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# Votive weapons in the panhellenic sanctuary of Olympia (10<sup>th</sup>–5<sup>th</sup> centuries B.C.): a diachronic analysis

RAIMON GRAELLS I FABREGAT – CLEMENS SCHMID

Votivwaffen im panhellenischen Heiligtum von Olympia (10.–5. Jh. v. Chr.): Eine diachrone Analyse

**ZUSAMMENFASSUNG** In diesem Beitrag werden die ersten Ergebnisse einer quantitativen Analyse von Metallobjekten vorgestellt, die im Zeusheiligtum von Olympia gefunden wurden und aus der protogeometrischen bis klassischen Zeit stammen. Wir konzentrieren uns auf Waffen als eine der am umfassendsten untersuchten Kategorien von Votivgaben, untersuchen ihre räumlichen und zeitlichen Deponierungsmuster mit diachroner Datenvisualisierung und rekonstruieren ein konkretes Veränderungsmuster am Beispiel griechischer Hoplitenrüstungen. Aufgrund der langen Nutzungs- und Ausgrabungsgeschichte ist die Anzahl der in Olympia dokumentierten Artefakte hoch, der räumliche und zeitliche Detailgrad der relevanten Kontextinformationen jedoch sehr gering. Die zeitliche Zuordnung der Objekte beruht fast ausschließlich auf der typenchronologischen Klassifizierung. Trotz dieser Einschränkung können die vorliegenden Daten zum Verständnis von Moden von Waffenweihungen im Heiligtum beitragen, die sich nicht zuletzt als Ergebnis sich verändernder religiös-kultureller Wahrnehmungen, religiöser Vorschriften, politischer Interessen und bewusster Verwaltung des Heiligtumsbereichs herausbildeten.

*Schlagwörter* Votivgaben; Panoplien; Hoplit; Quantifizierung; diachrone Analyse.

**ABSTRACT** This paper presents the first results of a quantitative analysis of metal objects found in the Zeus sanctuary of Olympia, dating from the Protogeometric to the Classical period. We focus on weapons as one of the most comprehensively studied category of votive offerings, explore their spatial and temporal deposition patterns with diachronic data visualization and reconstruct a concrete pattern of change on the example of Greek hoplite panoplies. Due to its long occupation and then excavation history, the amount of artefacts documented in Olympia is high, but the spatiotemporal resolution of relevant context information very low. The temporal attribution of artefacts relies almost exclusively on typo-chronological classification. Despite this limitation, the dataset can contribute to an understanding of fashions of weapon offerings in the sanctuary which emerged not least as an outcome of changing religio-cultural perceptions, religious regulations, political interests and conscious management of the sanctuary space.

*Keywords* votive offerings; panoply; hoplite; quantification; diachronic analysis.

Αναθηματικά όπλα στο πανελλήνιο ιερό της Ολυμπίας (10ος–5ος αι. π. Χ.): Διαχρονική εξέλιξη

**ΠΕΡΙΛΗΨΗ** Σε αυτό το άρθρο παρουσιάζονται τα πρώτα πορίσματα μιας ποσοτικής ανάλυσης μεταλλικών αντικειμένων, τα οποία βρέθηκαν στο ιερό του Διός στην Ολυμπία και χρονολογούνται από την πρωτογεωμετρική έως την κλασική περίοδο. Εστιάζουμε στα όπλα, δεδομένου ότι πρόκειται για μία από τις κατηγορίες αναθημάτων που έχουν διερευνηθεί στον μέγιστο δυνατό βαθμό, εξετάζουμε τα χωρικά και χρονικά μοτίβα απόθεσής τους με διαχρονική οπτικοποίηση δεδομένων και ανασυνθέτουμε ένα συγκεκριμένο μοτίβο αλλαγών λαμβάνοντας ως παράδειγμα ελληνικές πανοπλίες οπλιτών. Εξαιτίας της μακράς ιστορίας χρήσης και ανασκαφών στον χώρο, ο αριθμός των τέχνηργων που έχουν καταγραφεί στην Ολυμπία είναι μεγάλος, όμως ο βαθμός λεπτομέρειας των σχετικών πληροφοριών που τα εγγράφουν σε ένα χωροχρονικό πλαίσιο παραμένει περιορισμένος. Η χρονική απόδοση των αντικειμένων βασίζεται σχεδόν αποκλειστικά στην τυπολογική και χρονολογική ταξινόμηση. Παρά τον περιορισμό αυτό, τα διαθέσιμα δεδομένα έχουν τη δυνατότητα να συμβάλουν στην κατανόηση τάσεων στα αναθήματα όπλων στον χώρο του ιερού, όπως διαμορφώθηκαν ως αποτέλεσμα αλλαγών στις θρησκευτικές / πολιτισμικές αντιλήψεις, τις θρησκευτικές επιταγές, τα πολιτικά συμφέροντα και τη συνειδητή διαχείριση του χώρου του ιερού.

*Λέξεις-κλειδιά* Αναθήματα. Πανοπλίες. Οπλίτες. Ποσοτικός προσδιορισμός. Διαχρονική εξέλιξη.

## INTRODUCTION

Among all ancient Greek sanctuaries Olympia stands out for many reasons, of which two will be of primary interest to this investigation: the number of votive offerings and their continuity from the 10<sup>th</sup> to the 5<sup>th</sup> century B.C. Regrettably we cannot assess this entire period in detail, nor can we explore the specific features of exhibition of the individual artefact categories<sup>1</sup>. Instead, our aim is to provide a high-level analysis of weapon artefacts and the rhythms of their offering.

Nearly a quarter of the 25000 votive offerings recovered in excavations at the sanctuary are weapons<sup>2</sup>. The huge amount of material evidence recovered from Olympia compelled archaeologists from an early stage to focus on distinct material categories. This act of typological classification enables efficient research management and allows archaeological specialists to acquire high expertise on distinct functional artefact types. But sometimes it can also narrow the focus of their interest to these types alone, hindering their broader understanding of the behaviour associated with the offerings in the sanctuary, its general evolution and related diachronic changes. We suggest a new interpretation of the material record from Olympia, offering a more global perspective that is vitally needed to understand how, why and when Ancient Greeks and (perhaps) visiting foreigners offered votive objects in the sanctuary<sup>3</sup>.

There is a general consensus among scholars that material culture is a key component in understanding the development of ritual practices in the Greco-Roman world. Archaeological remains fossilize, concentrate and preserve the history of individual sanctuaries<sup>4</sup>. Moreover, they offer the only remaining evidence available for the reconstruction of life and ritual, which is not – or only poorly – represented in written sources. This holds especially true for the background and incentives of pilgrims visiting a sanctuary or smaller cults devoted to minor deities. Votive objects record the memory of a sanctuary and allow insights into the evolution of the actual procedures for offering artefacts at the shrine. This complex activity underwent continuous changes in the types and amounts of artefacts offered, the way they were prepared and deposited (complete, broken, drilled, bent, engraved or fragmented), and how and which objects from different (spatial or social) domains were introduced<sup>5</sup>. All these clues provide a key to understanding the biography of a sanctuary and the surrounding cult's progression towards greater religious complexity.

This research was developed in collaboration with the Römisch-Germanisches Zentralmuseum (RGZM) and the Deutsches Archäologisches Institut in Athens (Athens Department of the DAI), with the financial support of the Deutsche Forschungsgemeinschaft (DFG) under the Project title ›Olympia – Diachrone Entwicklung der Votivgaben vom 10. bis 5. Jahrhundert v. Chr.« [Olympia – Diachronic Development of the Votive Gifts from the 10<sup>th</sup> to the 5<sup>th</sup> Centuries B.C.] (BA 3197/1-1).

We are much indebted to Holger Baitinger and Reinhard Senff. We would also like to thank the following colleagues for their assistance with the project: J. Bonnes, M. Egg, G. Heinz, N. Kallas, A. Mees, A. Scarci. Finally, we would like to thank the anonymous reviewers for their comments, which have improved various aspects of the paper.

<sup>1</sup> Frielinghaus 2006; Graells i Fabregat 2017b; Graells i Fabregat 2017c.

<sup>2</sup> Offerings of weapons in sanctuaries are described in a large body of literature: Greenwell 1881; Kunze 1967a; Pritchett 1979; Jackson 1983; Jackson 1991; Jacquemin 1999; Baitinger 1999; Gabaldón 2005; Frielinghaus 2006; Baitinger 2011; Frielinghaus 2011; Baitinger 2012; Frielinghaus 2012; Baitinger 2016a; Baitinger 2016b; Graells i Fabregat 2016; Graells i Fabregat 2017a; Graells i Fabregat 2017b; Graells i Fabregat et al. 2017; Baitinger 2018; Graells i Fabregat – Longo 2018; Graells i Fabregat 2019b; Graells i Fabregat 2020; Scarci 2020.

<sup>3</sup> Previous attempts in Felten 1982; Kilian-Dirlmeier 1985; Philipp 1992; Philipp 1994; Baitinger 2016b.

<sup>4</sup> Luce 2010.

<sup>5</sup> Graells i Fabregat 2017b.

Only a few published attempts have been made to apply explicitly quantitative and statistical analysis to the study of votive offerings in Greek sanctuaries. The works of S. Hodkinson<sup>6</sup> and J. Larson<sup>7</sup>, who focused mostly on bronze objects, are a rare example of such an approach: they highlight the significant potential which is offered by metal offerings, as well as the rich diversity in forms and functions of ancient offering practices. Hodkinson<sup>8</sup> maintained that, although bronze survives in greater quantities than more expensive metals, the archaeological record of bronze votive offerings is compromised and depleted by several post-depositional factors, such as melting down, plundering and the conservation problems connected to the metal itself. This led him to suggest that the numbers of each type of offering should be considered individually, according to the differential effect of these factors upon each type (objects made of sheets of bronze versus casts, size, etc.). A reliable, parametrized algorithm to calculate this suggested weighting is a desideratum, though, and remains a challenge for future scholarly research.

A first attempt to survey the votive offerings from Olympia comprehensively was the pioneering work of F. Felten<sup>9</sup>, who tried to compare the offering activities there with those in Delphi. Some years later, I. Kilian-Dirlmeier<sup>10</sup> delved into the study of the origins of votive gifts in multiple Greek sanctuaries, including Olympia. In 1995, E. Jarva presented a quantitative analysis of weapons from Olympia – with a focus on body armour<sup>11</sup> – but the published results were severely called into question by H. van Wees<sup>12</sup>. Van Wees criticized the inconsistency of Jarva's proposals based on his own preconceived image of the Greek archaic panoply and army. Beyond Felten, Kilian-Dirlmeier and Jarva, other studies have examined the votive offerings from different points of view: some have attempted to summarise the chronological information on all votive offerings, mostly concentrating on the early phases of the sanctuary<sup>13</sup>, while others have investigated a specific group of artefacts, frequently weapons, from a diachronic point of view<sup>14</sup>.

Here we offer a new attempt in charting the development of votive offerings at the Zeus sanctuary of Olympia from the beginning of the archaeological record to the Classical period. The main goal of this project was to develop research ideas based on statistical analysis of the data recorded in the official database of the Olympia excavation project: iDAI.field.

The presented results are built upon three main pillars:

1. We only work with published material that has already been uniformly compiled in a dedicated database.
2. We thus work with a partially incomplete catalogue. We agree that complete publication and analysis of the finds is a fundamental requirement for a thorough study<sup>15</sup> and only a complete database of the finds will allow a conclusive quantification of the absolute number of dedications through types and periods. For the time being, however, we expect the large subset of published weapon artefacts to provide a meaningful statistical sample.
3. We limit the analysis to a time window from the 10<sup>th</sup> century – which corresponds to the first advent of votive offerings in the sanctuary – to the 5<sup>th</sup> century B.C.

In the following sections we will explain how we analysed the diachronic development of weapon artefacts by means of archaeological and statistical methods. We focus on the evolution of types, artefact numbers and associations of weapons. The results, which should be compared with observations from other sanctuaries in the future, are hoped to contribute

<sup>6</sup> Hodkinson 1998.

<sup>7</sup> Larson 2009.

<sup>8</sup> Hodkinson 1998, 56.

<sup>9</sup> Felten 1982.

<sup>10</sup> Kilian-Dirlmeier 1985.

<sup>11</sup> Jarva 1995.

<sup>12</sup> van Wees 1997, 154 f.

<sup>13</sup> Kyrieleis 2006.

<sup>14</sup> Baitinger 2001; Bartels 1967; Bol 1989; Philipp 2004; Philipp 2014; Frielinghaus 2011; Kunze 1967b; Kunze 1991; Graells i Fabregat 2019b.

<sup>15</sup> Hodkinson 1998, 56.

to the reconstruction of the history of Olympia and also to provide new insights into Ancient Greek warfare.

## MATERIALS AND METHODS

The database constructed and compiled for this project contains (as of May 2019) more than 13000 individual artefacts, of which ca. 4000 are published, and boasts an extensive amount of contextual and object-specific information in German. Its structure was devised by the IT-Team of the German Archaeological Institute at Berlin, supervised by R. Förtsch, and follows the general layout of the iDAI.field database Version 1<sup>16</sup>. It is implemented with the proprietary database development software FileMaker Pro Advanced Version 17. In the future, this database will be reimplemented in a PostgreSQL based environment provided by the iDAI.field database Version 2<sup>17</sup>.

All spatial data preparation for this paper was carried out with the GIS software QGIS version 3.4. All further data analysis was performed with the statistical data analysis environment R version 4.1.0<sup>18</sup>. We relied on the following >R packages<: cowplot, dplyr, forcats, ggplot2, ggrepel, ggrridges, ggspatial, janitor, magick, magrittr, pbapply, purrr, raster, readr, rsvg, sf, tibble, tidyr, tidyselect and wesanderson<sup>19</sup>. The code is reproducible<sup>20</sup> and available in a public repository on GitHub (<https://github.com/nevrome/olympia.votiveweapons.article2021>), as well as with a permanent digital object identifier (DOI) on the Open Science Framework Platform (<http://dx.doi.org/10.17605/OSF.IO/RV2ZF>).

For this paper, not all data were used, but only a specially prepared subset detailing weapon artefacts and relevant variables. While the raw source database cannot be published at present, the relevant subset is openly available in the repository. The supplementary Table 1 contains an overview of the variables in the subset table and their meaning (*table 1*). Each individual artefact has a unique object identifier, typological dating information based on published dates in the relevant material-focused studies, rough information about the documented excavation location and a hierarchical typological attribution. The supplementary Table 2 lists the literature used for the typological dating of each artefact type (*table 2*).

This dataset contains 3673 metal weapon artefacts documented and published during the complete excavation history of Olympia, as far as we have been able to reconstruct it. *Figure 1* is based on this dataset, but for all other figures a more strict filtering process had to be applied. They are computed from a selection of 3059 weapon artefacts that fulfil the following requirements:

1. The artefact must be typologically analysed and dated.
2. Its dating must fall between 1000 and 400 B.C.
3. The artefact must be spatially attributed to one of the site's macro areas (e.g. Temple of Zeus, Stadium, etc.).

*Figure 1* visualizes the material distribution by category and describes the precision of the available artefact dating information. The categories are deliberately broad to give a general overview. Each individually documented and published artefact is counted as one observa-

<sup>16</sup> Schäfer 2011.

<sup>17</sup> Cuy et al. 2017.

<sup>18</sup> R Core Team 2021.

<sup>19</sup> In the order of the packages: Wilke 2020; Wickham et al. 2021; Wickham 2021a; Wickham 2016; Slowikowski 2021; Wilke 2021; Dunnington 2021; Firke 2021; Ooms 2021a; Bache – Wickham 2020;

Solymos – Zawadzki 2020; Henry – Wickham 2020; Hijmans 2021; Wickham – Hester 2021; Ooms 2021b; Pebesma 2018; Müller – Wickham 2021; Wickham 2021b; Henry – Wickham 2021; Ram – Wickham 2018.

<sup>20</sup> Marwick et al. 2018.



Variable	R Data type	Description
general_id	Character	Unique object identifier.
dating_typology_start	Integer	Start of typological dating time window. All temporal information is based on typological attribution and the dating suggested in the respective literature. Negative numbers denote years BC, e.g. -674 = 674 BC.
dating_typology_end	Integer	End of dating time window.
find_area	Factor	Site macroregion, where the object was found.
typology_class_1	Factor	General typological attribution: <i>Waffe</i> (weapon), <i>Schmuck</i> (jewellery), <i>Pferdeausstattung</i> (horse tack), etc. Here only <i>Waffe</i> .
typology_class_2	Factor	More fine-grained artefact distinction: <i>Pfeilspitze</i> (Arrow head), <i>Helm</i> (Helmet), <i>Bronzene Speerspitze</i> (Spear head [bronze]), etc.
typology_class_3	Factor	Even more fine-grained attribution with partially chronologically relevant classes: <i>Korinthischer Helm</i> (Corinthian Helmet), <i>Illyrischer Helm</i> (Illyrian Helmet), <i>Thrakische Mitra</i> (Thracian mitre), etc. This column was not translated to English.
typology_class_4	Factor	Specific type attribution as proposed in the literature: IIA3d, D Stufe IId, IIIf, etc. This column was not translated to English.
orientation	Factor	Only used to distinguish greaves: left, right.

Table 1 Variables in the subset table and their meaning

Artefact type (typology_class_2)	Literature used for typochronological dating information
Arrowheads	Baitinger 2001
Spearheads	Baitinger 2001
Lances (Heads and sauroters)	Baitinger 2001
Shields	Bol 1989
<i>Episemata</i> (Shield emblems)	Philipp 2004; Philipp 2014
Helmets: Crested (A), Kegel (B), Illyrian (C), Corinthian (D), Multipart (E), Cretan (F), Chalcidian (G), Classical (H and J), Assyrian (K), Negau (L), Conical (M), Decoration Elements (N)	Frielinghaus 2011
Greaves	Kunze 1991; Jarva 1995
Foot guards	Kunze 1967; Jarva 1995; Graells i Fabregat 2019
Ankle guards	Jarva 1995
Thigh guards	Jarva 1995
Arm guards	Graells i Fabregat 2019a
Cuirasses	Graells i Fabregat in press
Mitres	Bartels 1967; Jarva 1995

Table 2 Literature used for typological dating

tion, so multiple artefacts – especially in the domain ›Shield and accessories‹ – might have belonged to the same original weapon. On the other hand, we can only count preserved artefacts, so weapon and armour categories that are usually made from organic material are most likely severely undercounted due to preservation issues. These and other effects skew the representativity of the artefact counts both in this and all other analyses and will be a recurring topic below.

For *Figure 2*, a map of the spatial origin of weapon artefacts, it was necessary to define the major areas of the archaeological site of Olympia. Most artefacts found during the early

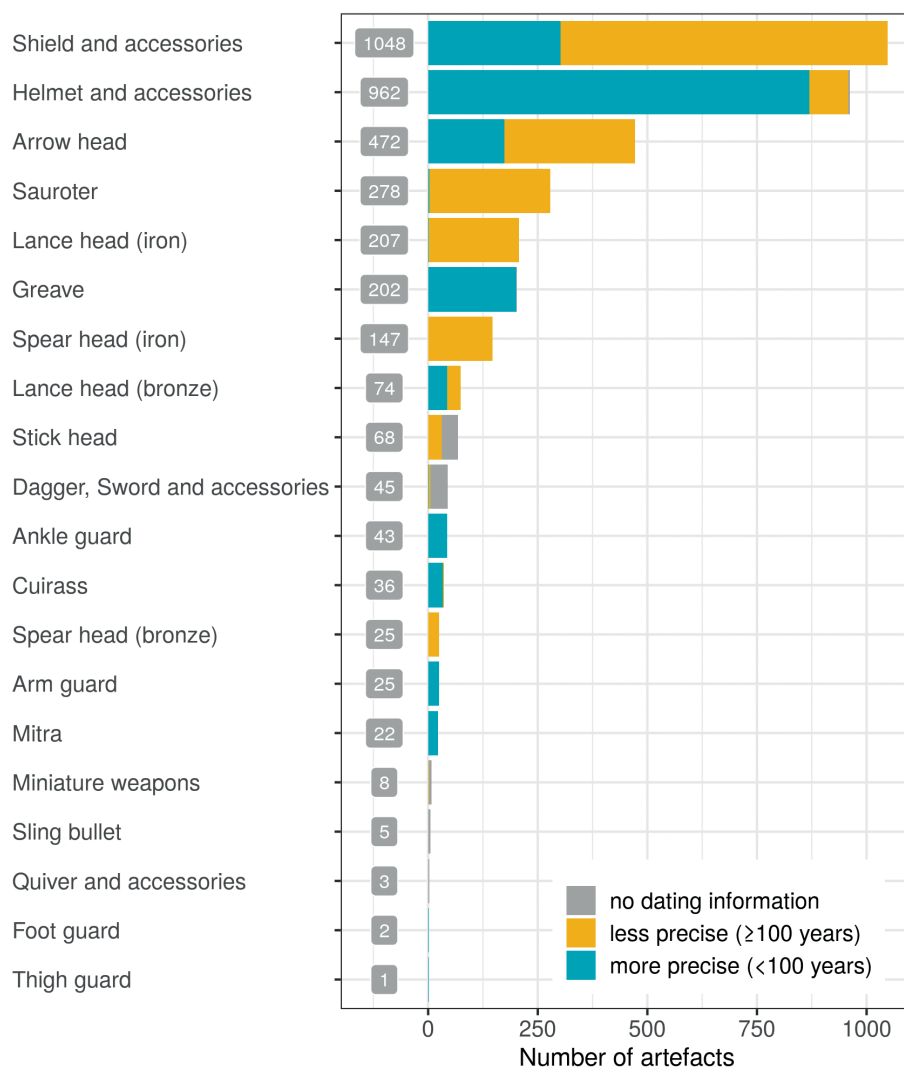


Fig. 1 Artefact category distribution in the Olympia weapon dataset. The labels show the total number of artefacts counted for the respective category. The fill colour of the bars indicates the proportion of the artefacts with dating information.

excavations in the second half of the 19<sup>th</sup> century were recorded, albeit with very imprecise information on their spatial context. The approximate area separation proposed here is based on preparatory work of the DAI Athens team and attempts to respect the geomorphological changes brought to Olympia in the post-antiquity period by the rivers Alpheios and Kladeos. However, the low degree of spatial precision for most of the old excavations renders this spatial attribution fuzzy. Also, the documented find position during the excavation does not necessarily represent the position at which an artefact was exhibited or even deposited, given the complex (building) history of the sanctuary. If significant amounts of earth were moved from one part of the sanctuary to another, then this earth might already contain votive offering fragments, and thus skew the archaeologically observed spatial distribution.

One of the most important features of the presented dataset is the widespread availability of (approximate) temporal information. The assigned time windows for each artefact are based solely on published domain expert knowledge: typological analysis and material comparison with finds from all over the Mediterranean world. This includes, firstly, data from Olympia, but also from other sanctuaries and cemeteries in Greece and Southern Italy.

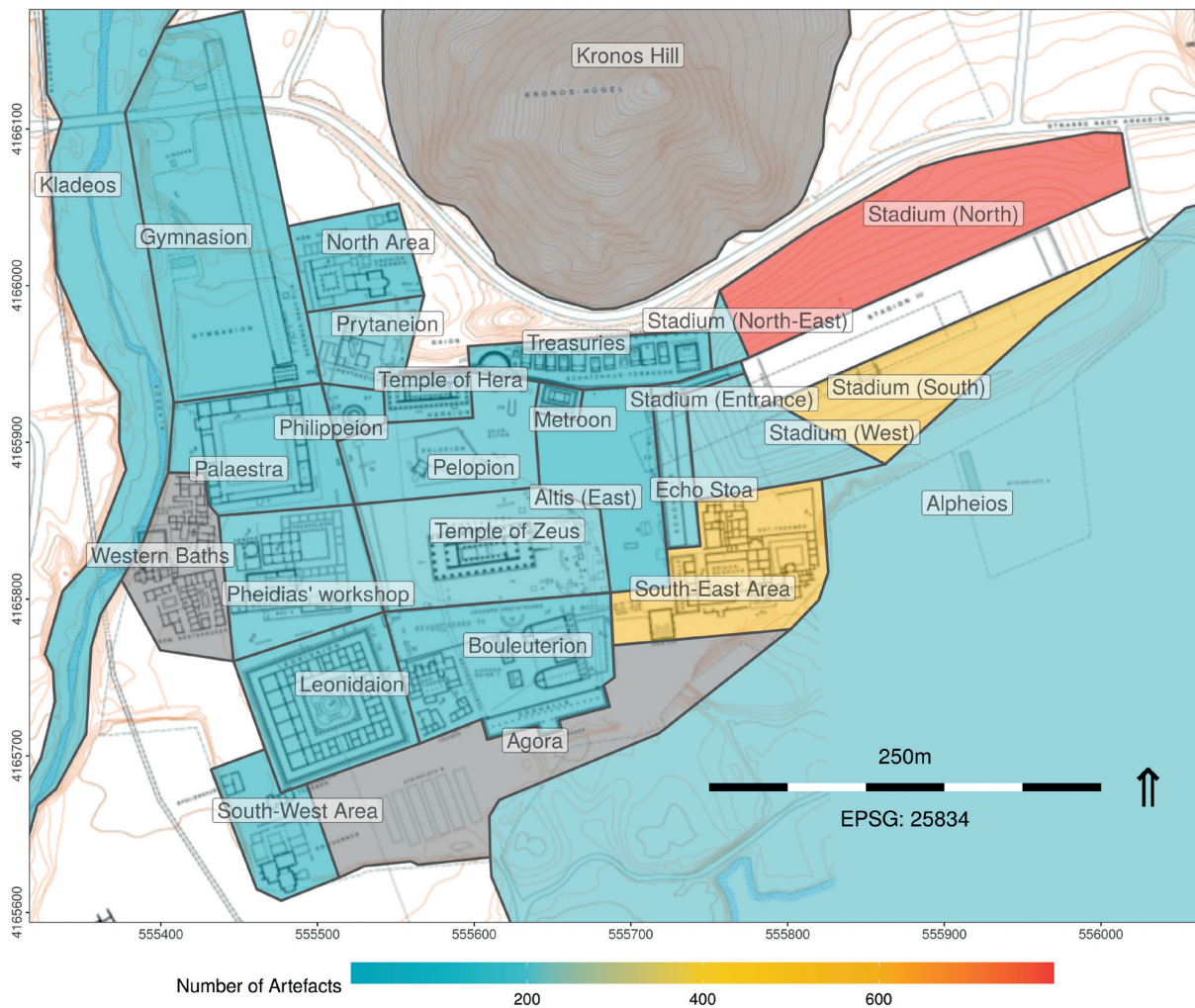


Fig. 2 Macro areas of the archaeological site of Olympia. The fill colour indicates the total number of weapon artefacts documented per area.

The datings are therefore often coarse and unreliable. Nevertheless, these data generally allow us to reconstruct the history of the votive offerings from an overarching, comparative perspective beyond the limitations imposed by individual material categories.

One major challenge in summarizing the temporal information quantitatively is the significant fluctuations in precision. For some artefacts, e.g. certain helmet types, very precise dating (<25 years) is available; for others, e.g. spearheads, only broad time windows (> 100 years) have been reconstructed typologically. These windows irregularly overlap. To overcome these issues and create structurally uniform and continuous time series of relative abundance, we employed the aoristic method. This method was initially developed in forensics to reconstruct the incidents of a crime. It works by explicitly spreading the probability of an event across a time window, within which the event could have taken place<sup>21</sup>, and allows for the calculation of a weight-corrected, year-wise measure of type occurrence. We used the R package *aoristAAR* to calculate these time series and (for some applications) the simpler, uncorrected per-year-count time series<sup>22</sup>.

With this time series construction method, the static map in *figure 2* can be split up to display the temporal development of votive offering depositions in the different areas of

<sup>21</sup> Johnson 2004; Mischka 2004.

<sup>22</sup> Hinz et al. 2019.