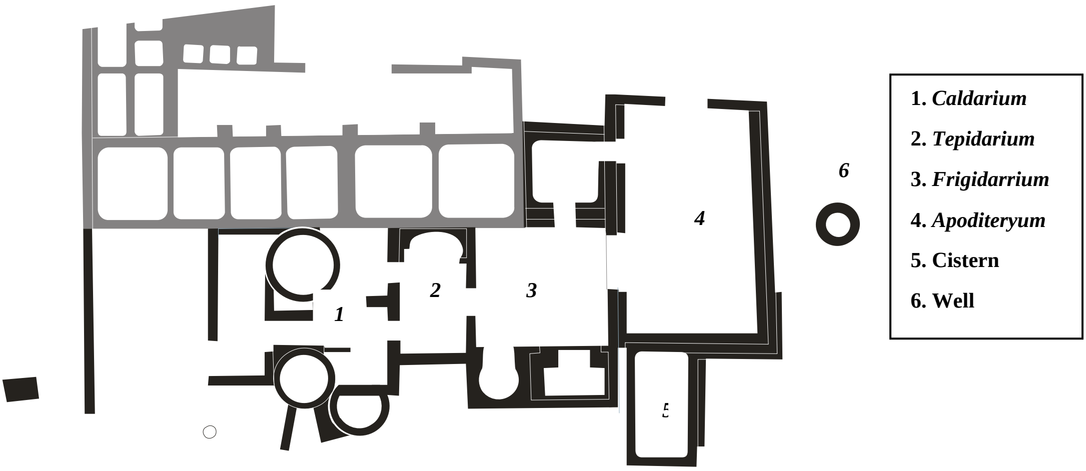

Fig. 3 – Roman Baths plan [2]

IV. BUILDING MATERIALS CHARACTERIZATION

The diverse compartments that compose this architectural complex can be grouped in the hot, tepid and cold sectors.

A. The hot sector

Praefurnium

The *praefurnium* [6], the compartment where the heat is produced in order to provide it for hot and tepid sectors, is located on the West side of the C*aldarium* wall. Its walls are made of brick masonry (*opus testaceum*) with a white color mortar and are poorly conserved. There are still remains of the start of a vault under the *hipocaustum*, over two exterior pillars and two others situated in the interior part. In interior surfaces as well as in the floor, burning vestiges can be observed as the surface are black shaded.

Caldarium

The *caldarium* is constituted by two quadrangular rooms: room 1 with 3,61m x 3,52m and room 2 with 3,63m x 3,62m, that communicates by a large opening (1,07m) through a wall with 0,62m thickness. These two rooms fit in a rectangular bloc, with external dimensions 8,60m and 4,80m. Each of these rooms has an external apse (South of room 1 and West of room 2). The floor is covered with ceramic tiles.

There is evident a good construction technology using various local stone and brick (*opus incertum*, *opus testaceum* and *opus mixtum*). Wall's basements are made on masonry, more or less prepared. About each 0,42m stone masonry height of the walls is intercalated and leveled with a line of bricks and roofing tiles fragments. Irregular stone and brick fragments are used in the walls masonry, with a coarse and sandy mortar. The *caldarium* walls (except the N wall, adjacent to a *cetariae*) are 0,60m thickness and are rendered, so that its verticality is assured.

Figs. 4 and 5 - *Caldarium*: *opus incertum* and *opus mixtum* wall and a detail of an *opus testaceum* pillar

B. The tepid sector

Tepidarium

The *tepidarium* is an almost rectangular room with interior dimensions of 4,10m South and 4,20m North, and a length of 6,60m (surface of 27 m^2). Perimeter walls are built like those of the *caldarium*, except the North one, with 0,60m thickness. This one is built in a more irregular form, due to the presence of the adjacent industrial plant wall. The West wall thickness vary from 1,795m (N top), to 1,93m in the central zone and 0,66m in the S top.

In the South wall there are two pipe orifices under a brick lintel, crossing the wall thickness (0,55m). These two orifices were occupied by two lead pipes, which feed the *tepidarium* pools and the Wes*t caldarium* pools. These orifices dimensions are 10cm x 14 cm and 10cm x 12,5cm.

The hypocaustum

This subterranean structure was composed by a succession of brick vaults and pillars where the hot air circulates [6]. Only the brick tile floor is preserved. In fact we can observe two kind of *laterae* with different dimensions: on the North side larger tiles appear and on the South zone the tiles are similar with the ones of the *caldarium* floor.

C. The cold sector

This is the better preserved sector and therefore easier to characterize. The *frigidarium*, the zone of *apoditherium* and a great room - the room of the three pillars, probably to the accomplishment of diverse exercises and meetings – can be identified.

Frigidarium

The *frigidarium* complex seems to be a section constructed after the block of the hot sector: a certain SW orientation seems to be determined by former constructions. It is composed by a room and two *labra* (*pools*). Dimensions are: 7,44m South, 7,48m North, 9,85m East and 9,75m West.

Construction technologies are similar to those described in other compartments. The use of broken bricks may be identified in an *opus incertum* masonry in order to reach horizontality. In this particular zone, big and regular stone blocks were used as well as bricks.

The central room has an irregular square plan: 6,44m S, 6,76m N, 6,43m W and 6,21m E, covering approximately an area of about 43,53 m^2. The floor is decorated with mosaic; the interior walls are rendered with a grey mortar; covered with mural paintings, with geometric motives in red and yellow. These decorative motives are similar to other found in the *apoditherium,* revealing some homogeneity in decoration.

Fig. 6 and 7 – Cistern render (*frigidarium*) and detail of the *opus signinum*

V. EXPOSURE, WEATHERING AND CAUSES OF DECAY

Major causes of decay identified in Troia Roman site are directly connected with its geographical location. Troia's Peninsula is located in the South margin of the river Sado estuary and in the vicinity of the Atlantic Ocean, where strong winds often occur. For this reason contamination with soluble salts is highly probable, with consequences in terms of soluble salt destructive effects. Those effects are visible in different porous building materials. Also the rising damp, high thermo-hygrometric variations caused by the strong winds and the extensive development of vegetation favored by the microclimatic conditions of the region, can be identified.

The most common degradation forms in the site are: structural deformation of partially excavated monuments (due to sand dunes pressure), masonry open joints, loss of cohesion of bedding mortars, biological colonization. In more critical situations partially ruined walls can be identified, which collapsed due to structural and constructive problems (progressive loss of mortars or disintegration by root pressure). A large number of roman constructions disseminated over a large area excavated since the XIX century suffered from a long time exposure to adverse external factors without any protection The lack of protective shelters and conservative and maintenance operations led to serious situations. And finally the human presence: tourism, vandalism and also inadequate interventions made in the past.

VI. ASSESSMENT OF PAST INTERVENTIONS

General aspects

Research in ancient conservation treatments field in any archaeological sites (and not only in Roman ones) is a difficult task because the information resources are very scarce and the physical in prints left by those interventions are not always very evident.

Photographic and graphic documentation of those interventions play today a very important role in this kind or research work in conservation field. This panorama is true, not only for Troia site, but also for the most important Roman sites in Portugal.

Other precious resource of data is the actual accurate observation of the past interventions, on which as much information as possible is collected, as well as their effects along the period of time of reaction with the original archaeological substrate and the environment factors.

For the present case study, the research was supported mainly in the scarce documentation (direct and indirect), oral testimonies and in some (very few) technical reports where more substantial and objective information could be obtained.

The main recent phases of archeological campaigns over the Troia site were conducted by archeologic teams: from 1948-49 until 1973 supervised by Prof. Manuel Heleno (archaeologist); from 1960 until 1976, held under supervision of Prof. D. Fernando d'Almeida (archaeologist); from 1976 until 1979 supervised by Dr. Cavaleiro Paixão (archaeologist), since then scientific responsible for the site. From the 70's to the 80's the conservation interventions were made by specialists in conservation and restoration works (conservation campaigns or practical lectures of Conservation Courses); since 1999 until the present moment the Conservation Plan for Troia Archaeological Site, developed by IPPAR[1] with an interdisciplinary team.

In the first archaeological campaigns excavations were made which led to great consolidation, conservation and protection works. From the XIX century to the 60-70's (XX century) those works were not documented in a systematic way. Few aspects were written, drawn and photographed; documents exist, but they are very sporadic and incomplete.

Simultaneously, the 'Conservation' discipline, as a profession was not yet a reality in Portugal and all the processes were carried out with little scientific support and technological expertises.

Since the 60´s (with the advent of International Conventions) the Government Authorities started to follow a new approach regarding the conservation matters, where DGEMN[2] and the Monographic Museum of Conímbriga played a leading role in the field.

In the scarce bibliography on these subjects, it is apparent that by that time these Institutions "imported" scientific and technical knowledge through the invitation of Italian conservator-restorers who came to Portugal to join the teams of some important interventions, such as

---

[1] Instituto Português do Património Arquitectónico
[2] Direcção Geral dos Edifícios e Monumentos Nacionais

mural paintings and mosaic pavements conservation interventions, among other works. Many interventions were then consecutively made in the archaeological sites with no specialized man-power, using local materials (regional as well as materials coming from the destruction of other archaeological structures), over the supervision of the architect or the archaeologist responsible for the monument.

These facts are not supported on physical evidences, namely on reports or photographs, but on the interpretation of existing "invoices" that correspond to payments of those specific materials and man-power.

Most common past interventions on archaeological sites represent conservative and protective actions. But many other interventions are in fact reconstructions, based not in a scientifical archaeological approach but in a "romantic" one – reconstruction without any scientific bases.

The most usual materials applied in conservative and reconstructive interventions were mortars based in Portland cement and selected aggregates, probably because by that time Portland cement, among the materials available in construction industry, was considered as having higher "cohesion" and therefore offering the perspective of having also better durability.

Historical of previous interventions

In order to develop a deepened and rigorous study on the current state of decay of this archaeological monument and looking forward to plan a coherent future conservation and restoration intervention, a complete understanding of the interaction between constructive materials of the original archaeological substrate and the materials (mortars and masonries) that had been applied successively during different chronological periods is essential. The evaluation of repair interventions held on the Roman time and the very posterior ones (during the decades of 60/70 of the XX century) will constitute an important tool to work with.

Considering a "conservation operation" as any action that contributes to minimize or to prevent some kind of deterioration, some remaining of late roman interventions from the late period of occupation can also be considered as conservative works. These operations followed more closely the ancient construction techniques, and its purpose seems to be the need of "solving" some decay problems, in order to maintain the functionality of some architectonic places.

Various Roman interventions can be identified, with very similar approaches and objectives. Floor covering reformulations was carried through a late Roman period [2], eventually for guarantee its constant use. Some different materials (mortars) were applied over the ancient ones. It happened in the interior of the circular swimming pools (c*aldarium* and *frigidarium*) where ruptures and waterproof problems probably existed. The solution adopted constituted in the application of thick layers of a coarse hydraulic mortar based on hydrated lime, with brick powder and fragments as a major component (*opus signinum*). Other example of a Roman repair can be observed in the *frigidarium* floor. The floor was primitively covered by an *opus tesselatum* pavement and due to its use or other occurrence, it was subjected to intervention. Two different types of repair can be registered: one similar to the former, where 80% of the floor had been overlapped by a fine grained *opus signinum* plaster and other where some missing parts of the mosaic pavement were mended by a coarse grained mortar.


Figs. 8 and 9 – Two examples of Roman ancient interventions.

Those interventions could eventually be contemporaneous since the materials used have much in common (the chosen materials are characterized for being a mortar with the same characteristics). However this introduction of new materials resembles to be a purely functional intervention, having the initial structures lost its primitive aesthetic enchantment.

After a first analysis, based only in an accurate visual observation, it is possible to say that all the carried interventions during Roman times present a adequate behavior since there is still a good adhesion between the repair mortar and the original substrate. No signs of fissuring were observed. In an aesthetical point of view, these repairs did not respect the original structure and its authenticity, occulting them and devaluating it. The systematic use of a hydraulic mortar could be eventually connected with durability and functionality aspects.

In what concerns interventions reported to the XX century, two distinctive periods and approaches may be considered. During the 60/70's campaigns, coarse grained mortars revealing high cohesion and grey color could be found on different operations: repointing, consolidation, *copertine*s, reconstruction and *anastilosys.* During the 80's, a consolidation intervention and repointing using a yellowish coarse mortar could be registered.



Figs.10 and 11- Reconstruction and *copertine* (70's) Fig.12 – Consolidation (80's)

Later repair operations, dated from the XX century, show varied evidences. Aiming essentially to restore the integrity of a ruin or to protect it, the new materials were applied strictly where needed. There is a curious relation between the materials used and the chronological period of the operation. During the 60/70's a wide use of cement based mortars in general building construction and the performance of this "new" material directly influenced the conservation operations developed. However, after some time, the behavior of these high cohesion mortars revealed to be critical, due to its incompatibility with the substrates. These concerns were taken in account in the following decade, by the skilled operators: conservators-restorers (earliest professional formation of conservation restorer courses from the 80's). A new attitude and conscience in approaching conservation building heritage arise. These can be seen in the latter interventions made on the Roman Baths, using lime based mortars, with compatibility concerns in materials selection to use.

VII. CONCLUSION

Two periods of very distinct interventions in time are identified in the thermal complex of the archaeological site of Troia. The interventions developed in Roman times, contemporarily to the use and that apparently wanted to guarantee the maintenance of use conditions (in detriment of aesthetic aspects) and the ones developed when the archaeological structures began to be studied. The interventions carried out in this last period can still be subdivided. In a first phase the interventions had been developed with cement based mortars, by technicians without specialized skills. Often there were restoration and reconstruction interventions, which in many cases would not be acceptable nowadays by currently recognized concepts of conservation by the international community. In the second phase and until the actuality, the interventions started to be carried out by specialized and interdisciplinary teams, the activities to be documented and registered and the use of materials which are compatibles with the substrate became fundamental.

It is intended that this work of analysis of the behavior of past interventions is integrated with the identification of pathologies, its causes and with the characterization of the material used, in view of the attainment of valuable information for the planning of correct future interventions on site.

BIBLIOGRAPHIC REFERENCES

[1] MACHADO, J. T. M. - *Como surgiu em Portugal a primeira Sociedade de Arqueologia.* Arqueologia e História, 9, Lisboa, 1962.

[2] ETIENNE, R.; MAKAROUN, Y.; MAYET, F. – *Un grand complexe industriel a Tróia* (Portugal). Paris, 1994.

[3] APOLLINÁRIO, M. - *Estudos sobre Tróia de Setúbal*; l-Piscinas; 2-Columbarium; 3-Thermas de Tróia. O Archeólogo Português, 3, Lisboa, 1897.

[4] CASTELO-BRANCO, F. - *Aspectos e problemas arqueológicos de Tróia de Setúbal*. Ocidente, 65, Lisboa, 1963.

[5] VASCONCELOS, J. L. - *Escavações reais em Tróia*. O Archeólogo Português, 3, 1898.

[6] ADAM, J.P. – *La Construction Romaine*. Grands Manuels, Picard, 1989.

[7] JUSTINO MACIEL, M. - *Antiguidade tardia e Paleocristianismo em Portugal.* Lisboa, 1996.

In International Seminar in Conservation. A Tribute to Cesari Brandi. Lisboa, LNEC, May 2006, p.273-282.