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IPERION HS – integrating platforms for the European Research infrastructure on heritage science

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The European Horizon 2020 project IPERION HS (G.A. 871034) brought together 67 institutions from 23 countries. The project enabled joint research and transnational access to research resources for over 1000 users, resulting in hundreds of research outputs to date. This article collection is a small assortment of such outputs and provides a window into the possibilities offered by transnational collaborations in heritage science. Building and growing since 1999 through a succession of pioneering EU funded projects (LabS TECH, Eu ARTECH, CHARISMA, IPERION CH, E-RIHS PP and ARIADNE), the project IPERION HS has left a clear legacy: validated methods, interlaboratory comparisons, advanced instrumentation, mobile services and training programmes and modules¹. This legacy will continue within the heritage science community, also through the recently inaugurated European Research Infrastructure for Heritage Science, E-RIHS ERIC².

IPERION HS worked proactively to strengthen analytical reliability across Europe, comparing protocols, establishing best practices, and ensuring safe application of advanced methods on heritage objects, buildings and sites. Two articles in this collection reflect these efforts. Díaz et al. organised a review and interlaboratory comparison of the Oddy test methodology. This critical multi-institution comparison confirmed the robustness of the Oddy test, although variations in test protocols affected corrosion outcomes and could guide future optimisation efforts to harmonise testing standards³. Csepregi et al. evaluated how ion beam analytical techniques may alter parchment. Their insights are crucial for safe ion beam usage and help the infrastructure refine protocols for sensitive organic materials⁴.

Several articles we present here concern preventive conservation and collection care, focusing on risk assessment, environmental impacts, and decision-making for long-term preservation. Elnaggar et al. showcase a comprehensive risk-assessment framework applied to the Museum of Fine Arts in Alexandria, providing an example of

how context-specific environmental, structural, and operational risks can be quantified in resource-constrained museum settings⁵. Álvarez-Martín et al. used targeted mass-spectrometry screening to evaluate emissions from construction and display materials. This approach may help museums make evidence-based choices that reduce chemical risk to collections⁶. Duijvenvoorden et al. demonstrated how non-invasive, mobile-lab techniques such as X-radiography, optical coherence tomography and micro-profilometry coupled to visible - near infrared spectroscopy can support systematic monitoring of deterioration in paintings over time⁷.

Another theme explored in this collection deals with chronology, provenance and historical contextualisation. The following three articles highlight how analytical methods help reconstruct material histories and timelines, which is a central contribution of heritage science to archaeological and art-historical questions. Medialdea, Damiani and Zeman applied optically stimulated luminescence dating to building materials to refine the construction chronology of Dubrovnik Cathedral⁸. Palladino et al. carried out an analytical survey of zinc white, building a large comparative dataset that provides insights into historical production variability, artists' choices and degradation compounds⁹. Jacquemain et al. contributed an investigation of decorative laminates from the latter half of the twentieth century, using Raman and infra-red spectroscopy to reveal the composition, manufacturing, and conservation concerns related to decorative laminates¹⁰.

Multiple articles relate to materials characterisation and degradation pathways, shedding light on how materials were made, how they age, and how new knowledge about their structure and chemistry supports conservation strategies. Winther et al. used non-invasive analyses of pigments in ten Swedish medieval manuscript fragments to investigate regional colourant choices, manuscript production practices, and North European material exchange¹¹. Verheyen et al. combined imaging, spectroscopy, and historical scholarship in an analysis of the Portrait of Philip the Good in Dijon, addressing technique,

state of preservation, and authorship issues surrounding this important Burgundian painting¹². Machado et al. used on-site diagnostics to demonstrate how laser-based spectroscopy can safely characterise the delicate grisaille layers on stained glass¹³. Another non-invasive study on glass, by Palomar et al., shows how optical coherence tomography can reveal layers and deterioration through imaging¹⁴. Lastly, the study by Knaflič et al. informs archaeological interpretation of bones by relating electron paramagnetic resonance data to bone heating temperatures¹⁵.

We trust the articles presented in this collection demonstrate that the international dimension of heritage science is not an added feature but its foundation: experts, samples, objects and mobile laboratories travelling across countries; researchers accessing advanced fixed laboratories, collaborations spanning heritage institutions, universities and research centres; and comparative datasets that transcend national boundaries. This collection, therefore, is more than a set of individual studies. It is a portrait of a research community working collectively, across borders and disciplines, to create an accessible, reliable and scientifically rigorous foundation for heritage science in Europe and beyond.

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Competing interests

The authors declare no competing interests.

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