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A New Approach for the Capping Interventions of Architectural Remains in Archaeological Sites

*Dr. **Nihan Kocaman Pavlovic**
Alanya HEP University, Faculty of Architecture, Alanya, Turkey
E-mail: nihankocamanahep@gmail.com

Abstract
A limited number of archaeological excavations have a budget or a suitable order of site to cover all the remains found on the site by a protective structure. Therefore, the method of protecting architectural finds excavated in archaeological sites with a protective layer is frequently used to control plant formation and to prevent the deterioration caused by climatic conditions. Even though capping is an effective way of preserving architectural structures, these interventions do not always slow the pace of decay. In this research, the main categories of hard and soft capping techniques in archaeological sites, and the preservation questions that these techniques raise, are examined along with their advantages and disadvantages. Following the examination, a new approach is proposed for capping the architectural monuments in order to protect the fragile structure of the unearthed archaeological heritage by minimizing the destructive effects of existing techniques.
Keywords: Conservation; Restoration; Archaeological Sites; Archaeological Heritage; Architectural Monuments; Capping.

1. Introduction

In the meantime, archaeological excavations, architectural remains of many different scales and sizes, ranging from single structures to building groups, are unearthed (Earl, 2001). One of the most essential steps for the protection of archaeological heritage with a highly complex structure is the conservation and restoration of artefacts (Jokilehto, 1999). A series of conservation and restoration interventions are applied in order to preserve the architectural remains in archaeological sites against natural conditions, to slow the pace of deterioration processes and to present them (ICOMOS, 1964; 1990; 2008, UNESCO, 1956). Among these conservation and restoration interventions, there are practices that can be called also as preventive intervention, such as comprehensive and time-consuming practices, and that are carried out immediately after the artefacts are excavated (Pedeli and Pulga, 2013). Conservation and restoration interventions, which are shaped according to the conservation state of the architectural remains, the structure it has, the conditions it is in, the budgets of the archaeological excavations, the labour and the working time, can be carried out by following different methods (Fig. 1).

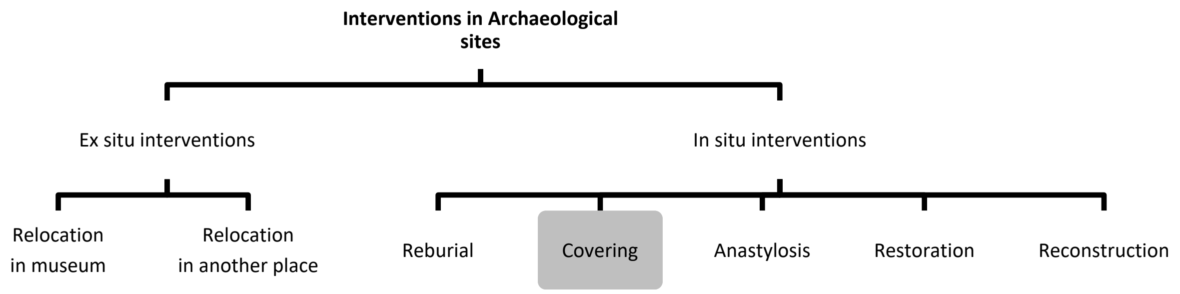

Figure 1. Classification of interventions for Masonry Architectural Remains in Archaeological Sites (Developed by Author).

In this research, capping practices for the conservation of masonry architectural artefacts unearthed during archaeological excavations are examined. The research focused on the archaeological sites in Mediterranean Basin particularly in Italy, Greece and Turkey that are rich with Roman architectural remains. In this context, 20 archaeological sites were visited and documentation of hard capping applications with mortar, stone and brick was made. Frequently applied hard capping interventions are classified considering the examinations. Related to this classification, the relation between the current hard capping interventions and the remains, the advantages and disadvantages of these applications are discussed. The research proposes a new approach in order to eliminate the limits and disadvantages revealed in hard capping applications. Discussing this new approach, which has not been applied yet, and comparing it with the existing practices are among the aims of the research.

1.1. State of Art

Masonry architectural remains unearthed in archaeological sites are subjected to a series of deterioration processes (Orbaşlı, 2008). Unless the necessary protection measures are taken, it is likely that architectural parts that have lost their protective cover partially or completely should face serious structural problems (Feilden, 1994). Among the main problems that need to be prevented are cracks on the surface of the artefacts due to climatic conditions and subsequent material losses. Covering the architectural remains is one of the easiest interventions that can be applied to avoid significant material losses (Fig. 2). Among the covering interventions, hard capping is an intervention technique that is preferred very often because of its fast and easy application and low cost (Lim, 2009). In hard capping applications made with mortar, stones or bricks, it is common for monuments to be deformed as a result of ground subsidence and thermal movement (Ashurst, 2007).

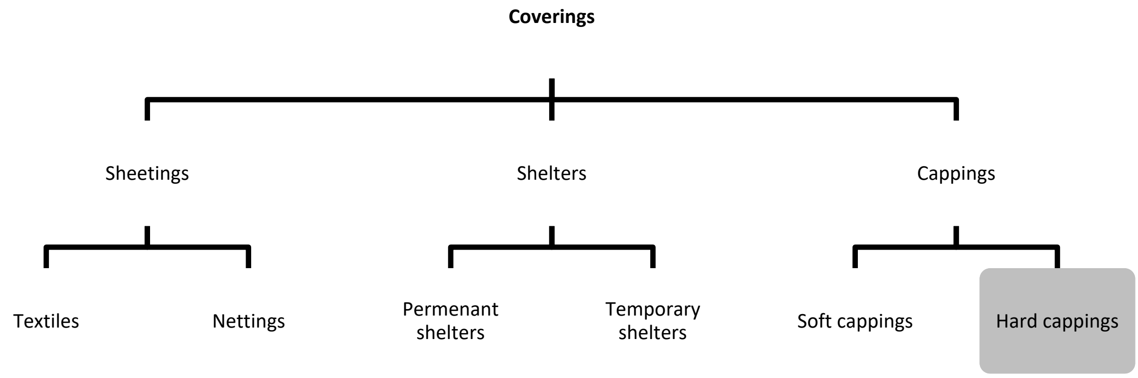

Figure 2. Classification of Covers for Masonry Architectural Remains in Archaeological Sites (Developed by author).

Unlikely, hard capping applications, which are frequently preferred, not only cause physical deterioration, but also chemical degradation, biological deterioration and authenticity problems (Fig.3, 4, 5, 6). The most common physical problems that are detected in hard capping interventions with mortar, stone and brick based applications are loss of mechanical properties of material, mass load and cracks whereas the most common chemical problems which are freeze/thaw cycling, salt and pollution based. Problems raised by algae, lichens, plants and bacterias are detected as biological degradation caused by hard capping applications. Besides, spolia material usage, disproportionate of modern material, incompatible applications and unqualified labour are the authenticity problems that the architectural remains are facing after hard capping interventions (Kocaman and Eyüpgiller, 2018).

Although all physical, chemical, biological and authenticity problems affect the preservation process of the works, this study focuses on physical and chemical problems of the remains.

Figure 3. Sample for mortar capping in Herculaneum/Italy (by author).

Figure 4. Sample for stone capping in Mikenai/Greece (by author).

Figure 5. Sample for stone capping in Miletos/Turkey (by author).

Figure 6. Sample for brick capping in Olympia/Greece (by author).

1.2. Analysis of Advantages and Disadvantages

In order to make a capping proposal, it was first deemed necessary to analyze the existing hard capping applications in detail and to reveal their most common advantages and disadvantages compared with each other. In this context, 5 different subtitles have been defined as advantages for hard capping applications. These are being compatible with the existing remains and site, the time that is passing from the beginning of the intervention till it is done as fast realization, the cost of the capping, the qualification of the labour needed and aesthetic.

Considering those subtitles, it has been concluded that the most common advantage is fast realization and low cost in capping applications with stone, brick and mortar. Another common advantage of the hard capping applications is being compatible with the existing remains and aesthetic (Table 1).

Table 1. The advantages of hard cappings related with their material

	Compatible	Fast realization	Low cost	Less labour	Aesthetic
Brick		√	√		
Stone	√	√	√		√
Mortar	√	√	√	√	√

Thus, those parameters are considered for the new approach to meet the need of low cost, fast realization, being compatible and aesthetic.

6 different subtitles have been defined as disadvantages for hard capping applications. These are mass load, being unresistant to climate conditions, being irreversible, to have poor water drainage, to interact with remains and detachment.

Considering those subtitles, it has been concluded that the most common disadvantage is being irreversible, poor water drainage and interaction with remains in capping applications with stone, brick and mortar. Another common disadvantage of the hard capping applications are having mass load and being unresistant to climate conditions (Table 2).

Table 2. The disadvantages of hard cappings related with their material

	Mass load	Unresistance to climate conditions	Irreversible	Poor water drainage	Interaction with remains	Detachment
Brick	√	√	√	√	√	
Stone	√		√	√	√	
Mortar		√	√	√	√	√

Thus, those parameters are considered for the new approach to meet the need of being reversible, having water drainage, not to interact with remains, not to have mass load on remains and being resistant to climate conditions.

2. Materials and Technique

At the time the existing hard capping applications are evaluated, a new application model should be developed due to the benefits and damages caused by these applications. The common benefits and limits of existing techniques are examined in detail in Table 1. Considering these most common advantages as fast realization, low cost in capping applications, being compatible with the existing remains and aesthetics (Table 1). On the other hand, common disadvantages are being irreversible, poor water drainage, interaction with remains, mass load and being unresistant to climate conditions (Table 2). Taking into account the benefits and limits of the hard cappings, it is essential for a capping application to be planned light, reversible and sufficient for waterproofing, beside being compatible, fast realization and low cost. Keeping these properties in the hand, this study proposes a new model for capping to be applied by following steps below.

First of all, the application should be started by cleaning the masonry remains to be capped. The cleaning process should be completed by slightly moistening the surface with plastic or brass bristle brushes, which will be selected according to the hardness and strength of the existing stones and mortars. Apart from this, if there is plant formation on the surface that requires more extensive cleaning, the traces should be removed from the remains.

In the following process, the conservation and consolidation processes of the residues should be completed. Especially unstable stones and the top row of wall should be consolidated. By checking the strength of the mortars, reinforcement works should be carried out in the different levels, starting from the ground and reaching the highest wall level on the remains.

At the end of the strengthening and consolidation processes, 0.4 mm thick caoutchouc sheet should be laid on the top level of the wall. This caoutchouc sheet will act as an insulation layer to prevent any possible water leakage from penetrating into the wall as well as protecting the remains from a possible stain coming from metal sheet caused by corrosion. This caoutchouc sheet also blocks the interaction of the capping with remains.

After the caoutchouc sheet, polyurethane foam should be applied to the surface to ensure the integrity of the caoutchouc sheet with the metal plate layer. Polyurethane foam fills the bottom of the metal plate, reducing the sensitivity against impacts and protecting the upper mesh of the wall from overcooling or heating of the metal.

In this approach, metal sheet plate was considered in order to make the material lighter compared to stone, brick and plaster and to prevent pressure on the existing work. Galvanized aluminum plates with 0.5 mm thickness are planned that the inner and outer surfaces of the metal sheet plate will be coated with epoxy to be applied by spraying in order to cut the oxygen relation of the metal sheet plate and to prevent corrosion that may occur in the long term (Fig.7). This epoxy coat also gives the opportunity to choose the colour of the capping which can be in contrast or unity with archaeological remains.

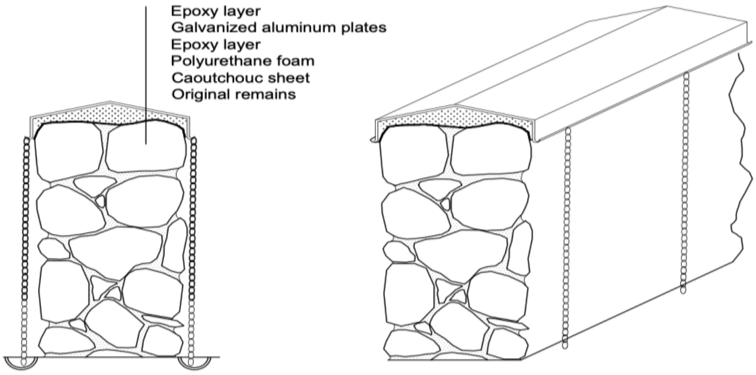

Figure 7. Layers of the Capping Proposal (Developed by author).

The metal plate is formed in a triangular section to have a slope on both sides which let rain water drain. The both edges of the plate are bent to outside in 2 x 2 cm to form a channel for water by the sides. It is planned to add metal chains without touching to the surface of the wall to these channels at 1-meter distances to each other on both sides of the metal cap, which is designed to prevent the very light metal plate and its substrates from being blown away by the wind. This chain goes directly from the metal cap to the ground. At the same time, the transfer of the rain water flowing over the metal plate to the ground through these metal chains and reaching the drainage channels to drain the water at the point where it joins with the ground ensures that the foundation of the remains is protected from water.

3. Discussion

In this study, it has been tried to suggest a new capping that can be applied in archaeological areas by eliminating the disadvantages of hard capping applications. This proposal stands out with a variety of advantages. Metal plate application is;

- light; it does not put a load on the works like stone, brick and plaster.
- water resistant; joints are protected and if regular surface maintenance is done, residues do not encounter water problems in the long term.
- reversible; allowing a different application or protection to be carried out on the wall surface in a later period.
- easy and fast; it offers a quick application to archaeological excavations with limited time.
- repairable; it can be easily replaced with a new module when a part is deformed or corrosive.

- noticeable; even non-professional visitors can easily perceive that this intervention was made in a different period.

Besides the benefits and advantages, this proposal also has limits and disadvantages. Metal plate application;

- needs preliminary preparation, a comprehensive feasibility study should be carried out before the application.
- needs maintenance; In order not to corrode the metal parts, the epoxy layer should be checked regularly.
- should be protected against impacts, deformations will occur in the metal plate in the face of severe impact.

Additionally, a cost calculation must be made in the area where metal capping will be applied. Accordingly, considering that a masonry wall is built with two or three rows of stone / brick, a cost comparison can be made in the light of calculations within the scope of workmanship and material as a result of covering 1 meter of wall with metal capping. As this differs from region to region and country to country, a comparison is not presented on this subject within the scope of the study.

4. Conclusions

Archaeological heritage is a source of information that is not renewable. The protection, interpretation and presentation of archaeological sites has a complex nature. The protection without presentation of those monuments or sacrifice of the monuments for the aim of presentation cannot be the attitude. Understanding archaeological heritage is essential for generations to preserve these remains as a legacy. Thus, it is very important that the monuments are protected in their own context by minimizing their adverse effects from atmospheric conditions and that they are presented in a clear and understandable way for visitors. This research proposes a capping technique to protect the architectural remains from archaeological sites against deterioration that may occur with direct precipitation. Although this capping proposal has not yet been implemented in one archaeological site, it is aimed that this study will be a step for further research to discuss the limits of hard capping applications and to enrich the field by suggesting alternative techniques.

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Conflict of Interests

The Authors declare no conflict of interest.

References

Ashurst, J. (2007). *Conservation of ruins*. Butterworth-Heinemann.

Earl, J. (2001). Building Conservation Philosophy, Dorset

Feilden, B. M. (1994). Conservation of Historic Buildings, Oxford

ICOMOS (1964). International Charter for the Conservation and Restoration of Monuments and Sites, Venice, (= The Venice Charter), online: www.icomos.org/charters/venice_e.pdf (accessed on September 2020)

ICOMOS (1990). Charter for the protection and management of the archaeological heritage, Lausanne, online: www.icomos.org/images/DOCUMENTS/Charters/arch_e.pdf (accessed on September 2020)

ICOMOS (2008). Charter on the interpretation and presentation of cultural heritage sites. Québec, online: www.icomos.org/images/DOCUMENTS/Charters/interpretation_e.pdf (accessed on September 2020)

Jokilehto, J. (1999). A history of Architectural Conservation, Oxford

Kocaman, N., Eyüpgiller, K. K. (2018). An Innovative Approach to Recent Interventions in Archaeological Sites: Re-Restoration, in: Eurasian Journal of Social Sciences, 6(2), pp. 12-23, online: www.academia.edu

Lim, A. B. (2009). *Soft Capping of Archaeological Masonry Walls: Far View House, Mesa Verde National Park* (Thesis, University of Pennsylvania). Access https://repository.upenn.edu/cgi/viewcontent.cgi?article=1131&context=hp_theses

Orbaşlı, A. (2008). Architectural Conservation: Principles and Practice, Oxford

Pedeli, C., Pulga, S. (2013). Conservation Practices on Archaeological Excavations: Principles and Methods, Los Angeles, online: www.researchgate.net

UNESCO (1956). Recommendation on international principles applicable to archaeological excavations, New Delhi, online: http://portal.unesco.org (accessed on September 2020)