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Classical Archaeology in the Digital Age – The AIAC Presidential Panel

Panel 12.1

Kristian Göransson (Ed.)

Propylaeum
SPECIALIZED INFORMATION SERVICE CLASSICS

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The AIAC Presidential Panel

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PREFACE

On behalf of the 'Associazione Internazionale di Archeologia Classica (AIAC)' the 19th International Congress for Classical Archaeology took place in Cologne and Bonn from 22 to 26 May 2018. It was jointly organized by the two Archaeological Institutes of the Universities of Cologne and Bonn, and the primary theme of the congress was 'Archaeology and Economy in the Ancient World'. In fact, economic aspects permeate all areas of public and private life in ancient societies, whether in urban development, religion, art, housing, or in death.

Research on ancient economies has long played a significant role in ancient history. Increasingly in the last decades, awareness has grown in archaeology that the material culture of ancient societies offers excellent opportunities for studying the structure, performance, and dynamics of ancient economic systems and economic processes. Therefore, the main objective of this congress was to understand economy as a central element of classical societies and to analyze its interaction with ecological, political, social, religious, and cultural factors. The theme of the congress was addressed to all disciplines that deal with the Greco-Roman civilization and their neighbouring cultures from the Aegean Bronze Age to the end of Late Antiquity.

The participation of more than 1.200 scholars from more than 40 countries demonstrates the great response to the topic of the congress. Altogether, more than 900 papers in 128 panels were presented, as were more than 110 posters. The publication of the congress is in two stages: larger panels are initially presented as independent volumes, such as this publication. Finally, at the end of the editing process, all contributions will be published in a joint conference volume.

We would like to take this opportunity to thank all participants and helpers of the congress who made it such a great success. Its realization would not have been possible without the generous support of many institutions, whom we would like to thank once again: the Universities of Bonn and Cologne, the Archaeological Society of Cologne, the Archaeology Foundation of Cologne, the Gerda Henkel Foundation, the Fritz Thyssen Foundation, the Sal. Oppenheim Foundation, the German Research Foundation (DFG), the German Academic Exchange Service (DAAD), the Romano-Germanic Museum Cologne and the LVR-LandesMuseum Bonn. Finally, our thanks go to all colleagues and panel organizers who were involved in the editing and printing process.

Bonn/Cologne, in August 2019

Martin Bentz & Michael Heinzelmann

Classical Archaeology in the Digital Age. The AIAC Presidential Panel

Ortwin Dally*

Fields of Research and Forms of Knowledge Processing

During the 19th century, especially in the 2nd half, we see the emergence of complex fields of work, which in turn were anchored as disciplines at the universities, museums and other institutions:[1] Classical archaeology, „Bauforschung" etc. The emergence of these disciplines is related to the emergence of new large-scale excavations such as those at Olympia, Pergamon etc. The knowledge of these excavations had been stored with specific forms of knowledge processing: Libraries, archives (scholars' discounts, excavation documents etc.), corpora, photo archives, analogous publications, museums and collections of plaster casts. Until today, archaeological fields of activity have become more and more complex, a result of the emerging importance of the natural sciences. There are excavations (documentation of architecture, stratigraphies, tombs etc.), prospections/surveys (inspections, test excavations, collections of pottery), analysis of finds/findings (e.g. pottery analysis), photogrammetry (e.g. buildings), chronology (different science and art based methods of dating objects), climate and landscape history (geology, geomorphology, hydrology) and anthropological investigations (skeletons; food pattern; diseases; genetics [living environment; affinities]).

The research projects generate a lot of different data: Primary data (photographs, aerial pictures, bitmaps, films/videos and metadata such as geo-referenced satellite photos, LiDAR scans, data bases, 3D-reconstructions and models, vector graphics, small and large format scans and drones.

The Problem of Long-Term Preservation

Archaeology is hugely dependent on a differentiated documentation of its research, because the research results are largely destroyed by an excavation, that means, once lost documentation steps cannot be repeated. This problem is posed in a completely new way in the digital age. Also a still increasing amount of data (dynamic data, static data, open data) gain a unique character with a high potential to preserve.

This results in the problem of long-term preservation of data. There are different levels: The first level can be described as a logical level that means questions related to the intellectual conception and purpose of a project: How do I create data, how do I document it, what data should be archived first?

The consequences have to be reflected: Transparency & documentation of data. Finally semantic interfaces have to be discussed (interfaces with a clearly defined structure defined by an international nomination body). A different level is the

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application level: What software do I use? What guarantee do I have that the software will continue to be developed in the future? What happens if the manufacturer goes bankrupt? Consequences are: if possible no proprietary software; instead open source-software with published program codes and data formats and the definition of technical interfaces.

A last level is the physical level, that means the question of a stable media transfer in a technical-mechanical sense and a business process that describes the way from the excavation site to a data centre, taking into account the availability of media such as external hard drives.

The consequences are the guarantee of media availability, usage and transfer that means creating infrastructures supported either by universities, large research centres or networked initiatives.[2] That is related to the definition of minimal standards:[3] the creation of a uniform, modular and comprehensive systems that can be used in various projects with different questions and the avoidance of individual systems that are reinvented, tested and financed by projects and that are unusable after the end of a project ("undocumented, archived on a CD-Rom"), the long-term development of software, hardware, personnel and financial structures, whereby the data of a project are also secured beyond its end and remain accessible/usable.

However, it would be wrong to conceive such systems solely as an archiving, visualisation and management tool of data. Rather, these systems express a general interest in research that does not exclude the study of individual groups of materials, but understand contexts as an overriding basis to scientific knowledge. The added value lies in the combination of sensible and logical units, which are extracted and linked together in automated processes.

Current Research Interests: What is Archaeology, and more Specifically Classical Archaeology today?

Classical archaeology has two origins: Art history and fieldwork.[4] The contemplation of contexts is sometimes e.g. in Germany integrated in larger research groups discussing such concepts as e.g. space, cultural contacts, migration, economy, oblivion and memory, landscape, power, innovations, religion, gender etc.[5] And there are anthropological questions about the history of humanity as a whole. Many research projects have a geographical or region-related research focus (e.g. the Mediterranean Sea; the Black Sea). This results in intersections with disciplines such as ethnology, anthropology, social sciences and historic sciences, but also natural sciences.

Consequence of the information technology: development of interdisciplinary systems that remove the dispersion of information according to analogous order criteria (library, photo gallery, archive, excavation files, publications of large excavations, etc.).

The topic space is one example: Geographical Information Systems[6] enable us to manage sites, to visualise and to publish them.[7] These computer systems for the processing of (geo) graphical information are also important for linking databases with mappings. Research questions that can be answered by using GIS-systems are e.g. the relationship of human – natural environments, territorial analysis, least-cost-path analysis or natural space studies (cultural landscape vs. "utility landscape") and predictive modelling for the evaluation of potentially rich (=worthy) regions. Another expression of space is 3D-models. They can help to reconstruct and understand the effects of physical environments.[8] On the one hand, the possibilities of information technology influence the development of archaeological questions, and on the other they contribute to the further development of complex database systems. From these questions of archaeological/antiquity scientific research, new research tasks and fields are emerging (archaeoinformatics).[9] The interface between archaeology and computer science finds a corresponding and emerging echo in publications.[10] In an increasing number of cases it becomes more difficult to put all information in one book. The databases themselves tend to become publications. Hybrid models have a greater significance;[11] research platforms are sometimes real-time platforms[12] and tend to be multilingual cultural archives.[13] They are more and more related to data-workflows in archaeology with high complex requirements (digital strategy; trained staff and specific archaeological software).[14] All these developments generate new requirements for data quality, e.g. in the form of ontologies or thesauri.[15]

Information technology's problem is: How can I include historical categories/concepts (e.g. time) in an analytic database based on a variety of different data? And are there so far unknown research questions that can be answered only by using databases?

These research questions raise the problem of interoperability, meaning linking different data, so that they are analysed together according to certain parameters and can be used. Again, there is considerable need for research.

Causes are a variety of data formats (primary and metadata), a variety of disciplines whose characteristics continue under the conditions of information technology with the consequence of heterogeneities (building research – Bauforschung, epigraphy, numismatics)[16] etc.

The information technology problem of linking objects and objects is the equivalence detection (record linkage, object identification, entity resolution, reference reconciliation etc.): An object of the so-called real world can be described so differently, that a computer-aided image or text analysis does not recognise that it is the same object. Visual model recognition and automatic recognition of unstructured objects had to be addressed e.g. in the frame of European projects like CLAROS[17] or CARARE,[18] a project for the interoperability of distributed data resources to Europe's archaeological monuments and historical sites with the Central European Digital Library Europaeana.

The information technology problem of linking texts and texts are multilingual texts, the use of the same terms, but still different meanings ("teapot") and automated word and text analysis tools (citations, arguments, etc.).

There is also an information technology problem of linking texts and objects. Object, image, geodata, etc. are relatively unique, that means, you do not have to cut or disassemble them and then rename those parts. Texts, on the other hand, have to be disassembled manually or automatically in order to access sections of texts that are specifically targeted to specific objects.

Linking a variety of analytical databases with corresponding primary, raw and metadata, consisting of texts and non-texts is another problem because of the great complexity of the data. One solution is the further development of internationally available metadata schemas like the DUBLIN CORE Metadata Initiative[19] or CIDOC-CRM, a metadata schema, for the controlled exchange of cultural heritage information used by archives, libraries and museums to improve the availability of knowledge. The author is the International Committee for Documentation of the International Council of Museums = CIDOC – Content Reference Mode.[20] Another standard of a high importance for integrating content, information applications and systems is the Semantic Web – World Wide Web Consortium (W3C).[21]

A different solution for addressing place names and sites can be a gazetteer.[22] A third solution can be subject indexing, content indexing, the use of vocabularies and thesauri. By capturing subject index data various specialist systems are networked together using thesauri and a simultaneous search for the same vocabulary about various specialised systems takes place, e.g. free search for keywords and topics.[23]

Conclusion

IT is one changing factor of our discipline. It opens up new methodological approaches. There are technical questions (standards; infrastructures; long term preservation, long-term interoperability etc.). In data modelling there is the chance to overcome the isolation of viewpoints between individual disciplines. There are new fields of research: e.g. archaeoinformatics. Increased visibility in the WWW in better formulated way: internationality and interdisciplinarity. By using and sharing data, new forms of publications, research platforms and teaching are being facilitated. New models of communication are created. Work groups and resources can organise exchange processes through exchange formats.

But archaeologists and classicists have historical questions. What exactly are the possibilities of such systems? Where are new research tools, questions and possibilities? And where are also the limitations in using codes and numbers? How can I manage the data? The debate about ways of viewing the past by using digital instruments might be an important topic for future AIAC conferences.

Notes

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[1] Marchand 1996; <https://digigeist.hypotheses.org/150> (13.12.2018).

[2] Cfr. e.g. <http://www.rfii.de/download/rfii-fachbericht-laenderanalysen-2017/> (22.03.2021). – Cfr. e.g. in Europe D-GRID (<http://www.d-grid.de>), TextGRID (<http://www.textgrid.de>), WissGRID (<http://www.wissgrid.de>), DARIAH (<http://www.dariah.eu>) or CLARIN (<http://www.clarin.eu>) and e.g. in Germany on a national level <https://www.nfdi.de> (22.03.2021). – Archaeological data centres: eDNA – e-Depot for Nederlandse Archaeology (<http://www.edna.nl>); Archaelogy Data Service (<http://archaeologydataservice.ac.uk>); IANUS (<https://www.ianus-fdz.de>).

[3] e.g. <http://guides.archaeologydataservice.ac.uk/g2gpwiki/> (13.12.2018);
<http://www.dcc.ac.uk/digital-curation/what-digital-curation> (13.12.2018);
<https://www.ianus-fdz.de/it-empfehlungen/> (13.12.2018);
<https://landesarchaeologen.de/kommissionen/archaeologie-undinformationssysteme/downloads> (22.03.2021).

[4] Alcock – Osborne 2007.

[5] <http://gepris.dfg.de/gepris/OCTOPUS?keywords_criterion=archaeology&findButton=Finden&task=doSearchSimple&context=projekt> (13.12.2018).

[6] <https://en.wikipedia.org/wiki/Geographic_information_system> (13.12.2018).

[7] <https://en.wikipedia.org/wiki/GIS_in_archaeology> (13.12.2018).

[8] e.g. http://www.digitales-forum-romanum.de (13.12.2018); <https://latinanostra.weebly.com/rome-3d----digital-maps.html> (13.12.2018); <http://colonia3d.de/colonia3d-home/> (13.12.2018).

[9] Important conferences: <https://caa-international.org> (13.12.2018).

[10] e.g. <https://www.journals.elsevier.com/digital-applications-in-archaeology-and-cultural-heritage/> (13.12.2018); <https://openarchaeologydata.metajnl.com> (13.12.2018); <https://idai.world/what/publications> (22.03.2021).

[11] e.g. <https://arachne.uni-koeln.de/drupal/?q=node/301> (13.12.2018).

[12] e.g. <http://www.agathe.gr> (13.12.2018).

[13] e.g. <http://www.fastionline.org/?lang=it> (13.12.2018); <https://idai.world/what/publications> (22.03.2021).

[14] <http://www.data-archive.ac.uk/create-manage/life-cycle> (13.12.2018);
<http://www.dcc.ac.uk/lifecycle-model/> (13.12.2018).

[15] (new footnote: <http://www.rfii.de/download/rfii-tagungsdokumentation-herausforderung-datenqualitaet-februar-2020-in-hannover/> (22.03.2021); <http://www.rfii.de/download/herausforderung-datenqualitaet-november-2019/> (22.03.2021).

[16] e.g. <http://laststatues.classics.ox.ac.uk> (13.12.2018);
<http://numismatics.org/ocre/> (13.12.2018); <http://www.edb.uniba.it> (13.12.2018).

[17] <www.clarosnet.org> (13.12.2018). The Claros Explorer displays digitized data from various object databases. The author is the Claros consortium. One particular example: <http://www.arachne.uni-koeln.de/drupal/> (13.12.2018) (Project Emagines [DFG]) together with data from the Beazley Archive, the

LIMC (Lexicon Iconographicum Mythologiae Classicae) and the Lexicon of Greek Personal Names in a tabular view, timeline and map).

[18] <http://www.carare.eu/eng> (13.12.2018).

[19] <http://dublincore.org> (13.12.2018).

[20] <https://en.wikipedia.org/wiki/CIDOC_Conceptual_Reference_Model> (13.12.2018); <http://cidoc.ics.forth.gr/> (13.12.2018).

[21] <https://en.wikipedia.org/wiki/Semantic_Web> (13.12.2018); <https://www.w3.org/standards/semanticweb/> (13.12.2018).

[22] <https://pleiades.stoa.org> (13.12.2018).

[23] e.g. <http://www.reteurbs.org> (13.12.2018); <https://www.propylaeum.de/home/> (13.12.2018); <https://zenon.dainst.org> (13.12.2018).

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Marchand 1996

S. L. Marchand, Down from Olympus: Archaeology and Philhellenism in Germany, 1750–1970 (Princeton University Press 1996).

3D Reconstructions: A Critical Reflection Starting from the Roman Forum

Paolo Liverani*

3D reconstructions of ancient buildings, and even of entire cities, is already familiar both to specialists and to the wider public.[1] There is also a substantial literature on the potential and the risks of this sort of approach, both for research and for divulgation. I want to present here some reflections on method, starting from the comparison of several existing reconstructions of the Roman Forum. This is an example that is particularly important, as much from the historical as from the methodological point of view. In fact, perhaps no other place in the ancient world is so rich in archaeological evidence, in text, and in iconography, not to mention the documentation both written and graphic, that has come down to us from the medieval period onwards.

I will look at some 3D images created in the last twenty years with different criteria, ends, and means. They do not represent the totality of the existing reconstructions but are the best examples for a comparative approach.

The first reconstruction (fig. 1), both for its chronology and its complexity, is the Rome Reborn project, launched by Bernard Frischer in the Cultural Virtual Reality Lab of the University of California at Los Angeles in the mid 1990's. The project is certainly the most ambitions of those examined here and has managed to reconstruct in 3D the whole of the city of Rome. Its final aim is to reconstruct Rome in various periods, but for the moment the model we see is based on the Rome of AD 320. This choice is the most logical, following the example of Italo Gismondi's great model of the city of Rome in the Museo della Civiltà Romana. It is the moment for we have the greatest amount of data and minimizes the need for reconstructive hypotheses devoid of evidence.

Obviously that minimum is still hardly negligible, and, correctly, the project divides buildings into two classes. The first is constituted by those sites for which there is sufficiently detailed evidence, the second by the around 6,750 buildings and monuments – such as single-family houses, apartment buildings, and warehouses – about which we lack precise information, but which are a fundamental part of the urban fabric. For the latter, Gismondi's model was digitized, corrected and brought up to date. Then, in 2008, it was entirely replaced by a corresponding 'procedural' model, which added far more architectural detail. The Rome Reborn project has migrated with its inventor, first, between 2008 and 2013, to the Virtual World Heritage Laboratory of the University of Virginia, and then to the School of Informatics and Computing of the University of Indiana. I will not get involved in technical details: the model was entirely redone twice in order to overcome the limits of previous platforms, bringing it up to date and incorporating colours and sculptures. We are thus using the third generation of the model. This is certainly the project that has confronted most seriously the problem of the general diffusion of the model, or at least some parts of it, working on the possibilities

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Fig. 1: Rome Reborn: the Roman Forum, west end.

of Virtual Reality in real time also for teaching purposes. Soon, it will be at disposal in a large number of different ways: VR headsets (Oculus, Vive, etc.), 360 video (GearVR, Daydreams, etc.) and Facebook Spaces.

Regarding the Roman Forum, the Rome Reborn project has made two versions. The first was created from 1997 to 2004 and is the subject of an article published in a JRA supplement in 2006[2] as well as a free-standing website, *The Digital Roman Forum*.[3] The latest version (fig. 2) was built from 2016 to 2018 and offers various improvements, including much more use of polychromy and taking into account the scientific literature that appeared after 2004.[4]

The second project, begun in 2011 and coordinated by Susanne Muth,[5] is the *Digital Forum Romanum* (fig. 3) of the Winckelmann Institute of the Humboldt-Universität of Berlin in cooperation with the Excellence Cluster TOPOI and the Architecture Unit of the German Archaeological Institute at Berlin. The project proposes to carry out reconstructions of the Forum in 18 different periods, as well as the actual state. So far seven of these have been created: two successive moments of the late Republican Forum and the situation in the Augustan, Flavian, Antonine, Severan and Tetrarchic periods, the latter around AD 310. On the website that presents the results is found, for each period, a view of the Forum, its plan, and a series of information sheets that explain the details of the various phases of the monuments with further images and reconstructions, both of details and of whole contexts (fig. 4), as well as a bibliography and links for navigating from one sheet to another. There is also a wiki,[6] still in its infancy (there are only three records) on which it is aimed to put all of the details of the proposed reconstruction. The authors have chosen to present the model only in black

Fig. 2: Rome Reborn: the Roman Forum, Rostra and the Arch of Septimius Severus.

and white, rather than adding colour. Their approach is solid, and relatively traditional. It is not possible to move around it in real time, except in the case of a few smaller models of single buildings.

The third project is an online course (MOOC Massive Open Online Courses) of the University of Reading carried out by Matthew Nicholls: *Rome, A Virtual Tour of the Ancient City*.[7] On-line only since 2017, it is the result of over a decade of work that has reconstructed the whole of the city of Rome in AD 315. Using fairly simple technology, based on Sketchup, the result is notable, if we consider that it is the project of a single scholar (fig. 5). The weight of the model does not permit its presentation online: here we find only pre-registered videos or stills. Laudable though it is, it does have serious limits in its completeness and in the possibility of bringing the reconstructions up to date. Roman topography is by now such a vast field that it cannot be fully grasped by a single scholar. Not by chance, the manual of the Topography of Ancient Rome is still that of Hülsen,[8] of the beginning of the twentieth century, and no single scholar has had the courage to rewrite it.

The fourth project is *Visualizing statues in Late Antique Roman Forum*, (fig. 6) directed by Diane Favro with the collaboration of Gregor Kalas and Chris Johanson at the

Fig. 3: Digital Forum Romanum: the Roman Forum from east in the Tetrarchic period.

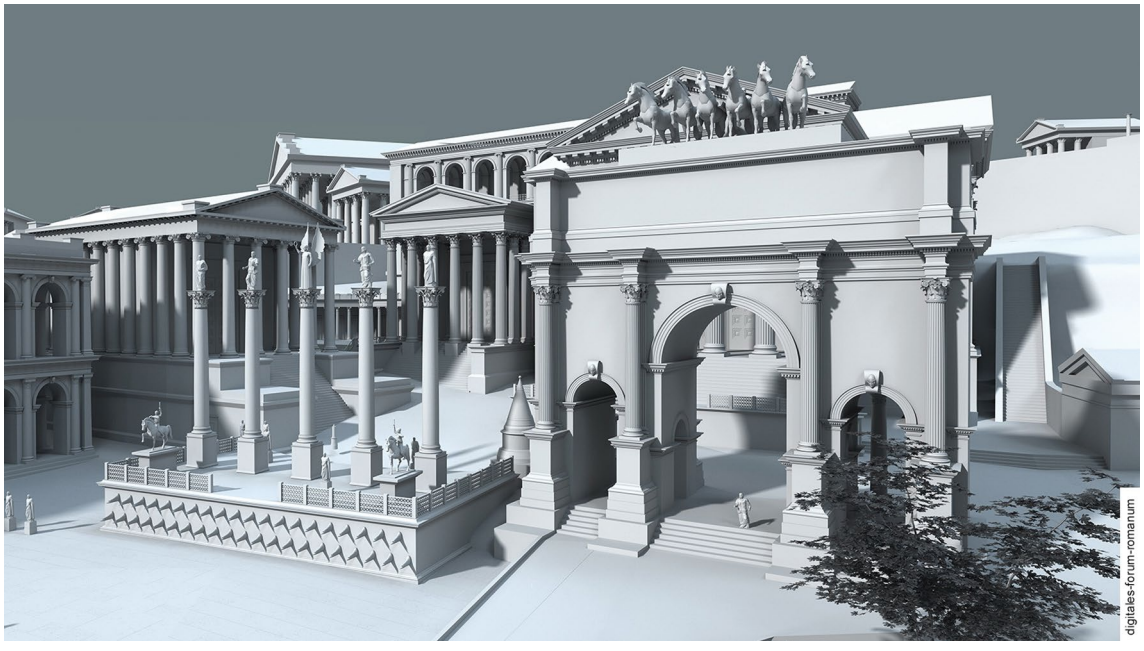

Fig. 4: Digital Forum Romanum: Rostra and the Arch of Septimius Severus.

University of California at Los Angeles. The focus of this project is concentrated on the decorative apparatus of the Forum and its meaning: thus the architectural context remains in the background, using the first model of *Rome Reborn* without the later

Fig. 5: Rome, A Virtual Tour: the Roman Forum from east.

updates. The results of the research are published on its website,[9] and, more in detail, in Kalas's volume: *The Restoration of the Roman Forum in Late Antiquity: Transforming Public Space*. To be honest, this is the weakest of those considered here: the reconstructions are sometimes approximate or barely justified at all: I am thinking of the reconstruction of an inexistent arch of Honorius in the middle of the square, of the position of the late antique *Atrium Libertatis* near the Curia of the Senate, and finally of the Grove of Marsyas – which we know instead to have been a tribunal.[10]

The last two projects should perhaps not be considered together with the previous ones because they aren't based on a virtual model. However, to give a complete panorama of this type of approach, it seems useful to consider them briefly. The first is a book, *The Roman Forum: A Reconstruction and Architectural Guide*, a fairly classical production along the same line as the great envoys of the French architects of the Prix de Rome. The volume presents the Roman Forum in the second half of the fourth century AD, through the illustrations of Gilbert J. Gorski and a text by James E. Packer.[11]

Fig. 6: Visualizing statues: the Roman Forum, Equestrian statue of Constantine in front of the Rostra.

The second descends from the models, in cork of the end of the eighteenth century, or in plaster in the last century, created by Paul Bigot and Italo Gismondi. The project was carried out under the direction of Martin Boss[12] at the Institute of Classical Archaeology at the University of Erlangen between 2003 and 2007. The models are now displayed at the Hirsvogelsaal of Nuremberg (fig. 7). Executed at 1 : 200, the wooden models represent the Forum respectively in the time of Caesar and in that of Augustus. As is obvious, their function is essentially didactic, and they cannot be used outside the exhibition space. However, the communicative capacities of this traditional technique should be noted. It is possible to discuss the issues in front of these models in a way that is simply impossible with a virtual model. The strength of the old technology is that it is 'transparent' in a semiotic sense, that is, that it does not remove our attention from the object represented. Virtual reality, instead, is still 'opaque' from this standpoint, leaving the user to be fascinated far more by the technique than by the subject it represents. In other words, the danger of the videogame in virtual reality is ever present. It is possible that, in the future, boredom with the technique will set in, and this risk will diminish.

Fig. 7: Hirsvogelsaal of Nuremberg: the Erlangen wooden model of the Roman Forum in the Augustan period.

On this basis we can attempt to outline a conclusion. In twenty years, virtual 3D reconstructions, initially viewed by archaeologists with a mixture of admiration and suspicious, have boomed. Further, studies of Roman topography, previously the hunting ground of a small number of Italian specialists, have become fashionable. Finally, archaeology itself has been transformed: on the one hand integrating with an ever-larger number of technologies and research methods from the hard sciences, on the other becoming ever less involved with historical culture and classical literature. This process has both positive and negative sides, as always. A larger international community permits a more interesting and vivacious discussion, but there is the risk that many of the international scholars do not have a deep knowledge of the places and the monuments. The problem here is the transformation of very concrete problems into abstract debates, with ideological readings outweighing merely structural considerations. Further, it is difficult to find scholars who unite technical competence with a classical preparation: it follows that the dialogue between 3D modellers and archaeologists could be insufficient to fill the gaps, or even that the archaeologist herself or himself lacks the necessary experience of direct documentation of monuments, the only school that

properly prepares one for a real understanding of the ancient city. In other words the risk is that experimentation and the desire for the new become more important than correct archaeological methodology.

A second level of the problem is that of documentation, both sources for a reconstruction and for the reconstructive process, or, in other words, the problem of *metadata* and *paradata*. The point is clearly expressed in the fourth principle of the London Charter: «Sufficient information should be documented and disseminated to allow computer-based visualization methods and outcomes to be understood and evaluated in relation to the contexts and purposes for which they are deployed».[13]

The difficulty of presenting a detailed accounting of the sources and interpretative criteria, and of distinguishing between certain elements and those that are uncertain or hypothetical, is even stronger when the target is the general public. Attention to *metadata* was already evident in the first generation of the Rome Reborn project. The above-mentioned website *The Digital Roman Forum* included a temporal map of the Forum and citation of the relevant ancient texts in both the original language as well as English translations. In the last model of Rome Reborn the choice has been made to insert this sort of information in a pdf file dedicated to the various monuments on the website of the project. *Metadata* and *paradata* are obviously clearly evident in the more traditional presentation of the Berlin project. They are altogether lacking in the Reading project, and unsatisfactory in *Visualizing statues*, although this is an interesting case because of its choice of a double channel of presentation, both a web site and a traditional volume. The problem is very different in the case of Gorski and Packer's book, or in the wooden models of Erlangen.

This seems to be the really crucial theme here: I am not aware of a completely satisfying solution for the accessibility of the *metadata* and the *paradata*, and feel strongly that this is the priority for the scientific community. I am not of course certain that I know of all the projects currently underway: several of them tried to tackle the issue but the proposals were focused on the specific model they deal with[14] and less concerned to formulate a more general proposal for standards of documentation. For this purpose, on the other hand, I would like to mention a couple of very promising attempts. The first is that of Emanuel Demetrescu,[15] at the Institute for Technologies Applied to Cultural Heritage of the Italian National Council for Research, who proposes an Extended Matrix, a formal language with which to keep track of the entire virtual reconstruction process. The second was elaborated by Mieke Pfarr-Harfst and Marc Grellert at the Digital Design Unit of the Technische Universität Darmstadt,[16] a proposal notable for its user-friendly approach already experimented in a good number of case studies.

A final observation regards the theme of colours: this field has been developing only over the last twenty years, particularly in the case of polychrome sculptures. In contrast, studies of polychromy in architecture have been few and far between. This is

what I have defined as the fourth dimension.[17] Currently colours are probably the most arbitrary element in all the reconstructions; not by chance, the project most concerned with a philological approach have side-stepped the problem – this is the case of the Berlin project. Those more oriented towards divulgation and cultural marketing, on the other hand, consider colour aesthetics essential. The motives of the last are entirely comprehensible but working with a method that is not yet rigorous enough could be risky.

If I could sum this up in a single phrase it would be that an archaeologist needs a lot of imagination and very little fantasy. I mean, that he or she should be able to consider an ample range of possibilities to avoid simplifications and mechanical solutions. However, his or her imagination must follow a rigorous method in order to avoid uncontrolled fantasies and gratuitous hypotheses.

Notes

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[1] I am indebted to Lisa Fentress for the English translation of my text and to Bernard Frischer for information about the Rome Reborn project.

[2] Frischer et al. 2006; Guidi et al. 2008; Wells et al. 2010; Dylla 2010.

[3] <http://wayback.archive-it.org/7877/20160919152126/http://dlib.etc.ucla.edu/projects/Forum/> (last visit: 10/10/2018).

[4] <https://www.romereborn.org/> (last visit: 10/10/2018).

[5] Muth 2014; <http://www.digitales-forum-romanum.de/?lang=en> (last visit: 10/10/2018).

[6] <https://wikis.hu-berlin.de/digiforo/Hauptseite> (last visit: 10/10/2018).

[7] <https://www.futurelearn.com/courses/rome> (last visit: 10/10/2018).

[8] Jordan – Hülsen 1907.

[9] <http://inscriptions.etc.ucla.edu/> (last visit June 2018). At the moment of closing the paper (10/10/2018) the site was not accessible anymore, but an earlier version can be visited at <https://web.archive.org/web/20180129214929/http://inscriptions.etc.ucla.edu:80/index.php/statues-and-memory/>.

[10] Giuliani – Verduchi 1987, 95–102 n. 13.

[11] Gorski – Packer 2015.

[12] It was completed by Robert Nawracala and Bernhard Steinmann: Steinmann et al. 2011; <http://www.klassischearchaeologie.phil.uni-erlangen.de/projekte/forum.html> (last visit 10/10/2018).

[13] <www.londoncharter.org>, cf. also the Seville principles <http://smartheritage.com/seville-principles/seville-principles>; Beacham et al. 2006; Denard 2012.

[14] An overview in Pfarr-Harfst – Grellert 2016, 43 f.

[15] Demetrescu 2015; Demetrescu – Fanini 2017; <http://osiris.itabc.cnr.it/extendedmatrix/> (last visit 10/10/2018).

[16] Pfarr-Harfst – Grellert 2016; <www.sciedoc.org> (last visit 10/10/2018).
[17] For the definition Liverani et al. 2016. An updated overview about the topic is in the Oxford Classical Dictionary (online ed. Feb. 2018) s.v. Polychromy, sculptural, Greek and Roman (J. S. Østergaard); Polychromy, sculptural, Greek and Roman (S. Zink).

Image Credits

Fig. 1–2: Courtesy of Bernard Frischer. – Fig. 3: http://www.digitales-forum-romanum.de/wp-content/uploads/2014/07/1-Phase-P_tetrarchisch_Blick-von-O.jpg – Fig. 4: http://www.digitales-forum-romanum.de/wp-content/uploads/2014/07/A-1-0603_O_Arcus-Severi_Kontext.jpg – Fig. 5: https://www.futurelearn.com/courses/rome – Fig. 6: http://inscriptions.etc.ucla.edu/ – Fig. 7: by the author.

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Digital Approaches to the Archaeology of the *Portus Romae*

Simon Keay – Graeme Earl*

The Portus Project (www.portusproject.org) is a collaborative research initiative involving the University of Southampton, the British School at Rome and the *Parco Archeologico di Ostia Antica*, with funding from the Arts and Humanities Research Council of the UK. Since 2007, it has been employing an integrated archaeological methodology to investigate the development of the *Portus Romae* and its relationship to Ostia, Rome and the broader Mediterranean.

The research built upon the results of the 1998–2005 magnetometry survey of the whole of the port and its immediate surroundings, and focused upon the central isthmus of the port between the Claudian and Trajanic basins and, in particular the Palazzo Imperiale, a building that has been identified as the Imperial navalia and the Grandi Magazzini di Settimio Severo. Both the large scale and richness of the archaeological site meant that a flexible digital strategy was needed for this research from the start. As such, the recording of the topographical and geophysical surveys, standing buildings, the excavations and the recording of the finds at the site can be said to have been born digital, but at the same time to have also incorporated more traditional approaches.

The paper explored some of the components of the strategy employed by the project. In the first instance, it stressed the importance of earlier cartographic work at Portus, not least by scholars such as Gismondi and Lugli, and to some extent Lanciani. As the site was arguably better preserved in their day, it was felt that these may have contained important topographic details that needed to be taken into account by our work. Particularly important was a cartographic survey of the Palazzo Imperiale undertaken by the *Soprintendenza per i Beni Archeologici di Ostia* in the 1980s, whose results were incorporated into our own plans of the building. All of this work was complemented by our own topographic survey, with particular emphasis upon producing a close-contour of the modern ground surface and standing structures. In order to further develop our understanding of the topography of the buildings prior to excavation, Ground Penetrating Radar and Electrical Resistance Tomography surveys were undertaken between 2007 and 2009, the results of which were combined with our own topographic survey to provide for us as clear an understanding of the sub-surface prior to excavation as possible. The work was further complemented by some limited aerial photography, which included infra-red coverage.

The development of this overall digital coverage for the central isthmus provided the framework for the excavations undertaken between 2007 and 2013. These were articulated by means of a computerised excavation database record, the Portus ARK, developed in conjunction with LP Archaeology, and which was stored on the Southampton University server. Although initial recording of individual contexts was undertaken

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manually on paper context sheets, the information was subsequently entered onto the database, together with sketch plans, photographs, preliminary matrices of structural relationships and details of finds. Individual contexts, walls, floors and other features encountered during excavation were planned both by use of a total station and, where possible, a Differential Global Positioning System (DGPS). This produced a huge amount of digital data which was subsequently re-constituted into computer-based digital plans of all three buildings for the seven periods of occupation back in the UK.

These data, together with the 2007 and 2009 geophysical data provided the basis for the creation of computer graphic models of all the buildings for each of the periods. The work for these began on site, with close two-way collaboration between the archaeologists and the computer-graphic modeller, and continued in the laboratory. The models underwent at least three different iterations, with valuable input being provided specialists in Roman architecture working with the project, who were able to add an extra interpretative dimension to the creation of the models. Creation of these models not only played an important role in the development of interpretations of buildings on the site, but has also greatly facilitated outreach, communicating the character of this key part of Portus to the general public and underwriting other forms of awareness-building and impact by means of Massive Open Online Courses (MOOCs). Parallel to all of this work was the digital recording of the finds, which included traditional photography, polynomial texture mapping of exceptional pieces, such as column capitals, inscriptions and fragments of sculpture and occasional brick stamps.

Data relating to all of this was stored on the project server and linked to the standard records of all classes of finds which were linked to the ARK-based context records.

The paper was at pains to point out that in order to reach this point, the project has had to process huge amounts of data, which made it absolutely vital for projects on this scale to have clear priorities for which data were to be stored. It then outlined a brief statement on the final destinations of the digital data produced by the project, which will be deposited at the *Parco Archeologico di Ostia Antica*, the Archaeology Data Service at York and the University of Southampton. It concluded with a brief statement on the ongoing publication process. This sees a traditional paper publication of the results of the excavations in two major volumes, underpinned by an online digital resource that will map on to the digital archives mentioned above.

Notes

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The Past on its Way to a Digital Future – Urban Archaeology in Cologne

Alfred Schäfer – Gregor Wagner*

Due to its rich history of more than 2000 years, the city of Cologne, once the capital of the Roman province *Germania inferior* and an important trading centre in the Middle Ages, has its own agency for archaeological monument conservation, which is located at the *Römisch-Germanisches Museum*. The urban area, which the agency is responsible for, has a size of approximately 400 km².

In the field of tension between the densely built-up inner city and the surrounding countryside with old village centres and remaining larger open spaces, mainly used for agriculture, Cologne's archaeological monument conservation is confronted with special requirements. A generally accelerated urbanisation process and the associated extensive construction activity pose special challenges. Due to the increasing settlement pressure, the existing settlement areas are becoming more and more densely built-up. In today's inner city, the need for efficient use of increasingly scarce and thus more expensive building plots leads to larger cubatures in new buildings, which includes the extension of the new buildings underground as well.

Therefore, in advance of construction projects it is important to forecast the expected archaeological monument substance for the affected areas as precisely as possible in order to be able to introduce a concrete action concept for the preservation of archaeological monuments into the planning process at an early stage. For this purpose, the archaeological potential of an area has to be determined by drawing on all available sources with archaeologically relevant content and, if necessary, the results of additional archaeological test excavations. Thus, it is possible to enforce the permanent preservation of archaeological monuments by designating appropriate, professionally substantiated protection zones. In areas where archaeological excavations are unavoidable, the prognosis result enables efficient planning and execution of rescue excavations and contributes to formulating scientific questions for these investigations.

The basis for a sustainable prognosis result is a detailed description of the already known underground monument stock. The most important source for the assessment of the archaeological potential of a planning area is the database of the local archive of the agency for archaeological monument conservation, in which all site-related information on archaeological sites in the urban area is archived by year and indexed by topographical sorting. The earliest written sources on archaeological sites recorded in the local archive date from the beginning of the 16th century, long before the establishment of a systematic urban archaeological monument conservation in 1923.[1] In addition to this data stock, all other available sources that provide information on the usage history of the affected areas are consulted within the scope of the evaluation of

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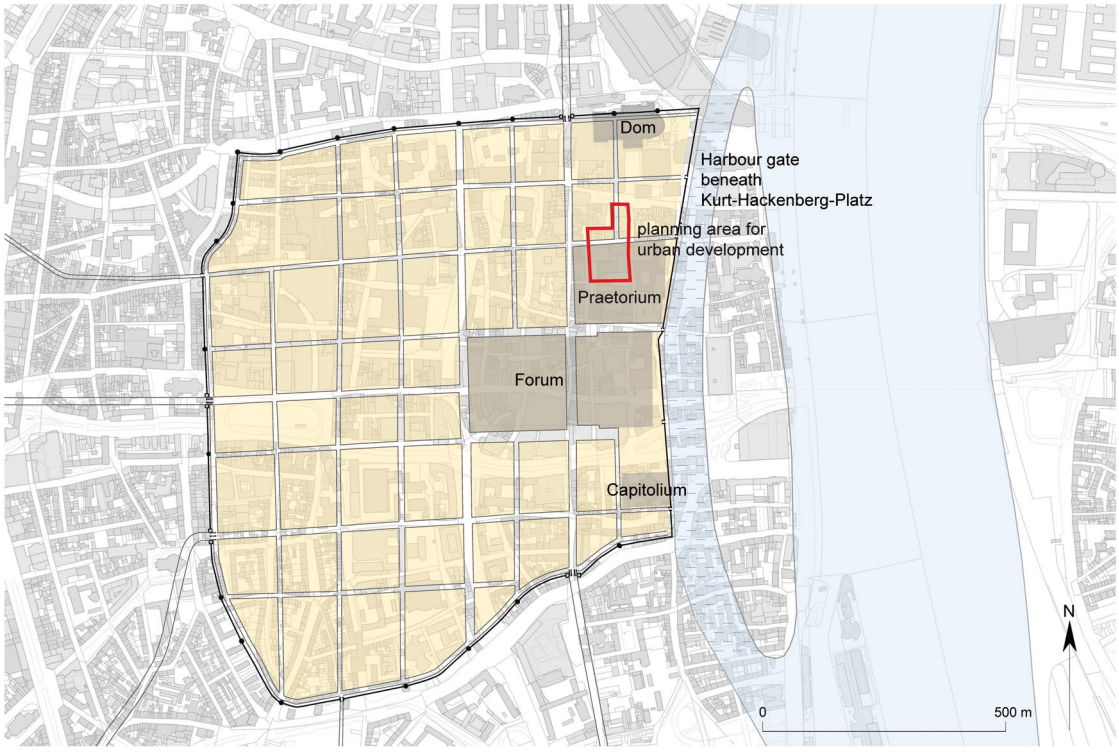

Fig. 1: Roman Cologne at the end of the first century with a current planning area for urban development (red line).

the archaeological potential. These are written records, old maps, cadastral maps as well as historical pictorial works and photographs.

For an efficient workflow, the existing archaeological data has to be available in a digital way, meaning that analogue data has to be made digitally accessible in a first step. The advantages of GIS-supported provision and processing of spatial archaeological data are used. Through the use of GIS technology, a comparative analysis and evaluation can be carried out, taking into account historical sources and maps as well as historical cadastral maps. In this way, layers with different thematic and chronological contents can be combined to overlay. It is possible to view and evaluate the available spatially related individual observations in their respective temporal and spatial context.

In the area of Cologne's historic city centre, the archaeological inventory to be expected on site is determined to a large extent by the spatial development of the city over time, which can be traced in its essential features with the help of the city fortifications. The Roman city wall essentially traces a natural flood-protected plateau on the edge of the lower terrace of the Rhine and encloses an area of 97 hectares (fig. 1). In the north, south and west, *suburbia* with residential and commercial use developed outside the city wall. After the fortified urban area had expanded to the east into the area of a former Rhine island in late Roman times, it was enlarged to at least 204 hectares in 1106 AD by the

integration of new medieval suburbs in the area of the former *suburbia*. In the course of Cologne's rise to a supra-regional economic centre in the High and Late Middle Ages, the former city area was extended again by a new landward semi-circular city wall. The medieval city centre now covered an area of 388 hectares, nearly four times the size of the Roman city within its walls. The core city of Roman times continuously remained the central area of the city. Therefore, the archaeological stratification sequence from Roman times to the most recent archaeological time horizons is most pronounced in this area.

Thickness of Archaeological Strata

An important parameter to be determined for a planning area in the city centre within the framework of the evaluation of its archaeological potential is the local thickness of the archaeological layer package. If this is known, it is possible to pre-evaluate the extent to which archaeological substance can be expected and from which periods of the city's history archaeological findings might be preserved. Approximately, the archaeological layer thickness for Cologne's Old Town can be determined as the difference between a digital terrain model of today's terrain surface and a digital surface model of the natural subsoil, which depicts the terrain surface in pre-Roman times.

Model of the Pre-Roman Terrain Surface

The model of the pre-Roman terrain surface of the inner city was interpolated from elevation data of the upper layer edge of the undisturbed soil, today usually covered by anthropogenic fillings containing archaeological structures that have developed in the course of settlement development (fig. 2). Particular attention was paid to height data for the upper edge of the natural subsoil recorded during archaeological excavations. Data from geological drilling and other subsoil investigations were also considered. The data used here are based on absolute altitude values compiled within the framework of two studies on relief development in the area of Cologne's Old Town.[2]

The digital surface model of the natural subsoil clearly shows the characteristic local topography before Roman occupation (fig. 2), which is assumed to have played an important role in the choice of the site for the foundation of the settlement in Roman times, the later *Colonia Claudia Ara Agrippinensium* (CCAA) and also influenced the spatial development of the medieval city. The Roman city within its wall lies on an elevated and thus flood-protected plateau on the edge of the lower terrace of the Rhine. Due to a convex riverbank, the plateau originally fell steeply towards the Rhine. Between the slope and a river island, accompanying the city plateau along its entire length, there was a tributary of the Rhine used as a port in Roman times and no longer existing today.

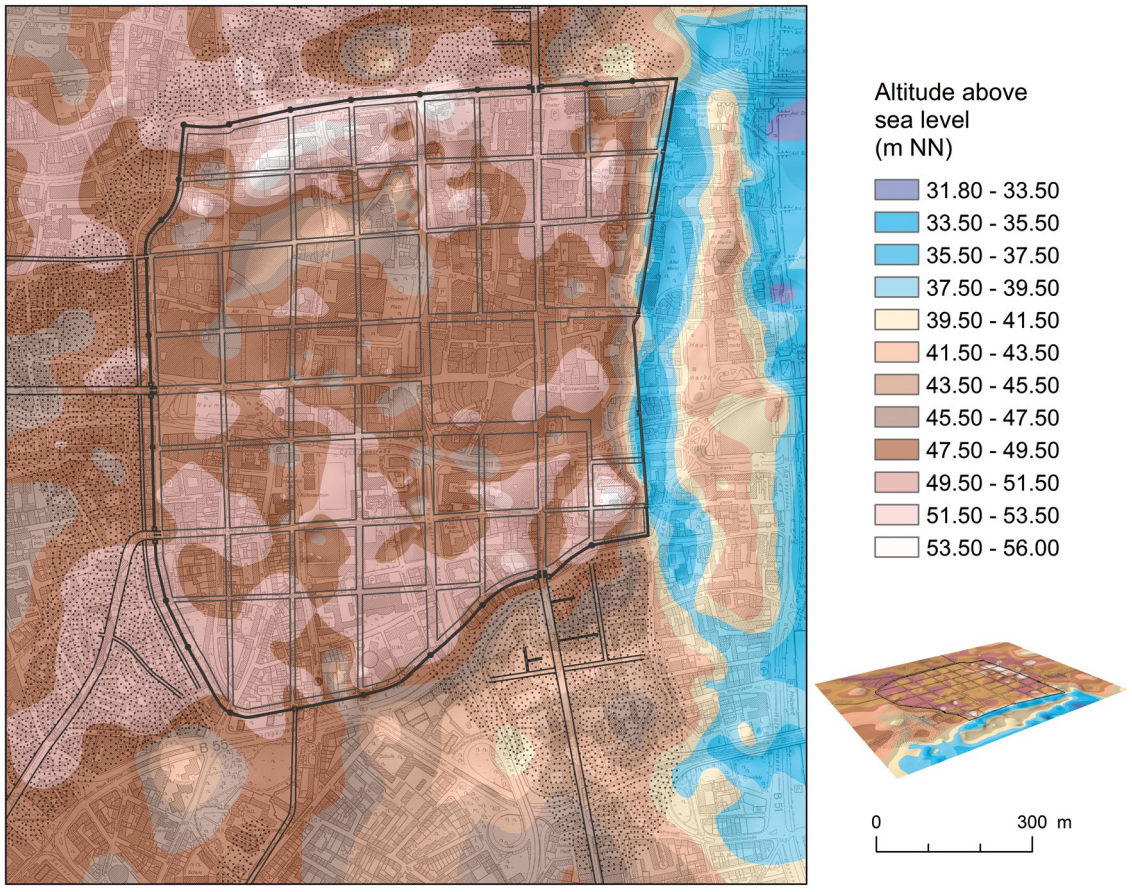

Fig. 2: Digital terrain model of the pre-Roman terrain surface in the inner City of Cologne (interpolation method: ArcGIS spline with tension).

Model of Today's Surface

The data basis for the terrain model of today's surface (fig. 3) is formed by area-wide height data acquired by the use of Airborne Laser scanning (ALS). Previously, vegetation and building structures were eliminated from the data. For taking into account the disturbances of the archaeological sequence of layers by modern buildings, a mapping of today's basements in the city centre, prepared within the framework of the project *Digitaler Archäologischer Schichtenatlas Köln* (digital archaeological layer atlas of the historic Old Town of Cologne)[3] was included in the calculation of the surface model.

The result is a prognosis map of anthropogenic fillings, which approximately represent the archaeological layer thickness in the inner city (fig. 4). As expected, the greatest filling thicknesses of up to 14 m lie in the area of the former Rhine channel. The filling of the Rhine channel with municipal waste and building rubble began in Roman times. In the course of the expansion of the settlement area to the former island

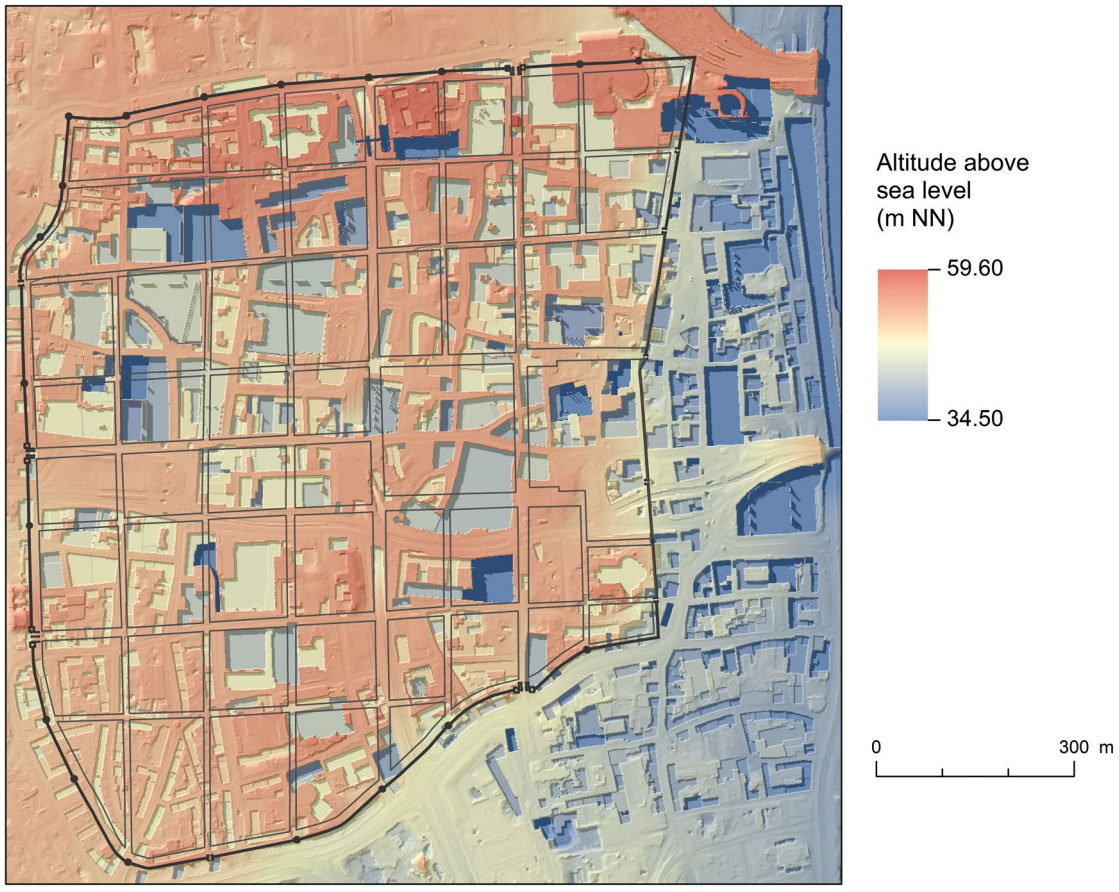

Fig. 3: Digital terrain model of today's terrain surface in the inner City of Cologne.

in late Roman times and in the Middle Ages, the fills were intensified in order to create sustainable building land.

In large parts of the Roman city there are layer thicknesses of up to 5 m, more rarely also up to 7.5 m. In several areas, however, the archaeologically relevant fillings have already been completely cleared out by modern buildings whose basements extend into the natural subsoil.

While the mapping of anthropogenic fillings already provides information on the expected local archaeological layer thickness, only the detailed evaluation of the entire archaeological and historical data available for a planning area and its immediate surroundings allows a forecast of the archaeological substance to be expected on site. The procedure can be sketched using a case study from the city centre of Cologne.

In the core area of the Roman city, a larger area is to be developed in terms of urban development (fig. 1). Based on an evaluation of expected archaeological findings, the agency for archaeological monument conservation enters requirements for the redevelopment of the site into the planning procedure.

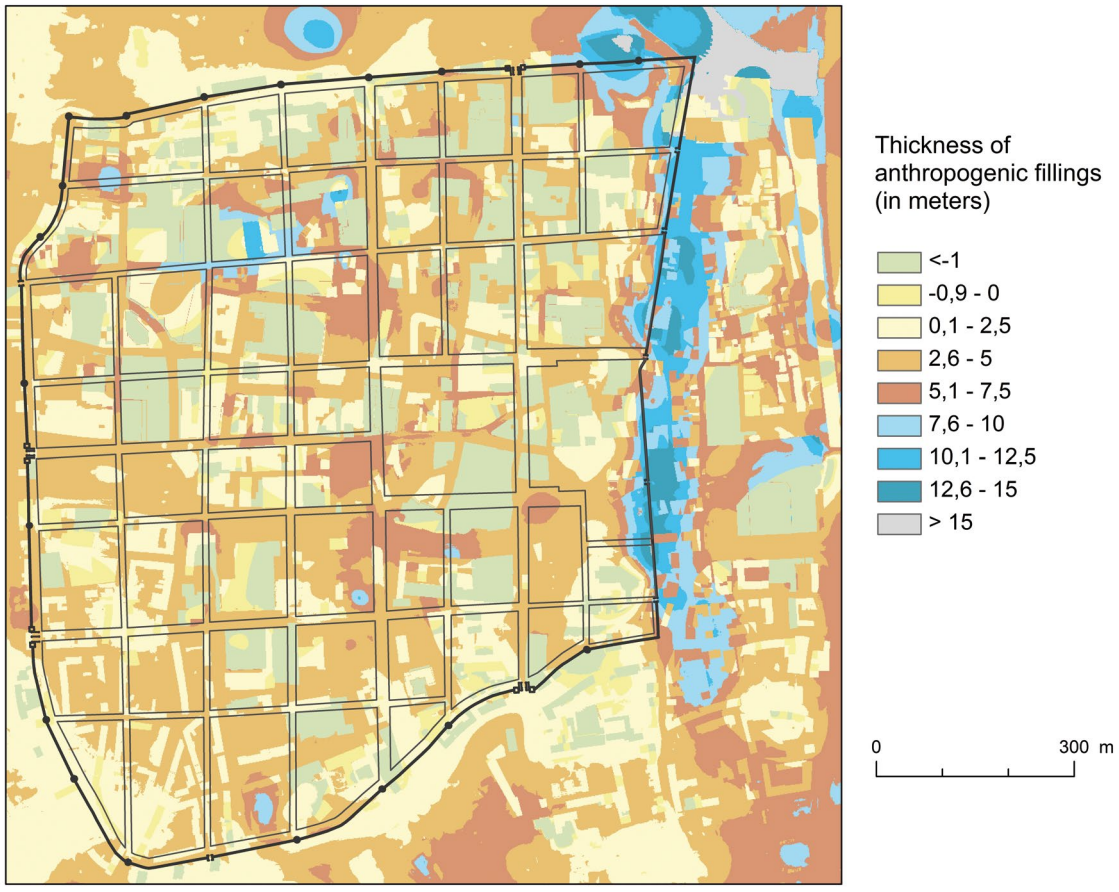

Fig. 4: Thickness of anthropogenic fillings in the inner City of Cologne.

In a first step the site-related archaeological data stored in the local archive of the Cologne agency for archaeological monument conservation concerning the planning area and its immediate surroundings are evaluated (fig. 5).

On the basis of archaeological features documented during earlier archaeological excavations it is possible to predict continuation of certain known archaeological features into the planning area and to estimate expected heights for contemporary archaeological findings in the planning area. By considering existing data on modern soil interventions, any existing losses of archaeological substance caused by modern buildings are taken into account. In order to get an idea of the archaeological findings to be expected in the planning area, it is helpful to be able to locate the investigated area precisely within the settlement topography of the affected settlement phases. The detailed reconstruction of the ancient settlement topography is facilitated by the GIS-supported recording and evaluation of the site-related archaeological data stored in the local archive of the Cologne agency for archaeological monument conservation. Regarding the layout of the Roman city (fig. 1), the planning area is situated in the Rhine side zone of the city, which is characterised by important public buildings. The

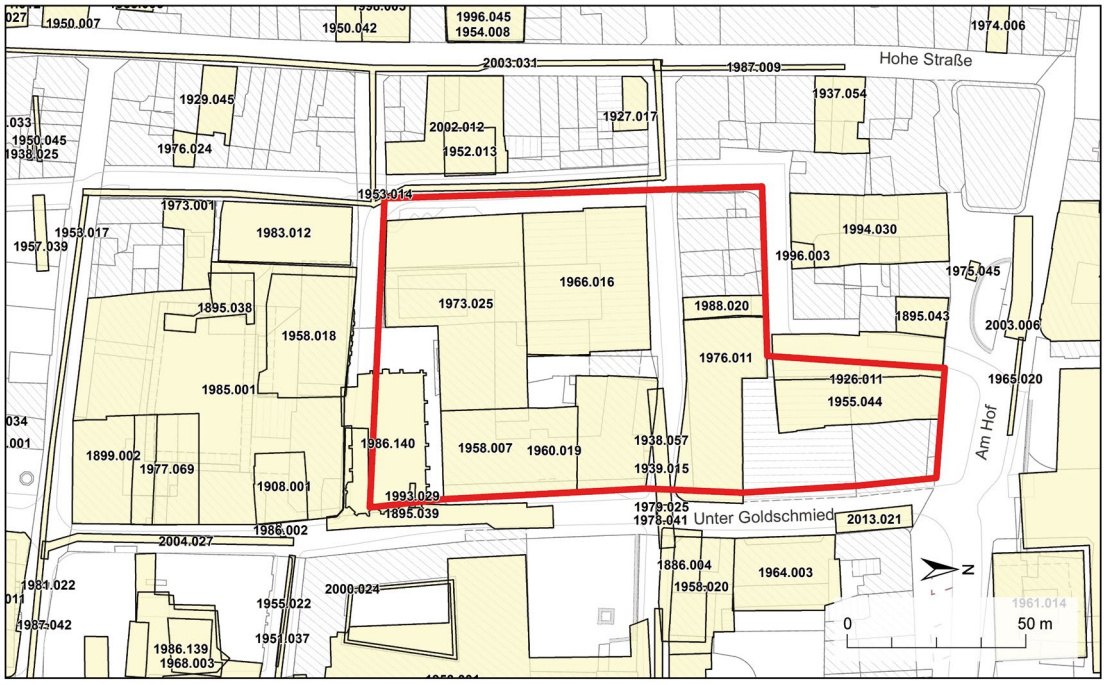

Fig. 5: Survey areas recorded in the local archive of the authority for archaeological monument conservation in a section of a current planning area for urban development in the inner City of Cologne.

planning area is partly within the area to be occupied by the *praetorium*, the governor's palace, between the city wall toward the Rhine and the *cardo maximus*, the north-south oriented main traffic axis of the CCAA. One of the main sewers of the Roman city runs through the investigation area in the route of a street leading to the cardo.

The remains of the post-Roman settlement phases are generally affected to a disproportionately stronger overstamping by more recent building activities.

For this reason, additionally historical sources must be consulted to open up larger sections of the city topography from the Middle Ages onwards.

Important information in this regard is provided by documents on real estate transactions, forerunners of today's land registers, dating back to the 12th century, as they contain important information on the development of individual land plots, which in many cases can be located to exact modern addresses. Other important sources are historical depictions of the city topography like the Mercator Plan from 1571 that gives an early overview of the city topography. Several buildings, some of them of medieval origin and described in written sources, can be identified in this historic plan. In many cases it is possible to link the results of excavations to buildings known from the pictorial and written sources.

The main features of the historical-topographical development over the last 300 years can be explored in Cologne's city centre on the basis of historical city plans and

Fig. 6: Cadastre Development in a section of a current planning area for urban development in the inner City of Cologne, a: Map of Johann Valentin Reinhardt 1752, b: cadastral map 1836/37, c: cadastral map 1938/49, d: cadastral map 2018.

cadastral maps. The Reinhardt plan of 1751 (fig. 6a) is the first precisely measured plan of Cologne's inner city. The cadastral map of 1836/37 (fig. 6b) and the cadastral map of the 1930s (fig. 6c) show the development of buildings and open spaces up to the current cadastral map (fig. 6d). By overlaying these maps, individual plots can be classified according to the intensity of construction activity. Since an increase in construction activity is to be expected with stronger disturbances of the subsoil, it can be determined, in which partial areas good preservation conditions for archaeological features near the surface, especially of the Middle Ages, are to be predicted and, in which areas these are presumably already destroyed by the more recent building development.

Based on the results of the evaluation of the archaeological potential, partial areas with different archaeological potential can be differentiated in the planning area (fig. 7). In the archaeological action concept to be developed, these sub-areas can be taken into account individually. The red areas in which an excellent preservation of the archaeological sequence has been proven or is to be expected are designated as archaeological monuments. These areas are to be permanently protected against destruction by ground interference. In the green areas, the archaeological layers have already been cleared out due to deep basements of modern buildings. In the remaining areas, archaeological excavations are to be carried out in advance of the construction of new buildings. The expenditure for archaeological fieldwork in the respective sub-

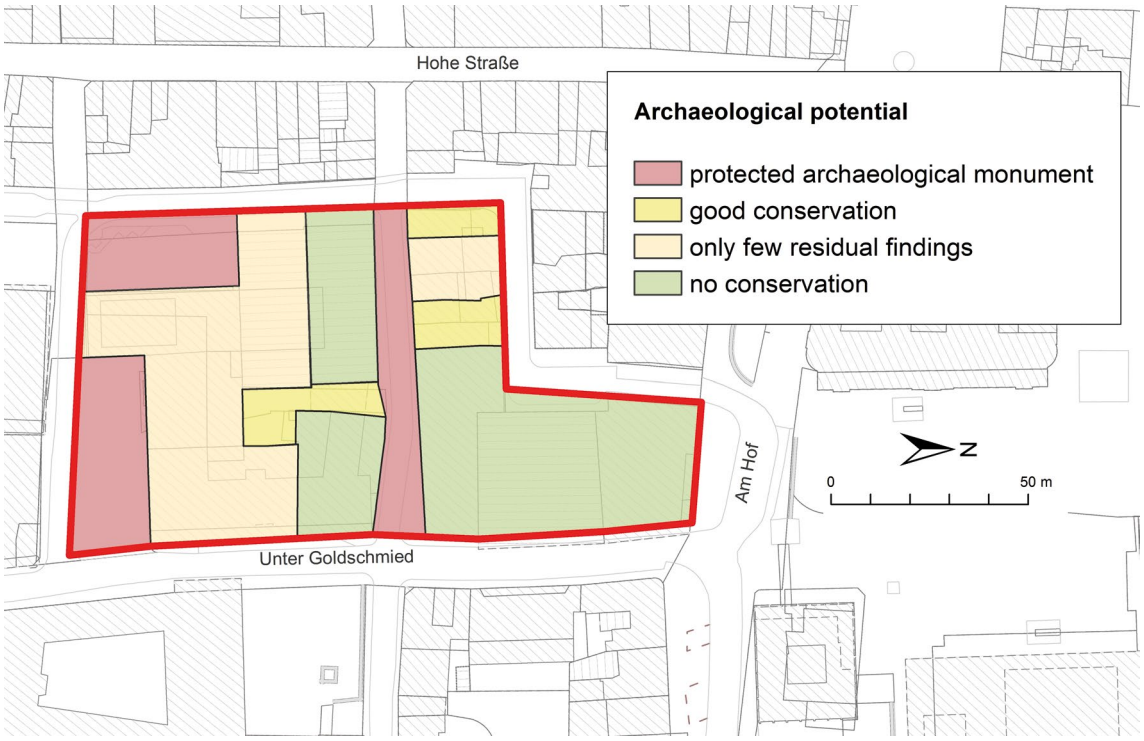

Fig. 7: Mapping of the archaeological potential for a current planning area for urban development in the inner City of Cologne.

areas can be estimated on the basis of the previously prepared detailed forecast of the archaeological stock to be expected.

Revealing a Roman Gateway to the Rhine

The second part of this article deals with the archaeology of the northern harbour gate of Roman Cologne, which was excavated during the construction of the north-south city railway 10 years ago. Individual steps of the documentation process will be presented, ranging from the accurate assessment of archaeological features, 3D laser scanning to digital reconstruction.

Not far away from the city's main cathedral a Roman harbour gate was excavated during 2007/2008.[4] It was the northern one of five gates that faced the Rhine along the city wall of *Colonia Claudia Ara Agrippinensium* (CCAA) (fig. 1). An almost 3.000 square metres large and 13 metres deep excavation was being produced on the Kurt-Hackenberg-Platz. This modern square is located on top of an old secondary arm of the Rhine, which existed in the first century A.D.[5] During the foundation of Roman Cologne the secondary arm of the Rhine could be used for shipping, but sedimentation processes started very early. So the main harbour of Roman Cologne should be located open to the Rhine.

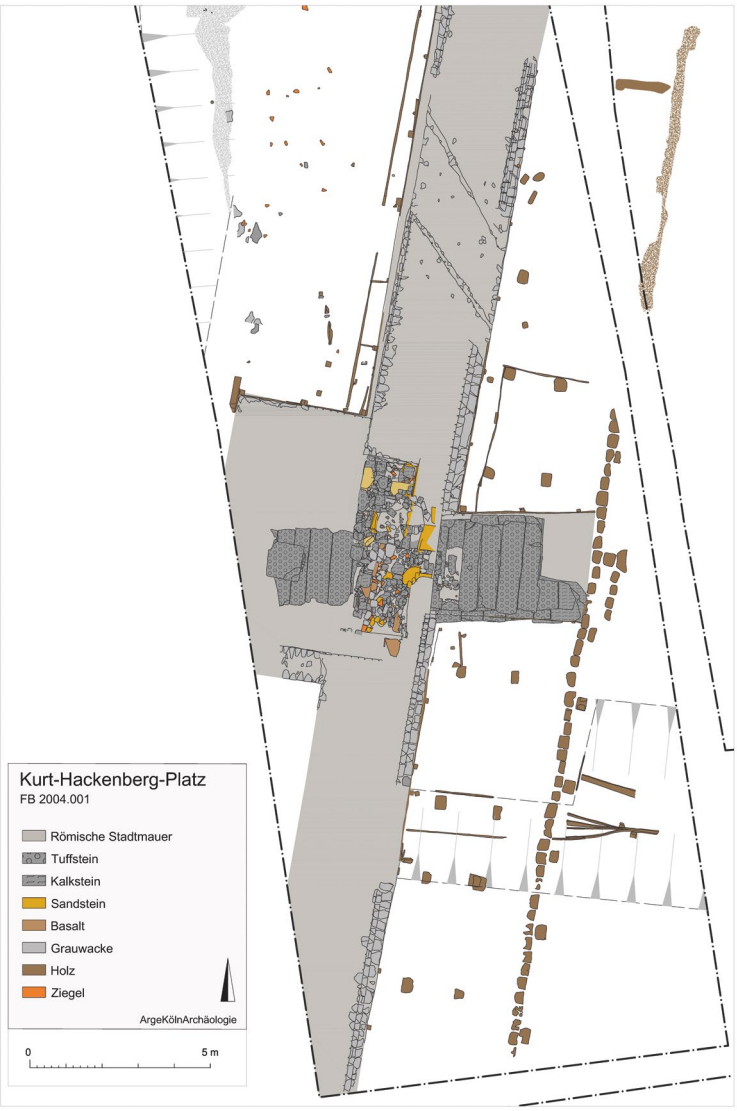

Fig. 8: Plan of the Roman contexts at Kurt-Hackenberg-Platz, Cologne (FB 2004.001).

The secondary Rhine arm was about 60–70 metres wide and more than one kilometre long. Towards the west, the area rises from the Rhine bank to the plateau, on which the Roman town was founded around the birth of Christ.[6] The Rhine-side Roman city wall runs along the foot of this plateau. Nearly one metre beneath Kurt-Hackenberg-Platz, the consortium KölnArchäologie, under the supervision of the *Römisch-Germanisches Museum*, came across the monumental remains of the town's fortifications facing the Rhine.[7] A section of the Roman town wall, c. 25 m long, traversed the modern construction pit in a north-south direction (fig. 8).

The view from the south records the town wall and the outlet of the main sewer located in the foundation of the gatehouse. The passageway through the 'harbour gate'

Fig. 9: Cologne, Kurt-Hackenberg-Platz. Wooden shuttering from the foundation of the Roman town wall.

is at the height of the slabs covering the sewer. In the late Roman period, the entrance was sealed with re-used worked stones; so-called spolia.

How may we imagine the harbour gate at Kurt-Hackenberg-Platz? There is evidence of a substructure for a 6.5 m deep and 7.4 m wide gatehouse on the inner face of the town wall. Between the red sandstone blocks, the inner width of the gate's opening was 2.7 m. The plan of the gatehouse permits a rough reconstruction of the superstructure. Including the elevation of the roof, an overall height of 13.5 m is likely.

The foundation of the Roman town wall rested on the firm gravel of the river-terrace. It comprises *opus caementicium* 3 m wide and over 4 m deep. Due to the wet soil near

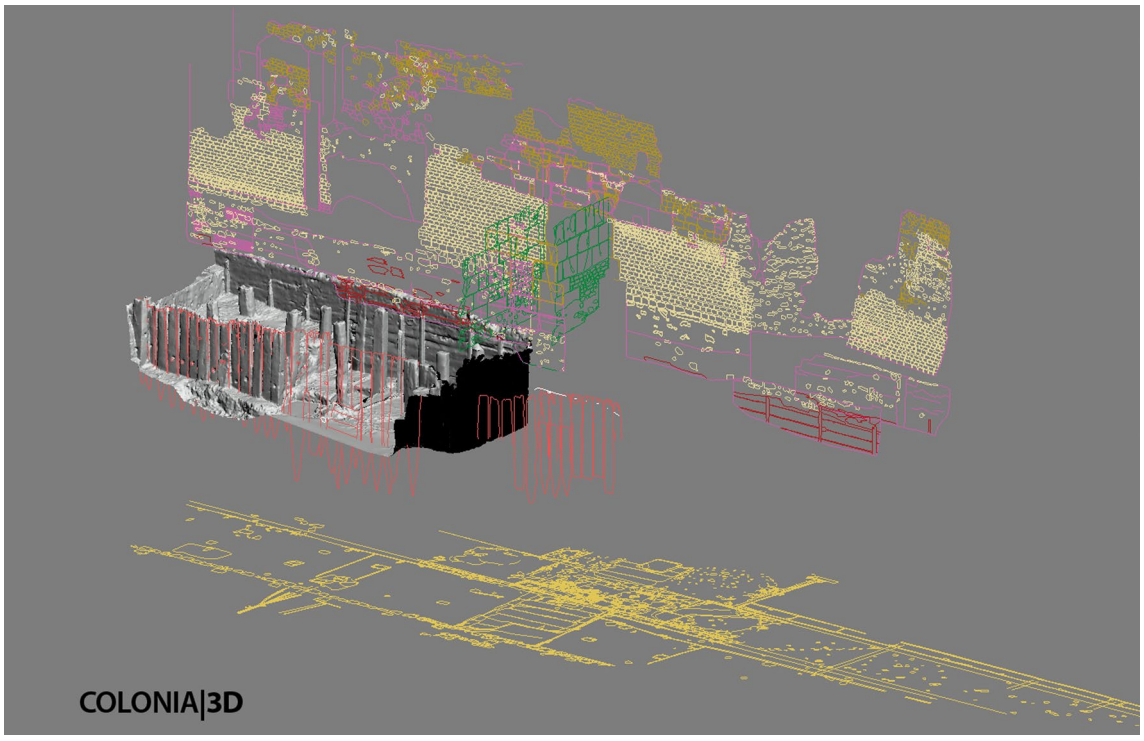

Fig. 10: Northern Harbour gate of Roman Cologne. CAD drawings and polygon model.

the level of the groundwater, the foundation's wooden shuttering remains almost fully preserved (fig. 9).

An analysis by Cologne University's Dendrochronology Laboratory established that this shuttering was of fir timber.[8] The firs were felled in the Black Forest, transported down the Rhine, and sawn to size at Cologne. The fir planks of the foundation's shuttering were in excellent condition. A contiguous row of oak stakes in the area of the riverbank were found in the construction pit at Kurt-Hackenberg-Platz. This plank wall was situated 4 m before the town wall and ran parallel to it. It functioned as shoring for the Roman town wall's construction trench, as clearly shown by the stratigraphic relationships. In addition, together with further posts, the plank wall also served as a pile-foundation grill supporting a wooden walkway situated at the same height as the base of the wall.

A ramp comprising fragments of greywacke was piled against the walkway that probably assumed the function of a quay during the building process of the wall. Analysis of 150 oak stakes from the plank wall confirms that all the trees, from which they crafted, were felled in 89 AD. In the last decade of the first century Cologne's bank of the Rhine was a building site.

The monumental remains of the harbour gate will be presented in a new museum in the underground. The planning process has just begun.

For the visualisation of the harbour gate and to make possible a 3D-reconstruction for the project Colonia3D, basically two sources were analysed and integrated: firstly,

Fig. 11: Digital reconstruction of the northern harbour gate of Roman Cologne.

a 3D-scan of the site and, secondly, CAD drawings containing plans and sections of the excavated town wall and the foundations of the gate. The resulting visualisation comprises a polygon model that lends volume to the archaeological remains.

Dipl.-Ing. Jost-Michael Broser from the Technical University of Cologne kindly supported the project with the provision of data from a 3D laser scan carried out on the site. The data from the scan were, as usual, in the form of a point cloud. Each measured point within such a cloud represents a three-dimensional coordinate and a colour value.

To be able to incorporate the scan within the digital reconstruction – the real time 3D model – a polygon mesh must be derived from the point cloud. Polygon meshes depict surfaces comprising contiguous triangles (polygons). The 3D scan captured only a relatively small part of the archaeological situation at the 'harbour gate' site (fig. 10). More than 50 individual CAD drawings recorded the remaining contexts, including the drain outlet, the sections of wall above the former street level, the wooden shuttering north of the outlet, and the gate foundations. The CAD drawings also had to be transformed into a polygon model in order to combine them with the (re-topologised) scan.

Afterwards the completed 3D model of the northern harbour gate (fig. 11) was promptly integrated within the application, Colonia3D, which may be viewed in Cologne's *Römisch-Germanisches Museum*. The flexible structure of the application allows the easy integration of new data.

Notes

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[1] Trier 2016.
[2] Mertens 2010; Holthausen 1994.
[3] Häuber et. al. 2004.
[4] Trier 2008; Schäfer – Trier 2013.
[5] Berthold et al. 2017.
[6] Eck 2004; Spiegel 2006.
[7] Neu – Riedel 2002; Eck 2007; Berthold u. a. 2017, Taf. I a.
[8] Schmidt 2005; Schmidt – Frank 2012.

Image Credits

Fig. 1: Copyright RGM; digital editing P. Fleischer. – Fig. 2. 4–5: RGM /G. Wagner. – Fig. 3: RGM /G. Wagner; elevation data DGM1, NRW Bezirksregierung Köln, Abt. Geobasis NRW, Land NRW, 2018. – Fig. 6: RGM; cadastral map 2018, NRW Bezirksregierung Köln, Abt. Geobasis NRW, Land NRW, 2018. – Fig. 7: RGM. – Fig. 8: Berthold et. al. 2017 Taf. I a. – Fig. 9: Photos RGM (A. Schäfer). – Fig. 10: Colonia3D. – Fig. 11: RGM/ Colonia3D.

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Archaeological Publication in a Digital World

Elizabeth Fentress*

Many years ago Shepherd Frere published a report on archaeological publication that divided the levels of archaeological documentation into four; the physical site and its finds, the raw excavations records, the curated archive and, finally, a selective and informative presentation of the site on paper.[1] A fifth, divulgation in the popular press, or in books for the general reader, was an option. The question in this report was about what to do with the third level – how much of what we now call 'grey literature' should be published. The answer, given the technology of the time, was 'little or nothing'. The internet has changed all that: there is no reason why 'grey literature' should not be available to all – the York University-based Archaeological Data Service, or the Dutch EDNA, which contains the data of archaeological research (GIS data, field drawings, data tables, photographs) as well as final reports, are both excellent examples of what can be done. What is now the question is what to do about level four: the publication of a research project. Should this, too, be online? As an editor of an online archaeological journal, *Fasti On Line Documents and Research (FOLD&R)*, my answer in most cases would certainly be 'yes'. But there are problems.

The appearance of three full-scale, online publications of archaeological sites in Italy spurred me to think about the advantages and disadvantages of online publication in general and that of archaeological sites in particular.[2] The advantages are obvious: especially if there is no paywall, the full details of the site become available to anyone who wants them, providing to the general public the sort of detail normally locked inside specialist libraries. Publications online are easy to find and may be hyperlinked and searched. Catalogues can be downloaded as spreadsheets which can then be rearranged, recombined and reused at will. Colour reproduction of photographs ceases to be expensive, and we may see the last of the elegant but often dreary black and white image. Paper and printing are saved, along with the money they cost. Finally, audio files and 3D images, of objects, of the stratigraphy, and of reconstructions become available. The advantages are obvious. What is not to like?

The answers are complex, and some unfair. Electronic publications are still the stepchild of archaeological publishing. Reviews of online books are vanishingly few. Part of the snobbism may derive from the fact that the internet is open to all, so that a necessary filter appears to be missing, but this makes little sense when an online book is published by a university press or in a peer-reviewed context. The objections to reading online are familiar, and not entirely age-related: books are not susceptible to cyber-attacks, can be read anywhere, have a physical presence that can be marvellous. And there are things that books do very well indeed, like providing two pages, one of which can hold the illustration that supports the text on the other. Footnotes have always been best at the bottom of the page: flicking down to them with one's eyes is

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infinitely faster than clicking on them. There are also things that printed books, by their very limitations, force you to do. Books limit space. Text is necessarily synthetic, and illustrations are worked over to provide the maximum clarity in the minimum of space. This is an important point: In recent publications line drawings have been eschewed in favour of the *realien* of walk-through site models. Access to the site database allows you to see the record sheet for the context, and the photographs taken while it is under excavation – in all its messy splendour. It is hard to know what the advantage of this deconstructed view is. For most people it is the excavator who should interpret the site, distilling it for the reader into a form that is easy and immediate to grasp – although the site archive serves to check that interpretation and permit other interpretations to emerge. Presenting archival materials, analysis and reconstruction in a single space blurs the distinctions between them, and risks burying the reader in undigested facts.

Graphic illustrations are also victims of this process. Over time, a complex symbology has developed that we all know how to read – continuous lines mean boundaries, of walls or of contexts, dashed lines indicate cuts, trench edges are indicated by dot-dash, and so on. We are used to reading these on phase plans, and it is those phase plans that are, in effect, described in the text. None of this is available from the 3D presentation of the site at a given phase, or from the record sheet, so that however detailed the text the reader is left without a clear, synthetic imagery to complement it. Even the full-dress photograph of, say, a room in a building tends to be absent. These are, of course, constructs ('that needs more cleaning,' 'the sections need to be straighter') but they are useful constructs, allowing the reader as clear a vision as possible of the ensemble.

My protest is against a form of positivism that substitutes the data for their analysis – while at the same time, providing elaborate 3D reconstructions of the spaces, reconstructions whose anchors to those images of dirt and stone are almost incomprehensible. We are, in sum, missing the intermediate phase, of synthesis and elaboration, passing straight from level 3 to level 5 (now the 3D reconstruction), without passing through synthesis and exposition.

The solution seems simple. The internet should be reserved for what it does best – levels 3 and 5, while synthesis and exposition of a large research site should remain in a printed book or journal. Stratigraphic reports, specialist reports, spreadsheets and colour images on the one hand, and 3D reconstructions and audio files on the other should be housed on the web – along with, if possible, access to the original databases for those who really want to dig down into the stratigraphy. This, of course, is tricky, as many university servers refuse interactive web sites for security reasons (the University of Michigan Press is an honourable exception). Such sites also need periodic software updates, more and more unlikely over time. However, html seems to be lasting well, and if a university host can be found that will guarantee that the site will not be discarded by a bored administrator in thirty years' time, this is a good solution. But let us, for the

moment, retain the option of the printed page for a concise, well-written and illustrated narrative of what an excavation tells us, useful to the scholar and accessible to the intelligent lay person.

Notes

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[1] Frere 1975. See also Jones et al. 2001; Richards 2004.

[2] Clarke – Montasser 2014; Luzón – Alonso Rodriguez 2017; Opitz et al. 2017: see Fentress 2018.

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The Pleiadic Gaze: Looking at Archaeology from the Perspective of a Digital Gazetteer

Tom Elliott*

Pleiades is an on-line, open gazetteer and graph of ancient places, spaces, and peoples.[1] Unlike traditional gazetteers it includes not only named features, but also geographic entities whose historical names are lost and even geographic entities that may never have had a name. Unlike traditional geographic information systems, *Pleiades* catalogs not only those places that can be abstracted into a point, a line, or a polygon on a map, but also those whose locations are lost, uncertain, disputed, or comprehended only through the aggregate locations of other, related places.

This flexibility arises from fundamental decisions taken at an early stage in the project (that is, between 1999 and 2006 when the project received its first grant from the US National Endowment for the Humanities).[2] We were certainly at pains to preserve and extend the information that had been carefully gathered during the Classical Atlas Project's 12-year, 200-person quest to produce the *Barrington Atlas of the Greek and Roman World*, which was published by Princeton University Press in the year 2000.[3] Some digital techniques had been used in the preparation of the Atlas (not least email!), but given the transformation in data management and geospatial computing technologies that transpired during the lifetime of the Atlas project, there could be no question that newer techniques would be needed in any follow-on effort to keep the information underpinning the atlas up-to-date.

In thinking about a follow-on effort, we were influenced then in no small way by the recent emergence of the so-called "wiki way."[4] We wondered if the crowd-sourcing approach being pioneered by Wikipedia could be adapted to the task of updating and expanding all our atlas information. The era of steady funding for *longue durée* academic projects was ending. Maybe we could use a wiki approach to assemble a globally distributed nerd army to succeed that Atlas Project warrior band. But if web-mediated, incremental, and asynchronous content creation could be a way forward for any descendant of this great atlas, it was obvious that we would have to change the fundamental structure of the information. The Atlas and its maps would have to be digitized, reorganized into little, discrete pieces, and somehow surfaced on line in a readily edited format. And we would need processes for both pre- and post-publication review of changes. Beyond data management, there were more and different user needs. How would one work effectively and economically with the restructured data? How would it appear online for human use? Could it be made available for other projects, digital or otherwise? How much could be done automatically?

It was clear by the turn of the century that a paper atlas and its twelve-hundred-page, two-volume companion directory could not adequately serve the users of new media and new computing tools. Indeed, in a laudatory (but critical) review of the Atlas

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for the *Journal of Roman Archaeology* in 2001, Susan Alcock, Hendrick Dey, and Grant Parker imagined a digital *Barrington Atlas* – more portable and less constrained by the limitations of map frame and scale.[5] Such a thing exists now, thanks to Princeton University Press, who brought out an iPad version of the *Barrington Atlas* in 2013 and has issued technical updates to same as recently as 2017.[6] It is a beautiful and wonderful thing, as far as it goes, but I think that if you've used it at all, you'll agree that it doesn't do much other than saving you from having to carry around a big double folio of dead trees.

Those of us gathered around the Atlas' birthplace in Chapel Hill, North Carolina, wanted portability and digital versions of the maps too. But we also wanted an environment in which other, more conceptual issues could be addressed. Among these was a concern also raised by Alcock, Dey, and Parker: the Atlas's selective omission in many areas of the results of archaeological survey.[7] In their view, the Atlas could be forgiven somewhat since "to replicate survey data to scale in hard copy would be an ordeal" but "(electronic formats … will have no such excuse)."[8]

No pressure!

We would need something that would let us add new features and refine existing coordinate pairs; to record finer or different temporal characteristics; to classify places more flexibly and indicate change in use over time; to add toponyms; to indicate relationships between places; to express uncertainty; to link information to scholarly literature, primary sources, physical objects, and archaeological data. And so, in the midst of a technological phase of the widely remarked, twentieth-century "spatial turn" in the humanities – a moment that most people equated with on-line maps, historical GIS, and spatial computing – we took the road less traveled.[9] We pushed the map to the side and put places themselves first. In pursuing place, we had helpful guides in Yi-Fu Tuan and other human geographers of the late 20th century who explored the idea of place as a cognitive or experiential construct.[10] In *Pleiades*, therefore, places are conceptual entities: we apply the term to any locus of human attention, material or intellectual, in a real-world geographic context, whether or not it can be named or mapped or visited today. The spatial aspects of *Pleiades* places (that is, latitude and longitude coordinates in space), as well as their ancient and modern names, are subordinated to this idea of place, becoming optional attributes in the information construct, rather than first-class entities.[11]

Various technical architectures and associated editorial processes were considered for dealing with these demands. You'll perhaps be happy to hear that we do not have time today to discuss any of them in detail, because I want to talk about a topic that Ortwin Daly introduced earlier in this panel. Suffice it to say that we decided to use and customize an open-source, web-based content management system named *Plone* in order to put *Pleiades* on line.[12] It was this plan that earned us our first round of funding and that attracted Sean Gillies to the project. Sean served as *Pleiades*' chief engineer for over 7 years. Now employed by Mapbox.com, he still deserves credit for the shape and

function of the *Pleiades* web application as it appears today, as well as its underlying data. This credit is especially due in three areas. First, Sean designed and built the code we needed to support geospatial indexing and mapping, functions that our content management framework didn't handle natively. Second, Sean led work on the linked data and export formats we needed to meet user needs, including one that evolved into one the most widely used web formats for spatial data today: GeoJSON.[13] Thirdly, Sean kept a relentless focus on clean, clear data structures and the paths to them, hiding implementation detail and privileging stability.

I'll be focusing my remarks for a bit on these last two areas: the formats in which we surface *Pleiades* data and the mechanisms whereby our users – both sentient and algorithmic – interact with the data. Why? Because it turns out that the way we do this is what makes *Pleiades* worthwhile. It's what makes us more than a big encyclopedia of not-very-consistent information about ancient places. It makes us more than a data management tool for a particular scholarly endeavor. It's all about citation.

Citation – the glue that holds together so much of the scholarly enterprise – was particularly ill served in the so-called "web GISs" of the late 90s and early 2000s.[14] Whereas at least with a paper atlas, one could refer to map number, grid square, and label in order to cite a specific place, most early on-line map systems seemed almost hermetically sealed. Despite the ubiquity of hyperlinks – the central affordance of the World-Wide Web and arguably its only distinguishing feature – one could not count on making a stable link to a particular place, map view, zoom level, or coordinate location.[15] All the specifics of these interactions were hidden behind the user interface and a simple, top-level web address or some kind of nasty, ephemeral search string. Would that such barbarism had been just a passing fad! But now, twenty years on, many online GIS and mapping environments still behave this way. They mimic desktop mapping software, embodying the assumption that whatever the system can do, it should only do it for the individual person interacting with it right now. Discovery, reference, and review, as well as collection and reuse of information: these are all fundamental scholarly activities that are completely dependent on stable citation. They cannot function under a regime like this. Moreover, the tantalizing possibility of computationally actionable citation – the idea that computer programs might exploit links and connected resources to do complex discovery, correlation, and even reasoning without direct human supervision – seemed in 2006 like a dream straight out of science fiction.[16]

On the world-wide-web, the identifiers necessary for citation should be front-and-center: they are the strings of characters that you put into the location bar of your browser in order to retrieve a web page. They are the essential magic in a hyperlink. Their technical name is "Uniform Resource Identifier," a phrase usually abbreviated with the acronym URI.[17] URIs (or yoo-ahr-ees, as they're sometimes pronounced) are cool.[18] They're cool because, if you construct them sensibly and connect them to interesting information and take care of them so they don't rot into uselessness, they make citation happen. In throwing off the normalizing tyranny of a single map view to embrace the

radical equality of all places, *Pleiades* was born citation-ready. Because Sean Gillies and others present at the creation payed attention to emerging best practice and cared about scholarly communication, *Pleiades* was born citation-friendly.

May I present a *Pleiades* URI?

https://pleiades.stoa.org/places/570182

This URI identifies the *Pleiades* place resource for the ancient site of Corinth in Greece. You can think of *Pleiades* URIs as the passport numbers for ancient places. They're simple. Each one uniquely identifies a *Pleiades* place resource. And we promise to keep them stable for as long as *Pleiades* exists. We embed them into all our export formats so that even when *Pleiades* does die, or when the World-Wide Web is replaced by something else that does things differently, a copy of our dataset can be retrieved from one of several digital archives and put back together with any other data that used our URIs for citation.

There's a growing body of such data. The *Peripleo* search engine demonstrates geographic connections between items in scores of different datasets concerned with ancient places and objects.[19] *Peripleo* is a demonstration tool, developed under the auspices of an international project known as the "Pelagios Commons" and funded by the Andrew W. Mellon Foundation. Peripleo's principal developer is Rainer Simon, a Senior Scientist at the Austrian Institute of Technology. The datasets indexed by Peripleo, helpfully listed on its "about" page, include not only *Pleiades* and a number of other digital gazetteers, but also several numismatic databases; epigraphic websites; university and museum collections; textual resources; and archaeological repositories. The gazetteers that have been indexed by *Peripleo* are not just reference points for other datasets. They cite each other, using URIs on the same standard model employed by *Pleiades*. With the place entries in the gazetteers collated, it's then possible to present together all the records from the other databases that cite one of those gazetteer entries. Because the the contents of the other databases also use stable URIs to identify each record they contain or object they describe, data from several can be combined, reused, and interrogated on the basis of common geographic referents with minimal fuss.

So, is *Peripleo* the tool you need for in-depth research and analysis on every archaeological topic? Unlikely, given its focus on visualization and demonstration. But its success brings home a very important fact with significant implications for future research work in archaeology: computationally actionable citation is here. We have scores of datasets on a variety of useful archaeological themes that can be quickly assessed for interrelationships of interest and then combined, as needed, to support a variety of research tasks. Geography is just one of the axes of citation we can exploit. "Gazetteers "for other things like named time periods, prosopography, materials, or building techniques already exist too or are being built. The opportunities and consequences should be obvious: if you use comparative or connective data in your work, learn how to exploit these new tools. If you produce datasets in the course of your research, define URIs for items of interest therein, publish the data on-line

under open license, and liberally cite the URIs from other datasets whenever it is appropriate to do so.[20]

There are several ways in which the *Pleiades* community is working to make this network of actionable citation more robust and more useful for the study of the ancient world. I'd like to use my remaining time to touch on a few of those that have specific bearing for archaeology.

One of our earliest and biggest efforts has been in increasing the precision and improving the accuracy of the spatial coordinates we provide. The scales used in the *Barrington Atlas* limited the effective precision of any coordinates digitized from the maps to a range between two and ten kilometers.[21] New *Pleiades* coordinates have come from a variety of sources, but increasingly, we've come to rely on *Open Street Map*.[22] OSM is a global collaborative resource for high-resolution, real-world mapping that often captures archaeological monuments, structures, and districts that remain in situ. And, despite its name, it takes in much more than just streets.

The data we inherited from the *Barrington Atlas* also had limits on the types of features mapped because of the available space on a given page and the density of features in a given area. These limitations necessarily percolated into *Pleiades* at the beginning. Things like temples, sanctuaries, churches, monuments, and tombs only appeared in the Barrington when they lay outside settlements. *Pleiades* has no such limitations, and so our contributors have begun adding these more compact places in many areas and connecting them to each other using a prototype vocabulary of topographical and thematic relationship types.[23] Recent work on the place resource for Nineveh demonstrates what's possible.[24] Jamie Novotny and colleagues, working under the auspices of Karen Radner at Munich, have added new place resources for palaces, temples, and other features attested at Nineveh, connecting to the place resource for the settlement itself.

What about – as Alcock, Dey, and Parker labeled it – "the small stuff" that the Barrington omitted?[25] That is, what about the findspots of coins and inscriptions, the kilns, olive presses, and *agglomeration rurale*? What about the interpreted results of regional survey? We're making a start by working with scholars like Alessandro Battisti on the data published at rusafricum.org.[26] This data derives from the joint Italian and Tunisian Thugga survey directed by Mustapha Khanoussi, Samir Aounallah, and Mariette de Vos. *Rus Africum* records have cool URIs and the data has already been put into Peripleo. The graph view in *Peripleo* demonstrates that, where a *Rus Africum* site matches up with a *Pleiades* place, Alessandro and his colleagues have already noted the equivalence and made an appropriate citation. Alessandro has also been working with Jeffrey Becker, one of *Pleiades*' volunteer Associate Editors, to improve *Pleiades* coordinates on the basis of Rus Africum's data, which, by virtue of its origin and mode of collection, displays much greater accuracy and precision. Where appropriate, they're adding the locations first to OSM, and through it, to *Pleiades*. What remains to sort out are the *Rus Africum* features not in *Pleiades*. Here are a few examples. How much

should come into *Pleiades* (with appropriate citation and provenance, of course) and how much should remain solely in the *Rus Africum* dataset? I don't know the answer to that question yet, but I'm confident of one thing. As a community, we'll weigh carefully factors like citation reliability and long-term utility as we work toward a solution.

These are a few of the ways in which the *Pleiades* community is working to support citation, to make *Pleiades* more useful for archaeologists, and to better use and reflect the results of archaeological work. But my time is up, so I'll conclude with a recruiting pitch. The *Pleiades* nerd army is an all-volunteer force. If you're interested in helping build and maintain Open Linked Data for Ancient Studies, please consider joining us. There are many ways to help, either by working on the content in the *Pleiades* gazetteer itself or by publishing datasets or software applications that use or link to it.

Notes

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[1] Bagnall et al. 2006.

[2] NEH Grant PA-51873-06 2008.

[3] Talbert 2000; Talbert 2018.

[4] Leuf – Cunningham 2001.

[5] Alcock et al. 2001, 461.

[6] Talbert 2017; Foss 2013; Ayer 2014.

[7] Alcock et al. 2001, 458–459.

[8] Alcock et al. 2001, 459.

[9] Guldi 2011; Gillies 2010.

[10] Tuan 1975; Tuan 1990.

[11] Gillies et al. 2017.

[12] Plone CMS n.d.

[13] Butler et al. 2016; Sean Gillies 2007.

[14] GIS = Geographic Information System; Fu et al. 2011.

[15] Shneiderman – Plaisant 2018; Wikipedia s.v. Hyperlink 2018.

[16] Elliott – Gillies 2009.

[17] Wikipedia s.v. Uniform Resource Identifier 2018; URI Planning Interest Group, W3C/IETF 2001.

[18] Berners-Lee 1999; Sauermann – Cyganiak 2008.

[19] Peripleo 2018; Simon et al. 2016.

[20] Berners-Lee 2009.

[21] Gillies 2005.

[22] OSM 2004.

[23] Pleiades Connection Types 2018.

[24] Roaf et al. 2018.

[25] Alcock et al. 2001, 459.

[26] de Vos Raaijmakers et al. 2017.

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Epigraphy in a Digital World: the Example of *I.Sicily*

Jonathan R. W. Prag*

Epigraphers have been assembling corpora of inscribed texts since the 15th century.[1] The limitations of hard-copy publication resulted in an excessive focus on text, at the expense of the material support. In the 20th century epigraphers increasingly emphasised the material aspects of inscriptions in the study of epigraphic culture. However, the creation of major text databases since the 1980s, while transforming basic text-searching tasks has coincidentally restored the emphasis upon text.[2] The development in the last decade of new standards for digital text encoding (EpiDoc, a TEI XML schema), as well as the framework and vocabularies for linked data, offer new possibilities for the creation of true digital corpora, rather than simple databases.[3] Such corpora can combine rich metadata with a critical edition, and offer new opportunities for wider dissemination and public engagement.

The *I.Sicily* project is developing such a corpus in order to study and make freely available the complete epigraphic culture of Sicily between the 7th century BC and the 7th century AD, across all languages.[4] Texts and metadata are encoded in EpiDoc, and the XML is held in an eXist database for xQuery access. URIs are maintained for the individual inscriptions (and museums), which are manipulated through a RESTful API; the bibliography is published as linked open data and edited directly in Zotero. The records can be queried and viewed through a web interface built with AngularJS and jQuery javascript components. Mapping is provided in the browser by the Google Maps API. Zoom, Pan, Rotate image-viewing is provided by the IIP image server, which enables the generation of IIIF metadata, and the OpenSeadragon javascript library. All data is made freely available under a CC-BY licence with a clear indication of the current status of each edition (unchecked, draft, edited). To reduce overheads and facilitate sustainability, a lightweight and distributed framework has been employed, using multiple existing open-source resources, such as GitHub for editorial workflow and Zotero for bibliographic management.[5] The use wherever possible of existing data ontologies, such as Pleiades and the EAGLE vocabularies,[6] facilitates standardisation and linked data (fig. 1).

Beyond the actual study of the individual inscriptions, the project has two primary aims. Firstly, to make as much information as possible freely available to researchers in as flexible a format as possible, to overcome the existing landscape of dispersed and uneven publication and to enable new research. Secondly, to work with museums and archaeologists on the island to catalogue and make available the epigraphic culture of the island. In order to achieve the latter ambition, we have created URIs for individual collections and the referencing of these in the individual editions enables the dynamic generation of open access catalogues for individual museums, which meets a key need of our primary content providers.

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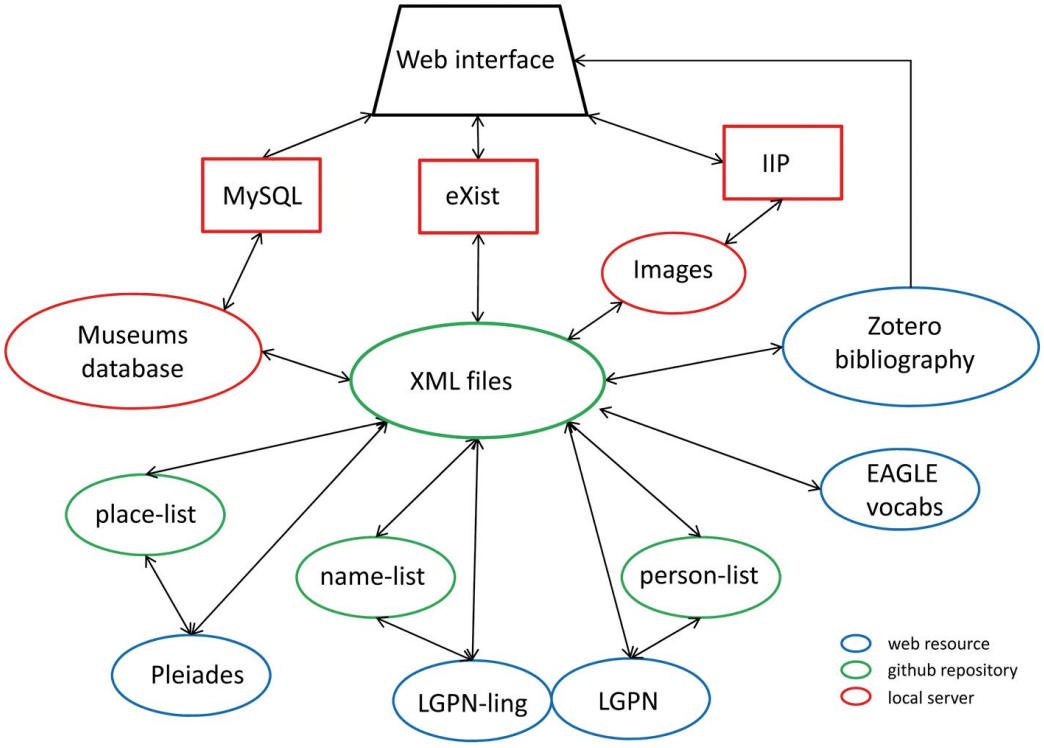

Fig. 1: Graphic representation of the data organisation of *I.Sicily*.

The continuous work of autopsy and editing provides major challenges and requires multiple collaborators, but also creates opportunities both for outreach and training. EpiDoc files are currently edited by a growing team of student volunteers, for whom training in EpiDoc is provided; workflow is managed through GitHub. Individual collections offer more specific opportunities: the collection of the Museo Civico of Catania was catalogued and presented in a new exhibition through a multi-partner collaboration between the museum, the Liceo Artistico Statale M.M. Lazzaro, the CNR Istituto di Scienze e Tecnologie della Cognizione, and the University of Oxford.[7] The initiative has inspired further projects on the island.

In the short term, the project's primary challenges lie in the availability of human resource for data curation, for which training and collaboration provide partial solutions. In the longer term the project faces similar challenges to many other digital projects, such as the establishment of Linked Open Data standards within the epigraphic community, the broader acceptance and standardisation within and beyond the academic community of modes of publishing digital editions which are subject to ongoing editing and change, and the more universal challenges of sustainability of such digital corpora so that they might ultimately replace the paper corpora that have been curated by libraries over the last centuries.

Notes

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[1] De Vido 1999 for the history of Sicilian *corpora*.

[2] E.g. <https://inscriptions.packhum.org/> and <http://www.manfredclauss.de/>.

[3] Bodard 2010; Elliott 2014; <http://epidoc.sf.net>. See <http://insaph.kcl.ac.uk/iaph2007/> for an early example.

[4] Prag – Chartrand 2018; <http://sicily.classics.ox.ac.uk>; <https://isicily.wordpress.com/>; <https://isicily.org>.

[5] <https://github.com/JonPrag/ISicily>; <https://www.zotero.org/groups/382445/isicily/items>.

[6] <https://pleiades.stoa.org/>; <https://www.eagle-network.eu/resources/vocabularies/>.

[7] Agodi et al. 2018.

Image Credits

Fig. 1: by the author.

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Bibliotheken, Archive und die digitale Forschungsumgebung des DAI

Thomas Fröhlich – Sabine Thänert*

An allen Abteilungen, Kommissionen und Außenstellen des Deutschen Archäologischen Instituts (DAI) bilden Bibliotheken und Archive einen wesentlichen Bestandteil der wissenschaftlichen Infrastruktur. In ihrer Beschäftigung mit digitalen Informationen sind sie einerseits in ihrer Rolle als vermittelnde Dienstleister tätig, treten daneben aber andererseits auch als Anbieter auf, indem sie beispielsweise digitale Ressourcen erwerben, analoge Informationen retrodigitalisieren und diese online zur Verfügung stellen.

Im Rahmen des DFG-geförderten Projektes „Die Rezeption der Antike im semantischen Netz" konnten in den Jahren 2010–2015 zusammen mit der Universitätsbibliothek Heidelberg, dem Archäologischen Institut der Universität Köln und der Winckelmann-Gesellschaft Stendal aus dem Bestand des DAI rund 2.700 alte und historische Drucke aus den Jahren 1500 bis 1920 zur Archäologie und Altertumskunde retrodigitalisiert werden (Abb. 1,[1] Abb. 2a und Abb. 2b). Insgesamt stehen seitdem rund 610.00 Seiten im Open Access in iDAI.objects/Arachne zur Verfügung.[2]

In einem zweiten DFG-Projekt mit dem Titel „Die Antike in Zeichnung, Plan und Bauaufnahme"[3] konnten von 2012 bis 2016 wesentliche Bestände des Archivs der Abteilung Rom des DAI digital zugänglich gemacht werden. Es handelt sich um fast alle Blätter des sog. „Archäologischen Apparats" aus der Zeit des „Instituto di Corrispondenza Archeologica" und aus den frühen Jahren des Deutschen Archäologischen Instituts. Insgesamt sind es rund 6.550 Zeichnungen, Aquarelle und Pläne aus der Zeit 1829–1915 (Abb. 3). Hinzu kommen gut 6.350 Blätter mit Bauaufnahmen und Grabungsdokumentationen der Abteilung Rom nach dem Zweiten Weltkrieg, die vor allem die Unternehmungen in Großgriechenland und Sizilien betreffen, aber auch solche in Rom und Umgebung, in Nordafrika sowie an anderen Orten (Abb. 4). Die Bücher und Dokumente sind nicht nur weltweit frei konsultierbar, sondern die Einbettung in die vernetzte Forschungsumgebung iDAI.welt (Abb. 5) bietet zusätzlich die Möglichkeit, sie mit antiken Monumenten und Objekten, mit Personen, Orten und Sammlungen in Beziehung zu setzen und in ihrem Kontext darzustellen. Auch die Integration in externe Datensammlungen ist erwünscht. So greift beispielsweise die Datenbank ICAR, Iconographie et archéologie pour l'Italie préromaine[4] direkt auf DAI-Datensätze zur Dokumentation etruskischer Grabmalereien zu.

Die digitale Bereitstellung und Erschließung von Archivmaterialien wird mit dem 2017 begonnenen DFG-Projekt „Gelehrte, Ausgräber und Kunsthändler: Die Korrespondenz des Instituto di Corrispondenza Archeologica als Wissensquelle und Netzwerkindikator" fortgesetzt,[5] welches sich mit den rund 25.000 Gelehrtenbriefen der Abteilungen Rom und Zentrale beschäftigt, die in den Jahren 1829–1915 verfasst

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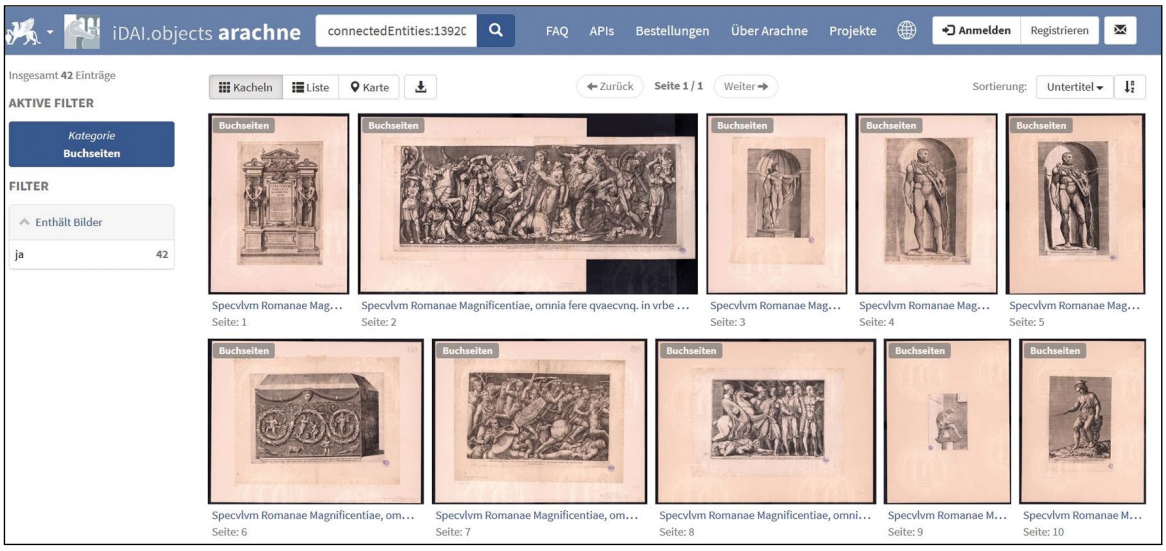
Abb.1: A. Lafréry, Specvlvm Romanae Magnificentiae (I), Rom 1519–1589. DAI, Abtlg. Rom, Bibliothek K 266 gr.fol. rara (1). Visualisierung in iDAI.objects/Arachne.

worden sind. Weiterhin erfolgt im Rahmen dieses Projektes unter anderem auch die Auswertung und Visualisierung von Netzwerken, bezogen auf Korrespondenzpartner, erwähnte Personen, Ortsangaben und Zeiten (Abb. 6).

Mit diesen und ähnlichen Projekten arbeitet das DAI daran, seine analogen Bibliotheks- und Archivbestände nach und nach in digitaler Form verfügbar zu machen.

Eine wichtige Hauptaufgabe der DAI-Bibliotheken ist aber auch die kontinuierliche Informationsversorgung der Wissenschaftler an den verschiedenen Standorten im In- und Ausland. In diesem Zusammenhang wird die in den letzten Jahren deutliche Zunahme an digitalen Publikationen im Bereich der Altertumswissenschaften als Chance gesehen, das Informationsangebot an allen Abteilungen und Kommissionen zu verbessern. Hierzu betreibt das DAI seit 2015 eine konsequente, gemeinsame Erwerbungspolitik, die darauf abzielt, möglichst alle digitalen Erwerbungen an allen Standorten zugänglich zu machen. Auf Grund der besonderen Situation mit 18 Einrichtungen sehr unterschiedlicher Größe in 13 verschiedenen Ländern[6] gestalten sich die Verhandlungen mit den Anbietern wie Verlagen und Plattformen dabei nicht immer einfach. Die gemeinsame Erwerbung als DAI-Konsortium verbessert aber überall nachhaltig das Informationsangebot, da digitale Publikationen aus allen Sparten der Archäologie von der Urgeschichte bis zur spätantiken Kunstgeschichte nun an allen Standorten zur Verfügung stehen, was besonders interdisziplinären Forschungsansätzen zu Gute kommt. Auch arbeitsökonomisch ist die gemeinsame Erwerbung der elektronischen Publikationen sinnvoll, da die notwendigen Vorgänge, die teilweise komplexe Herausforderungen beinhalten, an einer Stelle zentralisiert bearbeitet werden können. Die technische Abwicklung der Erwerbung von der Verhandlung mit dem



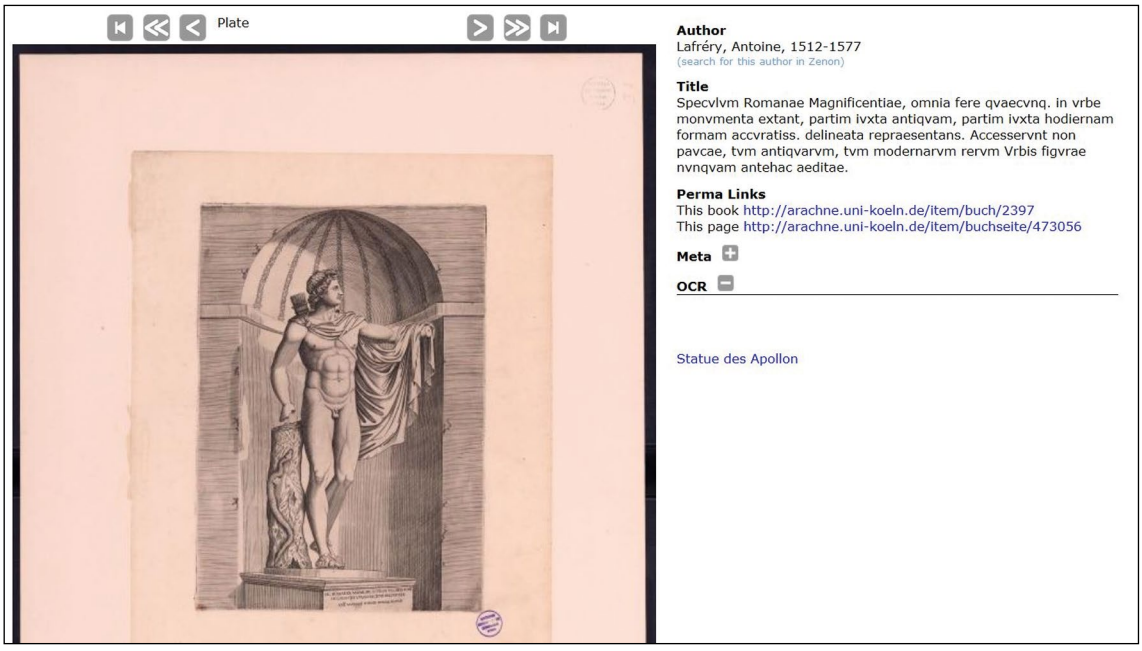


Abb. 2a, 2b: A. Lafréry, Specvlvm Romanae Magnificentiae (I), Rom 1519–1589. DAI, Abtlg. Rom, Bibliothek K 266 gr.fol. rara (1). Visualisierung in iDAI.objects/Arachne.

Anbieter, über die eigentliche Bestellung bis hin zur Katalogisierung und Kommunikation an alle Abteilungen erfolgt zentral von einer Bibliotheksstelle aus, die derzeit in Rom angesiedelt ist. Die Erwerbungsentscheidungen treffen hingegen weiterhin nach inhaltlichen Gesichtspunkten die einzelnen Abteilungen und Kommissionen, welche ihre Wünsche nach Rom kommunizieren. Zum jetzigen Zeitpunkt stehen etwa 28 Zeitschriftenpakete mit ca. 9210 elektronischen Zeitschriften den Bibliotheksnutzern

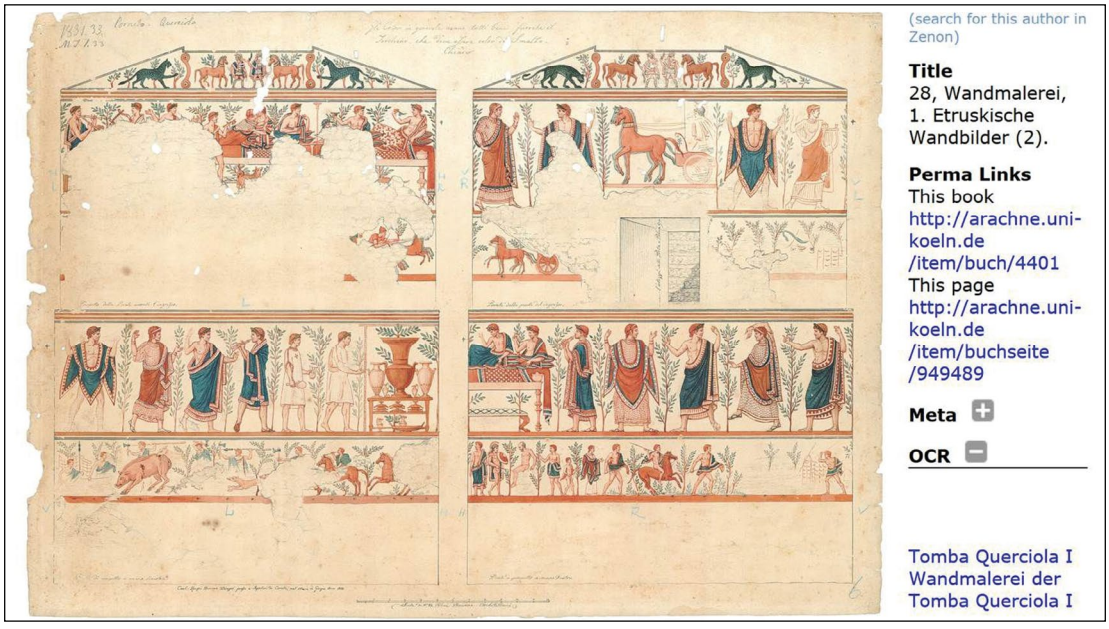


Abb. 3: C. Ruspi, Corneto (Tarquinia), Tomba Querciola. DAI, Abtlg. Rom, Archiv Inv. A-VII-28-003. Visualisierung in iDAI.objects/Arachne.

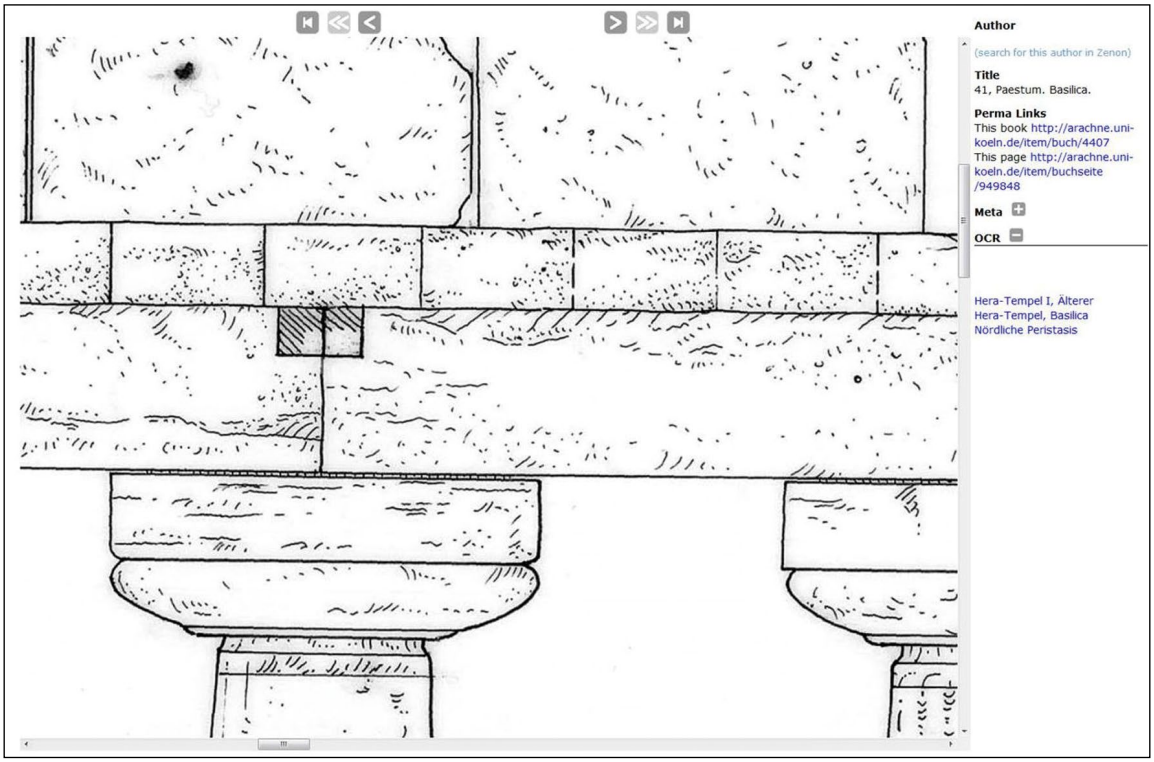


Abb. 4: Paestum, Hera-Tempel, Nordseite (Detail). DAI, Abtlg. Rom, Archiv Inv. B-41-41-012. Visualisierung in iDAI.objects/Arachne.

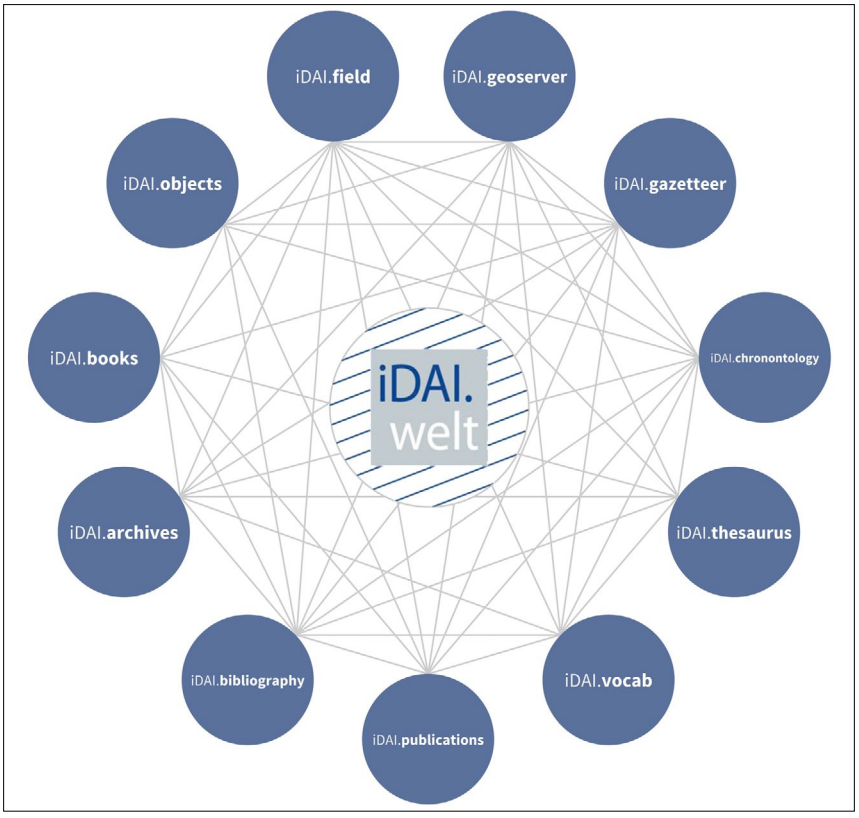


Abb. 5: iDAI.welt.

des DAI zur Verfügung, davon 120 kostenpflichtige Zeitschriften bis zur aktuellen Ausgabe. Im Bereich der E-Books sind derzeit rund 1400 kostenpflichtige Titel verfügbar. Kostenpflichtige Datenbanken wie die L'Année Philologique kommen hinzu.

Der Einstieg in die konsequente gemeinsame Erwerbung von E-Publikationen hat zusätzliche Mittel erfordert, die vom DAI selbst zur Verfügung gestellt worden sind. In den kommenden Jahren ist aber damit zu rechnen, dass diese Ausgaben durch Einsparungen im Print-Bereich zumindest teilweise kompensiert werden können. Dies dürfte vor allem auf Zeitschriften zutreffen, bei denen dank der Online-Ausgabe auf parallele Print Abonnements an mehreren Standorten verzichtet werden kann.

Das DAI nimmt auch an einigen der von der DFG geförderten Allianzlizenzen[7] teil, die kostengünstige Paketeinkäufe ermöglichen.

Der elektronische Bestand an Zeitschriften wird vom DAI auch in der „Elektronischen Zeitschriftenbibliothek Regensburg (EZB)"[8] nachgewiesen, der wohl umfassendsten und aktuellsten Datenbank für kostenpflichtige und kostenfreie E-Journals.

Gemeinsam mit den Printbeständen werden die elektronischen Publikationen im DAI-Verbundkatalog iDAI.bibliography/ZENON nachgewiesen,[9] der seit 2002 existiert und einen Datenbestand von ca. 1,3 Millionen Datensätze umfasst. Er ist mehr als ein reines Bestandsverzeichnis der vorhandenen Monographien, denn für einen

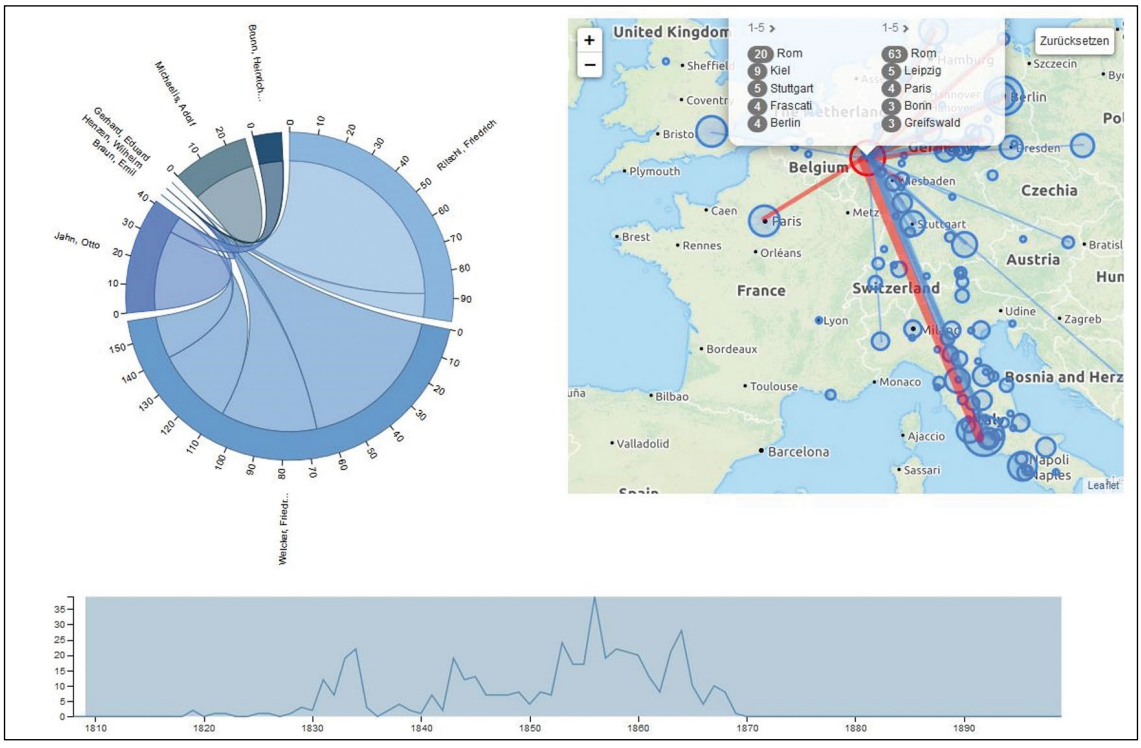


Abb. 6: Testumgebung Visualisierung Gelehrtenkorrespondenz-Netzwerk.

Bibliothekskatalog unüblich und im Bereich der Altertumswissenschaften einzigartig verzeichnet er mit eigenen Titelaufnahmen auch hunderttausende unselbstständiger Titel, sprich Aufsätze, und erfreut sich daher großer Beliebtheit.

Allerdings stößt das bisherige Nachweissystem in Bezug auf die elektronischen Angebote zunehmend an seine Grenzen. Vor allem bei umfassenden Paketeinkäufen und einem ständig wachsenden Angebot an Open Access-Publikationen müssen für eine konsequente, laufende Verzeichnung neue technische Wege beschritten werden. Mit dem Einsatz eines Resource Discovery Systems (RDS) können Daten des Bibliothekskataloges sowie weitere Datenquellen (beispielsweise alle JSTOR-Artikel) gemeinsam durchsucht werden. Derzeit wird deshalb auch daran gearbeitet, ein derart komfortables Rechercheangebot für iDAI.bibliography/ZENON umzusetzen.

Abschließend sei noch einmal auf die iDAI.welt hingewiesen. Die Daten der Infrastrukturangebote der iDAI.welt werden zunehmend miteinander vernetzt. So wird auch das Angebot an bibliographischen Daten in iDAI.bibliography schrittweise mit den Fachsystemen der iDAI.welt verschränkt. Monographien bzw. Aufsätze in iDAI.bibliography sind bereits zunehmend automatisiert mit Datensätzen in iDAI.objects/Arachne[10] vernetzt, bzw. Objektdatensätze in iDAI.objects referenzieren auf Einträge in iDAI.bibliography (Abb. 7[11]). Gleiches gilt für die Vernetzung zwischen iDAI.bibliography und iDAI.gazetteer,[12] dem webbasierten Normdatenservice des DAI für Ortsnamen.[13] Im Rahmen des durch die DFG geförderten Projektes Fachinformationsdienst

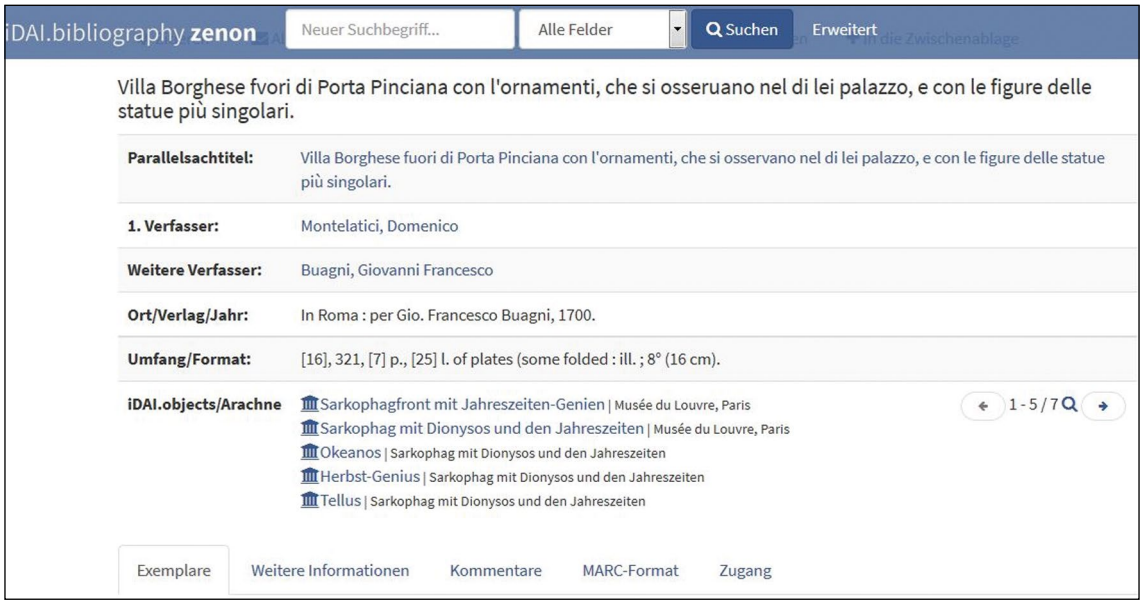


Abb. 7: iDAI.bibliography.

Altertumswissenschaften Propylaeum,[14] hat das DAI in einem Arbeitspakte u.a. ein Konzept für Match- und Merge-Verfahren zwischen iDAI.gazetteer und Ortsnamen der Gemeinsamen Normdatei der Bibliotheken (GND) entwickelt, um einen Brückenschlag zwischen wissenschaftlicher Fachanwendung und dem Bibliotheksbereich herzustellen. Durch die Vernetzung beider Datenbestände entsteht ein Mehrwert, der unter anderem in die Metasuche PropylaeumSearch einfließen wird.

Um die Vernetzung der Daten innerhalb der iDAI.welt zu verstärken, ist ein DAI. welt-Thesaurus in Arbeit, mit dem eine Neustrukturierung und Vereinheitlichung der bestehenden Vokabulare und Thesauri der einzelnen Abteilungsbibliotheken und Forschungsprojekte des DAI angestrebt wird.[15] Der neue Thesaurus wurde in Anlehnung an den BackBoneThesaurus von DARIAH-EU gegliedert[16] und soll zukünftig als Einstiegs- und Strukturierungswerkzeug für die Rercherchеplattform der iDAI.welt dienen.

Der Ursprung einer archäologischen Systematik und späteren Sacherschließung durch intellektuelle Verschlagwortung an der Bibliothek des DAI Rom ist im sog. Realkatalog von Emil Braun aus dem Jahre 1836 zu suchen.[17] Später wurden diese Bemühungen fortgeführt, so in dem von August Mau begründeten „Realkatalog“[18] bis hin zur „Archäologischen Bibliographie“,[19] die schließlich in eine digitale Umgebung überführt worden ist und heute in iDAI.bibliography/ZENON zur Verfügung steht. Angesichts der Vielzahl an elektronischen Publikationen und hybriden Informationsangeboten, die umfangreiche Volltexte zur Verfügung stellen, müssen jedoch heute neue Wege beschritten werden. Aus diesem Grund treten an die Stelle der intellektuellen Verschlagwortung nun automatisierte Verfahren (Textmining), welche den neuen iDAI.welt-Thesaurus nutzen.

Anmerkungen

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[1] <arachne.dainst.org/entity/1392080> (28.08.2020).
[2] <https://arachne.dainst.org/project/rezeptionantike> (28.08.2020).
[3] <https://arachne.dainst.org/project/handzeichnungen> (28.08.2020).
[4] <http://icar.huma-num.fr/web/fr/> (28.08.2020).
[5] <https://arachne.dainst.org/project/gelehrtenbriefe?lang=de> (28.08.2020).
[6] <https://www.dainst.org/dai/standorte> (28.08.2020).
[7] <https://www.nationallizenzen.de/> (28.08.2020).
[8] <https://ezb.uni-regensburg.de/> (28.08.2020).
[9] <https://zenon.dainst.org/> (28.08.2020).
[10] <https://zenon.dainst.org/Record/000868365> (28.08.2020).
[11] <arachne.dainst.org/entity/1075037> (28.08.2020).
[12] <https://zenon.dainst.org/Record/001350177> (28.08.2020).
[13] <https://gazetteer.dainst.org> (28.08.2020).
[14] <https://www.propylaeum.de/home/> (28.08.2020).
[15] S. Thänert – C. Colombi – L. Vitt, iDAI.thesauri, e-Forschungsberichte des DAI 2017, 1, 7–11: <https://publications.dainst.org/journals/efb/1944/6084> (28.08.2020).
[16] <https://vocabs.dariah.eu/backbone_thesaurus/en/>; <http://www.backbonethesaurus.eu/>
[17] (28.08.2020).
[18] T. Fröhlich, 1836 – Emil Braun und der erste Bibliothekskatalog des Archäologischen Korrespondenzinstituts in Rom, Archäologie Weltweit 2, 2016, 36. A. Mau, Katalog der Bibliothek des Kaiserlich Deutschen Archäologischen Instituts in Rom, neu bearb. von Eugen von Mercklin, Rom, 1913–1932.
[19] Archäologische Bibliographie hg. vom Deutschen Archäologischen Institut, Berlin 1932–1993.

Bildnachweis

Abb.1–4: iDAI.objects/Arachne. – Abb. 5: iDAI.welt. – Abb. 6: Testumgebung Visualisierung Gelehrtenkorrespondenz-Netzwerk. – Abb. 7: <https://zenon.dainst.org/Record/000868365> (28.08.2020).

Classical Archaeology is a discipline which has undergone major changes in recent decades. From its origin as an "Altertumswissenschaft" with a strong emphasis on art and architecture, Classical Archaeology has embraced the most modern methods in field archaeology and analysis of data. The application of digital humanities to Classical Archaeology has changed how archaeologists work, how data is collected and preserved, and how results are made available to the scholarly community and the public in general. The International Association for Classical Archaeology (AIAC) has been a forerunner in digital humanities with the creation and running of Fasti Online and the online peer-reviewed journal FOLD&R. This volume contains papers presented at the panel organized by AIAC in order to present the digital development of the discipline through examples from different countries. It is hoped that the case studies will provide a basis for a discussion on Classical Archaeology in a digital world – benefits, challenges and where the fast development may take our discipline in the future.

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