

Project Whitepaper

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Project Title: ARCS: Archaeological Resource Cataloguing System

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Rationale

With significant improvements in costs and ease of use, digital methods and computational approaches have become indispensable to archaeological research, preservation, curation, and public engagement. Vector-based and CAD software is used to illustrate artifacts, monuments, and draw excavation maps. Geographic Information Systems (GIS) are employed to generate digital site maps, create models of land use, and to do sophisticated spatial analysis. Digital photography, laser scanning, and LiDAR are used to capture both 2D and 3D imagery of archaeological landscapes, sites, excavations, and artifacts. All of this data is now stored and analyzed on laptops and tablets, which now provide ubiquitous access to excavation records in the field. These technologies are just some of the hallmarks of a new phase of “digital archaeology,” in which electronic records, imagery, maps, field journals, and repositories for the storage, management, and access of data are the norm.

As exciting as these developments may be for archaeological research that began in the digital age, projects with much longer histories and more traditional recording techniques are often left to determine for themselves how best to apply digital methods and computational approaches to archaeological data and information that was recorded and generated before this digital revolution. The importance and advantages of digitizing primary documents for “pre-digital” archaeological projects are clear enough. If properly developed and managed, digital repositories for legacy materials such as site forms, photographs, and field journals serve as an excellent way to provide access to records that are themselves artifacts of an earlier era. Perhaps even more importantly, thoughtfully conceived digital repositories can expose this previously “hidden” legacy data and grey literature to the broader digital archaeological data ecosystem.

At the same time though, the push to digitize older projects’ records has brought with it many challenges. Digitization is an expensive and lengthy process. As such, all but the most well-funded excavations have been able to systematically digitize their their legacy excavation records, photographs, and field journals. This has had the unfortunate effect of privileging the information from well funded sites and projects over those projects that don’t necessarily have the funds our resources to engage in long term digitization of their legacy materials. Moreover, projects that have decided to take on the challenge of digitizing their legacy materials face the difficult question of how to build and launch a platform that provides access to the digitized materials in such a way that the structure and essential character of the original physical archive isn’t lost.

It is important to recognize that many archaeological projects have developed their own idiosyncratic systems of documentation that depend on multiple forms of evidence that function together to give scholars the fullest impression of the past. Depending on the types of scholarly questions asked, certain types of data and information within these systems are clearly more important than others. Yet, the transformation of a collection of physical records into separate digital files runs the risk of creating a false sense of equivalency among all data. This is

especially the case in digital repositories, where the critical relationships and hierarchies between types of data and information are masked by the uniform appearance of digital files. Thus, in the growing world of digital archives, and repositories, data sharing and linked open data, it is more likely that an archaeologist will use (and perhaps misuse) information without firsthand knowledge of the underlying interpretive structure that provides critical context. What is more, in the generally isolated environment of digital repositories, there is typically no one present to provide the type of institutional knowledge and guidance that remains one of the strengths of being physically present at a site where that knowledge and experience is almost always present..

With these concerns in mind, we developed the Archaeological Resource Cataloging System (ARCS), an open source, web-based digital platform that allows any archaeological project to store, annotate, organize and display digitized legacy materials such as photographs, field journals, and excavation records in a way that reflects its unique identity and organizational structure.

Project Goals

With the support of an National Endowment for the Humanities Digital Humanities Start-up grant a small team of archaeologists, designers, and programmers had created a proof-of-concept version of ARCS that was used to assist the Ohio State University Excavations at Isthmia in the initial stages of its archival digitization project. The prototype version of ARCS showed great potential, but also revealed the need for additional development. Thus in collaboration with Michigan State University's MATRIX: The Center for Digital Humanities & Social Sciences, representatives from the Ohio State University Excavations at Isthmia, the Princeton Polis Expedition Medieval Monuments Project, University of Texas/National Preserve of Tauric Chersonesos Excavations at Chersonesos and the University of California, Berkeley Excavations at Nemea, with the guidance of an advisory committee, and with additional funding in the form of a National Endowment for the Humanities Digital Humanities Implementation grant, the ARCS team sought to improve the system in the following ways.

1) **Restructuring of the ARCS architecture** (*goal achieved*): Because the original ARCS project did not include the data management, preservation, and access features commonly associated with a digital repository, a primary project goal involved the adoption KORA, (<http://kora.matrix.msu.edu/>) as the backbone of the new version of ARCS. KORA is a free and open source digital library platform developed and supported by MATRIX.

2) **Adoption of a metadata standard** (*goal achieved*): The development of the original ARCS did not take into consideration the critical role that well-structured metadata plays in the efficient organization of a digital archive. Thus, a main goal of the ARCS project was to implement a metadata standard designed for archaeological / material cultural

applications. As part of the project, the ARCSCore Metadata Standard (discussed in detail below) was developed, published, and fully implemented withn ARCS

3) Import/Export Utility and Ontology Mapping (*goal achieved*): The original development of ARCS was focused on interacting with digitized documents that had already been added to the system. Yet, in order to make sure that ARCS could be easily adopted by archaeological projects with pre-existing digitized legacy materials but a shortage of technological support, it was necessary to develop a set of utilities that could allow files to be imported into the system and their associated metadata to be “mapped” onto the fields in the ARCSCore Metadata Scheme used in ARCS. At the same time, it was also important to support data portability by allowing project directors and participating researchers to export documents and data out of an instance of ARCS for additional analysis or archival-level storage and preservation elsewhere.

4) Improved monitoring of user access and activity (*goal achieved*): ARCS was conceived as a platform to assist archaeological projects without the necessary resources and capacity in their effort to provide easy and useful access to their legacy records. Because such efforts often involve community-based input and collaboration, it was critical to provide project administrators with the ability to monitor users’ interactions with the ARCS installation. On the other hand, not all projects wish to provide all visitors to their ARCS installation with unfettered access to all the projects materials and data. As such, it was also necessary to develop a sophisticated system in which project directors could limit and grant various levels of access to materials. These features required the development of a robust user account creation and authentication system.

5) Improved user experience (*goal achieved*): Within a short time of its completion, use of the prototype version of ARCS began to reveal user experience issues. As such, it was the goal of this phase of the project to re-design the user experience of ARCS. Of particular interest was to ensure that the new ARCS user experience was mobile friendly.

5) Linked Open Data Support (*goal achieved*): In an effort to make the data in ARCS as open as possible, the project strove to follow standards that have already been established in other ancient world and archaeological linked data projects. As such, all digital objects included in an ARCS installation have a stable URI so that they can be referenced by other LOD platforms. The added benefit to this is that, with a stable URI, digital objects can also be usefully referenced in traditional publications.

6) Installation Wizard (*goal achieved*): Because the original version of ARCS had been custom built by a team of programmers and designers to match the organizational structure of a single archaeological project, it was clear that a wider use of the software would require the development of an installation utility and associated documentation in order to simplify the process of installing and customizing ARCS in another setting.

7) **Hosted and Installed Versions of ARCS** (*goal achieved*): Understanding that many archaeological projects lack the necessary personnel to maintain a self-installed version of this program, it was necessary to develop a protocol for projects to be hosted and maintained at MATRIX. Yet it was also a goal to create a stand-alone version of ARCS for those projects who wished to install the platform on their own server infrastructure. .

Products / Outputs

The two most important products of this project are the ARCS software and the ARCSCore metadata standard, both of which are now available on GitHub (<https://github.com/matrix-msu/arcs> and <https://github.com/matrix-msu/ARCSCore>) along with the KORA digital asset management software that serves as the underlying backbone of the system (<https://github.com/matrix-msu/Kora3>).

In order to meet the original goals of the ARCS project, the following tools, features, and utilities were developed, tested, and launched during the grant period:

1) **KORA**: While ARCS provides visitors with an intuitive interface for working with digitized copies of archival documents (termed “resources” in ARCS), the original version of the project didn’t feature an underlying digital repository platform. In this new version of ARCS, the backbone of the system is KORA, an open source digital library platform geared towards the preservation of and access to complex digital media objects (text, images, audio, video). Created by MATRIX, KORA allows for the management, management, and search of all of an ARCS installation’s underlying digital objects and associated metadata. KORA 3, the newest version of KORA, was developed in parallel to this new version of ARCS.

2) **ARCSCore Metadata Scheme** (Appendix 1): Because of the complexity of the cultures they study, archaeological projects in various parts of the world have adopted and adapted a wide range of systems for organizing archaeological information. The unfortunate result is that no two project are identical in the way in which they record and organize archaeological data and materials. . ARCS recognizes the need to preserve this diversity as archaeological archives are moved from paper and film to digital formats. This is achieved through ARCSCore, a metadata schema that organizes digitized archaeological records according to the type of documentation used by a project rather than the objects and monuments that have been uncovered.

ARCSCore is based on the ArchaeoCore (<http://www.ifaresearch.org/archaeocore/>) metadata schema created by Lucie Stylianopoulos and Ann Burns for use in conjunction with the Artstor Shared Shelf digital repository.

Like most metadata schemata, ARCSCore is organized in several “nesting” levels of detail from the most general to the most specific. At the PROJECT level, ARCSCore records information about the overarching archaeological enterprise, including the project’s administrative details (permitting body, etc), the site’s physical details (country location, elevation, etc) details, and the site’s archaeological details (period, archaeological culture, etc). Next, at the SEASON level, ARCSCore records information about each period of time (season/campaign) during which archaeological research was conducted at the site or study area. At the EXCAVATION/SURVEY UNIT level, ARCSCore records information about each field data collection unit where archaeological research was conducted. At the RESOURCE level, ARCSCore records information about each archival document (field journal, map, photograph, etc.) created during the archaeological research. At this level, metadata for each archival resource is divided into three thematic units:

1. information concerning the original archival document
2. information concerning its digital copy
3. information concerning the archaeological material culture that this document describes.

At these most detailed levels of ARCSCore, it may be necessary to customize the controlled vocabularies that will appear alongside a resource in ARCS. Edits to ARCSCore options for controlled vocabularies are made in KORA3. The ARCS team strongly recommends that projects maintain separate documentation concerning their own unique controlled vocabularies.

While it is not required, most information related to a specific archaeological project (PROJECT, SEASON, EXCAVATION/SURVEY UNIT level metadata) can be recorded in ARCSCore at the time of initial installation of ARCS. ARCSCore metadata can be edited or augmented through the KORA3 interface at any later point in time.

2) Import Utility: Project administrators can import new resources into ARCS by using the KORA interface. First, files containing digitized archival documents should be added to the system in JPG format. This can be done by selecting a file or group of files by means of the KORA3 browser or by dragging and dropping files into the import utility interface. Similarly, files containing associated metadata (in XML or JSON format) are added to the system after the digital objects have been uploaded. KORA then checks the files and metadata for any discrepancies before completing the import process.

3) Open and Private Resources: While the ARCS team encourages all archaeological projects to adopt open access policies for archival documents that do not place sites, artifacts, or collections at risk, some projects may wish to restrict access to some of their archaeological information. As a result, the KORA platform on which ARCS is built

allows project administrators to set whether a resource is visible to the public, restricted to users with an ARCS account, or visible only to designated users who've been given express permission by the administrator to view the resource.. The public / private / special status of a resource may be determined upon upload or changed at a later point in time by a project administrator..

4) **Community-sourced metadata augmentation:** While many forms of metadata can be recorded quickly and with little additional effort at the time of data capture, other forms of metadata require much more intensive investigation of the documents. Therefore, ARCS is now able to allow digitized documents to be imported into a project with minimal metadata (resource title, resource type, and season). Once the digitized documents and the associated metadata have been imported, additional edits can be made through the ARCS Resource View interface.

To add metadata for a resource, individuals must open the digital record in Resource View. Any field at any level in the ARCScore metadata scheme can be edited by selecting the preferred level, then choosing "EDIT." Depending on the field, metadata is either entered directly into the associated text field or selected from a controlled vocabular dropdown menu. Each change to a metadata field must be approved by an individual with "Moderator" or "Administrator" status before it is displayed to a project's overall community.

Note: Individuals who wish to edit metadata through the resource view interface must be logged into their own ARCS account. See item #11 below for the creation and management of user accounts.

5) **Link Documents within ARCS:** Many forms of documentation in an archaeological archive can only be understood in combination with other documents (e.g. a grid reference in a field journal requires access to a site map or plan). ARCS allow users to create these connection between resources using the Annotation Utility. Linked resources can be located within or outside a project's ARCS (e.g. open access publications, internet databases and repositories, other projects' online archives), provided they have unique stable identifiers. Additionally, resources to which annotative links have been made can be linked back to the point of origin for the annotation. Annotations appear over a resource by default as a semi-transparent blue shape, but these can be switched off if they are deemed too distracting.

6) **Transcriptions/Translations:** Many archaeological documents are created in the midst of active fieldwork and, as a result, are often challenging to read or interpret. Other documents may appear in languages that are not common to the archaeological project. In order to address this challenge, ARCS provides a tool that allows users to manually transcribe or translate the text in a resource and then attach it to that resources, This in turn allows subsequent individuals to view both the original

document and its textual content side by side, as well as offer edits to improve the transcription.

7) **Keywords:** In those cases where a digitized document contains information that cannot be easily transcribed or entered into a specific metadata field, ARCS has been equipped with a tool that allows users to enter associated keywords. These user generated keywords enhance the discoverability of resources within an ARCS installation. .

8) **Conversation:** One of the benefits of work in a physical archive or an archaeological repository is the “institutional knowledge” held by certain scholars, collections managers, and archivists. These experts often serve as critical resource for individuals who are beginning to explore a collection of archaeological records. ARCS not only retains but builds upon that benefit by providing each resource with its own discrete discussion space. This allows researchers to ask questions, provide answers, or engage in a conversation with other scholars in a way that does not require all to be in the same place at the same time. A resources with an active discussion is indicated by an icon that appears beneath the thumbnail image in a search result or collection view.

9) **Build and Curate Collections** ARCS was designed in part to serve as a digital collaboration space / virtual research environment in which individuals can gather, organize, share, and discuss collections of resources with a larger community of archaeologists. In order to facilitate this, any public resources (or private resources to which an individual has access) can be gathered into a collection. Individuals can create new collections or add resources to existing collections. In order to protect the security of research projects in progress, collections can be marked private, rendering them accessible only to those with special permission.

All open collections that have been created for an ARCS project can be accessed through the COLLECTIONS tab. In addition, each collection its own unique stable URI, allowing individuals to reference and share collections with others via a single hyperlink. If a collection contains resources that have been designated “private,” an ARCS admin can give individual “special” status within KORA, which allows them to access these resources.

In addition, each individual resource also indicates any collections to which it belongs. This information is displayed in the collections shelf in the details tab to the right-hand side of a resource displayed in resource view, and is be a good way to serendipitously connect with other scholars who may be engaging in similar lines of archaeological investigation.

10) **Export Utility:** While ARCS is designed to assist projects to organize, improve, and share digitized legacy archaeological the system does not offer any quantitative or

spatial analytical tools. Even more importantly, ARCS is not intended to be used a preservation environment for digitized archaeological materials and data. In order to address these issues, all resources can be exported from an ARCS installation as XML or JSON. The result is a high degree of data portability, allowing users to move data into analytical tools or preservation environments.

11) Manage user accounts and permissions: Most archaeological archives and repositories have a system of seniority and access privileges which ensure that the most important tasks of documentation, curation, and dissemination are managed by those with the most experience and best understanding of the overall history and goals of the project. This is especially important in cases when archaeological research serves an alternate educational function or when a project relies upon the contributions of less experienced scholars or students.

Similarly, an ARCS installation features restrictions that govern individuals' ability to access and edit a project's resources and associated metadata. Individuals who wish to join a project first must create an account by registering a unique username and password on ARCS. As part of the account creation process, individuals indicate the projects for which they would like to have editing privileges. Upon completion of this process, the system notifies the administrator of the project for which the user has requested access and editing privileges. Administrators may approve or delete these requests on the "Pending requests" tab of the Admin utilities page. ARCS has four levels of user access:

Public: Public access is the base type of user account. It does not require the creation of an account, and allows users to search and view all resources (and associated discussions, transcription, and keywords) that have been designated as "Public." Individuals with this permission can complete the following tasks.

Researcher: Researcher status requires the creation of an ARCS account. In addition to all Public level access, users with Researcher level accounts can (1) export search results, (2) create or add to collections, (3) add annotations to resources, (4) add transcripts to resources, (5) start and participate in discussions, (6) add/delete keywords, (7) suggest edits to metadata, and (8) flag items (metadata, transcripts, annotations discussions).

Moderator: In addition to all Public and Researcher level privileges, users with Moderator level accounts can carry out the following tasks in the KORA 3 interface: (1) view user activity, (2) invite users to an ARCS installation, (3) approve/reject metadata, and (4) approve/resolve user submitted flags

Administrator: The highest account level, Administrators can carry out all of the following tasks using the KORA3 interface: (1) create projects, (2) import data and digitized materials, (3) manage all user accounts for an ARCS installation, (4) delete discussions, (5) delete resources, and (6) edit all project metadata.

12) Keyword Search and Advanced Search Functionality: One way in which ARCS represents a significant improvement over traditional archaeological archives is in the ability it provides visitors to search across thousands of digitized documents in a fraction of the time. There are three types of search in ARCS:

- **Keyword Search:** The basic or “keyword” search looks at the most commonly used metadata fields in an ARCS installation ARCS provides users with a , which will scan a limited subset of the most commonly used metadata fields:
 - Title
 - Resource Identifier
 - Resource Type
 - Date Created
 - Accession Number
 - Object Classification
 - Object Type
 - Object Period
 - Object Material
 - Object Technique
 - Object Dates of Production
 - User-generated Keywords

- **Advanced Search:** For more granular searches, ARCS offers the ability to search across any combination of metadata fields. Initial search results may be narrowed by filters.

- **Cross-project Search:** In ARCS installations that host multiple archaeological projects, users are able to search across the resources of all included projects. The result is a much broader and potentially comparative perspective on the legacy archaeological records contained within the projects.

It should be noted that if participating projects have made some of their resources private, it may be necessary for individuals to first establish a user account and hold the status of “researcher” in those restricted projects. Perhaps even more importantly, because ARCS allows projects to import resources with a minimal amount of metadata, initial search results for underdeveloped projects may be incomplete.

13: Browsing Resources, Search Results and Collections: ARCS has been designed to improve upon, yet preserve, the same types of research practices that are commonly

followed in a physical archaeological archive or repository.. Often, this involves browsing a collection of resources in the hopes of serendipitously discovering something of value, rather than conducting a search for a specific document. In support of this approach,, ARCS provides individuals with a browse display of all resources in a project organized by type (field journal, photograph, line drawing, etc.). Users can explore resources in these categories or from a search using the Collection View. This allows individuals to browse resource like pages in a book or through the scrolling display located below a displayed resource.

14: Flag metadata errors or incorrect annotations: ARCS is designed to enlist the help of dedicated individuals to improve the overall accessibility and usefulness of the resources included in an ARCS project. . Should individuals with “researcher” status notice errors with a resource’s metadata or annotations, , they can flag the issue and briefly describe the problem. When a resource is flagged, ARCS notifies project administrators who can determine the best resolution to the problem.

15: Installation Utility: The installation package and associated documentation allows any project or individual with the requisite hardware to set up their own “stand alone” version of ARCS. In addition, MATRIX continues to host the ARCS installation with the original four collaborating projects (Ohio State University Excavations at Isthmia, the Princeton Polis Expedition Medieval Monuments Project, University of Texas/National Preserve of Tauric Chersonesos Excavations at Chersonesos and the University of California, Berkeley Excavations at Nemea) on its own servers. These installations in particular will be maintained at MATRIX as a way to track use of the ARCS system and troubleshoot issues as the software continues to be developed and used. Also, MATRIX will continue to host a promotional website that describes the software and tracks its implementation in digitized archival projects anywhere in the world.

It is also significant that throughout the development and implementation process, members of the team have regularly reported on the progress in developing the ARCS software as well as some of the issues that the creation of an open source repository for (often unpublished) legacy data inevitably raised. This more formal dissemination of research progress has taken place at the following meetings and conferences.

1) Publications:

Frey, Jon M. “The ARCS Project: A ‘Middle Range’ Approach to Digitized Archaeological Records,” in *Proceedings of the 10th International Congress On The Archaeology Of The Ancient Near East*, in press).

Frey, Jon M., Timothy E. Gregory and Lita Tzortzopoulou-Gregory. “The Archaeological Resource Cataloging System (ARCS): A Better Way of Working with Digital Archives,” *Across Space and Time: Computer Applications and*

Quantitative Methods in Archaeology (CAA). Proceedings of the 41st International Conference, Perth, March 25-8, edited by A. Traviglia, 2015.

2) Presentations:

Frey, Jon M. "You Can Dig the Same Hole Twice: The Development of a Metadata Scheme for Archaeological Archives" MSU Library Endangered Data Lecture Series, April 18, 2017.

Frey, Jon M. "From Analog to Digital in Archaeological Archives," Annual Computer Applications and Quantitative Methods in Archaeology Conference, Atlanta, GA, March 14, 2017.

Frey, Jon M. "The ARCS Project – A 'Middle Range' Approach to Digitized Archaeological Records," 10th International Congress On The Archaeology Of The Ancient Near East (ICAANE), Vienna, Austria, April 28, 2016.

Frey Jon M. "Building ARCS Between Old and New Archaeological Research," CAP Café, March 31, 2016

Frey, Jon M. "Who Owns the Past? Evidence, Interpretation, and the Use of Digital Archaeological Data," AIA/SCS Annual Meeting, San Francisco, CA, January 7, 2016

Frey, Jon M. and Scott Schopieray. "Undergraduate Labor Ethics" Digital Humanities Reading Group, November 11, 2015

Challenges

Balancing flexibility / complexity and standardization: It has always been clear that archaeological recording systems are as diverse and unique as the ancient places and people that they seek to understand and describe. Taxonomies for material culture are so diverse (and often fiercely defended) as to render it difficult to impose a single, standardized system of classification. And while an archaeological "lingua franca" is without a doubt a desideratum, establishing a common vocabulary to describe both archaeological materials and the records that give them meaning fell well outside the limits of what is possible in the context of the funded project. At the same time, without a set of standards governing the description of archaeological data and materials, it is not possible to conduct even the most simple of searches across the records in an archive or repository.. This inherent conflict between a system that reflects the diversity of archeological recording systems and one that yields reliable, consistent, and meaningful results required that the ARCS team make difficult decisions at all stages of the project.

Metadata: One significant challenge concerned the development of a metadata schema that could be applied to archaeological records (field journals, excavation forms, maps, etc) for various geographic, cultural, and temporal settings. Collaboration with those who developed ArchaeoCore, as had initially been proposed, revealed that this metadata standard, with its focus on the archaeological object or monument, was not well suited to the needs of a system like ARCS, which is instead built to present digital copies of legacy archaeological documentation. Instead, it was decided that in order to function well for the widest range of digitized legacy archaeological documents, the ARCS system should be focused primarily on the format of the documentation rather than the information it contains (artifacts, features, archaeological landscapes, etc). For in spite of their various approaches to the study of the material past, archaeologists have consistently made use of a remarkably small number of recording techniques. This is especially the case for older excavations and surveys where for decades the bound field journal and the 35mm film camera were as universally used as the shovel and trowel.

In essence, there are three main components to any form of digitized legacy documentation: (1) the document itself, (2) its digital copy and, (3) the archaeological information that the document contains. Unlike other archaeological databases, ARCS would be focused on the first two components while at the same time enabling archaeological projects to determine for themselves how to structure the third. In this way, ARCS was modeled on the traditional operation of a public library where patrons request and retrieve a book, but are responsible for interpreting the information that this book contains.

This was a critical development for the ARCS project, but one that nevertheless required significant delays in the originally proposed work plan.

Privacy and the Protection of Intellectual Property: Although ARCS is built to provide open access to the types of legacy archaeological documentation that have traditionally been kept out of public view, it has always been understood that the system would need to accommodate some projects that wished to restrict access to materials for one reason or another. Thus, as described above, ARCS was built to empower project administrators to provide different levels of access to materials within their project. Unfortunately, creating a framework in which variable levels of access to resources could be implemented did not turn out to be as simple a matter as giving an individual a password or marking a single resource as “public” or “private.” Rather, the ARCS team decided that no fewer than four different user permission levels and three levels of resource accessibility were required in order to address all of the use scenarios that had been raised by the project collaborators. Exploring all of the possible permutations and ramifications (e.g. how best to share a collection of resources with a colleague who does not have permission on their own to see each of those resources individually?) proved to be very challenging. Ultimately, the work carried out resulted in an access and permissions model that recognizes the needs of certain projects and researchers to keep portions of their collections closed. .

Logic of Basic and Advanced Searches: One of the main shortcomings of the first version of ARCS was the inability of the underlying system to yield consistent and reliable search results in a timely fashion across a growing number of digitized resources and metadata. Certainly, substitution of the KORA digital repository platform for the bespoke database that was originally improved the reliability of searches in ARCS. However, in order to improve the speed of searching, the ARCS team concluded that it was necessary to distinguish between basic searches and more advanced queries of the data in a project's installation. Distinguishing metadata fields that were critical for all searches from those that could be left to more experienced users, and determining the logic for searches across complex expressions or taxonomy and chronology required much more lengthy periods of discussion and testing than the ARCS team could have reasonably predicted. In the end though, such careful consideration has yielded a much more reliable ARCS search utility.

Incomplete Data: Another issue that significantly impacted ARCS development was the approach to projects that began using the system with incomplete data. Given the many archaeological archives or repositories contain thousands of documents and that most projects have limited resources,, it is all but inevitable that the digitization process will last many years. Yet, it is equally likely that projects will wish to begin interacting with collections of legacy documents even in partially digitized form, especially in cases when the augmentation of a digitized collection utilizes a crowd sourced approach. Thus, the ARCS team needed to develop a workflow for importing new files into an already existing ARCS installation. Finally, so that resources uploaded without any associated metadata not become "lost" within an ARCS installation, it was necessary to create an "orphaned resource" category. In this way, the ARCS team has attempted to account for every possible scenario for the import of resources with incomplete data.

Before and after ARCS: As the above description clearly shows, ARCS has been equipped with a number of innovative utilities to help scholars with limited resources in their efforts to organize, curate, and share legacy archaeological records. At the same time, ARCS should not be considered a "one stop" solution for a project's needs. The limitations of the software is most evident in two significant ways.

Preparation of the digital files / metadata: As an online cataloging system, ARCS deals exclusively with copies of legacy archaeological documents that have already been digitized ahead of time. This means that the important process of creating a digitized version of a document remains the responsibility of each archaeological project. Therefore, depending on the equipment and staff available, the end result of this digitization process is likely to be of varying quality. The ARCS team strongly recommends that archaeological projects seek out and follow the standards (e.g. scan settings, resolution and file formats) of the professional / publication organizations that are most applicable to their field of study, but acknowledges that adherence to these standards is likely to be variable.

Furthermore, while the installation process for ARCS allows a project administrator to map their own field names onto the ARCSCore metadata scheme,, the actual metadata must still be properly prepared in advance for every digitized archival document that is uploaded to the system. To be sure, ARCS does allow an administrator to generate a minimum amount of metadata at the moment of import, but this process only works with batch uploads of many files that share a common set of characteristics (e.g. of a similar document type or time of original creation). As a result, in addition to overseeing the digitization process according to a set of established standards, project administrators are also responsible for ensuring that metadata is properly recorded for digital files in a format that can be imported into ARCS.

Long term storage: From the first stages of development, the ARCS team has attempted to be as clear as possible that the platform is not a long term preservation environment. Rather, ARCS fits within a larger landscape of digital solutions in that it allows scholars to augment (e.g. transcribe, link, discuss, organize into collections) copies of legacy archaeological documents that have already been digitized. This enables projects to move in a productive direction toward the goal of secure, long-term preservation of data provided by services such as the Digital Archaeological Record (tDAR) and the Archaeology Data Service (ADS). To this end, ARCS has been equipped with an “export data” utility that packages a JPG image of an individual resource with all of its associated metadata in either JSON or XML format. This data can then be bundled and uploaded to a long term preservation environment. One potential challenge to this process concerns the fact that for optimal performance, ARCS works best with files in JPG format, which is not an archival format. As a result, projects will likely need to create preservation copies of image files at the time of digitization to be used as a replacement for the exported JPG. This will likely require a considerable investment of time in order to prepare data processed in ARCS for long term preservation.

Future Directions

While the grant period may have ended, development of the ARCS platform will continue. This will take place in the following ways.

Continuing Implementation: Because of the delays caused by the addition of unforeseen, yet necessary stages in to the development process for ARCS, full and complete implementation of the software has not occurred at each of the four archaeological projects that served as the original collaborators on this implementation grant. As a result, MATRIX has agreed to continue to invest its own resources toward the fulfillment of its original commitments. This will provide the ARCS team with the opportunity to continue testing the software in these different archaeological / archival environments. At present this testing and evaluation will take the following forms:

Project director feedback: As ARCS comes to be more extensively used, evaluative responses will be requested from excavation/survey directors at the original collaborating institutions

(Isthmia, Polis, Chersonesos, Nemea). If deemed necessary, changes will be made to the ARCS source code and/or the ARCSCore metadata scheme based on this feedback.

Promotion: ARCS holds great promise as a solution for low-budget archaeological projects and scholars who wish to use and share legacy archaeological documents. Yet, because of delays in the development timeline, ARCS is only now at a point where it can be publicly released and widely advertised to the archaeological community. Thus in the months to come, the ARCS team will begin to work more deliberately toward making the platform a natural choice for budget constrained archaeological projects that are undergoing the transition from paper to digital archives. This will be done by drawing attention to the activities of the projects that collaborated on this implementation grant, and by using a companion promotional website and Github repository (<https://github.com/matrix-msu/arcs>) to demonstrate the value of ARCS. Likewise, the ARCS team will continue to present papers at conferences and in publications that focus on digital archaeology.

Cross-project collaboration: It is clear that one of the main strengths of long term study at a single archaeological site is the detailed evidence it yields for change over time. Yet, what is learned about any one particular site may be of limited value beyond the boundaries of that single excavation. On the other hand, archaeological surveys provide important information about larger-scale regions, but the evidence generated in this way lacks the detail of a traditional excavation. While it seems natural that the evidence from both forms of investigation should be combined to generate a more complete and holistic understanding of the past, the unique practices and forms of data collection have made collating the results of excavations and surveys a concept that is much more easily imagined than executed in reality.

The ARCS team believes that the unique approach it has taken to building a platform that empowers projects and scholars to provide access to legacy archaeological documents holds enormous potential to enable researchers to combine the data from both excavations and surveys in a meaningful way. By focusing on the documentation as the means of organizing records and encouraging archaeological projects to generate their own taxonomies at the most granular levels of the ARCSCore metadata scheme, ARCS could soon serve as the foundation of discovery framework that extends across multiple archaeological projects. At present, we see this taking place in two ways. Once ARCS has been adopted by a larger number of archaeological projects to manage their digitized legacy records, it will be possible to test and improve the cross-project search function. We expect that this will have the eventual result of revealing previously unrecognized connections among discoveries and lines of scholarly inquiry at multiple archaeological projects. Ideally, this would lead to research collaborations that might not have developed otherwise.

ARCHAEOLOGICAL RESOURCE CATALOGING SYSTEM: PROPOSED METADATA SCHEMA

Version 1.5

November 17, 2017 (Prior edits: 10/4/16 | 9/12/16 | 8/5/16 | 7/9/16 | 4/11/16 | 3/28/16 | 1/26/16)

Display labels and search fields added: August 2018

The Archaeological Resource Cataloging System (ARCS) is modeled on the ArchaeoCore metadata schema but includes several modifications intended to allow one to describe in a systematic way the original archival documents that have been digitized. The schema is organized in four levels, which proceed from the most general (and universally applicable) metadata fields at A: PROJECT LEVEL to the most granular (and document-specific) fields at D: ARCHIVAL OBJECT LEVEL. At the most specific level, the metadata fields are again divided into three sets: one (D:1-D:25) describes the original archival document, one (D:26-D:38) records info about individual pages of the electronic iteration of scanned archival resource (including technical metadata), and one (D:39-D:72) which defines the subject of observation (that is the actual archaeological artifact or structure) that has been described in the original document.

In the ARCS interface, users will typically interact with fields D:1-D:25 and D:39-D51. For best results, it is recommended that fields on the PROJECT LEVEL A:1-A:20, SEASON LEVEL B:1-B:16 and the EXCAVATION - SURVEY LEVEL C:1-C13 should be defined at the time the ARCS system is created for a specific project.

Search Fields

Keyword Search fields are indicated w/ * after label

Advanced Search fields are indicated w/ ** after label

All Keyword Search fields are also Advanced Search fields.

A: PROJECT LEVEL

Information about the overarching **archaeological enterprise**, including data that define the project in the modern era and the project location in antiquity

Field Name [data type] ARCS Display Label	Definition	Controlled vocabulary? Comments
1. Name [text] Label: Name	Titles, identifying phrases, or names given to an archaeological space.	
2. Country [list] Label: Country	A type of "nationality" field, though not in adjectival form; country refers to the modern name of the nation state in which the project is located	For Isthmia: Pleiades
3. Region [list] Label: Geographic Region	Geographic area where the project is located (modern)	For Isthmia: Pleiades
4. Modern Name [list] Label: Modern Placename	The modern toponym of the geographic location of the project	For Isthmia: Pleiades
5. Location-Identifier [text] Label: Location	Systematically assigned alphanumeric code identifying project location, if applicable	
6. Location-Identifier Scheme [text]	Scheme used to generate identification code Location-	

	Label: Location Source	Identifier, if applicable.	
7.	Geolocation [multi-text] Label: Coordinates	Coordinate pair(s) (latitude and longitude) that establishes a general location of project. ~*~*~*~*~*~* Formatting: Latitude,Longitude for example: 41.255678,13.435335	Use this site for latitude and longitude coordinates: http://www.latlong.net/ . N.B. There is no space between the coordinate pair -- only a comma.
8.	Elevation [text] Label: Elevation	Highest and lowest recorded altitudes of the project location, expressed as a range in meters according to the WGS 84 system.	
9.	Earliest Date [date] Label: Earliest Research Activity	Earliest date associated with project activity, expressed in <i>yyyy/mm/dd</i> format	
10.	Latest Date [date] Label: Latest Research Activity	Latest date associated with project activity, expressed in <i>yyyy/mm/dd</i> format	
11.	Records Archive [multi-list] Label: Archive / Repository	Location(s) of project documentation and records. Uniform name of the physical repository or repositories with full address.	This field will also include information recorded in RESOURCE.Repository field and ARTIFACT-STRUCTURE.Repository.
12.	Persistent Name [text] Label: Common Name	Name by which the location of the project is traditionally known.	
13.	Complex Title [text] Label: Associated Institution(s)	The name of the complex of which the project is a part, if applicable.	Example: The Ohio State University Excavations at Isthmia
14.	Terminus Ante Quem [date] Label: Earliest Cultural Activity	Date at which the project location begins to exhibit evidence of human activity.	This field should be inclusive of data recorded on the SEASON, EXCAVATION - SURVEY, and ARCHIVAL OBJECT levels.
15.	Terminus Post Quem [date] Label: Latest Cultural Activity	Date at which the project location ceases to exhibit evidence of human activity.	
16.	Period [multi-list] Label: Periods of Cultural Activity	Term that identifies the named, defined period(s) whose characteristics are represented in the project location.	PeriodO -- Each ARCS project will connect with PeriodO to make sure the period, like "Classical" or "Roman" is appropriately defined.
17.	Archaeological Culture [multi-list]	Recognizable and recurring assemblage of artifacts from a	Figure out useful controlled vocabulary or define local

B: SEASON LEVEL

SEASON dcterms:isPartOf PROJECT

Information about the **period of time** (season/campaign) during which archaeological research was conducted

Field Name [data type]	Definition	Controlled vocabulary? Comments.
1. Project Associator [associator] Label: None – not displayed	KORA identifier for the Project record that describes the overarching archaeological enterprise when this field research season took place.	
2. Title [text] Label: Title**	Title given to a particular physical configuration of the named project in an officially-defined short span of time	
3. Type [multi-list] Label: Research Activity**	Particular type of season (e.g. session, excavation, study) ~*~*~*~*~* Define local controlled vocabulary for each project.	Isthmia choices: Survey Excavation Study Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
4. Director [multi-list] Label: Director(s)**	Person(s) who bear responsibility for the execution of the season	Develop and maintain a project-specific list of standardized name or use resources like ORCID or FOAF for registries or dictionaries of consistent and unique names.
5. Registrar [multi-list] Label: Registrar(s)	Person(s) in an official position responsible for accurately recording season data	Develop and maintain a project-specific list of standardized name or use resources like ORCID or FOAF for registries or dictionaries of consistent and unique names.
6. Sponsor [multi-list] Label: Sponsor(s)	Entity/entities supporting the season	Develop and maintain a project-specific list of standardized name or use resources like ORCID or FOAF for registries or dictionaries of consistent and unique names.
7. Contributor [list] Label: Contributor(s)	Person who participated in the project during this particular season. ~*~*~*~*~* List only 1 name in this field. Use Contributor 2, Contributor 3... for	Develop and maintain a project-specific list of standardized name or use resources like ORCID or FOAF for registries or dictionaries of consistent and unique names.

	<p>other people who contributed to the Season.</p> <p>Identify the role(s) this contributor played during this season in the Contributor Role field.</p>	<p>~*~*~*~*~*</p> <p>Add additional Contributor and Contributor Role field pairs for more than 1 Contributor.</p>
<p>8. Contributor Role [multi-list]</p> <p>Label: Contributor Role(s)</p>	<p>Part or roles played by person identified in Contributor field.</p> <p>~*~*~*~*~*</p> <p>Define local controlled vocabulary for each project.</p>	<p>Isthmia choices: Photographer Assistant Director Field Director Archivist Conservator Architect Trench Supervisor Excavator Student Volunteer</p> <p>Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing</p>
<p>9. Contributor [list] and Contributor Role [multi-list]</p> <p>Label: N/A</p>	<p>Additional pairs of fields to accommodate the names and roles of other Contributors from this Season.</p>	
<p>10. Earliest Date [date]</p> <p>Label: Beginning of Season</p>	<p>Earliest date associated with project activity in this particular season, expressed in <i>yyyy/mm/dd</i> format</p>	
<p>11. Latest Date [date]</p> <p>Label: End of Season</p>	<p>Latest date associated with project activity in this particular season, expressed in <i>yyyy/mm/dd</i> format</p>	
<p>12. Terminus Ante Quem [date]</p> <p>Label: Earliest Cultural Activity</p>	<p>Date at which the project location studied in this season begins to exhibit evidence of human activity.</p>	<p>This field should be inclusive of data recorded on the EXCAVATION - SURVEY and ARCHIVAL OBJECT levels and also should be recorded at the PROJECT level.</p>
<p>13. Terminus Post Quem [date]</p> <p>Label: Latest Cultural Activity</p>	<p>Date at which the project location studied in this season ceases to exhibit evidence of human activity.</p>	
<p>14. Description [text]</p> <p>Label: Description of Season Activity</p>	<p>Concise narrative outlining the season, its goals, duration, outputs, etc.</p>	
<p>15. Orphan [list]</p> <p>Label: None – not displayed</p>	<p>Indicates that the Season record is not associated or linked to the appropriate Project record.</p> <p>TRUE=Not Associated to Project record FALSE=Associated to appropriate</p>	

	Project record	
16. Project Name Label: None – not displayed	Includes the name given to the project exactly as it is recorded in the Name field in the Project scheme. This will create a link between this Season record and the appropriate Project record it belongs to. This is redundant data for batch upload of records.	
Comments: These fields should be defined as completely as possible at the time of the initial setup of ARCS for a project, but updates to these records will be possible whenever relevant metadata comes to light.		

SEASON dcterms:hasPart EXCAVATION - SURVEY
Or sometimes...
SEASON dcterms:hasPart RESOURCE

C: EXCAVATION - SURVEY UNIT LEVEL

EXCAVATION - SURVEY dcterms:isPartOf SEASON

Information about 1 **field data collection unit** when archaeological research was conducted

Field Name [data type]	Definition	Controlled vocabulary? Comments.
1. Season Associator [associator] Label: Season(s) when Study took place	KORA identifier for the Season record that describes the period of time (season/campaign) during which this Excavation - Survey took place.	
2. Name [text] Label: Unit of Study**	Spatial section composed of material items and features, within codes developed for the project ~*~*~*~*~* Use a consistent format for representing the Unit Name, Unit Number, Sub-unit Number, for example Name - # - #.	For Isthmia: YY-XXX-NN where YY is 2-digit code for year of excavation, XXX is 2 or 3 letter code for location, and NN is the number of the trench
3. Type [list] Label: Type of Study**	Type of excavation or survey (e.g. open area, test trench, intensive) ~*~*~*~*~* Define local controlled vocabulary for each project.	Isthmia choices: Trench Survey Study ... Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRH069wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
4. Supervisor [multi-list] Label: Supervisor(s)**	Person or persons who directly supervised the excavation or survey of a spatial section	Develop and maintain a project-specific list of standardized name or use resources like ORCID or FOAF for registries or dictionaries of consistent and unique names.
5. Earliest Date [date] Label: Beginning of Study	Earliest date associated with project activity for this particular excavation/survey, expressed in yyyy/mm/dd format	
6. Latest Date [date] Label: End of Study	Latest date associated with project activity for this particular excavation/survey, expressed in yyyy/mm/dd format	
7. Terminus Ante Quem [date] Label: Earliest Cultural Activity for Study Unit	Date at which the excavation/survey unit begins to exhibit evidence of human activity.	This field should be inclusive of data recorded on the ARCHIVAL OBJECT level and also should be recorded at the PROJECT and SEASON levels.
8. Terminus Post Quem	Date at which the	

[date] Label: Latest Cultural Activity for Study Unit	excavation/survey unit ceases to exhibit evidence of human activity.	
9. Excavation Stratigraphy [text] Label: Description of Stratigraphy	Concise narrative description of the successive levels of excavated material	
10. Survey Conditions [text] Label: Description of Survey	Concise narrative description of the condition of the surveyed area (e.g. terrain, ground cover)	
11. Post Depositional Transformation [text] Label: Post-Depositional Activity	Concise narrative description of anthropogenic alterations to the excavation / survey unit.	
12. Orphan [list] Label: None – not displayed	Indicates that the Excavation - Survey record is not associated or linked to the appropriate Season record. TRUE=Not Associated to Season record FALSE=Associated to appropriate Season record	
13. Season Title [text] Label: None – not displayed	Includes the name given to the season exactly as it is recorded in the Title field in the Season scheme. This will create a link between this Excavation - Survey record and the appropriate Season record it belongs to. This is redundant data for batch upload of records.	
Comments: These fields should be defined as completely as possible at the time of the initial setup of ARCS for a project, updates to these records will be possible whenever relevant metadata comes to light.		

EXCAVATION - SURVEY dcterms:hasPart RESOURCE

D: ARCHIVAL OBJECT LEVEL: RESOURCE

RESOURCE dcterm:isPartOf EXCAVATION - SURVEY

But sometimes

RESOURCE dcterm:isPartOf SEASON (for surface finds)

Information about 1 **archival object** (document, map, photograph, etc.) created during the archaeological field research process

Field Name [data type]	Definition	Controlled vocabulary? Comments.
1. Excavation - Survey Associator [associator] Label: Study(s) when Resource was created	KORA identifier for the Excavation - Survey record that describes the field data collection unit when the archival object described in this Resource record was found.	
2. Season Associator [associator] Label: Season(s) when Resource was created	KORA identifier for the Season record that describes the period of time (season/campaign) when the archival object described in this Resource record was found. Only use for Resources like surface finds that are not tied to an Excavation - Survey.	
3. Resource Identifier [dcterms:identifier] [text] Label: Resource Identifier*	Unambiguous reference to a resource with in a given context. ~*~*~*~*~*~* For Isthmia: resource dependent code that uniquely identifies a an artifact or archival document This code will be repeated in PAGES and SUBJECT OF OBSERVATION records.	For more information about the coding structure at Isthmia, consult the lengthy explanation here: https://docs.google.com/document/d/18W-KmLBZolxaQ3_j9DV5TJBoraFCL8qFDGZ6kr1MBiM/edit?usp=sharing
4. Type [dcterms:format] [list] Label: Resource Type*	Classification of an original archival document that has been digitized (e.g. drawing, photograph, report, etc.) ~*~*~*~*~*~* Define local controlled vocabulary for each project.	Isthmia choices: Notebook Inventory card Photograph Plan or elevation Drawing Report Photographic Negative... Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRH069wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
5. Title [dcterms:title] [text] Label: Title*	Titles, identifying phrases, or names given to an original archival document that has been digitized ~*~*~*~*~*~*~*~*	

	Use only for titled pieces. ARCS will NOT use an invented or created title for untitled resources.	
6. Sub-title [dcterms:alternative] [text] Label: Sub-title	Subordinate title that provides additional information about the contents of original archival document that has been digitized	
7. Creator [dcterms:creator] [multi-list] Label: Author/Creator*	Name or other unique identification of a known person or persons who created an original archival document that has been digitized	Develop and maintain a project-specific list of standardized name or use resources like ORCID or FOAF for registries or dictionaries of consistent and unique names.
8. Creator Role [Not DC] [multi-list] Label: Author/Creator Role*	Part played by resource creator ~*~*~*~*~*~* Define local controlled vocabulary for each project. <u>Comment:</u> Role must be ordered appropriately to correspond with person identified in "Creator" field. If the same Creator played more than one role (i.e. a Photographer who was also a Student Volunteer), record the name of the person twice in the Creator field and make sure both Creator Role terms are included in this field and ordered to correctly align with the appropriate person identified in Creator.	<u>Isthmia choices:</u> Photographer Director Assistant Director Field Director Archivist Conservator Architect Trench Supervisor Excavator ... <u>Full list of Isthmia terms:</u> https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
9. Earliest Date [dcterms:created] [date] Label: Earliest Date of Resource*	Earliest production date of an original archival document that has been digitized, expressed in <i>yyyy/mm/dd</i> format	Recommended best practice is to use an encoding scheme, such as the W3CDTF profile of ISO 8601 [W3CDTF]
10. Latest Date [date] [dcterms:created] [date] Label: Latest Date of Resource*	Latest date for the creation of an original archival document that has been digitized, expressed in <i>yyyy/mm/dd</i> format. This is used for archival documents created during a span of time, for example field notebooks.	
11. Dimensions [dcterms:extent] [multi-text] Label: Dimensions	Measured size of an original archival document that has been digitized ~*~*~*~*~*~*~*~*	Document project specific guidelines for recording information in this field. For recommendations to

	<p>For Isthmia: Measurements for photographs, slides, negatives, maps and books are in <u>meters</u> written as whole numbers or decimal fractions to the nearest <u>millimeter</u>.</p> <p><u>Required format:</u> Type of measurement: numerical value unit of measurement For example: length: 0.279 m width: 0.216 m</p>	<p>standardize and document approach to this field, see: https://docs.google.com/document/d/1MYZkYRpIVnD_SVCgFvuHsu1Df-RPziPdHs5Ufzqs9F8/edit?usp=sharing</p>
<p>12. Language [dcterms:language] [multi-list]</p> <p>Label: Language(s)*</p>	<p>Language(s) of the resource itself.</p> <p>~*~*~*~*~*</p> <p>Recommended best practice is to use a controlled vocabulary.</p>	<p>Isthmia choices: English Greek...</p> <p>Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing</p>
<p>13. Description [dcterms:description] [text]</p> <p>Label: Description of Resource</p>	<p>Characteristics of an original archival document that has been digitized</p>	
<p>14. Transcription [Not DC] [text]</p> <p>Label: Transcription*</p>	<p>Typed representation of words written in and/or on the document or resource.</p> <p>~*~*~*~*~*</p> <p>Will not display on the frontend</p>	
<p>15. Pages [Not DC] [text]</p> <p>Label: Number of Pages</p>	<p>Number of pages in the document or resource.</p> <p>~*~*~*~*~*</p> <p>Use numeric expression only.</p> <p>Use for all resources in repository including documents, images, maps, and photographs.</p>	
<p>16. Condition [Not DC] [list]</p> <p>Label: None – not displayed</p>	<p>Description of current physical state of original archival document that has been digitized</p>	<p>Choices: Good Fair Poor...</p> <p>Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing</p>
<p>17. Rights [dcterms:rights] [text]</p>	<p>Information about rights management; may include copyright and other intellectual</p>	<p>For Isthmia use the following CC license: Attribution-NonCommercial</p>

Label: Rights	property statements required for use regarding the resource and/or its associated electronic file.	4.0 International (CC BY-NC 4.0)
18. rightsHolder [dcterms:rightsHolder] [multi-list] Label: Rights Holder	Person or organization owning or managing rights over the resource.	
19. Permissions [list] Label: None – not displayed	Defines record viewing privileges; specifies the type of user who can access this Resource record ~*~*~*~*~* Options: Public [open web]; Member [logged into ARCS]; Special [designated by Admin; based on ARCS username] "Special" usernames are included in "Special User" field of Resource record. ARCS Admin assigns "Special User" designation.	<u>Choices</u> : Public, Member, Special Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
20. Special User [text] Label: None – not displayed	Information about the person or people who have rights to access/view record and related metadata and digital files. ~*~*~*~*~* ARCS Admin assigns "Special User" designation . Required Format: Username Username. Use " " (SpacePipeSpace) between Usernames.	
21. Repository [dcterms:source] [list] Label: Archive / Repository	The name of the repository that is currently responsible for the resource including general institutional address (state/region, country)	Repeat info in this field in the PROJECT.Records Archive field.
22. Accession Number [dcterms:source] [text] Label: Accession/Catalogue Number(s)	Any unique identifiers assigned to an original archival document that has been digitized by the current or last known repository	
23. Orphan [list] Label: None – not displayed	Indicates that the Resource record is not associated or linked to the appropriate Excavation - Survey or Season record. TRUE=Not Associated to Excavation - Survey or Season record	

	FALSE=Associated to appropriate Excavation - Survey or Season record	
24. Excavation - Survey Name [text] Label: None – not displayed	Includes the name given to the excavation or survey exactly as it is recorded in the Name field in the Excavation - Survey scheme. This will create a link between this Resource record and the appropriate Excavation - Survey record it belongs to. This is redundant data for batch upload of records.	
25. Season Title [text] Label: None – not displayed	Includes the name given to the season exactly as it is recorded in the Title field in the Season scheme. This will create a link between this Resource record and the appropriate Season record it belongs to. This is redundant data for batch upload of records. Only use for a Resource like surface finds that are not tied to an Excavation - Survey.	
Comments: Subject of Observation records (see below) linked or associated to a record in this scheme will define the topic or subject of the original document.		

RESOURCE [dcterms:hasPart](#) PAGES

D: ARCHIVAL OBJECT LEVEL: PAGES

PAGES dcterms:isPartOf RESOURCE

Technical and organizational information about a **single scanned page** of the digitized archival document

Field Name [Dublin Core field] [data type]	Definition	Controlled vocabulary? Comments.
26. Resource Associator [associator] Label: None – not displayed	KORA identifier for the Resource record that this Pages record is part of. This Pages record contains a digital file and technical metadata for 1 scanned page of the referenced Resource.	
27. Resource Identifier [text] Label: None – not displayed	Unique identifier given to the original archival resource that has been scanned. This is the same as RESOURCE.Resource Identifier ~*~*~*~*~*~* For Isthmia: resource dependent code that uniquely identifies a an artifact or archival document	Use this field to create a direct reference to appropriate Archival Object Level RESOURCE record.
28. Format [dcterms:format] [list] Label: None – not displayed	Digital or electronic format of the access or distribution file of the resource. ~*~*~*~*~*~* Use Internet Media Types [MIME].	<u>Choice</u> : jpeg... <u>Full list of Isthmia terms</u> : https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
29. Type [dcterms:type] [list] Label: Type**	Broad term describing the nature or genre of <i>digital</i> file ~*~*~*~*~*~* Controlled vocabulary DCMI Type Vocabulary (DCMITYPE) <u>Choices</u> : StillImage = Static visual representation other than text (used for drawings, plans, maps) Text = Consisting primary of words for reading	<u>Choices</u> : StillImage Text... <u>Full list of Isthmia terms</u> : https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
30. Page Identifier [dcterms:identifier] [text] Label: None – not displayed	Unique numeric or alphanumeric identification ~*~*~*~*~*~* Alpha/numeric character string of file name for page including <i>file extension</i> .	

<p>31. Scan Number [text]</p> <p>Label: None – not displayed</p>	<p>Number indicating the scan sequence for a resource ~*~*~*~*~*</p> <p>Begin sequence with 1, for the first scan of resource, followed by 2, 3, and 4... for subsequent scans.</p> <p><i>Scan Number</i> is used to display image files associated to the original Archival Object RESOURCE in the correct order on the website. <i>Scan Number</i> does <u>not</u> record the actual page number of a book, for example.</p>	
<p>32. Image Upload [file]</p> <p>Label: None – not displayed</p>	<p>Upload jpeg image file of scanned archival document.</p>	
<p>33. Scan Specifications [text]</p> <p>Label: None – not displayed</p>	<p>Description of the dimensions, resolution, type of digitization and any other information pertinent to the creation of the electronic file. ~*~*~*~*~*</p> <p>Data types and formats: Bit-depth (e.g., 8-bit, 16-bit, 24-bit, etc.); color mode (e.g., RGB, CMYK, or grayscale); resolution (pixels per inch.)</p> <p>For example: 24 bit RGB mode - 400 PPI or 8-bit grayscale mode - 400 PPI</p>	
<p>34. Scan Equipment [text]</p> <p>Label: None – not displayed</p>	<p>Name or other unique identifier of the device used to create an electronic file. ~*~*~*~*~*</p> <p>Data types and formats: Scanner or digital camera brand, name, and model number; software name and version</p>	
<p>35. Scan Date [dcterms:created] [date]</p> <p>Label: Date Resource Scanned**</p>	<p>Production date of the electronic file, expressed in yyyy/mm/dd format</p>	
<p>36. Scan Creator [dcterms:creator] [text]</p> <p>Label: Creator of Scanned Resource**</p>	<p>Name or other unique identification of a known person responsible for the creation of the electronic file.</p>	<p>Develop and maintain a project-specific list of standardized name or use resources like ORCID or FOAF for registries or dictionaries of consistent</p>

		and unique names.
<p>37. Scan Creator Status [list]</p> <p>Label: None – not displayed</p>	<p>Information concerning whether the identification of a known person may appear in a publicly accessible format. ~*~*~*~*~*</p> <p>The purpose of this field it to "protect" information about volunteers including student who do not what name published.</p> <p>Public = Display name on website Private = Do not display name</p>	<p>Choices: Public Private...</p> <p>Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfy-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing</p>
<p>38. Orphan [not DC] [list]</p> <p>Label: None – not displayed</p>	<p>Used during batch upload of image files to indicate that the Pages record is not associated or linked to the appropriate Resource record.</p> <p>TRUE=Not Associated to Resource record FALSE=Associated to appropriate Resource record</p>	

D: ARCHIVAL OBJECT LEVEL: SUBJECT OF OBSERVATION -- General

SUBJECT OF OBSERVATION - general dcterm:isPartOf RESOURCE

Information about the archeological item that is the **topic of study** in the archival document (i.e. topic or subject of the inventory card).

Fields D:39-D:51 broadly describe a generic Artifact or Structure that is the topic or subject of the archival resource.

Fields D:52-D:72 specifically/granularly describe an individual instantiation of an Artifact or Structure that is the topic or subject of the archival resource.

Field Name [Dublin Core field] [data type]	Definition	Controlled vocabulary? Comments.
39. Pages Associator [associator] Label: Page ID with Topic Info	KORA identifier for the specific page of the Resource that this Subject of Observation record describes.	Subject of Observation record contains descriptions about 1 topic of study on 1 page of the original archival document
40. Resource Identifier [text] Label: None – not displayed	Unique identifier given to the original archival resource that has been scanned. This is the same as RESOURCE.Resource Identifier. ~*~*~*~*~*~* For Isthmia: resource dependent code that uniquely identifies an artifact or archival document	Use this field to create a direct reference to appropriate Archival Object Level RESOURCE record.
41. Subject of Observation Associator [associator] Label: Other Records with Topic Info	KORA identifier for the Subject of Observations record(s) that describe the exact same artifact/structure.	Subject of Observation (SOO) records about the same artifact/structure will be linked together. Use this field to connect SOO records created for an inventory card and a photograph of the exact same coin. This link indicates that both records describe the exact same artifact, that is, the same coin is referenced in both the inventory card and in the photograph.
42. Artifact - Structure Classification [dcterms:subject] [list] Label: Artifact / Structure Classification*	Specific category of artifact or structure according to a stated system. ~*~*~*~*~*~* Define or identify controlled vocabulary used by individual project.	Isthmia choices: Arretine Black Figure Candarli ... Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRH069wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
43. Artifact - Structure Type	Physical characteristic of artifact or structure.	Isthmia choices: Amphora Antefix Ashlar Base ...

[dcterms:subject] [multi-list] Label: Artifact / Structure Type*	~*~*~*~*~*~* Define or identify controlled vocabulary used by individual project.	Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
44. Artifact - Structure Type Qualifier [text] Label: Type Qualifier	Common and/or published system according to which an Artifact - Structure Type has been determined.	
45. Artifact - Structure Material [dcterms:subject] [multi-list] Label: Artifact / Structure Material*	Matter from which the artifact or structure has been produced. ~*~*~*~*~*~* Define or identify controlled vocabulary used by individual project.	Isthmia choices: Bone (Human) Bronze ... Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
46. Artifact - Structure Technique [multi-list] Label: Manufacturing technique*	Manner of production of artifact or structure ~*~*~*~*~*~* Define or identify controlled vocabulary used by individual project.	Isthmia choices: Chiseled Drafted Fired Flaked ... Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
47. Artifact - Structure Archaeological Culture [multi-list] Label: Associated Archaeological Culture	Recognizable and recurring assemblage of artifacts from a specific time and place. Thought to constitute the material remains of a particular past human society or group ~*~*~*~*~*~* This field will most often have a 1- to-1 pairing with a Period identified in Artifact - Structure Period field.	Figure out useful controlled vocabulary or define local vocabulary based on: Getty / Pleiades / Open Context ~*~*~*~*~*~* Repeat data in this field in the PROJECT. Archaeological Culture field.
48. Artifact - Structure Period [dcterms:temporal] [multi-list] Label: Artifact / Structure Period*	Named, defined portion of time whose characteristics are represented in the artifact or structure.	For Isthmia: Use PeriodO
49. Artifact - Structure Terminus Ante Quem [date] Label: Earliest Possible Date of Artifact / Structure*	Date(s) before which an artifact or structure could not have been produced	Data in this field should be recorded at the PROJECT, SEASON, and EXCAVATION - SURVEY levels.
50. Artifact - Structure	Date(s) after which an artifact or	

Terminus Post Quem [date] Label: Latest Possible Date of Artifact / Structure*	structure could not have been produced	
51. Orphan [list] Label: None – not displayed	Indicates that the Subject of Observation record is not associated or linked to the appropriate Resource record. TRUE=Not Associated to Resource record FALSE=Associated to appropriate Resource record	
Comments: While each individual project must determine for itself which field names and controlled vocabularies best suit its unique needs, at the very least, the fields listed in this section (D:39-D:51) should be defined for each artifact or structure described in a resource in the ARCS system. In determining which additional fields should be used (D:52-D:72), each project is encouraged to follow as closely as possible the ArchaeoCore metadata schema.		

SUBJECT OF OBSERVATION - General includes SUBJECT OF OBSERVATION - Detailed

D: ARCHIVAL OBJECT LEVEL: SUBJECT OF OBSERVATION -- Detailed

SUBJECT OF OBSERVATION - Detailed is included in SUBJECT OF OBSERVATION - General

Information about the archeological item that is the **topic of study** in the archival document (i.e. topic or subject of the inventory card).

Fields D:39-D:51 broadly describe a generic Artifact or Structure that is the topic or subject of the archival resource.

Fields D:52-D:72 specifically/granularly describe an individual instantiation of an Artifact or Structure that is the topic or subject of the archival resource.

Field Name	Definition	Controlled vocabulary? Comments
52. Artifact - Structure Title [text] Title: Title of Artifact / Structure	Titles, identifying phrases, or names given to an artifact or structure.	
53. Artifact - Structure Current Location [list] Label: Current Location of Artifact / Structure	The geographic location of the repository that is currently responsible for the artifact or structure.	For Isthmia: Use Pleiades for: "The Ohio State University Excavations at Isthmia Archives" which is in Kyra Vrisi
54. Artifact - Structure Repository [list] Label: Storage Repository	The name of the repository that is currently responsible for the artifact or structure.	Repeat data in this field in the PROJECT.Records Archive field.
55. Artifact - Structure Repository Accession Number [text] Label: Accession Number	Any unique identifiers assigned to an artifact or structure by the current or last known repository	
56. Artifact - Structure Creator [multi-list] Label: Artifact / Structure Creator	Name or other unique identification of a known creator of the artifact or structure.	
57. Artifact - Structure Creator Role [multi- list] Label: Creator Role	Part played by artifact or structure creator.	
58. Artifact - Structure Dimensions [multi- text] Label: Artifact / Structure Dimensions	Measured size or scale of the artifact or structure. ~*~*~*~*~*~* For Isthmia: Measurements for walls, coins, pottery, and other artifacts and structures are in meters written as whole numbers	Document project specific guidelines for recording information in this field. For recommendations to standardize and document approach to this field, see: https://docs.google.com/do

	<p>or decimal fractions to the nearest millimeter.</p> <p><u>Required format:</u> type of measurement: numerical value unit of measurement For example: height: 0.280 m width: 0.216 m thickness: 0.123 m</p> <p>Indicate "maximum preserved" parenthetically after unit of measurement for artifacts and structures that are measured but are broken and have incomplete dimensions (see examples).</p> <p>Use pipe " "(<u>SpacePipeSpace</u>) between dimensions (see examples).</p> <p><u>Examples:</u> height: 0.052 m diameter at rim: 0.162 m height: 0.223 m diameter: 0.147 m height: 0.054 m width: 0.035 m thickness: 0.005-0.007 m height: 4.813 m (maximum preserved) width: 2.405 m based on conversation below)</p> <p><u>Valuable dimensions:</u> length width height thickness interior diameter exterior diameter percent of diameter preserved</p>	<p>document/d/1MYZkYRpIVnD_SVCgFvuHsu1Df-RPziPdHs5Ufzqs9F8/edit?usp=sharing</p>
<p>59. Artifact - Structure Geolocation [multi-text]</p> <p>Label: Artifact / Structure Coordinates</p>	<p>Coordinate pair(s) (latitude and longitude) that establishes a general location of project. ~*~*~*~*~*</p> <p>Formatting: Latitude,Longitude for example: 41.255678,13.435335</p>	<p><u>Use this site for latitude and longitude coordinates:</u> http://www.latlong.net/.</p> <p>N.B. There is no space between the coordinate pair -- only a comma.</p>
<p>60. Artifact - Structure Excavation Unit [multi-list]</p> <p>Label: Artifact / Structure Excavation</p>	<p>Pre-declared unit of excavated soil, known by a systematically assigned unique identifier. ~*~*~*~*~*</p> <p>Define local controlled list used by</p>	<p>Will not use this field for Isthmia as it is included in SURVEY - EXCAVATION.Name.</p>

Unit*	individual project.	
61. Artifact - Structure Location [multi-list] Label: Project-specific Location*	Project-specific name for the place where an artifact / structure was first discovered ~*~*~*~*~*~* Define local controlled list used by individual project.	Isthmia choices: Architecture Bones ... Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
62. Artifact - Structure Description [text] Label: Artifact / Structure Description	General characteristics of an artifact or structure.	
63. Artifact - Structure Condition [multi-list] Label: Artifact / Structure Condition	Description of current physical state of artifact or structure	Isthmia choices: Burned Fragmentary ... Full list of Isthmia terms: https://docs.google.com/a/msu.edu/spreadsheets/d/1VdOipeBvhOLRHo69wfv-vMAhpDqRbDEsdOyqmxpOm8Y/edit?usp=sharing
64. Artifact - Structure Inscription [text] Label: Inscribed Text*	Lettering marked on artifact, especially for documentation or commemoration	
65. Artifact - Structure Munsell Color Number [text] Label: Artifact / Structure Color(s)	Index number for artifact or structure color.	Use this site for Munsell Color Standard: http://munsell.com/color-blog/category/color-matching-standards/
66. Artifact - Structure Date [date] Label: Precise Date of Artifact / Structure	Production date of object; only to be used when a specific date is known. Otherwise, Terminus ante and post quem should be used	
67. Artifact - Structure Subject [multi-list] Label: Subject of Artifact / Structure	General term(s) that identity the content or topic of a work of art; it is what is depicted in and by a work of art. It can also identify the function of an artifact or structure (architecture) that does not have narrative content. ~*~*~*~*~*~* Define or identify controlled vocabulary for each project.	Adapted definition from Categories for the Description of Works of Art (http://www.getty.edu/research/publications/electronic/publications/cdwa/18subject.html#general)
68. Artifact - Structure Origin [list] Label: Point of Origin	Original production location of artifact or structure.	For Isthmia: Use Pleiades

<p>69. Artifact - Structure Comparanda [text]</p> <p>Label: Comparative examples</p>	<p>Published examples of other artifacts or structures that are similar in type or style.</p>	<p>For Isthmia: Use URL/URI from World Cat</p>
<p>70. Artifact - Structure Archaeological Context [text]</p> <p>Label: Archaeological Context</p>	<p>Three dimensional position of find, and its relationship to other elements in the site's archaeological record</p>	
<p>71. Artifact - Structure Shelving Location [text]</p> <p>Label: Location in repository</p>	<p>Shelf mark or other shelving designation that indicates the location where the physical artifact/structure is available (on a shelf or in cabinet, for example).</p>	
<p>72. Page Identifier [text]</p> <p>Label: None – not displaying</p>	<p>Includes the unique identifier given to the scanned page exactly as recorded in the Page Identifier field in the Pages scheme. This will create a link between this Subject of Observation record and the appropriate Pages record it describes.</p> <p>This is redundant data for batch upload of records.</p>	
<p>Comments: Data in SUBJECT OF OBSERVATION - Detailed fields are not directly the concern of the ARCS project. These fields are to be created and left for specialists to complete as part of their individual or collaborative research. This set of field names will likely be generated by an import utility and be based on the field names in a pre-existing, non-ARCS database.</p>		