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CONSIDERATIONS FOR THE DEFINITION OF STRATEGIES FOR THE CONSERVATION OF STUCCO RELIEFS AND FRIEZES IN THE MAYA REGION

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The stucco reliefs and friezes are one of the most important manifestations at hand to understand the cultural processes of the different groups that developed in the Maya area throughout time. These vestiges have been object of interest and intensive investigations to reveal historic or ideological issues, and are today one of the major attractions for tourists who visit the archaeological sites.

Nevertheless, their conservation implies a serious challenge to the professionals in charge of their safeguard. The decay of materials derives not only from the environmental conditions typical of the a tropical warm climate, but also from the lack of maintenance and protection, the abandonment of sites and looting activities, together with other issues connected with the context of such places, like the limited human and financial resources available for undertaking long term programs. The alternatives for conservation depend on the efficacy and availability of the materials, as well as on the implications of interventions in the re-valorization of a site and in future investigations.

This article will examine a number of issues that should be considered at the time of defining the strategies for the conservation of stucco friezes and reliefs, and the implications of the different interventions as far as value and meaning of a site are concerned, together with its research potential. Special emphasis will be made on the re-burying alternative, as the professionals in the field feel that this intervention is one of the easiest and cheapest options at hand, particularly taking into account the lack of resources or adequate technologies for long term conservation and maintenance programs.

However, it is also clear that additional investigation is needed to understand the risks and benefits of reburying certain materials and features, particularly in humid tropical climates, and for ascertaining the best conditions and techniques for such a reburying. Although it is not the subject of this work, the cultural considerations that influence the archaeological investigation and the conditions for management, as well as requirements for visitors and interpretation, are also important in the decision-making to intervene a site. Besides, in the case of the Maya region, political and economic interests may also limit the alternatives for conservation, given the fact that the opening of a site and the exposure of decorated surfaces is not necessarily

determined by the site specialists, and in many cases are subjected to decisions based on their touristic or economic potential.

THE LIME TECHNOLOGY

The stucco façades and reliefs have been one of the most outstanding expressions of the technical and artistic abilities developed by the different cultural groups within the Maya area since the Late Preclassic period, as is the case with the masks at the sides of the stairway in Nakbe's Structure 1 (Hansen 2000), and up to the Late Classic period, with anthropomorphic façades like those present in Palenque, Chiapas (Littman 1959). The reliefs and friezes in these sites were formed mostly by modeled stucco produced with technological practices that varied chronologically and geographically, according to the availability of geologic resources, and regionally, according to the different cultures.

The technology used by the Maya was different from those used by other cultural groups in Europe. Given that most studies related to the material production and its application, and consequently of the adequate materials and methods for their conservation have been conducted to this day for the European case, it is necessary to re-evaluate this field of knowledge for its applicability in Mesoamerica. Some of the aspects where technology varied were the absence of evidence in the Maya area of the use of hearths and rotting pits. Apparently, the Maya used a number of different methods for burning stones which implied piling up wood outdoors. However, it has been argued that Late Classic closed hearths were present in Copan (Abrams 1996).

Regarding the rotting of lime, even today burnt limestone is exposed to the open air, generating a process where the formation of calcium hydroxide takes place with the environmental humidity and the rain, possibly excluding the use of rotting pits and even the aging of pastes. In addition, organic additives were used. There are over fifty documented recipes from modern informants both from Guatemala and Yucatan that imply the use of honey and several other vegetal extracts (Schreiner 2002). Laboratory studies have confirmed the use of extracts such as those of the quebracho tree, the chulcum, etc (Littman 1960), which help to reduce shrinking and cracking, and to strongly harden the surfaces.

In addition to the composition of the mix, a variety of colorants were used in Maya architecture, which include organic and inorganic compounds. The possible presence of organic dyes, in addition to inorganic pigments and the specific manufacture of the lime mix for the stuccos in the Maya area need to be considered to evaluate the chemical and physical characteristics required for an adequate conservation treatment, with materials of compatible characteristics.

DETERIORATION PROCESS AND CONSERVATION ALTERNATIVES

The deterioration of stucco results of the interaction of different environmental and cultural factors. The degradation processes start with the excavation itself, a fact

documented in countless cases, for example the losses of paintings and modeled features in the masks recorded in Uaxactun's Structure E-VII sub (Ricketson and Ricketson 1957). Even though when the accelerated decay of the component materials is an essential issue, the ranks and effects vary from one site to the other, and even within a same building or decorative feature. In most cases, humidity is an essential factor, as it generates mechanical and chemical processes that cause the loss of materials, a diminished material resistance, and disintegration, among other effects. Likewise, it promotes the crystallization of salts and generates adequate conditions for the development of micro-organisms and vegetation. Human activity generates deterioration too, as a consequence of environmental modifications and transformations such as deforestation, which brings about a change in the climatologic conditions, acid rains, vibrations, and visitors. Altogether, directly or indirectly this contributes to the deterioration of stucco by producing superficial erosion, and occasionally, even vandalic actions.

To face these deterioration processes, considerable effort is required as well as significant funds to allow for the exhibition *in situ* of the archaeological remains. Unfortunately, some of the degradation effects may be attributed to previous efforts accomplished for the conservation, maintenance, or re-valorization of a site. Many such interventions were accomplished with the technology available at the time, but without considering the causes and effects that led to the degradation of materials. In some cases, new materials were used without a previous evaluation of results in the short and long terms. The majority of the interventions carried out today, include structural stabilization using consolidating agents, the fastening of surfaces, repairs, bindings, mechanical and chemical cleansing, the removal of salts and micro-organisms, and occasionally, the full restoration and reintegration of the missing parts.

For the interventions of stucco consolidation, different materials were used, like acrylic resins such as Paraloid B72 and Primal AC33, or mixes of mortars with cement. The harmful results of these actions have been documented by different authors (Schávelzon 1990; Cedillo Álvarez 1991), a fact that has caused the present use of more traditional materials, and a greater interest towards understanding the properties of the different materials like lime and organic additives used since prehispanic times.

Although the use of these traditional materials has not caused the catastrophic results associated with the use of cement or synthetic resins, they do indeed have an impact on the matter as well as implications for the realization of subsequent scientific analysis that may allow for a greater comprehension of the technical practices of the Maya, together with the potential for dating materials. Like Papayanni notes, *"no conservation treatment whatsoever must be conducted without and exhaustive analysis and the accurate characterization of the mortars and mixes used"* (Papayanni, in Henriques *et al.* 2004).

The practice nowadays of using lime-based conservation materials derives from the theoretical principles of conservation that prioritize the compatibility of materials to avoid interventions that may contribute to greater deterioration processes (Hansen *et al*. 2003). The present state of knowledge at an international level may be analyzed

as of a number of articles published by the RILEM Workshop regarding Historic Mortars: Characteristics and Evidences (Bartos *et al.* 2000). In 1996 a Technical RILEM Committee was created, given that work in the field of historic mortars conservation involves many errors in the practice, at the time of choosing the mortars used in interventions, which results in considerable damage to the archaeological patrimony, in addition to significant economic losses (Thomson and Groot 1999). The Committee's report is in the process of being published, and will provide significant information regarding the methods and standards recommended for the characterization of each type of mortar. Despite these works and others derived from conferences and symposia, such as for example the *Colloquium on Historic and Archaeological Mortars: Analysis and Characterization*, organized by the Pennsylvania University and the US/ICOMOS Brick Masonry Specialty Committee (Charola *et al.* 2001; Matero 2001), and the report of the European Commission on Environmental Decay of Historic and Modern Hydraulic Mortars (Van Balen *et al.* 1999), the specific aspects of Maya technology and modern conservation practices in the region still remain to be analyzed, to re-evaluate the recommendations existing to this date.

Other efforts tending to the preservation of stuccos include tunnel excavations to expose and open an access to the modeled and painted sculptures, as was the case of Copan in Honduras. This implies tunneling towards the inside without removing the subsequent construction layers, to grant reliefs a greater protection (Williamson 1996). However, these cases still present unsolved problems, such as the interior environmental control, the impact caused by visitors (changes in the micro-climate), and the possible weakening of the overall structure.

The protective covers, as well as the re-burying actions, still are controversial decisions to make in archaeological sites (Stanley-Price 2001). Both interventions imply balancing different matters, like technical considerations, long term maintenance, and the availability of human, material and financial resources. Likewise, they change the context of a place, may affect other archaeological remains, and may change or generate new environmental conditions, and affect the perceptions regarding the importance of the place.

The main premise at the time of placing a protective cover is to protect the stucco reliefs and friezes from the direct impact of rain. For their construction, a variety of materials have been used, ranging from palm leaves to sheets of different materials. At times, the deterioration process accelerated under the covers, mainly those made with transparent materials with the capacity to exacerbate the cycles of heating and cooling. In other cases, when the materials used were not translucent, they increased the biological deterioration caused by micro-organisms, insects, birds, and bats.

As a consequence of the problems associated to stucco conservation, both in terms of decay and existing alternatives to this date, there has been an increasing interest in re-burying the original façades and reliefs and placing replicas instead (Hansen and Castellanos 2004). Theoretically, that is the way how the features would be better protected, while replicas could be maintained or replaced at will. Professionals in this field think this intervention is one of the easiest and more economic options to

execute, particularly when there are no resources or adequate technologies for long term conservation and maintenance programs. However, it is as well an accepted idea that further investigation is needed to achieve a full understanding of the risks and benefits of burying once again certain materials and features, particularly in humid tropical climates, as well as for defining the optimum conditions and techniques for reburying. In most cases, this intervention has been considered as the final alternative before the potential loss of highly valuable decorative features.

Some cases include the masks of Structure 5C-2 in Cerros, Belize, which were excavated in 1973 and buried once again in 1979. Prior to this intervention, the polychromatic surface was stabilized with polyvinylic alcohol before covering it with sand and building retaining walls with a cement mortar. The entire process was widely documented, but only few samples were taken to characterize the materials and to better understand the manufacturing processes, as well as for defining conservation strategies prior to any new excavation. Even when today there is concern in regard to the cement-derived salts and the formation of cracks at the beginning of walls, which let water leak in, reburying has made it possible to protect the structure, even in extreme tropical conditions.

In the case of Xunantunich, Belize, the west façade of Structure A-6 was reburied under a fiberglass replica in 1996. The stucco conservation, in collaboration with the Getty Conservation Institute, involved the consolidation, repairing and bordering of missing portions prior to reburying. In this case, the state of the masks was documented in detail prior to the intervention, so that in the future it will be possible to establish comparison parameters of the state of preservation in case the façade is excavated once more. However, the analysis of materials was limited to the identification of salts and the size analysis of particles (Magaña 2002). Therefore, and just like in Cerros, there are no elements to examine the technology used in Xunantunich, in comparison with other Late Classic sites. Given the fact that the frieze was intervened with lime-derived materials, future tests have been anticipated that will enable us to make progress in this field of knowledge.

In the case of the masks of Structure 34 at El Mirador, reburying was considered to be the sole viable strategy for conservation. The vestiges were documented, no conservation interventions were executed, and only the strained earth from the excavation was used for reburying (Hansen 1990). Several samples were taken that will allow us to make progress in the characterization of the materials used, in the comprehension of the manufacturing technology and in the definition of possible mortars, for some eventual intervention.

Together with the samples taken at Nakbe, a preliminary methodology was defined for the characterization of mortars based on petrographic sections. Likewise, the data obtained from the sampling at both sides have made it possible to elucidate the different variations implied in the stucco production, including the abrupt changes in technology occurred by the end of the Middle Preclassic and the beginning of the Late Preclassic periods, an information which may be integrated in the general descriptions of prehispanic societies to test the hypothesis on development and change of socio-political complexity (Hansen 2000).

The subject of reburying as a strategy of preservation of the archaeological heritage was widely discussed in the Colloquium of 2003 held in Santa Fe, New Mexico, by the Getty Conservation Institute, the United States National Parks Service and ICCROM (Rome). At that time, several cases were examined that ranged from the Chaco Canyon in the United States southwest to the Rose Theatre in London. Even though the advantages of reburying were acknowledged, there was consensus among the attendants on the fact that it was necessary to carry on investigating this subject, considering the large number of still unknown variables.

The authors (Hansen and Castellanos 2004) presented a synthesis of the main subjects that should be addressed for Mesoamerica, among which are the following:

- Conservation needs in relation with the susceptibility of prehispanic materials in humid climatic conditions.

- The management aspects: looting in the region, and the ecological and social impact of non-controlled development and tourism.

- The viability of interventions using protection covers and reburying actions, considering the available resources.

- The selection of methods and materials for the interventions.

- The impact of conservation interventions on the valorization and meaning of the sites.

One of the major conclusions derived was that in the design of projects for conservation interventions in the region, there is still an absence of accurate phases of documentation, evaluation and follow-up in varied degrees, in a way that systematic studies are needed to define the best conditions, methods and materials for reburying in humid tropical climates.

INVESTIGATION ABOUT MATERIALS

Notwithstanding the importance of the stucco reliefs and friezes as an evidence of complex technological processes, to this day technical analysis has been limited, compared to other aspects of the material culture, like ceramics. This is why it is important to consider, prior to the conservation interventions, the execution of a systematic sampling to enable us to analyze these issues.

According to Hughes and Callebaut (2000), there are two primary controls that operate in the sampling practices: the research goals and the tests (physical, chemical and descriptive) to achieve such goals. Therefore, before taking the samples, an accurate definition is needed regarding the problems to investigate within the overall context of the research process; additionally, the role of the characterization of materials in the documentation regarding the state of preservation is crucial. Many different tests may be used to ascertain deterioration, as well as the chemical, physical and mineralogical characteristics that could be of use to define

the properties, composition and specifications of the new mortars to be used in the conservation interventions. Likewise, analyses in conservation may make it possible to achieve a deeper knowledge of the deterioration mechanisms, the effects on the matter and to establish comparative ranks for the monitoring and evaluation of the state of preservation.

In addition to these analyses, the new available technologies allow for extrapolating information to study, among other subjects, the provenience of materials, the energy used in the construction activity, the dating, and the changes in technological practices. These studies contribute to the knowledge of the material culture and the development processes of different groups.

The studies already reported in previous conferences about Nakbe and other sites exemplify the usefulness of this investigation. For example, the Nakbe stuccos reveal changes in the composition, both macroscopic and microscopic, according to its period of construction and use. Such findings help to sort out the appearance of specialists and the dating of stuccos based on their composition. The composition of the stucco floors is different than that of architecture, while the stuccos of Preclassic façades is also different than those of Classic façades, suggesting that the production systems changed sometime between both periods. With the increase of studies about this Maya technology, it is possible to sort even more information about the culture and the development processes.

For the sampling, the minimum requirements include 4 to 40 grams of materials for the petrographic sections (Chiari *et al.* 1996).

However, it is important to acknowledge that stucco is not uniform and that the different layers provide relevant information. It should be as well underlined that these samples could be originated in secondary contexts, provided they were not intervened in the past, as this would compromise the veracity of the data. The use of lime particularly interferes in the determination of technologies, in dating (Rech *et al.* 2003), and in other scientific tests, as it is difficult to establish a distinction between ancient and modern calcium carbonate. As systematic samplings keep progressing, it will be possible to create centralized collections for research.

CONCLUSIONS

Stucco conservation still represents a major challenge. To this date, the deterioration processes are frequently “assumed”, creating photographic or graphic records of the effects that can be visibly distinguished, instead of basing them on a precise and methodological analysis of factors and processes including the analysis of materials. The analyses of conditions must not only include those conditions inherent to the climatic context and the transformation of the materials under such circumstances, but also the processes derived of conservation practices.

One of the crucial issues in this sense is the absence of a systematic collection of samples to analyze; however, this is not an exclusive problem of the region, as in the

field of conservation, there are still no common methods or standards for the investigation of stuccos.

Likewise, there is no consensus regarding the intervention alternatives, though in general there is an acknowledgement of the relevance of scientific analysis for defining which materials to use, even though there are questions still to be answered in regard to the functioning criteria. As long as the problems to be solved, as well as the entire context of the investigation, become clearly defined, better guidelines will be defined for a research protocol and the necessary sampling.

Regarding the alternative measures, the reburial of these friezes has been and is being considered, jointly with the construction of replicas, as a preservation strategy. In this sense, there are still crucial research issues to be addressed before adopting such an alternative. The rank of issues includes the need for conservation in relation with the decay susceptibility of materials in given climatic conditions, the viability of the reburying solutions in regard to the available resources, the methods and materials used, and the interdisciplinary collaboration necessary during the process.

Alike the protective covers, the risk of this measure lies in the fact that it is often considered a temporary intervention, though with time it ends up by being permanent, which derives in a series of problems due to the absence of a long term design. Consequently, both measures may become potentially detrimental to conservation.

In order to make progress in the conservation of stuccos in the Maya area, the following is necessary:

- To design and start with integrated research programs focused on the study of deterioration processes and mechanisms.

- To encourage the documentation, analysis and monitoring of conditions in different degrees.

- To strengthen the exchange of experiences and collaboration at different levels to make progress in this field.

- To establish standards for the terminology and contents of the conservation reports.

- To systematize the archives and to favor the access to information.

As to the selection of conservation materials, tests are essential to define those with the greater compatibility features that will prevent future deterioration processes derived from the interventions. However, compatibility must be evaluated depending on the type of sampling one wants to conduct, and the future for the overall site, because as mentioned earlier in this report, future tests may be compromised by the conservation interventions themselves.

Finally, it is important to emphasize that the decisions made around the conservation of stucco façades and friezes cannot be made in isolation. They should be inserted in a planning process where the values, meaning and importance of a site are the axis, so that the making of the decision may have the smallest possible impact on the interpretation of those values, compromising in a lesser degree the potential of these sites for future investigation. In addition, long term conservation must be in balance with the contextual realities of management and the needs of other groups of interest, including the sector of tourism and society in general. In this sense, not only more scientific research is necessary, but also an increase in the local capability, both at a professional and technical level, fit to adequately face the conditions of conservation and management.

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