



## **The concept of reversibility in the structural restoration of archaeological sites**

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### **Abstract**

Once the concept of a monument as a document forming part of the archive of a civilization's material history has been accepted, we are faced with the problem of conserving the monument in its material integrity in the interests of future historical research. This problem affects the whole of our historical building heritage, but is particularly crucial for archaeological remains, which owe their existence and conservation entirely to their documentary value. The archaeological heritage is subject to a number of natural and man-made hazards inducing continuous degradation. As time goes by, measures have to be taken more and more often to ensure conservation, and this tends to modify the status quo and compromise the artefact's integrity. Hence the methodological requirement for the "reversibility" of any conservation measure. Unfortunately however, even when reversibility finds consensus in methodological terms, it comes up against resistance both at the planning stage and on site, so that in reality most of the interventions carried out today are irreversible. The problem is particularly complex in the field of structural restoration (which would be better named "construction restoration"). Our research has investigated the topic of "potential reversibility" in both theoretical and practical terms, including the analysis of numerous restoration techniques and some case studies in the restoration of major archaeological monuments. At the theoretical level we have considered the problem of establishing the history of interventions carried out in the course of time, which more often than not compromise a monument's integrity. In practical terms we have identified a series of criteria to be followed during an intervention, which tend to ensure integrity and sufficient reversibility.

## 1. Archaeological remains

Archaeological remains may be defined as an artefact from a past civilization which is identified and conserved as a document of the material history of the civilization that produced it, [1]. They come in all shapes and sizes, involving the most widely varying materials, but have as a common denominator the evidence they bear of human history. Amongst the multitude of remains which constitute the archive of the material history of humanity, we pay particular attention to archaeological remains, evidence of the evolution of a civilization's mode of living and building.

It is rare for archaeological constructions to have come down to us in their original configuration: they have almost always been profoundly altered by successive mutilations and transformations, giving them a new configuration and state of equilibrium as ruins, [2]. It is this characteristic which makes archaeological remains the object of complex, interdisciplinary studies involving archaeologists and the applied sciences. What is more, in previous centuries characterised by a different, more limited view of history, archaeological remains were frequently incorporated into new constructions, making their anamnesis even more complex. In the light of our scientific understanding of history, we view a ruin as a multi-faceted document, and its integrity and conservation take on crucial importance.

Since we are focusing on archaeological artefacts, we are faced with highly complex problems of interpretation and conservation. In the first place it is necessary to identify the building's original function and the rationale that informed its construction, [3]. This should lead on to an anamnesis of the alterations and adaptations carried out, including any previous evidence of restoration or conservation and the discernible episodes of degradation, whether due to natural or human causes. In addition it is important to determine the material composition of the ruins by establishing the quality of stone used and its provenance, the nature and quality of mortar or other adhesive agents, the stratigraphy of the walls, the way in which they were laid down, the successive alterations and the conditions of degradation. Each of these items could merit a detailed résumé recorded in a data base.

Ruins invariably occur in a wider context as part of a residential or monumental site, and hence the conservation of one item is bound up with the conservation - and, very often, restoration - of the whole site. A ruin is linked by many significant threads to the archaeological context in which it occurs. Being a document in the archive of human history, its integrity must be conserved as far as possible, and this will only be possible by subjecting the ruin to periodic maintenance, in the best of cases, or else restoration.

## 2. Historical evaluation of the restoration interventions

In past centuries, as we said above, ancient ruins were often reused in new constructions, or else subjected to major operations of reconstruction. More recently they have undergone wholesale interventions of consolidation which have altered their rationale and static behaviour. Some recent theories of

restoration highlight the importance of tracing a historical profile of the successive interventions, in the interests of the building's value as a historical document, and go on to insist on the over-riding importance of the current status quo. Such a standpoint is indeed convincing if one is dealing with Stern and Valadier's recomposition of the Arch of Titus on the Palatine, or the completion of a large part of the ancient masonry at Pompeii done in the wake of excavation, or even Evans's reconstruction of the palaces of Knossos. However, this cannot become a dogma, superseding the historical analysis and critical appraisal which must accompany each specific case study. Many interventions, and not only in the past, have in fact been highly prejudicial to an objective reading of the original document.

Unfortunately archaeological sites have been subjected to far too many ill-considered, invasive interventions in the name of conservation in flagrant contrast with the ancients' construction culture. This was especially the case during the second half of the 20<sup>th</sup> century when, thanks to post-war reconstruction and the boom in house building, a shamefully cavalier approach to building prevailed. Moreover, some restoration projects have been closer to an architectonic reinterpretation of the ruins than a scientifically grounded reconstruction. We must never forget that new research may modify current thinking concerning a monument, requiring a revision of the restoration project. Finally developments in the realm of technology, which no one can foresee, may require the elimination of harmful materials; or again, as we have begun to see recently, progress in elaborating complex virtual reconstructions can lead to the dismantling of ill-conceived restorations in the interests of a scientific conservation of the archaeological monument.

### **3. A potential reversibility**

The concept of reversibility is bound up with a critical knowledge of history, and archaeology is a fundamental means to this end. The insistence on the document as an integral and unmodifiable entity is motivated above all by the need to be able to arrive at a different reading or interpretation of it in the light of more complete historical knowledge. We have to recognise the fact, however, that while the intangibility of any written document is sacrosanct in modern historical enquiry, this is still not the case for documents of material history, and in particular for the history of the building heritage, of which archaeological remains are the oldest manifestations.

This lack of commitment on the part of historians towards the material history of our building heritage has made it possible both for would-be "restorers" to go out of their way to leave a new imprint on monuments rather than safeguard their identity, and also for technical interventions that have ensured stability and functionality resorting to materials and techniques which were quite alien to conservation. If the prime objective is to safeguard and transmit the monument/document, it is obvious that the concept of reversibility plays an integral part in achieving this objective, and must inform both the restoration project and the process of programmed maintenance.

There are two criteria for ensuring these principles:

- safeguarding the construction rationale of the archaeological artefact,
- employing materials and techniques compatible with reversibility.

These criteria must be adopted as methodological tenets, even though their application in practice can come up against a lot of difficulties.

The practical implications of reversibility change according to whether it is adopted *a posteriori* in dismantling existing restoration work or *a priori* as a methodological grounding for new interventions. When it is a matter of dealing with situations in existence for some time, it is necessary to act with particular caution when significant new documents of material history have been grafted onto the archaeological remains, as for example when important archaeological relics have been incorporated into churches or monasteries.

Quite another matter, and it has occurred all too frequently over the last century, is the brutal insertion of new structural elements in an ancient building context. In such cases these should be eliminated whenever this can be done without seriously affecting the archaeological fabric. As an example we can take the atrium of the House of the Vettii in Pompeii. In the immediate post-war years a wooden roof erected in the late 1800s was replaced with a structure of the same dimensions in reinforced concrete. This intervention was badly flawed structurally and done using an inferior cement, so that it is now in very bad repair: the corrosion of the metal framework is in fact an all too common problem of interventions using reinforced concrete on archaeological sites. In this case the correct solution would be to replace the roofing, which exerts considerable pressure on the house walls, by a new wooden structure modelled on the 19<sup>th</sup> century construction, much more in keeping with both the ancient context and the rationale behind the house's construction, [4].

Another case in point is the Roman colonnade in front of the basilica of S. Lorenzo in Milan: during the 1950s the colonnade was dismantled, the segments were hollowed out or drilled through and filled with reinforced concrete, and the ancient crossbeams received the same treatment. This intervention, which is to all intents and purposes irreversible, has destroyed the integrity of the monument, making it impossible to reconstruct its history, [5]. We can postulate a potential reversibility for many cases based on technological progress at the service of conservation; thus for example applications of laser technology might make it possible to liquefy the metal rods which have ill-advisedly been inserted to pin ancient columns, but other cases, such as walling subjected to extensive metal stapling, seem to offer no hope of reversibility.

Turning to new conservation and restoration projects, we would hope that they will always be based on a historical approach that regards the integrity of the monument/document as paramount. This involves making a scientific study of the structure's status quo and drawing up a project based on potential reversibility and the recognisability of the interventions carried out. When reversibility becomes impossible in practice, as in the structural restoration of walls, materials and techniques should be used which are entirely homogeneous with the ancient ones, so as to avoid impinging on either the original building rationale or the structure's stress patterns, while maintaining its durability.

When requisites of restoration or access involve the introduction of new structural elements such as flooring, covering, etc., modern structural

engineering offers many technological means for introducing these elements so as not to alter the ancient structure or its structural behaviour, and keep to a minimum the connection and transmission of stresses between the ancient construction and the new structure.

#### **4. Some examples**

We shall now look at some practices which recur frequently in the structural restoration of archaeological sites. On account of the wear and tear produced by intensive public access, and to ensure the conditions and safety of visitor routes, it is often necessary to pave over some areas of a site. In preparation for this, the remains in such areas can be scientifically documented and mapped, and this information made available to visitors. The remains are then covered up with successive layers of terrain to make the ground level, remembering to allow for rainwater to run off, and paving can be laid which is in keeping with the context and fully reversible.

Again in the interests of public access, an archaeological monument may have to be provided with safety facilities, either for the structure itself or for visitors. Here again flooring and partitioning can divide up the existing spaces. Nowadays it is possible to create structures able to sustain sizeable loads which can rest on vulnerable structures without compromising them. Alternatively the horizontal elements can be anchored to the archaeological structures at a limited number of points using technologies which do not seriously prejudice the ancient walling. Analogous systems that can be even less invasive make it possible to rest roofing on remains so as to limit environmental damage and improve access.

Finally we can improve on conventional methods when it is necessary to shore up fractured elements such as capitals, metopes or remount blocks of masonry. Supporting elements can be made from modern metals, such as stainless steel or titanium, or innovative polymers, rather than resorting to metal rods or adhesive agents which alter the archaeological elements and are quite irreversible.

These simple measures are easy to put into practice. This was the case in the recent restoration of the temples at Paestum where we decided to restore the existing metal supports, and just occasionally, where necessary, to integrate them, rather than make new perforations or use innovative adhesive agents whose physical and chemical behaviour is still unfamiliar, especially over the long term. Similar procedures have been followed in the recent restoration work on the complex of Cecilia Metella on the Appia Antica, and in particular on Castello Caetani, [6]. After excavating down to the oldest layers of flooring in the great hall and recording all the findings, we ensured the appropriate conservation of the original level, isolating it from the new flooring, so that the hall can serve as an open-air antiquarium and also on occasions as a concert hall. In addition, current norms for monuments charging for admission require sanitary facilities as well as rooms for plant and changing rooms for personnel. This was all provided for below ground, making some important remains visible and putting in both roofing and flooring which are entirely reversible. If one day it is decided to get rid of these new structures, the ancient walls would be left

with only few, superficial traces of local anchoring which would be easy to make good.

The recent restoration of the Villa dei Quintili on the Appia Antica presents a different picture. Here it was a question of intervening on large-scale structures in masonry whose original configuration could not be established. We tried to keep reintegration to a minimum, rendering it always visible so as not to compromise future research following on further excavations. There is no escaping the fact that interventions on ancient masonry, however carefully carried out, are of necessity irreversible, [7].

A unique case of reversibility can be seen in the long programme of restoration carried out over the last twenty years on the Acropolis in Athens. The intervention, motivated by the wish to remove elements that had been wrongly collocated, safeguard caryatids and metopes by placing them in museums and remedy the disastrous effects of past cementification, found particularly favourable conditions in that the properties of the ancient marble meant that it could be separated from the cement, and extensive reintegration could be carried out using this same marble. In practice this has been the first example of full-scale de-cementification of a monumental site, including deconstruction and reconstruction on a grand scale as in the case of the temple of Athene Nike. However, this is such an exceptional instance of restoration that we have mentioned it here only for its overall significance: there is no question of such an approach being extended in the future to other archaeological areas in Ancient Greece.

## **5. Conclusions**

The recognition that archaeological remains form an archive of the material history of an ancient civilization entails adopting conservation measures which are reversible wherever possible, even though this often comes into conflict with questions of access and management of archaeological sites, problems which the current commercially oriented culture tends to exacerbate. Archaeological restoration comes to be seen increasingly as primarily conservation. Modern technologies open up the prospect of new modes of access and use which could substantially lessen the impact on archaeological remains, making it possible to programme conservational maintenance scientifically.

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