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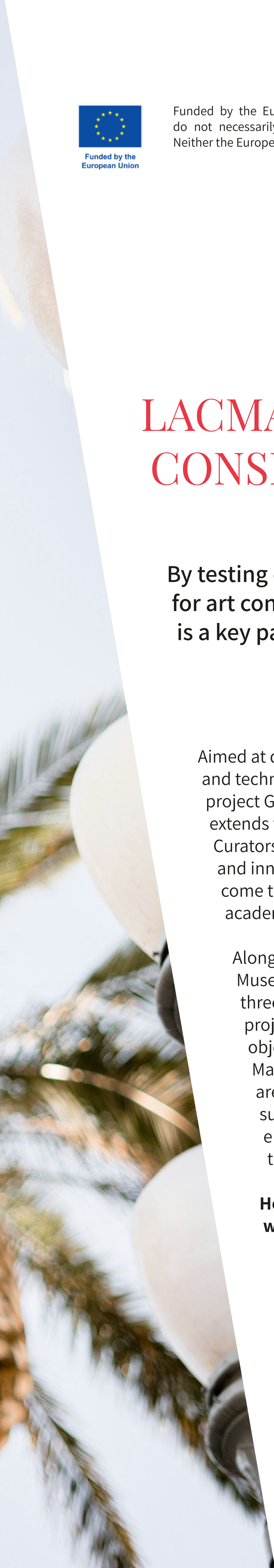
GREENART



LACMA: A PIONEER IN SUSTAINABLE CONSERVATION WITH GREENART

By testing cutting-edge, eco-friendly, and sustainable nanomaterials for art conservation, the Los Angeles County Museum of Art (LACMA) is a key partner in the European GREENART project.

Aimed at developing sustainable and ecological materials and techniques to preserve cultural heritage, the European project GREEN Endeavor in Art Restoration (GREENART) extends far beyond the borders of the European Union. Curators, scientists, art conservators, researchers, experts and innovative companies from around the world have come together in this collaborative consortium, thanks to academic and scientific partnerships with 28 institutions.

Alongside the Metropolitan Museum of Art and the Museum of Fine Arts in Houston, LACMA is one of only three American museums involved in this European project. Within this major Los Angeles Museum, objects conservator Jessica Chasen, head scientist Laura Maccarelli and conservation-researcher Chiara Biribicchi are contributing to the development of innovative and sustainable cleaning and packaging materials. These environmentally responsible practices aim to reduce the ecological footprint of art conservation.

How and when did you initially got involved with the GREENART project?
Laura Maccarelli (LM): In 2019, Diana Magaloni, Senior Deputy Director, Curator, and Director of Conservation, invited Professor Baglioni to give a lecture to LACMA's conservation centre team on the nanomaterials developed by CSGI. During his visit, Professor Baglioni also toured our laboratories, offering insightful suggestions on how to perform tests using these nanomaterials. Following his visit, the Mellon Fellow in Paintings and Textiles at LACMA began preliminary testing of the gels on two specific case studies. The first was a textile case study involving a *thangka* [a Tibetan Buddhist painting, editor's note] that had suffered extensive dye bleed due to past flooding. The second was a painting by Ernst Ludwig Kirchner, which had been coated with varnish during a 1970s conservation treatment, despite the artist's well-documented preference for matte, unvarnished surfaces. This initial testing led to an extensive exchange of emails between our team and Professor Baglioni's group as we worked to refine the application of these materials. I believe that this collaboration demonstrated our strong interest in and capability to work with these innovative gels. As Professor Baglioni and his colleagues were developing the GREENART project, they likely saw LACMA as a valuable partner for the beta testing phase, given our prior experience and engagement with these materials.

— Pierre Naquin and Carine Claude

As a non-EU partner, how do you "benefit" from the project?

LM: For LACMA, there is no direct financial or institutional benefit from participating in the GREENART project. However, our involvement allows us to test innovative materials, ensure their safety for use in the art world, and contribute to the development of guidelines for their application. LACMA is deeply committed to sustainability, recognising that museums, as custodians of cultural heritage, should play a leading role in driving positive change. Projects like GREENART and CRAIT — our Institute of Museum and Library Services (IMLS)-funded initiative focused on sustainable materials for art transportation — are essential for advancing more environmentally responsible practices in the field. By engaging in these projects, we aim to help shape a more sustainable future for conservation and museum operations worldwide.

With what Work Packages are you involved?

Chiara Biribicchi (CB): LACMA is involved in Work Package 2 (Cleaning) and Work Package 4 (Consolidants and Packaging Materials). For Work Package 2 we are testing organogels, focusing on the ECO-systems developed by CSGI [Consorzio interuniversitario per lo sviluppo dei Sistemi a Grande Interfase, Interuniversity Consortium for the Development of Large Interface Systems, an Italian research organisation affiliated with the Chemistry Department at the University of Florence, editor's note] in combination with specific solvents. Additionally, we are working with hydrogels based on Polyvinyl Alcohol (PVA) and various acids, including succinic acid (PVA-SU), salicylic acid (PVA-SA), and adipic acid (PVA-AD), alongside PG PLUS 3 and Peggy 5 and 6, which are CSGI nanogels developed during the Nanorestart EU project. All the hydrogels are being tested with both standard water-based solutions and new nanofluids based on diethyl ketone, provided by CSGI, and compared to more traditional hydrogels, such as agarose and a blend of xanthan gum, agarose and konjac. We are testing the cleaning materials on two different case studies. The first is a soffit [architectural element, editor's note] from a *Damascus Room* (polychrome wood, 1766-1767), which exhibits surface dirt accumulation, and potential degradation of its polychrome layers. The second case study is a Tibetan cabinet, which presents a complex stratigraphy of paint layers and coatings, requiring a careful and controlled cleaning approach.
For Work Package 4, we are evaluating the effectiveness and suitability of newly developed sustainable packaging materials for conservation use. Our primary focus is on the newly developed packaging material and absorbers, which shows promise for preserving deteriorating plastics.
For this part of the project, we selected a deaccessioned work by László Moholy-Nagy. The object is made entirely of cellulose acetate, a well-known problematic plastic that, when degrading, emits a characteristic vinegary smell due to off-gassing. The goal is to have the volatile organic compounds (VOCs) released by the object absorbed by filters incorporated into archive boxes made of sustainable raw materials, preventing them from spreading to other objects in the collection.

Why did you choose those works and on which criteria?

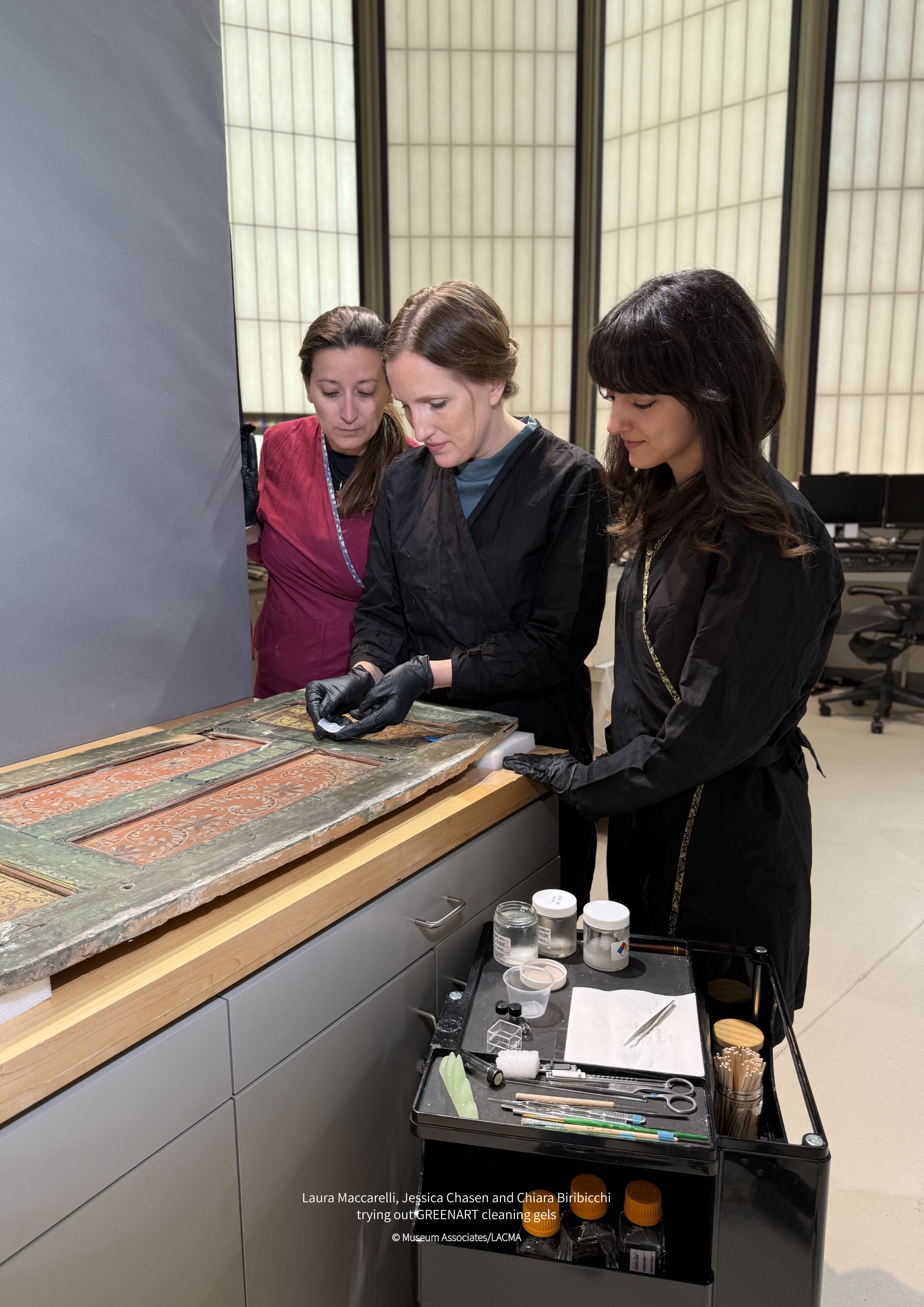
Jessica Chasen (JC): We chose these works based on their anticipated installation in the David Geffen Galleries, set to open in April 2026. As part of the preparation for display, the objects will undergo conservation treatment. Cleaning is a crucial step in this process to improve their readability and ensure they are presented in their best possible condition while preserving their historical integrity. These two three-dimensional objects with their water-sensitive paint surfaces represent a common challenge conservators face. Aqueous solutions are typically the most efficient for cleaning, but they can also risk compromising the original paint layers and porous wood substrate. Therefore, finding ways to contain these solutions to the surface interface is essential for safe and effective cleaning. While similar materials have been tested on modern painted surfaces, highly dimensional nature of these types of surfaces, combined with their complex histories, provided a new avenue to explore the versatility of the newly developed materials.

> "The green aspect of these products is very important to both LACMA and our conservation team, as we work toward integrating more sustainable practices into our work. At LACMA, we believe that museums should lead by example in the shift toward sustainability, which is why we are involved in projects like GREENART and CRAIT.
> — *Laura Maccarelli*


Laura Maccarelli

Damascus Room, Syria, Damascus (AD 1766-1767), AH 1180, Los Angeles County Museum of Art.

Conservation of the room was organised in partnership with King Abdulaziz Center for World Culture; additional conservation support was provided by the Friends of Heritage Preservation.



Laura Maccarelli, Jessica Chasen and Chiara Biribicchi
trying out GREENART cleaning gels

What are you evaluating and what is your evaluation process?

CB: The two case studies require different types of evaluations based on the specific needs of the object. In both cases, we have conducted preliminary assessments of the cleaning efficacy of various fluids. Afterward, we selected the best fluids and tried to incorporate them into hydrogels and organogels. For the soffit panel of the Damascus room, we chose to first evaluate the spread effect of the hydrogels to select those with the least spread effect for use on a water-sensitive object like the Soffit panel from the Damascus Room. In addition to these tests, we performed handling assessments to evaluate the hydrogels' ability to adapt to surfaces in relief. For the Tibetan cabinet, the evaluation process focuses on the cleaning system's ability to remove the layer of wax on the surface while preserving the underlying paint and varnish. To achieve this, we tested both nanofluids and selected organic solvents, both as neat fluids and in combination with hydrogels and organogels. The aim was to assess whether the gel system could reduce solvent release, thereby minimising the risk of damaging the underlying paint. As with the previous case, we also evaluated application times and considered the effects of repeated application cycles. For both case studies, different analytical techniques, such as technical photography in visible light and ultraviolet fluorescence, digital microscopy, spectroscopy and elemental techniques, will be used to assess cleaning efficacy and eventual varnish or pigment pickup. Results will be summarised in a star diagram.

With which universities are you interacting with?

CB: We are in constant contact with CSGI (Consorzio interuniversitario per lo sviluppo dei Sistemi a Grande Interfase), collaborating closely to refine and evaluate materials. Over the past month, we have held weekly meetings to discuss the testing of organogels loaded with fatty acids for the removal of a wax layer from the Tibetan cabinet. Both CSGI and LACMA are conducting tests to determine which solvents are most suitable for specific gel formulations. Our feedback focuses on several key aspects: solvent compatibility, assessing which solvents work best with different types of gels; Loading efficiency, evaluating how long the gels need to be infused with solvents for optimal performance and Gel behaviour, observing changes in release rate, malleability, and overall handling after solvent loading. Based on the partners feedback, CSGI refines and updates the formulations, providing us with new versions of the organogels for further testing. This iterative process helps ensure that the materials perform effectively in real conservation scenarios.

Can you tell us about some of your experiences of the products you tested?

JC: We compared the spread effect of different hydrogels and found that the fluid release is much more gradual compared to traditional gels. This is particularly important as it combines gradual release with flexibility and surface conformity, which traditional rigid gels achieve by using lower concentrations of gelling agents, resulting in faster release. With organogels, we observed that they perform well on flat surfaces with solvents of medium volatility, across a wide range of polarities, which is especially important because gels with these properties are lacking in the conservation field. Both hydrogels and organogels allow for gradual release of the encapsulated fluid, thereby minimising the conservator's exposure to solvent vapours and their release in the environment. These gels allow us a whole new level of control, enabling us to carefully tailor our treatments to meet a wide range of challenges often presented by a single object.

LM: The green aspect is essential. However, sustainability needs to be balanced with efficacy, ease of use, existing conservation know-how, and practical considerations such as cost and accessibility. While we fully support the development of greener conservation materials, their cost and availability can sometimes be a challenge, especially for institutions outside the EU. Many of these materials are still in development, and as with any innovative technology, they can be more expensive than traditional alternatives. Additionally, international shipping means that purchasing materials from the EU is not entirely carbon neutral, which is an important factor to consider when assessing their overall sustainability. For these greener materials to be widely adopted, it is important that they perform effectively, offering results that are comparable to or better than conventional materials; that they are practical to use, fitting seamlessly into conservation workflows; that they remain financially accessible, so that institutions of different sizes and budgets can incorporate them and that they consider the full environmental impact, including their production, transportation, and disposal. This is why our collaboration with CSGI is so valuable. Through testing and real-world application, we provide feedback to help refine these materials, ensuring that they meet both conservation and sustainability goals in a way that is practical for the field.

Are you participating in other international projects?

LM: At this stage, we are not participating in any other EU projects. LACMA is an exhibition-driven museum, which means that dedicating time to research can be challenging due to other institutional priorities. Additionally, the lack of funding for non-EU partners places an added strain on our budget, which often needs to be more exhibition focused. However, we do engage in other international research collaborations, which differ from EU-funded projects in terms of structure, funding models, and institutional priorities. While EU projects emphasise large-scale, multi-institutional collaboration with a strong focus on sustainability and knowledge sharing, other international partnerships are often more flexible, tailored to specific research questions and dependent on external grants or institutional support.

Will you be interested in participating in follow-up projects?

LM: We are always open to engaging with new projects; however, we have to carefully consider time and budget constraints with each new commitment. While we are certainly interested in learning about potential follow-up projects, we would need to evaluate internally whether we have the necessary resources to commit to another iteration of the project. Given LACMA's exhibition-driven priorities and budget constraints for non-EU partners, our participation would depend on the project's alignment with our institutional goals and the availability of funding and staff capacity.

Analysis of an altar table with auspicious symbols (19th century), Los Angeles County Museum of Art