ADVANCEMENTS OF THE H2IOSC PROJECT: ENHANCEMENT OF DIGITAL RESOURCES IN THE CULTURAL HERITAGE FIELD TARGETING ARCHAEOLOGY AND EPIGRAPHY. INTRODUCTION TO THE SPECIAL SECTION

1. Introduction

The overview of the results from the ongoing work within the H2IOSC Project ('Humanities and Cultural Heritage Italian Open Science Cloud') continues in this second special section, following the first edition published in «Archeologia e Calcolatori» (A&C), issue 35.1 (Caravale, Moscati, Rossi 2024). The Project is funded by the European Union NextGenerationEU and the Italian Ministry of University and Research as part of the National Recovery and Resilience Plan (NRRP) and started in November 2022 with the aim to establish a federated cluster of the Italian nodes of the CLARIN, DARIAH, E-RIHS and OPERAS research infrastructures in the ESFRI (European Strategy Forum on Research Infrastructures) domain focusing on Social and Cultural Innovation. This second section is focused on showing the progress made by the CNR-ISPC Open Data, Open Knowledge, Open Science research group within the Project, with special emphasis on developments related to the implementation of some of the products planned in Work Package 7 (Community pilots: innovative cross-domain services and environments), which could benefit from a fruitful collaboration with the activities of another NRRP project involving the ISPC, namely the Cultural Heritage Active Innovation for Sustainable Society (CHANGES) Project.

The focus is still centered on enhancing the visibility, integration and valorization of digital resources in the field of Cultural Heritage. This special section illustrates recent activities aimed at improving the consultation, searchability and reuse of key resources and services in the domain of digital archaeology and digital epigraphy, including the diamond open access journal «Archeologia e Calcolatori», its archive of figurative documents, and an open online catalogue of digital epigraphic resources.

A.C., P.M., I.R.

2. A&C website as a gateway to Digital Archaeology resources

The history of the journal «Archeologia e Calcolatori» (A&C) is closely tied to a series of milestones that underscore its pivotal role in advancing computational approaches to archaeology. Among these milestones, the international Symposium on Computing and Archaeology, held in 1995 at

the National Research Council (CNR) in Rome, played a significant role in bringing together an interdisciplinary community of scholars, researchers, and experts from across Europe and beyond to connect, share their knowledge, and engage in critical debates (MOSCATI 1996).

This meeting underscored the journal's commitment to fostering dialogue around digital innovation and highlighted the need for a dedicated platform that could disseminate cutting-edge research in this emergent area and provide broader access to its scholarly content. The advent of the Internet in the mid-1990s made it possible to launch the first version of the journal's website, which was implemented through the collaboration between the CNR Istituto per l'Archeologia Etrusco-Italica (IAEI), directed by Mauro Cristofani, and the Centro Interdipartimentale di Servizi per l'Automazione nelle Discipline Umanistiche (CISADU) at the Sapienza University of Rome, the point of reference of the interdisciplinary research group coordinated by Tito Orlandi.

The website – one of the earliest online initiatives in academic archaeological publishing – marked a significant advancement in the journal's transition to digital dissemination to address the demands of a growing international readership. Initially, it provided basic features such as publication indexes, editorial information, and submission guidelines. However, its very existence reflected a forward-thinking approach that recognised the potential of the web as a medium for scholarly communication. Indeed, within this virtual space, the 'Bibliography of archaeological computing' was first disseminated and the dual thematic and technological scholarly classification of computational archaeology was conceived.

Following its initial online publication, the website underwent several upgrades and grew in scope and complexity, reflecting both the evolving requirements of technological progress and broader shifts in digital scholarship. By making its content accessible online in 2005, formally adhering to the Open Archives Initiative movement, A&C expanded its reach beyond traditional print circulation. The pioneering decision to implement the Dublin Core Metadata Element Set for resource description and the OAI-PMH protocol for harvesting metadata exemplified the journal's commitment to open access, ensuring that research results were freely available to academics, students, and the wider public (BARCHESI 2019). This major overhaul transformed the website into a more dynamic and interactive platform, allowing it to play a new key role. It became much more than a digital repository: it turned into a hub for community engagement, promoting transparency, collaboration, and cross-disciplinary discourse within the field.

The decision to adopt open access for publishing the texts in electronic format also coincided with another milestone in the journal's editorial policy. Beginning with issue 61 (2004), the «Archaeological Computing Newsletter» (ACN) – established in 1985 and published by the Institute of Archaeology

at Oxford University – was published bi-annually as a Supplement to A&C (https://www.archcalc.cnr.it/pages/newsletter.php). Considering the Newsletter's success over its first twenty years, the editorial format was preserved, promoting the online dissemination of short articles, conference reviews, and event notices, essentially anything relevant to computer-using archaeologists. In 2007, the CNR Department of Social Sciences and Humanities, Cultural Heritage supported the launch of a new series of A&C Supplements (https://www.archcalc.cnr.it/pages/supplements.php) and ACN's publication was suspended. Nonetheless, the concept of fulfilling a news function persisted, with the activation on the website of specific links to social media platforms.

In recent years, the website has continued to evolve in response to shifts in digital communication and emerging research priorities, with the introduction of new features such as full-text search capabilities and multimedia content integration, advanced data visualisation tools, open data repositories, and collaborative digital projects. By showcasing the complexity and variety of the journal's content, these advancements encouraged deeper engagement with the analysis of the research data published on its pages (Moscati 2019).

For instance, the use of AI tools for the classification of articles has recently provided transformative potential, categorising articles based on their thematic focus, such as archaeological methods, computational tools, or case studies. This automated classification has facilitated the indexing process and provided more nuanced metadata, helping to identify emerging trends. Furthermore, AI-based tools facilitated semantic analysis, revealing hidden connections between articles and fostering a deeper understanding of the evolution of digital approaches in archaeology.

Today, the new technical conceptualisation, design, and evolution of the website, along with its expanded functionalities, offer a reflective overview of the journal's digital transformation over time (see Paraciani in this special section). At the core of the new design are the data exchange mechanisms enabled by the journal's REST API with the Open Digital Archaeology Hub (ArchaeoHub), which is currently under development as part of the H2IOSC project (WP 7: Community pilots: innovative cross-domain services and environments).

As thoroughly described in the journal's pages at each new technological step, the continuity of purpose of this more than 30-year-old publication, which has embraced the virtual environment as the most suitable platform for its modus operandi, positions the A&C website at the centre of a digital renewal. It now regulates and connects information flows and feeds external repositories and European e-infrastructures, linking scholarly texts and iconographic data, geographic locations and cultural contexts, subject classifications and bibliographic data.

P.M.

3. Enrichment and reuse of visual resources in a specialized journal

The work regarding the analysis and metadata of figurative documents, particularly the A&C visual repository presented in this special section (see Buscemi, Fazio), along with reflections on the methodologies and reference models employed, offers the opportunity to briefly review the history of the journal's visual archive. For over thirty years, A&C has been a unique testament to the evolution of information technology applied to archaeology. A development that has radically transformed the way archaeological data are researched, analyzed, and disseminated, contributing decisively to the evolution of this disciplinary field.

Over the years, the journal has collected and published a wide repertoire of images to complete the texts, which not only document the development of technologies but also offer a comprehensive overview of the innovative methodologies and tools adopted for the study of antiquities: from the first digital graphic representations, mostly two-dimensional and static, to today's sophisticated, dynamic, and highly detailed 3D models. To further enhance this important iconographic collection – a historical visual archive of technological evolution in archaeology – and to provide broader access to the data for both the scientific community and the public, the journal has promoted several initiatives over the years.

The first one dates back to 2005, when, alongside the introduction of online access to the journal, a dedicated section for the color image gallery was created on the same website. This allowed readers to view the plates published in each print issue, enhancing their visibility. However, the gallery was not updated beyond 2009, when color images were integrated into the individual PDFs of the articles. Despite this, the gallery remained accessible and searchable on the website, alongside other digital resources. Since 2019, thanks to a substantial institutional support and the technical collaboration of Edizioni All'Insegna del Giglio, the A&C Interactive Atlas of Digital Images (IADI) project (https://iadi.archcalc.cnr.it/) has been collecting and making accessible online all images published between 1990 and 2020 (Paraciani, Rossi 2023, 138-143). The Editor provided lists of these images along with their associated files and metadata in CSV format, automatically extracted from the PDFs, facilitating the import into IADI's database. This digital archive, consisting of approximately 5000 images, now offers structured access to the resources, allowing users to consult them through keywords and specific metadata, such as year of publication, title, and authors. Each image is linked to the original article in which it appeared, creating a bridge between the journal's visual repertoire and its textual content.

Other archaeological digital journals demonstrate how, especially in recent years, images are no longer merely complementary to text, but have

acquired an independent and often fundamental role in the communication process. A significant example is «Internet Archaeology» (https://intarch.ac.uk/), a journal that, since its debut, has innovatively exploited the multimedia possibilities offered by the web. The articles present a heterogeneous visual apparatus, also accessible independently from the text and enriched by interactive links, which allow a dynamic and active fruition of the contents. Another example is the more recent «Journal of Computer Applications in Archaeology» (https://journal.caa-international.org/), which enhances the visual support accompanying the texts with large, high-quality graphics, making the image a valuable tool for in-depth study and interpretation.

Starting with issue 31 of 2020, A&C also further enhanced the relationship between written text and images by making available, on the web page dedicated to each article, the entire visual apparatus published therein. Additionally, as an innovative element, navigable 3D models were included when present to accompany the written part. For the latter, in particular, the ATON 3.0 framework, developed in ISPC by Bruno Fanini (Rossi, Paraciani 2021), was used.

As part of a broader initiative aimed at enhancing the sharing and interoperability of resources, a new work is also underway, concurrently with the metadata project presented here, on the Open Digital Archaeology Hub (ArchaeoHub). This will be discussed in detail in the subsequent special section devoted to the results of the H2IOSC project (A&C, 36, 2025). In this new virtual platform, which mirrors the layout and design of the Open Digital Epigraphy Hub (see Rossi, Salvador in this special section) as a product of H2IOSC WP7, the journal's visual resources will be integrated with textual, bibliographic, and data mapped within the DHeLO database (Mancuso, D'Eredità 2024), which is dedicated to landscaping resources in the Cultural Heritage/Heritage Science sector. Thus, this rich and multifaceted new digital ecosystem represents the natural evolution of the long process of dissemination and valorization that began over thirty years ago.

A.C.

4. A reasoned catalogue of digital epigraphy resources

As mentioned, within the H2IOSC project, Activity 7.4 has been dedicated to the design and implementation of two platforms. Each platform focuses on aggregating, discovering, and sharing data, tools, and methods in the fields of digital archaeology and digital epigraphy, respectively, as part of the broader scope of Digital Heritage covered by the E-RIHS infrastructure: the Open Digital Archaeology Hub and the Open Digital Epigraphy Hub. In this special section, we present the Open Digital Epigraphy Hub (see Rossi, Salvador).

Epigraphy is situated at the intersection of different, major disciplines (e.g., textual studies, linguistics, archaeology, history, art history) and has thus emerged as an exemplary research topic within the H2IOSC project, in that it represents one of the 'inscribed objects' case studies selected to test the convergence of methodological and technological solutions developed by the four participating Research Infrastructures covering digital humanities, computational linguistics, heritage science, and open access editions. A review of literature and webliography has highlighted a significant challenge within the digital epigraphy disciplinary community: online resources remain highly dispersed, despite the fact that the past decade has seen a growing body of proceedings and monographs addressing digital epigraphy, complementing journal articles focused on computational applications in the humanities and archaeology.

A&C was a pioneer in addressing the emerging field of digital epigraphy. A search using the 'Epigraphy and Numismatics' subject filter on the journal website lists 43 articles published between 1990 – the journal's inaugural issue – and 2023. The 1990s alone counts 13 articles, with many concentrated in the 1996 volume that published the proceedings of the *III International Symposium on Computing and Archaeology* held in Rome in November 1995 (MOSCATI 1996). The contraction in contributions during the 2000s (only four articles) likely reflected a focus on developing and populating the first online inscription databases rather than on dissemination. It was rapidly followed by a new upturn in the 2010s (22 articles), witnessed by initiatives like the *Italic Inscriptions and Databases* workshop held in Rome in September 2014, whose proceedings (RAJALA 2015) show a new emphasis on textual annotation and spatial analysis of inscriptions. Many digital epigraphy projects were funded during this period to expand technical solutions, develop resource aggregators, and release open and linked data. At the Italian national level, initiatives like EAGLE (https://www.eagle-network.eu/) and DASI (https://dasi.cnr.it/) exemplify these advancements. These efforts yielded significant outcomes in data production, dissemination, and technological innovation, while also fostering theoretical and methodological discussions in traditional publications. Since 2020, the four articles on digital epigraphy that have appeared in A&C attest to a focus on virtual applications for documenting inscriptions. It is tempting to interpret such scarcity of contributions as a symptom of insufficient follow-up investments aimed at the implementation of large-scale initiatives targeted to technological advancements in digital epigraphy in recent years. The pattern detected in the survey of A&C epigraphic articles aligns with broader bibliographic trends over the last three decades, as shown in ROSSI, SALVADOR, §2.

Moving away from traditional literature (journals and books), a constellation of digital resources and tools – specifically epigraphic but also

epigraphy-related, such as those concerning historical linguistics, philology, palaeography, archaeology, etc. – is by now available on the web and continues to expand. Research literature only partially captures them, due to their varied and dispersed nature, and to the frequent absence of structured documentation or research dissemination. Epigraphists seeking to inform and orient their research thus struggle to keep pace with this rapidly evolving landscape. This challenge inspired the creation of a curated catalogue hosted on the H2IOSC cloud, conceived as an observatory for online digital epigraphy resources, the Open Digital Epigraphy Hub. This catalogue does not aim to be an aggregator – interoperability issues across platforms specialized in different epigraphic domains currently make this unfeasible. Instead, it offers an open, searchable list of online resources such as corpora, archives, tools and standards, richly described at both content and technology levels. It provides insights into their accessibility and interoperability aligning with H2IOSC's commitment to fostering Open Science in the Humanities and Cultural Heritage domains. The aim of the Hub is precisely to support current epigraphic research by addressing the needs of the scholarly community, pushing for collaboration and networking, with a view to facilitating future efforts toward automated information linking, exchange, and reuse in the field of digital epigraphy.

The Open Digital Epigraphy Hub itself emphasises the standardization of its descriptive metadata and the establishment of semantic relationships among internal and external online resources, including archives developed within the H2IOSC project, such as H-SeTIS and DHeLO (Scarpa, Valente 2024; Mancuso, D'Eredità 2024), within a Linked Open Data framework. The concern for the history of disciplinary research which distinguishes the Open Data, Open Knowledge, Open Science group of the CNR-ISPC leading this pilot project, also informs the content of the Hub, which integrates an open Zotero Group library launched to keep track of scientific literature on digital epigraphy.

I.R.

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