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The Conservation of Plasters in Earthen Archeological Sites

The preservation of architectural ruins and earthen archeological sites presents complex problems of conservation, interpretation, and management. Because of the tremendous difficulties and limitations in stabilizing such fragmented and exposed sites, remaining original fabric must be given maximum protection, and implemented contemporary preservation standards must be thoroughly documented. Sites open to the public must meet these requirements while providing interpretation that is both sensitive to their long-term preservation as well as comprehensible to the visitor. Satisfying these requirements is difficult in any ruin site and in particular those with fragile materials such as earthen walls and plasters, which are best understood in context but are highly susceptible to deterioration from exposure and weathering. The many diverse prehistoric and historic sites in the American Southwest offer a unique opportunity to consider the problem of the preservation of architectural plasters within earthen and masonry ruins.[1]

Plasters as Architectural Materials

Regardless of their appearance, composition, application method, and use, all plasters, stuccos, and renders may be characterized as secondary non- structural components applied to a building's primary structural system for protection, decoration, and meaning. These materials, generally applied as one or more thin and continuous layers, protect a building by concealing its structural core and its vulnerable construction joints. As continuous skins, plasters generally provide protection and a reduced surface area to water intrusion, mechanical abrasion, and biological attack. If damaged or failed, plasters and stuccos are more easily repaired or replaced than is the structural core.

All plasters exhibit certain properties in their wet and cured states, and these properties allow them to perform successfully as protective skins. At the very least, plasters must possess good plasticity and adhesion in the wet state and low shrinkage and a hard durable surface after cure. Specific environmental conditions or use impose other requirements such as resistance to moisture, heat, or abrasion. As an integral component of the entire construction system, a plaster's formulation, application, and use are dependent on its composition and chemical and mechanical compatibility with its structural support. This often produces specific systems of installation, keying, or the addition of various organic additives such as animal hair, plant fiber, gums, oils, and resins. Because plasters require large and exact amounts of water for adequate preparation and because their successful drying or cure is often affected by ambient conditions of temperature and humidity, plastering as an activity is often determined by optimal seasonal or environmental conditions. Other factors affecting plaster's manufacture and use include the availability of raw materials and sources of fuel for calcining.

Plaster occurrence, type, and frequency of application can connote important archeological information about past technical knowledge and attitudes toward space and its differentiation. Moreover, the presence of specific components that determine physical appearance or performance can be useful indicators for identifying cultural values be they aesthetic, utilitarian, or

Cliff Palace, Mesa Verde National Park.

Architectural finishes on the Speaker Chief Tower in Cliff Palace, Mesa Verde National Park.

symbolic. For example, the selection and use of certain binders or aggregates for color, texture, plasticity, low shrinkage, and early or damp set all suggest a level of sophistication in keeping with other technological achievements.

As skins, plaster surfaces are susceptible to the elusive evidences of building use and alteration that might not be readily discernible in a building's structural elements. Such ephemeral information—detected on these fragile surfaces as wear, profile ghosts of architectural details, and other marks—makes them remarkably subtle indicators of past human activity.[2]

Preservation Issues

Whether used externally or internally, plasters generally function as intentional or *de facto* temporary materials that were periodically and sometimes regularly removed or reapplied. Maintenance of this protective skin is tantamount for protection of the entire architectural structure as well as for aesthetic conformity. In a preservation context, these functional requirements and traditional approaches to maintenance are often difficult to satisfy since after years of weathering the plaster surfaces often no longer function effectively as well-integrated and continuous protective coverings. As a result, these materials are generally removed and replaced, often without sufficient documentation or analysis. If replacement materials less compatible with the structural support or existing plasters are used, the result is often unsatisfactory. Unlike inhabited sites, archeological sites whose structures are incomplete and whose materials are exposed in ways never intended (unroofed or fragmented) or in new unstable environments (after excavation) present a particularly difficult problem. In these situations, remaining plasters will almost always deteriorate rapidly or catastrophically.

Despite the earlier practice of complete or selective removal of decorated and painted plasters from ruins and archeological sites for protection and display indoors, preservation and interpretation *in situ* is ideologically the preferred solution, even if reburial or sheltering are the only options. *In situ* conservation of architectural plasters ensures future study of the entire resource and allows visitors an opportunity to understand the ruin as a once-complete structure. Finishes of surviving plasters often assist in site interpretation because they define interior and exterior spaces and make tangible and present on a human scale what otherwise might be incomprehensible.

In situ preservation of extant plasters within ruin sites has received limited attention due to earlier preferences for the removal of choice decorated fragments and the neglect of more common architectural remains. This inattention is probably the result of a bias toward plaster's ephemeral nature, especially as compared with other more durable materials, coupled with a dearth of research on practical site conservation techniques. Published research and field work on *in situ* plaster treatments are limited and have focused largely on lime plasters; little attention has been given to earthen plasters as well as to lime, gypsum, or earthen plasters on earthen supports such as adobe, rammed earth, and *jacal*. Moreover, treatment studies have tended to focus specifically on materials and techniques for consolidation and not on surface finishes. Despite the widespread observation of and many reports on the detachment and loss of historic plasters from earthen and masonry walls, almost no research on reattachment methods has been published. A major research program on this subject was initiated in 1991 by the University of Pennsylvania's Architectural Conservation Laboratory of the Graduate Program in Historic Preservation with the Intermountain Region-Santa Fe Support Office of the National Park Service. This program is directed toward the research, design, and implementation of techniques to record, characterize, test, and treat historic and prehistoric plasters at ruin sites in the American Southwest.

Preservation Strategy

Plasters often represent a large percentage of the architectural finds still *in situ* at archeological sites. Their ephemeral nature (especially when compared with stone or brick) and poor fragmentary condition necessitate the development of a phased preservation strategy that allows for efficient and immediate documentation, stabilization, interpretation, and maintenance of these finds.

Documentation

Documentation of plasters should provide as complete a record as possible of the physical evidence, including fragment location in plan and elevation; support material(s), construction techniques including mechanical keying; number of layers and their thickness, color, texture, and composition (all verified with laboratory examination and analysis); application methods and work sequence; existence of secondary finishes (paints, incisions, relief, etc.); existing conditions (including environmental); and any subsequent alterations or treatments. The specific methods of survey and documentation will depend on available funds, time, and expertise, and the level of recording should be commensurate with the significance of the site and the finds. A standard lexicon of terms, including those describing conditions, should be established and used for long-term assessment and multi-site comparison.[3]

Stabilization

The most important goal of any archeological plaster stabilization effort should be the minimal treatment necessary to insure the preservation of the physical fabric so its informational value remains unimpaired for future study and interpretation. Depending on the conditions of the plasters, their support, or the environment, stabilization may take the form of temporary emergency work (often necessary after excavation) or long-term remedial treatment, such as consolidation and reattachment. Because rates of change (that is, deterioration) are a critical aspect concerning the relevance and efficacy of any intervention, every effort should be made to record and identify the causes and mechanisms of deterioration before treatment. Unlike other integral materials, such as stone or brick, plasters are particularly susceptible to catastrophic failure from subtle conditions such as blind detachment, which leads to collapse and complete loss. As such their present and anticipated conditions must be accurately diagnosed by professional conservators.

Kiva "C" finishes, Mug House, Mesa Verde National Park.

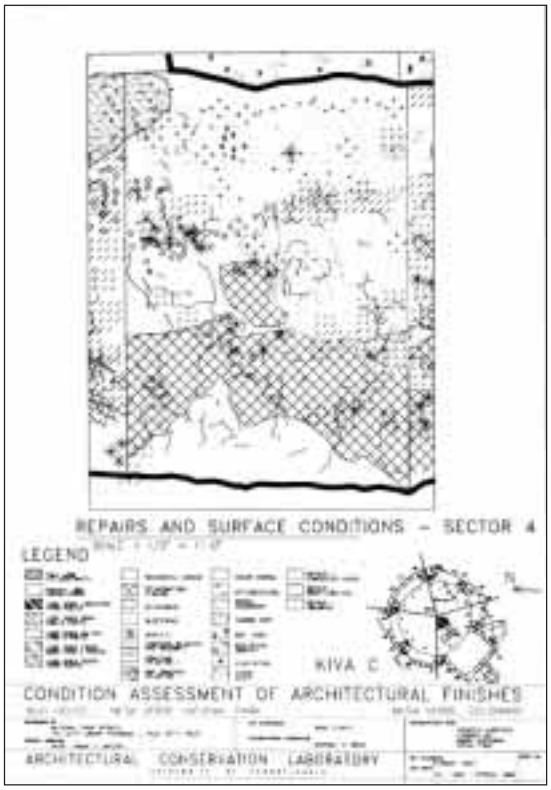
Priority should always be given to intact surfaces and finish layers because features such as tooling, painted decoration, and wear marks often carry much information. In areas where the finish layer is lost and the intermediate or base layers are exposed, preservation is always recommended although it may be discretionary. In areas where a complete loss of plaster has occurred, additional problems may arise due to the instability of isolated non-supported fragments or the deterioration of the structural core resulting from the loss of the protective plaster; such is the case with water-sensitive adobe. Stabilization measures may range from simple protective coverings to complex reburial, or they may involve temporary emergency facing treatments until full-scale conservation can be implemented. Detachment is a common problem affecting many site plasters, especially those of or on earthen materials. During the past eight years, detached plaster has been treated successfully by using moderate strength, low viscosity grouts of moderately hydraulic lime, fine sand, and ceramic microspheres.

Interpretation

The goal of interpretation is to offer a clear explanation of a site and its elements in their fragmented state. While this has sometimes been viewed as an opportunity for reconstruction, or "consolidation" as it is sometimes termed in archeological parlance, the process is most successful when the intervention to the fabric is minimal and supporting materials deciphering the physical remains and enhancing the visitor's understanding of the site are provided. In the case of plasters, effective site solutions that both stabilize and emphasize surviving fragments and their architectural context without requiring the removal or replication of entire finishes can be designed.

Maintenance

Most, if not all, conservation treatments are temporary in that they require monitoring, maintenance, and usually eventual re-application. While modern conservation principles demand treatments to be executed with stable materials and in a manner that allows for re-treatment in the future, it would be incorrect to think that many necessary stabilization techniques, such as consolidation or grouting, regardless of the materials used, are in fact reversible or allow for complete re-treatment. Therefore, every effort should



Condition assessment of architectural finishes, Mug House, Mesa Verde National Park.

be made to employ techniques that best balance preservation needs with the anticipated requirements of future studies and the maintenance of the materials and the site. Although most conservation research has focused on long-term treatment solutions, effective preservation can often be achieved by opting for indirect protection provided by shelters or reburial, or by selecting directly applied prophylactic techniques, such as water repellents, and sacrificial shelter coats, which offer easy renewable protection options but with a higher replacement cycle due to their lower durability. Only through on-site comparative monitoring can such methods be evaluated in contrast to other solutions designed to be long-term.

Conclusions

Developing an effective preservation strategy that is conservative yet responsive to the existing and varied contexts of any ruin site and takes into account the ephemeral nature of surviving building materials (such as adobe and plaster), the vulnerability of the ruin's condition, and the increasing demands for public interpretation is a difficult task. Past and current preservation practices include replacement; encapsulation with nonhistoric veneers; protective shelters and reburial; and remedial conservation treatments including capping, grouting, and consolidation. These practices have been employed at many sites around the world with varying degrees of success.

Their selection, however, must be based on a careful consideration of the site's significance, present materials and building systems, environmental and human factors, maintenance, and treatment predictability. Low pressure injection grouting with a mixture based on a moderately hydraulic lime, ceramic microspheres, and fine silica sand offers an effective method of reattachment and meets the essential performance criteria of injectability with low viscosity, reasonable setting time, minimal shrinkage and weight, maximal stability, adequate adhesive bond strength, and good water vapor transmission. Furthermore, using hydraulic lime as a single component binding material is advantageous because it is cost effective, readily available, chemically compatible, and easy to use. These techniques have been used for plain and decorated mud and lime plasters on a variety of earthen and masonry structures at historic and prehistoric sites in the American Southwest.

Notes

1 The most complete source on the development and standardization of stabilization techniques for ruin sites in the American Southwest is R. V. Richert and R. G. Vivian, *Ruins Stabilization in the Southwestern United States* (Washington, D.C.: National Park Service, 1974). Plaster stabilization, however, is not addressed in this text.

2 Both historical and current terminology is imprecise on the exact meanings of and distinction between these terms. The term plaster is used here to mean any inorganic binder (such as clay, lime, gypsum, natural or artificial cement) used alone or in combination with aggregates that when mixed with a suitable amount of water forms a plastic mass. When this plastic mass is applied to an interior or exterior surface, it adheres to it and subsequently sets or hardens, preserving in a rigid state the form or texture imposed during the period of plasticity.

3 A comprehensive three-part graphic documentation program for the Southwest has been proposed by the Intermountain Region Cultural Resources Management Program (NPS) for historic and prehistoric sites and structures.

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Photos courtesy the author.