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Billur Tekkök – John Wallrodt – Sebastian Heath*

Post-Bronze Age Ceramic Data at Ilion, from In-Field Use to Digital Publication

Abstract

This article discusses the database structures that support in-field processing and subsequent publication of Post-Bronze Age (PBA) ceramics at Ilion.[1] Although grounded in a specific project, the following is not a complete description of the data management system employed by the PBA team at the site. During the more than twenty years of the project's work, technologies and methods have changed and the authors, along with others, have continued to adapt our specific systems to the increasing capabilities of the available tools. Accordingly, the database we use in the field accommodates that history while also enabling record-keeping processes that are idiosyncratic to our work. Many details of implementation are therefore not of interest beyond the project participants, a situation that is likely matched at many other excavations around the Mediterranean and beyond.

Zusammenfassung

In vorliegendem Beitrag werden die Datenbankparameter erörtert, die der Erfassung nachbronzezeitlicher Keramik von Ilion während der Aufnahme vor Ort sowie der nachfolgenden Publikation zugrunde gelegt werden.[2] Bedingt durch die übergreifende Projektstruktur stellen diese freilich nur einen Teil des vom »PBA-Team« zur Dokumentation genutzten Datenverwaltungssystems dar. In mehr als zwanzig Jahren Forschung haben sich die zur Verfügung stehenden technischen Möglichkeiten und Methoden nachhaltig weiterentwickelt, und es wurde von uns versucht, die im einzelnen angewandten Arbeitsweisen stets an das Potential der neuen Verfahren und Anwendungen anzupassen. Diese Entwicklungen spiegelen sich in der von uns während der Grabungskampagnen eingesetzten Datenbank wider und zieht nunmehr verschiedene Protokollierungsprozesse nach sich, die im Rahmen unserer Arbeit idiosynkratrisch erscheinen mögen. Zahlreiche Details der Datenerfassung sind zudem lediglich für die jeweiligen Sachbearbeiter von Interesse – eine Situation, wie sie auch von anderen Ausgrabungsorten im Bereich des Mittelmeers und darüber hinaus bekannt sein dürfte.

Our goal in the following discussion is instead to broadly describe the database structures that enable us to record and utilize the corpus of ceramic knowledge the project has assembled over the course of its work. It will also be clear to the reader that the language we employ is, with few ex-

* The authors wish to thank Prof. Ernst Pernicka, director and Prof. C. Brian Rose, director of the the Post-Bronze Age team for permission to work at Troy. Much of the work described here was undertaken while the late Professor Manfred Korfmann was director.

1 The term Ilion is used to refer to the Greek and Roman city, Troy refers to the site and archaeological project as a whole.

2 Als »Ilion« wird im folgenden die griechisch-römische Stadt bezeichnet, während mit »Troy« Bezug auf die archäologische Fundstelle und das Forschungsprojekt als ganzes genommen wird.

ceptions, not overtly technical. We try to describe these structures in such a way that they can be readily compared to the work of similar projects. Finally, we are not advocating adoption of any specific system. By offering a discursive overview of the Troy Post-Bronze Age ceramic database, we hope to contribute to an ongoing discussion that may lead to greater interoperability of archaeological information.

Archaeological research at Troy is driven by large-scale goals, such as establishing the size of the Late Bronze Age city, or the investigation of cult practice in the Greek and Roman periods.[3] As undertaken on a daily basis in the individual trenches, a main purpose of excavation is to identify coherent stratigraphic units and remove them in such a way that their relationship with surrounding units is recorded, with all artifacts and other relevant physical evidence from a unit retained for later study. In this regard, the work at Troy falls within the mainstream of modern archaeological practice.

Relationships within the Post-Bronze Age Ceramic Data

As is the case with the archaeological investigation of other ancient Mediterranean cities, the most abundant category of artifact that the Troy project processes, records, and stores its pottery.[4] The PBA ceramic database currently contains more than 57,000 records that provide information for more than 400,000 sherds of pottery, tile, and related ceramic objects. The database we use to hold this information is relational in design. Unique identifiers are used to link information about distinct categories of archaeological information that is efficiently divided between tables containing repeated records, each of which stores similar information.[5]

The assignment of unique identifiers to each stratigraphic unit is an essential part of the excavation process. Like most excavations, the PBA team maintains a database of all units along with information such as location and date of excavation. Pottery information is stored in a table consisting of records that identify the stratigraphic unit from which the pottery comes, and which provide further information about these sherds. As an introduction to this widely employed concept, Table 1 indicates that the stratigraphic unit K/L16/17.0417, which was excavated at Troy in 1997, contained two sherds of the common Late Roman ware African Red Slip (ARS), and that both of these are of form Hayes 45. Table 1 can also be taken as an abstract representation of a row within a database table, one that is in turn divided into columns.

Such a row in a table can easily be associated with information about K/L16/17.0417, such as its location on the site, the dates of excavation, etc.; indeed, such linking is a fundamental capability of a modern archaeological database.[6]

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3 Rose et al. forthcoming

4 Horejs – Jung – Pavuk 2010.

5 Codd 1970. In this article we adopt this terminology of table, row and column in place of the more technical terminology, relation, tuple and attribute, used in the computer science community.

6 Kadar 2002.

Tab. 1 Schematic ceramic database.

Stratigrapic Unit	Ware	Generic Form	Typology	Part	Count
K/L16/17.0417	African Red-Slip	Dish	Hayes 45	base	2

Some additional comments on this table structure partially illustrate our approach to recording ceramic information. The first is simply a matter of presentation within this chapter. While Table 1 uses fully spelled out terms, such as »African Red Slip,« the actual project database used abbreviations such as »ARS« or, in the case of a base, »b« and »bf« for a body sherd. Other projects will have different abbreviations, but that level of detail falls outside the scope of this paper.

More important, our goal is to have each column hold a single piece of information. Application of this principle is essential for those columns that will be used either to form relational links with other tables or to serve as terms in searches expected to produce accurate results. Counting rims or other vessel parts is a capability common to most ceramic databases, one that we will examine more closely below. Here, we wish to make the point that accurate searching requires the separation of information about individual sherds into discrete indivisible units. Accordingly, Table 1 splits the conceptually simple phrase „2 ARS bases« into three columns, each making an indivisible assertion about the pottery being described. Without such division into discrete units of information, it would be difficult to identify the numeric component of these statements.[7]

More substantive is the question as to whether a database that records quantities of vessel parts can provide useable information. Issues related to the quantification of ceramic data have long been discussed by archaeologists working in the old world.[8] Peña has recently offered a review of the fundamental concepts and a trenchant criticism of their application, at least within the field of Roman ceramics.[9] To paraphrase his strongly worded assessment, he writes that »any study« comparing quantitative pottery data that relates to two or more stratigrahic units and that was obtained by only counting sherds »is not statistically valid«.

At Ilion we count sherds, and this is likely the case at many other field projects. Given Peña's unambiguous statement that this method is invalid, it is important to acknowledge that this can be the case, but one should also ask if the collection of our data is worth the effort. We think yes, but wish to emphasize that we do not mean this as a challenge to Peña's evaluation of quantification methods. Rather, we accept his premise that the use of such data can be flawed. We will, however, take this opportunity to illustrate circumstances in which a database such as that generated in the field by the PBA team can be a basis for effective and useful interrogation of excavation results. We further believe that such preliminary processing is an important component of speeding the process of subsequent publication.

By way of example, we can say that 3,885 sherds of the common Roman period red-slipped table ware known either as Çandarlı or Eastern Sigillata C (ESC) have been explicitly recorded in the database. This number compares to 302 of the late Roman ware Phocaean Red-Slip (PRS) and 190 of African Red-Slip (ARS).[10] These are gross numbers generated by counting total sherds

7 Prior to 1996, the PBA database did rely on textual descriptions of the ceramics in a stratigraphic unit. Frustration with that system led to the development and application of the principles described here.

8 Orton 1993; Slane 2003.

9 Peña 2007, 154.

10 For definition of these wares see Hayes 1972.

with no account of weight or percentage of the rim circumference preserved. Nonetheless, such numbers complement the architectural and numismatic evidence indicating that Ilion was prosperous in the middle Roman period, and that its urban fabric was ruptured by an earthquake in the early sixth century AD. Had the city continued to thrive, one would expect greater amounts of both Phocaean Red-Slip and the imported African Red-Slip.

Looking more closely at the particular forms further confirms the contribution of ceramic studies to defining the chronology of the end of Roman Ilion. Both African Red-Slip and Phocaean Red-Slip are well-studied wares with highly developed typologies that allow many forms to be quite closely dated. For ARS, a preliminary counting of identified forms shows 153 sherds of forms dating from the third through early fifth century, and only 6 unambiguously dated to the sixth century. The same trend is seen with Phocaean Red-Slip. The database records sherds from more than sixty-five Hayes form 3's ranging in date from AD 400 to 550, but only 8 examples of Hayes form 10, all of which date after the late sixth century at the earliest. Even accounting for the approximation of numbers and the ambiguity of dating, the implication of these very different search results seems clear: Ilion saw a major reduction in fineware imports in from the fifth to the late sixth centuries. As we have previously said, this observation is part of constructing an image of urban decline following the early sixth-century earthquake. Our main point in including these preliminary numbers is to show that our database is structured in such a way that it can contribute to such historical discussions and suggest future research questions.

Site-wide searches are an important tool that can illuminate large-scale trends at the site, but these searches do not take account of the stratigraphic units within which the pottery was recorded. As noted above, however, all sherds are assigned to such a unit. A closer look at the implementation of the relationship between sherds and unit allows further illustration of how the project represents and uses its ceramic data.

In general, we divide the data recorded about each sherd into two broad categories:

1. sherds whose descriptions exist only as attributes of the stratigraphic unit from which they were excavated; and
2. sherds that have their own unique identifier and can therefore be individually addressed within the database and project workflow.

The nature of the distinction between these categories can be easily understood by looking at records drawn from the Troy database, and we return to the stratigraphic unit K/L16/17.0417 to supply our examples.

As noted above, ›K/L16/17.0417‹ is the unique identifier of a stratigraphic unit excavated at Troy in July of 1998. Within the context of the project, such units are known by the German term ›Behälter‹ or ›holder‹, though a more generic term is employed here. K/L16/17.0417 represents the fill of a pit deposited after the destruction of a house in Ilion's predominantly domestic Lower City. On the basis of the pottery within the fill, this episode of destruction dates to the late third century AD and may be associated with the activity of the Germanic group known as the Herulians, though a full discussion of this point is beyond the scope of this paper.

Ceramic Information as an Attribute of its Stratigraphic Unit

Subsequent to excavation, the pottery from K/L16/17.0417 was washed, allowed to dry, and then brought into the pottery processing tent where it was counted and arranged in bags for storage. As recorded in the ceramic database, a total of 476 sherds were counted at this time. Table 2 shows an adapted excerpt of this data that adds to the information in Table 1.

For the purposes of this discussion, these records are arranged in order of increasing specificity of the information recorded for each entry. The first line indicates that 32 unclassified fragments of tile were counted within the deposit. The second line indicates the presence of 28 unclassified courseware body sherds. The subsequent lines record sherds for which specific wares were recognized, including the two ARS Hayes 45 bases included in Table 1.

It is certainly the case that the material described here could be the object of more specialized study; but as recorded in this schematically specified table, they cannot be addressed outside the context of the stratigraphic context to which they belong. To put this in practical terms: at Troy, pottery described at this level of detail is stored in canvas bags identified as holding material from a particular stratigraphic unit, in this case K/L16/17.0417. While it is possible to retrieve and examine this pottery as a group, it is not possible to retrieve any particular sherd with confidence. With this level of detail, a request to pull all black-slip kantharoi from the unit can be satisfied, but not a request to pull »the exact one examined last year by a particular visiting specialist.«

Individually Identified Sherds

Table 3 adds the concept of »Sequence Number« to the database. Using the conventions of the Troy project, the last five sherds now have unique identifiers formed by the concatenation of the stratigraphic unit and the sequence number. This means that the last row has an identifier of ›K/L16/17.0417:2‹, a number that appears written in ink on the relevant sherd. Note that the two ARS bases now appear in individual rows with sequence numbers 6 and 5. Furthermore, one of the Çandarlı Hayes form 4 sherds has been assigned sequence number 2 and is now described as a full profile.

All these numbered sherds can be confidently identified and retrieved for subsequent documentation and study.

Stratigrapic Unit	Ware	Form	Part	Count
K/L16/17.0417	Coarseware	Tile	Unclassified	32
K/L16/17.0417	Coarseware	Unclassifed	Body Sherds	28
K/L16/17.0417	Black Glaze	Kantharos	Handle	1
K/L16/17.0417	Aegean Thin Walled	Cup	Base	1
K/L16/17.0417	African RS	Unclassified	Body Sherd	1
K/L16/17.0417	African RS	Hayes 45	Base	2
K/L16/17.0417	Çandarlı	Hayes 4	Rim	5

Tab. 2 Selected data for K/L16/17.0417.

Stratigrapic Unit	Sequence Number	Ware	Form	Part	Count
K/L16/17.0417		Coarseware	Tile	Unclassified	32
K/L16/17.0417		Coarseware	Unclassifed	Body Sherds	28
K/L16/17.0417		Black Glaze	Kantharos	Handle	1
K/L16/17.0417		Çandarlı	Hayes 4	Rim	4
K/L16/17.0417	11	Aegean Thin Walled	Cup	Base	1
K/L16/17.0417	9	African RS	Unclassified	Body Sherd	1
K/L16/17.0417	6	African RS	Hayes 45	Base	1
K/L16/17.0417	5	African RS	Hayes 45	Base	1
K/L16/17.0417	2	Çandarlı	Hayes 4	Profile	1

Tab. 3
Pottery database with added sequence numbers.

Visual Documentation

One fundamental relationship to implement is that between a sherd and its visual documentation, which most commonly takes the form of drawings and photographs. At Troy, the workflow for each sherd selected for drawing is now relatively straightforward. Giving a sherd to an illustrator results in a profile drawing of that piece on a drawing sheet, which is itself assigned a number. This in turn leads to database records that pair sherds and sheets (Table 4).

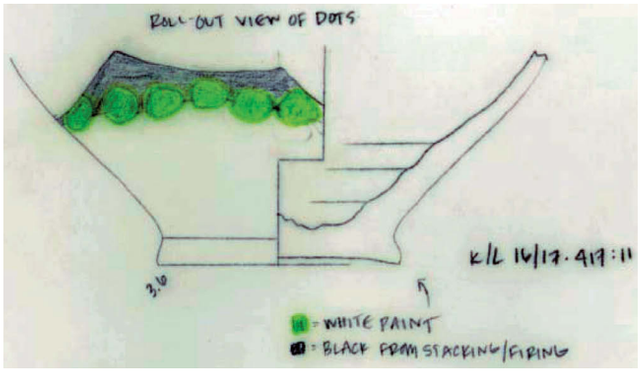
Subject ID	Drawing Sheet	Drawing Type
K/L16/17.0417:11	1769	Profile Drawing
K/L16/17.0417:6	1770	Profile Drawing
K/L16/17.0417:5	1770	Profile Drawing
K/L16/17.0417:2	1008	Profile Drawing

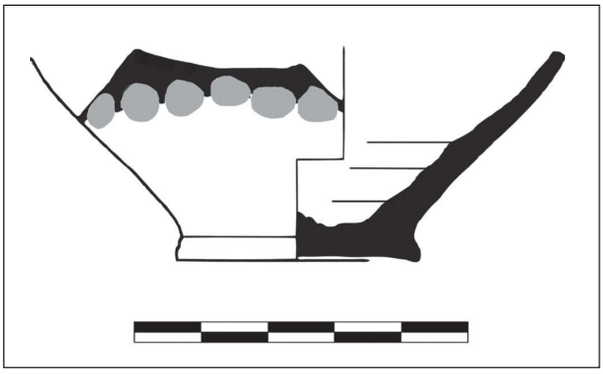
Tab. 4
Simple photodatabase structure.

As with the ceramic database, additional fields, such as artist or date drawn, can be added to a related table to fit the needs of an individual project. The physical manifestation of this relationship is seen in Fig. 1, which shows a small portion of a scan of drawing sheet 1769. The ›K/L16/17.417:11‹ appearing next to the profile drawing is an unpadded version of the full unique ID. In this instance the drawing was first drawn in pencil, then inked by hand. The current practice is now to trace such images in a vector drawing program such as Adobe Illustrator (Fig. 2). This process produces an individual file whose name matches the sherd number with the important caveat that the ›/‹ and ›:‹ characters are converted into ›-‹. This last observation suggests that in the future, projects may want to avoid characters, such as ›/‹, that have a reserved meaning in the context of computer file systems. At Troy, we avoid use of the colon character because of our preference for Apple Macintosh computers, which in some circumstances use »:« to indicate separate directories. The association between sherds and photographs is implemented by a pairing of subject and image, in which a photograph is analogous to a drawing sheet (Fig. 3).

Pottery as Small Finds

At Troy, as at many field projects, objects that are particularly well preserved or otherwise felt to be sufficiently distinctive, are designated as small finds and assigned a separate number. This as-





Figs. 1 and 2
KL16/17.417:11.

pect of post-excavation processing has undergone considerable change since the early days of the project, so this section describes current best practice at the site.

The small finds collection is divided into major categories defined by either material, technique, or a combination of both. Each category is identified by its own separate sequence of numbers. Accordingly, »ST0010« is the tenth stone object catalogued, ›C0267‹ is a coin and »P0150« is a ceramic vessel. The implementation of these distinct sequences highlights the fact that a major reason to assign small find numbers is to facilitate their separate storage. At Troy, coins are kept together in an environment that is relatively stable in terms of humidity, a requirement for the proper curation of these objects. Likewise, all ceramic small finds are stored together in locked storage. Since these finds are registered with the Turkish government, this arrangement makes it easy to audit the integrity of the collection.

In Table 3 above, sherd K/L16/17.0417:2 is also small find »P0656«. That identity is maintained in the »Small Finds« database but does not replace the sherd number. While the doubling of the identities assigned to a single object might seem to be a concern, it is important to remember that the small find number is predominantly an indicator of storage location. It is the combination of stratigraphic unit and sequence number that can insure the integrity of relationships recognized during excavation. Ideally, as this object moves from cataloguing to drawing, the unit and sequence number will be used to identify it.

A similar construct applies to the PBA Ceramic Study Collection, which consists of sherds that illustrate both the most common and certain unusual types of pottery found at Ilion. Again, every sherd in the collection is assigned a standard sherd number. Additionally, each sherd is marked with a number that indicates in which box of the study collection it is stored. As with small finds, a sherd can have additional identities – a small find number or a study collection number – but these do not interfere with effective tracking of the object so long as these additional numbers are layered on top of a primary scheme that maintains stratigraphic relation-

Fig. 3
Photograph showing sherd number K17.0759:9 (Troia PBA Digital Image 004248).

ships. It is useful to accommodate different modes of storage, but it is extremely important to ensure that such complexity does not lead to future difficulty in accessing both information and the physical objects themselves.

Towards Publication

The goal of an archaeological field project is necessarily publication of its results. By allowing straightforward tracking of stratigraphic information, descriptive records, and visual documentation, we have found that the structure of our database has facilitated the publication of the pottery recovered during excavation.[11] This can be seen in two abbreviated catalog entries adapted from the forthcoming publication of the Hellenistic and Roman architecture and stratigraphy from the Lower City.[12]

Aegean Thin-walled Painted Cup Base (3rd Century AD)

P.H. 2.9; D. base 3.6; Th. 0.25. Fig. 2.

K/L16/17.0417:11. Single sherd preserving complete base. The fine fabric is unevenly fired to brown with frequent small white inclusions and occasional mica on surface, with distinct lighter section at the base. A band of.045 high painted white dots, with 7 at least partially extant, separates the lower lighter colored area from the higher darker one.

Added white decoration is well known on thin-walled vessels. Cf. Hayes 2008, no. 1608.

Çandarlı Hayes Form 4 Profile (3rd Century AD)

P.H. 3.3; Est. D. r. 17 (1/2 preserved); Th..02.

K/L16/17.0417:2. Small find number: P0656. Five joining fragments preserving complete profile. Fine red (2.5YR 7/6) fabric with occasional small white inclusions and more common small voids.

Hayes 1985, 78, pl. XVIII. 4.

To be very clear, catalog entries such as these include information generated by ceramic specialists sometimes working outside the context of the project's FileMaker database. They therefore

11 A list of ceramic publications by members of the PBA team is available at http://classics.uc.edu/troy/grbpottery/html/bibliography_ilion.html.

12 Rose et al. forthcoming.

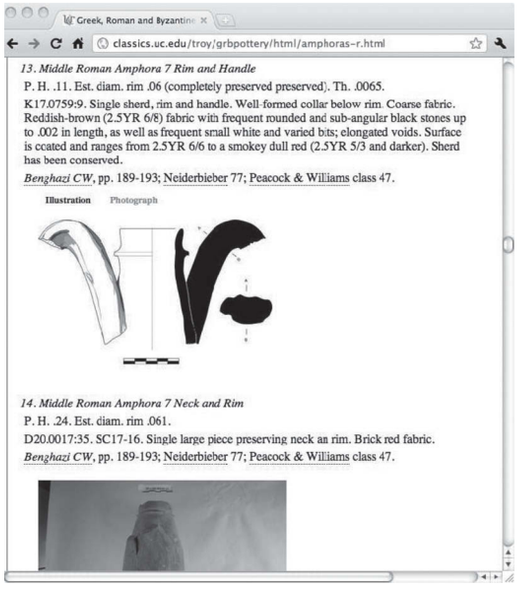


Fig. 4
Page from Greek, Roman and Byzantine Pottery at Ilion (Troia); showing entry for sherd K17.0759:9.

represent a combination of database-assisted publication and carefully crafted scholarly output. Note, however, that the catalog entry maintains and publishes the unique identifiers assigned to each sherd, including the small find number ›P0656‹ in entry #2. During the process of publication, maintaining these identities facilitates the very practical task of assembling profile drawings and photographs. After publication, these identifiers remain the primary means of accessing the sherd itself, should that ever become necessary. While the fact of publication, along with the catalog number, can be recorded in the FileMaker database, no new unique, project-wide identifier is created. This maintains simplicity going forward.

We also believe that such consistency of identification will be important as more of the data from the PBA team becomes available online. As of this writing, the most substantial publicly available collection of digital records for ceramics from Ilion is the publication *Greek, Roman and Byzantine Pottery from Ilion (Troy)* – abbreviated *GRBPIlion*.[13] This work consists of pre-published catalog entries; entries that are in preparation for print publication; and a growing selection of entries describing important sherds not currently intended for inclusion in any other study, with many of these coming from the PBA study collection. The intent of *GRBPIlion* is to provide an overview of the major categories of pottery found at the site, with the categories often corresponding to a well-recognized ware – e.g., Attic Red-Slip. Each category has an introductory paragraph, followed by a catalog of illustrative sherds. Fig. 4 features a screen capture from the site; the profile drawing shown is of the same amphora neck and handle appearing in Fig. 3. In all cases, the digital publication reuses the sherd, small find, and study collection numbers previously assigned.

The profile drawings likewise make use of the sherd number to derive a file name. While some ad hoc photography was done for *GRBPIlion,* the great majority of the photographs are identified by the number first assigned to them by the project. Indeed, the digital publication usually includes a copy of the original project photography at full resolution.

As the amount of information from the project increases, we expect that this reuse of identifiers will greatly ease the process of linking between disparate types of information. Our intention is to anticipate an environment in which it is easy to see which coins or other category of small find were found with the pottery from a stratigraphic unit and to further explore that same question for adjacent units.

13 Heath – Tekkök 2009.

Conclusion

Our goal in this article has been straightforward: to stress that simple database constructs can promote in-field use and subsequent publication of ceramic data. We particularly stress that it is important to assign a primary identity to all sherds that will be subject to individual study. This identity should follow naturally from the stratigraphic context of the object. A primary identifier can be used in conjunction with other numbers that indicate where a sherd is stored, but these additional numbers should not replace the original unique ID. Such a system will promote well-organized collection and rapid retrieval of information, which will in turn lead to speedier publication. We also note that within such a system, quantification of sherd numbers can provide preliminary assessment of an assemblage and also assist in identifying tractable research goals.

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