STATE OF CONSERVATION REPORT

Precolumbian Chiefdom Settlements with Stone Spheres of the Diquís

(2014, Ref. 1453)

COSTA RICA

44 COM
Index

State of Conservation Report

*Precolombian Chiefdom Settlements with Stone Spheres of the Diquís – COSTA RICA*

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B. Annexes
   2. Analysis of micro samples of the sphere of el Silencio site, and characterization of sands prior to the conservation process – reintegration (2018-2019 season) - UNAM
Report on the Recommendations given by the World Heritage Committee:
Decision: 42 COM 7B.36

Precolumbian chiefdom settlements
with stone spheres of the Diquís

November, 2019

Ministry of Culture and Youth
Republic of Costa Rica
Summary

This report presents a continuation of the one sent in 2018 about the progress made in complying with the recommendations provided by the World Heritage Committee (WHC) through Decision: 42 COM 7B.36 42th Meeting of the World Heritage Committee, Manama, Bahrein, in July 2018, at the serial site “Pre-Columbian Chiefdom Settlements with stone spheres of the Diquís (1453), Costa Rica.”

On specific recommendations, to develop cooperation mechanisms with local communities and associations for management purposes is still a complex process. Legal and administrative issues are being analyzed to find alternatives. A joint project with the University of Costa Rica to develop a participatory co-management system with local and indigenous communities is in the process of implementation.

Additionally, the project “Engaging youth from local communities in participatory management and conservation of the Pre-Columbian Chiefdom Settlements with stone spheres of the Diquís”, with an investment from the cooperation of the Government of Germany have started and aims to participatory management and conservation of the sites.

Concerning the educational activities, they are focused on Heritage Education. During 2019 we can mention educational campaigns with different sectors of local population. The aim is to create inter-institutional links with the organized groups of the community and the region, with the purpose of creating spaces for the interpretation and appropriation of the archaeological, historical, social, cultural and natural heritage present in the World Heritage Site. Information is also provided about a web portal of the declared sites, the celebration of 5th anniversary of the declaration, and visitation data to the museum site of Finca 6 in the last year.

In regard to the buffer zones, the progress in this issue continues to be difficult, since it depends in the development of the Regulatory Plan of the canton of Osa by the local municipality. Nevertheless, new efforts have been made to obtain a specific regulation through an administrative resolution.

For the Risk Preparedness and Management Disaster Plans, joint work between the Internal Audit of the National Museum of Costa Rica and the administration of the Visitor Center of the Finca 6 Site-Museum has been done, to assess the risks associated with each of sites. A document with the results is expected for the first quarter of 2020.

In the case of additional staff, a new position, for a receptionist, was approved and is collaborating with the four people already in property positions. The process of consolidating the administrative unit as a program of the General Directorate continues. The contracting of maintenance and surveillance services has been renewed.

Finally, in relation to the execution of Heritage Impact Studies (HIA), there is no further development on the information presented for the HIA of the hydroelectric project. The project continues in an indefinite halt by the government. Concerning the HIA related to the Southern International Airport no decision has been taken by the Civil Aviation Council about the feasibility of the project.

A full report on conservation activities during 2017-2019 is included as annex. Additional information includes the completion of the second stage of the Visitor Center in Finca 6, and the operation of an interinstitutional team to follow aspects of the declaration of World Heritage.
Team meeting at El Silencio site.
On November 2018, a first report was submitted regarding the recommendations and state of conservation. Following, there is a complementary report of the activities that have been performed on each recommendation during 2019, with their different level of accomplishment according with the internal capabilities and external factors:

a) 4. Encourages the State Party to pursue its efforts to finalize cooperation agreements with local communities for management purposes, and to develop educational initiatives that highlight the property as a reference for cultural heritage potential in Costa Rica;

The exploration of mechanisms that allow joint management activities with some of the communities near the sites continues. Costa Rican legislation does not contemplate this in an explicit way.

The issue remains central in the management of the sites and through a cooperative project with the University of Costa Rica, joint management activities with some of the communities near the sites are being explored to develop a participatory co-management system with local and indigenous communities. The project was approved in November 2018, and is directed by Dr. Daniela Arroyo Barrantes and will last two years (Pry01-1588-2019- Contribution to development of the participatory co-management system with local and indigenous communities of the site UNESCO World Heritage Site: “Pre-Columbian Chiefdom Settlements with stone spheres of the Diquís”)

During 2019, with an investment of 95,200 dollars from the cooperation of the Government of Germany, the National Museum and UNESCO San José, have started the project “Engaging youth from local communities in participatory management and conservation of the Pre-Columbian Chiefdom Settlements with stone spheres of the Diquís”, which aims to train and to guide a group of young people from the 6 districts of Osa and the 2 indigenous territories, in the participatory management and conservation of the sites of stone spheres of the Diquís, so that they can carry out a process of local and sustainable management of the archaeological heritage of the area.

The objective of the project is to strengthen the participation and leadership of young people from the communities of Osa canton and indigenous territories of Curré and Boruca, in the conservation and management of the World Heritage site, through a series of educational and technical workshops that will provide participants with the necessary knowledge and tools.

The whole process has a duration of 18 months and will take place between 2019 and 2020. The participation of young people between 15 and 35 will be sought.

Additionally, a meeting with an indigenous group that live next to the Batambal site was held in October, 29th to explore possibilities of join work that benefit directly the local community,
Educational initiatives that highlight the property as a reference for cultural heritage potential.

The educational management is focused on Heritage Education. The aim is to create inter-institutional links with the organized groups of the community and the region, with the purpose of creating spaces for the interpretation and appropriation of the archaeological, historical, social, cultural and natural heritage present in the World Heritage Site, and in the Osa region in general. In this sense the project “Engaging youth from local communities in participatory management and conservation of the Pre-Columbian Chiefdom Settlements with stone spheres of the Diquís” will include training, through a series of educational and technical workshops, in the basic concepts of World Heritage, as a reference in the participation and leadership of young people from the communities of Osa and indigenous territories, in the conservation and management of the World Heritage site. The project responds to the concerns of the World Heritage Committee raised by Decisions 42 COM 7B.36 and 40 COM 7B.3, as well as the common goals set by the “Action Plan for World Heritage in Latin America and the Caribbean” (PARALC 2014-2024) adopted in Brasilia in 2014 and endorsed by Decision 38 COM 10B.4 of the World Heritage Committee.

As in previous years, several educational activities were performed as part of the of the inter-institutional coordination between the interested groups and the educational staff of the visitor center in Finca 6.

1) Educational activities carried out in the Osa canton

From October 2018 to October 2019 a total of 104 educational activities were carried out with the participation of 2599 people (Table 1). The most outstanding activities were: an educational campaign carried out within the framework of the presentation of a didactic suitcase, the celebration of the fifth anniversary of the declaration of the sites, the celebration of the independence of the country, and the closing educational campaign, carried out in November, whose data has not yet been systematized.

Support was also provided to the community of Palmar Sur in different educational, cultural and projection activities, including support to participate in the international contest for you people living next to UNESCO World Heritage in Central America, named “World Heritage in my community project”, to contribute to the appropriation of World Heritage Sites and their visibility at national and regional levels.

This project was sponsored by the UNESCO Office in San José, in collaboration with the Cultural Centers of Spain in El Salvador, Honduras, Nicaragua, Costa Rica and Panama, and provided financial support ($2700) for signs, designed by local young people, in public spaces with information about World Heritage. The inauguration of the activity was on November 27th, 2019, with the participation of Esther Kuisch Laroche, director of the UNESCO San José Office.

Another important activity was carried out with a low-income population from Palmar Norte, as part of a proposal of cultural citizenship, whose workshops ended in November (data to be systematized).
Opening activity of the “World Heritage in my community project” at Palmar Sur public park.
Unveilment of the main sign at Palmar Sur public park.
2) Educational Campaign in the Osa Canton / Presentation of the “Diquís Chiefdom Settlements with Stone Spheres” educational suitcase

On April 23-26, 2019, a series of activities were carried out in educational centers in the Osa canton, in order to present the educational suitcase of the “Diquís Chiefdom Settlements with Stone Spheres” to the students and teachers. Personnel from the Museological Projection Department and the Finca 6 Museum Site participated in the activity, as well as the person in charge of the production of the suitcase.

The suitcase is an educational resource in order to bring to the schools, but also to other audiences, the themes of the World Heritage sites. It has accessible information explained through illustrated panels, an animated video, audio guide, reproductions of archaeological objects and various games and activities, which teachers or managers of educational groups can perform directly.

Among the educational centers visited are: Finca 8, La Palma, San Gabriel Finca 5, Barrio Alemania, El Vergel and Palmar Sur elementary schools. The Finca 8 School students had the opportunity to visit El Silencio site to observe the restoration work that was carried out on the stone sphere. At El Vergel school, a puppet workshop and the presentation of the play “Namaimí, Sueños del Agua” (Namaimí, Water dreams) were held. Finally, a workshop and a storytelling presentation were organized at Palmar Sur elementary school.

A total of 11 activities were carried out with a population of 275 people, including 251 students and 24 teachers in the area. The educational

<table>
<thead>
<tr>
<th>Number of participants</th>
<th>II Semester 2018</th>
<th>I Semester 2019</th>
<th>II Semester 2019</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>October</td>
<td>November</td>
<td>December</td>
<td>January</td>
<td>February</td>
</tr>
<tr>
<td>171</td>
<td>294</td>
<td>0</td>
<td>84</td>
<td>363</td>
</tr>
</tbody>
</table>

Table 1: Number of participants in educational activities in the period October 2018-October 2019.
Educational activity with children at a local school.

Presentation of educational suitcase.
suitcase and its activities were very well received by teachers and students in the area and made it possible to create a different learning space for the student groups involved, where they stopped being spectators, to take part in educational and recreational experiences that promote a creative way of learning.

3) Web Portal “Chiefdom settlements with stone spheres from the Diquís delta”

At the beginning of 2017 the web portal “Chiefdom settlements with stone spheres from the Diquís delta”, www.diquis.go.cr, was launched. The portal provides with amply information about the World Heritage Site and its different components, history of research, the timeline of occupation of the Diquís delta, animations, aerial views, natural environment, modern multicultural communities, agenda of activities, tourist attractions of the Osa canton, and other aspects.

From November 1, 2018 to October 31, 2019, the Diquís portal www.diquis.go.cr was visited by 8428 different users, who have made 10 862 browsing sessions and have seen an average of 1.77 pages per session, for a total sum of 19,234-page views during the period. The average time of each session is 2 minutes with 24 seconds. Most visitors are new (86.5%) and the rest (13.5%) are recurrent.

Visits were received from users from 88 countries. The majority of sessions at the Diquís portal were carried out from Costa Rica (73.4%), secondly from the United States (7.14%) and third from Mexico (2.07%).
Other countries from which visits were received are: Spain, Colombia, Panama, Canada, El Salvador, Guatemala, and Argentina.

4) Celebration of the 5th anniversary of the Declaration of World Heritage by UNESCO

To celebrate the 5th anniversary of the inscription on the World Heritage List of the series “Pre-Columbian Chiefdom Settlement with stone spheres of the Diquís”, the Ministry of Culture and the National Museum held a protocol ceremony, in June 21, at the Finca 6 site, in Palmar Sur, Osa canton, with the participation of the Minister of Culture, Sylvie Durán Salvatierra, the director of UNESCO San José, Esther Kuisch Laroche, the director of the National Museum, Rocío Fernández Salazar, and the German Ambassador, Martina Nibbeling-Wriessnig, who was also the German Ambassador to UNESCO in Paris and a member of the World Cultural Heritage Commission.

Within the framework of the celebration several activities were carried out to systematize and generate capacities from concrete educational actions for the development of knowledge about the archaeological, historical, social, cultural and natural heritage of the Osa canton and southern Pacific region, in general.

Also as part of the celebration activities, the permanent exhibition was remodeled at the Finca 6 Visitor Center. This included updating the information of the texts, changing furniture, a new museographic design, and the placement of original ceramic and stone artifacts due to conservation and security improvements. Additionally, the exhibit...
General view of the permanent exhibition at the Finca 6 Visitor Center.
General view of the Wooden Masks exhibit at the temporary exhibition hall.
View of objects and information panels of the permanent exhibition at the Finca 6 Visitor Center.
View of objects and information panels of the permanent exhibition at the Finca 6 Visitor Center.
View of the new temporary exhibit at the Finca 6 Visitor Center.
View of the new temporary exhibit at the Finca 6 Visitor Center.
“Wooden faces: traditional Boruca masks” was inaugurated in the new temporary exhibition hall. The purpose of this room is to provide the visitor with more information and motivate people who have visited the site to return.

5) Finca 6 museum site general visitation data

From October 2018 to October 2019, 9111 people visited the site, of which 5701 (62.5%) were national visitors, and 3410 (37.4%) foreign visitors.

<table>
<thead>
<tr>
<th>Total</th>
<th>Gender</th>
<th>Age Ranges</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Identified</td>
</tr>
<tr>
<td>National</td>
<td>5701</td>
<td>2752</td>
<td>2818</td>
</tr>
<tr>
<td>Foreign</td>
<td>3410</td>
<td>1612</td>
<td>1714</td>
</tr>
<tr>
<td>Total</td>
<td>9111</td>
<td>4364</td>
<td>4532</td>
</tr>
</tbody>
</table>

Table 2: Visitation Flow according to type of visitors in the period October 2018-October 2019, Visitor Center Site Museum Finca 6

In 2019, the signaling and interpretation of the four sites was carried out. For this, 40 signs were made with written and graphic information that were placed along trails on the sites. The objective is that the visitor can make a self-guided visit. As part of this same effort, wooden bridges were built on canals present at Finca 6 and Grijalba-2 sites.
Welcome sign at Finca 6 site.
Information signs at Grijalba-2 and Finca 6 sites.
Orientation signs at Finca 6 site.
Wooden bridge at Finca 6 site.
b) 5. Notes with concern, however, delays in the implementation of actions that are essential for the proper management and conservation of the property, in particular the preparation of the Osa Canton Regulatory Plan, the Risk Preparedness and Disaster Management Plans, and management arrangements with the local and indigenous communities;

**Osa Canton Regulatory Plan and buffer zones**

In previous reports we mentioned that in Costa Rica the Regulatory Plan is the main technical and legal instrument available to municipalities to exercise its powers, and it is developed taking into account a regional and national framework as reference. It is the instrument through which local government and community plan land-use and guide the current and future economic activities, land uses, educational activity and health, according to the Urban Planning Law No. 4240 of 15 November 1968 and its amendments.

The Osa Canton Regulatory Plan is still in a suspended status. It was entrusted to a private company, but several problems arose in its execution and the Municipality decided to terminate the contract in 2015. Since then, the efforts to elaborate it by a team of officials from the same municipality has not have significant advances.

Given the difficulty of having a regulatory plan in the near term, a specific regulation for the issue of buffer zones was developed in a joint effort to be presented for approval by the Municipal Council. This specific regulation was presented for approval by the Municipal Council (10/31/18). The Council did not approve it, but moved it to the Legal Affairs Committee for review.

Since no news of the legal review were received, new requests were sent to the Council, in 2019, urging for a definition in the issue. Additionally, the topic was addressed by the interinstitutional technical team.

In October 30th a new audience was held at the Council Ordinary Meeting. A presentation about the nature and reach of buffer zones was done. The situation of the legal review pendant from last year was commented and a new accord was taken to ask the legal team to have a criterion. A consultation of the topic with owners and stakeholders in the buffer zones was raised as a condition.

It is important to note that the conditions on the proposed buffer zones has not changed during the last 5 years. The MNCR will continue with its objective of obtaining an administrative regulation for the buffer zones of the declared sites and expects to report positive results in the near future.

**Risk Preparedness and Disaster Management Plans**

In 2018, a joint work was initiated between the Internal Audit of the National Museum of Costa Rica and the administration of the Visitor Center of the Finca-Site-Museum 6, to assess the risks associated with each of the archaeological sites declared World Heritage. For this, 7 large risk factors were defined:
Effects of the tropical storm Nate in Finca 6 site.
1. Economic Factor.
2. Legal Factor.
3. Environmental Factor.
4. Political Partner Factor.
5. State Political Factor.
6. Geographic Factor.
7. Protection and Conservation of the Archaeological Heritage Factor.

Once these risk factors were defined, a methodology provided by the internal audit was carried out to assess the level of risk and the impact of each of these factors applied to the archaeological sites. The final work sessions were carried out in the months of September and October, 2019. The document generated was sent to the Heritage Protection, and Anthropology and History Departments for review and final contributions. After this, the results will be presented to the National Museum Administrative Board for validation. Once this risk analysis is completed, the final elaboration of the Risk Plan will continue.

Likewise, as the National Museum of Costa Rica is a public institution that provides visits to the general public, it must comply with Executive Decree No. 39502 - MP, which establishes the Emergency Preparedness and Response Plans for Work Centers or of Public Occupation. With this standard and the bibliography of Disaster Risk Management for World Heritage and Risk Management Guides for Museological Heritage, the Risk Management Plan will continue.

In the emergency care section, the incident command methodology will be implemented, this in order to standardize the attention of future emergencies that may occur. The document will be finalized in the first quarter of 2020 and the final approval is expected in the second quarter of 2020 by the Administrative Board of the National Museum of Costa Rica.

**Relation with indigenous communities**

In the previous report it was informed about the project “Consulting and Production Management of Sociocultural and Community Museology, 2016-2018” that provided museum support and education to the indigenous community of Boruca.

During 2019 a visit by a group of indigenous people from Boruca was planned to observe the conservation activities carried out at El Silencio site. In April, 2019, the visit was made. Archaeologists and curators explained the criteria followed in the intervention on the largest stone sphere recorded and an associated cobbled area. The visit also included a Batambal site tour, and a dialogue session.

Other activities included an assembly meeting with the Boruca Community Authorities, in order to inform them, among other aspects,
of the progress of the Conservation Program. An informative meeting with the Artisans Association La Flor de Boruca was also held at the Boruca Community Museum in order to invite them to the communitary dialogue event and inform them about the progress of the Conservation Program. During this meeting it was presented the Didactic Suitcase. Boruca authorities, as a response, invited the conservation team to perform a diagnosis and intervention in the spheres that are located in the Boruca town.

It is also important to mention that the indigenous communities of Curré and Boruca are included within the scope of the project “Engaging youth from local communities in participatory management and conservation of the Pre-Columbian Chiefdom Settlements with stone spheres of the Diquís”, that has as an objective the participation of young people in the management and conservation of the sites of stone spheres of the Diquís. All of this will contribute a better offer of the community museum, to create links with the World Heritage Site, and to a better knowledge of the deep history of the indigenous groups.
c) 6. Requests the State Party to submit to the World Heritage Centre, by 1 December 2018, a work plan and timetable for the implementation of its recommendations and to increase the human and financial resources necessary for these actions, and for the broader conservation and management objectives for the property;

Attached is a table with the tasks to be performed, the progress made, the deadline and institutional responsible. These actions are included in the Cultural Property Management Plan.

<table>
<thead>
<tr>
<th>Strategies to address recommendations</th>
<th>Indicators</th>
<th>Advances</th>
<th>Term and Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a Conservation Plan for the cultural property</td>
<td>Records of diagnoses made</td>
<td>Database with files designed</td>
<td>2019-2020 Department of Heritage Protection</td>
</tr>
<tr>
<td></td>
<td>Databases designed and running</td>
<td>Diagnostic records designed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Programs designed and running</td>
<td>Diagnosis of the state of conservation of the stone spheres located in the archaeological sites El Silencio, Finca 6 and Grijalba 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of actions and preventive and corrective studies carried out</td>
<td>Document Protocol for the monitoring of archaeological sites with stone spheres</td>
<td></td>
</tr>
<tr>
<td>Task Description</td>
<td>Progress</td>
<td>Year</td>
<td>Responsible Bodies</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>--------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Develop a Risk Plan and Disaster Management Plan</td>
<td>Plans already prepared</td>
<td>2019-2020</td>
<td>Finca 6 Site-museum /Department of Heritage Protection</td>
</tr>
<tr>
<td>Request the budget allocation to meet the needs of personnel, equipment and supplies.</td>
<td>Applications made and financed</td>
<td>2019-2020</td>
<td>Management Plan Committee / Finca 6 Site-museum /Department of Administration and Finance/General Direction</td>
</tr>
<tr>
<td>Development of technical administrative unit profile</td>
<td>Profile made</td>
<td>2019-2020</td>
<td>Management Plan Committee / Finca 6 Site-museum /Department of Administration and Finance</td>
</tr>
<tr>
<td>Request the inclusion of the buffer zones in the Regulatory Plan of the canton of Osa.</td>
<td>Amounts of steps taken</td>
<td>2019-2020</td>
<td>Finca 6 Site-museum/ Management Plan Committee /General Direction</td>
</tr>
<tr>
<td>Analyze the legal and administrative viability for the co-management of the sites</td>
<td>Analyzes carried out</td>
<td>2018-2020</td>
<td>Finca 6 Site-museum 6 / Direction / Legal Office, Management Plan Committee</td>
</tr>
<tr>
<td>Task</td>
<td>Status</td>
<td>Timeframe</td>
<td>Responsible Party</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------</td>
<td>------------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>Formalize co-management with community organizations through agreements, letters, among other possible mechanisms.</td>
<td>Agreements signed</td>
<td>2018-2020</td>
<td>Finca 6 Site-museum / Direction / Legal Office, Management Plan Committee</td>
</tr>
<tr>
<td>Execute in a continuous way the institutional Education Plan directed to educational centers in the canton of Osa.</td>
<td>Document made and approved</td>
<td>2017-2020</td>
<td>Department of Museological Projection/Finca 6 Site-museum</td>
</tr>
<tr>
<td>Promote an information campaign for the general population in the media, providing updated data.</td>
<td>Annual meetings with national and regional supervisors in the areas of Civics and Social Studies. Annual work plan including annual activities for the areas surrounding the sites (Osa canton)</td>
<td>2019-2020</td>
<td>Department of Museological Projection</td>
</tr>
<tr>
<td>Heritage impact assessments of regional development projects</td>
<td>Assessments done</td>
<td>2017-2020</td>
<td>General Direction / Management Plan Committee</td>
</tr>
</tbody>
</table>
Financial and personnel resources

Official guidelines for not hiring new positions in the central government, mentioned in previous reports, continued during 2019. The fiscal situation of the country has some improvement but not enough to lift regulations.

Property positions for a team of four people, located on the Finca 6 site: an administrator (in charge of the administration and general management, maintenance, security and visitation of the site Finca 6 and the maintenance and protection of the other sites), an educator, a ticket clerk and a maintenance manager was a significant advance in 2018.

For 2019, one more person, to work as receptionist, was hired in May 20, 2019, in interim terms. The position was approved by the STAP, (Budgetary Authority of the Technical Secretariat). This will help to have a better attention to visitors.

Temporary workers continue to be hired for maintenance work in different sites, currently there are 5/6 workers hired through the figure of wages. Budgetary provisions have been made to continue hiring these workers for the next year. Similarly, a contract with a private company provides 24-hour surveillance of the Finca 6 site and another contract covers the cleaning service, which keeps the Visitor Center building in adequate conditions for visitors.

As mentioned in the 2018 report an administrative unit is in process of being created for the administration for the Visitor Center and the archaeological sites, as a dependency of the General Direction. After completing the internal process, the documentation must be sent to the Ministry of Planning for approval. It is expected that the required documents will be sent by the first half of 2020.

d) 7. Urges the State Party to conclude the Heritage Impact Assessment (HIA) of the international airport project and to provide it, including a section in the impact of the project on the Outstanding Universal Value (OUV) of the property, to the World Heritage Centre for review by the Advisory Bodies, as soon as it becomes available;

The project of a Southern International Airport, outlined in previous reports, has not have any particular advance and continues in its feasibility stage. The Environmental Impact Assessment (EIA) has not been approved by the Environmental Technical Secretariat after the request of the National Museum of Costa Rica (Official letter DG-639-2015), no to do so until the Heritage Impact Assessment (HIA) is completed by this institution.

Likewise, the Technical Council of Civil Aviation sent a similar letter to the SETENA (Official letter CTAC-AC.2015-1244) requesting the temporary suspension of the environmental analysis until we have the results of the Heritage Impact Assessment. Additionally, the government has invested in upgrading existing regional airports, including the Palmar Sur airport, which is located in the Diquís delta.
Despite, contacts, since 2017, with the General Direction of Civil Aviation to begin the assessment of the Southern International Airport project, this has not been initiated. The new administration has not taken any decision regarding with this project.

In October 2019, a new letter was sent to the Civil Aviation authorities requesting information on the status of the project. Despite several calls, there was no answer up to the sending of this report.

e) 8. Notes with concern that the HIA for the El Diquis Hydroelectric Plant has taken a narrow focus and that technical details and visualisations show that, although the dam will be located outside of the Diquís delta, ancillary constructions in the wider setting of the Batambal site would have potentially negative impacts on the landscape context of the chieftown settlements, and thus on the OUV of the property, and are at odds with the aims of the Management Plan, and therefore also urges the State Party to reconsider the project;

This issue was addressed in the 2018 report. The situation remains the same, with all activities of the hydroelectrical project indefinitely suspended.

f) 9. Also requests the State Party to submit to the World Heritage Centre, by 1 December 2019, an updated report on the state of conservation of the property and the implementation of the above, for examination by the World Heritage Committee at its 44th session in 2020.

A report on the conservation activities carried out between 2017 and 2019 was prepared by the team of conservators and restorers who have been working on the issue. It provides detailed information on the different activities and interventions carried out. This report is attached as Annexes 1 and 2.

Additional information

Two additional elements that are important to mention.

Construction and inauguration of the second stage of the Visitors Center, Finca 6 site

As planned in the infrastructure project presented in the nomination file in 2014, the Visitor Center consisted of two sections. The first was built in 2013, The second was ended in May 2019. This is a construction of 236 m² that will provide a better administrative area, a temporary exhibition room, a small auditorium with technology for presentations, as well as simultaneous online communication, a work area for curators and researchers and a storage room.
As part of this second stage of construction, shelters and sanitary services were built at the Finca 6, Grijalba 2 and El Silencio sites. Each construction unit was 22 m$^2$ and seeks to provide basic facilities for site visits.

In addition, this November, has begun the construction of a small archeology and conservation laboratory and a storage deposit, with an area of 80 m$^2$, attached to the main building. The works are expected to be completed by April, 2020.

**High-Level Commission and Inter-institutional technical team**

As informed in the 2018 report, a High-Level Commission and Inter-institutional technical team were created by a presidential decree for the integral management of the site, validate the evaluation of the impacts on the universal and exceptional value of the sites, and link with the World Heritage Center of UNESCO. The Inter-institutional technical team has held several meetings.
Extended visitor center at Finca 6 site.
Restrooms and new parking lot at Finca 6 site.
Credits

Responsible Authority
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Republic of Costa Rica
Ministry of Culture and Youth
GENERAL PROGRESS REPORT
MANAGEMENT PLAN FOR THE “PRE-COLUMBIAN CHIEFDOM SETTLEMENTS WITH STONE SPHERES FROM THE DIQUIS”, COSTA RICA
CONSERVATION PROGRAM
January 2017-July 2019


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I. INTRODUCTION

This initiative originates from the efforts made in the last four years by the National Museum of Costa Rica (MNCR), the Cultural Institute of Mexico of the Embassy of Mexico in Costa Rica, and the Ministry of Foreign Affairs (SRE), the Ministry of Culture (SC) and the National Institute of Anthropology and History (INAH), the three in Mexico, under the Program of Cultural and Educational Cooperation Mexico-Costa Rica 2015-2017, Project 12 “Heritage Impact Evaluation of World Heritage Sites: Pre-Columbian Chiefdom Settlements with stone spheres of the Diquís, Costa Rica”

As a result, in 2016, Dr. Isabel Medina-González from the National School of Conservation, Restoration and Museography (ENCRYM-INAH) was commissioned to advise the elaboration of the Management Plan of the Diquís Chiefdom Settlements (PMACD), whose structure was defined based on the strategic orientations developed by Plan of Action for World Heritage in Latin America and the Caribbean 2014-2024 (WHC 2014). In this sense, the strategic structure of the PMACD (MNCR 2017) was oriented towards compliance with 5 strategic lines given by UNESCO, called: credibility, conservation, capabilities, communication and community. Based on that, the Conservation Program was designed to comply with its own vocation, but also to add, transversely, to the other strategic lines.

In 2017, Dr. Isabel Medina-González assumed the role of coordinating and advising permanently to the Conservation Program, whose areas of action are directed in an integrated way to the research, preservation, intervention, management and dissemination of the archaeological sites declared as World Heritage, within a framework of interdisciplinary collaboration, community participation and international cooperation. The goals established for the first annual cycle (2017-2018) were:

- Perform an integrated diagnosis of the 5 stone spheres located in situ in the Finca 6 archeological site.
- Start research in areas of materiality and changes in those monuments.
- Carry out preventive conservation actions, including re-excavation and re-burial (with inert deposits) of the 5 spheres already mentioned.
- Carry out an inspection of the physical condition of the 3 stone spheres transferred from Finca 4 archeological site to the deposit in Finca 6.
- Train the conservation staff of the MNCR in the diagnosis of archaeological stone heritage.
- Carry out dissemination work on the relevance of the stone spheres and their conservation to local, national and international communities through various formats and means of relevant communication.
- Advise the research program on conservation of the areas established by the MNCR.

That same year, MNCR’s Department of Cultural Heritage Protection (DPPC) conducted a two-week field work season at Finca 6 site, from June 16 to 27, with the participation of Rest. Ana Eduarte, Rest. Alfredo Duncan, M.Sc. Javier Fallas, all from MNCR, and Dr. Isabel Medina-González (ENCRYM-INAH). Likewise, the collaboration of Dr. Francisco Corrales, from the Department of Anthropology and History (DAH), and Finca 6 workers to perform tasks typical of the archaeological field. Also, the logistical support of Jeisson Bartels, administrator of the Site Museum of Finca 6, as well as its collaborators in educational and administrative matters. In the diffusion work we had the role of the head of the Department of Museological Projection (DPM) of the MNCR, Lic. Mariela Bermúdez, as well as Lic. Wendy Segura, of the Communication section of the same department. In the planning, organization, execution and reporting phases, M.Sc. Myrna Rojas, head of the DAH-MNCR had a significant contribution. The whole activity was supported by the MNCR director, Lic. Rocio Fernández, and its Administrative Board.
The cabinet work that resulted from the field season continued for almost 12 months. In Costa Rica, the work was in charge of M.Sc. Javier Fallas and Rest. Ana Eduarte. They were responsible for gathering information for the generation of a project’s institutional file, as well as of processing the information derived from the diagnosis. In parallel, in Mexico, and thanks to the ad honorem collaboration of Dr. Manuel Espinosa, from LANCIC-ININ (Laboratory-National Institute of Nuclear Research) and LANCIC-IIE (Laboratory, Institute of Aesthetic Research), research on the materiality and alterations of the spheres of Finca 6 was conducted.

In 2018, with the support of the MNCR’s director, Lic. Rocio Fernández, Lic. Marlin Calvo, head of the DPPC, and his collaborators, Lic. Leidy Bonilla and M.Sc. Javier Fallas, rejoined their efforts with Dr. Isabel Medina-González (ENCryM-INAH) to organize a second cycle of the Conservation Program, whose annual goals were:

- Monitor the conservation status of the 5 stone spheres located in the Finca 6’ site alignment, which were subject to diagnosis and re-burial in the 2017 season.
- Prepare an integrated diagnosis of the monumental sphere of the El Silencio archaeological site.
- Continue research in areas of materiality and alteration in the sphere of El Silencio, as well as inaugurating a line of scientific studies on intervention materials.
- Continue training the DPPC-MNCR conservation staff in diagnosis and monitoring of archaeological stone heritage.
- Strengthen communication efforts aimed at disseminating sites and spheres relevance, as well as the MNCR efforts regarding their conservation among various local, national and international communities, through various means of relevant communication.
- Initiate a line of intercultural dialogue on archaeological conservation with the local communities, particularly Boruca indigenous persons.
- Start a professional exchange strategy through conferences and relevant articles to present the Conservation Program actions and advances before the national and international academic community.
- Advise the research and management program in the framework of the Management Plan for the “Pre-Columbian Chieftdom Settlements with Stone Spheres of the Diquis.”
- Prepare a Conservation Program general progress report for its integration in the general report to the World Heritage Committee.

In the field season participated, by ENCRyM, Dr. Isabel Medina-González and Lic. Valeria Villalbazo; and, by the DPPC-MNCR, Rest. Alfredo Duncan, M.Sc. Javier Fallas, Rest. Alonso Silva and technicians, José Alexis Matamoros and Miguel Rodriguez. Also, there was logistic support from Jaison Bartels, coordinator of the Site Museum of Finca 6, and its administrative and educational team. Dr. Francisco Corrales and ArqI. Adrián Badilla (DAH-MNCR), were involved in archaeological and management work. In the fields of dissemination and inter-cultural dialogue, there was essential support from DPM-MNCR, head of department, Lic. Mariela Bermúdez, as well as from Lic. Maribell Mendieta. In the planning, organization, execution and reporting phases, we had the support of MNCR’s director, Lic. Rocio Fernandez, and the Administrative Board.

From June 2018 to April 2019, the DPPC-MNCR team made up of Fallas, Silva and Duncan continued with both cabinet and field tasks in Costa Rica. Among the first we must highlight the continuation of the information file, reports elaboration, and progress in the systematization of monitoring and diagnosis derivatives made in Finca 6 and El Silencio sites. Regarding the field work an integrated diagnosis of the stone spheres at Batambal and Grijalba-2 archeological sites was made. In Grijalba 2, preventive re-excavation and re-burial tasks (with inert deposits) were performed in the sphere located in situ, which made clear the training processes’ maturation. In Mexico,
together with the completion of the corresponding report, considerable progress was made in the investigation of materiality and alterations of the sphere of El Silencio, this together with Dr. Manuel Espinosa of LANCIC-IIE.

Following largely previous season organizational logic, the 2019 third cycle of work, had these goals:

• Intervene the monumental sphere of El Silencio archaeological site in order to restore its stability and favor its interpretation.
• Intervene a sector of the cobbled area next to the monumental sphere of El Silencio, in order to stabilize it and favor the interpretation of the site as a whole.
• Present the research results in areas of materiality and alteration in the sphere of El Silencio.
• Start the training of DPPC-MNCR conservation staff in archaeological conservation of movable and immovable monuments.
• Strengthen communication efforts aimed at disseminating sites and spheres relevance, as well as the MNCR efforts regarding their conservation among various local, national and international communities, through various means of relevant communication.
• Strengthen the line of intercultural dialogue on archaeological conservation with the local communities, particularly Boruca indigenous persons.
• Start a professional exchange strategy through conferences and relevant articles to present the Conservation Program actions and advances before the national and international academic community.
• Advise the research and management program in the framework of the Management Plan for “Pre-Columbian Chiefdom Settlements with Stone Spheres of the Diquis”.
• Prepare a Conservation Program general progress report for its integration in the general report to the World Heritage Committee.

In the field season, which took place from April 7 to May 18, 2019, participated, on the part of the ENCRyM-INAH, Dr. Isabel Medina-González and Rest. Ana Miramontes; and, on the part of the DPPC-MNCR, Rest. Alfredo Duncan, M.Sc, Javier Fallas, the Rest. Alonso Silva and technicians, José Alexis Matamoros and Miguel Rodríguez. There was also Jeisson Bartels logistic support, and of the administrative and educational team of Finca 6. Also, the archaeological and management work was led by Dr. Francisco Corrales (DAH-MNCR). In the areas of dissemination and inter-cultural dialogue, the support of DPC-MNCR, Lic. Mariela Bermúdez was essential of, as well as Lic. Wendy Segura. In the planning, organization, execution and reporting phases, we had the support MNCR’s director, Lic. Rocío Fernandez, and the Administrative Board.

This document synthetically gathers the work carried out from 2017 to 2019 by the Program of Conservation of the Diquis Chiefdom Settlements Management Plan (PMACD), an initiative under the umbrella of the Mexico-Costa Rica Cultural and Educational Cooperation Program 2015-2017. Project 12 “Heritage Impact Evaluation of World Heritage Sites: Pre-Columbian Chiefdom Settlements with stone spheres of the Diquis, Costa Rica”, Costa Rica” has been jointly co-financed by AMEXCID-SRE (Mexico), INAH (Mexico) and the National Museum of Costa Rica (Costa Rica). In these efforts is worth making visible the efforts and unconditional support of Mtro. Arturo Valencia, director of the Cultural Institute of Mexico in Costa Rica, Lic. Rocío Fernández, director of National Museum of Costa Rica, and the directors of ENCRyM-INAH, in particular its current director, Mr. Gerardo Ramos Olvera.
II. SCOPE

The scope achieved in each of the annual cycles (2017, 2018, 2019) has been organized analytically in accordance with the programs, objectives and strategies established in the PMACD, as follow:

CONSERVATION

Specific Objective: To establish a protocol for decision-making regarding the preservation and conservation of cultural property.

Strategic Line: To establish a general decision-making methodology.

In order to have a methodological basis for decision-making regarding archaeological conservation in the Diquis Chiefdom Settlements (ACD), a strategic sequence of moments of action was established:

• Documentation and Valuation.
• Diagnosis
• Investigation
• Decision making
• Preventive Care
• Healing, Corrective and Interpretive Intervention
• Monitoring
• Maintenance
• Review and Adjustment

These strategic fields have been translated into specific objectives of the Conservation Program.

Specific Objective. To know, register and document the archaeological assets that require preventive care or conservation actions.

Strategic Line. To implement a registration and documentation program of aspects related to the cultural good, either physically or electronically.


In 2018 and 2019, the compilation and digitalization of information (reports, graphic and photographic records) on the biography and conservation of the stone spheres, from the Diquis Chiefdom Settlements, which was compiled into a physical as well a digital collection, continued. The documentation has been compiled from both DPPC's own collections, as well as other instances of the MNCR, including DAH and DPM. Likewise, permits for the compilation of protected information in the collections of the Department of Archeology of the University were requested.

In parallel, backups of the three seasons photographic archives of the Conservation Program have been done, as well as the reports. The compilation and digitalization of written and graphic materials has been consolidated as a DPPC permanent activity. The most important challenge corresponds to the compilation and digitalization of photographic records, since many of them are scattered in institutional and personal archives. There is also news that the local population
Specific Objective: To diagnose the conservation status of the cultural asset with the different disciplinary techniques to establish requirements and priorities.

Strategic Line: To develop a diagnostic program of the main heritage elements from an interdisciplinary perspective.


For the development of the integrated diagnosis of spheres A, B, C, D and E, Finca 6 Site, the deposits where these monuments are partially buried were re-excavated. The deposits had already been explored, at the request of the DPPC, both in 2013 and 2016. During 2017, the re-excavation task was carried out under the coordination of Dr. Francisco Corrales. It included an excavation pit two meters per side derived from a north-oriented grid, whose depth reached the previously released level; that is, approximately 10 centimeters above the lower limit of the monument, a condition that did not jeopardize its stability. During this excavation the wooden supports that had been placed in 2013 as a support were removed since they were in a state of decomposition. In fact, this layer of wooden supports served to identify the lower stratigraphic limits of the previous intervention. In the case of sphere B, the re-excavation led to the recovery of a possible archaeological artifact at the lower limit, which was recorded and is currently under analysis. In this way, it is possible to affirm that the processes of conservation of the stone spheres allowed to recover relevant information about their archaeological context.

The diagnosis was based on a methodology, designed by Dr. Isabel Medina-González (ENCryM-INAH), based on the review of specialized bibliography, including the OVO Method (Pedelli 2014) and the experiences derived from previously developed diagnoses in Mexico and Central America, mainly in the World Heritage sites of Copán (Honduras), Tikal (Guatemala), Quapah Ñan (Chile) and Chichen Itzá (Mexico) (Medina-González 1994; 2005a; 2005b, 2013).

Its development contemplated a series of methodological phases, to follow:

- **Photographic documentation**: digital photographic shots of each of the faces of the spheres with cardinal orientation (N, NE, E, SE, S, SW, W and NW) were prepared, as well as the zenith. These images were referenced with a scale, a signpost for the magnetic North, and a blackboard with information relevant to the record. The four side views were taken at half the height of the monument to avoid distortion and at approximately 1.5./2 m equidistant distance. Photographic shots of technological details and alterations were also made.

- **Organoleptic observation** for the identification of the main alterations present.

- **Alterations registry.** Based on the application of ICOMOS-ISCS: Illustrated glossary on stone deterioration patterns, and organoleptic analysis of each of the spheres, an international language was generated, but of specific derivation, of alterations, formed by a typology

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1 Steps have been initiated to establish the Diquis Stone Spheres Conservation Information System: a database which seeks to synthetically understand identification, life history, assessment, results of scientific studies, previous interventions, diagnosis, management, decision making, interventions and monitoring aspects.
endowed with a symbology. Each type of alteration was photographed while the symbology served to manually register the alterations present in each of the faces of spheres in acetates, with indelible markers. The result was a detailed alterations registry divided into 7 items: a) Biotic Colonization, b) Chromatic Alterations, c) Physical-Mechanical Alterations (Cracks and Deformations), d) Alterations due to Detachment, e) Alterations due to Material Loss, f) Internal Alterations: Cavities; g) Alterations by Human Action.

- Monitoring of general environmental conditions. With a digital thermohydrograph, environmental humidity and temperature conditions were recorded in areas close to the spheres 3 times of the day: morning, noon and afternoon.

- Measurement of properties and behavior of the rock matrix: Data on the properties and behavior of the rock matrix were compiled, such as texture, color (Munsell ©) and hardness (Mohs scale). Likewise, measurements of surface temperature (RadioShark © digital infrared thermometer) and Humidity (Survey © Protimeter) were recorded, three times a day, both in the zenith area and at an intermediate point of each of the cardinally oriented faces. Mechanical resistance tests (Hammer Schmidt), surface detachment (Tape ²) moisture absorption (Karsten column ©³), particularly in the crowns of the spheres, were carried out, so the vertical measuring column was used. The points where the corresponding measurement/test was performed were recorded in general photographic shots, while their results were compiled in manual tables for further processing.

- Sampling for scientific studies of characterization of constituent materials and alterations. Controlled samples (recorded on location in the photographs of the sphere and with individual photographic record) were taken from both "healthy" rocky substrates and specific alterations for the purpose of their scientific study by border technologies. The extraction of the samples was done in little visible and altered places; The extraction was done with spatulas and stainless-steel tweezers. The samples were stored in plastic containers that were labeled with permanent markers in their covers with the following information: sphere number, consecutive sample number and type of sample (healthy, stratigraphic, alteration name). A photographic sample was taken that includes scale and reference data. The exact place of extraction of the sample was recorded in respective diagrams.

- Sampling of burial/contact deposits. Twelve samples were taken from the deposit of each sphere, which included both the surface layer, and the substrate one meter deep, as well as the base level of the monument. The samples were stored in plastic containers with identification tags. The purpose of this activity is to submit the samples to general chemical tests to understand the dynamics of conservation/alteration of the burial context.

The total written, graphic and photographic record derived from the diagnosis was delivered to MNCR for systematization and safekeeping. During 2017-2018, the DPPC-MNCR was in charge

2 The Tape test procedure consists in placing standardized sections of adhesive tape in contact with the rocky surface to generate the detachment of tensile disintegrated constituent material. The weight of these sections, determined by Granatariar Balance, is subsequently compared with the weight of references not submitted to the experiment.

3 The procedure of this test is to verify the absorption of water in milliliters, first every minute for 5 minutes, then every 5 minutes until 40 minutes, and then, every 10 minutes, completing one hour for the test. There are several factors that can influence the test results: the stone temperature, the liquid saturation on the surface, or thick concretions among others. (Silva-González, 2018; Fallas-Fallas, 2018.)
of the process of digitizing the graphic record of alterations. The samples were transferred to STCA, ENCRyM-INAH for further study.

Diagnosis of Spheres A, B, C, D and E, Finca 6 site

Example of digitization of alterations of sphere C, Finca 6 site.
**Actions (2017): Technical inspection of physical condition of 4 spheres of Finca 4 site transferred to Finca 6.**

At the request of the MNCR, and in follow-up of the preventive conservation actions carried out for the protection of the spheres of Finca 4 site, which led to their relocation from a road neighborhood property to the Finca 6 shelter deposit, a technical inspection was done, consisting of a general photographic record and a pre-diagnosis of physical condition. In conclusion, it was established that the spheres did not suffer any damage during their transfer, but that it is necessary to proceed, as soon as possible, to carry out a comprehensive conservation diagnosis. As an immediate preventive measure, it was suggested to install a tarp as a temporary protection to cover these spheres that, due to the fact that they are mostly made of limestone, present a high vulnerability to environmental agents.


The integrated diagnosis of Spheres F and G of the Finca 6 site was based on the methodology already established in 2017. However, since the diagnosis is a dynamic system that draws on the specific experiences of the cases under study, it is worth mentioning some peculiarities:

- **Alteration registry:** These sculptures can be considered “twins”: besides being practically the same size, in pre-Columbian times they were elaborated to occupy an analogous role; that is, as flanking sculptures to the access ramp of Structure 1 (or Mound 1). However, each sphere has been exposed to differentiated environmental contexts; on the one hand, the open-air exhibition of the F sphere means its continuous exposure to natural weathering agents and, while the other, the G sphere, has remained buried since pre-Columbian times, except for the brief moment when was excavated. The combination of both variables meant that the development of the diagnosis became an opportunity for a comparative analysis of alterations.
**Diagnosis of sphere G at Finca 6 site**

**Actions (2018): Integrated diagnosis of sphere, El Silencio site.**

The integrated diagnosis of the sphere El Silencio site was based on the methodology already established by the project in 2017. However, some specific considerations are noted to the case:

- **Photographic documentation.** Aerial shots required the installation of a 3 meters high scaffold. Likewise, to facilitate the standardization of photographic shots by cardinal orientation in future monitoring actions, photographic points were established at an equidistant distance of 2.5 m; These points were formalized by burying eight 20 cm construction rods that were placed in plastic cups filled with white cement, so that the mark stood out just a centimeter from the surface. Given the dimensions of the element and the requirements of a detailed register, photographs of 64 quadrants were also taken, resulting from a sectorization, derived from the application of a grid that made up 8 parallels (A-H) and 8 meridians (1-8).

- **Alterations registry.** The diagnostic typology of the sphere of El Silencio was carried out both on a general scale -photographs by cardinal and zenithal orientation- and in detail -quadrant images-. 26 alterations were recorded, divided into 8 items: a) Bio-colonization, b) Chromatic and depositional alterations, c) Physical-mechanical alterations (Cracks and Deformations), d) Alterations derived from detachment, e) Alterations derived from material loss, f) Internal alterations: Cavities; g) Alterations due to human action and h) Previous interventions.

- **Measurement of matrix rock properties and behavior:** The measurements of surface temperature (RadioShark © digital infrared thermometer) and Humidity (Survey © Protimeter)
were carried out three times a day, both in the zenith area and at the top, intermediate and lower
in each of the monument orientations.

- **Sampling for characterization of constituent materials and alterations scientific studies.** 60
controlled samples (recorded on location in the photographs of the sphere and with individual
photographic record) were taken from both "healthy" rocky substrates and specific alterations
for the purpose of their scientific study by border technologies.

- **Sampling of burial/contact deposits.** 4 samples were taken from the contact reservoir of the
sphere for the purpose of conducting general chemical tests.

The total written, photographic and graphic record derived from the diagnosis is held by the
DPPC/MNCR, whose work team has made some progress in terms of its systematization and
digitalization.

Integrated diagnosis of stone sphere, El Silencio site
Actions (2018): Integrated diagnosis of the sphere, Grijalba-2 archaeological site

The integrated diagnosis of sphere of the Grijalba-2 site was carried out by the DPPC team and was based on the methodology established by the project since 2017. The particularities of the case are described below:

- **Photographic documentation.** In addition to the cardinal orientation shots (N, E, S and W) and the zenithal view, for the first time a nadir view of the sphere was obtained, thereby achieving the first complete record of a pre-Columbian stone sphere located in situ. For the nadir view, the installation of a 3-meter-high scaffold was required, to which a 2-ton manual chain hoist was installed, from which 4-ton slings were attached to hold the sphere; in this way the monument could be raised to 45cm in height to take a picture from the ground (Fallas-Fallas, 2018; Silva-González, 2018).

- **Alterations registry.** The diagnostic typology of Grijalba 2 sphere included 17 types of alterations, distributed in 5 categories: a) Biocolonization (brown biofilm, complex green biofilm and plants), b) Chromatic-deposit alteration (concretion, sub./sup. Limit, saline veil and iron cores); c) Physical alterations: Cracks and deformations (major fissure and minor fissure); d) Alterations derived from detachments (delamination). E) Alterations due to loss of material (differential alteration, multilevel loss, loss of matrix in the form of alveoli, loss of matrix in rounded form, detached element, missing and increased roughness). (Fallas-Fallas, 2018).

- **Monitoring of general environmental conditions.** With a digital thermo-hydrograph, environmental temperature and relative humidity conditions were recorded in areas close to the sphere at 3 times of the day: morning, noon and afternoon.

- **Measurement of properties and behavior of the rock matrix:** The resistance test (Schmidt Hammer) was carried out on different sectors of the sphere, both in "healthy" substrate sectors
and in alterations, in order to carry out a comparative study. 13 alternate data were recorded, whose location was recorded on a sheet, which included measurements on the brown bio-film, a concretion, a crack and an area of increased roughness (Fallas-Fallas, 2018). Regarding the measurement of temperature and surface humidity, five points were selected in the zenith zone center, (north, south, east and west), and four in the intermediate zone of the cardinally oriented faces, which included specific alterations such as brown biofilm, concretions and increased roughness. Due to the lack of equipment, color measurements by Munsell © scale, or hardness on the Mohs scale were not performed. Nor Tape tests were performed (Fallas-Fallas, 2018).

- Sampling for characterization of constituent materials and alterations scientific studies. A total of 11 samples were taken; 10 of them correspond to substrates that have characteristic alterations, while one corresponds to a stratigraphic section that comprises the outer surface and the inside of the sphere.

- Sampling of burial/contact deposits. Since the day prior to the collection of the samples it rained heavily and, therefore, there was a high probability of contamination, sediment sampling was not performed (Fallas-Fallas, 2018).

Alterations recorded in 2018 on the W side of the Grijalba-2 site sphere

**Actions (2018): Integrated diagnosis of spheres A, B, C and D, Batambal archaeological site**
Between November 19 and 23, 2018, the diagnosis of the four stone spheres exposed at the Batambal archeological site was made. Methodological parameters previously established in 2017, were followed (Medina-González, 2017, 2018; Duncan, 2017, 2018; Eduarte, 2017; Fallas, 2017, 2018a, 2018b, Silva, 2018a, 2018b), the case-specific information is presented:

- **Photographic documentation**: Photographic shots of the faces, oriented to the cardinal points and the zenithal view, were prepared. Thanks to the installation of a scaffold and a manual chain hoist, sphere A was lifted in order to take a nadir photograph and assess the conservation state of its base.
• **Alterations registry:** 23 types of alterations on the surfaces of the Batambal spheres were documented, distributed in the categories of a) Biocolonization, b) Chromatic-deposit alterations, c) Physical alterations (Cracks and deformations), d) Derived alterations of detachment, and e) Alterations derived from the loss of material. These alterations were recorded in 54 general plates.

• **Measurement of properties and behavior of the rock matrix:** 24 hardness tests were performed (Hammer Schmidt model Ht-225a). Due to the lack of the required equipment, it was not possible to collect data on color, hardness and surface absorption survey of sphere A from the Batambal site.
Specific Objective. To develop a research program that supports decision making regarding prevention and conservation of cultural property

Strategic Line. To carry out scientific research tasks on constituent materials and processes of alteration of in situ spheres at Finca 6, El Silencio, Batambal and Grijalba 2 sites.


With a background in a prospective sampling of constituent materials of some spheres located in situ carried out in 2016, in 2017, the “Research Project on constituent materials, alteration processes and intervention alternatives for the conservation of archaeological assets from the Diquis Chiefdom Settlements of Costa Rica”, a collaborative initiative between Dr. Manuel Espinosa Pesqueira (LANCIC ININ and LANCIC IIE) and Dr. Isabel Medina-González (ENCryM-INAH), was begun. The first phase (2017) consisted of a controlled sampling of constituent materials and alterations of spheres A, B, C, D, E and F of Finca 6.

At this time a systematic protocol for the control of the samples was established, which consisted of photographic shots with scale and essential data from the sampling area, photographic plates to record the exact location of their place of origin in diagrams, the labeling of containers with sphere number, consecutive sample number and description according to the type of alterations agreed in the diagnosis and the generation of sampling list. Preliminary research advances involving the use of border analytical techniques - X-ray Fluorescence, X-ray Diffraction, Correlative Microscopy and Scanning Electron Microscopy coupled with EDS — were presented by Dr. Espinosa Pesqueira to the work team in the 2018 final campaign meeting. Also, during the 2018 field season, a strategic sampling of the constituent materials and alterations of the sphere of El Silencio Site, and of spheres F and G of the Finca 6 site was carried out. Investigation results of constituent materials and alterations of the sphere of El Silencio were presented to the work team at the beginning and end of the 2019 campaign, both by Dr. Isabel Medina and by Dr. Espinosa Pesqueira. It should be noted that as part of this project, in 2018, Dr. Pesqueira was asked for his support in the analysis of some intervention materials - mortar loads - whose results were decisive for the intervention decision making. It is also worth stressing that some results of this research have already been presented in forums and academic congresses in order to promote the exchange and dissemination among specialists. Currently we are working on publishing processes.

Dr. Manuel Espinosa Pesqueira explores the sphere of El Silencio site
Actions (2017, 2018, and 2019). Follow-up to the Research Consultancy called “Study and characterization of the stone spheres of Diquis Valley for the development of a new conservation material of” prepared by the University of Costa Rica (UCR).

In June 2017, M.Sc. Geraldine Conejo, from the Chemistry School of University of Costa Rica (UCR) presented the scope of the component “Study and characterization of the stone spheres of Valle Diquis for the development of a new conservation material”, an initiative of the UCR, whose objectives are: the examination of generic samples of the crowns of the pre-Columbian spheres and rock deposits by X-ray Diffraction and Scanning Electron Microscopy techniques coupled with X-ray Fluorescence for their characterization and the determination of possible source quarries; the monument physical evaluation by electronic pulse rate and the development of new conservation materials. After the exchange between researchers of the UCR and the MNCR, the importance of completing the studies, signed in an agreement, and of generating bridges to link the research objectives with the needs of the Conservation Program was established. The final report of this initiative was delivered in 2019 and is under review.

Strategic Line. Research on direct intervention alternatives.


Based on the initial research results provided by LANCIC-ININ on the materiality of the spheres, it was proposed to conduct pilot field tests with grouts and traditional mortars for sacrifice layers. The grouts were made with limestone-hydrate purchased in Costa Rica, previously hydrated on the site, and marble powder in a 1:1 ratio. Traditional mortars were made with limestone-hydrate purchased in Costa Rica, previously hydrated on the site, and local river sand screened and washed with distilled water. Mortar ratios were 1:1, 1:1: one. With these mortars and grouts, specimens were prepared and subjected to comparative hardness tests. The layers with the best results were 1:2 and the 1:1 grout.

Subsequently, these two formulations served to test sacrificial layers no greater than two centimeters in length on the surfaces of spheres A, C and D, Finca 6 site. The sacrificial layers tests were skated with local clays and natural pigments for their chromatic integration to the monument\(^4\). The location of the tests was recorded on photographic plates, they have remained one year in situ to assess their performance. In 2018, these tests were evaluated. The grouts did not remain. However, the mortars did withstand the climatic attacks, even when exposed to tropical storms (Tropical Storm Nate, 2017).

\(^4\) In addition, a 1:1.5 mortar test was developed in sphere B in order to analyze its behavior under burial conditions in a three-year cycle.
In 2018 in preparation to the intervention of the monumental stone sphere of El Silencio, exploratory tests were carried out for the preparation of makeup mortars. The studies concluded that the sphere is a rock of siliceous mineralogical composition. The review of the bibliography and intervention reports indicated that successful results have been reported with the application of two types of makeup mortar: on the one hand, those made with silicate derivatives, such as colloidal silica with sand and, for other side, those based on limestone and sand.

With this information under consideration, samples were made from a local limestone quarry, washed with normal water and de-ionized water in proportions 1: 1, 1: 1.5 and 1: 2. All mortar tests were prepared with LUDOX® HS-40 colloidal silica\(^5\) and burned lime from the Patarrá Limestone Quarry,\(^6\) which was subsequently extinguished and screened on site by Finca 6 workers (cf. Jaidar personal communication; Grimaldi, Perez and Porter 2012, Buitrago 2016).

The results of the specimens were very significant, since the tests elaborated with LUDOX® HS-40 did not set,\(^7\) probably due to the high level of moisture present at the site, while the lime pastes forged adequately even in the presence of rains. A set of makeup tests were kept as specimens in a reserved rock both at the Finca 6 site and at El Silencio site. Since the mortar with the most adequate hardness was 1: 2, some control resonates were made in the sphere of El Silencio, in order to assess its performance for one year. Likewise, samples of washed and

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\(^5\) The technical sheet of this material can be found at [https://www.sigmaaldrich.com/catalog/product/aldrich/420816?lang=en&region=MX](https://www.sigmaaldrich.com/catalog/product/aldrich/420816?lang=en&region=MX)

\(^6\) For more information on Calera de Patarrá, see [https://elobservadordesamparadeno.wordpress.com/2018/10/24/resenadel-distrito-patarra](https://elobservadordesamparadeno.wordpress.com/2018/10/24/resenadel-distrito-patarra)

\(^7\) Cf. Mendiolea Ortega, José Manuel 1985 “Colloidal silica as a consolidator of stone materials in situ”, thesis of a Degree in Restoration of Personal Property, Mexico, ENCRyM-INAH.
unwashed sand were collected for analysis within the framework of the LANCIC-IIE-ENCryM-INAH Research Project.


Samples of sand obtained from the local limestone quarry, both unwashed and washed in potable and deionized water underwent DFRX studies within the framework of the LANCIC-IIE-ENCryM-INAH Research Project. Thanks to these studies it was determined not only that the sands composition is compatible with the rock’s composition, but it is also very relevant to wash them to remove soluble salt contents.

**Action (2017-2019). Follow-up on research conducted by UCR.**

As noted above, the joint meeting with researchers from the UCR School of Chemistry that took place in 2017 included clarification of the research on sacrificial layers that were proposed as a research alternative. It was recommended to consult the relevant bibliography, as well as to maintain observance on the use of traditional materials (lime sand mortars) and avoid natural and/or artificial polymers given the environmental conditions in which the spheres are exposed. The final report of this investigation was delivered by this research group and is under review.

**Actions (2017). Micro-climate environmental monitoring of spheres A, B, C, D and E, Finca 6 site.**

During the 2017 field season, and for a period of 5 days, the microclimate environmental monitoring was carried out in the areas close to spheres A, B, C, D, and E of the Finca 6 site.

This monitoring was carried out according to a protocol that consisted of:

- **Eventual registration of environmental temperature and relative humidity.** In the morning shifts (7:00 and 8:00 hrs), noon (12: 00-13: 00 hrs) and afternoon (15: 00-16: 00 hrs), a Radio-Shark Brand Thermo-hydrograph was used, whose results were recorded in tables. The measurement was carried out in the proximity areas of the spheres, approximately 8 cm north of the monuments. The information obtained is being processed by the DPPC-MNCR staff; preliminary data show temperature in ranges of 29.8 °C to 33 °C and humidity in ranges of 46% and 76%.

- **Rain pH measurement:** Rainwater samples were collected, whose pH was measured with sensitive paper strips. The initial results consistently show the presence of neutral and slightly acid rains (7-6.5), resulting from the density of CO2 in an area of high plant density.
PH measurement of rainwater

It is expected to continue these micro-climatic studies to compare measurements from other periods of the year. Likewise, the recorded environmental temperature data were collected from the meteorological tower installed at the entrance of Finca 6 in order to carry out comparative studies, which are in process.

**Actions (2018) Micro-climatic environmental monitoring of areas near to spheres E and F, Finca 6 site.**

During a 5 days period, a microclimate environmental monitoring was carried out in the areas near the spheres F and G, Finca 6 site, in accordance with the protocol established in 2017. Likewise, rainwater samples were collected, whose pH was measured with sensitive paper. The results of these measurements are in process by the DPPC-MNCR personnel. The initial results consistently show the presence of neutral and slightly acid rains (7-6.5), resulting from the density of CO2 in an area of high plant density.


The environmental monitoring of the sphere of Grijalba 2 site was carried out based on the protocol established in 2017. Some specifications regarding the case are presented below.

- **Eventual registration of ambient temperature and relative humidity.** The measurements were made three times a day: at approximately 07:00, 12:00, and 15:00 hours. The device was placed at three specific points: in the zenith part of the sphere, 10 m east of the sphere (location corresponding to the forested area associated with the Balsar River flow ravine) and 10 m west of the sphere (location corresponding to the alternate path of entry to the central sector of the Site, where a forested area with ventilation prevails. The results obtained are: In the zenith part of the sphere: temperature ranges between 26.1°C and 31.6, and of a relative humidity between 51% RH and 87% RH. 10m east from the dial: temperature ranges between 26.4°C and 32.5°C and relative humidity values from 42% to 89%. 10m West from the sphere: variable temperature values from 26.8 °C to 32.5 °C and relative humidity ranges between 42% to 87% RH (Fallas-Fallas, 2018).

- **Rain pH measurement:** It was not possible to collect samples due to the absence of rainfall events during the test.

In both years, it was carried out the micro-climatic environmental monitoring of the El Silencio sphere based on the protocol established in 2017. However, due to the particularities of the case, the environmental surroundings, and above all the presence of the roofing, methodological adjustments were described as described below:

• *Eventual registration of temperature and relative humidity inside the roofed area.* The measurements were made three times a day at approximately at 07:00, 12:00, and 15:00 hours. A point close to the zenith of the sphere was selected. In 2018, 7 measurements were recorded, while in 2019 37 measurements were collected. The results of 2018 reported ranges of 26.3°C - 44.9°C and 31% RH-88% RH in 2018; During 2019 we detected variations of 25.2°C -40.3°C and 46% RH-90% RH. (Fallas-Fallas, 2018). It should be noted that the differences in temperature and relative humidity respond to adjustments in the roof covering material ⁸, which saw the replacement of a semi-permeable saran cover to a solid sheet of zinc.

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⁸ The roof of the El Silencio sphere comprises a structure and coverage system. The structure is made up of a system of square iron tubes (4X4 inches) painted with anticorrosive and green paint. By means of screws, these tubes form a simple and easily removable frame of 4 vertical posts topped by four crown beams, with a crossbar that forms a ridge that, by virtue of its inclination, establishes a two-water roof. The structure occupies an area of 5.74 meters from East to West and 5.78 meters from North to South and a height close to 6 meters. On this structure initially a simple green saran was mounted, which, although the rainfall decreased and generated some shade, did not eliminate runoff or solar radiation. For these reasons, the saran was replaced in 2019 by a frame of wooden beams that serve to support a layer of black polyurethane plastic and, on it, sheets of zinc and polycarbonate. Polycarbonate sheets are expected to be replaced by zinc shortly.
• Eventual registration of environmental temperature and relative humidity. The measurements were made three times a day at approximately at 07:00, 12:00, and 15:00 hours. Two measuring points were selected: at 10 meters east orientation (location corresponding to the access of the site, an open area, without vegetation cover, exposed to solar radiation, rain and direct aeration) and 10 meters north orientation (location corresponding to the space of a creek, with vegetation cover, exposed limitedly to solar radiation and aeration). The results processed by the DPPC-MNCR staff expose the following ranges. At 10m east from the sphere: during 2018, ranges between 30.7°C - 36.1°C and 50% RH-81% RH were recorded; while for 2019 the reported values showed oscillations between 26.9°C -40.2°C and 41% RH-87% RH (Fallas-Fallas, 2018). At 10m north from the sphere: in 2018, the instruments registered ranges from 30.4°C - 33.5°C, as well as 66% RH-80% RH; In comparison, for 2019, the ranges varied between 25.3°C - 38.5°C, as well as 43% RH-91% RH. (Fallas-Fallas, 2018).

• Continuous record of temperature and humidity inside the roofed area. In 2019, a digital Data-Logger was acquired, an instrument that allows to record the temperature and relative humidity continuously for 24 hours. The model obtained offers a battery of three months duration and digital memory, whose data is transportable to Excel format. To compare the efficiency of the instruments, for three days parallel measurements were made located at the zenith of the sphere both with the thermo-hydrograph so far used as with the newly acquired Data-logger. The results obtained reported differences of just 0.6 °C and 1.2% RH respectively. Subsequently, the programming of the Data Logger equipment was carried out for the measurement of temperatures every 4 hours in 12:00h, 16:00h, 20:00h, 24:00h, 04:00h, 08:00h hours. Its installation was carried out on the east side of the roof, inside, above the height of the crown beam and below the ridge. With the help of the technical team, a camouflage and protection box for the instrument was developed. The Data-logger will recover measurements corresponding to 12 weeks, corresponding to the period May 7 to August 27, 2019, date on which the data must be downloaded to a computer, change the 3.6V lithium battery and reprogram the intervals for the next 3 months.

• Initial processing of environmental data. The DPPC team has begun to process the environmental information recovered with the different instruments in El Silencio during the 2018 and 2019 seasons.

• Measurement of Rain Ph. It was collected samples of rainwater; whose pH was measured with strips of sensitive paper. The initial results consistently show the presence of neutral and slightly acid rains (7-6.5), resulting from the density of CO2 in an area of high plant density.
Strategic Line: On-site studies on mechanisms for the alteration of cultural assets

*Actions (2017).* **Implementation of witnesses for monitoring cracks and exfoliations on spheres A, B, C, D and E, Finca 6 site.**

As part of the record of alterations achieved in the diagnosis, fissures and dislocations were identified on the surface of the spheres. In order to monitor them, witnesses made with lime and sand mortars were placed in 2:1 proportion, so they served as a practical and harmless mechanism to control movement or advancement. A record of the location of the witnesses was made, as well as control photographs. It is proposed that in the following seasons the witnesses will be verified to confirm whether the cracking process is active or stable.

Witness of limestone and sand in sphere C, Finca 6 site.
**Actions (2018). Monitoring of cracks and dislocation by means of witnesses in spheres A, B, C, D and E, Finca 6 site.**

Most of the sand and limestone witnesses implemented in the spheres A, B, C, D and E of Finca 6 were located in the buried area of the sculptures. However, sphere E has a pair of witnesses exposed in the area attached to its crown. Also, since sphere D was re-excavated in 2018 for monitoring, it was possible to assess the performance of buried witnesses. In both cases, it was observed that all the witnesses are functioning properly, since they are forged and with an adequate hardness (corresponding to number 2 of the Mohs Scale). None of them reported detachment or fracture, which indicates that the cracks and detachments of the D spheres are stable. This study is expected to continue in subsequent years.

**Action (2018). Crack monitoring through witnesses in the sphere of Grijalba-2 site.**

Parallel to the diagnosis of Sphere A of Grijalba-2 site, on its east side a sacrifice witness of lime-sand paste was placed in the eastern sector on a large fissure and below the sub/sup limit. The procedure for recording the implementation of the witness previously established in 2017 was followed. The witness was prepared with 2: 1 mortar as a small block of 3cm² by approximately 1.5cm thick (Silva-González, 2018)
**Strategic line. Research on support substrates and burial of spheres located in situ.**

**Actions (2017 and 2018). Research by standard physicochemical techniques on burial conditions of spheres A, B, C, D, E and G, Finca 6 site.**

As a result of the exchange with the DPPC-MNCR conservation team, as well as the result of meetings under the Management Plan during the year 2016 it was determined that it was necessary to establish a strategy of both preventive and direct actions of the spheres. For this, it was proposed to conduct an investigation into the conditions of the support and burial deposits of the spheres located in situ in Finca 6, El Silencio, Grijalba-2 and Batambal sites.

The sample collection procedure was established in 2016: the deposits were taken directly in the northern monument sector in plastic containers using clean plastic instruments.

In 2016, prospective surface samples were taken from deposits in spheres A, B, C, D and E of Finca 6. Subsequently, as explained in the diagnostic item, during the re-excavation of the monuments surface samples (between 10 cm) were recovered, at a depth of one meter and at the base level of the sphere. This same procedure was followed in 2018 in the case of sphere G. That same year, samples were recovered from the support deposits of sphere F of Finca 6 and the sphere of El Silencio. For 2019, analogous samples were recovered from the burial deposits of the sphere of Grijalba 2 site and of support area of spheres A, B, C, D and F of Batambal site. The analysis of the samples recovered in 2016, 2017 and 2018 was carried out as part of the activities of the ENCRyM-INAH Archaeological, Ethnographic and Paleontological Conservation Laboratory: they consisted of color measurements (Munsell Chart ©), texture determination (use of sieves), pH measurement, organic matter content and presence of salts (Ca, Su, Ni) based on the protocols proposed by Barba et. al (1991) and Medina-González (1998). So far, the samples of 2016, 2017, and 2018 have been processed. The 2019 samples remain to be processed.

As a result of this study it was identified that the burial and support substrates of the spheres are generically clay substrates with liquid retention properties and a considerable organic matter content. They lack contaminating soluble salts, although they have identifiable iron contents. A very remarkable property is that they have a slightly acidic pH, which is characteristic of its high proportion of organic matter and clay texture, as well as its exposure to a natural environment of high concentration of carbonic acid due to the plant layer density present. It is plausible that the acidic pH of the soil is also a consequence of contamination of pesticides, based on copper, during the banana plantation period in the region; however, no identification test of this element was performed. Based on this investigation a decision was made to replace burial deposits with substrates that will optimize the preservation of the constituent materials, an action described at a later point.

**Strategic Line. To develop, in addition to the diagnosis, a program to monitor the state of conservation of cultural property.**

**Actions (2018). Monitoring the conservation status of exposed crowns in spheres A, B, C, D, and E, Finca 6 Site.**

In follow-up to the diagnosis of the conservation status of spheres A, B, C, D and F prepared in 2017, in the 2018 field season, the conservation status of their crowns was carried out. For this, the diagnostic methodology adopted by the Conservation Program described above was replicated.
Monitoring of exposed crowns in spheres at Finca 6 Site.

Actions (2018 and 2019). Performance monitoring of deposit surfaces of burial, Finca 6 site
In follow-up to the actions of optimization of re-burial deposits carried out in spheres A, B, C, D, and E of the Finca 6 Site in 2017, the surface revision of the re-burial deposits was carried out, both in 2018 and in 2019 to assess its annual performance. This evaluation was of greater importance in 2018 given the effects of the incidence of rain, flooding and hauling surface water derived from the effect of Tropical Storm Nate. As a result of the monitoring, it has been concluded that the re-burial surface substrates have had a satisfactory performance, since they certainly impede the growth of plants, as well as reduce moisture retention in the crown of the spheres.

Additionally, measurements of humidity and surface temperature in the crowns of the spheres, the surface of the re-burial sand deposit, and the clay soil substrate that forms the site indicate that the re-burial layer functions as an equilibrium buffer against changes. The evaluation also indicates that, although some surface centimeters of the re-burial deposits are lost as a result of the water run-off at the site, most of the deposit remains stable in situ. In both years, it was observed that the surface deposit undergoes hauling and coating by a layer of approximately 2-3 cm of fine clay, which does not generate any damage on the crowns of the spheres, but is conducive to biological growth. Therefore, it was decided in both years to eliminate this layer of clay and replace it with sand. This procedure has been included as part of the maintenance protocol.

One year after the optimization of re-burial substrates in spheres A, B, C, D and E, the decision was made to monitor their internal performance, taking sphere D as a case study. Arql. Adrián Badilla was in charge of re-excavating a third of the sphere following the procedure used in 2017. Once the sphere was completely released from the deposit, the restoration team carried out the following operations:

- Photographic record from orientations N, NE, E, SE, S, SW, W and NW.

- Registration of alterations according to the methodology applied in 2017.

The results obtained will allow a comparative study to be made towards the prognosis of the sculptural good, which is in process. However, the observations in situ indicate that the performance of the sand deposits is adequate since they contribute to control alteration agents, by considerably reducing the retention of moisture as well as reducing the growth of plants. It is to be considered that the deposit also functions as a container system that stabilizes the progress of cracks and fissures, as the witness monitoring study suggests. A factor to evaluate
in the future is the performance of the geo-textile since it is not clear if it is functioning as a barrier and/or a root anchor zone.

Monitoring of internal performance of spheres re-burial deposits


An inspection was carried out on the tests of sacrifice and makeup layers that were applied in 2017 on the surfaces of the spheres A, B, C and D of the Finca 6 site. As a result, it was detected that tests in the sphere C were lost because this element was the most affected by Tropical Storm Nate: however, it should be noted that the loss does not lead to reminiscence of residues or surface traces, which is indicative of its reversibility. Comparatively, the tests of sacrifice layer mortars in the A and D spheres, despite the incidence of Tropical Storm Nate, largely maintained their one-year resistance, which is indicative of their stability. In one of them, a preferential growth of microorganisms was observed that represents an index of their sacrificial role. Due to the loss of reintegration patina and as a result of the elimination of specific outcrops of microorganisms, all the tests that remained were mechanically eliminated, which allowed to verify that their reversibility is total against the mechanical action and surface cleaning with water -alcohol. It should be noted that the makeup test in the sphere B, which remained with adequate resistance (hardness 2 on the Mohs Scale) and adhesion, remained in situ as a control for future monitoring exercises.
Specific goal. To establish risk management and preventive conservation strategies.

Strategic line. To develop preventive strategies based on optimization interventions for re-burial deposits.

**Actions (2017). To optimize the re-burial deposits of the spheres located in Finca 6.**

Once the diagnosis of spheres A, B, C, D and E, Finca 6 site, was completed, based on exploratory studies of deposit substrates, it was programmed to optimize the re-burial deposits, replacing them with screened river sand of local origin, whose pH measurements - taken by dissolving in distilled water (pH 7) and strips of pH paper - resulted in a neutral count (7). The burial deposit contemplated a sphere perimeter thickness about 30-40 centimeters, this was made using wood tables to progressively add the sand.

At a depth of approximately 20 centimeters from the surface, a layer of geotextile was placed to favor moisture stability, prevent erosion and control root growth. On top of it a sand layer was placed which was given the slope and finish suitable for the exposure of the spheres’ crowns. In the case of sphere E, the sand was used to fill cracks where the presence of anthills was identified, as well as to offer a volumetric reintegration of the missing sphere sectors, in order to optimize the interpretation.

**Actions (2018). Optimization of the re-deposit of sphere G, Finca 6 site**

Following the logic of the interventions of 2017, and in parallel to the diagnosis of the Sphere G of the Finca 6 site, its re-burial deposits were optimized. For this, the procedure already established with some natural variables derived from the specific case was followed: a border was formed approximately 40 cm away from the edge of the sphere, which was filled with river sand until it completely covered the monument. Approximately 20 cm from the surface, a geotextile fragment was placed in order to create an intermediate surface that limits the growth of plants roots, while allowing the exchange of natural soil moisture. The mark left by the sand deposit on the surface of the land - a square of approximately one meter on the side - has been left in sight in order to integrate it as part of the public interpretation strategy, since it forms a mark of location of the G sphere with respect to its twin on the surface – the sphere F.

Aspects on the optimization of burial deposits in Finca 6
**Actions (2018). Optimization of burial deposit of the sphere of Grijalba-2, site**

This procedure is based on the methodology established by the program since 2017. However, in this specific case two variables were introduced, as follows:

- Instead of covering only one perimeter halo and the upper face, the change of the substrate deposit was extended to the base. This was possible since the sphere was raised to obtain a complete photographic record of its base and to check the extent of the main crack. In this way, the optimized deposit made with screened river sand completely covers the sphere. This means that the monument is completely isolated from the characteristic acidity of the clay filler, from the water table and from the growth of lower and upper plant organisms.

- The orientation of the geotextile also was arranged vertically around the sphere in order to separate the sand deposit from the clay mud. This was done in order to create a barrier against the rhizomes of plants and grasses that grow in the soil of the area. The following sketch shows the differences between the methodologies used in Finca 6 (left graph) and in Grijalba-2 (right graph): it is a projection in profile cut that includes the strata, the geotextile and the sphere.
Methodological differences in the process of re-burial in Finca 6 (left) and Grijalba-2 (right)

In detail, the re-burial procedure carried out in the sphere of Grijalba-2 contemplated:

- **Stone support arrangement:** A medium-sized bed, 20 to 30cm long, was placed just at the base of the sphere, in order to prevent its own weight from lowering it below its original level. Boulders were chosen from the Balsar riverbed that borders the area.

- **Sand bed:** On the stone support, a sand bed of a screened river sand was arranged, achieving an insulating bed. This step determined the height of the re-burial, which coincided with the original depth of the sphere before the process.

- **Descent of the sphere to its original place:** With the use of the manual chain hoist the sphere was slowly lowered to be placed on the newly distributed sand bed. With the support of the photographic record, reference points were taken in the sphere and corroborated to place it in the same position and depth as it was before the survey.

- **Re-burial with substrate change:** To perform this procedure the following steps were followed. First, wooden boards (plywood) were placed vertically forming a hexagon around the sphere. They moved away from the stone at a distance of approximately 35cm-45cm. These boards served to place the prepared sand inside the hexagon, as well as clay outside it. Subsequently, the earth was rammed so that it acquired a higher density and did not sink with the rains and through time. About 50cm below the final surface level, the boards were replaced by the geotextile fiber.

- **Geotextile arrangement:** As explained above, the geotextile was placed vertically separating the sand from the mud, from approximately 50cm below the surface to the top.
Strategic line. To develop preventive strategies based on optimization interventions of adjacent land surfaces to the support of exposed spheres.

Actions (2018). *Optimization of adjacent land surfaces of Sphere G of Site Finca 6 and Sphere of El Silencio site.*
Following the logic of the re-burial interventions in 2017, in 2018 a decision was made to carry out interventions aimed at forming a buffer area for humidity and temperature change control, as well as a plant growth barrier, on the adjacent land surfaces to two spheres that are exposed in situ: Sphere G of Finca 6 site and the sphere of El Silencio site.

In the case of the Sphere G of Finca 6 the action consisted in an excavation of approximately one square meter around the sphere which extended up to about five centimeters into the surface, this contour - understood as a natural container – was filled with river sand.
A similar action was carried out around the sphere of El Silencio, with the variable that the intervention extended to the entire roofed area. Because this area is in a slope, and there have been runoffs of water evacuation, a contour of stones was placed to serve as containment.

Support surface optimization, Sphere of El Silencio site


In the spheres located at the Batambal site, the clay filling around was replaced by screened river sand. For this purpose, 5 cm of the surrounding grass layer was removed; and in other cases, the sphere was raised to place sand at the base of the sphere. This measure works as a barrier that prevents the growth of vegetation around these stone objects and also reduces the formation of biocolonization and moisture concentration on the surface.

Placement of sandy substrate around sphere B of the Batambal site.

In 2019, two deficiencies were detected in terms of the optimization of the support substrate for the sphere of El Silencio prepared in 2018: on one hand, the sand surface showed little resistance to traction and displacement due to the incidence of storms and, on the other hand, the edge of slabs generated some reading confusion about the archaeological context: some visitors reported perceptions about the presence of an indigenous structure. Therefore, it was decided to make some adjustments in the intervention. These modifications were possible thanks to the fact that a controlled excavation of a perimeter of approximately 30 centimeters and 20 centimeters deep around the sphere was carried out, whose purpose was to recover detached fragments.

Once the excavation and registration of rescued fragments was completed, the empty space was filled with gravel stone. Both the depth of the excavation strip and the size of the gravel are assumed as a guarantee of tensile strength, coupled with the fact that the aspect does not give rise to misinterpretations regarding the presence of structures associated with the sphere. In addition to the above, the edge of the roofed floor was provided with a runoff resistance fence, consisting of wooden strips that protrude only a few centimeters. This is expected to go invisible as a result of the growth of the manicillo grass that grows on the site. The performance of this solution will be evaluated throughout the year.

Strategic line. To develop preventive strategies based on protection cover optimization interventions.


The roof of the sphere of El Silencio comprises a structure and coverage system. The structure is made up of a system of square iron tubes (4X4 inches) painted with anticorrosive and green paint. By means of screws, these tubes form a simple and easily removable frame of 4 vertical
posts topped by four crown beams, with a crossbar that forms a ridge that, by virtue of its inclination, establishes a two-water roof. The structure occupies an area of 5.74 meters from east to west and 5.78 meters from north to south and a height close to 6 meters. On this structure, initially a simple green saran was mounted, which, although the rainfall decreased and generated some shade, did not eliminate runoff or solar radiation. For these reasons, the saran was supplanted in 2019 by a frame of wooden beams that serve to support a layer of black polyurethane plastic and, on it, sheets of zinc and polycarbonate. Polycarbonate sheets are expected to be replaced by zinc shortly.

Optimization of sphere protection cover of El Silencio site

Specific goal. To establish and develop direct intervention strategies.

Actions (2017). Identification of fragments detached in deposit, sphere B, Finca 6 site. A fragment detached by shedding in the burial deposit of the sphere B, Finca 6 site. was detected, it was possible to discover its original location, which was photographed. The fragment was protected for non-destructive analysis and its eventual adhesion as part of the integral intervention of the monument, to be carried out in 2020.
Actions (2017 and 2018). Control of microorganisms in crowns of exposed spheres in Finca 6, El Silencio, Grijalba-2 and Batambal sites. exposed

In 2016, it was detected that all partially or completely exposed spheres of the Finca 6, El Silencio, Grijalba and Batambal sites were widely populated by microorganisms, which resulted in various alteration effects such as hydrolysis, loss of coherence, and detachments. Also, biocolonization hindered the appreciation of the elements, as well as their inspection for conservation diagnostic purposes. Therefore, since 2017, a progressive process of control of microorganisms began in all the monuments already mentioned. This process is based on the current perspective of archaeological conservation that biocolonization is recognized as a dynamic and changing system respect to environmental conditions, which requires long-term monitoring and control. Therefore, the selected biocolonization strategy was aimed at eliminations in the earliest stages in order to avoid frequent and aggressive cleaning, as well as an annual monitoring system that allows reviewing the actions carried out.
This process began in the 2017 field season in the crowns of the spheres A, B, C, D, E and F of Finca 6. The procedure consisted in the application of a mixture of water and ethyl alcohol (1: 1) with a soft bristle brush. As a result, the appearance of the rocky surface was revealed, including physical and physical-chemical alterations generated by the biofilm, including the persistence of green, brown and purple spots. Based on the review carried out in 2018, it was concluded that this action was partially successful: on one hand, certainly no growth of plants or bryophytes were located, and in all cases, the microbiological population was considerably less in scale as in intensity than the one registered at the beginning of the 2017 season; on the other hand, specific colonization of algae and lichens persisted, particularly in areas of moisture concentration: edges and cracks, which appear to have resulted not only from exposure to moisture and light, but, decisively, to the deposition of clays resulting from runoff generated by the extraordinary event of Tropical Storm Nate. Therefore, in 2018 it was decided to eliminate the populations of microorganisms present, by means of punctual cleaning with water-alcohol 1: 1. Likewise, in order to delay the cleaning effect aseptic washes were made with hydrogen peroxide and distilled water, followed by the sprinkling of an anti-fungal and anti-bacterial product derived from natural origin (grapefruit seeds), controlled acidity and low toxicity: 5% Ecofox © (Citricidin ©) in water; treatment that has already been used in various archeological zones of Mexico for the control of agents of biological deterioration, particularly in humid tropical zone.

Cleaning of microorganisms in crowns of exposed spheres

This treatment, but in a generalized way, was applied both in the sphere F of Finca 6 site, the sphere of El Silencio site, the sphere crown at Grijalba-2 site and the five spheres exposed in Batambal site, which presented an intense biocolonization, which was associated with aggressive alteration processes in stone constitutive material, due to the concentration of moisture that cause the formation of spots, and, in the case of lichen and moss, the physical-mechanical action that were generated by the penetration of rhizomes. As a follow-up strategy, the MNCR has agreed on the need for a routine of micro-flora monitoring and control in the
spheres located in situ in the four sites, which will consist of the quarterly inspection of the goods, taking pictures, spray application of Ecofox © 5% in distilled water, and where appropriate, timely removal of microorganism outcrops.

**Actions (2018). Trims and emergency makeups in the sphere of El Silencio site.**

During the integrated diagnosis of the sphere of El Silencio site, carried out in 2018, areas of vulnerability were detected regarding the severity of the effects of detachment, mainly associated with cavities. Due to the risks of these alterations, the decision was made to add makeups and emergency trims with a mortar made with lime and sand in 1:2 proportions, which
were skated with pigments and natural earth to achieve their chromatic integration. This task was also assumed as a training element for the local professionals, which would allow their action in similar situations. These makeup and trims were monitored in 2019 and because they fulfilled their function, they served to finish defining the integral intervention of the sphere of El Silencio in 2019.

Trims and emergency makeup in the sphere of El Silencio site.

**Action 2019. Integrated intervention of the sphere of El Silencio site.**
The integrated intervention in the field of conservation of the sphere of El Silencio took place in 2019. It consisted of a series of specific treatments described below:

- Surface cleaning. It was performed, in general, with soft bristle brushes to remove dust and microorganisms deposited on the surface. Likewise, bamboo tips were used to eliminate rhizomes with localized growth without affecting the cohesion of the constituent material.

Mechanical surface cleaning of the sphere of El Silencio site
• Chemical-mechanical cleaning. It was done with the aim of eliminating the localized presence of microorganisms, which had recurred, but with much less power, on the rocky surface. The treatment consisted of the application of distilled water and alcohol in a 1:1 proportion by spraying and the use of soft plastic bristle brushes, which guaranteed the total elimination of bio-colonization. Subsequently, a 2% hydrogen peroxide solution (hydrogen peroxide) was sprayed, followed by a bath of distilled water. Unfortunately, due to the lack of provision of the product in the market it was not possible to apply a 5% Ecotox layer to promote resilience to the proliferation of microorganisms in the medium term.

Chemical-mechanical cleaning of the sphere of El Silencio site.

• Perimeter excavation. In order to recover possible detached fragments, the excavation of a 30 cm perimeter strip around the monument was carried out, which reached a depth of 20 centimeters. This operation was successful as it allowed the controlled recovery of a considerable number of fragments, which were labeled and photographed individually. Subsequently, location tests of the fragments were made, many of which were returned to their original location.

• Preparation of intervention materials. Before starting the stabilization processes - fragment union, makeup and reintegration - intervention materials were prepared. The quicklime was quenched in plastic containers at Finca 6 and sifted in buckets for transfer to El Silencio. Adhesion slurry was prepared by filtering the lime using nylon and adding marble powder in a 1:1 ratio for the formation of fine paste. The sands were screened in two thick and medium textures, as well as washed with drinking water and distilled water, to dry. With these sands lime-sand mortars 1:2 were prepared. These pastes were subjected to standardized drying tests to check their hardness and satisfactory compaction. These procedures are essential to ensure the quality of the interventions performed.
Union of fragments. For several years, MNCR officials have recovered fragments detached from El Silencio sphere either on surface surveys and, in particular, during the archaeological excavations carried out by Corrales and Badilla (2012). Also, in 2019, during the excavations of the perimeter area of the sphere and the cobbled area an important number of fragments were obtained. With the objective of recovering the sphere volume and shape, fragments were located that, by coincidence of color, volume and shape, were exactly coupled to the missing ones of the sphere: although the origin of the located fragments was dispersed in different areas of the sphere, an important number (11) corresponded to the depression of the zenith. The fragments were adhered in the places where exact coincidence was found: the union was made with lime-sand mortars 1:2, and when necessary with a minimum portion of epoxy resin.

Consolidation: After the union of fragments, makeups and trims were applied to ensure its stability. These same treatments were performed in order to protect exposed edges, provide greater stability to the cavities, as well as promote formal and volumetric reintegration. The makeups were made with lime and sand pastes of different nature. The makeups with structural function were made in a 1:2 ratio: one part of lime and one of coarse river sand. The makeups and trims to integrate the shape and finish were made in a 1:2 ratio, a part of lime sifted by one of medium textured sand. To provide greater stability to the exposed edges, not associated with joining fragments, 90° resonates were applied with fine paste, in a 1:1 ratio, which consists of a volume of sifted lime and a volume of fine river sand. The trims applied to areas of delamination or multilevel were made with 1:1 mortar, lime and marble dust.
Aspects of Consolidation: Application of trims and makeups, fragment reinforcement and volumetric reintegration

- Chromatic reintegration. Since the mortar pastes differ from the color of the rocky substrate, a chromatic reintegration process was carried out based on the mixed application of lime and watercolor pigments; the background was achieved by spotting and details by pointillism to match the patterns of color and texture.

Chromatic reintegration and general appearance of its results
The conservation and restoration work carried out at El Silencio archaeological site, in the 2019 season, involved work on the semi-rectangular pavement associated with the sphere. This paved area is made up of cobblestones and limestone, has an approximate length of 12 m long and between 1.5 and 2 m wide, and was documented in 2012 during excavations carried out by the Department of Anthropology and History of the Museum National of Costa Rica (Corrales and Badilla, 2012, 54-68). The intervention of the cobbled area in the 2019 field season contemplated 6 phases of work:

• Re-excavation. To assess the state of preservation of the cobbled area, the layer of clay covering was removed, by means of a rectangular re-excavation of approximately 9 m long x 3 m wide, which covered 60% of the extension of the paved area. The grid established 7 years ago was taken as a reference again to re-excavate the areas of interest for interventions, from
the southern part to the central sector. This work was coordinated with the archaeologist Francisco Corrales of the Department of Anthropology and History. The excavation did not respect stratigraphic levels, because the purpose was to reach the level of paving.

Re-excavation of cobbled segment.

- Excavation. The investigations of Corrales and Badilla in 2012 showed a cobbled segment of approximately 1.5 x 1 m with rock removal due to modern cultural disturbances, and on that occasion, it was not excavated, only the planimetric drawing of the surface level was made. In this 2019 season it was necessary to intervene in this sector because it was an intermediate area. The visit to the site, on May 2 and 3, by archaeologists Adrián Badilla and Mónica Aguilar (members of the National Archaeological Commission (CAN)) made it possible to express the need to explore this area. The subsequent approval of the CAN representatives helped to excavate this sector of the pavement, collecting transcendental materials for the restoration work that was being carried out in the sphere, because rock fragments were found that were later reintegrated into the zenith sector of the sphere. After the excavation carried out in this sector of the cobbled area, the boulders and limestone initially removed were integrated again.
Excavation: cobbled segment showing the finding of rock fragments from El Silencio site sphere.

- Stabilization-Integration. After the re-excavation and cleaning of the cobblestone sector, the position of approximately 134 cobblestones and limestones that make up the structure was verified, based on the review of the photographs and the planimetric drawing made in 2012. For a systematic control, an individual numbering of the stones was assigned, which in general terms maintain the position registered 7 years ago, although in the SW sector several cobblestones were displaced due to transformation processes of natural origin, specifically roots of a probable Gmelina tree. Subsequently, the stabilization treatments corresponding to the reintegration of slightly displaced boulders were made, while in the empty spaces some 55 selected cobblestones with similar characteristics were integrated.

- Pavement consolidation. The clay surrounding each stone was consolidated by wet clamping (distilled water) with a wooden tool. Subsequently a layer of gravel stone was placed in the empty spaces between the cobblestones or limestones that make up the pavement. The area was then moistened and covered with a thin layer (approximately 5 cm thick) of a mortar paste made of lime and sand, whose materials are compatible with those that make up the cobblestone and comply with the principle of restoration of reversibility. When the pasta was still fresh it was skated with a mixture made of clay with distilled water.

Consolidation process carried out in a pavement segment of El Silencio site.
• Re-burial. This process was carried out with the purpose of improving the conditions of preservation of the cobbled area, specifically in the southern sector measuring 5 m long x 3 m wide. In the first instance, a layer of sifted river sand, approximately 20 cm thick, was placed. A geotextile was then placed horizontally and clay was added until it reached the surface level, which had been removed from the excavation at the beginning of this 2019 season. Subsequently the landfill was rammed to maintain consistency and stability.

Initial process of re-burial a segment of the cobbled area.

• Exposition. The cobbled segment adjacent to the sphere, in an area approximately 4 m long x 2 m wide and slightly flatter than the rest of the structure, was exposed to assess its short-term behavior and in turn to show the public another archaeological element of El Silencio site. Since the stabilization work, measures were taken aimed at the partial exposure of this archaeological structure, therefore small pebbles were placed in the intermediate spaces among the new integrated cobblestones, a restoration technique called as “rajueleado”.

Final view of the cobbled segment exposed to the public.
In parallel, absorption wells were placed in empty spaces where cobblestones were not integrated and close to one of the roofing posts on the sphere. These absorption wells correspond to semicircular holes about 25 cm deep, and covered first by gravel and then by river sand.

The interventions carried out in El Silencio were based on the use of materials that respect the construction systems used by the pre-Columbian populations of southeastern Costa Rica, as well as the various traces that remained over time. In this way, the integrity and authenticity of these elements of the archeological site is maintained, because these treatments meet professional conservation-restoration criteria explained in the credibility section. Likewise, it is important to note that the interventions on the cobbled area and the sphere help to recover the integrity of the archaeological site.

Final aspects of the El Silencio site intervention
Specific goal. To establish strategies for publication, academic exchange and socialization of research and interventions in the field of conservation of cultural property.

Strategic Line. To carry out the delivery of conservation reports according to the logic of the Management Plan.

At the Management Plan update meeting it was agreed that it was necessary to establish terms of reference for the project’s intervention and investigation reports, in order to have the necessary inputs, as well as to facilitate their incorporation into the respective Management Plan Report.

As part of the logic of the report of interventions and investigations, the 2017 report was made according to the updated Management Plan, organized according to the UNESCO 5 Cs strategic document. The report was delivered in a timely manner both to the MNCR authorities, as well as to the Ministry of Foreign Affairs of Mexico, and to the INAH.

In follow-up to the 2017 agreements, it was confirmed that the 2018 report would be carried out in accordance with the logic of updating the Management Plan, whose organization is established in accordance with the 5 Cs strategic document. The report was delivered in a timely manner both to the MNCR authorities, as well as to the Ministry of Foreign Affairs of Mexico, and to the INAH.

At the last meeting of the 2019 season, the MNCR expressed the need to have a report covering the three years of work. To simplify deliveries, it was agreed that the 2019 report would include the 2017 and 2018 activities.

Actions (2019). Academic Exchange
As part of the agreements with the MNCR, it was agreed to carry out academic exchange activities in order to inform the national and international community about the progress made. To date, three papers have been presented. The first one took place at the MNCR itself on Friday, May 17th, 2019; This presentation was attended by members of the Costa Rican scientific community. This paper was co-authored with Dr. Manuel Espinosa Pesqueira (LANCIC-IIE, UNAM)

The second exchange event took place within the framework of the Latin American Archeometry Congress held at the Universidad de los Andes in Bogotá, Colombia, on June 6, 2019. The focus of this paper was basically directed to the topic of scientific research, it was co-authored with Dr. Manuel Espinosa Pesqueira (LANCIC, IIE-UNAM) and M.Sc. Javier Fallas. Finally, a small reflection on working with communities was presented at the ENCRyM-INAH Academic Forum held on July 31, 2019; This paper was basically presented to students and professors of the ENCRyM-INAH.
CAPABILITIES

Specific goal. To update local conservation staff on theoretical, methodological and technical aspects of archaeological conservation to optimize the permanence of the site’s OUV.

Strategic Line. To update local conservation staff on theoretical, methodological and technical aspects of archaeological conservation to optimize the permanence of the OUV of spheres and monuments.

**Actions (2017) Training in spheres research, diagnosis and conservation interventions.**

As part of the logic of the mission, it was planned and achieved that all the tasks of diagnosis, research and direct intervention in the field of conservation of the stone spheres were translated into a theoretical, methodological and practical teaching-learning strategy for three professionals of the local conservation staff, who have now acquired skills in these areas, as well as identified new areas of training opportunity. The link between advice, intervention and training has been shaped as an action policy in terms of conservation of monuments.

![Research, diagnosis and conservation interventions](image)

**Actions (2018 and 2019) Training in re-burial techniques.**

As part of the logic of the mission, the re-burial intervention was planned and translated into an interdisciplinary teaching-learning strategy for an archaeologist from the DPPC, who not only obtained capabilities but also was responsible for executing the task of re-burial of sphere D, with varying degrees of accompaniment and advice. It should be noted that the training already paid off because the trained archaeologist was already in charge of performing his first re-burial action in the sphere of the Grijalba-2 site.
Both in the 2018 and 2019 season, there was the visit of Dr. Manuel Espinosa Pesqueira (LANCIC ININ, IIE-UNAM) for scientific research advice. These occasions have served to initiate a training in this field.
**Actions (2019) Training in criteria and technical intervention.**

The integral intervention of the sphere of El Silencio was the most favorable situation for the training of the DPPC-MNCR counterpart persons in terms of technical criteria and technical treatments. The first item consisted of a small explanatory workshop that served to socialize the work criteria and contrast it with the technical proposal to follow. The second item consisted of the transfer of skills in preparation of intervention materials and the development of restoration treatments. In the case of the sphere of El Silencio, these competences were directed to dry cleaning, wet cleaning, the joining of fragments, the application of makeup and trims, and the chromatic reintegration. In the case of the cobbled area it consisted of the consolidation by joining materials, the reintegration of empty areas and the re-burial. The competences were progressively appropriate; thus, it was moved from the demonstration to the supervision, and from there to the independent resolution. It is expected that future interventions will allow the application and evaluation of this active teaching-learning platform.
CREDIBILITY

Strategic Line. To establish and monitor the application of a relevance regulatory framework for the intervention in the field of conservation of the spheres and other monuments of the Diquís Chiefdom Settlements (ACD).

Specific goal. To establish, apply and socialize regulations for the intervention of the monuments of the ACD.

Actions (2017 and 2018). To exchange of national and international regulations for the creation of own regulations.
In accordance with the agreements, in 2017 and 2018, a folder with national and international regulatory information was shared with the DPPC, for review in order to develop a collegiate workshop to establish an own normative policy.

Actions (2019). To establish, explain and socialize the intervention criteria of the ACD monuments.

This allowed to establish some conservation principles and criteria focused to the intervention of the ACD monuments, namely:

• The conservation will be carried out through a methodological process that will include a study, assessment, a diagnosis and a moment of decision making, all based on the work of an interdisciplinary team and whose purpose is to contribute to the understanding, preservation and transmission of values of cultural heritage.

• Conservation decisions will be based on the experience, knowledge, judgments and expertise of professionals specialized in the field.

• The conservation of cultural heritage will give preference to preventive actions over curative, corrective or direct actions

• All conservation actions must be documented, ensuring that their results are socialized, published and disseminated.

• All conservation actions must be carried out with the highest possible quality.

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10 See http://www.international.icomos.org/charters/venice_e.pdf
11 See: http://www.international.icomos.org/charters/arch_e.pdf
• All actions must be socially responsible and, preferably, come from community participation schemes.

The main intervention criteria will be:

• Respect authenticity / integrity
• Proceed according to the minimum intrusion required
• Promote reading without creating false historical or aesthetic
• Use physically-chemically compatible materials with respect to those corresponding to the invoice.
• Promote reversible or retractable processes
• Allow the denotation of the Intervention

Specific goal. To promote the establishment and operation of coordination and cooperation mechanisms at national and regional levels for the conservation and management of ACDs.

Strategic Line. Creation and Operation of a Regional Network of Stone Conservation Specialists of Monuments in ACD.


Based on the formation of the regional stone conservation network, since 2017, the collaboration of Dr. Manuel Espinosa Pesqueira, responsible for LANCIC-ININ and LANCIC-IIE, has been carried out in the preparation of some scientific analyzes on samples of stone of the ACD spheres using micro-XDR and MEB-EDS. Steps have been initiated to continue this cooperation for subsequent research phases in the framework of international cooperation. It is expected that by 2019 the MNCR can establish a specific collaboration agreement with the LANCIC-IIE.

Likewise, during 2017 Mtra. Cristina Corona (INAH Colima Center) has collaborated providing bibliography on stone. Lic. Valeria Villalbazo and Arqa Lucía Sánchez Bustamente, have also collaborated in the substrate research efforts. They are adjunct and advisory professors of the Laboratory of Archaeological and Ethnographic Conservation of the ENCRyM-INAH.

In 2019, talks were held to establish research networks with the National Nanotechnology Laboratory (LANOTEC), the Costa Rica Institute of Technology (TEC) and the SG Group.
COMMUNICATION

Specific goal. To promote greater awareness and knowledge about the OUV of the ACD declared World Heritage, among the general and canton of Osa populations.

Strategic Line. To promote the inclusion of World Heritage in formal education programs by generating updated inputs for the programmatic contents of the educational curriculum.

To achieve this objective, every year visits of local school groups have been attended, with the purpose of transmitting messages about the OUV of the site and its monuments, as well as the efforts made in its conservation. This with the purpose of raising in the local young student population, as well as the teachers, sensitization and knowledge of the ACDs sites declared World Heritage.

In 2017, 2018, and 2019, talks about the ACD OUV have been offered to young students of the Osa Professional-Technical High School. During these presentations, information has also been disseminated on the progress that the MNCR has made in the site conservation, and other programs associated with its status as a World Heritage site, including the WHC youth leader program. These strategies have been useful for engaging in exchanges with the local community young students regarding their local identity and their connection with the ACDs.

Views of talks to students of Osa Professional-Technical High School
Strategic Line. To promote a media information campaign for the general population about the ACD, its OUV and the efforts that the MNCR makes in relation to their conservation and management.

**Actions (2017, 2018, and 2019). Dissemination of information in mass media: press releases, MNCR website, and social networks on issues related to ACDs, their OUV and the progress regarding their conservation and management.**

Since 2017, and as a joint development between the DPPC and the DPM, a mass media communication campaign including written press, MNCR website and social networks has been carried out to disseminate both outstanding values of the ACDs, and in particular of the spheres, as well as of the efforts that are made for their conservation. This as part of a strategy of sensitization and knowledge of the Diquis sites declared World Heritage. Each year this strategy has expanded and achieved greater reach. As a result, as part of the field seasons, press conferences, radio and television interviews are carried out, informative notes are prepared and informative communication videos are prepared. In the 2019 season, the integrated intervention of the sphere of El Silencio received an unprecedented mass media coverage that marks a milestone in the dissemination of the ACD and archaeological conservation in Costa Rica.

Actions (2018, 2019). Dissemination of information in the media coordinated by the Cultural Institute of Mexico, the Mexican Embassy in Costa Rica and the Ministry of Foreign Affairs.

The Cultural Institute of Mexico, the Mexican Embassy in Costa Rica and the Ministry of Foreign Affairs have been instrumental in the dissemination of the activities of Project 12 “Heritage Impact Evaluation of World Heritage Sites: Pre-Columbian Chiefdom Settlements with stone spheres of the Diquis, Costa Rica” For this they have organized press interviews, conversations in UCR radio, and are currently preparing a special statement of activities. These actions reinforce the importance of Mexican diplomatic work in the conservation of Costa Rica’s cultural heritage.
COMMUNITY

Specific goal. To inform the community about the progress made, as an information and consulting strategy in a participatory planning framework.

Strategic Line. Public communication strategy for information and promotion of participatory planning

**Actions (2017, 2018, and 2019). Communication with the local community of Palmar Norte.**

In 2017 and 2018, and 2019, a communication campaign was carried out with the community of Palmar Norte, Osa canton, regarding the importance of the ACDs, the progress made in their management, conservation and results dissemination, as well as future work prospects. In addition to meetings with average attendance, posters have been made that have not only sought to stimulate the inhabitants of Palmar Norte to visit the sites during the field seasons, but also the purpose of establishing a transparent and coadjuvant dialogue towards the socialization of the OUV of the declared sites and the importance of their conservation with a view to the social agents collaboration. As part of this strategy, an informative poster was installed on the site of El Silencio on the conservation tasks carried out there, in view of future significant interpretation actions on the site.

Communications activities about the conservation tasks at El Silencio site

Specific goal. To establish contacts and relationships with interested local actors to promote the dissemination of ACDs, their OUVs and the efforts made around their conservation, management and divulgation.

Strategic Line. Intercultural dialogue with indigenous Boruca communities.

**Actions (2017). Exchange within the framework of the visit of members of the Boruca community to the Finca 6 Site.**

In 2017, a first informal exchange was held with a small group of indigenous people from the Boruca community, including members of the Association of Artisans “La Flor de Boruca” - Founders of the Community Museum - who visited the site in order to know the activities carried out by the Conservation Program in relation to the diagnosis of spheres A, B, C, D, and E. The visit was an opportunity for full observation of the spheres, which at that time were totally
exposed by the re-excavation of their deposit. This first exchange allowed to distinguish some common questions among researchers, restaurateurs and members of the Boruca community about the history and valuation of the spheres. Likewise, the idea of making a formal visit of community members to the diagnostic work of the following year was raised.

**Actions (2018) Meeting with representatives of the Boruca community on the OUV of the sites declared as World Heritage, as well as their conservation.**

In 2018, an exchange event was organized with members of the Boruca community with the purpose of promoting an intercultural dialogue on the valuation of the site and the spheres, as well as the perspectives of their conservation. The purpose was to initiate a propitiatory exchange of participatory planning processes and multi-sector responsibility. The event consisted of a visit to the El Silencio site where the results of the diagnosis made that year were reported and the scenarios of their intervention were raised. Subsequently, after a community lunch, a meeting was held on the grounds of Finca 6 to encourage the exchange of opinions. A notable aspect was that the visit brought together members of the Association of Artisans La Flor de Boruca - Founders of the Community Museum -, including the leader Margarita Lázaro. The exchange was valuable as a consensus was reached on the need and priority of the intervention, in the field of conservation, of the sphere of El Silencio.

View of 2018 meeting with representatives of the Boruca community
**Actions (2019) Meeting with Boruca Community Authorities.**

In 2019, an assembly meeting was held with the Boruca Community Authorities, in order to inform them, among other aspects, of the progress of the Conservation Program. This meeting was favorable to invite them to the dialogue event to be held both at the site of El Silencio and in Palmar Sur. Likewise, the assembly expressed interest in talks about the ACDs in the Boruca primary schools.

![View of 2019 meeting with Boruca Community Authorities](image1.jpg)

**Actions (2019). Meeting with members of the Association of Artisans La Flor de Boruca in the Boruca Community Museum.**

An informative meeting with the Artisans Association La Flor de Boruca was held at the Boruca Community Museum in order to invite them to the community dialogue event and inform them about the progress of the Conservation Program. During this meeting it was also presented the Didactic Suitcase, which includes a game that incorporates inputs of the diagnosis of the spheres as a form of teaching-learning in a format of playful instruction.

![View of 2019 meeting with members of the Association of Artisans La Flor de Boruca.](image2.jpg)
Actions (2019): Intercultural dialogue event with Authorities and members of the Boruca indigenous community.
Following the format established in 2017, a cultural dialogue event was organized with authorities, leaders and members of the Boruca indigenous community. In 2019 consisted of an informational meeting-visit on the progress of the conservation of the sphere of El Silencio Site, a Batambal site tour, lunch and a dialogue table. During the latter, the criteria followed in the intervention of the sphere and cobbled area of El Silencio were informed, as well as the decision-making and results in order to gather information derived from the consultation of expectations. An important step in the construction of a trust bond was established with the invitation to perform a diagnosis and intervention in the spheres that are located in the Boruca town.

Views of the visit of representatives of the Boruca community to El Silencio and Batambal sites
III. CONCLUSIONS

During the past three years, significant progress has been made in relation to the Conservation Program of ACDs in general and their stone spheres in particular. These scopes have been achieved thanks to a methodological and professional approach that has addressed regulatory and technical issues as a constituent part of the decision-making process.

Without a doubt, one of the greatest achievements of the program has been the diagnosis of all the spheres that remain in situ, as well as the establishment of preventive conservation, maintenance and monitoring actions. Likewise, it is worth noting the integral intervention of the sphere of El Silencio site, which constitutes a milestone in the on-site archaeological conservation of Costa Rica.

The strategic approach from the orientation of the 5 C's has also allowed the Conservation Program to acquire a mainstreaming towards Credibility, Capacity Building, Communication and, significantly, the link with the Community.

Finally, it is worth emphasizing that the Conservation Program itself is an innovative initiative of the International Collaboration where the efforts, supports and wills of the Ministry of Foreign Affairs of Mexico, AMEXCID, have been united through the Cultural Institute of Mexico, the Mexican Embassy in Costa Rica, the National School of Conservation, Restoration and Museography of the INAH in Mexico, and the National Museum of Costa Rica, within the framework of the Mexico-Costa Rica 2015-2017 Cultural and Educational Cooperation Program: Project 12 “Heritage Impact Evaluation of World Heritage Sites: Pre-Columbian Chiefdom Settlements with stone spheres of the Diquís, Costa Rica”. In these efforts are worth making visible the actions and unconditional support of Mtro. Arturo Valencia, director of the Cultural Institute of Mexico in Costa Rica, Lic. Rocio Fernández, director of the National Museum of Costa Rica, and the directors of ENCRyM-INAH, in particular its current director, Mr. Gerardo Ramos Olvera.

Churubusco, August 12, 2019
“Analysis of micro samples of the sphere of el Silencio site, and characterization of sands prior to the conservation process - reintegration (2018-2019 season)”

Author: Dr. Manuel E. Espinosa Pesqueira
Investigator. LDOA-LACIC IIE Coordinator
1. Background

Within the framework of the conservation project of the “El Silencio” sphere, coordinated by Dr. Isabel Medina González of the National School of Conservation, Restoration and Museography of the National Institute of Anthropology and History (ENCRYM-INAH) and MSc. Javier Fallas Fallas from the National Museum of Costa Rica (MNCR), the collaboration with the Artwork Diagnostic Laboratory of the Institute of Aesthetic Research of the UNAM began during 2018 and 2019. It initiated with a series of studies of characterization of micro-sample materials of the El Silencio sphere, as well as local sands prior to the conservation process intervention of the aforementioned sphere. The samples were collected in a controlled manner from both the “El Silencio” sphere and from local river sands. Subsequently, the samples were received by the LDOA-LANCIC-IIE-UNAM to propose a microstructural characterization route and determine its elementary chemical composition and identify its crystalline mineralogical composition. This report shows the first results progress since we are currently working on the analysis of the entire group of samples.

2. Objective

• To analyze and determine the sample components of the “El Silencio” sphere and local sands for possible application in the conservation and reintegration processes of the sphere.
• To characterize the samples by means of crystallographic studies using X-ray diffraction (DRX) and correlative microscopy: scanning and optical electronics, both of high resolution.

3. Experimental procedure

X-ray diffraction (DRX): The equipment used for crystallographic analysis was a multi-purpose Bruker D8 Discover diffractometer with a Cu $\lambda$ =0.15406 nm. Also, a 1D BRUKER LINX –EYE solid state detector with 192 slots and a Vantec 500 2D detector for micro diffraction, both ultra-high speed. A Rigaku diffractometer, Ultima IV model of multiple optics that uses a high-speed D/tex Ultra solid-state detector was also used. Preparation of cross-sectional samples: The samples are embedded in special translucent resins of the Struers brand (ClaroCit) and contained in silicone molds, once the polymerization was finished the encapsulated samples were subjected to a mechanical process of controlled speed polishing, using different sandpaper from 240 to 4000 mesh.
Correlative microscopy: This technique required the use of a Zeiss EVOMA25 high resolution scanning electron microscope (SEM) with a 3.0 nm resolution, it has a characteristic X-ray dispersion spectroscopy (EDX) probe, Bruker Brand of 30 mm2, Si-Drift free of liquid N2. The micro photographs were acquired using a backscattered electron detector with magnifications from 20 to 20,000X. Zeiss Z2 high resolution optical microscope. Axio Imager, has a 5 mega pixel Axiocam CCD camera. The micro photographs were acquired in dark field mode in reflected light (DFRL), the amplifications used in this study were 5, 10, 20 and 50 X.
4. Advance results and discussion

4.1 Characterization of micro samples of the “El Silencio” sphere

The sphere of "El Silencio" is characterized by being composed of granodiorite, which is characterized by its texture similar to granite. Its mineralogical composition mainly contains feldspar, quartz, amphibole, iron phyllosilicates (group of micas), hornblende, among others. The micro samples were subjected to a previous analysis in top view by SEM-EDX, with the purpose of observing the differences of mineral compounds present. Figure 1a-1d, is a sample identified as Di 18 Si EA M15, which was observed in top view, the micrographs reveal some structures with crystalline habit of laminar type (mica). Figure 1d is an elementary chemical distribution mapping corresponding to 1c, where magnesium iron oxides (pink hue), silicoaluminates (feldspars), quartz and calcium phosphates (acicular fibers) were also identified. EDX analyzes are presented in Figure 1e.

![SEM-EDX micrographs in top view of a sample of the “El Silencio” sphere, d) elementary chemical mapping and e) graph showing the corresponding chemical analyzes.](image)

4.2 Preparation of samples in cross section for microscopic analysis

Once the analysis was performed in top view, the samples were carefully prepared in cross section, these were placed in special translucent resins to not generate some type of chemical reaction with the sample, and with a high-speed polymerization. The result is encapsulated samples that subsequently underwent mechanical speed polishing with different sandpaper from 240 to 4000 mesh. The result allowed to analyze them by correlative microscopy (figures 2e and 2f), thus showing the microstructure (figures 2a - 2d). Figure 3a-3c are the micrographs product of the correlative microscopy of a sample Di 18 Si EA M15 of the sphere of “El Silencio”. In “3a and 3b” the dark-field microscopy images are reflected in reflected light (DFRL) and scanning electron microscopy (MEB-EDX).
Figure 2.- Selection and positioning of the resin sample at room temperature, mechanical polishing and microstructural analysis by correlative microscopy (scanning optics-electronic, both of high resolution).

Figure 3a identifies feldspars (white hue), iron compounds (brown and red hue). In 3b the chemical-elementary differences are observed where the compounds with high iron content stand out in white hue. The diversity of mineralogical compounds is confirmed through elementary chemical mapping (3c).

Figure 3.- Micrographs product of the correlative microscopy of a sample of the sphere of "El Silencio".

Figure 4b is a greater magnification of "4a", crystalline compounds of laminar habit (micas) were identified, these structures are capable of generating delamination. In addition, a fissure was identified that is noted next to the mica crystals, which reaches the surface of the sample. Figure 4c shows the clear diversity of compounds the crystalline compounds identified.
Figure 4.- Laminar habit crystals (micas) were identified, these structures are capable of generating delamination.

4.3 Characterization of sands by X-ray diffraction

Once the different sand samples from the locality of the “El Silencio” site were provided, they were analyzed before and after a washing process with distilled water and ethanol, done by the conservation team coordinated by Dr. Medina González and MSc. Javier Fallas. To avoid high background noise in the DRX tests it was necessary to use oriented silicon sample holders (Si), taking advantage of the maximum sensitivity of the detectors and identifying compounds in low proportion in the samples. Figures 5a and 5b show the type of instrumentation used, both diffractometers have multiple purpose optics, this increases the effectiveness and efficiency of the characterization processes of mineralogical compounds.

Figure 5.- Multi-purpose X-ray diffractometers a) Rigaku, Ultima IV model and b) Bruker D8 Discover.
The analysis of the sand samples before and after the washing process was aimed at eliminating some crystalline compounds. The diffractogram of Figure 6 corresponds to one of the unwashed sand samples, where compounds such as clays (volkonskoitite, kaolinite), feldspar (albite and anorthite), amphibole (magnesium-hornblende), zeolite (sweeper), microcline, oxides of silicon iron and quartz. Figure 7 shows the diffractogram of washed sand, it is clearly distinguished that some compounds were removed such as the barrierite (zeolite), magnesihorneblende (amphibole), silicon oxide iron, microline and a considerable decrease in the proportion of feldspars.

Figure 6.- Difractogram resulting from a sample of sand without washing.

Figure 7.- Difractogram resulting from the washed sand, some compounds were eliminated.
5. Preliminary conclusions

• The analysis by correlative microscopy and DRX has so far identified part of the mineralogical composition of the micro samples of the “El Silencio” sphere, which contains feldspars, quartz, amphibole, iron phyllosilicates (micas), hornblende, among others.

• The characterization of the sands by DRX before and after the washing process allowed to identify what type of compounds managed to be eliminated, the above provided important information for the decision-making of the multidisciplinary group of the project of conservation of the sphere “El Silencio”, for the 2019 season where conservation, reintegration and consolidation work was carried out.

• This report is a preview of results and the rest of the results are currently being processed as a result of the material characterization of the rest of the samples.

6. References


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