European Association of Archaeologists

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MATERA 2025

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Technologies in the Americas: From Ancestral Knowledge to AI

Fourth European Assembly of Archaeology of the Americas

MATERA

MAY 23-24 2025

CASA CAVA

Welcome

The Community for the Archaeology of the Americas of the European Association of Archaeologists (EAA4Am) warmly welcomes you to the Fourth European Assembly of Archaeology of the Americas!

This year, we are gathering in the extraordinary city of Matera, thanks to the kind invitation of the National Research Council of Italy.

Our hosts in Matera, the conference organizers, are Nicola Masini (CNR Institute of Heritage Science), Rosa Lasaponara (CNR Institute of Environmental Analysis), and Carolina Orsini (Milan Museo delle Culture).

This year's assembly is co-financed by CNR (ISPC and IMAA), the Center for Andean Studies of the University of Warsaw, the European Association of Archaeologists and Cluster Basilicata Creativa.

The theme of this year's meeting "Technologies in the Americas: From Ancestral Knowledge to AI" invites us to reflect on long-standing and emerging intersections between technical systems, environmental knowledge, and the archaeological record in the Americas.

For two days, twenty-two contributions will explore the following topics:

- Indigenous Technologies and Environmental Knowledge in Latin America
- Digital and Scientific Technologies in the Study of Pre-Hispanic Landscapes and Material Culture
- Scientific Approaches to the Study of Inca Culture
- New Challenges in Archaeological Research
- Technology Applied to Material Studies and Chronology

Organized for the fourth consecutive year, this European Assembly for the Archaeologies of the Americas aims to offer a space for exchange and collaboration among archaeologists, heritage professionals, and researchers working on the Americas from European institutions, and visiting researchers from all over the world who wish to meet the European community.

To learn more about the EAA4Am Community, please visit our webpage:

☞ https://www.e-a-a.org/EAA/Membership/Communities%20pages/EAA4Am.aspx

Recordings from previous meetings are available on our YouTube channel:

📽 https://www.youtube.com/@EAA4AmCommunity

Thank you for joining us. We wish you an inspiring and collegial Assembly! Enjoy the conference!

The Organizing Committee

Matera, May 2025

General Information

Venue

CASA CAVA, Via San Pietro Barisano 47, 75100 Matera

https://www.meetingecongressi.com/it/struttura/matera/140719/casa_cava.htm

Zoom virtual room for remote participation

https://univ-antilles-fr.zoom.us/j/87601362617

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Program edition

Lesly García, Thibault Saintenoy, Carla Betancourt y Nicola Masini

Design of the conference poster (the front cover of this book) by Nicola Afflitto

Scientific program, day 1, Friday 23/5, Casa Cava

Opening	9:00-9:30	**Greetings & Introduction**	
	9:30-10:00	Keynote by Carla Aloe	*Inventing the New World: Tommaso Stigliani's "Mondo Nuovo"*
Session 1	**Indigenous Technologies and Environmental Knowledge in Latin America**		
	10:00-10:20	Arianna Campiani	*Technological and social effects in the modification of the environment: infrastructure at Classic Palenque (600-900 CE), Mexico.*
	10:20-10:40	Lesly García-Soto, Carla Jaimes Betancourt and Igor M. Mariano Rodrigues	*Exploring ceramic technology in the Bolivian Amazon: Ethnoarchaeological perspectives on temperants and cultural practices.*
	10:40-11:00	Francesco Orlandi	*The rehabilitation of indigenous technologies: Approaching the study of the ruins of development and divergent heritage processes in Tiwanaku (Bolivia) and Quilmes (Argentina).*
	11:00-11:20	Thibault Saintenoy, Hanne Cottyn, et al.	*A microhistory of early postcolonial industrial capitalism in the South-central Andes: insights from Changamoqo, Oruro, Bolivia.*
	11:20-11:30	Session 1 synthesis (Q&A)	
Refresh!	11:30-11:50	**Coffee Break**	
Session 2	**Digital and Scientific Technologies in the Study of Pre-Hispanic Landscapes and Material Culture**		
	11:50-12:10	Carla Jaimes Betancourt, Jörg Faßbinder and Lena Lambers	*Geophysical surveys and Lidar analysis at the El Cerrito site: New perspectives on the urbanism of the Casarabe culture (500-1400 AD).*
	12:10-12:30	Rosa Lasaponara, Denise Pozzi-Escot, Janet Oshiro, G, N. Abate and N. Masini	*Integration of Satellite, Close-Range, and Geophysical Investigation for Archaeological investigation in Pachacamac- Lima: From Site Discovery to Monitoring and Preservation*
	12:30-12:50	Angel Sanchez, N. Masini, N. Abate and I. Ghezzi	*Geoglifos en Casma: nuevos resultados de la investigación con múltiples sensores en drones*
	12:50-13:10	Alessandra Pecci, Natàlia Moragas, Luis Barba and Agustín Ortiz	*Avances en la investigación del barrio del río San Juan en Teotihuacan: Límites y perspectivas*
	13:10-13:30	Session 2 synthesis (Q&A)	
Reload!	13:30-15:00	**Lunch**	
Session 3	**Scientific Approaches for the study of Inca Culture**		
	15:00-15:20	Mariusz Ziółkowski and Jacek Kościuk	*In search of the main administrative centre of Inca's Kuntisuyu*
	15:20-15:40	Alexei Vranich	*Miliarium aureum ab Incapa Imperii. (The center of the Inca empire)*
	15:40-16:00	Dominika Sieczkowska, Kubicka-Sowińska Anna and Jose M. Bastante	*Inca Measurement Systems: Anthropometric Units in the Architectural and Hydraulic Design of Chachabamba - Implications for Heritage Conservation*
	16:00-16:20	Nicodemo Abate, S. Berquist, A. Vranich, R. Lasaponara and N. Masini	*Identifying archaeological and archaeologists' traces through the integration of archival documents and Remote Sensing technologies: the case study of Sacsayhuamán, Cusco, Perù.*
	16:20-16:40	José Alejandro Beltrán-Caballero, Manuel Silva, Ignaci Fiz, Pere Manel Mártin, Artur López, Ramiro Matos and Ricardo Mar	*Suchuna (Saqsaywaman archaeological park, cusco): use of drones, photogrammetry and photoscan in the cultural reconstruction of a hydraulic-religious inka landscape*
	16:40-17:00	Session 3 synthesis (Q&A)	
Enjoy!	20:00 - 23:00	**Social Dinner**	

Scientific program, day 2, Saturday 24/5, Casa Cava

Opening	9:15-9:30	**Good Morning Welcome**	
Session 4	**New Challenges**		
	9:30-9:50	Francesca Colosi, Francesca Di Stefano, M. Sanità and E.S. Malinvern	*Walled Compound Chol An (formerly Rivero): From 3D Modelling to Automatic Segmentation of Architectural and Functional Elements*
	9:50-10:10	Nicola Masini, Ivan Ghezzi, Fulong Chen, Antonio Minervino Amodio, Nicodemo Abate, Dario Gioia, Maria Sileo and Rosa Lasaponara	*SAR based monitoring mountain vegetated areas to preserve Cultural Heritage in danger: the case study of Kuelap (Peru)*
	10:10-10:30	Jacob George, Stephanie Loo and Alexei Vranich	*From Data to Display: Integrating Remote Sensing for Archaeological Research and Public Engagement*
	10:30-10:50	Marisa Lazzari, Ioana Oltean, Adrián Oyaneder Rodríguez, María Cristina Scattolin and Lucas Pereyra Domingorena	*Andean landscape technologies: assessing and understanding ancient connectivity and productivity practices*
	10:50-11:10	Dagmara M. Socha, Stephanie Panzer, Franz Edwin Martin Grupp Castelo, Winnie Celeste Martínez Sulca, Johan Reinhard and Alice Paladin	*CT-scans reveal new findings on mummified frozen Inca child from the volcanoes of Ampato and Sara Sara, Peru*
	11:10-11:30	Session 4 synthesis (Q&A)	
Refresh!	11:30-11:50	***Coffee Break***	
Session 5	**Technology applied to Material Studies and Chronology**		
	11:50-12:10	Mike Lyons	*Obsidian in Pre-Hispanic Northeast Honduras: Long-Distance Exchange Networks and Social Complexity*
	12:10-12:20	David Buti, Davide Domenici, Joanne Dyer, Danny Zborover, Chiara Grazia and Federica Bonifazi	*Shades of Blue: unveiling the composition of blue paints in Mesoamerican codices. From non-invasive spectroscopic techniques to new dissemination approaches*
	12:20-12:40	Christian Mesia-Montenegro	*Resolving Chronological Challenges of the Andean Central Coast Formative Period: A Bayesian Reanalysis*
	12:40-13:00	Session 5 synthesis (Q&A)	
Closing	13:00-13:30	**Closing Ceremony**	
Relax!	13:30-14:30	Lunch	
Enjoy!	16:00-17:30	**Visit to the Sassi Quarter of Matera**	

Abstracts of Session 1. Indigenous Technologies and Environmental Knowledge in Latin America

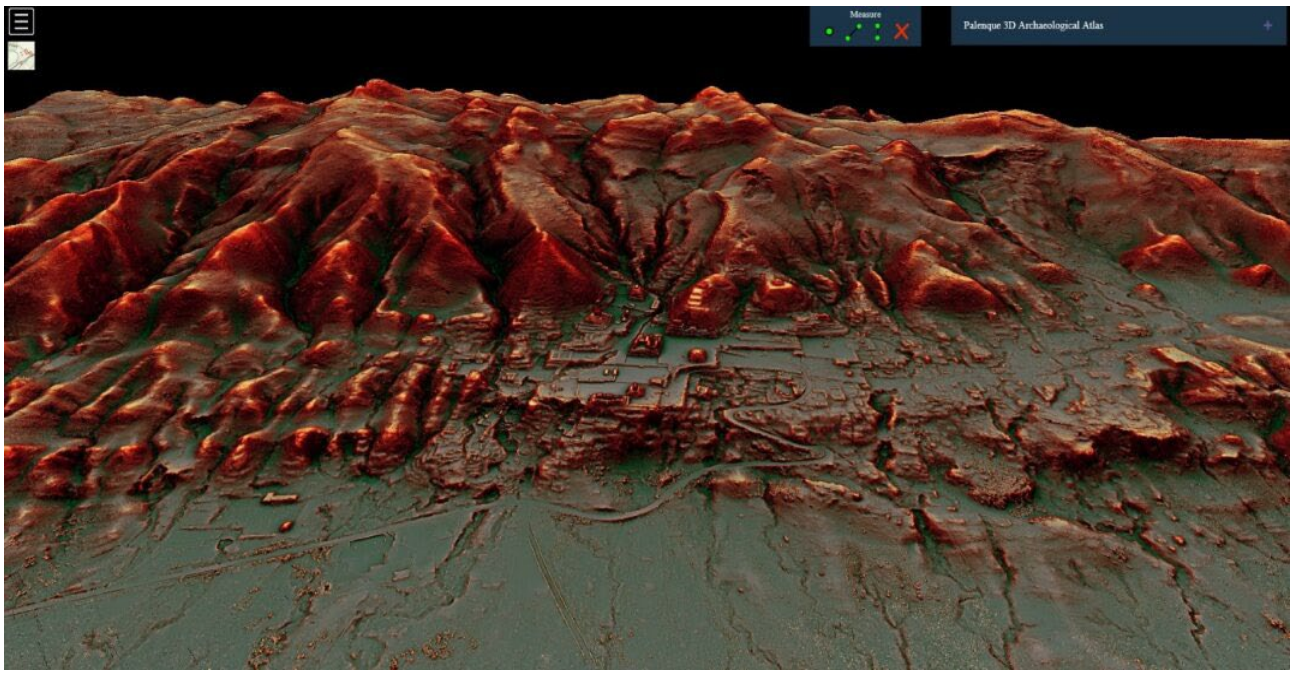
Title: Technological and social effects in the modification of the environment: infrastructure at Classic Palenque (600-900 CE), Mexico.

Author: Arianna Campiani

Affiliation: Università La Sapienza, Rome, Italy

Contact: arianna.campiani@uniroma1.it

Abstract: The Maya city of Palenque was built on a 2.2 Km^2 plateau at the foothills of the Sierra de Chiapas, Mexico. The urban form we appreciate today corresponds to the VIII century CE, and it is the results of several centuries of modifying the natural environment in order to allow settling. Palenque inhabitants shaped their surrounding environment through an extensive infrastructure network, adapting the available space to their needs and allowing the city to function through time. Huge works of levelling and containment shaped artificial terraces where to build houses, temples and public plazas, while a sophisticated hydraulic system permitted to control the flow of water of the several streams that cross the plateau. Thanks to the recent acquisition of LiDAR data we have been able to reassess the amount of infrastructure, its relation with empty space and how the hydraulic and physical infrastructure are differently distributed throughout the plateau. By addressing Palenque with morphological and spatial analyses and with a particular emphasis on the neighborhoods integrating the city, in this talk I will explore the negotiation processes associated with infrastructure construction and their social implications.



Exploring ceramic technology in the Bolivian Amazon: ethnoarchaeological perspectives on tempers and cultural practices.

Authors: Lesly García-Soto[1], Carla Jaimes Betancourt[1] and Igor M. Mariano Rodrigues[2]

Affiliations: [1] University of Bonn, [2] Instituto de Ciências da Sociedade, Universidade Federal do Oeste do Pará (UFOPA), Santarém, Brazil

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Abstract: This research examines the documentation and analysis of traditional ceramic production techniques used by two Indigenous Peoples of the Bolivian Amazon. Specifically, it describes the use of cauixi temper by Cayubaba potters and the combination of turtle shell and ground bone with grog by Tsimane' potters. These case studies contribute to the field of Amazonian archaeological ceramics, which has predominantly been limited to identifying organic and inorganic tempering agents. Ethnographic research with potters from two distinct regions within the Llanos de Moxos emphasizes the complexity of ceramic production, highlighting the diverse range of materials and techniques involved. The ethnographic documentation of these tempering agents is vital not only for their identification in archaeological contexts but also for understanding the rich variety of practices and environmental interactions tied to ceramic technology. Equally important is the recognition of the beliefs and customs that determine the appropriate handling of materials, which are considered crucial for the success of pottery-making and need to be considered alongside the *chaîne opératoire* to better ascertain the variations in human-material relationships. This comprehensive understanding sheds light on the cultural significance and intricate relationships that define the ceramic technology of these communities, including the intentionality of other agents as well as part of ethnoconceptions that describe technical relationships.

Turtle shell temper preparation process, Tsimane Pottery, Bolivia.

The rehabilitation of indigenous technologies: approaching the study of the ruins of development and divergent heritage processes in Tiwanaku (Bolivia) and Quilmes (Argentina).

Author: Francesco Orlandi

Affiliations: Postdoc Research Fellow, University of Macerata; Honorary Research Fellow, Centre for the Archaeology of the Americas, University of Exeter

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Abstract: The valorisation of ancestral technologies and knowledge as indigenous heritage is one of the most prominent aspects of the relationship between archaeology and development in Latin America. This articulation finds resonance in the popularisation of participatory methodologies that promote a multivocal understanding of cultural heritage, as well as in the institutionalisation of culturally appropriate codes of conduct and ethical protocols to integrate the purposes of conservation and archaeological research into the socio-territorial fabric and historical development of local communities. While there is a broad consensus on the use of heritage for the intertwined agendas of sustainable development and the recognition of cultural diversity, multicultural policies nevertheless expose the contradictions inherent in the reduction of indigenous knowledge, territories and identities to scientifically, economically and politically exploitable resources. The paper calls for a reflection on the articulation between technology, society and the cosmopolitics of heritage in the context of the struggles for recognition of indigenous rights in Tiwanaku and Quilmes. It shows that the agricultural technology recovery and rural ethnodevelopment projects that have affected the communities and territories around these important archaeological sites give rise to divergent heritage processes and the coexistence of multiple temporalities. The counter-mapping of long-term socio-territorial relations at both sites illustrates the sedimentation of this multiplicity as material traces in the landscape and in the collective memory of the communities, revealing a transversal reading of the rehabilitation of indigenous heritage in the southcentral Andean region.

The remaining ashes of a ritual offering on the clay altar built in the centre of the ceremonial enclosure of Kalasasaya form a palimpsest of interventions in the cultural landscape of Tiwanaku. June 2018

A microhistory of early postcolonial industrial capitalism in the South-central Andes: insights from Changamoqo, Oruro, Bolivia.

Authors: Thibault Saintenoy[1], Hanne Cottyn, Rodrigo Riveros, Felipe Carvajal, Marta Crespo and Pablo Cruz

Affiliations: [1]Instituto de Ciencias del Patrimonio (Incipit-CSIC)

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Abstract: This microhistory examines postcolonial European industrial capitalism in the Andes, focusing on the abandoned site of Changamoqo in Bolivia's former Carangas Province. The area features ruins from a 19th-century marketplace and foundry at the base of a sacred pre-Hispanic mountain. Archaeological research, archival analysis and oral histories reveal why foreigners invested heavily in this remote indigenous region. The site exemplifies a capitalist model developed by European immigrants and local partners, adapting the Andean Tambo premodern institution. Thus, Changamoqo offers crucial insights, from a bottom-up and situated perspective, into the long history of postcolonial extractivism in the Andes.

Panoramic view of the commercial and industrial establishment of Changamoqo, in a bofedal, at the foot of a pre-Hispanic sacred hill

Session 2. Digital and Scientific Technologies in the Study of Pre-Hispanic Landscapes and Material Culture

Geophysical surveys and Lidar analysis at the El Cerrito site: new perspectives on the urbanism of the Casarabe culture (500-1400 AD).

Authors: Carla Jaimes Betancourt[1], Jörg Faßbinder, Lena Lambers

Affiliations: [1]University of Bonn

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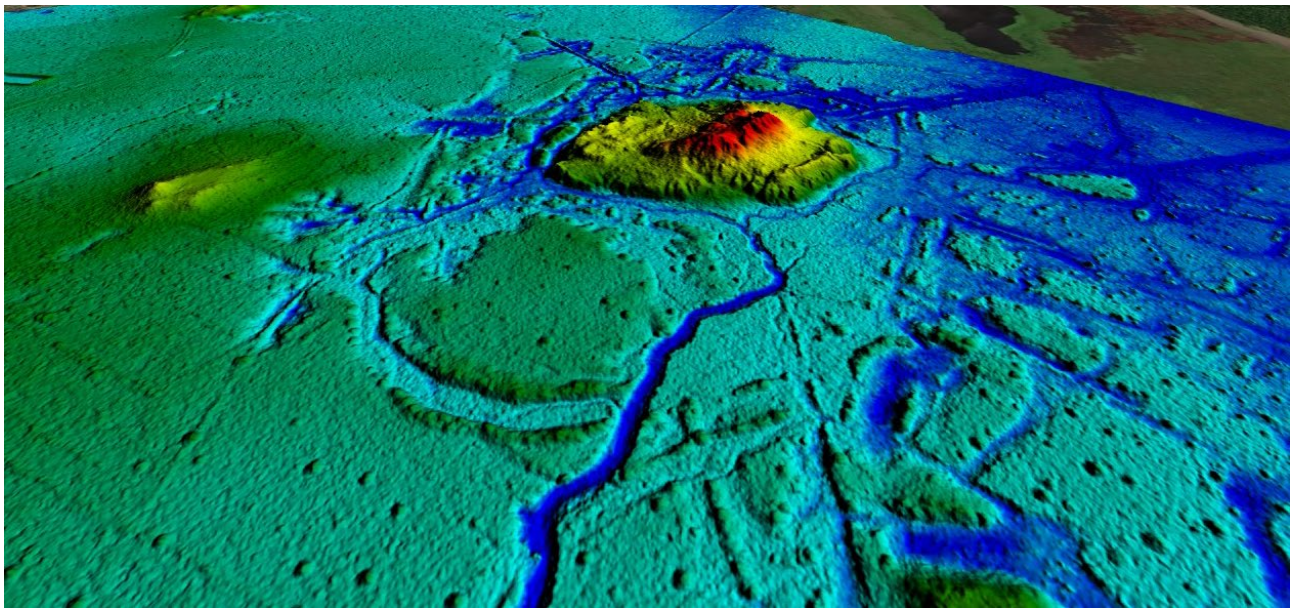
Abstract: The Casarabe culture (500-1400 AD) developed in the southwestern Bolivian Amazon and reached its peak around 1000 AD. Despite its territorial extension -estimated at more than 4,500 km²-little is known about the internal organization of its settlements and the architecture of its buildings. Recent studies based on Lidar technology have revealed a high density of monumental sites, known locally as lomas, interconnected by causeways and artificial canals (Prümers et al., 2022). However, to understand the hidden features beneath the surface, it is necessary to complement the Lidar analysis with geophysical survey methods. This presentation exposes the first results of a pilot study at the El Cerrito site, located 10 km east of the present town of Casarabe and protected as a communal reserve. El Cerrito stands out as one of the most important civic-ceremonial centers of the Casarabe culture, with a 6 m high quadrangular basal platform that covers about 6 ha and dominates an architectural complex of approximately 1 ha. In the central area, several large structures were identified, distributed around a central platform, in addition to a system of at least four causeways that radiate from the core to other sectors of the site and connect it with at least eight secondary settlements Magnetometer and electrical tomography (ERT) measurements revealed traces of wooden structures, pits, hearths, and artificial canals, as well as significant differences in soil magnetization linked to intense anthropogenic activity. These data open new perspectives for understanding low-density urbanism and landscape transformation in pre-Hispanic Amazonia.



LiDAR Map of El Cerrito. Casarabe Culture, Beni - Bolivia

Integration of satellite, close-range and geophysical investigation for archaeological investigation in Pachacamac-Lima: from site discovery to monitoring and preservation

Authors: Rosa Lasaponara[1], Denise Pozzi-Escot[2], Janet Oshiro[2], G, N. Abate[3] and N. Masini[3]

Affiliations: [1]CNR-IMAA,Potenza, Italy; [2]Museo de Pachacamac, Peru; [3]CNR-ISPC, Italy

Contact: rosa.lasaponara@cnr.it

Abstract: The archaeological site of Pachacamac, located approximately 30 km south of Lima, Peru, has been extensively studied using remote sensing technologies to enhance conservation and understanding. This 465-hectare sanctuary comprises roads, enclosures, and huacas (pyramidal adobe structures) dating from the 2nd to the 16th century CE. The integration of satellite imagery, close-range sensing, and geophysical investigations has significantly advanced research at Pachacamac, within the framework of international cooperation between Italian scientists from CNR (IMAA and ISPC) and archaeologists from the Pachacamac Museum. This interdisciplinary approach is crucial for sustainable archaeological research, enabling data-driven decision-making while minimizing destructive interventions. The integration of these methodologies has enhanced the ability to detect hidden archaeological features and track long-term changes due to natural and anthropogenic factors. Current research focuses on:

- Enhancing data fusion techniques and real-time monitoring to optimize site preservation.
- Integrating geospatial analysis with artificial intelligence and machine learning to improve pattern recognition and predictive modeling.
- These advancements will refine archaeological research at Pachacamac, ensuring better conservation strategies and a deeper understanding of its historical and cultural significance.

Advances in the research on the San Juan River neighbourhood in Teotihuacan: limits and perspectives

Authors: Alessandra Pecci[1], Natàlia Moragas[2], Luis Barba[3] and Agustín Ortiz[3]

Affiliations: [1]ERAUUB-IAUB-INSA-UB; [2]ERAUUB-IAUB-UB; [3]IIA-UNAM

Contact: Alepecci@gmail.com

Abstract: Since 2018, research has been carried out in the so-called San Juan River neighborhood in Teotihuacan, an area located in the political, economic and religious center of the City that, surprisingly, has received little attention from the various research projects carried out throughout the 20th century. The use of various technologies by the archaeological prospecting laboratory for this huge area of research forces us to annually reevaluate and rethink the best approaches and technologies to reach a better understanding of the internal dynamics of this place.

Geoglifos en Casma: nuevos resultados de la investigación con múltiples sensores en drones

Authors : Angel Sanchez, N. Masini, N. Abate and I. Ghezzi

Affiliations: CIAP, Lima, Peru

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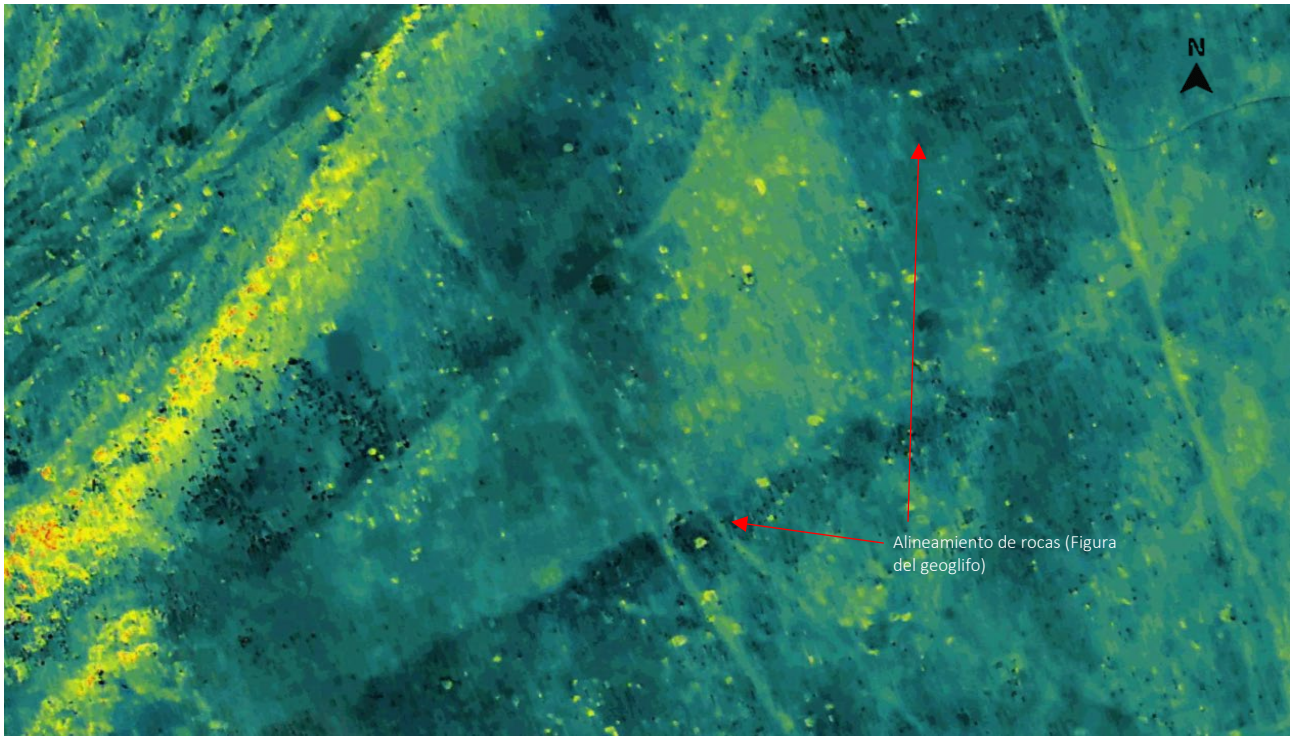
Abstract: Durante los últimos 4 años nuevas investigaciones han revelado una concentración importante e inédita de geoglifos en el valle medio del río Casma en la Costa Norte del Perú. El registro de estos nuevos geoglifos se ha hecho utilizando los lentes convencionales, sin embargo, se ha puesto a prueba un nuevo registro utilizando drones con múltiples sensores con el objetivo de tener un registro más completo que nos ayude a su entendimiento. Este registro se ha iniciado en una zona donde existen geoglifos que han sido dañados por actividades recientes pertenecientes a la minería informal y zonas agrícolas con el objetivo de hacer un mejor análisis que nos pueda facilitar la identificación e interpretación de geoglifos dañados. Los resultados obtenidos han sido bastante buenos, no solo se ha complementado mejor el registro convencional con drones, sino que es posible aplicar nuestro análisis para labores de restauración de geoglifos.



Session 3. Scientific Approaches for the Study of Inca Culture

In search of the main administrative centre of Inca's Kuntisuyu

Authors: Mariusz Ziółkowski and Jacek Kościuk

Affiliation: University of Warsaw, Center for Andean Studies

Contact: mziolkowski@uw.edu.pl

Abstract: The study concerns, on the basis of archaeological and, in part, ethnohistorical sources, the formation and organization of Cuntisuyu, the fourth (and to date the least known) part of the Inca Empire - the Tahuantinsuyu. Work carried out in recent years in collaboration between the Center for Andean Studies of the University of Warsaw and the Catholic University of Santa Maria de Arequipa, allowed the identification of two shrine-oracles of the mountains, considered sacred by both the Incas and their predecessors: Maucallacta (district of Pampacolca) associated with the cult of the Coropuna and Muyu Muyu (district of Chichas), its counterpart in what concerns the cult of the Solimana. It has also been possible to reconstruct a whole network of more than 20 satellite settlements, associated with the worship of the aforementioned mountains, as well as with administrative and economic functions. However, although all of them show evidence of Inca presence and are undoubtedly important, it would be very difficult to attribute to one of them a truly dominant position over the others. In other words: it is necessary to define where the Inca main administrative center, or capital, of, at least, this part of the Cuntisuyu, was located. The main objective of the project in progress is to verify the hypothesis that this main Inca administrative center was located in Ccopan, in the district of Andaray, on the summit of the eponymous hill, between approx. 3200 m and 3300 m.a.s.l.

Ccopan. Aerial view of monumental Inca Tomb 1 in Sector D. (photo Ruddy Perea).

Miliarium aureum ab Incapa Imperii (The center of the Inca empire)

Author: Alexei Vranich

Affiliation: University of Warsaw, Center of Andean Studies

Contact: avranich@gmail.com

Abstract: This paper integrates ethnohistorical analysis, archaeological excavation, and virtual reconstruction to examine how the Inca physically and ideologically transformed an earlier Middle Horizon ruin to align with their imperial narratives. Specifically, it explores the proclamation of the empire's center and how modifying preexisting ruins provided tangible evidence to justify the Inca conquest and rule. Over time, reinterpretations of these historical accounts have altered the original meaning of this foundational narrative. By critically reassessing these evolving readings, this study highlights the need for a more rigorous methodological approach to using ethnohistorical sources. The paper calls for a more disciplined integration of documentary and archaeological evidence to refine our understanding of imperial narratives and the materialization of political ideology in the Andean world.

Inca measurement systems: anthropometric units in the architectural and hydraulic design of Chachabamba - implications for heritage conservation

Authors: Sieczkowska Dominika[a,b], Kubicka-Sowińska Anna[c], Jose M. Bastante[d]

Affiliations: [a]Silesian University of Technology, Gliwice (Poland); [b]Center of Andean Studies, University of Warsaw (Poland); [c]Wroclaw University of Science and Technology, Faculty of Architecture (Poland); [d]National Archeological Park of Machupicchu– Ministry of Culture (Peru)

Contact: d.sieczkowska@uw.edu.pl

Abstract: This study examines the lasting influence of Inca architecture while investigating the speculative measurement system used by Inca builders, as referenced in post-conquest chronicles and 16th-century Quechua dictionaries. It is proposed that the Incas employed an anthropometric system based on human body proportions. Through *cosine quantogram* analysis and statistical verification, we explore the presence of a standardized measurement system utilized by Inca architects and stonemasons. Our primary dataset constitutes a collection of length measurements from 3D point cloud data of architectural and hydraulic elements at Chachabamba, located within Machu Picchu National Archaeological Park. For this project, our analysis was based on original photographs taken at the site in 1940 to eliminate the influence of modern restoration features, ensuring that our study focused solely on original Inca architectural elements. Understanding these Indigenous engineering techniques is crucial not only for reconstructing historical practices but also for preserving Inca heritage. Recognizing the principles that guided Inca builders allows contemporary preservation efforts to align with traditional design logic, honoring the original construction methods and cultural significance of these sites.

Architectural remains at Chachabamba: modern / in 1940 / 3D point cloud.

Identifying archaeological and archaeologists' traces through the integration of archival documents and Remote Sensing technologies: the case study of Sacsayhuamán, Cusco, Perú.

Authors: Nicodemo Abate*, S. Berquist, A. Vranich, R. Lasaponara, N. Masini

Affiliations: *National Research Council – Institute of Heritage Science (CNR-ISPC), C.da S. Loja, Tito Scalo (PZ), Italy

Contact: nicodemo.abate@cnr.it

Abstract: Archaeological sites are complex ecosystems formed over time through the succession of human actions and natural events, as well as alternating phases of use and abandonment. The site of Sacsayhuamán, Cusco, is no exception and, to date, is nothing more than the sum of the events that have occurred over the years since its construction. The site is located not far from the city centre of Cusco, and was probably built in the 15th century, under the Inca emperor Pachacùtec. The site was modified by the conquistadors, who also used it as a quarry for stone material. Today, the area is partly open to visitors and hosts tourist routes within it, while other areas are occupied by modern buildings. The aim of this study is to demonstrate the usefulness of a combined approach between new technologies and the study of documents for reconstructing the evolution of archaeological contexts. In this case, (i) UAV LiDAR data segmented by artificial intelligence, (ii) GIS-based techniques and (iii) archival documents, including graphic documents and excavation data, were used. This approach has proved very useful in providing archaeological traces useful for reconstructing the historical context, as well as traces left by past excavations to understand the effects of human action on Peru's archaeological heritage. In addition, given the nature of the data used, this approach can be replicated in other similar contexts.

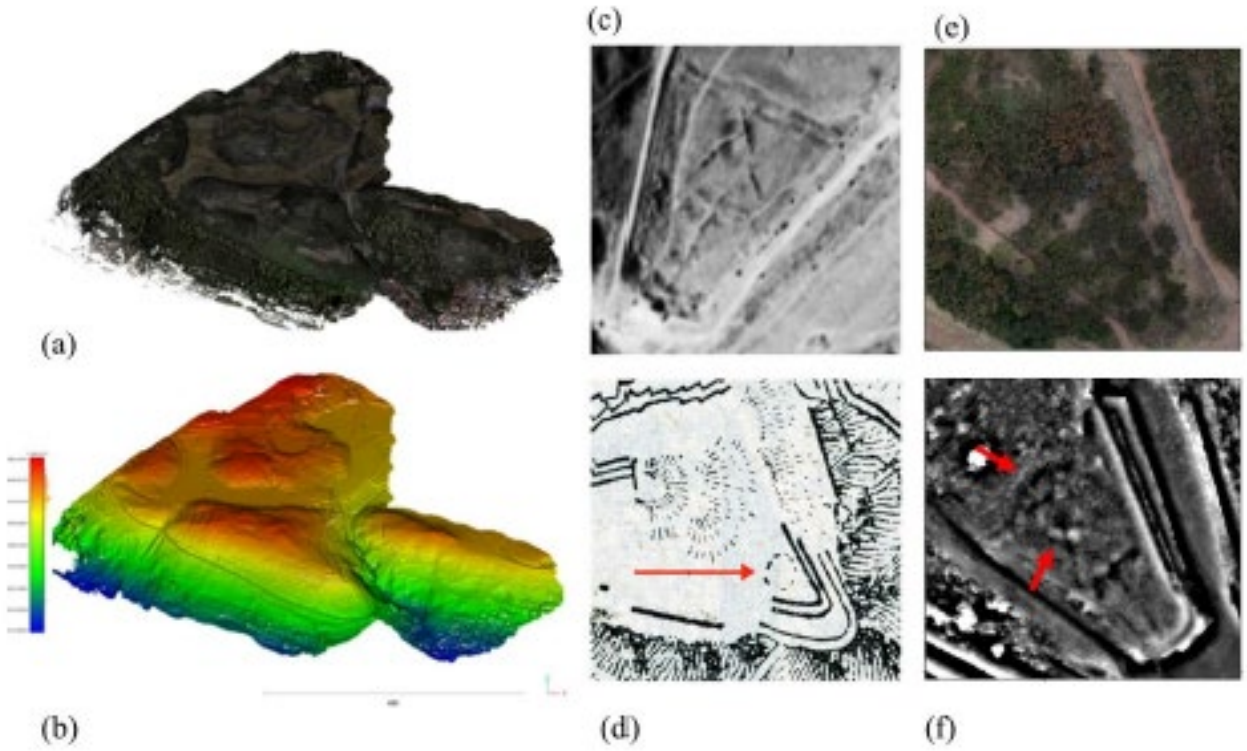


Figure 1. Example of the identification of archaeological features through the integration of heterogeneous data: (a) Point cloud from LiDAR RGB; (b) Point cloud from LiDAR without high-, mid-, and low-vegetation coloured by altimetry; (c-d) archival documents; (e) zenith view of the area indicated in (d) from the orthophoto RGB; (f) result of the Simple Local Relief Model (SLRM) applied to the LiDAR data (b) in the same area of (e).

Suchuna, Saqsaywaman archaeological park, Cusco: use of drones, photogrammetry and Photoscan in the cultural reconstruction of a hydraulic-religious inka landscape

Authors: José Alejandro Beltrán-Caballero[1], Manuel Silva, Ignaci Fiz, Pere Manel Mártin, Artur López, Ramiro Matos and Ricardo Mar

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Abstract: This paper presents the latest results of the reconstruction work of the Inka cultural landscape in the highlands of Saqsaywaman in Cusco (Peru). From the images obtained with the drone flight and with terrestrial photographs managed with different three-dimensional restitution programs, it has been possible to visually recreate the system of buildings, reservoirs, chincanas, wakas, shrines, terraces and hydraulic canals that organized the area known as “Rodadero” in the Inka period. This initiative is part of the project “Visualizing Cusco Inka” that since 2011 has been coordinated by the Rovira i Virgili University of Tarragona, Catalonia, Spain.

Session 4. New Challenges

Walled compound Chol An (formerly Rivero): from 3D modelling to automatic segmentation of architectural and functional elements

Authors: Francesca Colosi[1], F. Di Stefano[2], M. Sanità[2], E.S. Malinverni[2]

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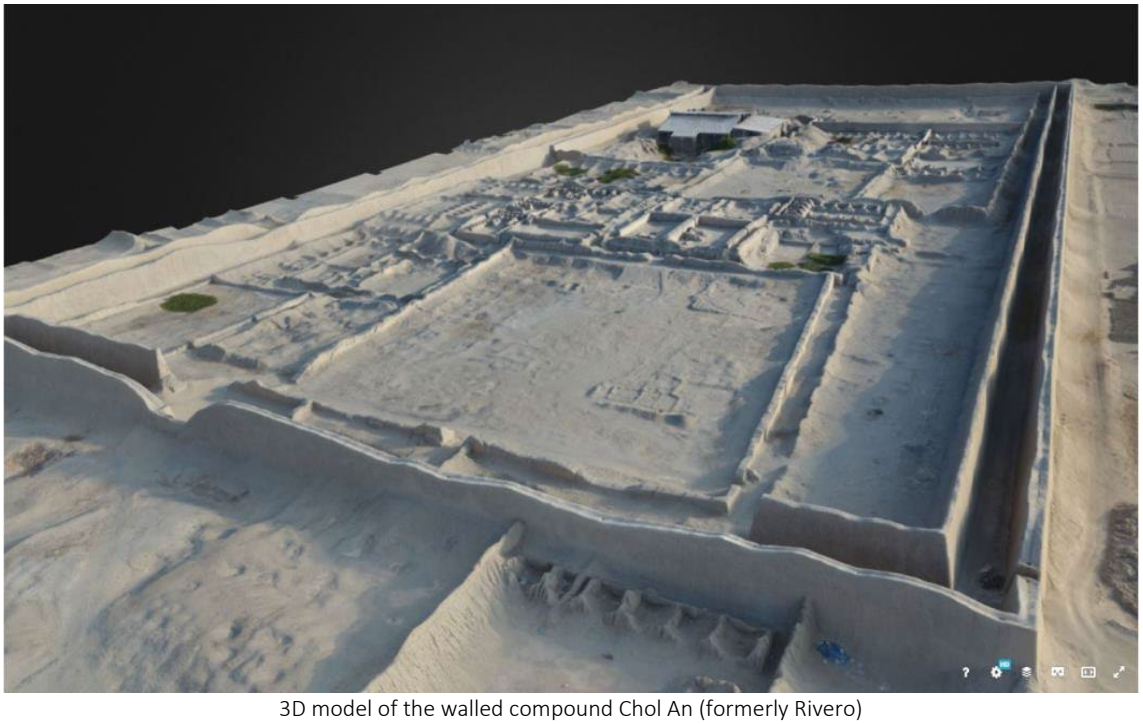
Abstract: The Italian Mission in Peru (MIPE) of the CNR-Institute of Heritage Science has been working on the archaeological complex of Chan Chan, a UNESCO World Heritage Site, for over twenty years, conducting research at both the territorial and monument scale. The architectural study has focused on the smallest and most recent of the typical *conjuntos amurallados* that constitute Chan Chan: Chol An (formerly Rivero). Geometric documentation and planimetric and structural analysis of the monument have posed a significant challenge due to the compound's vast dimensions and the fact that Chol An, as well as the whole Chan Chan, is entirely built with adobe. The data acquisition has been carried out by a drone photogrammetric survey conducted in collaboration with the *Proyecto Especial Complejo Arqueológico Chan Chan* (PECACH) in 2019. This effort enabled the production of orthophoto and 3D model of the *ciudadela*. This paper describes an AI approach of recognizing the architectural and functional elements that make up the *conjunto amurallado* (perimeter walls, storage rooms, *audiencias*, *plataforma de entierro*, etc.) through a segmentation of the acquired point cloud based on the level of detail for the identification of the various components. The segmentation of the monument's various components serves as the base for creating a semantic ontology, which is a preliminary step toward implementing HBIM. The application of BIM methodology for the analysis, monitoring, and management of historic buildings can be an effective tool for planning conservation and restoration interventions on the fragile adobe structures of the archaeological complex.



3D model of the walled compound Chol An (formerly Rivero)

SAR based monitoring mountain vegetated areas to preserve Cultural Heritage in danger: the case study of Kuelap (Peru)

Authors: Nicola Masini[1], Ivan Ghezzi, Fulong Chen, Antonio Minervino Amodio, Nicodemo Abate, Dario Gioia, Maria Sileo and Rosa Lasaponara

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Abstract: This study introduces an interdisciplinary methodology to assess the impact of climatic and human-induced stressors on cultural heritage in mountainous, vegetated regions. A key focus is the citadel of Kuelap, an iconic archaeological site of the Chachapoya culture in Peru's southern Amazonas region, now severely threatened by structural instability. By integrating multisensor, multitemporal, and multiscale investigations, the research employs advanced Earth Observation techniques, including SAR interferometry, unmanned aerial systems (UAS), and geophysical surveys, combined with precipitation-related ancillary data. This approach enables the identification and characterization of structural instability phenomena that continue to jeopardize the architectural integrity of the monumental site. Beyond advancing the understanding of the risks facing Kuelap, the study highlights the critical role of interdisciplinary strategies in cultural heritage preservation. By revealing the underlying processes that endanger Kuelap, the research contributes to broader efforts in conservation and risk mitigation for heritage sites worldwide.

From data to display: integrating remote sensing for archaeological research and public engagement

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Abstract: “From Data to Display” is a pioneering initiative that leverages advanced remote sensing and data processing technologies to transform archaeological research into immersive visual experiences, enhancing both academic study and public engagement. Using a drone equipped with LiDAR technology, the project surveys and maps Sacsayhuamán (a UNESCO World Heritage site in Cusco, Peru), capturing high-resolution three-dimensional data. This precision imaging not only documents the current state of the ruins but also detects hidden anomalies invisible to the naked eye, guiding archaeologists toward key excavation points. Once imaging is collected, advanced data analytics and CAD software digitally reconstruct the site from the ground up. This approach refines academic research with data-driven insights while making archaeological discoveries accessible through 3D renderings and visual storytelling. In collaboration with the Department of Culture of Cusco, the project involves students from the University of California, Berkeley’s Aerospace Department, technicians and scholars from the Italian National Research Council (CNR), and archaeologists from the University of Warsaw. Integrating cutting-edge technology with cultural heritage, “From Data to Display” bridges scientific inquiry with public dissemination, redefining how we visualize and understand the past.

Andean landscape technologies: assessing and understanding ancient connectivity and productivity practices

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Abstract: The south-central Andes region provides an exceptional record of high-altitude human settlement and circulation at various spatial scales. Andean technologies of landscape—the practices and techniques that created landscapes as artefacts--wove people, artefacts, plants, animals and other beings with places and routes in multilayered ways. Previous work on NW Argentina's Formative period social networks has shown how lithic and pottery technologies acted as material synthesis of the continuum between small and wider scales relationships and connections. These wide social worlds could not have existed without the farming and husbandry technologies that generated the necessary individual and communal capital to participate in them. Considered as the most effective climatic barrier in NW Argentina, the Aconquija Sierra (66º 15' Long W; 27º 15' Lat S), is exemplary of the Andean high-altitude landscape as artefact made of intermingled connectivity and productivity practices developed over the long term since the earliest Formative period settlements, throughout the Late and Inca periods, the Spanish colonial occupation, and into the present. Building on earlier aerial, satellite, and field-based research, our presentation discusses new opportunities presented by recent excavations and UAV surveys on the western slopes of the Sierra. We contextualise this work within Andean ontologies of technology, which provide a useful framework not only to better understand the nuances of past practices, but also to develop an integrated multiscalar approach that balances the potential 'truth effects' created by modern technologies, potentially contributing to crosscontinental collaborative heritage and productivity strategies for sustainable futures.

CT-scans reveal new findings on mummified frozen Inca child from the volcanoes of Ampato and Sara Sara, Peru

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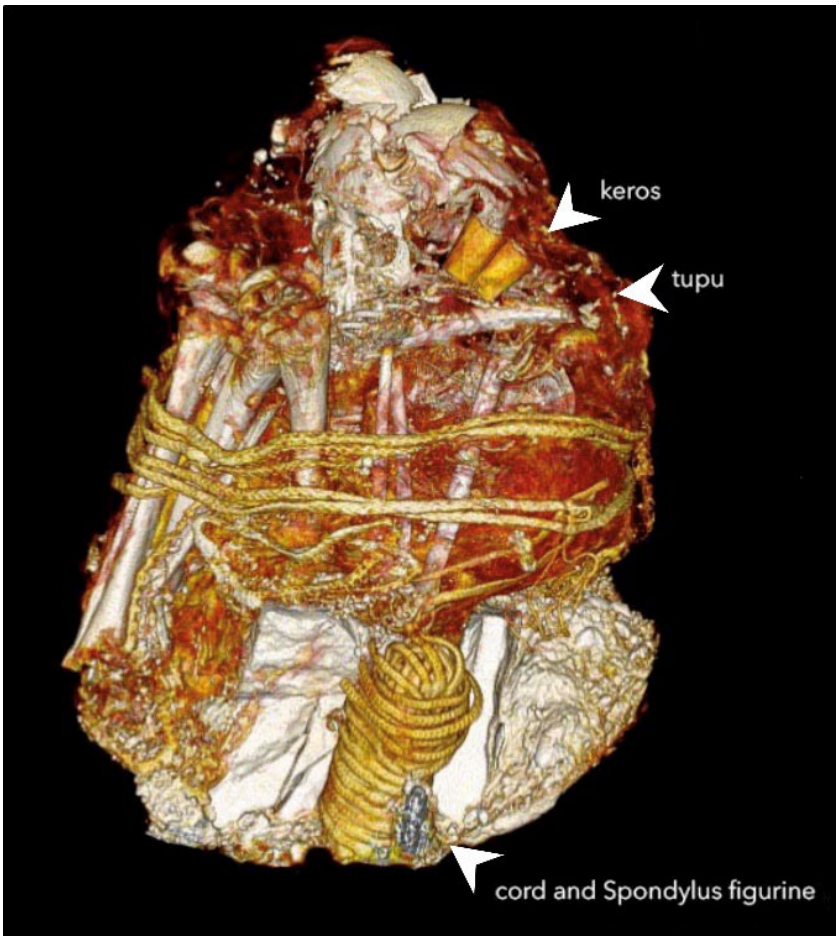
Abstract: This study examines 500-year-old mummified individuals sacrificed by the Inca (Sara Sara, Ampato #1, #2, and #4) using non-invasive CT scans. Discovered in the 1990s by Johan Reinhard and José Antonio Chávez, these children were sacrificed during the most important Inca ritual: *Capacocha*. The aims of this presentation are to evaluate taphonomic processes, assess the state of preservation and paleopathological profiles, and understand the cultural significance of sacrifice. Despite the similar burial locations, CT scan data reveal that the bodies underwent different taphonomic processes. Evidence from Ampato #4 suggests the possibility of a rare secondary burial, showing signs that internal organs were replaced with textiles. Signs of blunt force trauma to the skulls of Ampato #1, Ampato #2, and Sara Sara suggest a ritualized concept of violence. Additionally, in the case of Ampato #2, pathological changes indicative of Chagas disease were detected.



Session 5. Technology applied to Material Studies and Chronology

Obsidian in Pre-Hispanic Northeast Honduras: Long-Distance Exchange Networks and Social Complexity

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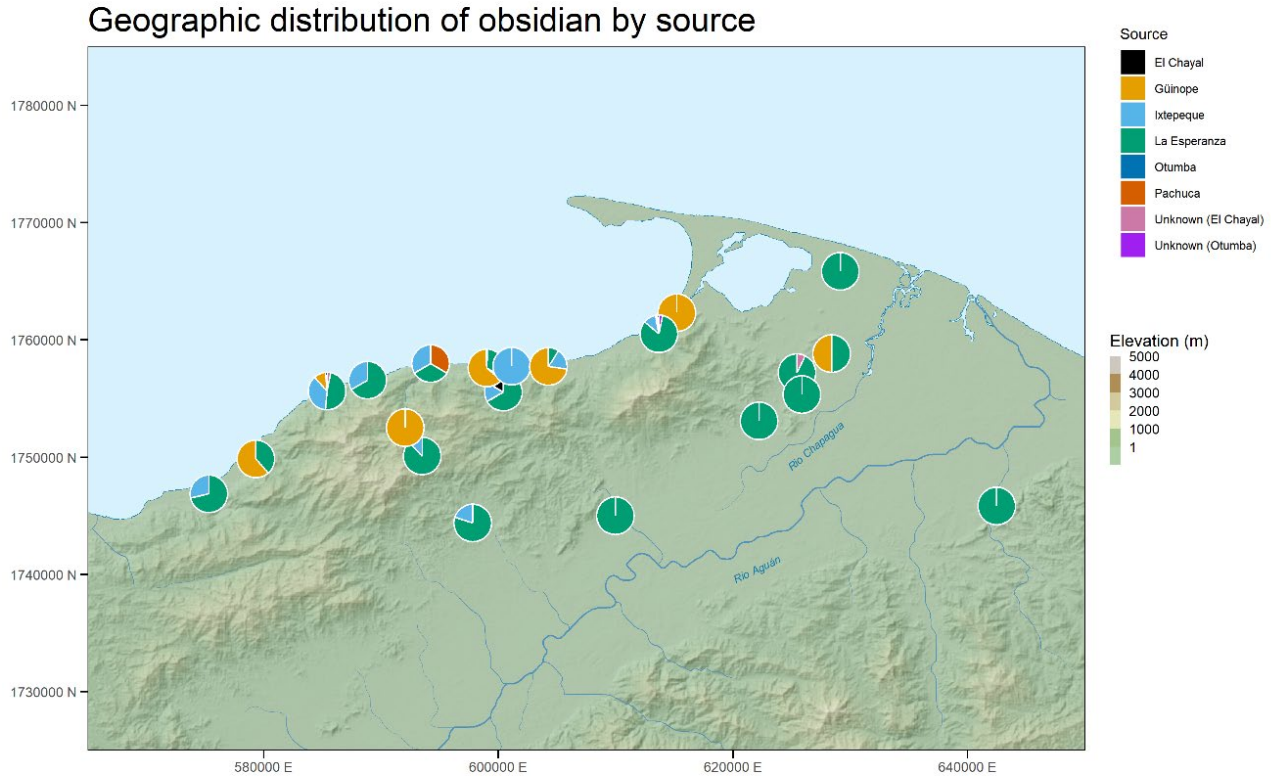
Abstract: Obsidian import into northeast Honduras during the pre-Hispanic period changed over time and space. Our investigations have uncovered a dynamic past in which the import of obsidian begins in the Late Formative period, ceases almost altogether during the Classic, and increases drastically during the Postclassic. Obsidian finds from over 20 sites in the region have been sourced via x-ray fluorescence and tested with a new AI sourcing method to reveal the import of goods from both local Honduran sources as well as those in present-day Guatemala and Mexico. The large dataset allows us to paint a picture in which obsidian was not distributed equally among settlements. Instead, high quality material was funneled to larger settlements, while lower quality material found its way to smaller, coastal communities. These observations imply that the exchange networks and management of obsidian resources was controlled by various actors throughout time, highlighting a major aspect of the region's social complexity.



Shades of Blue: unveiling the composition of blue paints in Mesoamerican codices. From non-invasive spectroscopic techniques to new dissemination approaches

Authors: David Buti[1], Davide Domenici[2], Joanne Dyer[3], Danny Zborover[3], Chiara Grazia[4], Federica Bonifazi[1], Alfonsina Pagano[1], Enzo D'Annibale[1], Costanza Miliani[1]

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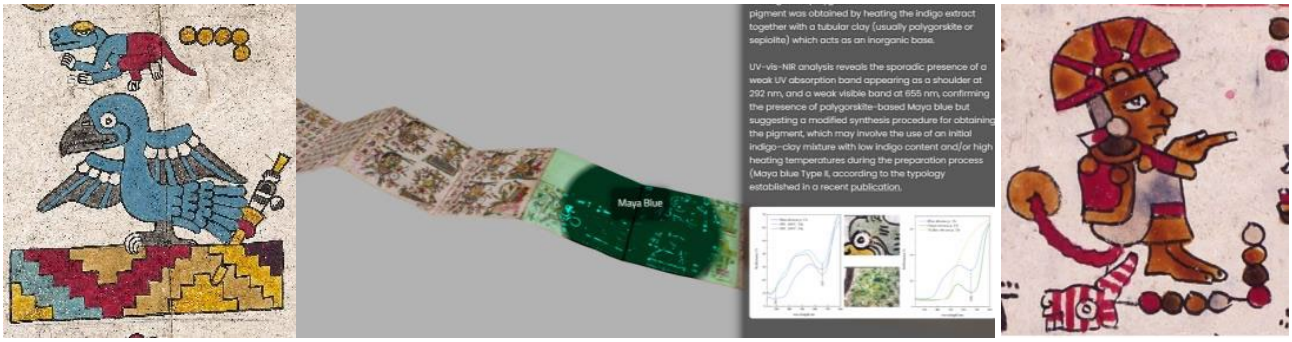
Abstract: Ancient Mesoamerican pictorial manuscripts were sacred objects preserving the histories and genealogies of indigenous societies and ubiquitous in important divinatory rituals. Treasure chests of indigenous cultural memory, accomplished artists painted the manuscripts, keepers of both sacred and technological knowledge. Today, the scientific study of these manuscripts using non-invasive and portable analytical techniques has enabled the complex technology of pigment manufacture used by indigenous artists to be better understood via an extensive characterization of their painting materials. The multimodal approach carried out by the E-RIHS mobile laboratory platform (MOLAB) and the British Museum's Scientific Research Department, which included hyperspectral imaging, XRF, UV-VIS-NIR Reflectance, FTIR and Raman spectroscopy, indicates a clear preference for organic materials extracted from plants and insects used as ingredients of hybrid pigments. The preparation of these pigments, composed of organic dyes supported on inorganic substrates, required specialist knowledge unique to pre-Hispanic Mesoamericans. Early colonial codices, on the other hand, reveal that technological changes caused an increase in the use of mineral pigments, both of local and of European origin. The palette of blue colours has the highest variability, both in terms of tonality and composition, and can be used to illustrate the complexity of Mesoamerican technological knowledge. Our paper, describing the different blue colours detected on Nahua, Mixtec, and Maya codices intends to provide an overview of the blue painting materials in ancient Mesoamerica and at the same time propose new documentation approaches and visualisation solutions towards the interpretation and dissemination of the scientific results.



Different types of blue paints (Codex Tonindeye, left; Codex Selden, centre); digital twin of Codex Cospi (right).

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Resolving chronological challenges of the Andean central coast formative period: a Bayesian reanalysis

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Abstract: This study applies Bayesian computational modeling (OxCal) to refine radiocarbon chronologies from 14 Formative-period sites (190 dates) on Peru's Central Coast and Chavín de Huántar. By constructing four alternative models with varying chronological hygiene standards, we challenge conventional timelines, demonstrating that Formative ceramic societies (1500–500 cal BC) coexisted with Late Archaic monumental centers such as El Paraíso and Buenavista. Our results indicate that U-shaped architectural traditions peaked between 1500–1000 cal BC, overlapping with Chavín's highland influence (1100–550 cal BC). This study underscores the power of computational tools in refining archaeological chronologies, enhancing temporal precision, and enabling cross-regional comparisons. It also establishes a scalable digital workflow for synthesizing fragmented datasets and resolving cultural synchronicities. The findings provide a foundation for future research, contingent on further radiocarbon dating.