Lichliter Project White Paper: Table of Contents

Introduction

Who is responsible for this project and the resulting information?

The project was conducted by the Dayton Society of Natural History (DSNH), a 501c3 non-profit organization that operates three museums in southwest Ohio: the Boonshoft Museum of Discovery, SunWatch Indian Village/Archaeological Park, and Fort Ancient Earthworks and Nature Preserve. (Fort Ancient is operated in partnership with the Ohio History Connection.) The project was conducted by the staff and volunteers of the DSNH Anthropology Department. The primary staff member for the project is Sarah Aisenbrey (Registrar), supervised and assisted by William Kennedy (Curator of Anthropology), and assisted by Erin Steinwachs (Project Intern). Additional DSNH staff members who supported the project include Jill Krieg-Accrocco (Associate Curator of Anthropology) and Lynn Hanson (Vice-President of Collections and Research). Staff were assisted throughout the project by volunteers, most of whom are students or alumni of the Anthropology or Public History programs at Wright State University. Project staff were aided in presenting online content by DSNH staff from the Marketing and Astronomy departments. The cataloging of the Lichliter collection took place at the Boonshoft Museum of Discovery and all collections objects, materials, and data are permanently housed at that location.

Who is this information intended for?

This information is intended for professional archaeologists in the field and laboratory who may work in a variety of settings (e.g. universities, museums, culture resource management, government) as well as museum professionals who manage archaeological collections but are not archaeologists, including: curators, registrars, collections managers, and administrative staff. We anticipate that some readers may be students who do not yet have an in-depth knowledge of either archaeological methods or museum curation. Although we anticipate that most readers will need some basic knowledge of American archaeology to fully understand the project, we have intentionally kept the presentation of this information accessible to the broadest audience as possible. This series of pages is not intended to be an academic publication nor a technical manual about cataloging artifacts. We have tried to avoid both archaeological and museum jargon and opted to explain concepts and terminology in accessible language as much as possible. We have endeavored to create a set of pages that we would want to read by adopting a conversational tone that we hope readers will find useful and engaging in an online setting. The type of archaeology discussed in these pages is distinctly American and focused almost exclusively upon prehistoric Native American cultures, although readers interested in related disciplines (e.g. historic archaeology and classical archaeology) will hopefully find the project equally useful.

Is this a product review or an advertisement to promote ArcheoLINK over other software packages?

No. This project is a case study advocating an approach to the curation of archaeological research collections that utilizes an existing product for a purpose that it was not specifically designed for. The organizational model and conventions underlying ArcheoLINK are similar to those generally used within Europe and are different from those normally used in the curation of American archaeological collections. It is that model that we applied in this project in the form of ArcheoLINK and it is ultimately that model that we have evaluated. Comparisons with other software packages or methodologies are made for the purposes of illustrating alternative approaches. While we encourage readers to further investigate the capabilities of ArcheoLINK and other software packages, our concerns are limited to the proper curation of archaeological collections and data.

There are good reasons why ArcheoLINK might not necessary be the right path for an organization or researcher, such as: cost, avoidance of proprietary software solutions, lack of digital infrastructure, or other considerations. We suggest that ArcheoLINK represents well thought-out solutions to common problems and a paradigm that originates in European archaeology where conventions differ. At a minimum, American archaeologists and curators will benefit from this paper in recognizing the limitations of our existing paradigm. We recommend that whether or not readers choose to explore or utilize ArcheoLINK as a software solution, they should look carefully at the types of information and relationships that are discussed in these pages. These types of relationships are unique to archaeological collections and it is precisely these relationships that are important for maintaining the long-term research potential of such collections. Such relationships are seldom accounted for in standard curation practices and the lack of attention to the dynamic nature of archaeological collections is a serious limitation of existing solutions, a point we specifically address in multiple contexts.

ArcheoLINK is a commercial product being marketed and sold by QLC. No portion of the project or these pages has been sponsored, censored, redacted, omitted, or otherwise compromised in order to promote this specific software package. No fees, services, or discounts have been provided by QLC or any other for-profit company. The project was funded by general operating funds of the Dayton Society of Natural History (DSNH) and a grant by the Council on Library and Information Resources (CLIR), neither of which has any financial interest in QLC or any related enterprises. No individuals associated with the project as staff or volunteers have a financial interest in QLC or any related enterprise. No product endorsement is made by DSNH, CLIR, or any partner organizations nor should any be implied by readers. Project staff have worked with the vendor for training and technical support but are entirely responsible for all aspects of the project and for all content within these pages. Some graphics from the ArcheoLINK training materials have been used with permission or adapted to illustrate concepts.

Finally, we further note that this is not a product review as project staff have applied only a subset of the full suite of modules available in ArcheoLINK at this stage. The scope of the project described here is limited largely to discussing the cataloging and management of physical objects and samples. ArcheoLINK has more functions than are discussed, most notably a GIS module that allows the user to digitize and incorporate maps and other spatial data. Reference is made to this functionality because of its implications for the analysis and interpretation of objects, but no attempt has been made to evaluate or compare that GIS functionality to other solutions. As a stand-alone all-in-one software solution, there are very few alternatives to ArcheoLINK that duplicate all or most of its functionality. There are many alternative software packages available in the United States that perform similar functions to individual modules, such as ESRI's ArcMap, which are not tailored to archaeological collections. Readers are advised to make their own decisions about what software solutions are best-suited to their individual needs and goals, but to bear in mind that such solutions should incorporate appropriate solutions as discussed in these pages.

Section I

IA: Glossary of Common Archaeological Terms

Archaeological Record

The archaeological record refers to all of the physical remains produced by past human activities. It is a more or less continuous distribution of the products and by-products of human behavior on and within the land surface. This distribution is highly variable in density, with denser areas recognized as "sites." In addition to sites, the archaeological record also includes isolated artifacts, isolated features, natural features that hold information about past environments, and empty spaces where humans did not conduct activities or conducted activities that left no material trace. The term archaeological record refers to the material remains themselves, not to the field records that archaeologists create to describe those remains.

Artifact

An artifact is a portable object whose form is modified or created by human activity. An artifact could be a single object, a composite of several materials, or only a fragment of an object. In prehistoric American archaeology, the most common material classes are lithics (chipped stone tools; ground stone tools), ceramics (earthenware pottery), and organic artifacts made from faunal materials (objects made from animal bones, shells, teeth, antler, and other remains). A group of artifacts from the same site is often termed an "assemblage," which may refer to all artifacts from a site or all of the artifacts of just one material class from a site (also termed as an "industry" or in certain uses, a "tradition").

Association

Archaeological specimens have provenience-based relationships with adjacent objects noted at the time of discovery. Objects that are found together in the same level of a feature/stratum are considered to be associated with each other due to their proximity in space (and presumably time). Associations between objects found in the same level of a feature/stratum are common, obvious, and easy to document: a mixed lot of artifacts found together would simply be bagged together and share a field specimen number. Association however is not limited just to specimens that were found on the same day and were collected in the same bag. Associations can potentially span many vertical levels or horizontal units, because artifacts are likely to be associated with those of other levels in the same feature and/or adjacent areas in the same stratum. For example, features are normally excavated in many separate individual levels; all specimens of all material classes in all the features levels are likely to be associates even though they are recovered from different levels at different times. Likewise, specimens recovered from a non-feature midden unit may be considered associates of those from adjacent units where the same midden continues.

Component/Multi-component

A component is a temporal sub-division of a site, reflecting the use of the same landform at different periods of time. It is common for sites to include objects and features from multiple occupations (i.e. a "multi-component" site) as people tend to be drawn to the same resource-rich landforms over centuries and millennia. It is often the case that the more thoroughly a site is investigated, the more likely it is to yield at least modest evidence of additional components. Differentiating components is primarily about recognizing and articulating the temporal aspect of a site. Some archaeologists refer to the process of assigning features to temporal components as "phasing" but this term is not used universally. Different components may represent either lengthy periods of occupation (often centuries) by related peoples or non-continuous use by unrelated groups. For example, the Fox Farm site in Mason County, Kentucky, is referred to as a single site with one name, but it actually includes three separate village components used by the same culture continuously over several centuries from 700 to 400 years ago. In contrast, the Fort Ancient earthwork in Warren County, Ohio, was built by the Hopewell people approximately 2000 years ago and abandoned within a few centuries. A different Late Prehistoric group built villages approximately 1000 years ago on a floodplain adjacent to the earthwork and occasionally buried their dead within the earthwork walls. Fort Ancient is a multi-component site where the components have no direct relationship to each other. Some multi-component sites have discrete, identifiable occupations and some are difficult to delineate because of temporal/spatial overlap.

Context

Archaeological specimens have provenience-based relationships with non-objects, such as features and cultural strata, which are established by an object's provenience. The context of a specimen is key to interpreting its own significance and the significance of the context. For example, a ceramic vessel's interpretation would be different if the vessel were found in a human burial rather than if the same vessel were to be found within a trash midden. Likewise, the interpretation of a human burial would be altered if that burial included a rare ceramic vessel from a distant, exotic origin (i.e. the burial would be more likely to be interpreted as that of a high-status individual).

Diagnostic

The term "diagnostic" is sometimes used interchangeably with "special find." Diagnostic objects are those which have characteristics specific to a named artifact type (e.g. a "Chesser" projectile point), or specific to a particular culture, tradition, or time period. These objects can be related to a known cultural phenomenon that has a corresponding temporal and spatial range. For example, "bladelets" are a distinct type of formal stone tool that was manufactured prehistorically by the Hopewell people of the Middle Woodland time period in Ohio and at no other point in Ohio prehistory.

Ecofact

Ecofacts are portable natural objects that are not artifacts, but have cultural relevance. These frequently include objects like faunal remains (e.g. animal bones from butchering animals) or floral/botanical remains (e.g. seeds, nuts, carbonized wood). Ecofacts are often byproducts produced by human behavior that may be intentional (e.g. burned corn cobs related to ritual behavior) or unintentional (e.g. fire-cracked rocks damaged by exposure to high-temperatures from cooking). Some items, such as a bone with cut marks from butchering the carcass, could be considered either an artifact or ecofact and the distinction is less important than the type of information that is potentially recoverable. Some ecofacts can be used to reconstruct human behavior (e.g. cutmarks reveal butchering patterns) and some can be used to reconstruct past environments (e.g. pollen indicates past floral environments). Ecofacts are often fragile materials and preservation can be very uneven between sites and regions. Examples: 1) In the Midwest, bone preservation can be excellent due to favorable soil conditions while bone in the Southeast is more likely to be degraded by acidic soil. 2) In the arid Southwest, wood can be preserved unharmed for centuries while only carbonized remains might be recovered in the more humid eastern U.S.

Excavation

Excavation is used to investigate and recover subsurface artifacts, ecofacts, and features from an archaeological site. Excavation is usually targeted towards either answering specific archaeological research questions or the mandated salvage of endangered cultural materials prior to their destruction. Very few archaeological sites are ever excavated and of these, usually only a portion of a site is excavated. Even when a site is in imminent danger of complete destruction, archaeologists almost never attempt full recovery of an entire site. There are three primary reasons for sampling: 1) Feasibility. Excavation is expensive, labor intensive, and produces large amounts of material that must then be analyzed, reported, and stored. Every day spent excavating cultural materials in the field will require multiple days just to process the resulting collections. 2) Redundancy. It is not necessary to excavate an entire site when a representative sample will yield the same results. All archaeological collecting is intended as sampling. 3) Conservation. Given the finite, non-renewable nature of cultural resources, it is unethical to excavate sites that are not endangered except to answer specific research questions. Archaeologists leave as much cultural material undisturbed as possible so that future researchers will be able to apply new technologies and ask new questions of cultural resources. These three reasons are also central to a growing shift in archaeological investigation to use non-invasive and non-destructive geophysical surveys as much as possible to minimize the need for manual excavation.

Feature

Features are non-portable human-made remains that cannot be removed without altering or destroying their form. Features can be simple (e.g. a clay hearth for cooking) or a composite (e.g. an architectural structure that is the sum of many smaller individual features that represent the foundation of the building). In the Midwest, common features include molds (the decomposed remains of prehistoric posts or stakes), thermal features (e.g. hearths, earth ovens), pit features (e.g. storage pits, trash pits), and mortuary features (burials, cremations). In most American archaeology, features are found below the surface because they have been buried (e.g. a site in a floodplain buried by annual flood deposited silt) or because they were constructed below grade (e.g. a human burial). Shallow or disturbed sites may have no intact features below the surface. In some cultural contexts, features may be observed above-ground (e.g. the stacked stone walls of a southwestern pueblo) or are effectively indistinguishable from the ground (e.g. earthen walls forming a Midwestern earthwork). Most features have relatively discrete boundaries in order to be identified as such. Features may contain artifacts and ecofacts and those within features are usually considered to be more useful for research because they have clearer context and associations than identical artifacts not contained within features.

Geophysical survey

In recent years, new technologies have been applied to document subsurface cultural resources to accompany or even replace a traditional survey. Most non-archaeologists are aware of Ground penetrating radar (GPR), but there are other types of ground-based geophysical survey such as magnetometry, electrical resistance, electromagnetic conductivity, and more. Each tool detects different phenomena such as slight changes in the local magnetic field from areas associated with intense burning or slight differences in soil moisture that indicate where the matrix has been disturbed by human activity. Each tool produces either 2D or 3D visualizations that indicate the locations of possible cultural resources (and possibly some idea of the nature of those resources). Although these are usually expensive, highly technical endeavors, they can produce impressive amounts of information about a site that may complement or surpass traditional survey methods. Geophysical surveys are non-destructive and non-intrusive, which can make them more desirable than destructive excavation methods of data recovery. It is generally necessary to ground-truth the results of a geophysical survey to assess the accuracy of the findings. For example ground-truthing might include using a soil probe, auger, or manual excavation to test areas where geophysical anomalies were detected.

Matrix

A site's matrix refers to the physical medium that surrounds, holds, and supports archaeological remains. This is usually soil, but could include other mediums like gravel or volcanic ash. Archaeologists document the matrix in many ways, but usually texture (e.g. sand; silt loan) and color at a minimum. Color is documented with the Munsell color system, which produces a quantified notation (e.g. "10 YR 3/2"). Archaeologists document the matrix for a number of reasons, such as indicating the level of decay, determining the stratigraphic position of artifacts, and to enable reconstruction of the prevailing natural environment in ancient times. Archaeologists often collect soil samples for additional post-field analysis. For example, the matrix of a site often holds non-visible archaeological evidence like plant seeds that can be recovered through a laboratory process called flotation. The physical matrix of a site is altered by long-term human activity and some of it is literally the decomposed remains of organic debris. It is increasingly common for archaeologists to utilize non-destructive geophysical survey to collect data about the matrix, especially prior to excavation. Geophysical survey is used to measure differences in soil chemistry (e.g. phosphate analysis), magnetism from burned/heated features (e.g. magnetometry), and other soil properties (e.g. electrical resistance; ground penetrating radar). Geophysical surveys are used to predict where features are likely to be found, to delineate boundaries of human activity, and to approximate the general layout and structure of a site beyond what is usually possible with excavation.

Midden

In contrast to features, many habitation sites may include a midden. A midden is a stratigraphic layer within the matrix that represents the approximate ancient living surface and may or may not include features. A midden is often an undifferentiated organic layer of sediment that includes many artifacts, ecofacts, and features and is the result of heavy utilization of an area. Over time, dropped or decomposed materials become incorporated into the living surface and alter the physical composition of the soil. Some archaeologists use the term midden in a more restricted usage to refer specifically to an area used for discarding refuse. Middens can sometimes be extremely dense. For example, in areas where shellfish are consumed in quantity, massive piles of discarded shells accumulated to form mounds or layers as people effectively buried their settlements in their own non-biodegradable rubbish.

Prehistoric

Prehistoric literally means "before history" and is used to refer to time periods where there is no written historical record (i.e. written documents; photographs or drawings, etc.) Most of the human past is prehistoric; the only way in which we will ever know about these cultures is to interpret the archaeological record. Since the point at which the historical record begins varies from place to place, the arbitrary point where prehistory ends also varies. The term "proto-historic" is sometimes used to reference the transition period from prehistory to history where written records are sparse or indirect accounts. There are effectively four different kinds of archaeology in the United States: prehistoric, historic, nautical, and old world/classical archaeology. These four divisions are separate enough that they can be considered as separate disciplines with little overlap: each has its own practitioners, academic programs, peer-reviewed journals, and museums. The majority of American archaeologists study prehistoric Native American cultures with very few who cross-over into any of the other kinds.

Provenience

Provenience is one of the most important concepts in archaeological investigations as it is a description of the location where an artifact or some other cultural phenomenon was discovered, collected, or detected. Provenience can take diverse forms and is not always precise. At its most precise, provenience could be denoted be geographic coordinates accurate to a few centimeters. A broader provenience might only indicate a specimen's county (or county-equivalent) of origin (e.g. Montgomery County, Ohio), city (e.g. Dayton, Ohio), parcel (e.g. Smith Farm), site (e.g. Lichliter site) or similar geographic/administrative designator. County-level provenience is the broadest level that would be useful for most archaeological research and even then, only for certain types of research questions (e.g. distributional studies of a particular artifact type).

The most useful provenience information indicates the origin of a specimen within a site's boundaries, but this information could take many forms. Common examples on an archaeological site:

- An object could have 2D (X,Y) or 3D (X, Y, Z) coordinates that indicate a specific point on a grid, measured in centimeters relative to an arbitrary fixed point.
    - Example: A projectile point is mapped with a Total Station to indicate its coordinates relative to the site grid. Its position is recorded as 25.15 North, 100.75 East, 26.25 Elevation. (25.15 would refer to 25.15 meters, or 25 meters and 15 centimeters, north of an arbitrary grid benchmark.)
- An object could have two sets of measurements that specify its distance from two known points on a site grid ("triangulation").
    - Example: A stone axe is recorded as being 8.71 meters from 25N 100E and 6.25 meters from 30N 100E. These measurements can be converted into coordinates, but that conversion would usually take place in post-field processing. Such measurements are often taken manually with long surveying tapes.
- An object could have a provenience that specifies a particular excavation unit. Only the name or coordinates of the unit would be recorded, meaning that the artifact could have originated within any part of that particular area of the matrix.
    - Example: A ceramic sherd is recovered from an excavation unit that is labeled as "25N 100E" which is a 2x2 meter square unit of soil whose southwest corner is located at 25 meters North and 100 meters East of an arbitrary grid benchmark. Alternately, the unit could have a different designation, such as "Trench 1, Unit 4", or "Unit G6" that reflects a different form of site grid.
- An artifact could have a provenience that references a cultural feature, which is a type of "natural" unit that is an entirely different form of information than the arbitrary coordinates of the previous examples.
    - Example: A mussel shell hoe was recovered from a trash pit designated Feature 2016.1.

Note that in most modern excavations, there is an expectation that some indicator of depth, elevation, or stratigraphic position is recorded. This may be described simply as its "level." If one were using the above examples, there would be additional information that further specifies the fixed or relative vertical position.

- An artifact from the unit 25N 100E was recovered at a depth of 27 centimeters below the surface. This might be noted as 27 centimeters (which references a flat plane at that elevation) or alternately the less specific 25-30 centimeters (which references a volume of soil that includes all elevations between those two measurements).

The vertical position of an object may not refer to a specific measured depth and may instead refer to a stratigraphic layer on some sites. In sites where such layers can be defined, it would always be preferable to use those layers in favor of arbitrary coordinates. Such layers may exist across a site (e.g. a definable midden stratum) or they may be fills within a feature (e.g. a lens of ash and charcoal in a trash pit).

- Example: A sloping rockshelter has identifiable stratigraphic layers, each of which lay above or beneath other layers. Each layer is assigned a designator to denote its position within a sequence, such as "Layer 16A".

It is also possible for an object to have both natural and arbitrary provenience information recorded.

- Example: An object's provenience could be "Feature 2016.1, Layer 16A; 25.15N 100.75E 26.25 elevation"

It is a normal, expected, and acceptable practice to use all of the above types of provenience within a single project. For example, a principle investigator might choose to record precise 3D coordinates for formal tools (e.g. projectile points), but only assign a unit-level provenience to the less important artifacts. In this case, the investigator has decided to collect more detailed information for the special finds; an entirely expected and appropriate field methodology.

On large sites where multiple excavations have been undertaken over a long period of time, it is common for multiple types of provenience to be used on a single site as different investigators utilize different field methodologies. It is also common for methodologies to be modified over time within a single excavation as investigators learn more about a site and modify their strategies and tactics as new questions arise. In a long-tenured excavation, it is likely that methodologies will be adjusted as resources change. [Within the Lichliter excavation, the principle investigator used at least three completely different systems of provenience. Prior investigations by an amateur collector utilized a completely different system. Any future work on the site will undoubtedly utilize a system completely different from any of the previous four.]

Refit

A refit is a relationship between two or more objects that were once part of the same original composite object. Refits can be used to reconstruct objects from fragments, allowing a superior analysis of the composite in comparison to analysis of its subordinate pieces. Although refits can be useful in enhancing the research potential of individual objects, refits enable archaeologists to build interpretations of human behavior at large scales. For this reason, it is important to recognize and document the nature of the relationship between objects, because refits can be used to build many different kinds of interpretations. For example, refits can be used for reconstructing prehistoric behavior (e.g. establishing a link between a house and a nearby trash pit); demonstrating contemporaneity between features or activity areas within a site (e.g. demonstrating that two houses are from the same period or occupation); and understanding the process by which an object was created or modified (e.g. chipped stone tools).

Refits generally represent some kind of breakage and can be the result of many different kinds of processes. The breakage could have occurred during the object's use-life, intentional breakage reflecting social or ritual behavior, or breakage that naturally occurs over time as objects are affected by natural (e.g. freeze and thaw) or cultural (e.g. plowing) processes. For example, objects of chipped stone are directly the result of intentional controlled breakage to create the object; such refits allow an analyst to reverse-engineer the manufacturing process of a tool. In contrast, most ceramic breakage is accidental during use; ceramic refits may be used to interpret social divisions within a community, disposal patterns, etc. Although American archaeologists implicitly make refits on a continual basis, they are not always described explicitly or referred to as such.

Site

A site is a spatial clustering of archaeological data, which is usually composed of artifacts, ecofacts, and features. Common examples include campsites, workshops, quarries, villages, cities, middens, kill sites, cemeteries, ritual sites, and more. Sites can be highly variable in density with some being composed of just a handful of artifacts. Each state maintains an inventory of all recorded sites within its boundaries (e.g. Ohio has 50,000+ recorded prehistoric sites), but documented sites are only a sample of the much larger population of undocumented/undiscovered sites that exist. Few sites have discrete, recognizable boundaries (e.g. a wall; a ditch; a river); most are defined by an arbitrary boundary reflecting a drop-off in artifact density. Many sites are the accumulation of non-contemporary archaeological material over long periods of time or from different occupations ("components") separated by lengthy intervals. Most American archaeological sites in most regions are neither deep nor buried and in many cases have artifacts visible on the surface. American sites that are deep with multiple cultural stratigraphic layers tend to be some of the most important and dramatic sites (e.g. bison jumps, sites in very active floodplains, pueblo trash middens, etc.) but these are not representative of the majority of extant sites. The most numerous types of sites in all regions are sparse, shallow, have few subsurface features, and represent temporary or intermittent habitations by hunter-gatherer populations.

Special Find

Artifacts from a site might number in the dozens or the hundreds of thousands, but only a small subset are usually objects of high individual significance for archaeological research. These unusual objects are termed "special finds" or "diagnostic" to differentiate them from the rest. A special find might be a finished, formal tool (e.g. an arrowhead), an ornament (e.g. a stone pendant) or an object that has some characteristic that represents greater research potential (e.g. a ceramic sherd that includes the rim of the pottery vessel). An object does not have to be complete to be a special find. Most of the artifacts from most sites are not formal tools or ornaments, but there are differences based on material type. Most of the lithic objects are likely to be waste products ("debitage") from the construction or use of stone tools. For example, there will almost always be more flint chips ("flakes") from the manufacture of arrowheads than finished arrowheads. Ceramic artifacts are likely to include far more broken earthenware fragments ("sherds") than complete or intact vessels. Faunal artifacts (e.g. a hoe made from a mussel shell) can be difficult to spot because they are often obscured by the co-occurrence of more numerous bones from the butchering and processing of animal carcasses (ecofacts).

Individual artifacts can be special for many idiosyncratic reasons unique to a site or time period. For example, ceramic sherds that include crushed mussel shell as a temper would be a significant find on certain sites of a particular time period in southern Ohio, while the same artifacts would be unremarkable and common if found at a temporally later site. Some objects may not be modified in any way but their presence is itself notable, such as marine shells found at a site in southern Ohio where they would represent trade goods. In a few cases, the context of an object might elevate an otherwise unremarkable specimen to the status of a special find, such as unmodified animal bones found in association with a human burial.

Stratigraphic layers/Stratum (singular); Strata (plural)

Archaeological sites are inherently three-dimensional. Within a matrix, there are usually layers resting above and below each other like the layers of a cake. Some of these layers originate from past human activity and incorporate artifacts, ecofacts, and features. Other layers are culturally sterile and originate from geological or biological processes. A midden would be an example of a stratigraphic layer that represents an ancient living surface or a deposition of cultural materials. In an undisturbed context, the layers at the bottom of the sequence are those that were deposited first and consequently are the oldest; the youngest layers would be found at the top. It is common to find subsurface features (e.g. a trash pit; a burial) where past cultures excavated down into older layers, therefore depth in and of itself is not necessarily indicative of age or position in a temporal sequence. Archaeologists document these layers by excavating down through all available layers to expose a vertical 2D surface. This vertical face can then photographed and mapped as a "section" or "profile." In most cases, sites do not have complex stratigraphy unless there has been: significant cutting or filling of the landform (e.g. construction of an earthen mound); many separate episodes of disposition (e.g. disposal of large amounts of trash over a long period of time); or dynamic natural activity (e.g. frequent flooding in a river floodplain that deposits soil). When sites do have identifiable stratigraphic levels, it is usually preferable to excavate the site one complete layer at a time in its "natural levels." [This common terminology is confusing because it can be misinterpreted by non-archaeologists to imply that the origin of a layer is geological rather than cultural, which is not the intended meaning.] For comparison, consider that most sites are shallow and have no identifiable stratigraphic layers; the preferred method of excavation would be to excavate the site by regular units of measurement (e.g. 10 centimeters at a time), which are "arbitrary levels." [In this project, we adopted ArcheoLINK's less confusing terminology to describe all "natural levels" as "fills" and all "arbitrary levels" as "segments."] Although most sites themselves may not have definable stratigraphic levels, it is common for subsurface features to be composed of many different stratigraphic fills (e.g. a lens of ash and charcoal in a trash pit) that need to be documented for interpretation.

Survey

Surveys can take many forms but are primarily undertaken to identify new archaeological sites. Surveys comprise the majority of archaeological fieldwork. Most surveys are undertaken because of a mandated requirement to document how cultural resources will be affected by construction projects that are publically funded, on public land, or require federal permitting. Most surveys are conducted by for-profit Cultural Resource Management (CRM) companies who have been contracted by a private developer or government entity. A lesser amount of survey work is conducted by government agencies (primarily on federally managed properties), university field schools, and museums/historical societies. In a setting where cultural resources are expected to be visible on the surface (e.g. plowed agricultural fields; areas with little vegetation), a typical survey would be a field crew walking in regular transects across a parcel of land. Any artifacts visually encountered would be documented, mapped, and collected. Some encountered materials might not be collected from the field if they are common (e.g. nails, bricks) or if they occur in large, dense quantities. In areas where artifacts are not expected to be found or visible on the surface (e.g. heavy vegetation; buried sites), shovel-testing is a common substitute. Shovel-testing is the excavation of small, shallow holes at regular intervals to look for subsurface cultural materials. In recent years, many traditional surveys are being accompanied by geophysical survey. Most surveyed sites will never proceed to an excavation, but most excavations are preceded by a survey.

Terminology FAQ: Why do archaeologists universally mispronounce "provenance" as "provenience"?

They do not, because these terms do not mean the same thing. Provenience is an unfamiliar term to many museum professionals, but is one of the most important concepts in archaeological investigations. Provenience is a description of the location where an artifact or some other cultural phenomenon was recovered. In contrast, provenance is sometimes used to mean the origin of an object or phenomenon, but in museum curation (esp. art museums) it is most commonly used to refer to the record of ownership (or chain of custody) of an object. Provenance is a term seldom used in American archaeology, especially in regard to the archaeological research collections discussed here.

IB: Unique Traits of Archaeological Collections

Archaeological collections differ from non-archaeological collections in unique ways, such as:

- Archaeological collections are used for education, exhibition, and research like other collections, but there is an important difference. Consider the contrast of an archaeological collection with a historic collection of tools, clothing, or artwork. By definition, historic collections are objects from periods of time where much is already known about the cultures they represent. Objects may be used to fill in gaps in the historic record or provide new perspective, but by definition these historic collections do not exist in a vacuum of knowledge about their functions, creators, or cultural context. In contrast, archaeological collections may be some of the only sources of information about certain aspects of their creators and have a primacy that is different from other collections. From the perspective of an archaeologist, archaeological specimens are proxies of human behavior that can inform us about cultures that are otherwise poorly understood. It is important to note here that archaeological collections from American sites originate predominantly from pre-contact Native American cultures, many of whom have descendent communities with rich oral histories about their ancestors. These oral histories are of no lesser significance or potential than written histories of other cultures, but centuries of forced removal and forced assimilation have led to the loss of traditional customs and knowledge in some Native American communities. In the Midwest where the Lichliter project takes place, some tribes have suffered great loss in this regard. Some native partners have expressed interest in studying archaeological collections themselves to recover lost cultural knowledge as preserved in these collections.

- The characteristics that are significant to an archaeological collection may be those that are also normally recorded for other kinds of collections, but the significance of those characteristics is different. For example, it is a standard practice in all forms of museum curation to record the types of material(s) of which an object is composed (e.g. wood, paper, canvas, leather, etc.) In an archaeological collection, there is usually a narrow range of materials represented (e.g. lithics, ceramics, faunal, floral, etc.), but material type is highly significant and is usually the primary criteria by which a collection is segregated for analysis and storage. Archaeologists routinely divide and subdivide material types into increasingly specific compartments for analysis.
- Archaeological collections can have massive disparities in object size, ranging from boulders to microscopic pollen within the same collection. The smallest objects may be the most or least significant for research depending on the site and the research questions of interest. For example, botanical remains from a 16,000 year old Late Pleistocene ("Ice Age") site might be the most important specimens in a collection since they allow the reconstruction of a poorly known natural environment that is radically different from the modern environment. Similar specimens from a site more recent in age would be informative but would not likely have the same significance.
- The most scientifically important collections are not necessarily the rarest, oldest, largest, most complete, most complex, or most aesthetically pleasing. The research value of a collection is primarily dependent on the quality of its documentation from its initial field recovery. A collection of rare or exceptional objects with poor provenience has less potential than a collection of common objects that are well-documented. Where an object was recovered will always be at least as important as what was recovered.
- Not all archaeological specimens are equally important within a collection. Some specimens are individually significant or research, while others are only collectively significant when they occur in large numbers and/or recognizable spatial/temporal patterns. The idiosyncratic nature of these collections makes it difficult to predict which specimens will hold the most significance.

- There is wide variation in the potential significance of individual specimens or groups of specimens, much of which is dependent on the quality of the metadata. The most important metadata about an archaeological object is usually spatial (i.e. provenience). In the case of isolated finds, provenience is itself sufficient for research purposes. When objects are found in a cultural context, provenience data is accompanied by data about context and association which increase research potential. Two identical objects from the same site may have differences in context that render one more significant than the other. For example, a ceramic sherd found on the surface would not necessarily have the same potential as a similar sherd from the same pot found in a subsurface feature; dependent in part upon what questions are being asked.
- Precision does not necessarily correlate with research potential. Given the importance of provenience, it stands to reason that the more precise a specimen's provenience - the greater its scientific value, but this would be a misleading oversimplification. In general, an archaeologist would always seek the most precise level of provenience that is feasible, but precision on its own merits is not necessarily meaningful. In many projects, archaeologists pursue different scales of precision for different specimens.
- Archaeological collections can have massive disparities in collection size, which do not necessarily correlate with research potential. A collection of 100,000 nails from a historic site may not have any greater research potential than a representative collection of 500 nails from the same site, all other things being equal. Most specimens are most useful when they occur in groups where spatial and temporal patterns can be observed and interpreted. The collection of 500 nails may have more potential depending on the associated data (e.g. spatial position) recorded at the time of discovery.
- Archaeological sites can vary in complexity for a wide variety of reasons. A large collection is not necessarily a complex collection. Complexity can be the result of how a site is composed, but it could also be the result of a sophisticated field methodology designed to address very specific research questions.

IC: A Brief History of Midwestern Archaeology Collections

[Note: Far more exhaustive and comprehensive accounts of the discipline exist, such as Trigger's *A History of Archaeological Thought*. Although a nuanced understanding of archaeological theory is not necessary for proper curation, a broad understanding of the different eras of collecting is necessary to differentiate the many different kinds of collections in need of care. This section is written from the perspective of Midwestern archaeologists to be illustrative of general trends in the discipline while avoiding modest regional differences that obfuscate larger trends. Similar, but not identical trends, occurred throughout other regions (see Chapter 2 in Sullivan and Child's *Curating Archaeological Collections*). There are some distinctions between regions based on independent factors, such as the large percentage of federally owned land in the western United States versus the relatively small amount in the east. The purpose in focusing on the Midwest is to present a cohesive narrative that illustrates how and why archaeological collections were generated for extremely different intellectual purposes and how collecting practices were shaped by larger changes in theory and the structure of the discipline.]

American archaeology emerged from a non-scientific antiquarian origin that bears little resemblance to the profession as it exists in the modern era. Prior to the twentieth century, most collections were recovered in non-systematic excavations generally equivalent to modern looting. In addition to trophy hunting by local collectors, some collecting was also undertaken for what might be described (at the time) as more scholarly pursuits. The primary scholarly question of regional and national interest was the identity of the mysterious "Moundbuilders" of the eastern states, whom many at the time speculated were an advanced civilization that had been destroyed by primitive invaders. The "Myth of the Moundbuilders" required guilty parties and as a result, the racist labels of "savages" and "barbarians" were readily applied to the Native American tribes who were presumed to have destroyed the (supposedly) culturally superior Moundbuilders. The speculative and romantic notion of the lost Moundbuilders generated great public interest in determining their identity and fate. Some of the earliest (mid to late nineteenth century) collections were used to either promote or discredit the Moundbuilder myth. Most were personal collections obtained from mortuary contexts in earthen mounds. Other than a few notable exceptions, most have since been dispersed although a few collections or individual artifacts made their way into the care of museums.

In the Middle Ohio River Valley where the Lichliter project takes place, the widespread looting of archaeological sites was especially rampant in the late nineteenth century as collections were procured in haste for exhibition at the 1893 World's Columbian Exposition, for the collections of large museums, and for personal collections. Antiquarians (e.g. Ohio's Warren K. Moorehead) were primarily interested in objects of high aesthetic value or exotic origin and recorded only minimal information about where those objects were found. Although not necessarily at odds with popular expectations of the era, the disturbance of human graves (usually in burial mounds) to acquire the most attractive or unusual objects was especially callous and narrow-minded. The pursuit of archaeological objects as personal or institutional trophies was common and minimal contextual data was collected or maintained in this era. Although many of these late-nineteenth collections are extant in museum collections and these artifacts continue to be re-examined with emerging technology, their unfortunate lack of contextual data precludes a complete understanding of their cultural use and significance. In most cases, maps and associated documentation were of minor concern during excavation.

As the twentieth century dawned, American archaeology began to emerge as a more serious scholarly discipline as museums began to play a less dominant role and field archaeology became practiced increasingly by university researchers and investigations undertaken or funded by government entities. The completion of an exhaustive study by Cyrus Thomas in 1894 compelled the scholarly community to acknowledge that the prehistoric mounds and other sites spread across the United States were in fact the work of Native American ancestors, which brought about many new questions. For example, if Native Americans had built these monuments and impressive constructions, why was there seemingly so little extant cultural knowledge of their purpose and meaning? If perhaps these sites had been created in deep antiquity, what depth of time was represented? How long had these people been here? Were these ancient builders similar to or different from descendent groups? The discovery of human artifacts in association with extinct Pleistocene ("Ice Age") mammals in the late 1920s was especially shocking as it was unambiguous evidence that prehistoric populations had been present in North America for more than 10,000 years. Scholars increasingly recognized that these sites represented not only an immense depth of time, but also significant change over time as different groups occupied the same landforms but practiced different behaviors. Following the lead of European scholars, attention began to be paid to concepts like stratigraphic position as an indicator of the sequences of cultures over time. Temporal relationships were often poorly or erroneously understood, but were a high priority and compiled in earnest.

In the 1930s, the Great Depression brought high unemployment across the United States. The federal government responded with the New Deal program, an economic stimulus intended to employ laborers in a variety of pursuits that could advance the public good. The Works Progress Administration's (WPA) archaeology program (and others) resulted in an unprecedented amount of archaeological fieldwork led by some of the country's best and brightest minds. Although concentrated in the southeastern United States (where an abundance of both mounds and warm year-round weather are found), these programs yielded new and extensive collections along with associated contextual data from across the country. Although much of the work was conducted by unskilled laborers, the resulting collections were the product of systematic excavation methodologies even if they might be simplistic in comparison to more modern excavations. These methodologies were used to record provenience data about artifacts and the larger characteristics of sites themselves as represented by features, stratigraphy, and spatial relationships.

The first half of the twentieth century yielded data that was used primarily to establish "culture history" - the who/what/when/where of prehistory (note that "why" is excluded). Archaeological data was used at a broad level to define the occurrence of recurring artifact types and behavioral traits across time and across geographic expanses (e.g. river valleys). These types and traits were regarded as proxies for common "normative" behaviors and group identities; such commonalities were deemed more important than recognizing variation. Archaeology was not yet practiced as or considered a science by many of its own practitioners, as the focus on defining culture history was descriptive, but not explanatory. Many practitioners of the era did not consider archaeological data as having potential beyond timelines, trait lists and classifications, which were produced in quantity.

By the 1940s and 1950s, some anthropologists promoted the concept of culture as a non-biological form of adaptation to the natural environment, which led to increased interest in the culture ecology of modern and ancient populations (e.g. How do populations change in response to changes in the environment? How do they in turn modify the environment?) This notion filtered into archaeological inquiry by the 1960s and stimulated new interest in understanding prehistoric environments as they are represented in the archaeological record by ecofacts and other data. Excavations of mounds and mortuary sites continued, but there was also growing interest in finding and excavating habitation sites where basic information about economy and subsistence could be found. Although habitation sites had always been exploited, investigators increasingly made efforts to collect or note the more mundane artifacts and ecofacts of habitation sites. This interest became increasingly feasible with development of flotation in the 1960s; a new method for collecting carbonized plant remains that would previously not have been recoverable.

The invention of radiocarbon dating in the late 1940s was a major technological breakthrough in the dating of sites and cultures. Prior to radiocarbon dating, most of the temporal aspect of American archaeology was limited to relative dating: understanding sequences of cultural phenomenon through stratigraphic excavation, which was not always feasible in regions like the Midwest which lack deep, stratified sites. Radiocarbon dating offered a new opportunity for calendrical dating, which resulted in increased collection of datable archaeological ecofacts like wood charcoal, nuts, and seeds. Early radiocarbon dates were often unreliable in comparison to the more technically sophisticated methods employed today, but were still useful in providing a temporal dimension that was previously lacking in regions like the Midwest.

The Processual Archaeology of the 1960s was the culmination of many evolving ideas about the purpose, role, and goals of American archaeology. As a result, American archaeology began to diverge from the rest of the discipline as it is practiced in all other countries, where it is generally seen as an extension of history. Modern American archaeology is the fusion of a humanities and scientific approach, which was the result of conceptual changes to the discipline that had been building for some time and were popularized around the 1960s. During this time, Processual Archaeology (i.e. the "New Archaeology") emerged and was popularized by Willey and Phillips, Lewis Binford (coincidentally a close personal friend of Virginia Gerald whom excavated the Lichliter site), and others. At this important juncture, American archaeology became inextricably linked with anthropology and became focused on describing how and why cultures change (i.e. "process") among other theoretical concerns.

Processual Archaeology was the intersection of a variety of theoretical concepts that changed the practice of archaeology by advocating positivist hypothesis testing and the application of ethnohistoric models. One of the most important concepts for field methodology was the idea that spatial provenience was a physical reflection of behavior and relationships as they actually were practiced in antiquity. For example, one of Binford's most infamous studies was a first-hand observation of Nunamiut (Eskimo) hunters butchering caribou in which he recorded the distribution of different skeletal elements as the hunters processed and discarded them. Binford then applied this as a model to interpret a Mousterian (Pleistocene/"Ice Age") assemblage from France where similar animal butchering had taken place in antiquity.

An alternative to Processual Archaeological began to develop in the 1970s and by 1985, a new approach labeled "Post-Processual Archaeology" emerged, advocated by theorist Ian Hodder and others. Proponents argued that Processual Archaeology was environmentally deterministic and rejected systems theory, cultural materialism, and cultural ecology – these ideas treated culture change as external and regarded humans as passive objects molded by outside forces. Post-Processual archaeologists called for a more dynamic model of culture, instead of the passive model of normative and ecological paradigms. They recognized the human capacity to create and modify idea systems as an important source of how societies operate and change.

Many modern American archaeologists identify their theoretical approach as "Processual Plus," which reflects a modification rather than an outright rejection of Processual ideas. For example, although Processualism may have over-sold the interpretive potential of the ethnohistoric approach, the importance of intrasite spatial provenience (as well as context and association) remains an important priority of modern American archaeology. Most changes to archaeological field and lab methodology since the 1960s relate more directly to changes in technology and the nature of the profession itself rather than to shifts in theoretical stance or the types of information being collected.

Perhaps the largest change of the past fifty years of American archaeology is the birth and growth of the Cultural Resources Management (CRM) industry. In regard to archaeology, CRM is government-mandated archaeological practice that is often legally required when a project utilizes public land, public funding, or requires federal permitting. CRM has grown substantially since the 1970s and now accounts for about 90% of all archaeological fieldwork. The majority of CRM archaeological fieldwork is survey (which increasingly includes geophysical survey) with additional sampling and evaluation when potentially significant resources are detected. Some sites are deemed significant and in these cases, CRM companies are directed to mitigate the impending destruction or alteration of cultural resources. This mitigation often employs excavation as method for recovering information from the archaeological record.

The growth of the CRM industry produced massive amounts of new archaeological collections and has exacerbated an already significant curation crisis. Although the disposition and curation of CRM-generated collections was not always accounted for in the early years of the industry, this began to change in the 1990s. Modern CRM projects usually address the curation of recovered objects and many of these collections are then sent for permanent storage at museums and other qualifying repositories. These collections are normally inventoried prior to transfer and may even be organized, labeled, and placed in storage mediums by the CRM company following the directions of the intended curation facility. In other cases, the collection will be processed by the curation facility after transfer. In the modern era, CRM collections tend to be fairly well inventoried and organized since these projects usually require a quick turn-around in analysis, reporting of results, and determining the disposition of collections and data. Until recently, most CRM collected information was in paper analog format, but a transition to born-digital data collection has already begun by many larger CRM companies. Born-digital data invites its own set of curation issues as the profession struggles to deal with rapid changes in technology, storage mediums, software, and the long-term preservation of digital information.

ID: Different Types of Archaeological Collections

In regard to curation, there are significant differences in the content of American archaeological collections that relate to the eras in which they were recovered. For the purposes of discussion, some operational terminology is needed in order to differentiate collections by their composition and their respective challenges:

"Antiquarian" Collections - These are generally the earliest collections and were obtained by amateurs and/or investigations sponsored by state or local historical societies and sometimes universities. These collections are primarily artifacts from mortuary contexts (e.g. mounds) or surface contexts. Most artifacts are formal tools or ornaments, while more common domestic debris is usually absent. Ecofacts are uncommon. Provenience information is often present (although often imprecise) and ranges from county-level provenience (e.g. "Montgomery County, Ohio") to site-level (e.g. "Lichliter" or "33 My 23") or possibly feature-level provenience (e.g. "Mound 10, Burial 4"). Contextual data is minimal or absent. Maps and notes are minimal or absent. No more collections of this type are being generated by the professional community because such non-systematic activity in the modern era would generally be treated as looting. Data are in analog format, often hand-written. Some or all data may have survived only because it was hand-written on the artifacts themselves.

"Amateur" Collections - These collections are common in museums and historical societies. Some come from the proverbial (or literal) farmer's coffee can - surface finds collected opportunistically by a landowner (e.g. grandpa's collection of arrowheads from plowing his fields). Most have no associated data for individual objects, but may retain some provenience in that all objects originated from a discrete parcel of property. Other amateur collections are those collected by hobbyists (e.g. "arrowhead hunters") or avocational practitioners. These are composed primarily of surface finds from non-systematic amateur surface activities. Contextual data is usually absent, but county-level or site-level provenience is common. Maps and notes are minimal or absent. Few new collections of this type are being generated as a result of changes in farming practices, the decline of "artifact hunting" as a hobby, and the commercialization of artifacts that discourages owners from donating them to museums or historical societies. Data are usually in analog format, often hand-written. When provenience exists for individual artifacts, this information was often hand-written on the artifacts themselves. More prolific collectors sometimes created inventories or ledgers of their collections. Undocumented amateur collections can be dubious for research because it is common for amateur collectors to trade, buy, or sell specimens and intermingle the resulting specimens without documenting their disparate origins.

"Survey" Collections - These collections are more common in collections curated by state or federal agencies, including state-level historical societies and universities. These are most frequently generated by CRM companies, university field schools, and government agencies. They result from systematic surveys over large areas for the purposes of documenting new archaeological sites, often through visual surveys (e.g. collecting artifacts from plowed agricultural fields) or shovel-testing (systematic shallow digging at regular intervals across a field). Some lesser amount of these collections represent small exploratory test excavations conducted after survey to evaluate the potential significance of individual sites. Collections usually consist of artifacts, but few ecofacts or subsurface finds. Most are from projects no older than recent decades and these collections are the most common type being collected in the present day due to legal mandates. Many of these collections are well-documented, mapped, and usually have site-level provenience at a minimum. Data format may be analog or digital, depending on the era in which the collection was generated. In recent years, most survey provenience data is now collected with GPS, which yields highly precise digital spatial coordinates. Geophysical survey is increasingly being used as an efficient, non-intrusive method of data collection alongside traditional survey methods. Geophysical data is exclusively digital in format.

"Legacy" Collections - These were collected in the 1930s or later, especially from the 1960s onward and continuing to the present. These are analog collections that were obtained through controlled excavations and have modest to large amounts of contextual data. Provenience is usually feature-level at a minimum, but may include provenience from individual levels of features. Maps and notes are often extensive. Collection size can vary considerably, but all types of artifacts, ecofacts, and subsurface features are likely to have been recovered or documented. These are often from lengthy excavations, the nature of which varies considerably across different types of sites and regions. They originate from projects sponsored by universities; state or local historical societies; CRM companies, federal or state agencies; and museums. Although they may have digital inventories or finding aids, these are primarily analog collections where most or all of the non-object data (maps, field notes, photographs, etc.) exist in analog form. Equivalent collections continue to be generated in the present by universities, museums, and CRM companies where some data are collected in analog format (e.g. unit or feature maps; field notes) and some in digital format (e.g. total station; GPS; photographs). In modern projects, analog data are usually reformatted into digital format in post-field processing.

"Born-Digital" Collections - These are new collections with associated digital data that were obtained through controlled excavations and have modest to large amounts of contextual data. Provenience is usually feature-level at a minimum and spatial positions may even be measured with centimeter or sub-centimeter precision. Maps and notes are extensive and standardized. All types of artifacts, ecofacts, and subsurface features are likely to have been recovered or documented. These are often from trench or block excavations, the nature of which vary considerably across different types of sites and regions. There are probably very few existing collections where all information is born-digital, but we anticipate that such collections will become common in the near future. Although it may be decades until digital data collection completely replaces analog (if ever), some CRM companies, government agencies, and universities have already begun the transition some time ago. Most archaeologists have been using digital cameras and collecting spatial data with total stations or GPS for many years, but the movement to using tablet-based entry for other kinds of field data will likely grow considerably in the foreseeable future. Adoption will be uneven: the high expense of equipment and software will likely result in a slower adoption by universities, museums, and smaller CRM companies. Born-digital data collections are currently structured around multiple independent digital technologies (e.g. GIS technology; digital cameras; geophysical data collectors), but some of these functions will likely be consolidated into fewer devices over time or linked together through enterprise level cloud applications.

Collection Type	Antiquarian	Amateur	Survey	Legacy	Born-Digital
Likely Era	1850s-1960s	1900s-2000s	1960s-Present	1930s-Present	2000s-Present
Context	Surface; Mortuary	Surface	Surface	Subsurface	Subsurface
Level of provenience	County; Site; Feature for mortuary contexts	County; Site	Site; Feature for test excavations	Feature; SubFeature	Feature; Subfeature
Collection composition	Artifacts (lithics and mortuary objects)	Artifacts (lithics)	Artifacts (lithics)	Artifacts (all materials), Ecofacts (all materials), Soil samples, etc.	Artifacts (all materials), Ecofacts (all materials), Soil samples, etc.
Associated data	Minimal or absent; Some maps	Minimal or absent; Some maps	Moderate to High; Maps and spatial data; Field notes	Moderate to High; Maps and spatial data; Field notes, Photographs	High; Maps and spatial data; Field notes, Photographs
Data format	Analog	Analog	Analog; Digital	Analog; Analog+Digital	Digital
Research potential	Low to Moderate	Low to Moderate	Moderate to High for some types of inquiries	High for many types of inquiries	High for many types of inquiries

IE: Fragmentation

Legacy and born-digital collections often exhibit moderate to severe fragmentation. Fragmented collections are those whose specimens or metadata have been separated, isolated, compartmentalized, or otherwise compromised for future research by a lack of integration. For an analog legacy collection, this might mean that metadata is spread across many different documents (e.g. field records, maps, catalog cards, hard copy photographs, analytical results, reports, etc.) and that no full compilation of metadata into a single dataset has been achieved. For a collection that is partially or fully digitized, this may include unnecessary duplication of metadata into different formats, incompatible file formats, inconsistent or truncated data across digital platforms, or lack of an effective unique identifier (a "primary key") to link together metadata from different sources. Fragmentation is the result of increasing specialization within the archaeological discipline and the lack of digital solutions to consolidate information into integrated relational databases.

Over the past 50 years, the shift to a discipline dominated by Cultural Resource Management (CRM) represented a sea change in the roles and responsibilities of different individuals associated with an archaeological project. Prior to CRM, most archaeological collections were curated and analyzed by the same individuals (or their assistants) who had served as the primary investigator of the surveys and excavations in which these materials had been collected. These individuals were curators at museums or historical societies, academics employed by universities, and staff or contractors of government agencies. Prior to CRM, the burdens of fieldwork, analysis, reporting, and curation were shouldered by a small number of individuals and their students or assistants. This is somewhat still the case in regards to archaeologists employed by universities and museums, but these professionals now represent the minority of the discipline. The majority of fieldwork is now conducted by professionals in the CRM industry or their government equivalents.

No sector of archaeology has remained unchanged over time, because all professional archaeologists have become increasingly specialized in their research interests and analytical skills. The early generations of professionals were expected to be proficient in multiple classes of artifacts (e.g. lithics, ceramics, and faunal materials) as well as multiple cultures from a diverse expanse of time, due in part to the low number of professionals and the limited funding for professional staff. In contrast, many modern archaeologists tend to specialize primarily in only one or two types of analysis (e.g. lithics) or even subspecialties (e.g. lithic microwear analysis). Many of these specializations and subspecializations did not exist until relatively recently and new specializations will undoubtedly continue to emerge over time. In the twenty-first century, analytical specialties are increasingly based less on knowing local artifact typology and more upon technical proficiency with emerging technologies. Many modern professionals also specialize primarily in only one or two time periods/cultures. As archaeological projects have become increasingly more complex and comprehensive, there has been a fragmentation of roles.

The fragmentation of roles and responsibilities has led to a fragmentation in information.

A large modern CRM project can be logistically complex, involving many individuals who do not necessarily even work in the same locations. Medium and large CRM companies often maintain field offices in multiple states and may receive contracts for remote work in yet still other states. Survey and excavation are undertaken by a field crew, whom are often seasonal employees that move from one project to the next (and from one company to the next), including across states and regions. Data collection in the field may be spread across many individuals, some of whom are specialists proficient in new technologies that did not exist until recently (e.g. GPS, GIS, geophysics, surveying instruments, etc.) Even a small project may have mapping or photography assigned to a single specialist or supervisor. Roles and responsibilities within a CRM project may be highly segregated between individuals as companies seek efficiency and economies of scale.

The principle investigators who organize these projects are usually full-time employees who are responsible for managing multiple aspects of a project, including budgeting, logistics, and writing reports. Post-field analysis is often aided by a handful of specialists, who may or may not participate in fieldwork and/or may be employed as a subcontractor rather than an employee. Each artifact class might potentially be examined by a different specialist depending on the requirements, scale, or scope of the project. If the analyst is a contractor rather than an employee, it is a common practice to loan subsets of the collection to the analyst for off-site analysis. The organization of the completed collection and associated data may be undertaken by a variety of individuals whom will then surrender these collections for permanent curation by a staff at a museum, historical society, or other repository.

At each juncture of the process, new information is added to a collection, but there is also a potential for information to be lost or ignored if it is not recorded in consistent integrated formats. As a collection and its metadata accumulate and move from one stage to the next; there is potential for the physical and digital components of a collection to become resorted, compartmentalized by analysts, and for each of form of metadata to become increasingly separated from the others. Spatial data (coordinates, unit maps, feature maps, profiles, geophysical data, aerial photographs, LiDAR data, etc.) are often destined for use in mapping (CAD or GIS) software. Specimens that were initially collected together from a single provenience become separated from each other as they are sorted into different material classes (lithics, ceramics, faunal, floral, carbon samples, soil samples, etc.). Each material class is likely to be further subdivided as analytical specialists sort the material (e.g. different raw material sources; different stages of manufacturing debris). Special finds (tools, ornaments, artifacts with diagnostic traits) are isolated from non-special finds during field recovery, cataloging, or analysis. Additional metadata on each material type (at the level of individual objects and the level of the assemblage) are generated during analysis. Final versions of maps and photographs may be further edited by a graphic designer. Final reports condensing all of this information are written by principle investigators and submitted for approval. When the project is complete, all of these objects, documents, and files will at some point usually be surrendered for curation at a museum, historical society, or repository. Curation of the collection is likely to be handled by professionals not associated with the project and in addition, may be specialists in collection management whom do not have any archaeological training.

Other serious forms of fragmentation also occur.

Although not topic addressed in the Lichliter project, there are other common sources of fragmentation. In some cases, objects and associated data (i.e. field records) are not submitted for curation at the same institution, perhaps because of conflicting or unclear ownership where multiple government agencies overlap. In other cases, archaeologists surrender objects and final reports, but neglect to include the original field records and raw data. Finally, it is also common for large collections to be split between more than one curating facility. This occurs frequently with large complex sites where multiple separate investigations have been undertaken by different entities.

For example, the Lichliter site collection is split between the Dayton Society of Natural History (DSNH) and the Ohio History Connection (OHC). DSNH curates all of the materials from its own investigations at the site from 1962-1970 and a small amount of surface-collected material donated by a local collector in the years since. Prior to DSNH's activities, an avocational archaeologist John Allman (who first discovered the site) had excavated a significant portion of the site in the late 1950s. Despite their overlap with DSNH's excavation, Allman's collection and notes were independently donated to OHC to accompany his collections from other sites.

IF: A Brief Survey of Archaeology Cataloging Practices

Ohio History Connection (OHC)

- Inventory system
  - Organized by site, then by survey/excavation unit, stratum within an excavation unit, feature, stratum within a feature, then object type
  - Staff issues collection numbers/catalog numbers
  - Required lexicon
  - Diagnostic artifacts have individual object numbers
- Documentation
  - Field notes, field maps, images, photographic records, project proposal, project report, collection catalog, conservation reports, NAGPRA-related documents, special analyses, documents signed by private property owners, and titles required if applicable
- Object Catalog Form Example

Coll #	Obj #	Artifact	Material	Count	Provenience	CMBS

https://www.ohiohistory.org/OHC/media/OHC-Media/Documents/ArchCollAcquisProced01012015.pdf

National Park Service (NPS)

- Inventory system
  - No required lexicon/numbering system
  - Field records cataloged as archival/manuscript collections and cross-referenced
- Minimum mandatory provenience data required
  - Field site number

    - State site number
    - Site name
    - Within site provenience

https://www.nps.gov/museum/publications/MHII/mh2appe.pdf

University of Wyoming (UW)

- Inventory system
    - No required lexicon/numbering system
    - Each artifact must have: catalog number, FS#/map#, block/unit, north/east, point plot/other provenience, level, elevation, feature, screen size, shovel/auger, count, description
- No provisions for associated records – requirement to attach photograph forms

University of California (UC)

- Inventory system
    - No required lexicon/numbering system
- Organization in one of two ways
    - By artifact class then catalog number
    - Exclusively by catalog number
- Field notes, maps, photographs, and artifact catalog required
- Artifact catalog fields: accession number, catalog number, site, unit, level, class, object, modifications, material, weight, count, discards

http://www.anth.ucsb.edu/sites/secure.lsit.ucsb.edu.anth.d7/files/sitefiles/resources/repo/SubmProcedures_2008.pdf

Idaho State University (ISU)

- Inventory system
    - Required lexicon
    - No required numbering system – each item sample and lot in the collection must have horizontal and vertical proveniences either listed in the catalog or directly in the catalog number
- Required documentation
    - Smithsonian site number

- Site forms
- Catalog of materials – catalog number, object name and description, material type, condition, measurements
- Reports and other documentation
- Photographs

Summary Observations

In the sample, only OHC requires a specific lexicon AND assigns its own catalog numbers (so all catalog numbers in the repository are consistent)
Only NPS requires cross-referencing of archival materials/maps with artifacts
All information is kept in forms or Excel databases = hundreds of pages/files

	OHC	**NPS**	**UW**	**UC**	**ISU**
System of collection	Inventory	Inventory	Inventory	Inventory	Inventory
Specific lexicon required?	Yes	No	No	No	Yes
Specific catalog numbers required?	Yes – assigned by staff	No, but could vary depending on separate park policies	No	No	No, but must contain provenience
Archival materials required?	Yes	Yes	No	Yes	Yes
Archival materials cross-referenced with artifacts?	No	Yes	No	No	No
Smallest level of provenience required	Level within feature	"Within site provenience"	Level within feature	Level within feature	Not mentioned

IG: The Dynamic Nature of Archaeological MetaData

Archaeological metadata is dynamic for a variety of reasons. First and foremost, it is accretional knowledge accumulated over a lengthy period of time by different individuals at different stages of a project. Much of the most important information generated about specimens is not necessarily known or recorded at the time of an object's field recovery. Additional information is added during laboratory processing and during analysis, such as catalog numbers, type designations, measurements, weights, drawings, and images. Individual specimens may also be subjected to additional specialized testing, such as radiocarbon dating, carbon isotope analysis, residue analysis, etc. Some archaeological data relate only to specific objects (one-to-one) and some relate to multiple objects (one-to-many relationships).

Secondly, specimen metadata includes relationships that are apparent at both the time of discovery and in subsequent stages. At the initial recovery, an object's provenience is documented as well as its context and associations, but this information can easily be subject to change as the object's relationships are further recognized or modified. A unique trait of archaeological collections is that relationships exist between objects and other objects, but also between objects and physical non-object spaces (e.g. features, stratigraphic layers, and empty spaces) that are equally important. As more objects or information are added to the collection, these relationships may change in their content, significance, or interpretation.

Finally, the unique nature of archaeological investigation brings about great unpredictability in what information will be recovered, when it will be recovered, and seemingly minor details can later become highly significant in the interpretation of objects, features, sites, and cultures. Archaeology is about discovering the unknown, which includes false starts, unexpected twists and turns, revisiting old collections, and constant reevaluation of what we think we know across diverse scales of inquiry. Some archaeological projects take place intermittently over years and decades with shifting personnel and methodologies, the introduction of new technologies, and ever-changing interpretations.

The Story of a Humble Sherd

A landform containing prehistoric archaeological sites is being evaluated in advance of a highway construction project. An archaeological investigation will be used to evaluate the landform for cultural resources that may be adversely affected by construction. A local site grid is set up and a surface survey for artifacts is conducted to ascertain whether or not further investigation is justified. Clusters of artifacts are found in several locations and small excavation units are established for further investigation. Since this is an agricultural field, the first 25 centimeters below the surface are expected to have been disturbed by past plowing activities; commonly designated as the "plowzone." Artifacts are likely to be found in the plowzone, but plowing normally eliminates any features. Surface or plowzone artifacts are consequently assumed to be indicative of potential subsurface features and additional artifacts, but are not ideal since they lack true context and associations are unreliable. For example, it is common for artifacts of different time periods to be mixed together in the plowzone. Although some shallow sites have no subsurface features, the field crew hopes to find preserved subsurface cultural materials beneath the overlying plowzone. A young field assistant is directed to hand-excavate (with shovel and trowel) a two by two meter unit (designated as "25N 100E") to a depth of 25 centimeters below the surface.

At 25 cm, the field assistant levels off the unit to a flat floor, produces a map, and photographs the unit at this level. A single ceramic sherd from the rim of an earthenware pot is conveniently found at this level. Its provenience is recorded simply as 25N 100E, 25 cm (its depth below an arbitrary known reference point on the surface). No other artifacts or cultural materials are found with it (i.e. there are no obvious associations with other objects at that depth) and no features are seen, although our field assistant noted he had a difficult time getting a good photograph because the soil kept drying out quickly in the hot weather. Some charcoal flecks are noticed near the sherd and in a few other places within the unit. The soil properties (color and texture) and charcoal flecks are recorded on the map. The charcoal flecks are too small to be collected, nor is there any specific reason to do so. Our field assistant removes and bags the sherd with its associated provenience data recorded on the paper bag. The field specimen bag is sent to the lab at the end of the day, the map and photograph are filed, and the crew heads home for the weekend. It appears that provenience, context, and associations have been recorded, but have they? Consider the following realistic scenario.

On Monday morning, our field assistant is sick and a different, more experienced field assistant is assigned to continue excavating down to the next level: 30 centimeters below the surface. The dark soil color and warm weather made it hard to see much of anything at 25 centimeters, but the soil matrix is getting lighter as the field assistant removes soil. It is now clear to our experienced worker that there are subtle cultural features visible at the 30 centimeter level (a difference of only 5 cm or approximately 2 inches). The exact spot where the sherd was located is now identifiable as a likely postmold (a stain where an ancient post was placed and subsequently decayed in place). Upon reviewing the photographs in the lab, it becomes clear after the fact that the postmold was subtle, but was even slightly visible in the 25 cm photograph even though it wasn't noticed at the time. The charcoal flecks (remnants of the ancient post) continue in this spot as the field assistant trowels down to the next level and the soil texture there is softer than in the surrounding soil matrix. It is now clear, well after the time of initial discovery, that the sherd was in a postmold. The postmold is given the designation F2016.18. The sherd now has additional significant provenience information ("F2016.18") which does not negate or replace the original provenience information (25N 100E, 25 cm), but needs to be appended to it.

How is appending the provenience information problematic?

In this common scenario, there are several potential pragmatic limitations that may prevent the postmold data from being effectively appended to the sherd's data (and potentially the 25 cm map as well). First, the experienced field assistant may not necessarily be aware that her colleague recovered a sherd from the previous level. This may be because the experienced worker was not present at the time of recovery, or has simply forgotten about it in the intervening week, or perhaps doesn't think to go back to the previous level's data and update it because there are dozens of other sherds found every day. Second and more importantly, the additional provenience information cannot be immediately added to the field specimen bag containing the sherd because the bag is no longer in the field. It is in the lab where the sherd is being washed, inventoried, and placed into a storage container. The most likely outcome is that the additional contextual information (its location within a feature) does not get added to the sherd in most cases because *the information was not immediately available*. In addition, at the time of discovery *it was not possible to predict that the additional information would be available at a later date*.

Does it matter?

If provenience did not matter, there would be little distinction between archaeology and looting. This distinction is exactly why previously discussed antiquarian collections have limited research potential beyond their individual physical attributes. Recording provenience, context, and association is a key prerequisite for archaeological research and these relationships are arguably the most important aspect of most, if not all artifacts. On its own individual merits, the sherd's functional and stylistic properties tell archaeologists only a little new information. Context and association provide the essential information necessary to build larger arguments about human behavior that go beyond the characteristics of individual artifacts. Smoking guns (meaning individual points of data of very high significance) are relatively rare in science. Few artifacts are individually very informative in most archaeological investigations, but the temporal and spatial patterns in which they occur are some of the most meaningful information recovered. Those patterns cannot be recognized or articulated with inconsistent or incomplete metadata.

Does it always matter?

Not necessarily, because in most archaeological practice, not all artifacts are equally useful for analysis. Some artifacts will (and should) receive more attention than others. For example:

- A sherd from the rim of a pot ("rimsherd") is usually more informative than a sherd from the body of the pot and would be designated a "special find."
- An artifact from an intact subsurface context is more informative than one from a disturbed (e.g. plowzone) context.
- An artifact from a feature context is often more informative than one from a general undistinguished midden layer.

In this example, the sherd in question fits all three of these criteria. Its distinction as a rimsherd alone would immediately be noticeable as likely to yield more information than other artifacts. There are other reasons why an artifact might be designated a special find, only some of which might be apparent at the time of discovery. The problem is that *we often don't know and can't predict which artifacts will ultimately turn out to be special finds* of high significance because of the gradual accretional process of how information is recovered, encountered, and generated.

The project continues…

The excavation temporarily shuts down during the winter season. The crew is reassigned to process artifacts and to other higher-priority projects. Since no further field work can be undertaken during the winter, most of the field crew is not retained and most move on to other opportunities.

As spring weather arrives, the supervisor returns to the site with a new crew for the next stage of the project. Given that the original test unit was productive, he directs additional units to be opened around the original unit. Our supervisor knows that a single postmold does not necessarily indicate architecture, but is hoping to find evidence of domestic homes at the site.

More postmolds and more artifacts are found. It is now clear that the postmold is one of many that represent the continuous wall of a house. Other postmolds that do not clearly belong to this house are also found in the vicinity and may be part of this house, other adjacent houses, or no house at all. Additional provenience information (the house number "Structure 2016.3") is now available for our sherd excavated last year, but no one has any reason to remember the humble sherd that we started with nor any of those recovered since - all of which have long since been catalogued and placed in temporary storage to await analysis. As new sherds are recovered, those associated with the house are assigned provenience information accordingly. Due to the sequence in which data was recovered, the full and most useful provenience (its association with the postmold and with the house) of the original sherd was not initially clear at the time of discovery and was only evident months later after more excavation was completed.

One sherd did not get all of its provenience/context information effectively recorded. Is this really a widespread problem? Can it be fixed by adding some oversight in a post-processing stage?

Significant omissions in metadata happen countless times every day to finds of high and low significance. Limiting our scenario to a single sherd makes it easier to provide an example for discussion, but it also misleadingly implies that this is only an occasional problem that affects few objects at one stage of the process. It is a widespread problem of data management, which will become increasing difficult to handle as the project continues.

Months pass while this site (and many others nearby) are evaluated to determine which sites are significant enough to justify further work. The site is slated for destruction by the new interstate. A new crew returns to the site. They re-establish datum points on the original grid system and are directed to mitigate what remains of the site prior to demolition. This crew has more funding, but less time to work. The decision is made to use mechanical stripping to remove the plowzone, record intact features, and excavate a sample of those features. The new crew does not have time to excavate and map individual units. Although they use the same arbitrary mapping grid, they do not set up physical stakes or pins for mapping. Instead, they use a total station to record the 3D coordinates of the features and individual artifacts they recover from the area of the house. They record more postmolds, more ceramic sherds, and many other kinds of artifacts.

In contrast to our original sherd (which has a unit and level provenience), the other hand-excavated sherds (which have a unit, level, feature, and house number), the sherds from the mitigation have provenience information only in the form of 3D coordinates (and no other provenience information reflecting their membership in the house or individual units.) There is now a problem of metadata that is partially incompatible with the data collected from the earlier stages of the project. This occurred because field methodologies are also dynamic and change as different resources or requirements are introduced throughout the course of a project.

The same arbitrary grid was used to collect both types of provenience information, so it is possible to at least overlay these different spatial datasets to make a composite map. In the lab, maps are made by overlaying the coordinate data with excavation maps, but all of this three-dimensional spatial information is confined within the mapping software. There is no mechanism for its incorporation into other applications, such as those being used to catalog/inventory the specimens, which contributes to metadata fragmentation.

During the mitigation, many postmolds are located. A sample of postmolds are excavated and small amounts of wood charcoal are recovered from their fill. Some samples are kept for botanical analysis (for wood species identification) and others are sent for radiocarbon dating. The fieldwork is completed and the site is destroyed by construction. Due to the speed of the mechanical stripping and the use of the total station, the mitigation went quickly. As the project nears completion, the investigation unravels in light of new findings. After the radiocarbon date results are received months later, it becomes clear that the postmolds represent adjacent houses from completely different time periods whose artifacts will need to be differentiated in the lab. Good provenience information is the only way to tell which artifacts go with which house/time period prior to their analysis.

These appear to be problems in field methodology. How is this a problem in curation?

It is not a problem limited to field recovery, but it begins there. It is ultimately a problem related to the curation of specimens and metadata, which begins in the field, continues to the lab, persists in storage, and is further exacerbated each time the collection is inventoried or re-analyzed. Long after an artifact is recovered and inventoried, additional data becomes incrementally available (e.g. radiocarbon dates) and new relationships (e.g. refits; groupings) are recognized.

More months pass. When it comes time to perform the ceramic analysis (and analysis of other artifact types), the uneven manner in which provenience information was discovered and recorded makes this a cumbersome task. Given the constraints of time and funding, the ceramic analyst tries to choose the lesser of evils:

- Should the analyst attempt to append, update, and reconstruct the provenience of all significant ceramic finds? This would be very time-consuming because it requires consulting multiple sets of non-integrated data just to be able to look at one assemblage in the collection. The subcontracted analyst has no first-hand familiarity with the site or the field methodology and has not participated in the project until this stage. In addition, our analyst is not a specialist in computer mapping and does not possess the skills or tools to compile new maps from raw field data.

- Should the provenience information be ignored? This would be especially unwise given that we now know this is undoubtedly a multi-component site. Objects made hundreds or even thousands of years apart from each other would be lumped together in artificial groupings that have no real meaning. (The inability to differentiate components within sites was a consistent failure of many archaeological endeavors in the early twentieth century.)
- Should the analyst query the data and just retrieve the artifacts that have clear provenience information that connects objects to specific house numbers? Only a portion of the sherds (the most recently recovered sherds) have this information and only some of them are rimsherds. This produces very small sample sizes or perhaps no specimens at all for the analysis.
- Should the analyst just take their best guess at which artifacts go with which house and begin the analysis? Probably, but why was that information collected in the first place if it couldn't effectively be utilized in the analysis? How will the results of the ceramic analysis compare with those of other analyses (e.g. lithics) if each analyst is left guessing what to include or exclude?

The analyst arbitrarily selects a sample of what she believes to be a representative sample of the most significant specimens, which are rimsherds and other decorated sherds with motifs. She is conscientious, reviewing and compiling the provenience data for the selected sherds into a spreadsheet. In the process, she is able to fill in some of the obvious missing provenience metadata. The remainder of her spreadsheet includes measurements on each sherd such as weight, thickness, dimensions, and other information generated by the analyst. She also creates additional new information about each artifact in other formats, such as photographs and digital illustrations of rim profiles. All of this information is compiled into her own spreadsheets and files, none of which is likely to be used to populate the catalog, especially since the catalog was completed in the lab months ago.

For her sample, she locates rimsherds from different postmolds across the sites that are similar to each other. Some of these rimsherds originate from the same pots and can be physically rejoined or "refitted." Refits are a type of relationship that can be highly significant in the interpretation of behavior at a site. Refits can be used to make many different kinds of arguments, which differ based on the type of artifact. For ceramics, refits are commonly used to increase the sample size of a pot, which allows for a more accurate reconstruction of the shape, size, and form of the complete vessel. In the context of this site, refits will be also used to demonstrate that certain features are contemporary with each other, aiding the primary investigator in interpreting this multi-component site. Refits could be denoted in several possible ways. The analyst produces a spreadsheet listing refits between individual ceramic specimens. The primary investigator then uses this list to interpret which features are contemporary with each other, ultimately producing a table and map visually denoting these links.

The analyst reviews the remainder of the ceramic assemblage, which are body sherds that fall into several categories based on the type of temper used to construct the pot in prehistory. For these non-special sherds, she seeks only to produce a count and a weight for each temper type. In order to do so, it is necessary to further subdivide most of the groupings into sub-groupings based on temper type. These subgroupings will need to be differentiated from each other with some form of new inventory number. In addition, their original inventory numbers will have to somehow be negated or annotated to avoid the erroneous appearance of the sherds suddenly doubling in number within the catalog inventory.

In the process of sorting the body sherds, the analyst finds additional rims and decorated sherds mixed in with the body sherds. These were missed by the non-specialists who processed the collection in the lab many months ago. These sherds should be separated and placed with the other special finds. New inventory numbers will need to be generated, the count will need to be adjusted within the existing inventory, new storage containers, new storage locations, etc. Lacking time or a processing procedure, the analyst is unsure what to do with these special finds.

The pragmatic process of an archaeological project causes the most useful metadata to be the least likely to be incorporated in the final catalog.

Although our hypothetical team of professionals will presumably manage to complete the excavation, conduct the analysis, and produce the necessary reports, the types of messy obstacles described here will not be resolved at the completion of the project. Objects, documents, and files will be placed in storage, but the organization of the collection and its associated data will be very difficult for future researchers to understand or reverse.

This is a hypothetical scenario that may not directly resemble the process of any one organization or agency nor the wide divergence in the types of sites and material culture that American archaeologists investigate. The types of problems identified here (which are by no means comprehensive) should hopefully be familiar enough to most archaeologists, especially those who are charged with the curation of archaeological collections.

For non-archaeologists, it is most important to understand that the data associated with artifacts are not just another kind of metadata that is recorded once or can only be assigned in one acceptable way. The provenience, context, and associations of an artifact are recorded at the time of discovery, but they are dynamic and subject to change or be appended as new objects, information, or relationships are added. It is common for changes and additions to occur throughout the initial recovery as well as long after the completion of an excavation.

A large part of the underlying problem is that we often do not know (and cannot expect to know) all of the potentially relevant information about an object at the time of its initial discovery (e.g. the relationship of the sherd to a feature; the relationship of that feature to other features), what information might later prove to be informative (e.g. the sherd's attributes provide information about the feature/site; the sherd refits that helped resolve some of the ambiguity in dating; the radiocarbon dates provide an independent set of information about dating that relates to the sherd), and other information that results from analysis or an improved understanding of context.

IH: Numbering Systems

How are numbering systems used by museum professionals to track specimens?

All museums and repositories use a numbering system to assign unique identifiers to specimens and groups of specimens, but with diverse and sometimes bewildering systems of notation. Accession numbers and catalog numbers are common and used to track different types of information. Accession numbers usually, but not always, refer to groups of objects. An accession is the transfer of ownership from an outside party to the museum/repository. Accession numbers are assigned to record the details of transactions by which objects are added to a collection. Catalog numbers often, but not always, refer to individual specimens. Catalog numbers are assigned to specimens because they are used to incorporate object metadata and record actions taken by the collection manager specific to those specimens.

Readers unfamiliar with museum curation should note that these terms "accession numbers" and "catalog numbers" have generally agreed upon meanings readily available in textbooks and manuals. In practice, however, the terms are sometimes used incorrectly, inconsistently, or interchangeably. This is especially likely when curation is being undertaken by personnel (e.g. archaeologists) whom are not specifically trained in museum registration or when established local conventions (i.e. "house rules") have dictated an atypical usage.

As with other types of museum collections, an **accession number** is often the first number attached to an incoming specimen or collection. Accession numbers are used in museums to denote a single transaction between a source (e.g. a donor) and the institution. An accession number often refers to a "lot" of objects, but it is also possible for individual specimens to be assigned an accession number if there is only one object in the transaction.

There are numerous systems in part throughout the museum community. For the purposes of this white paper, we focus on the two most common systems for accession numbers:

- A running single-number sequence ("1301"; "1302"; "1303"; etc.) in which every item is given a number
- A double-number (or triple-number) sequence in with the first number is the calendar year of accession and a running sequence as a suffix ("2016.1"; "2016.2" "2016.3; etc.) per item or group of items

It is not uncommon to see additional numbers or letters used as prefixes and suffixes to these numbers and every institution will be different. Even a museum that follows strict conventions is likely to have many deviations that resulted from accessioning or cataloging activities undertaken in the institution's past. Most museums have multiple systems in active use, because they opt to continue the use of old existing systems rather than attempt to renumber or change an established system.

Most large museums use a double or triple-number system. For example, a natural history museum receives a single donation that includes two projectile points, a fossil, and a set of preserved leaves. In this case, this lot of objects would receive an accession number (in double-number format) which will be permanently shared by all of the objects. The accession number ("2016.10" denotes the tenth accession of the year 2016) exists to maintain the link between the objects and the transaction. The accession number will be accompanied by data about the donor, his contact information, the date of the donation, and other relevant information about the transaction itself. After an accession number is assigned, each object is then prepared to be sent to a different collection: projectile points to archaeology; the fossil to paleontology; and preserved leaves to the herbarium.

At this stage, each object can now be assigned a **catalog number** to distinguish it as an individual specimen which has its own metadata. In this case, the museum uses a two-number system to denote accessions and a three-number system to denote catalog numbers. The projectile points are assigned "2016.10.1" and "2016.10.2" and each has an independent catalog record that lists its provenience, point type, measurements, etc. The fossil is assigned the catalog number "2016.10.3" and its record includes different information such as species, geological age, etc. The leaves in the herbarium are assigned collectively to be "2016.10.4" because they are fifty identical leaves from the same tree and the botanist has no reason to treat them as individual objects. Should the botanist later change her mind, the catalog number could be continued (e.g. "2016.10.5"; "2016.10.6"; etc.); further divided (e.g. "2016.10.4.1"; "2016.10.4.2"; etc.); or suffixed (e.g. "2016.10.4a"; "2016.10.4b"; etc.) following institutional convention.

Two and three-number systems are popular in museum curation and are preferred by most large institutions. One reason is that a sequential single-number system is poorly suited for an institution that processes multiple new accessions at the same time. A sequential single-number system would require that each accession be processed one at a time in sequence before the next could begin. As a result, single-number systems are more likely to be used in small collections where there is little growth and few accessions per year. For small organizations, accession and catalog numbers may be one in the same and known by either name.

Depending on the institution, the systems of accession and cataloging notation may be entirely independent of each other or there may be an obvious numerical link between them, as in the examples given above. Many variations and other systems are also in use, but most museums and repositories tend to at least process new accessions by these notation standards.

How are numbering systems used by archaeologists to track specimens?

Archaeologists routinely use multiple complex numbering systems for a wide range of purposes and there is virtually no standardization within the discipline. In particular, they frequently use arbitrary systems to number or otherwise denote provenience in a wide variety of systems. There are perhaps only two common numbering conventions that archaeologists routinely follow: site numbers and field specimen numbers.

Site numbers are a unique combination of letters and numbers permanently assigned to an archaeological site by a State Historic Preservation Office or equivalent. The system used is known as the "Smithsonian trinomial" or "Smithsonian tripartite" and has been used continuously since the 1930s. With some minor variations, it is used in all 50 states. The first two numbers are a code to indicate the state, the second sequence indicates the county or county-equivalent, and the final number is a running sequence which denotes the order in which a site was listed. The Lichliter site is "33 My 23" ("33" = Ohio; "My" = Montgomery County; "23" = Lichliter was the 23rd site listed in Montgomery County, Ohio). Site numbers are used heavily and usually appear on every bag, form, and physical source of data from a site.

The only other widespread convention is the use of a "**field specimen**" or "**FS**" number. An FS number is usually the unique identifier for an individual bag as objects are collected in the field and placed in the bag. FS numbers can take any format - their presence on an artifact field bag is the only reliable constant. When a sample is taken from a particular provenience, all artifacts and ecofacts are usually placed in the same bag. The FS number is the link between the bag and the provenience, which is itself a link to the context and associations of the objects. FS numbers always accompany artifacts and specimens throughout initial processing stages, but may or may not continue to be used in post-processing analysis or storage.

After a field bag is completed, the bag will then be sent to a laboratory where the contents will often be cleaned (e.g. washed or dry-brushed) since they are likely to be dirty from field recovery. Many other possible steps subsequently happen at this stage. For example, some objects may be re-examined after washing, determined insignificant (e.g. random natural stones picked up by accident), and discarded in the lab. After washing, other objects may be recognized as more significant than originally thought (e.g. a rim sherd that was not recognized in the field) and separated out as special finds. Some institutions will physically label the artifacts, while others will only label the bags or containers. Labeling archaeological specimens is notoriously problematic since artifacts and ecofacts can be very small.

Once a field bag has entered a lab for processing, there is usually one significant constant across all institutions. The materials are sorted into their different material types (e.g. lithics, ceramics), rehoused, and permanently separated. Material class is the primary criteria by which archaeological materials are divided because each material class will be examined by a different specialist. Special finds (e.g. tools, ornaments) are also likely to be isolated from the rest of their material class, if they were not already isolated in the field.

There is great inconsistency between institutions at this stage in regards to the FS number and the disposition of the now-sorted material types. The original bag is presumably empty and ready to be discarded, because each material type has been placed into its own independent bag. Any special finds may also be isolated in independent bags. What becomes of the FS number? Organizations might continue to use the original FS number on all of the bags, use the original FS number with a suffix added, or create entirely new numbers to track these new containers. During analysis, the contents of bags may be further modified. For example, an analyst may subdivide a bag into finer categories or isolate additional special finds that are deemed significant for analysis.

How do archaeologists and collections managers reconcile these systems of notation to create meaningful catalogs?

In most cases, they probably do not. Archaeologists assign systems of notation that are useful for analysis and later surrender the objects for curation without an understanding of how those numbers might be translated into accession or catalog numbers. A museum professional must process the collection and either adapt these numbers to the museum's catalog or generate new numbers by some other rationale. Depending on the institution, an archaeological collection's catalog numbers could hypothetically represent any type of division within the collection.

For example, a registrar might receive a site collection for curation. The collection has been thoroughly sorted by multiple archaeological specialists and analysts. It includes 500 individual bags of lithics (sorted by stone type) from 250 different proveniences, 100 bags of ceramics (sorted by temper type) from 50 different proveniences, and 1000 bags of animal bone (sorted by species) from 250 different proveniences. Field records and other files are surrendered for archiving at the same time.

How should the registrar process this collection? By what criteria should the registrar number and process these lots of specimens? What format will the FS numbers (assuming they exist) on those bags take in the museum catalog? Should be they given sequential numbers, numbers with suffixes, two or three-number designators? What systems of provenience were used at the site and what forms of notation do they take? Was their provenience information copied to the new bags when the collection was sorted? How will the link to the field records be maintained? Will it be feasible later to reconstruct what lithics/ceramics/bones were found together from any specific provenience? How likely is it that when the registrar finishes, that this collection will be easy for a researcher to query, access, and retrieve specimens from?

None of these questions will be easy for the registrar to answer and the solutions imposed by the museum professional may not be ones that archaeologists find desirable. The survey illustrates that there are effectively no standards as to how specimens are assigned accession/catalog numbers, what metadata is included, and some do not provide any sense of what exactly these accession/catalog numbers might mean. For example, an accession/catalog number could reference the entire contents of a site collection or could refer to some subdivision of the collection (e.g. a group of objects that share a common provenience, common material type, or other shared characteristic.) As a result, a site collection might have a single number for the entire collection or many different numbers for individual features or levels of features. This is likely to depend upon the size of the collection and the complexity of the collection's organizational scheme.

Section II: Project Summary & Data

Where did the Lichliter collection originate?

The Lichliter site excavation began as DSNH's first excavation in 1962 and multiple seasons of fieldwork were conducted at this unique site until 1970. The site was excavated carefully utilizing a methodology that was well-informed and forward thinking in its time. Despite the completion of the fieldwork and strong interest from the scholarly community, Lichliter remains one of the most poorly reported sites in the Ohio River Valley nearly a half-century later. After the completion of the fieldwork, the original excavator Virginia Gerald continued to work on the analysis of the collection for many years. In 2012, her family made arrangements to return the collection to DSNH's possession so that it could be made available to other researchers.

What is the Lichliter site and why is it significant?

The Lichliter collection represents a unique opportunity for scholars to investigate an important cultural period in the prehistory of the Eastern United States. The site is one of only a few Late Woodland (ca. A.D. 450-1000) sites ever excavated in the Ohio River Valley and one of the most completely excavated sites of its kind. By definition, there are no written records from prehistory to indicate the name of this culture in their own (or any) language. Midwestern archaeologists often use the term “Late Woodland” to describe the people of this cultural period, but this term can be problematic since it is not used consistently from one region to the next. Other related terms in current or past use in the Midwest might include "Newtown," "Intrusive Mound Culture," and others. Despite inconsistent terminology outside of the Ohio River Valley, this time period encapsulates similar contemporary lifeways throughout much of the Eastern U.S. It is a period that is poorly known and often described as a "dark age," yet notable for dynamic cultural change: the formation of the first nuclear villages; the adoption of maize agriculture as a staple of prehistoric economy; and the adoption of the bow and arrow.

The collection holds potential for understanding broad trends of national significance. For example, the site’s layout and chronological position indicate that it is one of the earliest (perhaps A.D. 350-500) and greatest concentration of large non-mortuary architectural structures known anywhere in Eastern North America during this time period. (It is not yet known if Lichliter should be termed a "village" because the function and possible contemporaneity of its large wood frame structures have not been established.) In addition, the period is of particular interest to scholars because it follows immediately after the poorly understood collapse of the earthwork-building Hopewell culture and precedes the rise of hierarchical Mississippian chiefdoms in the Midwest and Southeast. The site is essential to understanding not only the period within which it is chronologically positioned, but in modeling the extraordinary cultures that temporally bracket it. The Lichliter site is listed on the National Register of Historic Places.

What is included in the Lichliter collection?

The Lichliter collection includes artifacts, maps, field notes, photographs, and related documentation by the original investigator, however the scope of the project described here is limited primarily to a discussion of cataloging artifacts. The maps and field notes from the excavation have not yet been digitized. Most of the excavation was concentrated upon a series of large circular wooden structures (as represented by postmolds), portions of other structures, and adjacent activity areas. Most of the artifacts are from a shallow non-discrete midden layer that includes many objects, but few features. In contrast to other sites excavated by DSNH, few pit features or thermal features were encountered. Artifacts include ceramic sherds, projectile points and other chipped stone tools, an unusual number of chipped slate discs, and a few ground slate objects. Ecofacts include carbonized botanical samples (seeds, nutshell, and wood fragments), modified and unmodified animal bone, and soil samples. A small percentage of the overall collection is represented by finished formal tools or ornaments. The majority of artifacts represent waste products or byproducts of human activity across a broad range of domestic activities such as the manufacture of tools, butchering animals, processing plant foods, and cooking. Some objects were recovered from the plowzone, some from the general low-density midden underlying the plowzone, and some from subsurface features.

Section IIA: Training Guide

This guide is specific to the Lichliter Site Project (33MY23). For future excavations, new guides will be made. Because the Lichliter Site is unique in that the entering of the database did not take place during actual excavation, many conventions were used that may not be present in other future projects within ArcheoLINK.

General Lichliter Project Information

The Dayton Society of Natural History (DSNH), with the help of a generous grant from the Council on Information Resources for 2014-2016, is in the process of cataloging a large collection of archaeological artifacts from the Lichliter site near Dayton, Ohio. The materials are from the Late Woodland, a poorly known time period in Ohio prehistory. DSNH's first Curator of Anthropology, Virginia Gerald, led excavations at this site throughout the 1960s and kept the collection with her as material for a dissertation. Despite wide interest, no other professional had ever seen the artifacts, maps, or notes until the return of the (now highly disorganized) collection to DSNH in 2012. The first part of our project is to decipher and catalog the site collection into a meaningful, cross-referenced database that will also integrate maps and notes. There is no existing solution for this type of problem in American archaeology and most archaeological research collections do not lend themselves well to normal cataloging procedures or available software. To accomplish this, the DSNH staff selected and trained on QLC's ArcheoLINK software. This European program is an all-in-one solution that enables the user to link archaeological artifacts, maps, and notes into a single database. DSNH has cataloged over 6,900 artifacts (90% of the total collection) in ArcheoLINK to date, with over 1,300 staff and intern hours logged. The second stage of our project will be to publish a case study illustrating how ArcheoLINK can be used to untangle a complex and disorganized collection. This project will serve as the first case study in applying ArcheoLINK as a collection management solution for archaeological research collections.

General ArcheoLINK Information and Terminology

Background

ArcheoLINK was designed primarily to be used in recording new excavation data and to process collections as they are being excavated. It was not designed with the intent to process old collections although this project will allow us to demonstrate how it can be used in this way and the best ways in which to approach such a project. It would be much easier to apply ArcheoLINK to a new project or to a collection that had not been processed in any way since it requires a different conceptual approach to organizing archeological data. The hierarchical organizational concept implicit in ArcheoLINK reflects a European approach that is arguably superior although somewhat at odds with how most American archaeologists routinely collect data.

Terminology

Barcode – this arbitrary number includes the site number of the project (e.g. 33MY23), leading zeroes (used because they are consistent with how computers expect numbers to be formatted and they are helpful with migration to other databases such as MS Excel), the find number, the artifact category (or artifact type, such as ceramic, bone, lithic, etc.), and a subcategory number (*see Fig. 1*)

Feature – any disturbance in the soil (can be natural or manmade); manmade examples include postmolds, trash pits, latrines, etc.

Field Find – associated with an artifact's general information, such as provenience, find date of the associated feature, and any other remarks; it is generally a group of artifacts of many types, unless the artifact is a diagnostic (*see Fig. 1*)

Fill – the type of material found in a feature (clay, sand, loam, etc.), as well as any inclusions (charcoal, ceramic, shell, etc.)

Find – associated with an artifact's find number, artifact category, quantity, and weight; it is always specific information about a single artifact or a group of artifacts of the same type

Find Number – the number is a consistent and arbitrary number that increases incrementally with each group of artifacts (*see Fig. 1*)

Plana – level; represented in cm or inches

Segment – refers to the process of excavating a feature in parts; e.g. bisecting a feature

Square – optional term for unit; will usually be entered arbitrarily

Subcategory Number – an arbitrary number that increases incrementally within a barcode number; this is used for a number of reasons: first, to keep the amount of find numbers down so as not to overload the database; second, to separate artifacts if there were too many for one bag or jar

Trench –unit; usually in grid form (or coordinates) on an X-Y axis (e.g. 340E060S or G115W)

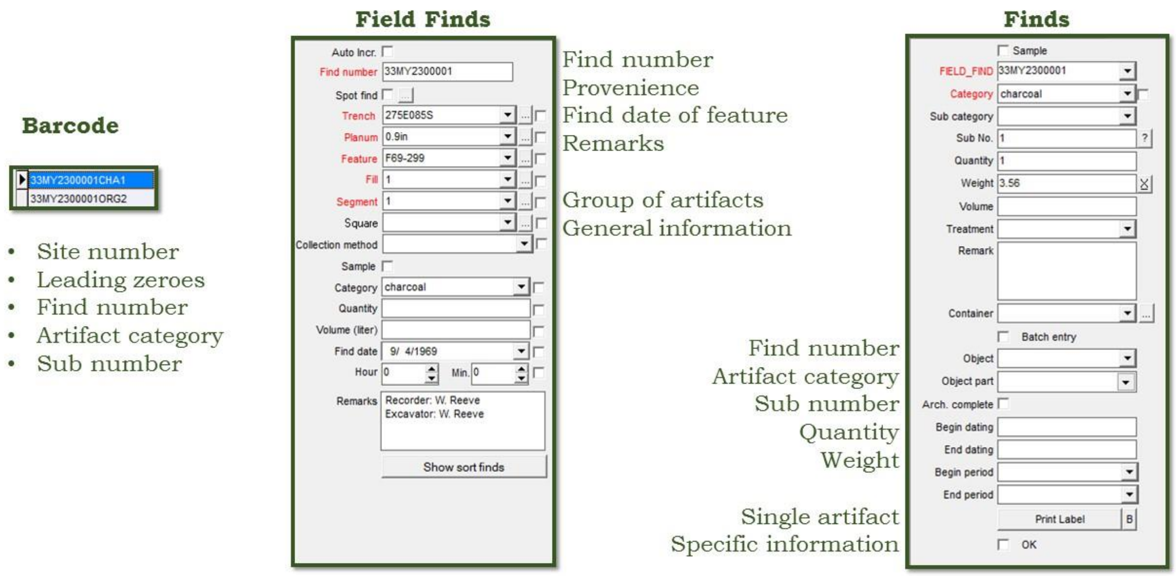

Figure 1: Barcodes, Field Finds, and Finds

<u>Opening the Program and Logging On</u>

1. Open program
    a. Data (:Z drive) – ArcheoLINK – Software – ArcheoLINK demo set – ArcheoLINK – ArcheoLINK (trowel icon)
    b. ArcheoLINK_old_462015 and ArcheoLINK_old_4232014 are older versions of the database
2. Open database
    a. File – Open APR Database – Dialog box will open – choose from Hard Drive (:C drive) 33MY23_Hard_Drive_Copy.APR
    b. To access older versions of the database, open folder "ArcheoLINK Archive" in Hard Drive (:C drive)
3. Login
    a. You will be prompted to login once you open the APR database
    b. Choose a name (Sarah Aisenbrey, William Kennedy, and Jill Krieg)
    c. All usernames are administrators, so the user will be able to access any part of the program
    d. All passwords are "Hello"

Tabs on Entrance Screen

1. File – used for opening and closing the program, opening an APR database, and compacting an APR database
2. Project – includes information on the current project, including the name and project code (for Lichliter, 33MY23)
3. Field
    a. Field Labels – settings for labels such as text size, layout, etc.
    b. Trenches – units
    c. Plana – levels
    d. Features
    e. Fills
    f. Segments
    g. Squares
    h. Field Finds
    i. Measurements – includes a feature to input measurements for planum heights and feature measurements (this is a part of the system that is still in the beginning stages of development)
4. Find Processing
    a. Finds
    b. Containers – allows user to input information about storage containers within a physical facility
5. Specialist Tables – used for analysis of artifacts
6. Analysis – GIS component for maps and notes
7. Images – allows user to upload photographs of artifacts and manage them
8. Quantity/Checks – allows user to complete and save queries; coding skills needed to run query
9. Settings
    a. Scale – scale settings
    b. Labels – label settings; note: X.lbl is a QR code and .lbl is a barcode
    c. Forms – user can input any forms necessary (such as field notes, etc.; currently must be coded)

d. Image Options – settings for importing photographs

e. Reference Lists

   i. Persons – users in the system

   ii. Standard Reference Lists – authority files for all fields in program except specialist tables

   iii. Specialist Reference Lists – authority files for specialist tables

f. Management

   i. Passwords – user passwords

   ii. User Profiles – user access to system; allows user to restrict user access to interns or volunteers if necessary

Entering Artifacts into the Database

1. Locate bag or bottle of artifacts
2. Locate provenience on the bag or bottle; this can include:
   a. Feature – FYEAR-#; e.g. F69-456; F65-12
   b. Unit – three scenarios:
      i. Grid: G160W; L140W
      ii. Coordinates: 240E050S; 300E090S
      iii. Test Unit: Unit 1; Unit 4
   c. Run – range from Run 1 to Run 12
   d. House – range from House 2 to House 11
   e. Strat Test – e.g. Strat Test #1
   f. Test Trench – e.g. Test Trench 1
3. **If bag has feature information:**
   a. Look up feature in field notes (see Appendix A for directions)
   b. Open the trench screen under the field tab and enter new Trench if necessary (click the "new" button in the bottom right corner)
      i. Conventions: 280E090S or G150W
      ii. In the "remark" section, write any extraneous information, such as Runs, Houses, East or West field, or any other relevant info
      iii. If trench already exists, move to d.

iv. Click “ok” to save the record.

c. Open the plana screen under the field tab and enter new Plana if necessary (click the “new” button in the bottom right corner)

    i. Enter plana in inches – 0.9in; 2.0in

    ii. If plana does not exist, write UNK for “unknown”

    iii. Click “ok” to save the record

d. Open the feature screen under the field tab and enter new Feature if necessary (click the “new” button in the bottom right corner)

    i. In the dropdown trench menu, select the correct trench (see Appendix B for information on system glitches if the trench cannot be located)

    ii. Conventions: FYEAR-#; F69-98, F65-45, F70-345

    iii. Select the correct interpretation in the dropdown box

    iv. Enter the total depth in centimeters

    v. In discussion, write any information about the matrix or any other relevant information

    vi. Click “ok” to save the record

e. A dialog box will open that will ask if the user would like to enter fill information. Click “ok.”

    i. The fill will always be “1” – this is a function of ArcheoLINK (if there were 2 fills for one feature, the next fill would be labeled as “2”)

    ii. Enter information in the relevant dropdown boxes, check the correct boxes in the inclosures section, and write any other information in the remarks section

    iii. Click “ok” and close to save.

f. Open the Field Finds screen under the field tab.

    i. Enter a new find number. This is made up of the site number (33MY23), leading zeroes, and the next incremental number (if the find before was 33MY2300001, the next would be 33MY2300002; 33MY2300009 → 33MY2300010; 33MY2300099 → 33MY2300100; 33MY2300999 → 33MY2301000

    ii. Use the dropdown boxes to associate the correct provenience. See Appendix B for system glitches.

    iii. Enter the find date.

iv. In the remarks field, enter the recorder and excavator.

v. Click ok to save the record and close to exit this screen.

g. Open the finds screen under the find processing tab.

i. Use the FIELD_FIND dropdown box to find the correct find number.

ii. Use the category dropdown box to label the find with the correct artifact category.

iii. Enter a subcategory number in the sub number box

1. This number grows incrementally with the amount of bags in a find

2. If there are 3 bags in a find, the last bag will have a sub number of 3

iv. Count the artifacts and enter that number in the count box

v. Weigh the artifacts and enter that number in the weight box. Weight is in grams

vi. Click "print label" to print a label. See Printing Labels on page ___ for more information.

4. **If bag does not have feature information:**

a. Open the trench screen under the field tab and enter new Trench if necessary (click the "new" button in the bottom right corner)

i. Because these artifacts are not associated with a feature, more descriptive trenches will be necessary; use the year along with the provenience if applicable (e.g. Run 7 1969; East Field 1970)

ii. Conventions: 280E090S or G150W

iii. In the "remark" section, write any extraneous information, such as Runs, Houses, East or West field, or any other relevant info

iv. If trench already exists, move to d.

v. Click "ok" to save the record.

b. Open the plana screen under the field tab and enter new Plana if necessary (click the "new" button in the bottom right corner)

i. Enter plana in inches – 0.9in; 2.0in

ii. If plana does not exist, write UNK for "unknown"

iii. Click "ok" to save the record

c. Open the feature screen under the field tab; because these artifacts do not have features, enter "N/A" for not applicable. No other information is required.

d. A dialog box will open that will ask if the user would like to enter fill information. Click "cancel."

e. Open the Field Finds screen under the field tab.

  i. Enter a new find number. This is made up of the site number (33MY23), leading zeroes, and the next incremental number (if the find before was 33MY2300001, the next would be 33MY2300002; 33MY2300009 → 33MY2300010; 33MY2300099 → 33MY2300100; 33MY2300999 → 33MY2301000

  ii. Use the dropdown boxes to associate the correct provenience. See Appendix B for system glitches.

  iii. Enter the find date.

  iv. In the remarks field, enter the recorder and excavator.

  v. Click ok to save the record and close to exit this screen.

f. Open the finds screen under the find processing tab.

  i. Use the FIELD_FIND dropdown box to find the correct find number.

  ii. Use the category dropdown box to label the find with the correct artifact category.

  iii. Enter a subcategory number in the sub number box

    1. This number grows incrementally with the amount of bags in a find

    2. If there are 3 bags in a find, the last bag will have a sub number of 3

  iv. Count the artifacts and enter that number in the count box

  v. Weigh the artifacts and enter that number in the weight box. Weight is in grams

  vi. Click "print label" to print a label. See Printing Labels on page ___ for more information.

5. **If a special find/diagnostic:**

  a. Follow the above procedures for artifacts with/without features until opening the field finds screen.

    i. Enter a new find number. This is made up of the site number (33MY23), leading zeroes, and the next incremental number (if the find before was 33MY2300001, the next would be 33MY2300002; 33MY2300009 →

33MY2300010; 33MY2300099 → 33MY2300100; 33MY2300999 → 33MY2301000

ii. Use the dropdown boxes to associate the correct provenience. See Appendix B for system glitches.

iii. Enter the category of the artifact (ceramics, lithics, etc.)

iv. Enter the find date.

v. In the remarks field, enter the recorder and excavator.

vi. Click "register special." This will make the artifact a special find. Select the artifact part from the drop down box (rim, seed, point, etc.)

vii. Click ok to save the record and close to exit this screen.

b. Open the finds screen under the find processing tab.

i. In the database list (in the middle of the screen), scroll to the bottom to find the newest find number – click it and it will appear on the right side of the screen for database entry

ii. Select the correct artifact category.

iii. The sub number will already exist as "sp." Do not add any numbers or other conventions to this sub number.

iv. Count and weigh the artifacts (most special finds will have 1 as their count).

v. In the object drop down box, select the correct artifact type.

vi. In the object part drop down box, select the correct artifact part.

vii. Click "print label" to print a label. See Printing Labels on page ___ for more information.

<u>Printing Labels</u>

The printer that is compatible with the ArcheoLINK database is the Zebra ZT230 printer (thermal transfer). On the Finds screen under the Find Processing tab, click the "Print Label" button to print a label. **DO NOT CHANGE ANY LABEL SETTINGS.** They were put into the system by a QLC representative and are specific to this project.

For detailed information on the printer, please refer to the Zebra Products website: https://www.zebra.com/us/en/products/printers/industrial/zt200-series.html#mainpartabscontainer_fc9=detailed-specs

To load ribbon/media, please refer to this link: https://www.youtube.com/watch?v=VNK_Y9jV_1o

<u>Containers</u>

Naming Conventions – base name of container on find number – 33MY2300001

1. Keep categories together when entering containers (33MY2300001_CER; 02CER; 03CER; 04CHT, etc.) because there are no subcategory #s on the container screen
2. Container tab
    a. Select container type and category
    b. Use this tab to keep track of loans with date in and out dropdowns
    c. Depot – DSNH
    d. In remark - write location (cabinet/drawer)
3. Batch Processing Tab
    a. Target container: choose container to put finds into
    b. Find #: use barcode scanner to input find #
4. General
    a. Add ONE CONTAINER AT A TIME and switch to batch processing after EACH CONTAINER IS ADDED

Appendix A: Looking Up Feature Records

In order to look up a feature, the field notes from Lichliter must be used. Two copies exist – one in the Anthropology office (bound in red books) and one in the Lichliter archival material (the originals). It is preferable to use the bound books.

For each year, the feature numbers are in sequential order.[1] The unit numbers are usually not in sequential order – in order to find planum information, leaf through each page to find the correct unit.

Feature records almost always include:

- Date
- Feature number
- Unit number
- Triangulation
- Definition

[1] This is not always the case. E.g. 1964-1965; many of these years' records were destroyed in a fire, so many features do not exist in the records or they are out of order.

- Depth
- Matrix
- Associated artifacts with sketches
- Fill
- Photographs
- Samples taken (soil, carbon, flotation)
- Recorder/Excavator
- Plan/Profile drawing
- Extraneous notes

Unit records almost always include:

- Unit number
- Stake number
- Elevation
- Plan/Profile drawing
- Levels (plana)
- List of artifacts found
- Features worked
- Photographs taken
- Samples taken (soil, carbon, flotation)
- Recorder/Excavator
- Date
- Extraneous notes

Appendix B: System Glitches

ArcheoLINK is a work in progress, and so is the DSNH server – this means that glitches may occur either through the software or because of the DSNH network. The following describes glitches that have been encountered from August 2014-May 2015. These may change in the future depending on software updates or network changes.

1. Dropdown box provenience in trench, plana, feature, and field finds screens: many times provenience information will not be linked on its own and the user must establish these links manually. In order to do this:
    a. Click the small box on the right of the desired dropdown box (looks like a box with an ellipsis in it → […])
    b. Clicking this box enables the user to go back to the original provenience screen that the dropdown box represents.
        i. By clicking […] next to the Trench dropdown, the trench screen loads
        ii. By clicking […] next to the Feature dropdown, the feature screen loads
    c. Once in the correct screen (trench, plana, feature), select the correct unit, plana, or feature that should be connected – this will force the system to make the correct connections manually
2. Error message: "Arguments are of the wrong type, are out of acceptable range, or are in conflict with one another"
    a. When deleting "feature 0" after declining to define fills
    b. This happens fairly regularly but does not seem to pose serious problems
3. As of 5/20/15, the system can only be operated on one computer at a time; the data itself currently exists on the hard drive of the computer inside the Anthropology office; keeping the data on the network caused too many errors and unlinked provenience problems
4. Dutch error messages – do not be alarmed, your computer will not explode

Appendix C: General Lichliter Processing Information

How we entered artifacts into ArcheoLINK

1. We started with the largest artifact type (which we thought was ceramics and turned out to be carbon). This strategy did not work because it was unorganized and ArcheoLINK software issues made it impossible to continue.

2. We decided to separate all artifacts by their provenience. This was accomplished by making a Microsoft Word document with all information found on bags or associated archival resources.

Over the course of doing this, we discovered which units went into which Runs or Houses. We also made separate sections for artifacts with little to no provenience information.

3. Using paper plates, we wrote down all provenience information to keep artifacts together physically. This was an ingenious idea – it took up a large amount of space, but it made entering artifacts into ArcheoLINK much more organized and efficient. I was able to pick up a plate and enter all of the artifacts from a certain provenience at one time – this meant that, unless I made a mistake, I would not have to look up any artifacts twice.

4. To look up artifacts, we used Virginia Gerald's Unit and Feature Records. These included the feature number, the feature type (sometimes), the depth of the feature with level information (sometimes), information on matrix and fill (sometimes), who recorded or excavated the feature, a plan and profile drawing of the feature, and other extraneous information (such as "where the hell is this" or "this is junk" or "this should never have been excavated").

5. Within ArcheoLINK, we made two specific rules for ourselves.

> a. We kept Virginia Gerald's feature numbers for consistency.
>
> b. We made our own arbitrary find numbers. These numbers are sacred. Associated data (such as provenience) can change, but the number cannot. 33MY23 is the Lichliter site number and is followed by a five digit sequential code. Each find number represents one feature or one special find.
>
> c. Barcodes (which will help us identify the physical location of a bag of artifacts within the museum's collection) consist of the find number, along with the artifact type, and a subcategory number.
>
> d. We defined "special finds" as diagnostic artifacts. These included rims, decorated sherds, projectile points, scrapers, drills, bladelets, worked bone, nutshells, corn, seeds, celts, adzes, gorgets, hammerstones, and Lichliter discs.

6. Subcategory numbers were one of the hardest decisions to make in this entire process. We used them for two main reasons.

> a. To keep the amount of find numbers down so as not to overload the database – we did not need a find number for each bag if they were within a feature and not special finds).
>
> b. To separate artifacts if there are too many for one bag or jar.
>
> c. General note on subcategories: Each find number represents one feature with many artifacts or one special find (one artifact). Therefore, many subcategories can exist in features, but only one can exist under a special find.

Timeline

2012: Virginia Gerald, along with her family and their dog, returned the Lichliter collection to the DSNH in an RV with a trailer attached.

2013: The DSNH was awarded a $91,000 grant from CLIR to process the artifacts from the Lichliter collection. The project is slated to last until 2016.

May 2014: The staff at the DSNH trained on QLC's ArcheoLINK software. This European program enables the user to link archaeological artifacts, maps, and notes in one place. Its main functionality is for field use during excavations; however, the DSNH is using it in a curation setting and is one of the first museums in the United States to do so.

June 2014: DSNH staff and interns rehoused over 9,000 artifacts into archival bags and jars; this was essential for preservation. This step also enabled us to do an inventory of how many artifact types and archival resources were present. The number of artifacts and quality of research exceeded our original estimations. Artifacts comprised 60% of the total 50 cubic feet of material; archival material comprised 40%.

August 2014: The cataloging process involved much trial and error. We began to enter artifacts into ArcheoLINK by artifact type; however, this proved to be impossible because Virginia Gerald had separated artifacts into too many categories for our purposes. This forced us to reorganize and reverse the entire excavation by placing artifacts in their correct proveniences physically.

September 2014-December 2014: After organization was complete, 90% of the artifacts were entered into ArcheoLINK.

January 2015-May 2015: The remaining 10% of artifacts (about 700) include those that have no provenience information or those that have a provenience that must be checked manually with a series of card catalogs.

11B: Terminology

Lichliter (Virginia Gerald) Terminology

- **Field:** Lichliter was divided into East Field and West Field. These were determined by a tree line going through the site. This may have also been based on the datum, which was originally placed by Allman in the 1950s.
- **Run:** 12 Runs exist within the Lichliter Site. These appear to be areas where a bulldozer took off the top layer of soil.
- **House:** 10-12 house patterns were found on the Lichliter Site. House 1 was excavated by Allman, the rest by Gerald.
- **Unit:** Units were typically 5x5 feet, usually dug in 0.4 inches
- **Feature:** 907 features were excavated from 1962-1970. Of these, 65% were excavated in 1969-1970.

Lichliter Naming Conventions

- **Unit:** G150W = arbitrary grid used from 1962-1968; 250E050S = XY axis grid used 1969-1970
- **Feature:** F69-250 = feature number 250 from 1969
- **Artifact:** L65/340 = Lichliter artifact number 340 from 1965

ArcheoLINK Terminology

- **Trench:** This is a unit in American Archaeology (any opened area during an excavation)
- **Planum:** This is a level; this indicates levels of depth while excavating a unit or feature
- **Feature:** This term is the same as in American archaeology
- **Fill:** The type of soil or inclusions within a feature or unit
- **Segment:** A part of a feature that was examined further or a bisected feature
- **Square:** Section of a unit that does not contain a feature
- **Find:** An artifact(s) pulled from a unit or feature

IIC: Artifact Cataloging and Processing

Artifact Processing

1. **Started with the largest artifact type** (which was thought to be ceramics and turned out to be carbon). This ***strategy did not work*** because it was unorganized and ArcheoLINK software issues made it impossible to continue.

2. **Separated all artifacts by provenience**. This was accomplished by making a Microsoft Word document with all information found on bags or associated archival resources. Over the course of doing this, the entire site's layout became clear. A separate section of the document contained information about artifacts with little to no provenience. In order to do this, artifacts were placed on paper plates with each provenience written on the edge of the plate. Then, the plates were physically arranged from largest provenience to smallest. This took up a large amount of space, but it made entering artifacts into ArcheoLINK much more organized and efficient; it allowed for entering all artifacts from one provenience together, which cut down on the potential redundancy of looking up artifacts more than once.

3. **Using DSNH's unit and feature records, artifact proveniences were identified**. These included feature/unit number, feature type, depth of feature with level information, information on matrix and fill, who recorded or excavated the feature/unit, a plan and profile drawing of the feature/unit, and other extraneous information.

4. **Rules were established for entering artifacts within ArcheoLINK**.

- Keep original feature/unit numbers for consistency

- Make arbitrary find number. Associated data (such as provenience) can change, but the number cannot. 33MY23 (Lichliter trinomial) is followed by a five digit sequential code. Each find number represents one feature's artifacts or one diagnostic artifact
- Barcodes consist of find number, artifact type, and subcategory number
- Diagnostic artifacts include: rimsherds, decorated potsherds, projectile points, scrapers, drills, bladelets, worked bone, nutshells, corn kernels, seeds, celts, adzes, gorgets, hammerstones, and Lichliter discs.

5. **Subcategory numbers were used for a number of reasons**.

- To keep the amount of find numbers down so as not to overload the database; e.g. two bags did not need their own find number if the artifacts were from the same feature
- To separate artifacts if there were too many for one bag or jar
- Many subcategories can exist in features, but only one can exist under a special find

Artifact Storage

Lichliter artifacts were stored utilizing the storage function within ArcheoLINK. This involves utilizing the barcodes on the tags printed by the thermal printer for artifacts. Archival boxes were fitted with adhesive plastic tag holders to hold their own tags; therefore, each box has a tag and each artifact bag has a tag.

Each box's tag includes the box's number (for purposes of location within the anthropology vault), the weight of the contents in the box, as well as the range of artifact numbers in the box. Excel spreadsheets were made of the contents of each box in addition to the lists within ArcheoLINK – these lists were printed and are physically with the artifacts in the drawer.

IID: Summary of Storage Procedure

1. Opening ArcheoLINK and Accessing the Storage Module

- Go to Microsoft Menu (in bottom lefthand corner of screen)
- Click on "Computer"
- Click on Z: drive, called "Data"
- Click on folder named "ArcheoLINK"
    - Click on folder named "software"
    - Click on folder named "ArcheoLINK demo set"
    - Click on folder named "ArcheoLINK"
    - Click on "ArcheoLINK" – the first available link – this will open the software
- Click "File" in the upper lefthand corner of the screen

- Click “Open APR database”
- An “open” dialogue box will pop up – double click on 33MY23_Hard_Drive_Copy.APR
- A “login” dialogue box will pop up
    - Sarah Aisenbrey will be selected automatically – don’t change this
    - Choose “Administrator” for profile dropdown (doesn’t matter which one)
    - Password is “Hello”
- Click on “find processing”
- Click on “containers”

2. Continuing with a Container that is Already Started

- To continue with a container that is already started:
    - Check the box number written on the front of the box (Box 8, e.g.)
    - Check the artifact type (CER, CHT, etc.)
    - In the container screen, there are two main screens: “Containers” and “Batch Processing” – to continue to add artifacts into a container that’s already been started, click on “Batch Processing”
    - Click the dropdown arrow for “Target Container” on the righthand side of the screen
    - Locate the container you would like to add to (33MY23CER8 is Box #8 of ceramics, e.g.)
    - Scan tags in with barcode scanner in the “find number” box (make sure your cursor is inside of this box before you scan)
    - Once the box is finished, switch over to “containers” screen by clicking the “containers” tab at the top lefthand corner
    -  At the bottom of the screen, click on the circular arrow (looks like the symbol here) to refresh the data
    - Click “print label”

3. Starting a New Container

- To start a new container
    - Check the box number written on the front of the box (Box 8, e.g.)

- Check the artifact type (CER, CHT, etc.)
- Click “new” on the bottom right of the screen
- In the “containers” screen, enter in the following in the fields on the right side of the screen:
    - Container: name of container – this will either be the drawer that the containers are in (12A09, 12B34) or the box itself; check the drawer number before entering boxes
    - In container: If container is a box, click on the drawer it fits into (e.g. 33MYCER8 would go into 12A34)
    - Type: choose either box or drawer, depending on which you are adding
    - Category: choose the artifact category (ceramics, chert, etc.)
    - Date in: choose today’s date
    - Remark: for boxes themselves, type “contains 497CER2 through 805CER2” or whatever numbers are included in the box; for drawers, type “Anthro vault Cabinet 12 Drawer B34”
    - Depot: Select Dayton Society of Natural History
- Click “ok” to save the record
- Click on “Batch Processing” in the top lefthand corner of the screen
- Click the dropdown arrow for “Target Container” on the righthand side of the screen
- Locate the container you would like to add to (33MY23CER8 is Box #8 of ceramics, e.g.)
- Scan tags in with barcode scanner in the “find number” box (make sure your cursor is inside of this box before you scan)
- Once the box is finished, switch over to “containers” screen by clicking the “containers” tab at the top lefthand corner
-  At the bottom of the screen, click on the circular arrow (looks like the symbol here) to refresh the data
- Click “print label”

4. Exporting Data to Excel

- To save boxes/drawers as excel documents

    - In the “batch processing” screen, above the data itself, click on the last icon above the words “storage_name, etc.” – the box looks like two pieces of paper with a black arrow going between them
    - This will open the exporter screen
        - Click “Excel XLS (the first option)
        - Save the file as the name of the box or drawer
        - Click “export”
    - Click on Microsoft start menu, then on computer
    - In the upper lefthand corner, click “search computer”
    - Search for the box you just named
    - Double click on the XLS file
        - When you open the file, a dialogue box will pop up – click “yes”
    - When the file opens:
        - Delete the column “storage_name”
        - Delete the column “voorkeur_standplaats”
        - Delete the column “content”
        - Delete the column “recorder
        - Delete the column “record_time”
    - Click File
    - Click “Save As”
    - Under recent folders, “box lists” will be an option – doubleclick that
    - The file name will be blank – name the file the same as the box or drawer

5. Printer Issues

- Printer problems that may happen
    - The label doesn’t print
        - Turn the printer off and on again (the switch is on the back lefthand side of the printer)

        - The printer will spit out a few empty labels, then will print the label you wanted to be printed; you may have to print it again because the data sometimes prints in between labels

    - The printer has an error message like “no supplies” and a red light is on over “data”

        - Open the top of the printer by lifting the lid from the righthand side
        - Once open, you will see the black tape and the white labels – look for where they converge at the front of the printer
        - There is a small black and yellow lever at the last knob in the front of the printer – lift that up
        - Make sure the white labels are flush with the front of the printer (there is a silver ledge where the labels rest – make sure the labels line up with this ledge)
        - Flip the yellow and black lever back down
        - Push the “pause” button on the front of the printer
        - A few blank labels with print, then you can print what you need to
        - Close the lid
        - https://www.youtube.com/watch?v=VNK_Y9jV_1o – YouTube video with the above instructions

IIE: Technical Specifications, Hardware, Storage, Mediums

Artifacts

Lichliter artifacts were preserved following basic archaeological conservation strategies recommended by the National Park Service and other accredited institutions. Artifacts were housed in polyethylene bags with archival paper tags. These tags were printed using a thermal printer, so no ink was used. Bags were organized by artifact number in archival, PAT-tested acid-free boxes. Any charcoal or soil samples were housed in flint glass jars with polyethylene lids. Tags were affixed to jars with acid-free twine. Jars were also housed in archival, PAT-tested acid-free boxes. All artifacts are housed in temperature- and humidity-controlled conditions. The cabinets housing artifacts are industry standard (Delta cabinets with continuous welds at the seams, continuous rubber gaskets at the doors, powder coated metal paint, and mounted on a Uni-strut system elevated 8 inches off the floor.

Database/Digital Files

When in active use, the ArcheoLINK database is backed up between one and three times a week. If not being used daily, the database is backed up every three to five months. Backups are housed on an external hard drive, flash drive, cloud storage (Google Drive), and local computer hard drive. Backups are exported from the ArcheoLINK database into Microsoft Excel and Microsoft Access databases; they are also saved in their original file format (APR).

The ArcheoLINK software is usually updated once or twice a year, depending on the amount of work being completed, training taking place, and software updates put out by QLC. All software backups are saved with dated and unique filenames based on the nature of the updates.

All files generated during the CLIR grant have basic metadata, all based on Dublin Core and the Digital Archaeological Record's metadata schemas.

ArcheoLINK is a relational database that uses an APR database file. This file type is essentially an Access Database file (MDB) with password protection. It is able to be opened within ArcheoLINK and within MS Access.

Archives

Archival materials have received basic preservation, including removal of paperclips and binders and replacement of aging folders. All folders are archival and PAT-tested. General processing has taken place – all files were kept in original order and an inventory was done on the nature of the records present. Maps, photographs, slides, and negatives are currently kept in a temperature- and humidity-controlled environment.

List of Equipment Used

- Zebra ZT230 Thermal Printer
- OHAUS Scout Pro Scale
- Symbol Barcode Scanner
- Acid-free tags
- Polyethylene (red line) bags
- Flint glass jars with polyethylene lids
- Acid-free cardboard boxes (PAT-tested)

Section IIF: ArcheoLINK Evaluation

Using QLC's ArcheoLINK software to catalog a decades-old archaeological collection has been a challenge, and as the first case study of this type of project, challenges were to be expected. The Dayton Society of Natural History (DSNH) adopted ArcheoLINK in the summer of 2014 with a generous grant from the Council for Library and Information Resources (CLIR). Through training with ArcheoLINK's developer Michiel Kappers, technical issues, and much trial and error, DSNH staff have been able to master the software within a museum setting. Many of the following summations and suggestions are specific to the DSNH project; however, some are more general in nature and could be applied to any institution's needs (specifically museums in the United States).

In general, ArcheoLINK's interface can seem cumbersome to first-time users. A more user-friendly interface may help the speed of training, allowing more time for work on the project and less staff time spent on setup. Also, an updated user guide with more general information about the differences between European and American archaeology could also cut down on training time. At the DSNH, only one staff member is completely trained on the system because of these time constraints (along with many other factors that are not contingent on ArcheoLINK). For example, a checkbox could be used to indicate if a find is from the surface, which would negate filling in arbitrary fields (such as the feature field) with "not applicable." Also, deletion of records is complicated. The user must delete every field – the field find, the feature, the planum, and the trench – separately and in that order; if only one of these fields must be deleted, all preceding fields must be deleted also. Instead of this, a dropdown box for deletion of records could prompt the user with options on which field to delete.

The DSNH project included many conventions of archaeology in the 1960s and 1970s. These include a reliance on more hierarchical fields than are used today. Because ArcheoLINK utilizes only trench, planum, feature, fill, and square, DSNH staff have had to include other hierarchical fields in the remarks section. This section is not searchable, so not all hierarchies are able to be represented in a query or analysis of the site's geography. ArcheoLINK could include more hierarchical fields, or could give the user the option to break down existing hierarchical fields into larger units of investigation. The "find group" concept could be used here; for example, a trench could contain many different units that would all be connected, like the pieces of a broken artifact are connected.

Decades-old museum collections post other challenges to twenty-first century technology, also. The notes fields in each of the provenience levels do not provide a large amount of space for remarks from field notes. Because the notes are almost fifty years old, the authors did not plan to keep their observations to a certain number of characters. Making these fields larger and searchable would be ideal.

Technological issues were also prevalent with this project. Although some of these issues may have been on the DSNH side, many other small institutions may come across the same problems, so a permanent solution may be necessary. The DSNH system will only support one person working on ArcheoLINK at a time with the data on a desktop hard drive and backed up on an external hard drive; this has slowed our progress and our ability to train more staff or volunteers to use the system. This could be an issue for institutions that keep a minimal amount of artifacts in curation and run on one independent server, such as CRM firms. This problem may require more research, such as collecting data on the institutions that utilize ArcheoLINK and the setup of their servers.

Finally, terminology is another hurdle that DSNH has had to jump. Switching the European conventions to American conventions would be helpful, especially for new users. Also, Dutch error messages could be translated into English for ease of database entry.

These improvements would assist the DSNH with future projects, and would have an impact on other museums trying to inventory decades-old archaeological collections Things the DSNH would change before starting a new project within ArcheoLINK would be to: a) start with maps instead of artifacts (staff was unable to do this because of stipulations of the CLIR grant); and b) if in the field, predetermine a numbering system that could be entered into ArcheoLINK before artifacts were entered.

Section IIG: Summary of Findings and Lichliter Site Statistics

The Lichliter Site, excavated by the Dayton Society of Natural History from 1962-1970, is an early Late Woodland site, dating back to approximately 500 A.D. It consists of 10-12 house patterns. Out of the 907 features, 417 postmolds and 57 pits were excavated (see Figure 1). In total, 10,500 square feet were excavated by hand and 18,050 square feet were stripped by machine.

YEAR	PERCENTAGE (%) OF FEATURES EXCAVATED
1962	**3**
1963	**13**
1964	**6**
1965	**10**
1968	**2**
1969	**34**
1970	**32**

Figure 1: Percentage of Features Excavated by Year

10,927 artifacts were collected during the Lichliter site excavation. See Figure 2 for a breakdown of artifact types. 277 diagnostic artifacts were collected. See Figure 3 for a breakdown of diagnostic artifacts.

ARTIFACT TYPE	AMOUNT (#)
ANIMAL BONE	**3806**
CERAMIC	**3724**
CHARCOAL	**398**
CHERT	**2229**
FOSSIL	**18**
GEOLOGICAL SPECIMEN	**21**
FLOAT SAMPLE	**17**
MIXED	**106**
METAL (HISTORIC)	**1**
NUTSHELL	**20**
OTHER LITHIC	**170**
SOIL SAMPLE	**29**
SEED	**6**
SHELL	**39**
SHALE	**2**
SLATE	**300**
UNKNOWN	**17**
WOOD	**20**

Figure 2: Amount of Artifacts and their Type

ARTIFACT	AMOUNT (#)
ADZE	**2**
CELT	**9**
DECORATED RIMSHERD	**3**
DECORATED POTSHERD	**9**
GORGET	**8**
KNIFE	**2**
LICHLITER DISC	**26**
LUG/HANDLE SHERD	**3**
NUTSHELL	**16**
PROJECTILE POINT	**87**
RIMSHERD (PLAIN OR CORDMARKED)	**79**
SCRAPER	**2**
SEED	**4**
SHOULDER SHERD	**3**
WORKED BONE	**24**

Figure 3: Diagnostic Artifacts

Project Conclusions/Synthesis

Lichliter Project Statistics

- **701** Files Created
- **10,927** Artifacts Processed
- **3,500** Hours Spent on Project over 2.5 Years