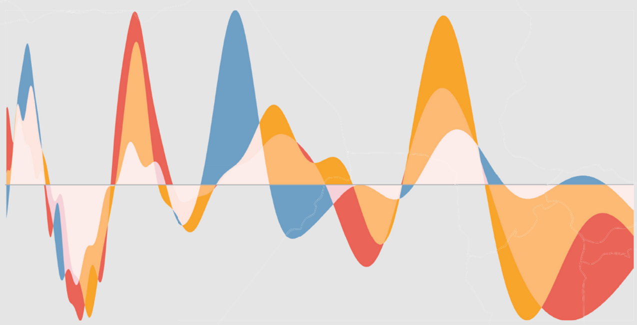
Weight & Value 4

Weights and Balances of Bronze Age Europe

by Nicola Ialongo



GEORG OLMS VERLAG

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Weight & Value

Edited by Lorenz Rahmstorf
Seminar für Ur- und Frühgeschichte
Georg-August-Universität Göttingen

Volume 4

Publications of the ERC-2014-CoG:

WEIGHTANDVALUE: Weight Metrology and its Economic and Social Impact on Bronze Age Europe, West and South Asia

Göttingen
2025

Weights and Balances of Bronze Age Europe

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Nicola Ialongo

GEORG OLMS VERLAG BADEN-BADEN

This publication was funded by the European Research Council [Grant no. 648055]
The present volume has been peer-reviewed.

Redaktion: Sandra Busch-Hellwig
Satz und Layout: Heiko Marx

DOI: doi.org/10.5771/9783487170558
ISSN: 2702-9336 (Print) / 2748-5528 (Online)
ISBN 978-3-487-17010-7

Cover:
Back cover (top): Bone balance beam: Marolles-sur-Seine, La Croix de la Mission, France (cat. no. 7).
Photo by Vincent Riquier.
Back cover (bottom, left): Bronze parallelepiped weight: Barbuise-Courtavant, Grèves de Frécul, France (cat. no. 116).
Photo by Vincent Riquier.
Back cover (bottom, right): *Kannelurensteine*: Hitzacker, Germany (cat. no. 445, 463, 473). Photo by Heiko Marx.
Back cover (bottom, down): 3D reconstruction of a chipped weight (fig. 4.3). Image by Nicola Ialongo.

Georg Olms Verlag Baden-Baden 2025
Gedruckt auf säurefreiem, chlorfrei gebleichtem Papier

Preface by the editor of the series

"The results of researching the weights and balances develop to major implications for understanding trade, connectivity and socio-economic systems in Bronze Age Europe and beyond" and "the conclusions – based on an impressive and comprehensive analysis of the evidence at a continental and millennial scale – highlight a very different perspective from the previous regional/typological approaches." These comments by one of the peer reviewers of the present volume, whom I thank for their very valuable help in further improving the study, characterize very well the content of the present volume.

I would like to thank Nicola Ialongo not only for this monography on Bronze Age weights and balances from Europe (without Greece) but also for his general contribution to the success of the WEIGHTANDVALUE-Project. He developed the methodological approaches further and demonstrated the metrological configuration of scrap metal from the Bronze Age. His contributions were the most valuable in the project and will still make an impact on prehistoric research in the future to come.

In the past two or three years, several fundamental publications have already appeared that deal with early weights, scales and weight systems. This is volume 3 (2022) in this series by Enrico Ascalone (Bronze Age Weights from Mesopotamia, Iran & Greater Indus Valley. Weight & Value 3. Kiel/Hamburg 2022; Open Access: https://www.nomos-shop.de), the publication (2022) of the habilitation thesis by the author of this preface (L. Rahmstorf, Studien zu Gewichtsmetrologie und Kulturkontakt im 3. Jahrtausend v. Chr. Universitätsforschungen zur prähistorischen Archäologie 379. Bonn 2022; Open Access: https://www.habelt.de/bookshop) and the PhD-publication (2023) by Thibaud Poigt (De poids et de mesure. Les instruments de pesée en Europe occidentale durant les âges des Métaux (XIVe-IIIe s. a.C.). Conception, usages et utilisateurs. DAN 8. Pessac 2023; Open Access: https://directory.doabooks.org/handle/20.500.12854/112643). The later publication has a similar focus as this study but both were independently written and are using a slightly different approach. Both together offer new and up-to-date discussions of the current archaeological data.

Heiko Marx was responsible for the layout of this book. All figures were designed by Nicola Ialongo himself. Sandra Busch-Hellwig corrected the text on short notice. I would like to thank also all colleagues and institutions who gave Nicola access to the finds.

The next volume in this series by the editor of this series will deal with silver objects in the Copper and Bronze Age in Europe, the Mediterranean and West Asia and their potential metrological structure. In another volume in the making by L. Rahmstorf and N. Ialongo the important early weights from the Diyala excavations in central Mesopotamia will be published.

Göttingen, October 2024,

Lorenz Rahmstorf

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Acknowledgments

My gratitude goes to all the researchers, professors, and public officers that granted me access to archaeological collections during the making of this book: Gianfranca Salis, Alessandro Usai, Dirk Westendorf, Luca Doro, Cecilia Conati Barbaro, Marco Rendeli, Rebecca Peake, Alberto Cazzella, Maria Clara Martinelli, Bernhard Heeb, Horst Junker, Anita Crispino, Thorsten Lemm, Giulia Recchia, Cristina Lemorini, Giuseppe Pisanu, Grazia Corrias, Marcella Giorgio, Nicoletta Frapiccini, Roberta Vittori, Anna Desantis, Franz Schopper.

And to the institutions they represent: Museo Archeologico Regionale Paolo Orsi, Siracusa (Italy); Università di Roma "La Sapienza" (Italy); Museo Civico Giovanni Marongiu, Cabras (Italy); Musée départemental de Préhistoire d'Île-de-France, Nemours (France); Museum für Vor- und Frühgeschichte Berlin (Germany); Museo Archeologico Nazionale delle Marche, Ancona (Italy); Storerooms of the archaeological excavations at Sant'Imbenia, Alghero (Italy); Museo Archeologico Etnografico Modena (Italy); Museumsinsel Schloss Gottorf, Schleswig (Germany); Soprintendenza Speciale Archeologia, Belle Arti e Paesaggio di Roma (Italy); Museo Nazionale G.A. Sanna, Sassari (Italy); University of Sassari (Italy); Musées de Sens (France); Museo delle Origini (Italy); Museo Archeologico e Paleobotanico di Perfugas (Italy); Museo Archeologico di Dorgali (Italy); Museo Archeologico di Cingoli (Italy); Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (Italy); Archaeologishes Museum Hamburg (Germany); Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (Germany); Soprintendenza Archeologia, belle arti e paesaggio per la città metropolitana di Cagliari e le province di Oristano e Sud Sardegna (Italy).

Friends and colleagues, old and new, whose knowledge (and wisdom) spans ages, continents and technologies: Thomas Terberger, Eleonore Pape, Andrea Cardarelli, Katharina Körber, Małgorzata Siennicka, Agnese Vacca, Ben Roberts, Andrea di Renzoni, Enrico Ascalone, Sarah Clegg, Lorenzo Cardarelli. Thank you for the advice, tips, proof reading, encouragement, and heated discussions throughout all the work that eventually led up to writing this book. Two friends, Giancarlo Lago and Raphael Hermann, deserve a special mention: Their research laid the groundwork for much of what is contained in this book.

And finally, Lorenz Rahmstorf, without whom Weight & Value – and this book – would have never existed. He convinced an ERC panel that research on Bronze Age weighing technology was the next hot thing. As it turned out, he was right.

1 Introduction

1.1. Setting the stage

Together with bronze metallurgy, weighing technology is one of the great original innovations of the Bronze Age. Both played pivotal roles in shaping the era. The only reason why weighing technology seldom takes centre stage in the grand narratives of the Bronze Age is that, unlike bronze metallurgy, it has been historically overlooked as a research subject. It is hard to overstate the significance of weighing technology in modelling Bronze Age economies, yet articulating its role in historical processes, particularly in Bronze Age Europe, is a challenging task. This is mostly because the large-scale phenomena that either required or were facilitated by weighing technology have been evident for a very long time before weighing technology – at least, beyond Mesopotamia – even became a focus of research. Suffice it to say, the concept of a Bronze Age 'global' trade network has been a central theme in archaeological grand narratives since at least Gordon Childe's time, whereas research on weighing technology in Europe started to become systematic only on the verge of the 21st century (Pare 1999; Cardarelli *et al.* 2001; Vilaça 2003). Among the influential figures of European prehistory who never directly engaged in the technicalities of weight metrology, C. Renfrew (2012) was one of the first to fully realise the untapped potential of this research field, and the oddity of overlooking it for such a long time. Bringing weighing technology under the spotlight does not make these phenomena more visible, nor does it reveal new ones. Instead, it introduces a new crucial variable, the long absence of which may have led to overlooking or misinterpreting some of the causes behind these phenomena. In other words, understanding weighing technology and weight systems can help explain why certain known processes occurred and how they unfolded.

The substantial number of research papers and edited books published in the last few years demonstrates a renewed interest in Bronze Age weighing technology and weight-related economic phenomena (*e.g.,* Rahmstorf/Stratford (eds.) 2019; Hermann *et al.* 2020; Ialongo *et al.* 2021; Kuijpers/Popa 2021; Poigt *et al.* 2021; Rahmstorf *et al.* (eds.) 2021; , Chambon/Otto 2023; Lago *et al.* 2023; Ialongo/Lago 2024). Perhaps even more telling is the fact that this book is only the fourth monograph on Bronze Age weights and balances published in less than two years, each covering different periods and regions of Western Eurasia, and pursuing different objectives (Ascalone 2022; Poigt 2022; Rahmstorf 2022). What all such monographs – including this one – have in common is a high emphasis on data. The field of Bronze Age weight metrology is in dire need of data, especially in pre-literate Europe, as research in this area lags significantly behind that of other regions in Western Eurasia, where studies began much earlier. Large amounts of data are needed to define the typological variability of weighing tools, assess their chronological and geographical spread, recognize the contexts in which they were used, and reconstruct the weight systems with which they complied.

This book compiles the largest database of weighing tools from pre-literate Bronze Age Europe available to date, encompassing 696 weights and 18 balance beams, distributed unevenly but widely across Continental Europe and the British Isles. In spite of its size, it is safe to remind the reader that such a dataset merely scratches the surface of a research field poised to advance more rapidly in the near future than it has thus far. While this collection marks an improvement over previous research, it still pales in comparison to better-known prehistoric artifacts. To put things into perspective, imagine how much we would know about Bronze Age metalwork if all we had was roughly 700 objects. Probably not bad for a study published in the 19th century, but definitely a long way to go to catch up with today's knowledge. These limitations define the objectives of this book. Bronze Age Europe as a whole – at least, the portion of Europe that is delimited by the study area – is the subject of research. For now, the only feasible approach to working with sufficiently large datasets that maintain statistical validity is to keep the data together. All the observations on typology, diachronic diffusion, contexts, and metrological structure are drawn with the aim of uncovering overarching trends. This, of course, comes at the expense of local peculiarities, which most likely existed, but which the available data do not consent to address in any meaningful way.

The results presented in this work are the outcome of previous and ongoing research on weighing technology, weight systems, and weight-based trade in Bronze Age Western Eurasia. Although this book focuses exclusively on data from Europe (west of Greece), it is based on theoretical and methodological principles that can be consistently applied to any region where weighing technology was used extensively. The evidence suggests that while the general framework of each macro-region resulted from original developments, these developments were constrained by a set of fundamental principles that influenced the spread of weighing technology and the formation of weight systems across the Bronze Age world. These principles can be summarized as follows:

- the main purpose of weighing technology is the quantification of economic value;
- balance weights have no formal requirements;
- the spread of weighing technology is the outcome of a diffusion process;

- weighing technology is used by both public and private subjects;
- weight units are indeterminate in nature;
- weight systems emerge from, and are regulated by the market.

When introducing a book on Bronze Age weighing, it is somehow inevitable to reserve at least a small space to the Ancient Near East. When it comes to the origins of weighing technology in the Bronze Age world, there is little doubt that the Mesopotamian documentation provides by far the best benchmark to understand these principles. The prominent role of the Ancient Near East is not only dependent on its chronological primacy – weighing technology was invented between Mesopotamia and Egypt around 3000 BCE (*e. g.*, Rahmstorf 2022) – but also on the unparalleled abundance of high-quality data. Mesopotamia is the only region of the Bronze Age world for which extremely detailed textual evidence is sided by abundant archaeological data. This, in turn, makes it inevitable to take this region of the Bronze Age world as a sort of methodological benchmark to test assumptions and interpret the development of weighing technology elsewhere in Western Eurasia. For these reasons, several of the concepts illustrated throughout this book are sometimes introduced by, or evaluated against a discussion of the Mesopotamian setting.

Including this introduction – which also fulfils the role of conclusions – this book is composed of five chapters. Chapter 2 illustrates the general typological assessment, and the diachronic and geographical distribution of weighing devices in the study region, based on materials coming mainly from Italy, Switzerland, Germany, France, England, Portugal and Spain, with sporadic data from eastern Europe. In Chapter 3, I present an analysis of the find-contexts of weighing tools – settlements, burials, and hoards – in order to identify clues about their users and the circumstances in which they were used. The statistical analyses presented in Chapter 4 focus on reconstructing the metrological structure of weight systems and exploring their implications for understanding the economic system of Bronze Age Europe. Finally, Chapter 5 includes a typological catalogue, and a detailed description of the typology, chronology, distribution, and construction materials of each formal type.

Each chapter is conceived as a self-contained treatment of a specific problem or question, and can be approached in any order. All contain data-intensive quantifications and/or statistical analyses, explained in detail in the text and illustrated in graphs and tables. The typological catalogue provides all the raw data and information necessary to replicate each of these analyses. The full dataset is available for download on Zenodo: https://doi.org/10.5281/zenodo.13903718.

Although the chapters are conceptually separated, they address different aspects of the same broader problem. The second part of this introduction, then, is devoted to the formulation of a unifying narrative, briefly illustrating each chapter's main results and connecting them together in order to paint a general picture of the significance of weighing technology and weight systems for the study of prehistoric economies in Europe.

1.2. Typology: unremarkable objects

The balance weights of pre-literate Bronze Age Europe belong to 14 different formal archetypes, almost all of which can be traced back to simple solid geometric shapes (Fig. 1.1.). These observations largely confirm the overall typological variability already identified by previous studies focussing on limited regional and chronological contexts (Pare 1999; Cardarelli *et al.* 2001; 2004; Vilaça 2011; 2013; Feth 2014), while significantly expanding the catalogue of identified objects (see Chapter 2).

The typological assessment combined with metrological analyses shows that the formal archetypes are sharply divided into two separate orders of magnitude: a class of 'light weights' – corresponding to multiples and fractions of a *shekel* (*i. e.*, a small unit) of *c.* 10 g – and a class of 'heavy weights' – corresponding to multiples and fractions of the *mina* (*i. e.*, a large unit) of *c.* 440 g. Overall, while there seem to be regional and chronological differences in the distribution of different formal types, the sample is still too unevenly distributed to exclude that these differences may be simply due to chance.

With some exceptions, the evidence seems to speak against the possibility that the manufacture of balance weights usually required specialised skillsets. The most apparent characteristic of most balance weights is being "*aesthetically* […] *unremarkable, if not downright unappealing*" (Petruso 1992, vii), which means that they frequently lack any skill-intensive decorative or functional feature. Moreover, aesthetic canons appear to have been rather lax, allowing for a high variability within archetypes. For example, many of the stone parallelepipeds (cat. no. 19-58) – the most frequently attested archetype in the *shekel*-range – have variable proportions and roughly-sketched outlines. Not to mention the unknown amount of unshaped natural pebbles and casual objects that could have been occasionally used as weights (see Chapter 2). Interestingly, more complex shapes seem to be mostly represented in heavy weights in the *mina*-range. On the other hand, some types of balance weights, especially those made of bronze, sometime show more elaborate features, such as the parallelepipeds with wavy mouldings (cat. no. 116-127) which are occasionally attested in elite burials.

Overall, the typological appraisal does not seem to suggest that balance weights were exceptional objects with particular aesthetic or symbolic value. Such an unremarkable character appears to be consistent with the evidence related to archaeological contexts and metrological structure.

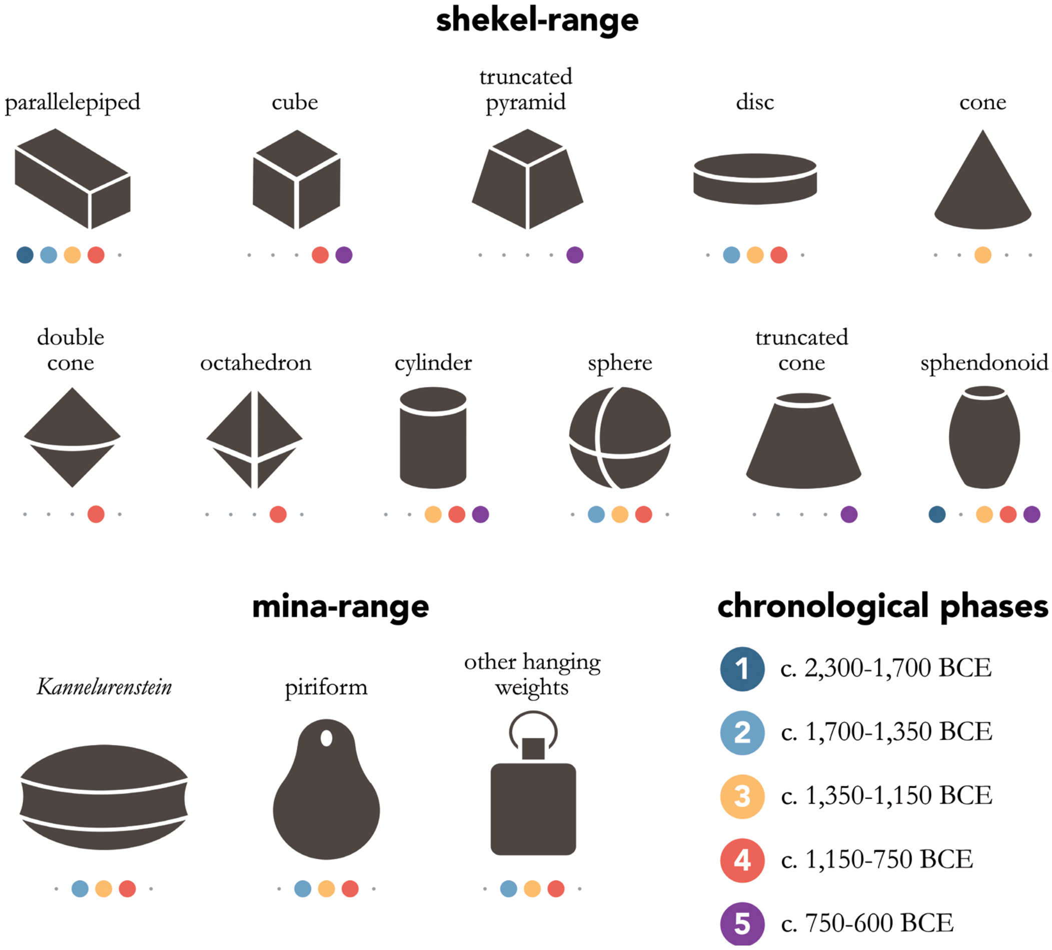


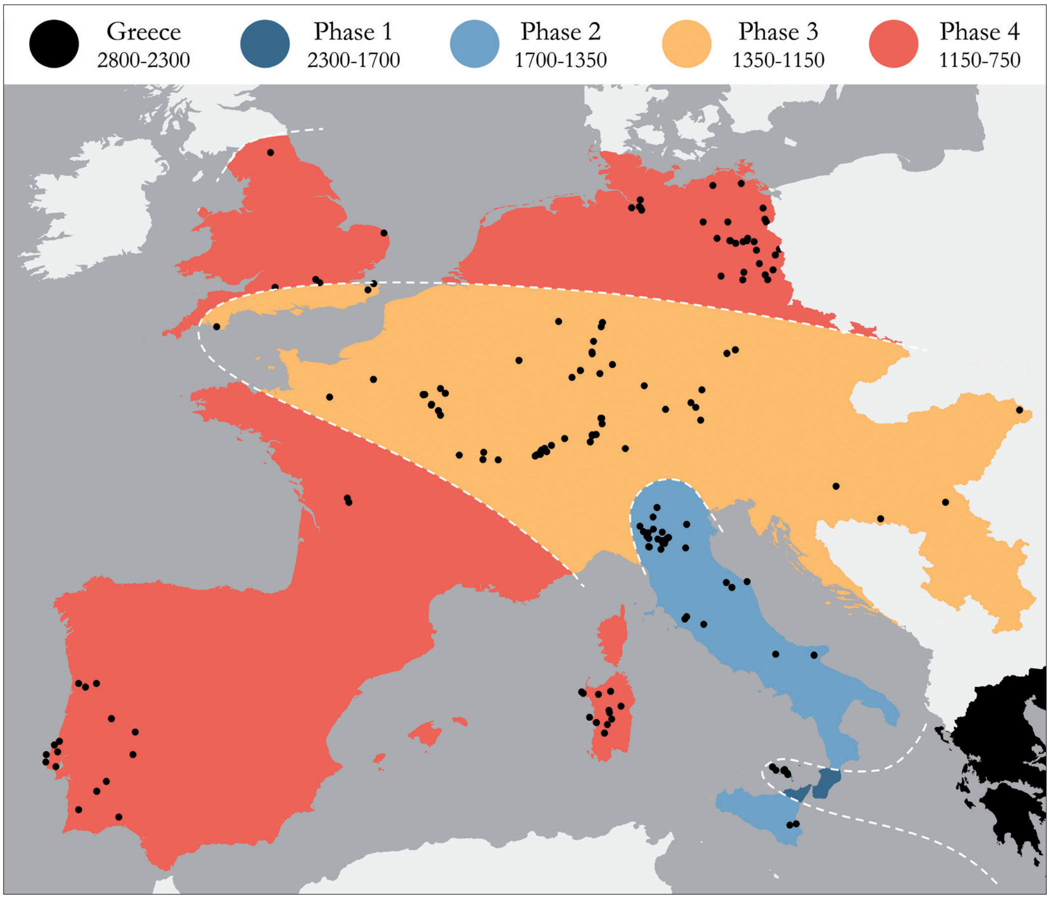
Fig. 1.1. Typology of the balance weights of Bronze Age Europe. The icons are a simplification of the ideal archetype, and they are not to scale. The archetypes are grouped according to their respective order of magnitude. The colours identify the chronological phase in which they are attested.

1.3. Geographical distribution: a gradual spread

The data analysed in this book confirm previous observations (Ialongo/Rahmstorf 2019), and suggest that weighing technology spread across pre-literate Bronze Age Europe gradually, in a time-span of roughly 1,000 years (Fig. 1.2.). Balance weights appear in southern Italy around 2000 BCE, and are first attested in northern Italy by *c.* 1600 BCE; they then spread north of the Alps around 1350 BCE – apparently reaching the southern coast of England – and they are eventually documented in the Iberian Peninsula and in the rest of England only in the final centuries of the 2nd millennium BCE. The evidence appears consistent with the relatively slow process of technological diffusion that characterises the spread of weighing technology virtually everywhere in Western Eurasia, starting from its origin point between Egypt and Mesopotamia around 3000 BCE (Rahmstorf 2011; Ialongo *et al.* 2021).

In Chapter 2 I highlight the current limitations of the available evidence in pinpointing the precise timing of the spread of weighing technology, which are largely dependent on the still uneven distribution of the data – some European regions, such as Austria, have not been sampled at all – and partly on the difficulty of correlating the many local chronological sequences of different regions of Bronze Age Europe. While in some regions balance weights might have existed even before the available evidence allows us to assess at the moment, it is nonetheless safe to assume that their appearance in the visible archaeological record reflects an increment in their actual use.

These observations raise a question: Why was the spread of weighing technology so gradual and seemingly slow? There is little doubt that, everywhere in Western Eurasia, the adoption of weighing technology is the consequence of the generalised adoption of the abstract concept of weight – or better, mass – as a universal measure of economic value. For the first time in history, the invention of weights and balances allowed economic agents to convert the values of a virtually limitless array of goods into one another, based on an objective frame of reference (Powell 1979; Renfrew 2012; Rahmstorf 2016a). On a long-duration, cross-continental perspective the gradual spread can easily reflect a model of technological transmission: simply put, trading agents from a non-weighing region get in contact with their peers from a weighing-region, see the advantages of the new technology, and eventually adopt it as their own. Such a transmission model is supported by statistical models simulating the gradual emergence of slightly different weight systems in Western Eurasia throughout the 3rd and 2nd millennia BCE (Ialongo *et al.* 2021; see also Chapter 4). What statistical models cannot



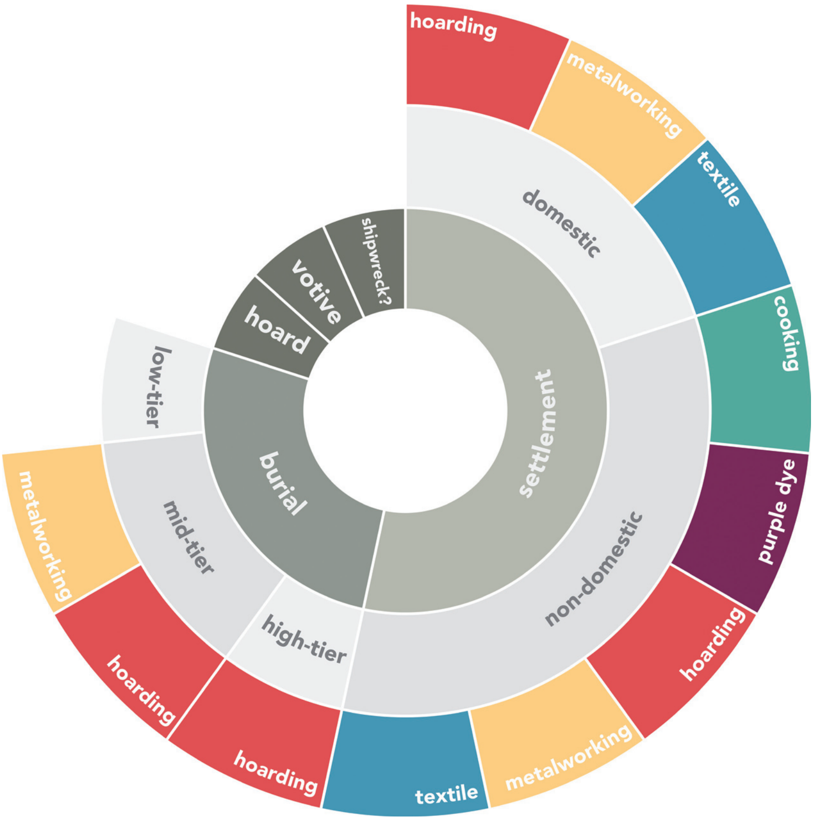
▶ *Fig. 1.2. The gradual diffusion of weighing technology in Bronze Age Europe. The isochrones represent a simplification of the distribution maps illustrated in Chapter 2.*

pinpoint, however, are the historical circumstances in which such a transmission happened, especially for Bronze Age Europe. In particular, it remains to be explained why the adoption of weighing technology in different regions of Europe seems to be often separated by several centuries.

As already observed, the regional shift might have been actually smoother than the available evidence might seem to suggest. This, however, still does not explain the objectively long time-span it took before weighing technology was adopted everywhere. The diffusion of weighing technology, then, might be seen as a proxy of the intensity of trade relationships between two regions: If weighing technology is transmitted through trade, does it mean that the transmission takes longer when trade relations are relatively weaker or more occasional, and proceeds faster when they are more intense?

The available evidence does not seem to offer a clear-cut answer. One can try and address the question from the perspective of mainstream models. It is commonly accepted that, between the 3rd and the beginning of the 2nd millennium BCE, the diffusion of tin-bronze technology on a cross-continental scale triggered the formation of a global trade network aimed at the procurement of essential raw materials – tin and copper – that were universally on demand, but whose sources were relatively rare and unevenly distributed (Vandkilde 2016; Kristiansen 2018a). There is evidence that, in Mesopotamia, the invention and initial spread of weighing technology at the onset of the Bronze Age is correlated to a surge in metal trade. A large number of cuneiform tablets throughout the 3rd millennium reports transactions in which metals were traded by weight (Powell 1977; 1987; Englund 2012), their occurrence being so frequent and systematic to suggest that the origin of weighing technology was connected to the need to assess the economic value of a material – metal – whose 'amorphous' nature was incompatible with traditional quantification methods, such as volume and simple counting (Rahmstorf 2016a).

Such a strict relationship between the origin of tin-bronze metallurgy and weighing, however, does not appear to be supported for Bronze Age Europe. Weighing technology appears in southern Italy around 2000 BCE – possibly following contacts with Greece – and gradually spreads northwards until reaching the southern coast of England. Tin bronze metallurgy, however, seems to follow the opposite route (Pare 2000; Nessel *et al.* 2018). While the chronology of both phenomena still has relatively wide error margins, a direct correlation between these two processes does not seem consistent with the evidence. If future research confirms these observations, the available evidence would seem to indicate a clear chronological mismatch between the appearance of weighing technology and the adoption of tin-bronze metallurgy. It follows that, if we assume that tin bronze is the engine of the Western Eurasian trade in the Bronze Age – and there is no reason to think otherwise – then the spread of weighing technology in Europe, for now, cannot be directly connected to the spread of tin-bronze metallurgy. In principle, this neither contradicts the importance of trade at the onset of tin metallurgy, nor the economic function of weights and balances: While it may be true that trade is the main purpose of weighing technology, not all trade is necessarily always carried out by weight. The evidence might simply indicate that the formation of an international trade network was not in itself enough to prompt the diffusion of weighing technology in pre-literate Bronze Age Europe, at least not at its onset. Further observations suggest a different explanation.



▲ *Fig. 1.3. Sunburst diagram illustrating the graphic summary of all the activities documented in association with weighing devices in archaeological contexts.*

1.4. Weights in context: a technology for everyone

In Chapter 3 I analyse the archaeological contexts of weighing technology, in order to collect clues about its users and the circumstances in which it was used. The data, collected on a continental scale, seem to contradict the results of previous research based on regional contexts, that sought to establish a direct connection between weight-based trade and elite groups (Pare 1999; Mordant *et al.* 2021; Poigt *et al.* 2021). The data rather show that there is no clear association pattern between weighing technology and any particular social category. In burials, weights and balances occur in association with the complete spectrum of social categories that are commonly recognised by European archaeologists based on the accompanying grave goods, from 'elite warriors' – actually, a minority of all analysed graves – to undifferentiated individuals.

Data from settlements further show contextual associations of weighing technology with a wide variety of economic activities: associations with metalworking are frequently attested, but also with textile production, hoarding, purple-dye production, and cooking (Fig. 1.3.). Furthermore, all these activities seem to be indistinctly distributed between houses, open areas – both inside and outside settlements – and burials. All in all, the data suggest that weighing was not only a technology that everyone could potentially use, but one that everyone could potentially have a use for.

As already observed in connection with the chronological pacing of the diffusion process, the evidence from the archaeological contexts appears to be partly at odds with standard models of trade in Bronze Age Europe, in which high emphasis is generally put on elite individuals and groups, exchanging high volumes of goods with peers across long distances. While there is indeed evidence of the occasional association of weighing equipment and elite contexts, such associations are decidedly minoritarian.

If we look at the data, weighing tools appear associated with diverse activities, all of which can be directly or indirectly classified as 'economic' in many ways. In particular, one should not view the economic function of weighing tools only narrowly in connection with the productive activity to which they are associated. For example, the 'economic' connection between, say, weighing and textile production – widely attested in Early and Middle Bronze Age texts in Mesopotamia (*e. g.*, Powell 1996; Peyronel 2014; Dercksen 2021) – was not limited to assessing the value of the good being sold, *e. g.*, wool, but also included assessing the value of the good being received in payment, such as metal. This reasoning can be extended to any other economic activity that we find associated with balance weights: weighing technology is never exclusively associated with this or that good or activity, simply because weight-based value – as Renfrew (2012) put it – lies at the nexus of potentially any good whose worth can be assessed by weight. In this perspective, which activity weights are associated with is not really important, because weights, by their very nature, can be used to measure an extremely wide variety of goods.

If one were to approach the question with a statistical mindset, one would have to concede that there is no proof of any statistically significant correlation with this or that social category or economic activity, and derive that we cannot exclude that the distribution of weighing equipment is simply random. A minimalist explanation for the apparent ubiquity of weighing tools, then, would be to think that they were just so common, that they happen to be randomly scattered and associated with the most diverse activities – even though they were not necessarily directly connected to them, at least not always. In other words, weights and balances can have been a common element of many individuals' personal equipment, stored in houses or even carried around in pouches (Pare 1999; Roscio *et al.* 2011; Uhlig *et al.* 2019), and hence randomly lost by their owners – and just as randomly found by archaeologists. The fact that our current quantitative appraisal of weighing tools in archaeological contexts is certainly greatly underestimated (see Chapter 2) further reinforces this impression.

1.5. Metrological structure: a market for everyone

The metrological analysis in Chapter 4 confirms previous results (Ialongo 2019; Ialongo/Rahmstorf 2019; Ialongo *et al.* 2021), showing that all balance weights across Bronze Age Europe tend to comply with the same weight system, based on a light unit of *c.* 10 g and a heavy unit of *c.* 440 g (Fig. 1.4.). In a purely conventional fashion, I labelled these units, respectively, *shekel* and *mina*, in order to reflect the standard terminology in common use in Mesopotamian metrology. Both units belong to the same orders of magnitude of their counterparts in different regions of Western Eurasia, but they are different enough to stand as independent systems (Fig. 1.4.).

The methodological and interpretive approaches adopted in this book are substantially different from those adopted in traditional metrological research of the Bronze Age world, and are discussed in detail in Chapter 4. The main results can be summarised as follows:

Units are not exact numbers, but normally-distributed intervals with a conventional Coefficient of Variation of *c.* 5 %;

Available methodologies cannot identify prehistoric units, but only shared multiples and fractions;

The concept of 'unit', as understood through modern common sense, did not exist in prehistoric economies. In prehistoric Europe, there were no official norms that regulated the value of weight units, let alone official authorities that could enforce them. This also implies that weight units could not be 'imported' as-is from other regions;

The identified units are purely conventional values: We will never know if these values were actually perceived as '1' by their users. What the data indicate is that, regardless of the theoretical unit value, all weight systems in Europe were organised according to multiples and fractions of *c.* 10 g (*shekel*) and *c.* 440 g (*mina*);

This implies that, theoretically speaking, a multitude of different units may have coexisted, but all seamlessly connected through a common system of fraction and multiples, which – from both a practical and analytical perspective – is tantamount to having just one unit;

Weight systems were created and regulated from the bottom-up as a result of economic interaction between agents, *i. e.*, they were created and regulated by the market.

If weight systems are regulated by the market, then their structure provides information on the market by which they are regulated (Ialongo *et al.* 2021). In particular, weight systems are quantitative proxies of the kind of person-to-person interactions that form the backbone of every market: economic transactions.

In Chapter 4, I describe a model that can explain how weight systems were kept relatively stable without top-down control, through one-to-one, interpersonal economic relationships. In short, the satisfactory outcome of a transaction between two trading agents will largely depend on the reciprocal trust that both agents are using fair weights. If one of the weights is not deemed fair it will be removed, otherwise reciprocal trust will be broken. When framed within a network with a multitude of agents, this one-to-one relationship becomes many-to-many, and deviant weights can be excluded as a result of indirect control. It follows that the statistical error of a weight unit can be kept under check from the bottom-up without the need for top-down regulation.

What needs to be explained next is how the abstract formulation of this model fits the evidence of a relatively stable weight system stretched across a continent: In other words, how can one explain that, say, Italy and Portugal had the same weight system? Given the premises, the answer must reconcile what may sound as the two opposite propositions of a paradox: Agents must be, at the same time, close enough to have frequent transactions,

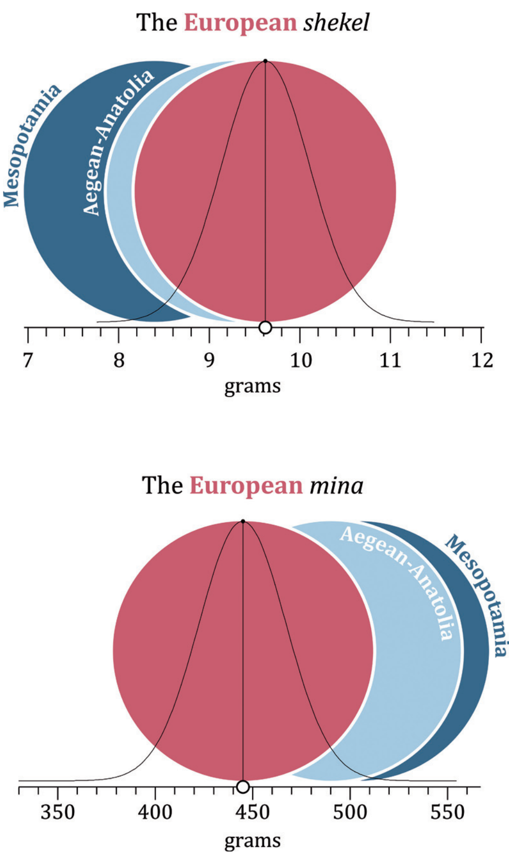


Fig. 1.4. Weight units of Bronze Age Europe. The images show the theoretical values of the European shekel (above) and mina (below) compared to the theoretical values of similar units in the Aegean-Anatolian area and in Mesopotamia. The bell-shaped curves represent the normal-distribution model for the European units, and the vertical lines indicate the mean. The width of the circles represents the statistical interval of each theoretical unit, with a Coefficient of Variation of 5 %, at three Standard Deviations. Each value falling within this interval corresponds to the unit, regardless of the distance from the distribution mean.

and far enough to regulate the system on a continental scale. The long-distance, elite-centred model alone cannot explain the archaeological evidence, as it only accounts for the second requirement. The model, then, must include a second variable that is often overlooked: small-scale exchange between 'commoners' in local markets.

Local markets are sometimes evoked to explain the archaeological evidence connected to Mediterranean trade that the long-distance model cannot explain (Harding 2013a; Knapp *et al.* 2022; Powell *et al.* 2022; Ialongo/Lago 2024). But what is, practically, a 'local market'? The term simply represents an analytical tool, a convenient simplification to convey a concept, but its meaning must be understood in a relative dimension. Local markets are not physical places and do not have definite geographical boundaries. The term rather denotes a social network of economic relationships between agents that operate approximately in the same area. This is to say that a local market does not begin where its neighbour ends: Local markets are not discrete entities, but a seamless continuum only defined by who knows whom, and can overlap to large extents (see, *e. g.*, Knapp *et al.* 2022, fig. 3). By the same token, the same individual can be part of different 'local markets' that exist approximately in the same region, but slightly shifted. It follows that a continuous 'chain' of local markets can indirectly bind together an extremely wide region. This is to say that a local market located, for example, in Sicily was seamlessly connected to another local market located across the Strait of Messina, which was in turn partly encompassed by a Tyrrhenian market to the north and a Ionian market to the east, and so on until reaching the opposite ends of Western Eurasia. In a similar system, goods could theoretically travel from point A to point B without traders from A ever setting foot in B, and vice versa, regardless of the distance: Things were, in other words, more mobile than people.

The interconnectedness of local markets, moreover, introduces the possibility that price shocks at one extremity of the continental network, in time, may produce an effect on the opposite end, according to the law of supply and demand. This can explain why weight systems remained relatively stable across Europe throughout roughly a millennium. This can also explain why it took a long time for weighing technology to spread, in two ways: 1) If exchange was not mostly directional but rather distributed, and there was no top-down regulation, the slow pace of the diffusion roughly corresponds to the slow pace of the gradual formation, generation after generation, of new relationships in local markets located progressively further away from the diffusion centre of the new technology; 2) Each time weighing tools reach a new region, one can assume that a more or less long acclimation period was necessary for new users to change their habits and embrace the new technology.

In the last part of Chapter 4, I introduce the emergence of metallic money as a further variable in the general model of weight-based trade in Bronze Age Europe. The problem of pre-coinage money in Europe is vast and complex, and only tangential to the aims of this book. Here, the discussion is largely based on analytical research on a vast sample of metal objects spanning northern Europe and southern Italy (Ialongo/Lago 2021; 2024), on the background of recent theoretical studies re-evaluating the purely commercial instances of supposedly 'primitive' economies (Baron/Millhauser 2021; *e. g.*, Blanton/Feinman 2024). In short, the data show that metal fragments in European hoards start to comply with weight systems as soon as weighing technology reaches a new region, suggesting that metal circulated as weight-regulated currency. This also suggests that the spread of metallic money could have been the main material vector of the formation of the Pan-European weight system.

1.6. Concluding remarks

In Bronze Age Europe, the diffusion of weighing technology seems to be mostly correlated to three factors: the development of local markets, the engagement of progressively larger swathes of the population in market exchange, and the spread of metallic money.

While the standard model of high-volume, long-distance elite exchange is not entirely inconsistent with the evidence related to weighing technology and weight systems, it can only explain a relatively small part of it. In order to fill the gap, one must admit the existence of a widespread sector of the Bronze Age economy that has been so far largely underestimated: low-volume exchange in local markets, involving elite individuals and 'commoners' alike.

There is nothing in the available data excluding that money and weighing technology can have been involved in high-volume, long-distance trade between elites, but there is more substantial evidence supporting small-scale exchange between different strata of the population in local markets.

The unremarkable aspect of balance weights, the slow spread of weighing technology, the transversal ownership of weighing equipment, and the bottom-up regulation of weight units – cast on the background of the remarkable stability of weight systems across time and space – all point to a continental-scale economic system that was sustained by the collective participation of the European population, operating both on a local and international basis. At the same time, in order to explain the wide diffusion of weighing technology and the emergence of metallic money, our definition of 'trade' must be extended to include a wide range of petty economic transactions that took place in local markets on a frequent basis, many of which were carried out by average, non-elite individuals.

2 Typology, chronology, and geographical distribution

2.1. A note on the selection of the sample

The sampling strategy was not aimed at collecting an exhaustive sample of weighing devices in pre-literate Bronze Age Europe, but rather at filling significant voids in the available documentation, in way that would make it possible to achieve four main objectives:

- assess the overall typological variability of weighing devices;
- assess the diachronic spread of weighing technology;
- assess associations in archaeological contexts;
- reconstruct weight systems.

In the initial phase of data collection, I could rely on a few published studies that systematically addressed the identification of weighing devices in northern Italy (Cardarelli *et al.* 2001; 2004), Sardinia (Ialongo *et al.* 2015), Central Europe (Pare 1999), France (Roscio *et al.* 2011; Roscio 2018), Switzerland (Feth 2014), and Portugal (Vilaça 2003; 2011; 2013), and an unpublished database collecting *Kannelurensteine* from pile-dwelling settlements in Switzerland, kindly provided to me by its author, M. Trachsel. Further published evidence was collected by screening archaeological literature, in particular large publications of settlements and burial sites. The sample of published data, however, left a few conspicuous blind spots that demanded further investigation.

The first and most conspicuous gap to be filled was the absence of systematic research in southern Italy and the consequent, almost complete lack of available data. Verifying the presence of weighing devices was then of utmost importance, especially in consideration of the frequent contacts between southern Italy and the Aegean in the first half of the 2nd millennium BCE (Jones *et al.* 2014), where weighing technology was already adopted in the early 3rd millennium BCE (Rahmstorf 2010). Hence, ascertaining the potential presence of weighing devices in southern Italy would have played a crucial role in testing the hypothesis of a gradual diffusion of the technology from east to west (Rahmstorf 2011). Starting from hints provided by old publications – *i. e.*, pictures of unidentified objects that somehow recalled similar ones already identified as balance weights elsewhere in Europe – I systematically reviewed the published and unpublished finds of some of the most important Bronze Age excavations in southern Italy: the several Bronze Age settlements on the Aeolian Islands (sites no. 3-6, the materials are preserved at the Museo Archeologico Eoliano 'Luigi Bernabò Brea' on Lipari; Bernabò Brea/Cavalier 1968; 1980; 1991) (Ialongo 2019), the necropolis of Thapsos in south eastern Sicily (site no. 2, Museo Archeologico Regionale 'Paolo Orsi' of Syracuse; Orsi 1895) (Ialongo 2022), and the fortified settlement of Coppa Nevigata in northern Apulia (site no. 21, Museo delle Origini, Rome), the latter thanks to the kind collaboration of G. Recchia and A. Cazzella, directors of the ongoing excavations at the site (*e. g.*, Cazzella *et al.* 2012). In all three cases, the investigation returned very positive results, and led to the identification of *c.* 60 unpublished balance weights ranging from the Early to the Final Bronze Age (*c.* 2300-950 BCE).

Another problem left open by the available data was the uneven state of the documentation available for the so-called *Kannelurensteine*, one of the most widespread types of balance weights between southern Italy and the Baltic Sea (Horst 1981; Cardarelli *et al.* 2001; Ialongo/Rahmstorf 2022). While the graphic documentation was already sufficient to assess typological variability and geographical distribution, almost all the objects that had been published in Germany were lacking mass values, which, in turn, prevented assessing the variability of their metrological structure. Therefore, the second phase of data collection was devoted to the first-hand documentation of *Kannelurensteine* in Germany, mostly focussing on the collection of the Museum for Pre- and Early History in Berlin, and the Schloss Gottorf Museum in Schleswig.

Further first-hand documentation was also required to integrate the available documentation for the Terramare settlements in northern Italy. Previous research, in fact, had only identified heavy balance weights (*Kannelurensteine* and piriform weights; Cardarelli *et al.* 2001; 2004), but none that could be compared to the small weights common in southern Italian settlements and in Central European burials. Reviewing the unpublished materials from several old and new excavations – preserved in the storerooms of the Museo Civico Archeologico Etnologico of Modena – provided the opportunity to fill this gap, also thanks to the indications kindly provided by A. Cardarelli.

2.2. The identification of prehistoric balance weights: methodological challenges

2.2.1. Form and function

In principle, mass is the only relevant attribute in defining the function of a balance weight, everything else is secondary. No matter what they look like, the only requisite of balance weights is to comply with the weight systems they are meant to represent, and to occur in a quantitative range that is wide enough to assess the value of many different substances. It follows that, as far as its function is concerned, the shape of a balance weight is largely irrelevant. This, in turn, very often determined objective difficulties in their identification (Petruso 1992; Alberti *et al.* (eds.) 2006; Rahmstorf 2010).

Defying any functional expectations dictated by common-sense, the second most common shape of balance weights in Middle Bronze Age Mesopotamia was that of a sleeping duck: weights ranging from less than 1 g to almost 10 kg were crafted in order to comply with a remarkably strict aesthetic canon which had absolutely nothing to do with aiding their function (*e. g.*, Ascalone 2022, cat. no. 546-617). Granted, duck weights – always made of stone – always have a flattened base that allowed them to sit stably on the balance pan, preventing them from moving around and potentially disturbing weighing operations. Curiously, the overwhelmingly most common shape of balance weights in use between the Persian Gulf and the eastern Mediterranean did not even have such a convenient feature: Most sphendonoid weights have a round cross-section and a thickened middle point, and nothing prevented them from rolling all over the balance pan at any given time (*e. g.*, Pulak 1997; Kulakoğlu 2017; Ascalone 2022, cat. no. 2-527). Moreover, some weights even present perforations that could be used to hang them directly on one of the extremities.

All in all, the Near Eastern documentation stands as a warning that relying on functional features is not necessarily a viable strategy for the identification of balance weights. Throughout the 2,000 years or so following their invention, balance weights have been spheres, parallelepipeds, cubes, pyramids, cylinders, pear-shaped and spool-shaped objects, sphendonoids, discs, truncated cones, octahedra – not to mention ducks, frogs, lions, and seashells – and yet, their formal traits seem to have never negatively affected their functionality. The inevitable conclusion is that literally any object of any shape could have fulfilled the function of a balance weight.

Of course, the inherent formal indeterminacy of balance weights affects our ability to identify them in the archaeological record. Differently from, say, swords, not being able to associate form and function creates an objectively difficulty, that can eventually lead to over- or under-identification, which is precisely one of the historically most challenging problems in pre- and protohistoric metrological studies (Petruso 2019). However, it is nonetheless legitimate to expect that – just like any other kind of functional object – balance weights will eventually tend to follow recurrent shapes in a given cultural setting. Past research demonstrates that balance weights indeed behave in a similar way, showing that different regions of Western Eurasia developed a relatively small quantity of widespread canonical types that archaeologists, today, can recognise quite easily (Petruso 1992; Pare 1999; Cardarelli *et al.* 2004; Vilaça 2011; *e. g.*, Ascalone 2022; Rahmstorf 2022). The obvious starting point for new research, then, is to focus on those types and expand the available dataset.

The general criteria I followed to identify and classify the balance weights collected in this book are based on a revision of previously-proposed strategies (Rahmstorf 2010; Ialongo/Rahmstorf 2019). Balance weights are expected to be a class of relatively standardised objects whose function is not unequivocally indicated by their shape, whose occurrence is documented by several objects from several sites in which they occur in sets, at least occasionally. Most importantly, their mass range should span at least one order of magnitude.

Construction materials have somewhat lax requisites too. In principle, the only requisite is that they should not be easily subject to substantial mass loss in a short period of time. This is to say that, for example, wood is not a suitable material, as the mass of the object can substantially change over time due to loss of water or splintering. Any material whose mass is not easily controlled during manufacture is also not a good fit, such as clay, which loses water during firing. Theoretically speaking, fired-clay objects could still be used as balance weights, provided that they are turned into weights *after* firing, for example by grinding a pottery sherd down to the desired mass. To my knowledge, however, clay was never used as base material for balance weights, at least not in the Bronze Age.

The best materials – and the only ones attested in prehistory – are metals and rocks. In the Bronze Age of Western Eurasia, metallic weights are either made of lead or bronze, with the former being majority in the Aegean (Petruso 1992), and the latter somewhat commonly attested in Central and Atlantic Europe (Pare 1999; Vilaça 2011). Stone weights, however, make by far the overwhelming majority of balance weights overall in Western Eurasia. The rocks used for balance weights tend to be relatively soft and easy to work – such as hematite in Mesopotamia and sandstone or steatite in Europe – but harder rocks, such as marble and porphyry, are also attested (Cardarelli *et al.* 2001). While both perfectly suitable, metals and rocks have opposite manufacturing processes: While the former must be weighed before giving them shape, the latter must be ground down by removing matter.

Further criteria – such as use-wear and inscriptions – are sometimes mentioned (see *e. g.* several contributions in Alberti *et al.* (eds.) 2006), but their reliability is questionable. Due to their frequently basic appearance, many balance weights can phase in and out of different functions several times during their lifetime. As a consequence, use-wear traces that are not connected to weighing operations are often documented on balance weights, even when clear quantity marks are present (Petruso 1992, 4; Rahmstorf 2016a). Quantity marks and inscriptions, in turn, are so rarely documented on balance weights – even in Bronze Age Mesopotamia, where inscribed weights are only 3 % of the total (Ialongo *et al.* 2021) – that their absence cannot be considered a relevant criterion.

As a matter of fact, there is nothing in the function of balance weights that is inevitably connected to their appearance, and very few indications are provided by their construction material. Their only defining attribute is their mass. It follows that the only meaningful way to determine whether or not a class of object is, in fact, a class of balance weights is to test whether or not their mass values are 'quantally-configured', *i. e.*, if they are approximate multiples of a single *quantum*, an analytical concept that can be roughly assimilated to that of 'unit of measurement' (see Chapter 4). This is to say that the identification of balance weights is entirely a statistical problem (Pakkanen 2011; Ialongo 2019; Petruso 2019), which means, in turn, that, at least for the time being, research on prehistoric balance weights must cohabit with two inherent limitations: 1) one can only hope to identify a relatively small part of all the objects that may have fulfilled the function of balance weights, and 2) one can never be absolutely sure that all the identified objects are – or were at any given time – actually balance weights.

This, in turn, implies that not all the objects classified in this book may have been, in fact, balance weights. Some of them can have been crafted as balance weights and used as such for some time, and then converted to some other use, such as hammers, grinders or whetstones. The opposite can also have happened: Tools that were originally meant to serve as hammers, grinders or whetstones – and potentially any other kind of hard tool, as well as beads and pendants – may have been eventually turned into balance weights. Overall, however, the results of the statistical tests confirm that a statistically significant portion of all the objects that form the dataset of this book were – at one point or another – indeed balance weights, all complying with the same weight system.

2.2.2. Pebble-weights and the indeterminacy problem

The realisation that form is not a requisite inevitably comes with the conclusion that literally anything can be used as a balance weight. This, in turn, exposes the biggest blind spot in our understanding of prehistoric weighing tools: natural pebbles used as balance weights. The cover photo of a recently published book perfectly exemplifies the puzzle of 'pebble-weights' (Chambon/Otto 2023). The photo portraits a street vendor in Iran selling oranges, and weighing them on a two-pan balance scale against what appear to be natural stones. Just like all known prehistoric weights, these stones seem to have no visible feature providing any indication about their mass, or that could even identify them as balance weights. Some of them even appear to have been broken, perhaps to bring them down to the desired mass. Most interestingly, customers do not seem to care.

Aside from the social implications of the utter unimportance of formally-standardised weighing tools, the very possibility of the existence of pebble-weights in the Bronze Age presents a clear problem for archaeologists trying to identify them in the material record. To be sure, pebble weights are among the earliest types of balance weights, appearing in the Near East at the onset of the 3rd millennium BCE, where some of them can be identified thanks to the rare occurrence of quantity marks appearing on their surfaces as incised lines (*e. g.*, Rahmstorf 2022, fig. 97,15.17, 110,4.17). It is when marks are not present that the challenge becomes hard to overcome. For Bronze Age Europe, L. Rahmstorf (2014) discussed the possible identification of two sets of pebble-weights that were found in association with balance beams, but unfortunately the data are not sufficient to confirm the existence of an underlying weight system. In these particular cases, the available excavation data do not even provide conclusive information that could allow one to exclude that such pebbles were simply part of the local soil.

As they pose specific methodological problems, research on pebble-weights was not within the scope of this book. A possible strategy to work around these uncertainties would be to collect a large number of natural pebbles from controlled excavations, analyse their mass values, and verify if they comply with multiples of a unit. We still would not be able to separate pebble-weights from pebbles that were used for different purposes – or that were not used at all – but at least we would have the confirmation of their existence. Unfortunately, natural pebbles are very often discarded during excavations, and even when they are not, they are very seldom published.

In synthesis, we will never be able to positively identify pebble weights except in those rare cases in which they come with quantity marks, which in turn only seem to occur in the Near East, and only in early periods. The logical consequence is to admit that pebble weights likely existed in pre-literate Bronze Age Europe, even though there is not much one can do to identify them. When trying to imagine the actual spread of weighing technology and its impact on the everyday lives of people, one must take into account that a large amount of weighing devices must have existed, that we will never be able to appreciate fully: A sort of dark matter that we know must have existed, but that we cannot possibly quantify.

2.3. Typology and orders of magnitude

The sample collected in this book includes 696 balance weights and 18 balance beams, unevenly distributed between Italy, Eastern Europe, Central Europe, Western Europe and the British Isles, roughly encompassing the whole duration of the Bronze Age and the very beginning of the Early Orientalizing period, *c.* 2300-700 BCE. Three

Fig. 2.1. Balance beams: morphological variants.

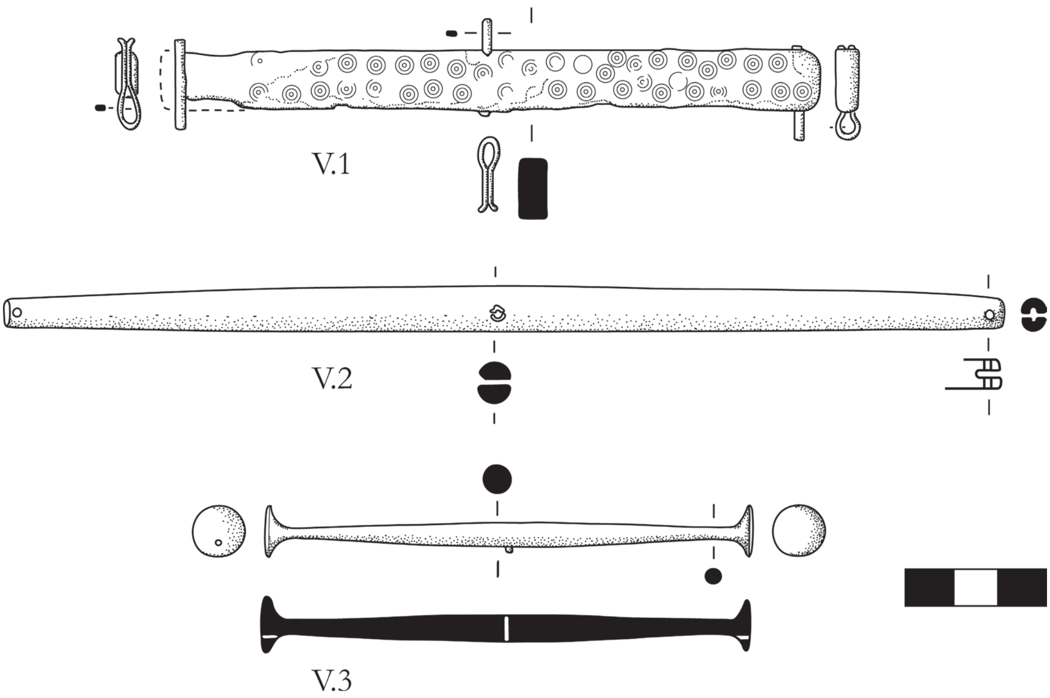
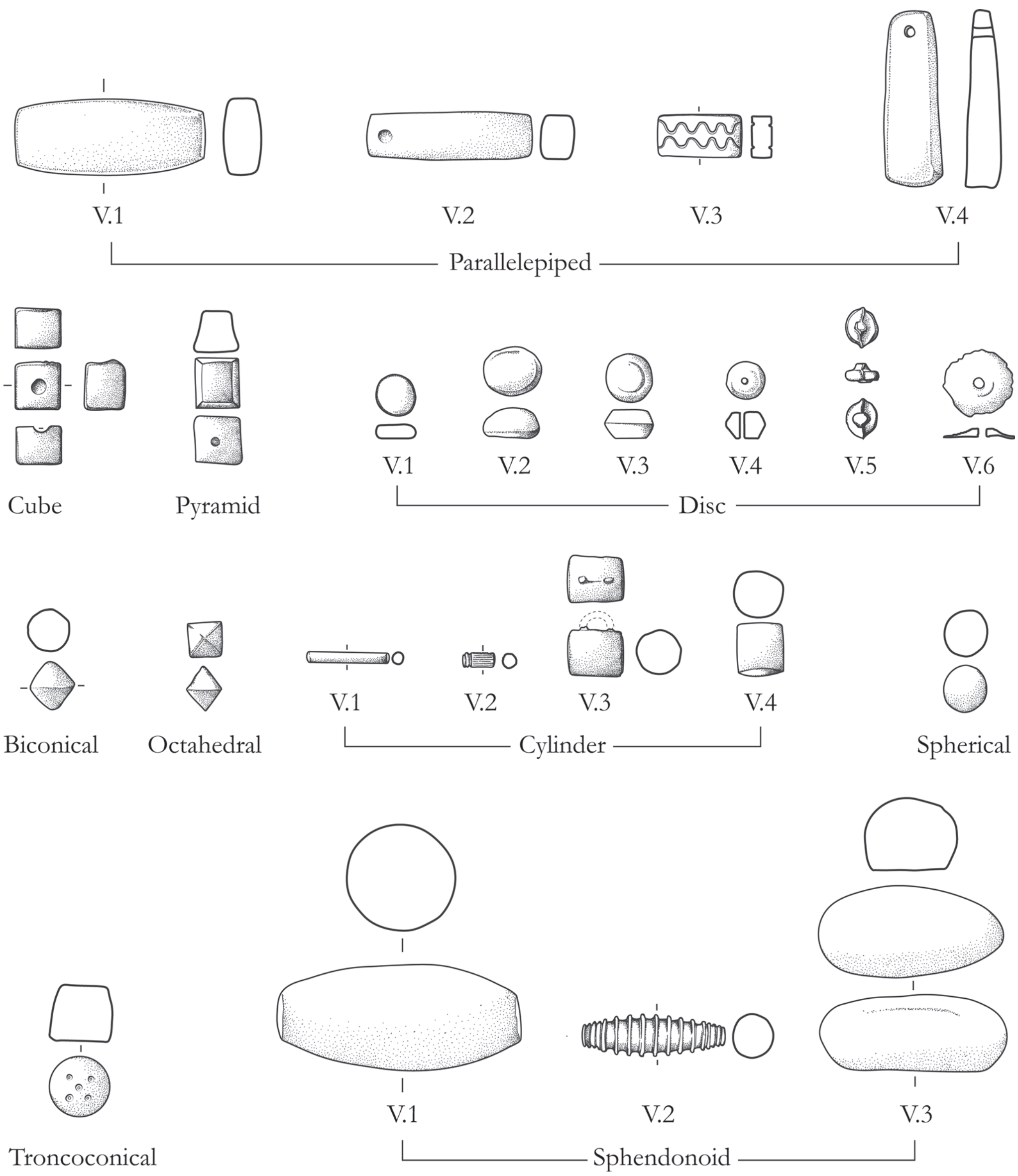


Fig. 2.2. Balance weights of the shekel-range: morphological types and variants. Scale: 1:3.



types of balance beams could be singled out, all made of bone (Fig. 2.1.), while balance weights attested in Bronze Age Europe belong to 13 distinct morphological archetypes, most of which show rather basic and unremarkable shapes (Fig. 2.2.-3.). General quantitative information on typology, chronology, orders of magnitude, contexts, and materials is shown in Fig. 2.5.-8. The detailed description for each morphological type is provided in Chapter 5.

Balance beams are always made of bone, and are divided into three main morphological types (Fig. 2.1.). V.1, represented by a single object (object no. 1) has a rectangular cross-section and is provided with three bronze loops, two for each pan and one to hang the balance itself. V.2 and V.3 both have circular cross-section, but while the extremities of the beam in V.2 are plainly cylindrical, the extremities of V.3 have with trumpet-shaped terminations.

A preliminary analysis of the mass distribution shows that balance weights form two rather sharply-defined clusters on typological ground. The first cluster of 'light' weights is mostly comprised between *c.* 3-100 g (Fig. 2.4.; from parallelepiped to sphendonoid), while the second cluster of 'heavy' weights is mostly concentrated between *c.* 300-1,000 g (Fig. 2.4.; from *Kannelurensteine* to 'other hanging weights'). These clusters seem consistent with what is known about the structure of weight systems in pre-literate Bronze Age Europe. Similarly to the largely contemporary Mesopotamian system (Powell 1979; Parise 1981), the European weight system was probably based on specific units for different orders of magnitude. Past research has identified at least two of such units (see Chapter 4): a lighter unit of *c.* 10 g – the so-called 'Pan-European unit' (Ialongo *et al.* 2021) – and a heavier one ranging *c.* 400-450 g, slightly oscillating according to region and chronology (Ialongo/Rahmstorf 2019; 2022). In order to maintain the standard terminology in use in Near Eastern metrology, I will use the terms *'shekel'* and *'mina'* to identify, respectively, the lighter and the heavier unit.

Interestingly, the theoretical values of the European *shekel* and *mina* cross the light and the heavy clusters of balance weights towards the lower part of their respective distributions (Fig. 2.4.). This seems to support the hypothesis that the balance weights in the light cluster were meant to com-

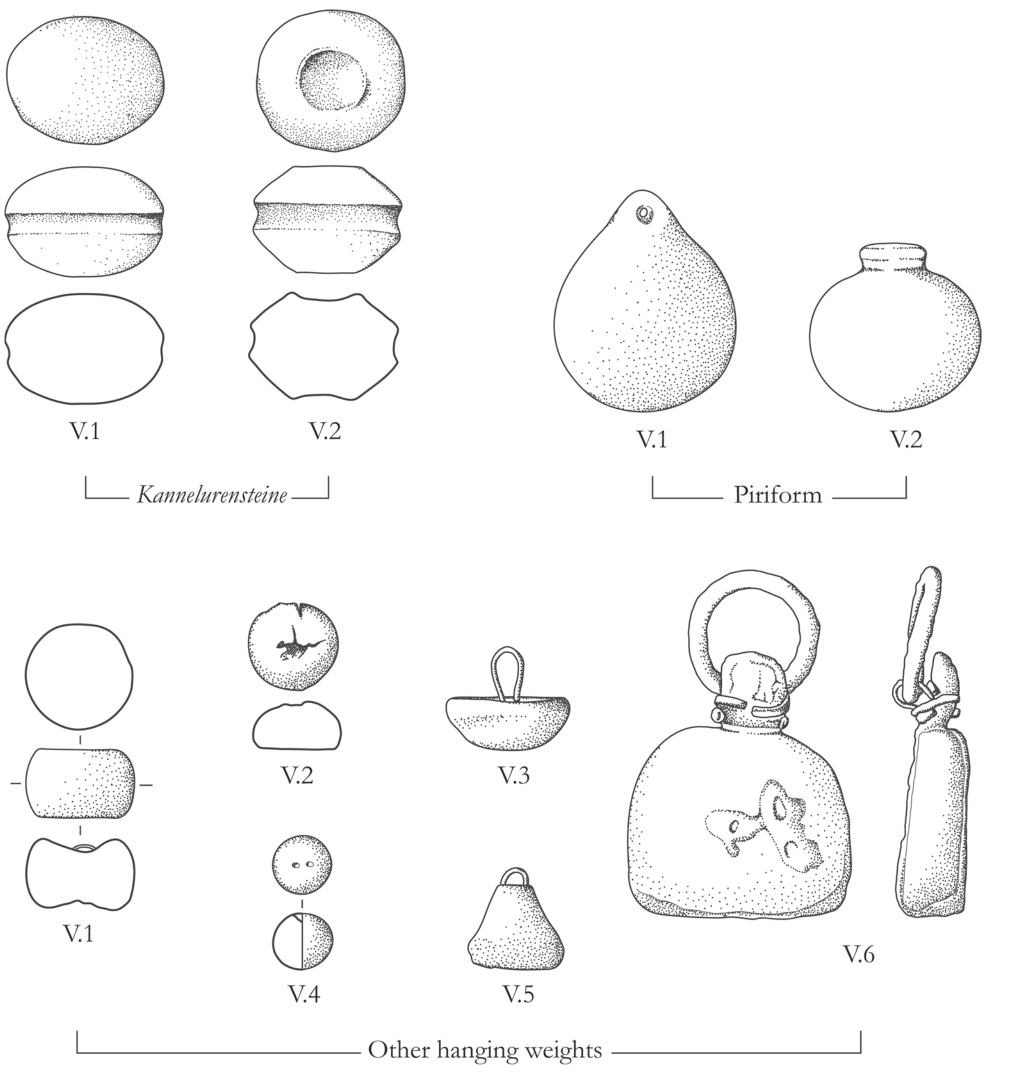


Fig. 2.3. Balance weights of the mina-range: morphological types and variants. Scale: 1:4.

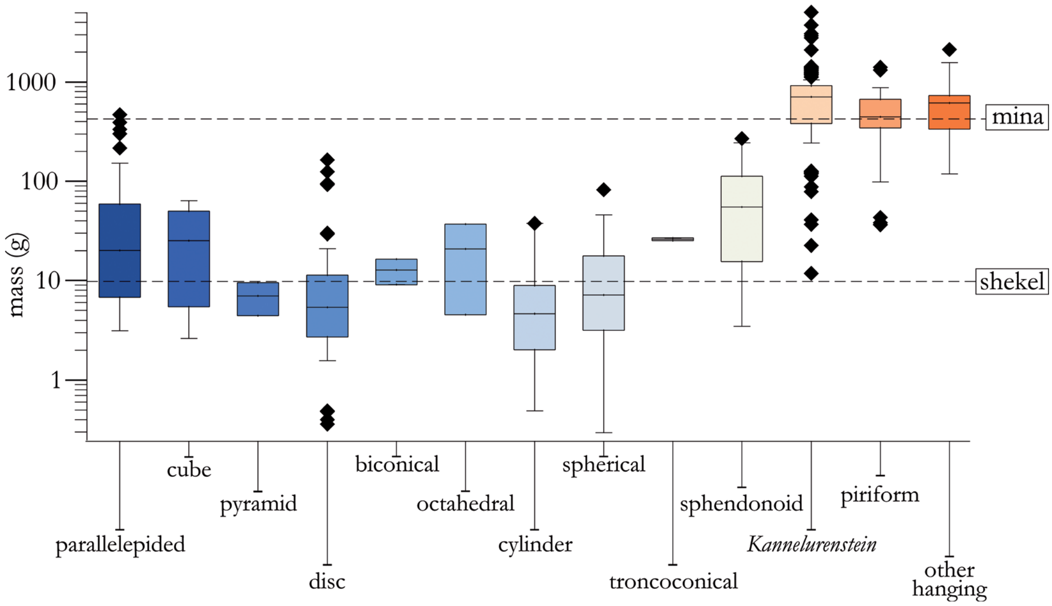
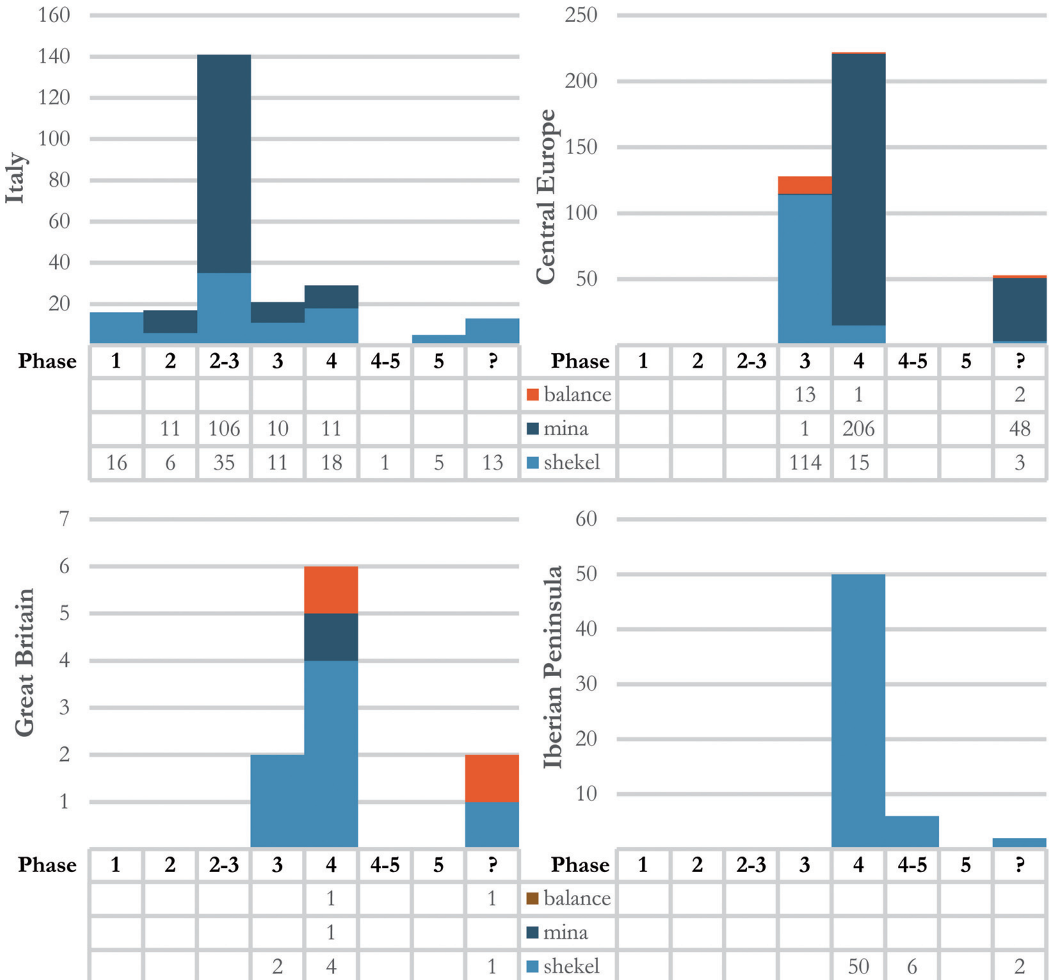


Fig. 2.4. Box-and-whiskers plot: comparative chart of the distributions of the mass values of each morphological type of balance weights. Blue-gray gradient: types of balance weights in the shekel-range; orange gradient: types of balance weights in the mina-range. The vertical axis is displayed in logarithmic scale. The dashed lines indicate the theoretical value of the European shekel and mina.



Italy

Phase	1	2	2-3	3	4	4-5	5	?
balance								
mina		11	106	10	11			
shekel	16	6	35	11	18	1	5	13

Central Europe

Phase	1	2	2-3	3	4	4-5	5	?
balance				13	1			2
mina				1	206			48
shekel				114	15			3

Great Britain

Phase	1	2	2-3	3	4	4-5	5	?
balance					1			1
mina					1			
shekel				2	4			1

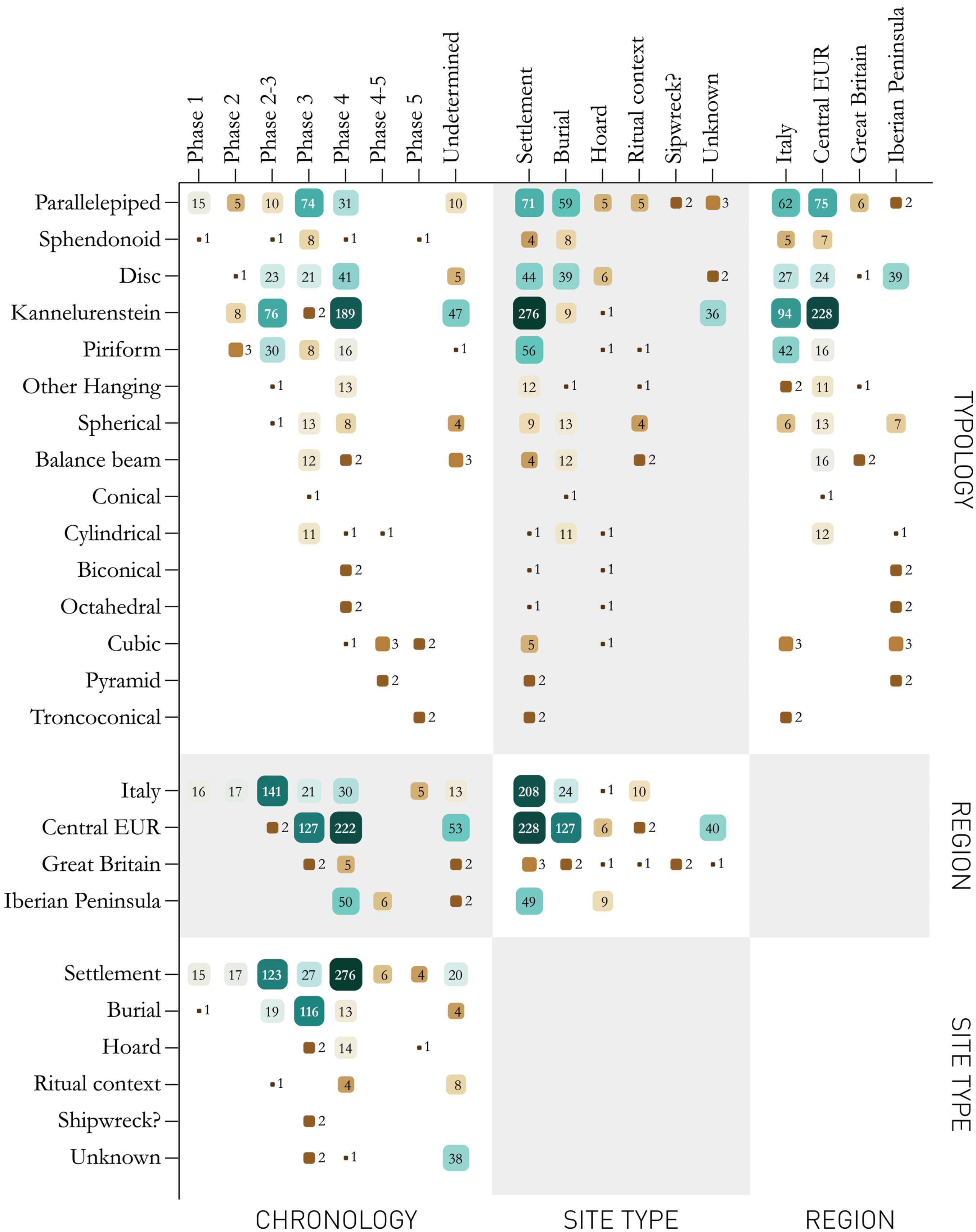
Iberian Peninsula

Phase	1	2	2-3	3	4	4-5	5	?
balance								
mina								
shekel					50	6		2

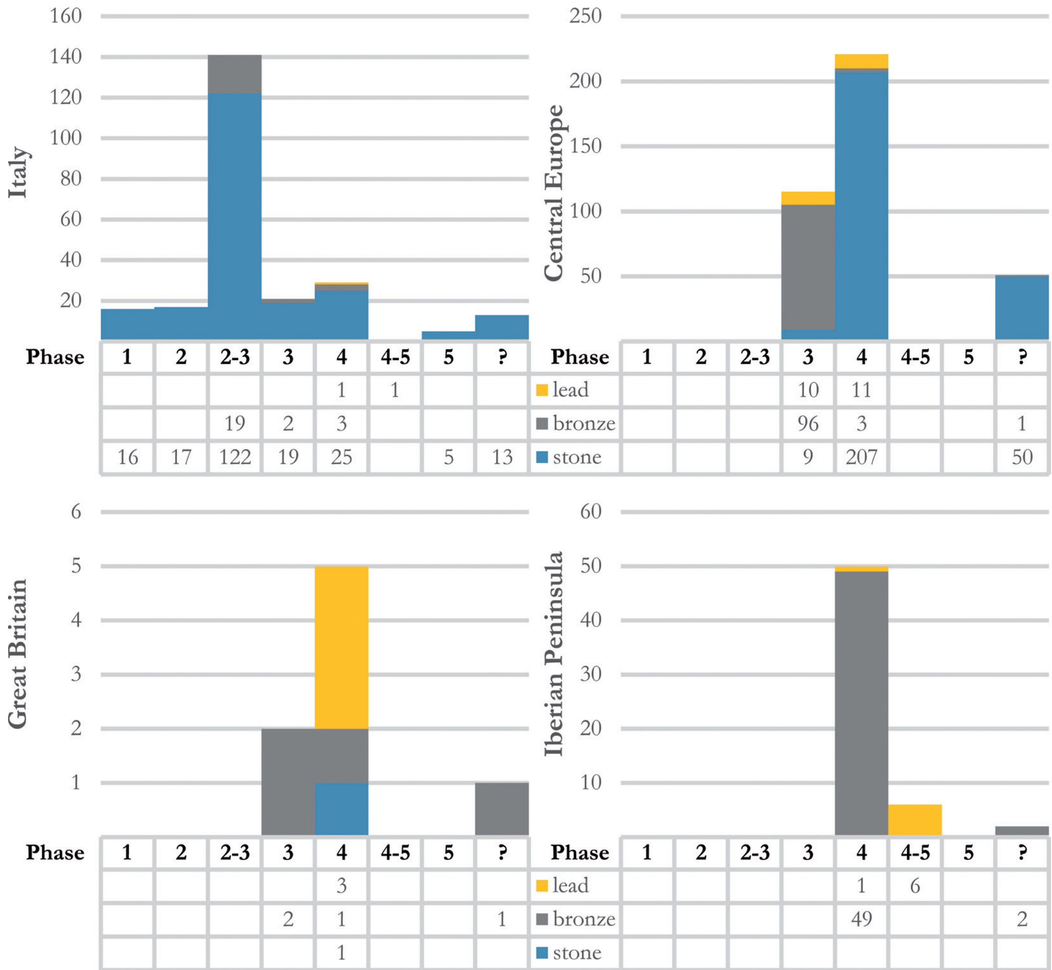
Fig. 2.6. Diachronic quantification of weighing devices (balance beams, shekel-range weights, mina-range weights) in the four main macro-regions.

ply with multiples of the *shekel*, while those in the heavy cluster were rather organized according to multiples of the *mina*. This, in turn, also suggests that different orders of magnitude also had their dedicated formal types of balance weights. Based on these observations, I will refer to these type-based clusters of balance weights as the '*shekel*-range' and the '*mina*-range'.

The *shekel*-range includes 302 objects, articulated into nine distinct morphological types, some of which are further divided into typological variants (V.) (Fig. 2.2.). Most objects do not have distinc-



▲ *Fig. 2.5. Matrix chart summarizing general quantification of several aspects of balance weights: typology, chronology, site type, and region. The size of the squares is proportional to quantity.*



Italy:

Phase	1	2	2-3	3	4	4-5	5	?
lead					1	1		
bronze			19	2	3			
stone	16	17	122	19	25		5	13

Central Europe:

Phase	1	2	2-3	3	4	4-5	5	?
lead				10	11			
bronze				96	3			1
stone				9	207			50

Great Britain:

Phase	1	2	2-3	3	4	4-5	5	?
lead					3			
bronze				2	1			1
stone					1			

Iberian Peninsula:

Phase	1	2	2-3	3	4	4-5	5	?
lead					1	6		
bronze					49			2
stone								

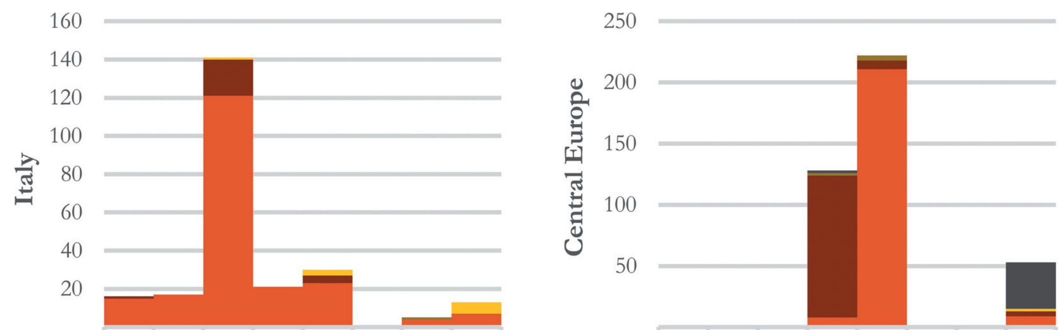
► *Fig. 2.7. Diachronic quantification of balance weights and their construction materials in the four main macro-regions.*

tive functional features, and all of them could be used simply by being laid on a balance pan, or any container hanging from one of the scale's extremities. Four variants are characterized by perforations or loops (rectangular V.4; disc V.4, 6; cylinder V.3), that could be used to hang the weight directly on one of the balance's arms. Concerning the weights securely dated to the Bronze Age, marks and decorations are in general extremely rare (parallelepiped V.2-3; sphendonoid V.2), and there is no evidence that they represent quantity marks or that they are in any way connected to mass values. On the other hand, a few objects dated to the 8th century BCE present markings that could be connected to multiples and fractions of weight units. These weights, however, always occur in regions (Sardinia and south-western Iberia) where Phoenician presence is attested, and could be also connected to eastern Mediterranean standards. Even in this case, however, the evidence is not conclusive (see Chapter 4).

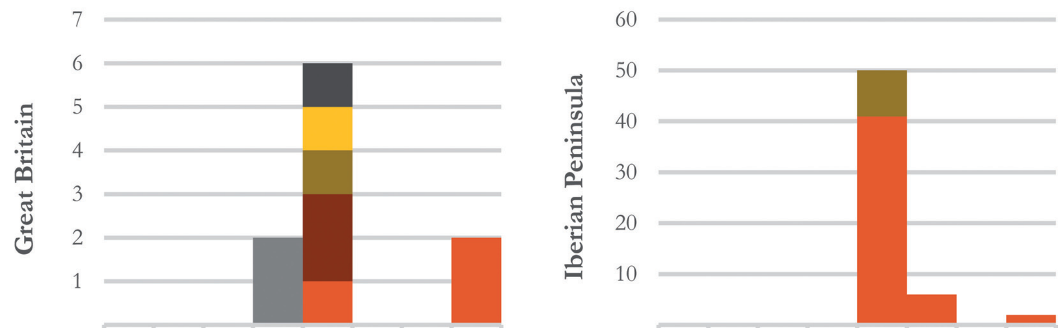
The *mina*-range includes 394 objects, divided into three main morphological types (Fig. 2.3.). *Kannlurensteine* are probably the most characteristic formal types of balance weights in Bronze Age Europe, as they do not seem to occur anywhere else in the central and eastern Mediterranean. They are attested in two variants: V.1 with plain surfaces and V.2 with circular indentations, the former appearing in Phase 2 in Italy and the latter characterized by an overall later chronology (mostly Phase 4; see Chapter 5). Piriform weights are attested in a variant with perforation (V.1) and one with an upper knob (V.2). Finally, a last heterogeneous category includes six variants of heavy weights provided with perforations or metal loops.

2.4. Diachronic spread of weighing technology

The synchronisation of local chronological sequences in Europe is notoriously a problem, as cross-regional indicators are not always available and absolute dates are often offset (*e. g.* Pacciarelli 2001; Primas 2008; Roberts *et al.* 2013). For the purpose of this study, I rely on a broadly-defined synchronisation scheme, divided into four phases. Phase 1 (*c.* 2300-1700 BCE) and 2 (*c.* 1700-1400/1350 BCE) correspond, respectively, to the Italian EBA and MBA, since weighing equipment, for the moment, is not attested elsewhere. Phase 3 encompasses the Italian Recent Bronze Age (RBA) and BzD in Central Europe (*c.* 1400/1350-1200 BCE). The often-unclear chronology of the finds from the Terramare settlements in northern Italy poses a definition problem for a clear break between Phases 2 and 3. The many finds from this area frequently come from old excavations of long-lived settlements, often encompassing both chronological



Phase	1	2	2-3	3	4	4-5	5	?		Phase	1	2	2-3	3	4	4-5	5	?
									unknown					2				38
									shipwreck?									
			1		3			6	ritual context									2
							1		hoard					2	4			
	1		19		4				burial					116	7			4
	15	17	121	21	23		4	7	settlement					8	211			9



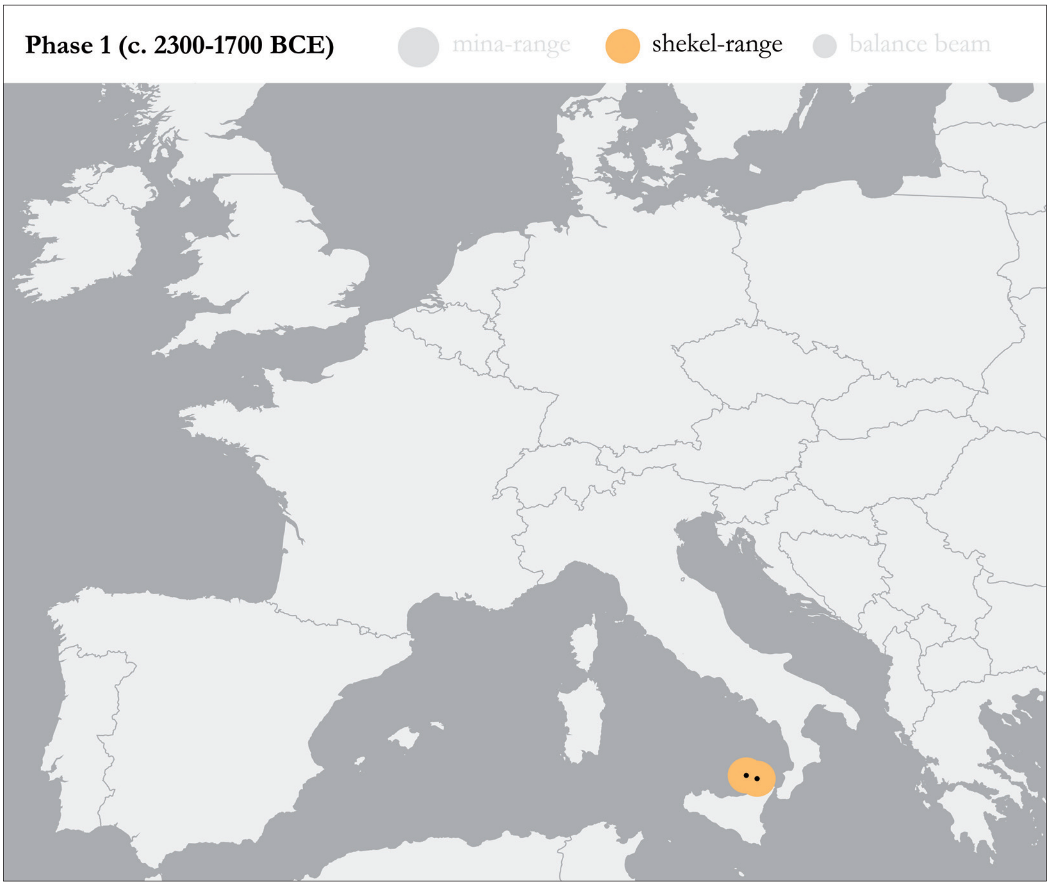
Phase	1	2	2-3	3	4	4-5	5	?		Phase	1	2	2-3	3	4	4-5	5	?
					1				unknown									
				2					shipwreck?									
					1				ritual context									
					1				hoard						9			
					2				burial									
					1			2	settlement						41	6		2

Fig. 2.8. Diachronic quantification of weighing devices and site types in the four main macro-regions.

phases, which in turn makes it impossible to attribute each find to a specific horizon. The abrupt end of the Terramare culture *c.* 1200 BCE, however, provides a solid *terminus ante quem* (Cardarelli 2009). Phase 4 includes the Italian Final Bronze Age (FBA; *c.* 1200/1150-950 BCE) and Early Iron Age 1-2A (EIA; *c.* 950-730 BCE), Hallstatt A-B in Central Europe and Period IV-V in northern Germany (*c.* 1150/1100-800 BCE), Wilburton and Ewart Park in the British Isles (*c.* 1150/1100-800 BCE), and Bronce Final III in the Iberian Peninsula (*c.* 1150/1100-800 BCE). Finally, Phase 5 includes only a handful of objects coming from late contexts in Italy and the Iberian Peninsula, dated between the late 8th and the 7th century BCE. While in some cases well-dated contexts allow for greater detail, the majority of the available data rely on broadly-defined chronological horizons. Therefore, it is necessary to scale down the chronological detail in order to allow comparability between different regions. Higher accuracy will be likely possible once a much bigger sample is available.

2.4.1. Phase 1 (c. 2300-1700 BCE)

West of Greece, balance weights are first attested on European territory on the Aeolian Islands (Fig. 2.9.), a small archipelago off the north-eastern coast of Sicily, in two settlements and a burial site dated to the early phase of the Capo Graziano horizon (sites no. 3, 5), corresponding to the Italian Early Bronze Age, *c.* 2300-1700 BCE (Ialongo 2019). The nearest region in which weighing technology was already widespread before this period is the Aegean, where weighing equipment is attested at least since *c.* 2800 BCE (Rahmstorf 2016b). Since all available data converge in showing a gradual diffusion pattern of weighing technology from Mesopotamia and Egypt towards other regions of Western Eurasia (Ialongo *et al.* 2021), it would make sense that the technology was first imported in Europe from the Aegean. The validity of this hypothesis must be evaluated against three observations that might appear to contradict it. First, the appearance of balance weights in the Aeolian Islands precedes the earliest secure attestations of



▶ *Fig. 2.9. Phase 1 (c. 2300-1700 BCE): geographical distribution of weighing devices.*

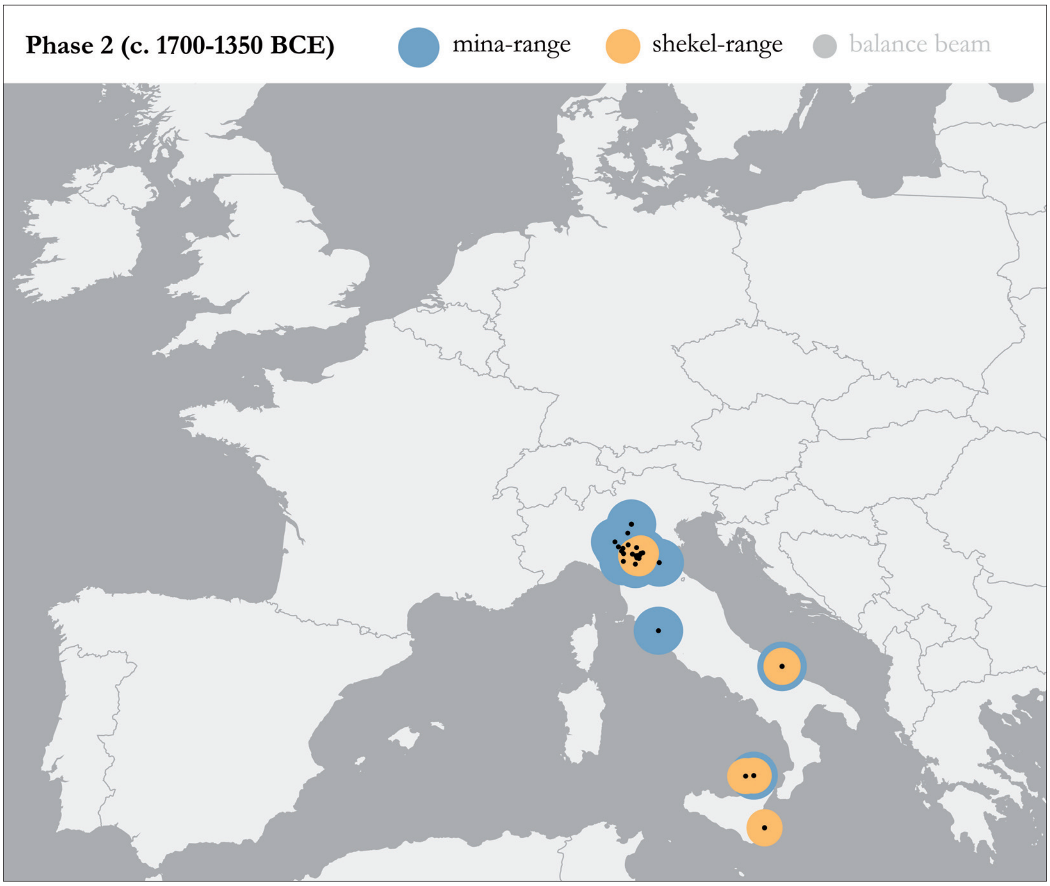
Aegean pottery in southern Italy, usually dated to the early phase of the Italian Middle Bronze Age (*c.* 1700-1500 BCE), corresponding to the Late Helladic II in Aegean chronology (Jones *et al.* 2014). Second, 15 out of a total of 16 weights attested in the Aeolian Islands in this phase belong to the parallelepiped type, and one to the sphendonoid type, neither of which is documented in this period in the Aegean (Rahmstorf 2022, 21-202). And third, the Aeolian weights already comply with the weight system that will later characterise Europe in the 2nd millennium BCE (Chapter 4; see also Ialongo 2019).

While the evidence does not unequivocally support transmission from the Aegean, the alternative would be even less likely. It is difficult to imagine, in fact, that weighing technology was discovered and developed independently in southern Italy. As already noted, the clear diffusion pattern observable between Mesopotamia and Europe is itself a strong hint of gradual technological transmission. Furthermore, one has to consider that the periodization of the Aeolian stratigraphy between *c.* 2300-1700 BCE is very loose, and that there is no reliable way to collocate our finds precisely within this long time-span. A third way, then, is to posit that the balance weights attested in the Early Bronze Age contexts of the Aeolian Islands belong to an already mature stage of the use of weighing technology in southern Italy, that in turn predates the earliest *visible* traces of contacts with the Aegean. In other words, the existence of weighing technology in the Early Bronze Age in southern Italy suggests that commercial contacts with the Aegean may predate the earliest evidence of Aegean pottery in Italy.

As already mentioned, only two types of weights are attested in the Aeolian Island in Phase 1: parallelepipeds (15 objects) and sphendonoids (one object), all made of stone and belonging to the *shekel*-range. Parallelepiped weights – together with *Kannelurensteine* and piriform weights in the *mina*-range – are the 'hallmark' of weighing equipment in pre-literate Bronze Age Europe. Attested throughout the whole Bronze Age everywhere in the study area, they are extremely rare in other regions of Western Eurasia (see Rahmstorf 2022 for an overview of morphological types between Western Asia and the Aegean). They are also the type most frequently occurring in sets (see below). Sphendonoid weights, on the other hand, are quite rare in Europe (although attested in every period) and extremely common in the Near East. All parallelepiped weights come from settlement contexts, while the sphendonoid weight is part of the grave goods of a burial (cat. no. 319).

2.4.2. Phase 2 (c. 1700-1400/1350 BCE)

Balance weights appear in northern Italy in Phase 2 (Fig. 2.10.). The Terramara settlement of Gaggio (site no. 40) provides a reliable stratigraphy with layers dating to the Italian Middle Bronze Age, which yielded eleven balance weights: three



◀ *Fig. 2.10. Phase 2 (c. 1700-1350 BCE): geographical distribution of weighing devices.*

parallelepipeds, five *Kannelurensteine*, and three piriform weights. The parallelepiped weights from Gaggio (cat. no. 34, 52, 151) belong to the same morphological type attested in the previous phase (and still attested in Phase 2) in the Aeolian Islands, and undocumented in the Aegean. *Kannelurensteine* are attested in this phase both in northern Italy and in the Aeolian Islands, and represent a peculiar European type that has no parallels in the eastern Mediterranean. Once again, the appearance of weighing technology generally predates the earliest visible proof of Aegean contacts, testified in north-eastern Italy by the local production of Italo-Mycenaean pottery (Jones *et al.* 2014). In this case, however, eastern Mediterranean contacts are not even necessary in the first place to explain the technological transmission, which could have happened mostly via Italian routes, either maritime or terrestrial, as the typology and metrological structure of balance weights seem to suggest (see Chapter 4; see also Ialongo/Rahmstorf 2019; 2022).

Weights in the *mina*-range are first attested in Phase 2 in Italy – both on the Aeolian Islands in the south and in the Po Plain in the north – with the appearance of *Kannelurensteine* and piriform weights. Both types will be later widespread between Italy and Central Europe until Phase 4, and both have scarce parallels in other regions of Western Eurasia. Disc weights are first attested in Phase 2, and they will become one of the most common types in subsequent periods, especially in the Iberian Peninsula. All balance weights attested in Phase 2 come from settlements.

2.4.3. Phase 3 (c. 1400/1350-1150/1100 BCE)

In Phase 3, weighing technology is widespread in Italy, Central and Eastern Europe, and across the Channel (Fig. 2.11.). Bone balance beams are first documented in this phase, in several burials in Central Europe and in the fortified settlement of Fort Harrouard in northern France (site no. 121). Since balance weights are useless without balance scales, it follows that the appearance of balance beams only in Phase 3 is entirely dependent on preservation issues. It is in fact very likely that most balance scales were made of perishable materials, and – as Egyptian depictions and cuneiform texts attest (Peyronel 2011; Rahmstorf 2022, 533-534) – their beams were mostly made of wood. Even though seemingly scanty, the European documentation actually stands out as exceptional when compared to other regions of Bronze Age Western Eurasia. In Mesopotamia, only one bone beam is documented throughout the entire Bronze Age, in the Aegean and on Cyprus only balance pans are generally preserved (Pare 1999; Rahmstorf 2022), and in the Indus Valley no balances are known, in spite of the presence of thousands of balance weights (Rahmstorf 2022).

In Phase 3, the use of metals (bronze and lead) is documented for the first time in the construction

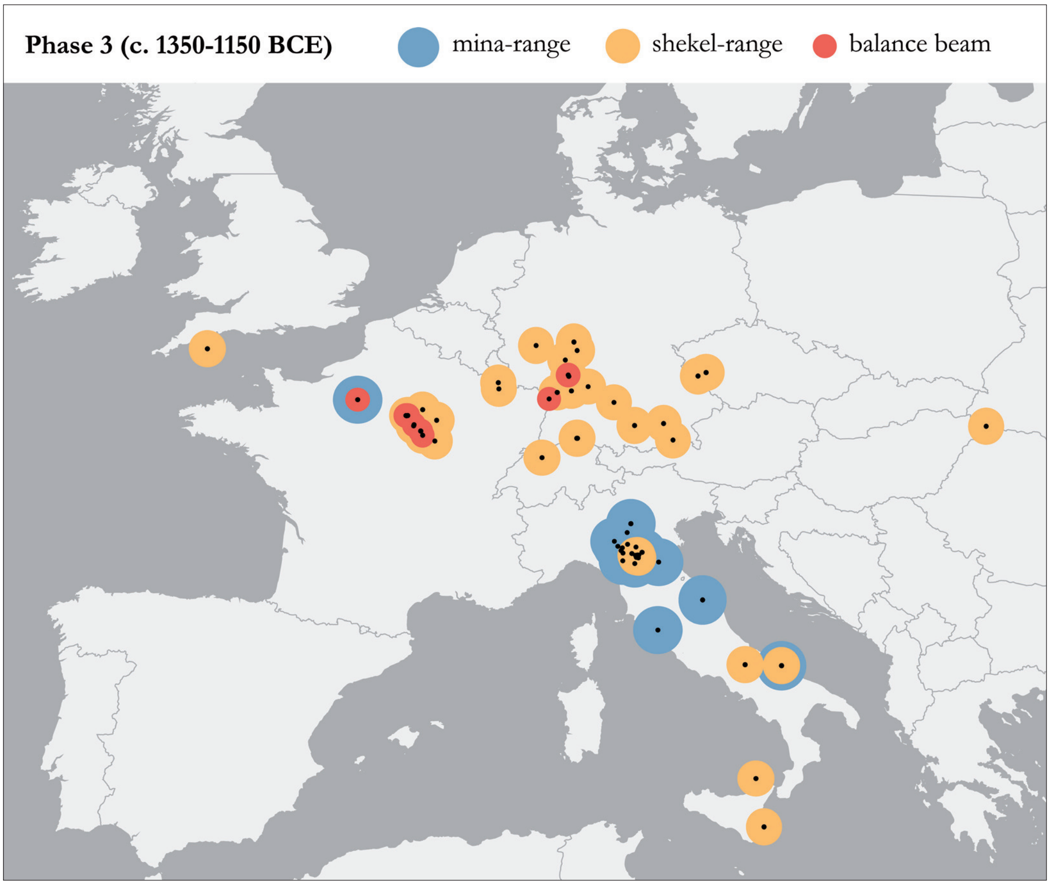


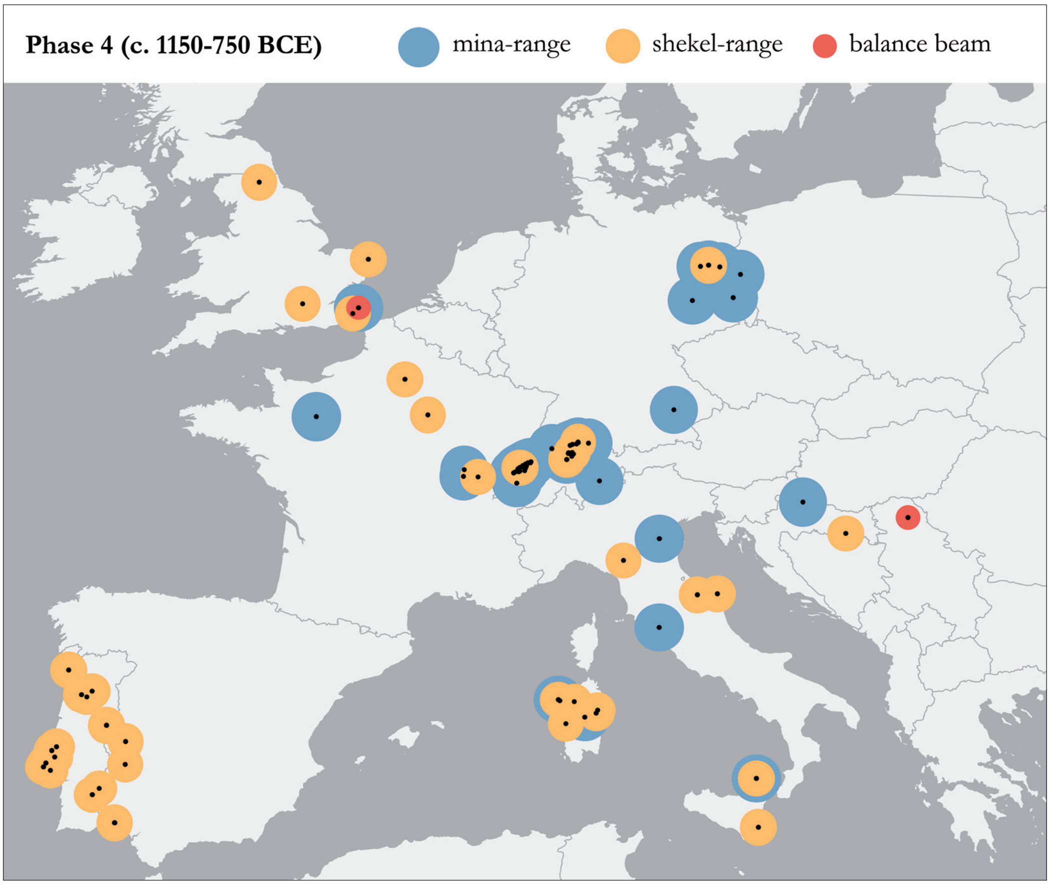
Fig. 2.11. Phase 3 (c. 1350-1150 BCE): geographical distribution of weighing devices.

of balance weights (Fig. 2.7.), and new morphological types appear, such as spherical and cylindrical weights. A peculiar variant of metallic parallelepiped weights with characteristic wavy mouldings appears in Central Europe (V.3), and a variant of disc weights with tubular protrusions (V.5) is attested in the necropolis of Thapsos, in Sicily. Italy and Central Europe differ substantially in terms of typological distribution and contexts. In Italy, most weights come from settlements – most of which are located in the Po Plain – and most of them belong to the *mina*-range. On the contrary, weighing equipment in Central Europe mostly comes from burials, and almost entirely belongs to the *shekel*-range. Such an uneven distribution does not necessarily have any cultural meaning, and likely depends on factors that are unrelated to the reasons why Bronze Age people chose one type of weighing equipment over another. One of these factors are the specific lines of research that characterised different regions of Europe. Most balance weights from the Terramare area in the Po Plain, for example, come from old, extensive excavations that collected large amounts of archaeological materials (Cardarelli *et al.* 2001; 2004). The high numbers of *Kannelurensteine* and piriform weights (both in the *mina*-range) are not counterbalanced by comparable numbers of light weights, likely because the latter were not recognised as significant artefacts and discarded during excavation or simply not published in preliminary excavation reports. This, in turn, underscores another significant challenge that could greatly hinder our ability to evaluate the true distribution of weighing equipment during the Bronze Age: The often unremarkable appearance of Bronze Age balance weights across Western Eurasia frequently leads to them being overlooked, misinterpreted, or discarded, and as a result, they are not prioritized in publication strategies (Petruso 1992; Rahmstorf 2010).

Finally, in Phase 3, balance weights are attested for the first time across the Channel, with two parallelepiped weights (both made of bronze) from the underwater deposit of Salcombe, off the coast of Devon, in England (site no. 135). One of them (cat. no. 123) represents the only attestation of the variant with wavy mouldings known to date outside of Central Europe.

2.4.4. Phase 4 (c. 1150/1100-800 BCE)

Phase 4 sees the definitive spread of weighing equipment everywhere in the study area, with balance weights now attested in the Iberian Peninsula (Fig. 2.12.). At the same time, the overall distribution of types and contexts changes substantially from the previous phase. Balance weights are first attested in the Iberian Peninsula in settlements and hoards, albeit only in Portugal and in south-western Spain. New morphological variants are introduced in this area, such as disc weights with biconical profile (both plain and perforated, V.3-4), along



◀ *Fig. 2.12. Phase 4 (c. 1150-750 BCE): geographical distribution of weighing devices.*

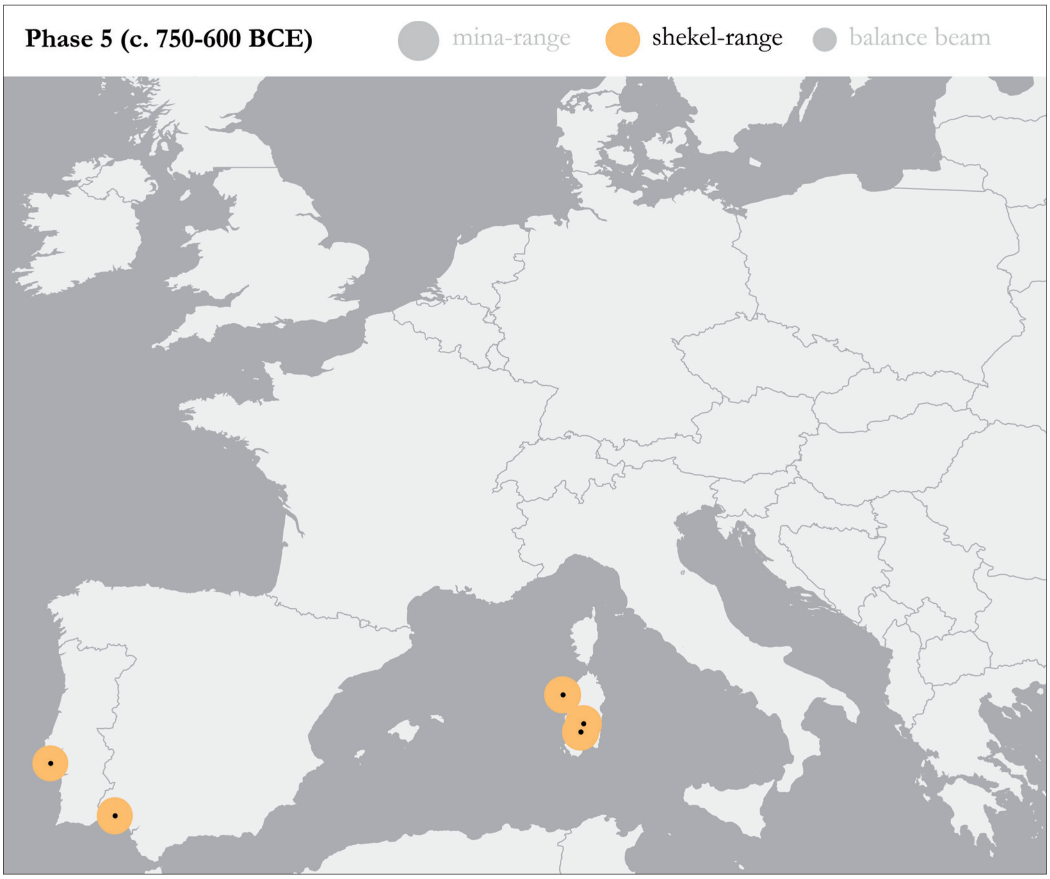
with peculiar types such as biconical and octahedral weights. All balance weights from the Iberian Peninsula are made of bronze, and all belong to the *shekel*-range. The concentration of finds in this area is, once again, likely dependent on the history of research. The weights of western Iberian Peninsula were, in fact, the object of systematic data collection in the past 20 years, which likely skewed the documentary framework in favour of this region (Vilaça 2003; 2011; 2013).

With the end of the Terramare culture *c.* 1200 BCE, finds of weighing equipment in the Po Plain – and in Italy overall – substantially diminish, but the evidence is more uniformly spread out, also as a consequence of the appearance of balance weights in Sardinia.

Compared to the previous phase, the overall distribution of the *shekel*- and *mina*-ranges is inverted: most of the Italian data still comes from settlements, but the majority of weights now belongs to the *shekel*-range; in Central Europe, weights in the *mina*-range are now the vast majority, and are equally present in burials and settlements. Bone balance beams are now attested only in the British Isles and Eastern Europe. The documentary framework in Central Europe in Phase 4 is highly discontinuous. The region between eastern France and southern Germany, which provided a wealth of evidence from burial contexts during Phase 3, now completely lacks data. The near totality of find spots are located in two distant concentrations: in the south, the pile-dwelling settlements of the western Alpine region provide most of the data; on the north, cremation burials and sporadic finds in north-eastern Germany document the first appearance of weighing equipment in the Baltic region. Most balance weights attested in both regions are now *Kannelurensteine* – heavy weights belonging to the *mina*-range – whereas in the previous phase weighing sets were mainly composed of small objects in the *shekel*-range. For many pile-dwelling settlements in Switzerland – whose finds come from old excavations – it is likely to expect the same kind of bias towards heavy weights hypothesised for the Terramare settlements.

2.4.5. Phase 5 (c. 800-625 BCE)

All the balance weights illustrated here come from Sardinia and south-western Iberia, and all come from contexts dated between the 8th and 7th centuries BCE (Fig. 2.13.). Cubic and pyramid weights appear for the first time, and those attested in contexts with a substantial presence of Phoenician materials – such as Huelva in Spain (site no. 189) and Sant'Imbenia in Sardinia (site no. 7) – are all made of lead. A peculiar type of troncoconical weights is documented in Sardinia. The earliest reliable attestation of balance weights with quantity marks is also recorded in Phase 5. Four stone weights from Sardinia (cat. no. 164-165, 307-308) bear inscribed signs that seem to be correlated to counting systems. Objects cat. no. 164, 307-308 are part of a set



▶ *Fig. 2.13. Phase 5 (c. 750-600 BCE): geographical distribution of weighing devices.*

from the settlement of Santu Brai (site no. 7). The troncoconical weights cat. no. 307-308 both bear five incised points on their base, while the cubic weight cat. no. 164 has an X sign across two faces, and a straight line on a third face. The cubic weight cat. no. 165 from the hoard of Forraxi Nioi has five parallel lines on one face. Two more lead weights – a cubic weight from the Sardinian settlement of Nuraghe Sant'Imbenia (site no. 8), and a pyramid weight from the Spanish settlement of Huelva-Plaza de las Monjas (site no. 189) – both have a single circular indentation on one face. As I am going to discuss further on (see Chapter 4), all these weights are compatible with the Pan-European *shekel* of *c.* 9.4-10.2 g, as well as with other weight systems allegedly attested in the eastern Mediterranean.

2.4.6. Diachronic spread: summary

The available evidence shows clear signs of a gradual diffusion of weighing technology, starting in the Early Bronze Age in southern Italy and progressively reaching Atlantic Europe by the end of the 2nd millennium BCE (Fig. 2.9.-13.). Balance weights are first attested in southern Italy on the Aeolian Islands, in settlements dated to the early phase of the Italian Early Bronze Age (EBA; *c.* 2300-1700 BCE), and subsequently appear in northern Italy in the Terramare area, at the beginning of the Middle Bronze Age (MBA; *c.* 1700/1600-1350 BCE). Complete sets of weights, often associated with balance beams, are widespread in Central Europe in the Bronze D phase (*c.* 1350-1200 BCE), and attested in Eastern Europe as well. In the same chronological horizon, at least one balance weight is attested in an underwater deposit off the south-western coast of England, at Salcombe (site no. 135). Weighing equipment is finally attested in northern Germany during the Hallstatt A-B/Nordic Periods IV-V (*c.* 1150/1100-800 BCE), mainly in burials, sporadically in Great Britain during the Wilburton/Ewart Park phases (*c.* 1200-725 BCE), and in settlements and hoards in western Iberia during Bronce Final III (*c.* 1200-800 BCE).

2.5. Chapter highlights

- Sample size: 696 balance weights and 18 balance beams;
- Two orders of magnitude, with exclusive morphological types: *shekel*-range (*c.* 1-100 g), and *mina*-range (*c.* 300-1,000 g);
- Five chronological phases: Phase 1 (c. 2300-1700 BCE); Phase 2 (c. 1700-1400/1350 BCE); Phase 3 (*c.* 1400/1350-1200/1100 BCE); Phase 4 (*c.* 1200/1100-800 BCE); Phase 5 (*c.* 800-625 BCE);
- Gradual diffusion of weighing technology throughout Europe: Phase 1: southern Italy; Phase 2: northern Italy; Phase 3: Central Europe, Eastern Europe, and the British Isles; Phase 4: western Iberia; Phase 5: no new regions are reached;

- Although not provable, it seems likely that weighing technology was first imported in southern Italy from the Aegean in the Early Bronze Age. Once the technology is adopted, however, balance weights are locally manufactured with original morphological types;
- The diffusion of weighing technology from one European region to another does not require further inputs from the eastern Mediterranean to be explained. Every time balance weights appear in a new region, the morphological types are similar to those attested in the closest region where weighing technology was already attested in the previous phase. Theoretically speaking, the transmission can have happened entirely via short-distance contacts on European territory;
- Weighing technology, once adopted, is never abandoned;
- Quantity marks appear only at the beginning of the Iron Age;
- The uneven distribution of weighing equipment is caused by factors that are independent from how weighing technology was used: *e. g.*, research traditions, general state of preservation, completeness of excavation reports;
- Balance beams are not as widely attested as balance weights simply because they are not preserved.

3 The contexts of weighing: tracing weights and balances back to their users

3.1. Introduction

Acknowledging that the main purpose of weighing technology is the quantification of transaction values provides a general background to understand its significance in Bronze Age economies. It also raises a question that delves deeply into fundamental, yet poorly understood aspects of Bronze Age societies: Who used weights and balances?

Clarifying the relevance of this question requires taking a step backward, and reflecting on how economic agency is generally perceived in Bronze Age research. The substantial research investment of the last two decades has provided impressive detail on production and trade in the Bronze Age (Kristiansen 2014). As a wide range of commodities (such as copper, amber, tin, wool, salt) was in constantly high demand across the continent, regional locales seem to have specialised in the production of single commodities for export (Schibler *et al.* 2011; Harding 2013b; Earle *et al.* 2015; Ling *et al.* 2018; Sabatini *et al.* 2018; Williams/Le Carlier de Veslud 2019). Massive production and export are seen as the engines of an exchange economy of continental reach. Regional locales act as firms in maximizing output for gains in line with standard macroeconomic theory, while local elites organise the massive labour input required to sustain the system, and entertain mid-to long distance relationships with peers across the continent to maintain trade routes (Ling *et al.* 2017; Kristiansen 2018b).

At a superficial glance, this model might appear to describe Bronze Age Europe as a fully-fledged market economy, if it were not for the conspicuous difference represented by individual agency and consumption patterns: Elites unilaterally control production and trade and are the only actors with some sort of entrepreneurial agency, sometimes joined by professional merchants (Vandkilde 2021). Everyone else – the so-called 'commoners' – is the passive recipient of redistribution mechanisms and does not directly engage in the 'commercial economy' in any significant form (Ling *et al.* 2017; Earle/Kristiansen 2020). Given such premises, then, it should not come as a surprise that the use of weighing technology in Bronze Age societies has been mostly addressed in relation with elites and with their role in administering production and trade (*e. g.*, Pare 1999; Mordant *et al.* 2021; Poigt *et al.* 2021).

3.2. Weighing technology and commercial agency

In this book, I use the terms 'trade' and 'commerce' to identify any form of sales and purchases – from long-distance shipments of raw materials to petty everyday transactions in local markets – in the same way as today we engage in commerce whenever we purchase a new phone, subscribe to an online streaming service, or buy groceries at the supermarket. There is, however, a lot of lingering ambiguity in how prehistoric archaeologists group largely synonymous terms such as 'commerce' and 'trade' under the overarching – and perhaps even more ambiguous – umbrella-term 'exchange'. It is often implied – although seldom spelled out explicitly – that 'exchange' is a prerogative of elites, something that the so-called 'commoners' would not even have the necessity to engage with, their basic needs being largely provided for by redistribution mechanisms, in turn overseen by the elites. One of the limits of this way of conceptualising economic agency is the unequal attribution of the motives for exchange, insofar as it implies that only elites have 'wants,' while commoners only have 'needs.' It is then unsurprising that only the elites are granted wide margins of entrepreneurial creativity, while the 'commoners' are somehow confined to a pattern of mechanical passivity.

Acknowledging that all human beings have wants (Bourdieu 1977; Appadurai 1986), however, also requires imagining how they might have fulfilled them: What if a farmer who does not own sheep wanted warmer clothes? What if a shepherd wanted a new dress pin? What if a bronzesmith wanted roast lamb for dinner? Pleading with the local elites to have their wants satisfied in exchange for services would have certainly been a viable option, but far from the only one: Purchase transactions provided for a solid alternative. In a world where material wants were largely limited to what was physically available in the immediate surroundings – however scarce, and regardless of how far away its original source was – many of such wants could be easily fulfilled by completing transactions with whoever it was that had whatever one wanted, and was willing to part with it in exchange for anything else of equal value. This way of exchanging things commonly goes by the name of 'monetary pattern of exchange' (Jones 1976), whereas weight was a universally recognised measure of economic value in the Bronze Age world.

The existence of local markets driven by small-consumer demand is indirectly supported by the statistical distribution of the mass values of the metal fragments that circulated in a monetary fashion in Bronze Age Europe (Ialongo/Lago 2024). As far as we assume that the mass of a metal object was proportional to its value, then the shape of this distribution is indistinguishable from that of household consumption patterns in contemporary Western economies, meaning that small everyday sales and purchases made up for the bulk of the total number of transactions in a given unit of time. It follows that, as far as the value of 'small change' was quantified by weight, at least one, if not both agents involved in a monetary transaction would have required the aid of weighing devices (Ialongo 2022).

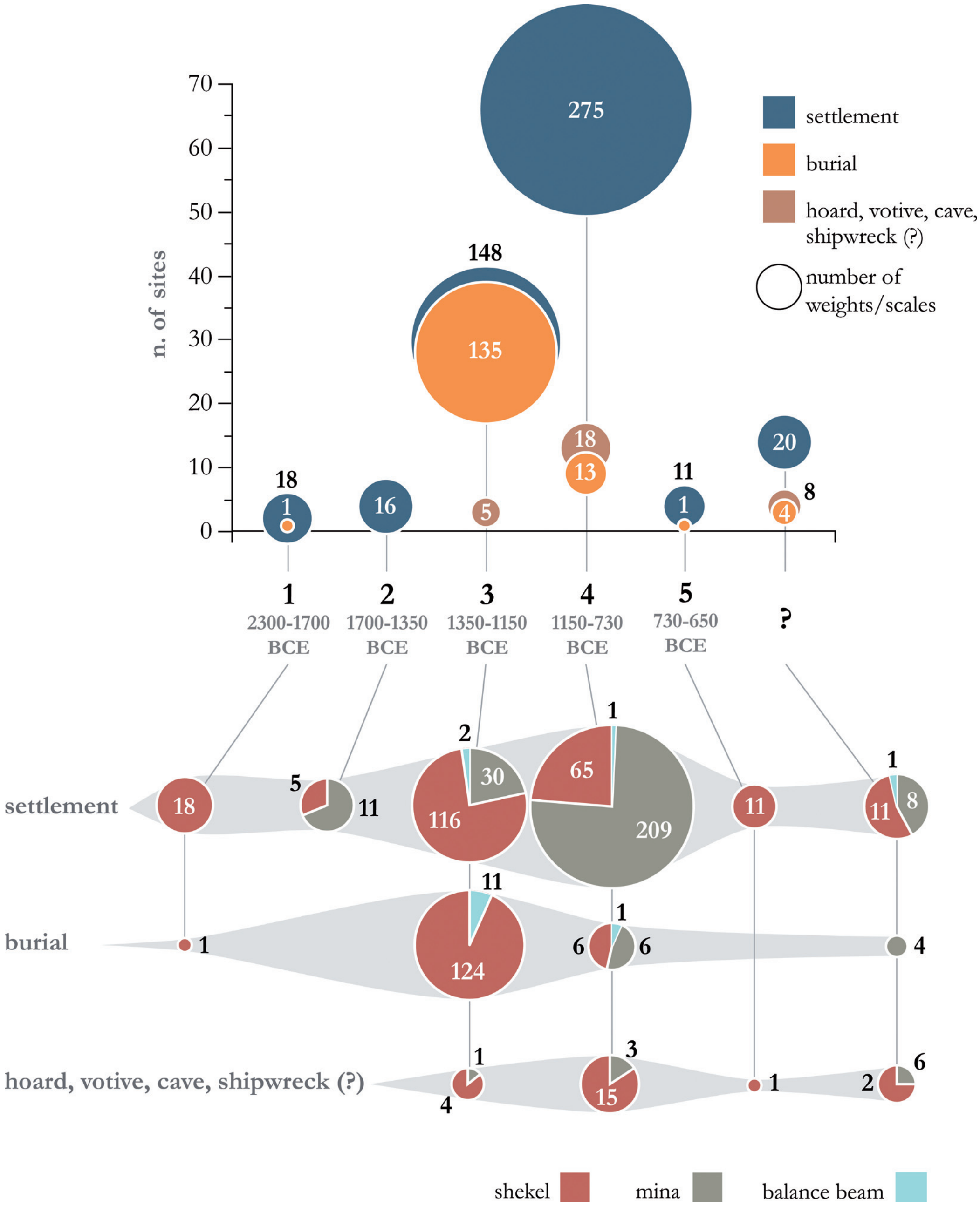


Fig. 3.1. Weighing devices and site types: general quantification. The upper half of the chart (bubble chart) displays the number of weights and scales occurring in different site types (identified by different colours) by chronological phase. The vertical axis indicates the number of sites, the size of each circle is proportional to the quantity of objects, which is also indicated as a number inside or next to each circle. The lower half displays the distribution of shekel-weights, mina-weights, and balance beams in each site type, by chronological phase. The size of each pie chart is proportional to the number of objects.

In this perspective, research on the early adoption of weighing devices provides the opportunity for a breakthrough: If the purpose of this technology is inherently commercial, then it is theoretically possible to extract information on the commercial agency of different categories of individuals by tracing weights and balances back to their potential users.

One way in which we can extract meaningful information on the relationship between weighing technology and its users is through the analysis of find contexts (Alberti *et al.* (eds.) 2006; Schon 2015; Ialongo/Rahmstorf 2019; Rahmstorf 2022). In this chapter, I will review the contextual evidence available for weights and balances in European contexts of the Bronze Age, and verify whether or not it is consistent with current models. In particular, I will address all cases of weights and balances found in settlements, burials and hoards for which the available documentation provides enough information to reconstruct, at least in broad strokes, the context of recovery. The contextual analysis is preceded by a general quantification of the occurrence of weighing equipment in different context types.

3.3. General quantification

As already observed in Chapter 2, the distribution of weighing equipment is highly uneven, mostly due to the discontinuous nature of the available documentation. The quantification illustrated here is intended to provide an overview of such discontinuity, with the aim of limiting interpretive bias.

The database comprises 714 weighing devices (18 balance beams and 696 weights) from 207 sites, the latter classified into three main categories: 1) settlements, including villages, open areas and sanctu-

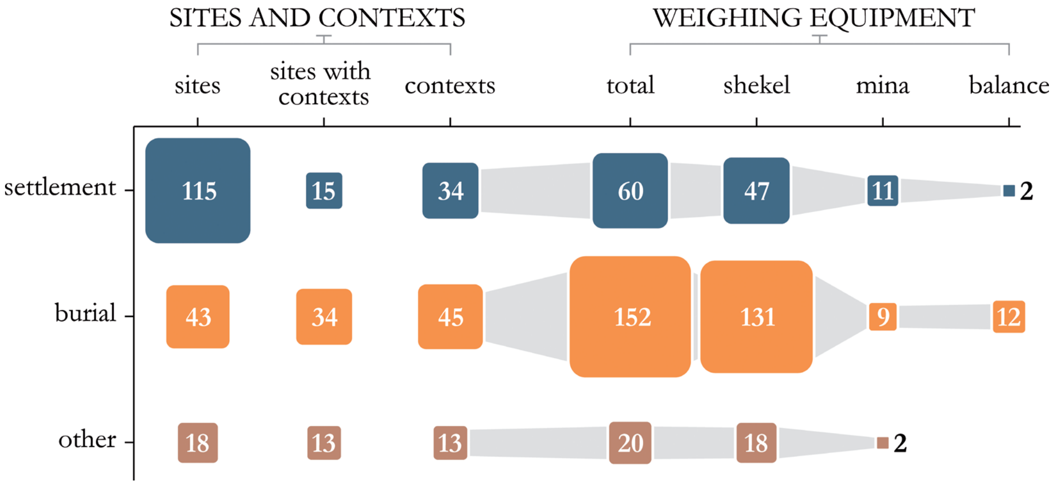


Fig. 3.2. Contexts and weighing equipment: general quantification. The left half of the chart ('Sites and contexts') illustrates the total number of sites belonging to each site-type, how many sites for each site-type have closed contexts, and how may closed contexts have been identified for each site-type. The right half displays the total number of objects that were found in closed contexts for each site-type, and further breaks down that number for shekel-weights, mina-weights, and balance beams.

aries (115 in total); 2) burials (n= 43); 3) a small, broadly-defined group made mostly of 'proper' hoards, but also including votive depositions, finds from caves (sometimes potentially part of hoards), and the remains of a potential shipwreck (n= 18). Thirty-one find spots do not provide enough information to determine their attribution to either of these categories.

The diagram in Fig. 3.1. gives an overview of how these devices are distributed in different site categories through time, offering a complimentary perspective to that illustrated in Chapter 2. The number of available data tends to grow throughout the 2nd millennium BCE, with settlements being always the most represented site category, and burials catching up only in Phase 3, thanks to the substantial amount of evidence from Central Europe. The lower part of the diagram breaks down the ratios of different categories of weighing equipment in different site types, showing that the primacy of weights in the *shekel*-range in both burials and settlements during Phase 3 is eventually upended in Phase 4, in which the *mina*-range becomes decisively more relevant.

Out of the total number of weighing devices, 446 objects (62 %) come from identifiable contexts (Fig. 3.2.). By 'context' I here intend a relatively circumscribed location within a site, with enough available information that allows one to define relevant associations. In the case of burials and hoards, the term is rather self-explanatory. In the case of settlements, 'contexts' identify all those cases in which weighing devices and/or their associated features and materials can be positioned with relative accuracy within the site plan, either indoors or in open areas. Among the 176 classified sites I could identify 92 distinct contexts, distributed in 62 sites. Of these, 45 contexts are burials, 13 are hoards, and 34 are found in settlements.

Focussing on contexts also provides the opportunity to address weighing sets. By 'weighing set' I here intend a group of two or more weighing devices, whose contextual information allows one to conclude that they were likely used simultaneously, sometimes by the same household (as in the case of sets found inside a house), sometimes by an individual (as with sets belonging to burials), and sometimes only generically (such as in the case of hoards or open areas). There are two main reasons why weighing sets are relevant: First, they document the complexity and diversity of personal weighing devices that belonged to single individuals; and second, they originally provided the first solid archaeological proof for the identification of balance weights in European Bronze Age studies. It was mostly thanks to the identification of several sets of small objects with recurrent shape and varying size, in fact, that C. Pare (1999) could confidently interpret parallelepiped weights in Central European burials as weighing devices. Shortly after, the same line of reasoning aided R. Vilaça's (2003) identification of disc weights in Portugal. In total, I could identify 31 weighing sets made up of 147 weights and four balance scales, distributed in 25 different sites. Ten sets are found in settlement contexts, 19 in burials, and two in hoards. The size of single weighing sets ranges from two devices up to a maximum of 19. All identified weighing sets are illustrated in the following pages, at the end of the section dedicated to the site-type to which they belong.

3.4. Settlements (Fig. 3.3.-4.)

In this section, I provide a description of all those archaeological contexts from settlements that provide meaningful associations, which give indications about their potential use.

3.4.1. Aeolian Islands (Italy, sites no. 3, 5-6)

The Aeolian Islands are a small volcanic archipelago, located off the north-eastern coast of Sicily. Between the 1950s and 1980s, the archipelago was the object of an extraordinary research program, leading to the extensive excavation of several settlements and cemeteries, spanning the entire arc of the Bronze Age (*ca.* 2300-950 BCE, in Italian chronology) (Bernabò Brea/Cavalier 1968; 1980; 1991).

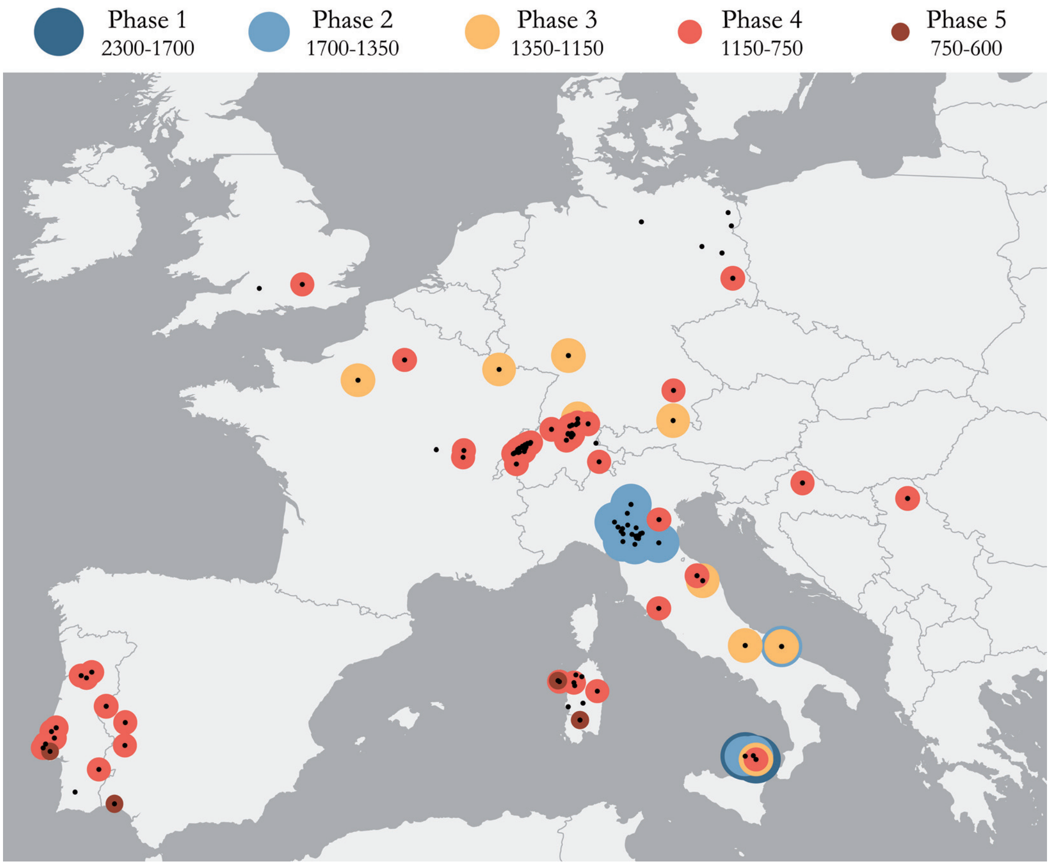


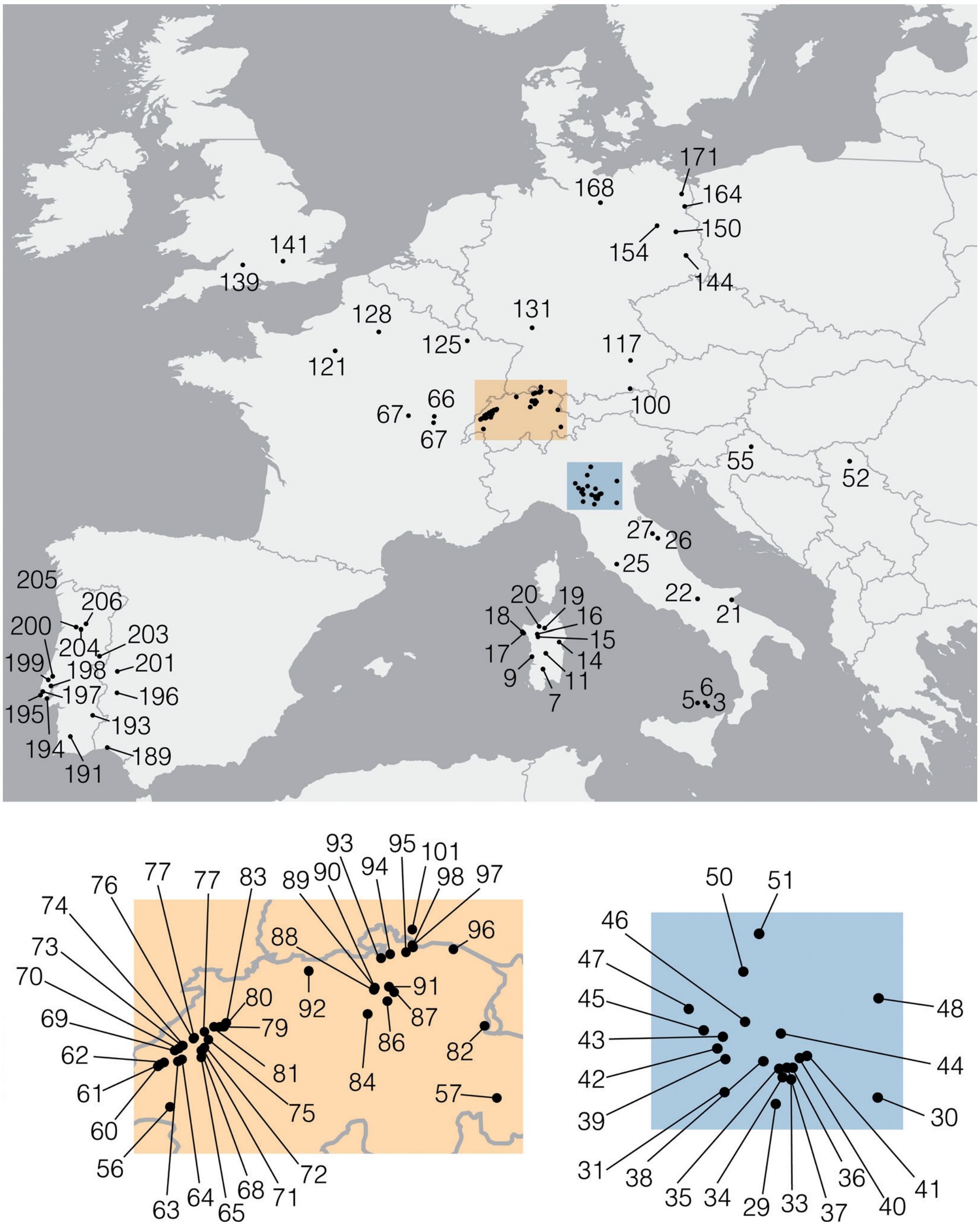
Fig. 3.3. Settlements: geographic and diachronic distribution.

For the entire duration of the BA, the Aeolian Islands are fully integrated in Mediterranean networks. Imported Aegean vessels are attested since at least the Capo Graziano 2 phase (*c.* 1700-1500 BCE), until the Final Bronze Age (*c.* 1200-950 BCE) (Jones *et al.* 2014, 50-54); Cypriot materials are found in layers dating to *c.* 1500-1350 BCE (Martinelli 2005, 255-260); proofs of external contacts also include metal and amber, distributed throughout the entire sequence, and the exceptional recovery of a large clamp made of pure tin (*c.* 1500-1350 BCE) (Bettelli/Cardarelli 2005); finally, impasto vessels of Aeolian production, dating to the first half of the 2nd millennium BCE, were recovered in Vivara (Naples), some 260 km northwards (Cazzella *et al.* 1997).

All the stone objects from L. Bernabò Brea's excavations (currently preserved in the Bernabò Brea Museum in Lipari) were sorted through, with the exception of flint and obsidian tools (Ialongo 2019). The typological range of balance weights is attested in the Aeolian Islands spans parallelepiped weights pertaining to different variants, sphendonoid weights, and *Kannelurensteine*. Parallelepiped weights are attested throughout the entire BA sequence, in three settlements located in as many different islands: Lipari-Acropolis (site no. 3), Filicudi-Capo Graziano (site no. 5), and Salina-Portella (site no. 6). Fifteen objects come from layers dated to the 'Capo Graziano' phase (*c.* 2300-1500 BCE), two from the 'Milazzese' phase (*c.* 1500-1350 BCE) and three from the 'Ausonio II' phase (*c.* 1200-950 BCE). Their occurrence in Early Bronze Age layers makes these weights the earliest known in Europe so far, outside of Greece. *Kannelurensteine* appear in the Aeolian record during the 'Milazzese' phase (*c.* 1500-1350), showing roughly the same overall chronological range attested in northern Italy and Central Europe. Four of these objects were identified in the Aeolian Islands: one from the acropolis of Lipari (Ausonio II phase, *c.* 1200-950 BCE), and three from Salina-Portella (Milazzese phase, *c.* 1500-1350 BCE). Finally, a sphendonoid weight with flat base is attested in the Ausonio I phase on the acropolis of Lipari (*c.* 1350-1200 BCE).

Contexts

The site on the acropolis of Lipari is a multi-stratified settlement with four superimposed building phases (Bernabò Brea/Cavalier 1980); balance weights are present in all occupation phases, except one (Milazzese phase, *c.* 1500-1350 BCE) (Fig. 3.5.). In the first settlement phase (Capo Graziano phase, *c.* 2300-1500 BCE), two sets of weights come from two of the best-preserved houses, while another one is associated with the casting-mould of an axe (Fig. 3.5.A). In the Ausonio I phase (*c.* 1350-1200 BCE), a parallelepiped weight is associated with a sphendonoid weight (Fig. 3.5.B). In the last occupation phase (Ausonio II, *c.* 1200-950 BCE), in the largest house of



▲ *Fig. 3.4. ID numbers of the settlements illustrated in fig. 3.3. 3 - Lipari, acropolis; 5 - Filicudi, Montagnola di Capo Graziano; 6 - Salina, Villaggio della Portella; 7 - Santu Brai; 9 - Sa Osa; 11 - Nuraghe Talei; 14 - Serra Orrios; 15 - Nuraghe Santu Antine; 16 - Monte S. Antonio; 17 - Nuraghe Palmavera; 18 - Nuraghe Sant'Imbenia; 19 - Sa Mandra Manna; 20 - Sa Tanca 'e sa Idda; 21 - Coppa Nevigata; 22 - Oratino; 25 - Sorgenti della Nova; 26 - Moscosi Piano Fonte Marcosa; 27 - Monte Croce-Guardia; 29 - Gaiato; 30 - San Giuliano in Toscanella; 31 - Bismantova, settlement; 33 - Monte Barello; 34 - Gorzano; 35 - Casinalbo; 36 - Gazzade; 37 - Montale; 38 - Scandiano; 39 - Servirola San Polo; 40 - Gaggio di Castelfranco; 41 - Redù; 42 - Basilicanova; 43 - Quingento; 44 - Savana di Cibeno; 45 - Cornocchio; 46 - Santa Rosa di Poviglio; 47 - Casaroldo; 48 - Frattesina; 50 - Bellanda; 51 - Peschiera; 52 - Bordjoš; 55 - Kalnik-Igrišče; 56 - Forel; 57 - Savognin; 59 - Ouroux-sur-Saône; 60 - Grandson-Corcelettes; 61 - Onnens; 62 - Concise; 63 - Estavayer-le-Lac; 64 - Autavaux; 65 - Avenches; 66 - Allerey-sur-Saône; 67 - Mont Beuvray-Bibracte; 68 - Vallamand; 69 - Bevaix; 70 - Cortaillod-Est; 71 - Guévaux; 72 - Haut-Vully; 73 - Colombier; 74 - Auvernier; 75 - Ins; 76 - Hauterive-Champréveyres; 77 - Saint-Blaise; 78 - Le Landeron; 79 - Mörigen; 80 - Nidau; 81 - Twann; 82 - Wartau-Herrenfeld; 83 - Port; 84 - Zug-Sumpf; 86 - Meilen; 87 - Uster-Riedikon; 88 - Zürich-Wollishofen; 89 - Zürich-Grosser Hafner; 90 - Zürich-Alpenquai; 91 - Greifensee-Böschen; 92 - Wittnau; 93 - Berg am Irchel; 94 - Andelfingen; 95 - Ürschhausen; 96 - Scherzingen; 97 - Eschenz; 98 - Insel Werd; 100 - Rachelburg; 101 - Singen, Mühlenzelgle; 117 - Landshut; 121 - Fort Harrouard; 125 - ZAC du Sansonnet, Metz; 128 - Saint-Pierre-en-Chastre, Vieux-Moulin; 131 - Mannheim-Wallstadt; 139 - Potterne; 141 - Runnymede Bridge; 144 - Klein Görigk; 150 - Friedersdorf; 154 - Groß-Glienicke; 164 - Felchow; 168 - Hitzacker; 171 - Klockow; 189 - Huelva - Plaza de las Monjas; 191 - Castro da Cola; 193 - Castro dos Ratinhos; 194 - Quinta do Almaraz; 195 - Penha Verde; 196 - Los Concejiles; 197 - Penedo do Lexim; 198 - Castro da Ota; 199 - Castro de Pragança; 200 - Abrigo Grande das Bocas; 201 - Cabezo de Araya; 202 - Monte do Trigo; 203 - Moreirinha; 204 - Santa Luzia; 205 - Nossa Senhora da Guia de Baiões; 206 - Canedotes.*

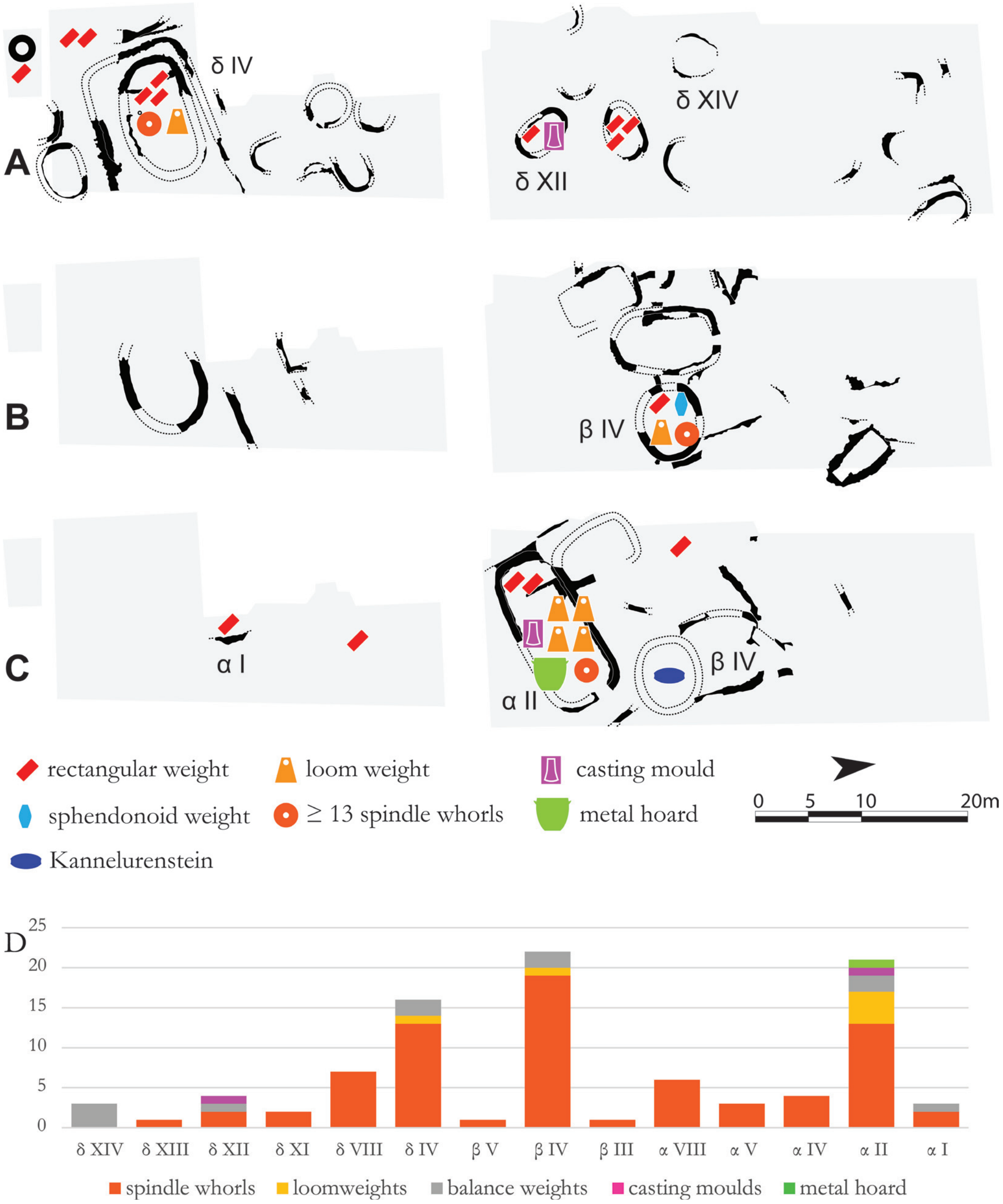


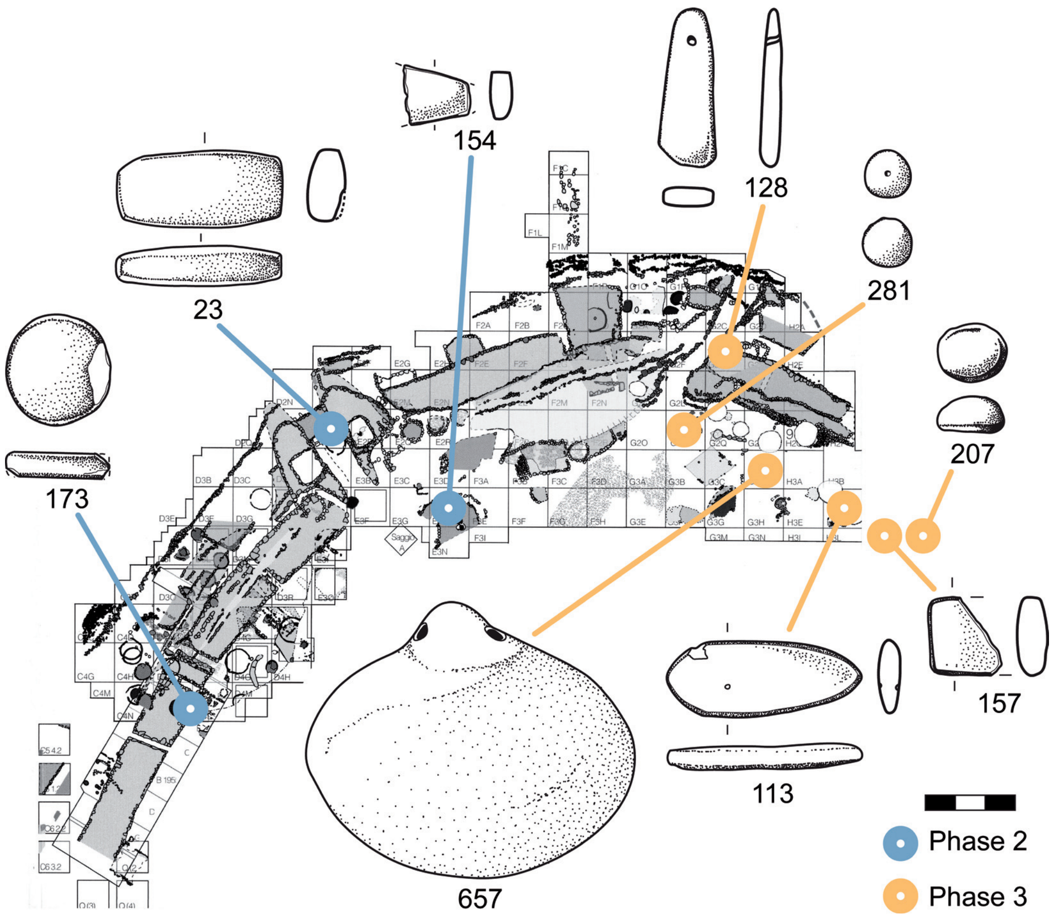
Fig. 3.5. Lipari, acropolis (Aeolian Islands, Italy) (site no. 3). Distribution of potential balance weights and of the evidence related to metalworking, metal trade and textile production (from Ialongo 2019). A: distribution map; the position of the symbols is not accurate, having the main purpose of showing which materials were found inside the houses. B: quantification of different classes of materials inside the houses. The Greek letters identify the different phases of the settlement, from the earliest (δ) to the latest (α).

the settlement, a pair of parallelepiped weights is associated with a casting mould and also with a hoard containing approximately 75 kg of ingots and scraps (Fig. 3.5.C).

Textile tools also show meaningful patterns of association (Fig. 3.5.D). All the loom weights found in the settlement are always associated with balance weights. The number of spindle whorls inside houses normally ranges between one and seven objects; there are only three houses – one for each phase – in which the spindle whorls range between 13-19 objects: such large amounts of spindle whorls are always associated with loom weights and balance weights.

Finally, in the site of Portella di Salina (*c.* 1500-1350 BCE), two *Kannelurensteine* were found in the same structure (R2), in association with a large clamp made of pure tin and a casting mould (Bettelli/Cardarelli 2005).

To summarize, balance weights on the Aeolian Islands often occur in small sets inside houses, and are significantly associated with evidence of metalworking, metal hoarding and textile production. The frequent occurrence inside houses suggests that balance weights were related to a household economy, rather than to professional merchants. This does not imply that specialized traders did not exist, but simply that their activity is not mirrored directly in the documentation available for the Aeolian settlements. Furthermore, the clustered distribution of balance weights, textile tools, casting moulds and hoards suggests that not every household was equally engaged in trade-dependent production. For example, the presence of the underfloor hoard, with 75 kg of scraps and ingots, hints at the capacity of a single household to gather and dispose of substantial quantities of raw metal that had to be acquired through external trade.



◀ *Fig. 3.6. Coppa Nevigata (Apulia, Italy) (site no. 21). Spatial and diachronic distribution of balance weights (site plan from* Cazzella *et al. 2012).*

All considered, it seems plausible that one of the basic purposes of weight-based exchange within a household economy was that of acquiring raw materials to be transformed into finished products; at the same time, weight-based exchange was also likely employed to transfer transiting commodities to Mediterranean traders, and vice-versa.

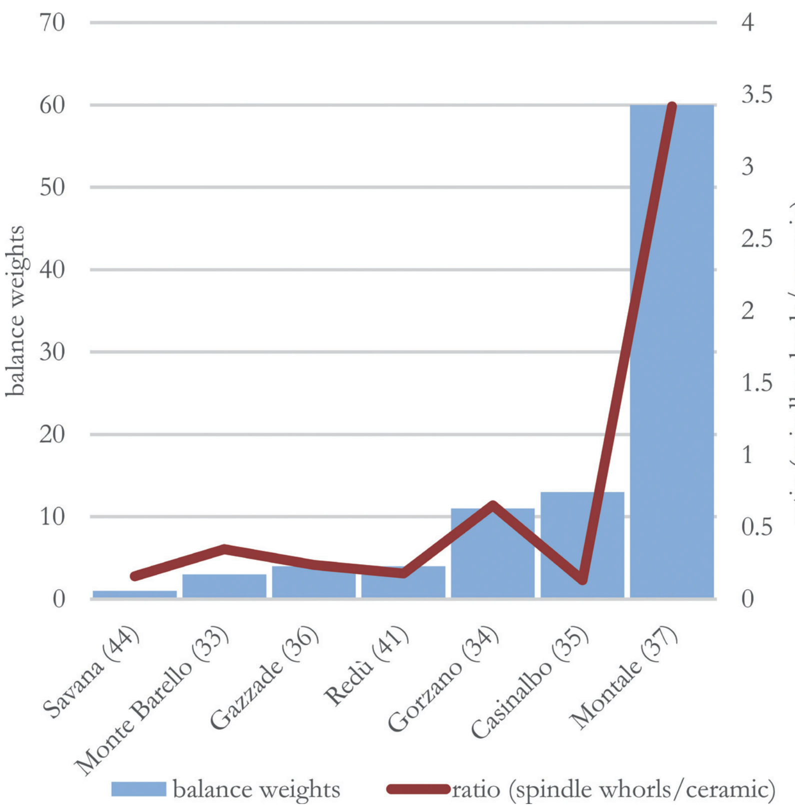
3.4.2. Coppa Nevigata (Italy, site no. 21)

Coppa Nevigata is a multi-stratified settlement close to the Adriatic coastline in northern Apulia, occupied throughout most of the 2nd millennium until the beginning of the 1st millennium BCE (Cazzella *et al.* 2012). The site was part of the Mediterranean network during the Late Bronze Age, as documented by imported and locally-produced Mycenaean pottery dating to the 13th-12th centuries BCE (LHIIIB-C) (Jones *et al.* 2014, 23). Like many other settlements in the region, Coppa Nevigata was surrounded by a massive dry-stone defensive wall guarded by towers, which was repeatedly refurbished during the Bronze Age. A unique case in the western Mediterranean, the site appears to have specialised in the extraction of purple dye from sea molluscs since *c.* 1900-1800 BCE (Cazzella *et al.* 2005; Minniti/Recchia 2018).

Regular excavations have been conducted since 1993, focussing on the north-western sector of the site (Fig. 3.6.). The sampling for this study was carried out in close collaboration with the excavation team, and in particular with G. Recchia, whom I sincerely thank for her precious help. Potential balance weights were selected after sorting through the entirety of the lithic and metallic materials currently preserved in the excavation's storerooms, located at the University of Rome "La Sapienza".

Eleven balance weights were identified, eight of which come from well-dated contexts belonging to the site's *'Protoappennine'* and *'Subappennine'* phases, roughly corresponding, respectively, to Phases 2 and 3 of the present study (Fig. 3.6.). The spatial distribution shows that the *Protoappennine* finds are only present in the western half of the site, while *Subappennine* weights are limited to the eastern half, which is probably connected to differential erosion patterns, that exposed earlier levels in the western sector.

Three weights have been found in close association with identifiable activities. A parallelepiped weight (cat. no. 23) was found in a small room inside the fortification walls, where conspicuous remains of purple-dye extraction were also identified. A fragment of a second parallelepiped weight (cat. no. 154) was recovered in an open-air area with cooking facilities. Finally, a large piriform weight was associated with a high amount of bronze and bone ornaments, a knife, and a rock crystal sphere, in a context interpreted by the excavators as connected to 'artisanal activities' (Cazzella/Recchia 2017).



▲ *Fig. 3.7. Terramare (northern Italy). Number of balance weights compared to the ratio of the total number of spindle whorls and the total number of ceramic objects for each site (data from* Sabatini *et al. 2018). The numbers in parentheses indicate the ID number of each site.*

3.4.3. Terramare (Italy, sites no. 29-50)

The so-called 'terramare' (sing. terramara) are characteristic settlements of the eastern Po Plain, which developed between *c.* 1600-1200 BCE along with peculiar metallurgy, pottery style, and burial rite (Di Renzoni 2006; Cardarelli 2009). A typical terramara is a relatively small settlement (*c.* 1-2 ha on average, but with outliers measuring up to *c.* 20 ha) completely enclosed by a perimetral wall and a ditch, with tightly laid-out rectangular houses which may or may not present above-ground floors. Terramare tend to grow in number and size in the course of the MBA and LBA until their definitive abandonment around 1200 BCE, which leaves the eastern Po Plain almost completely uninhabited until the end of the 2nd millennium BCE.

The terramara of Gaggio di Castelfranco (site no. 40) is the only site providing enough documentation to address the direct connection between balance weights and productive activities, indicating that three balance weights (cat. no. 34, 52, 674) are associated with metallurgical activities during the MBA (Balista *et al.* 2008). On a broader perspective, however, quantitative observations seem to suggest a connection between textile production and weighing technology in the terramare, and in particular at the site of Montale (site no. 37), near Modena. It has been recently reported that the terramara of Montale has yielded as many as 4,454 spindle whorls – mostly coming from a relatively small excavation sector – with the site of Gorzano coming second with 'only' 443 (Sabatini *et al.* 2018). The sheer number of spindle whorls is impressive in its own right, and it stands out even more when compared to other contemporary sites in the same region. The graph in Fig. 3.7. illustrates the ratio between spindle whorls and the total number of ceramic objects from seven terramare – all the sites for which S. Sabatini *et al.* (2018) could provide reliable figures. The graph shows that, at Montale, there are *c.* 3.5 spindle whorls for each ceramic sherd collected. Exploring further supporting evidence, the authors argue that this could hint that the settlement of Montale was specialised in the production of wool yarn for export.

Interestingly, Montale is also by far the site with the highest number of balance weights in Europe, with 60 objects against the 29 reported for the pile-dwelling site of Zürich-Alpenquai (site no. 90), in Switzerland, which comes second. The unusually high occurrence of both spindle whorls and balance weights might suggest that a connection existed at Montale between the commercial production of wool yarn and the necessity to quantify its value. Interestingly, almost all balance weights from Montale are heavy weights in the *mina*-range (n= 56). If future research will confirm the relationship between heavy weights and wool production in Bronze Age Europe, the case of Montale would find a close parallel in Bronze Age Mesopotamia. Since the 3rd millennium BCE, wool used to ship in bulks, with the *mina* being its main unit of measurement (Michel 2014). The connection between wool and heavy weight units was so close that several researchers hypothesize the existence of a special *mina* that was exclusively used to measure wool products (Peyronel 2014). Unfortunately, all the balance weights from Montale come from very old excavations with no detailed documentation, and the existence of such a connection in Europe remains, for now, hypothetical.

3.4.4. Monte Croce-Guardia (Italy, site no. 27)

Monte Croce-Guardia is a hilltop site in the Marche region (Italy), located on the mountainous area overlooking the middle Adriatic coast. Recent excavation campaigns exposed the foundations several rectangular houses, with use surfaces largely obliterated by natural erosion (Cardarelli *et al.* 2017). A concentration of bronze objects (both complete and fragmented), a fragment of a casting mould, two loom weights, and two balance weights (cat. no. 38, 320) dating to the Final Bronze Age (corresponding to Phase 4 in this work) were identified in the residual layers associated with House 3 (Fig. 3.8.). The excavators interpret these materials as residues of weaving, hoarding and casting activities.

3.4.5. Monte S. Antonio (Italy, site no. 16)

The site of Monte S. Antonio (Sardinia) was originally a Nuragic village that developed through the Middle and Final Bronze Age (*c.* 1500-950 BCE), eventually turned into a monumental sanctuary on the verge of the 1st millennium BCE (Ialongo 2011; 2018). The sanctuary – which partly oblit-

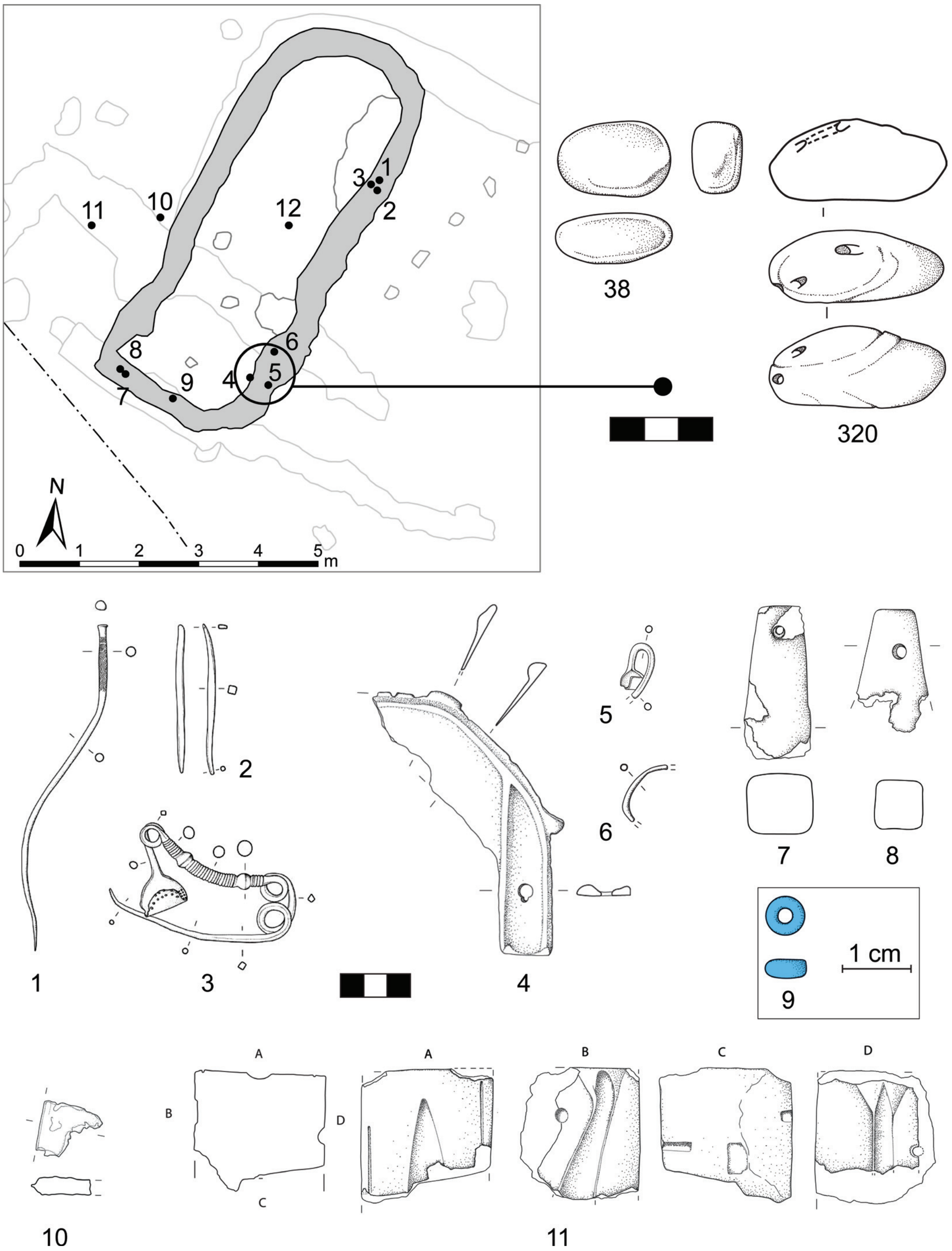
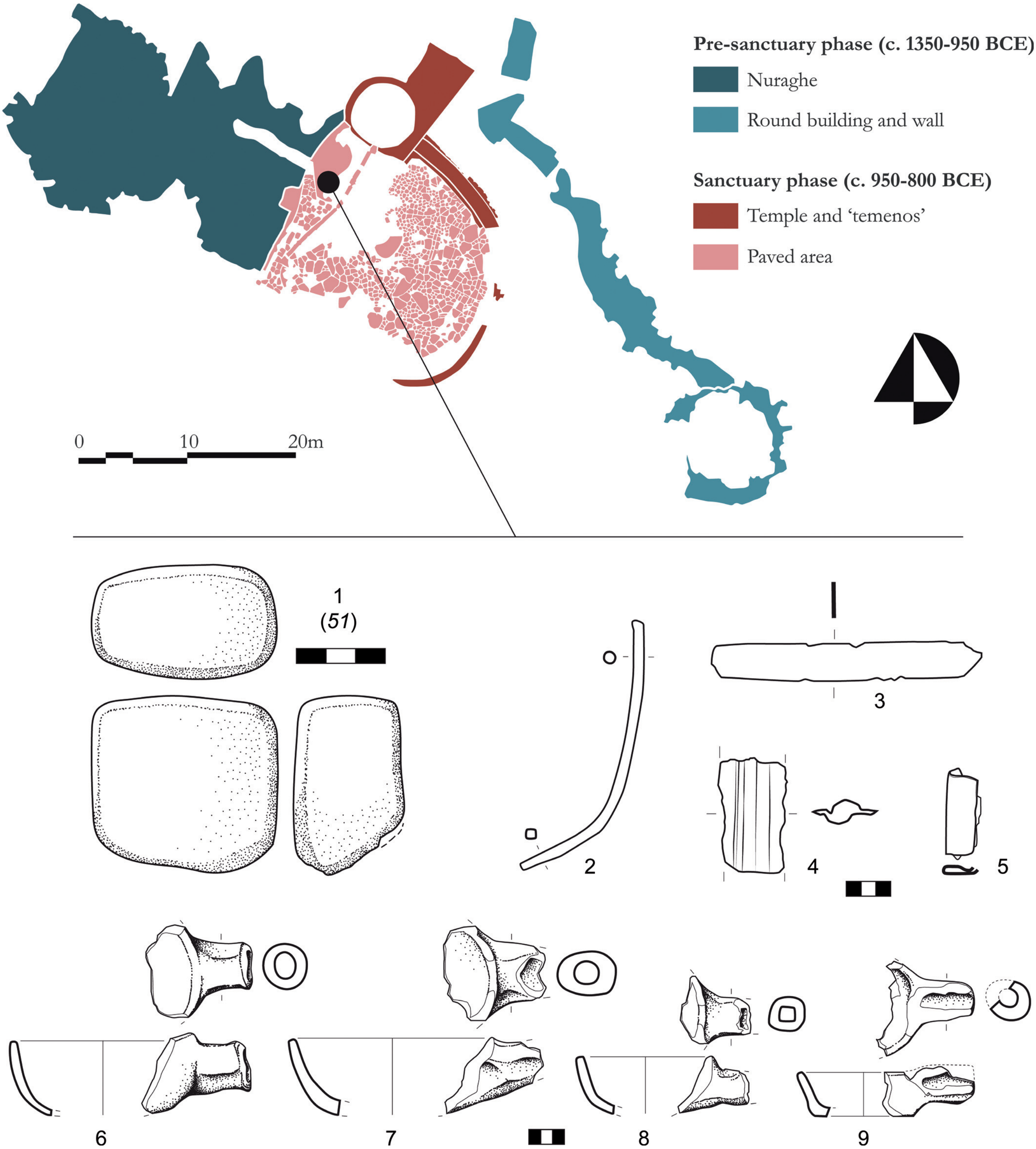


Fig. 3.8. Monte Croce-Guardia (Marche, Italy) (site no. 27). Plan of house 3 and localization of associated materials (from Cardarelli *et al. 2017). Cat. No. 38, 320: balance weights (stone). Associated materials (all bronze, unless specified): 1) pin; 2) awl; 3) fibula; 4) fragmented sickle; 5) fragmented fibula; 6) fragment of wire; 7-8) loom weights (clay); 9) blue glass bead; 10) bronze fragment; 11) multifunctional casting mould (sandstone).*

erates the pre-existing structures – is articulated into two architectural clusters, separated from one another by *c.* 100 m. The northern cluster – the one from which the balance weight comes from – presents a complex architectural sequence (Fig. 3.9.). An open-air paved area surrounded by a wall (a so-called *temenos*) with a 'well temple' on its northern side leans against a pre-existing nuraghe, and was built at short distance from a pre-existing massive wall leading to a circular house. Both the materials and the structural stratigraphy clearly show that the paved area was built much later than the nuraghe, but unfortunately the archaeological finds cannot always be easily attributed to a specific chronological phase.

The group of materials under examination here comprises a parallelepiped weight (Fig. 3.9.1, weight no. 51), four ceramic crucibles (Fig. 3.9.6-9), and four metal fragments, dated between the end of the 2nd and the beginning of the 1st millennium BCE (Phase 4). Based on what it could be possible to reconstruct from the unpublished excavation reports (Ialongo 2011), the materials formed a concentration located on the paved area right in front of the former access to the nuraghe. In itself, this group of materials would point to a connection with metallurgy and hoarding. Unfortunately, the available data are not sufficient to ascertain whether these materials pertain to the earlier village or to the later sanctuary. The typology of the materials



▲ *Fig. 3.9. Monte S. Antonio (Sardinia, Italy) (site no. 16). Plan of the sanctuary and preexisting settlement (from Ialongo 2018), and localization of the balance weight and associated finds (from Ialongo 2011). 1) balance weights (stone); 2) thick bronze rod; 3) fragment of bronze band; 4) sword blade fragment; 5) bronze sheet fragment; 6-9) ceramic crucibles.*

points at a rather generic horizon encompassing the end of the Final Bronze Age and the beginning of the Early Iron Age, in terms of Sardinian chronology, which is compatible with both architectural phases. At the same time, materials located in that area of the settlement could either belong to the dispersion of finds spread out on the paved area or to the deposit formerly contained within the nuraghe, which partly spread on the paved area following the collapse of the masonry closing the entrance to the nuraghe. Either way, the concentration of four crucibles is hardly accidental, as these objects were not found anywhere else on the site.

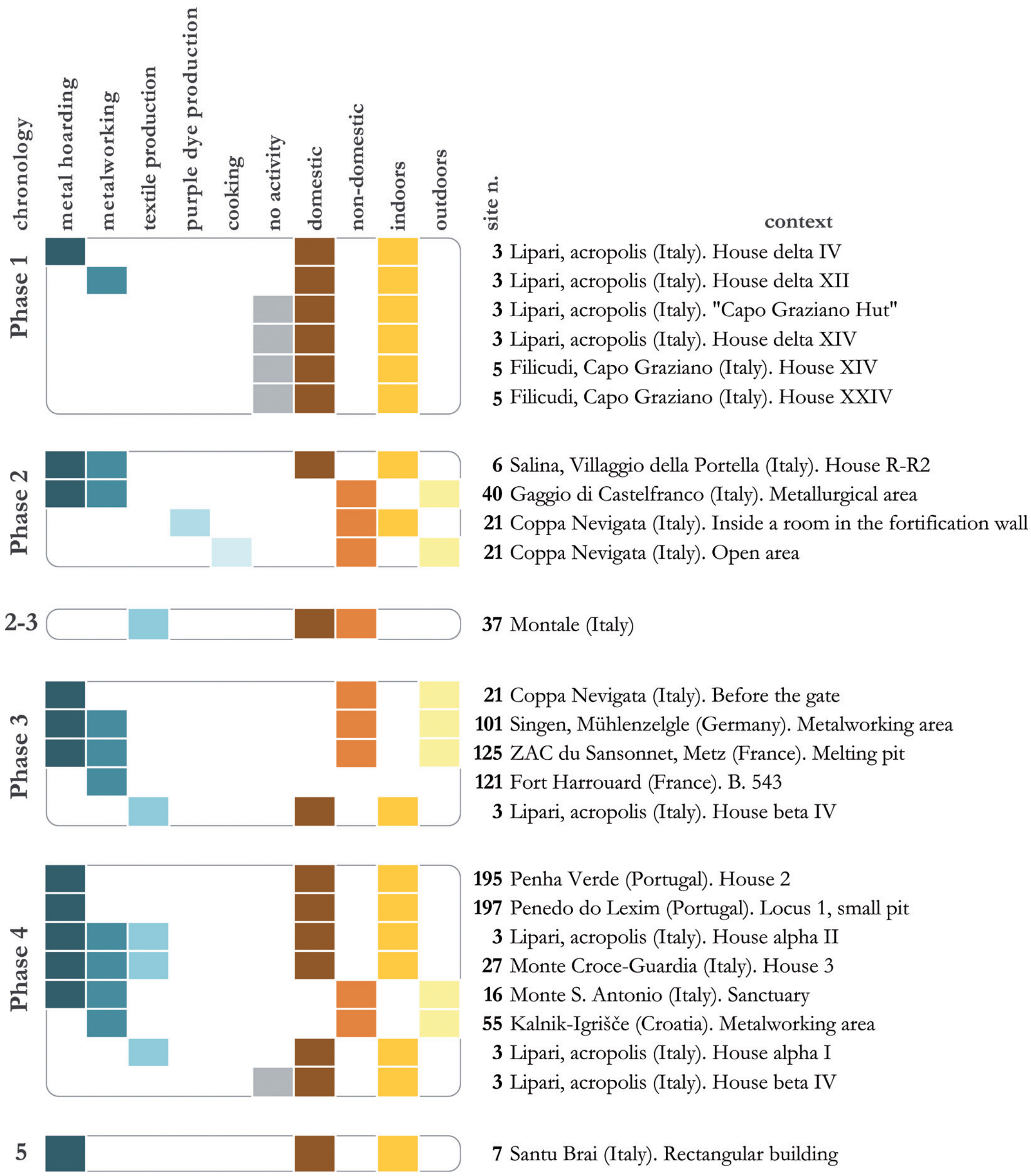


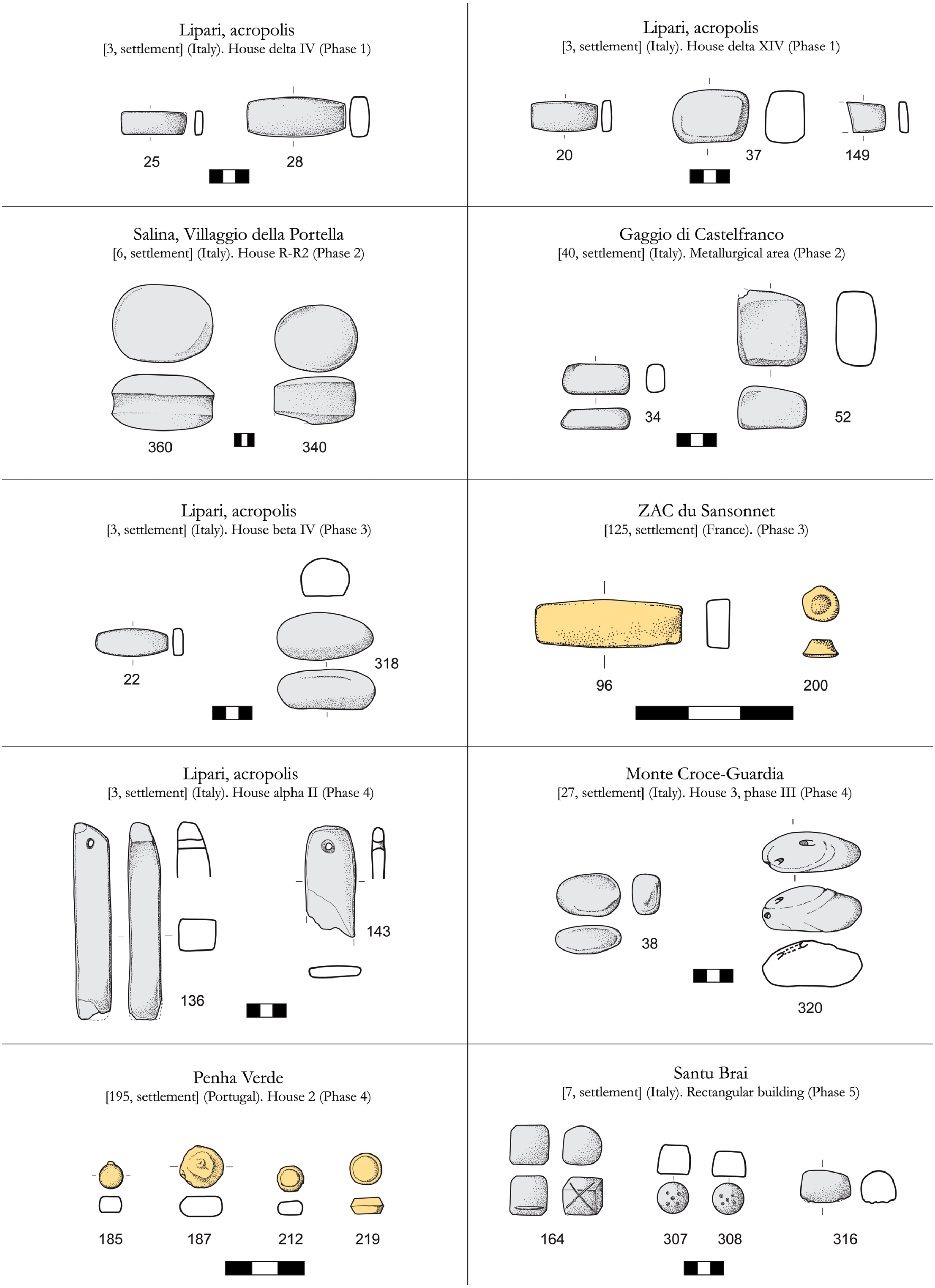
Fig. 3.10. Comparative table of different types of activities attested in well-documented contexts, in association with balance weights.

3.4.6. Other contexts

- Santu Brai (Italy, site no. 7), Phase 5. Set of four balance weights (cat. no. 164, 307-308, 316), two of which with quantity marks (cat. no. 307-308), from a rectangular house, in association with a small ceramic jug containing an awl, a small saw, a dagger, and a bronze fragment (Ugas 1986).
- Kalnik-Igrišče (Croatia, site no. 55), Phase 4. Balance weight (cat. no. 330) associated with open-air metallurgical facilities (Vrdoljak/Forenbaher 1995).
- Singen, Mühlenzelgle (Germany, site no. 101), Phase 3. Balance weight (cat. no. 105) associated with metallurgical activities (Hopert 1995).
- Fort Harrouard (France, site no. 121), Phase 2-3. Balance beam (cat. no. 8) associated with several clay tuyère (Mohen/Bailloud 1987, pl. 85.8).
- ZAC du Sansonnet, Metz (France, site no. 125), Phase 3. Set of wo balance weights associated with open-air smelting facilities (Klag/Wiethold 2020).
- Penha Verde (Portugal, site no. 195), Phase 4. Set of four balance weights (cat. no. 185, 187, 212, 219) inside a house, associated with fragment of bronze ingot, a fragment of a bronze arm ring, a gold pin, and a gold bead (Cardoso 2011).
- Penedo do Lexim (Portugal, site no. 197), Phase 4. Balance weight (cat. no. 217) found in a small pit inside a house (Sousa/Sousa 2018).

3.4.7. General observations on settlement contexts

The table in Fig. 3.10. shows a synthetic list of all contexts from settlements that provide indication of associated activities. In European settlements, balance weights are indifferently attested in connection with domestic and non-domestic spaces, both indoors and outdoors. Evidence of metal



▲ *Fig. 3.11. Weighing sets from settlements. Yellow filling: bronze; grey filling: stone.*

hoarding, metalworking, and textile production is attested in connection with balance weights in all chronological phases, with two or more of these activities being often attested simultaneously. Furthermore, several contexts with balance weights do not show any clear evidence of activities connected to trade or production. At the same time, due to the highly discontinuous state of the available documentation, one cannot even be sure that the absence of any direct evidence of either of such productive activities actually means that these activities – or any other – were not carried out at all. The proxies used here to identify productive activities are, for the most part, metal objects, casting moulds and textile tools – all of which are fairly common in many settlement contexts across Europe.

While future research, supported by a much more conspicuous amount of data, may eventually reveal local and chronological trends, it would not seem that, on a European scale, balance weights are significantly associated with a specific productive activity. In synthesis, the available data seem to indicate that there is no particular functional pattern in the distribution of balance weights in in European settlements during the Bronze Age. The absence of a pattern, however, emerges as a pattern in itself. Simply put, balance weights appear as mundane tools of everyday use, which one could find in the domestic equipment of potentially any household, regardless of whether or not its members engaged in any kind of activities that archaeologists would normally classify as 'trade' or 'production'.

3.4.8. Weighing sets from settlements (Fig. 3.11.)

Phase 1

- Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Sicily, Italy).
  - ▹ House delta IV, Area O, Strata 3-4 (Capo Graziano). Phase 1 (EBA-MBA 1-2) - Set of two weights (cat. no. 25, 28). Associations: bronze awl, three bronze fragments.
  - ▹ House delta XIV, Area Bh (phase Capo Graziano). Phase 1 (EBA-MBA 1-2) - Set of two weights (cat. no. 20, 37). Associations: two bone spatulae.

Phase 2

- Salina, Villaggio della Portella [site no. 6, settlement] (Aeolian Islands, Sicily, Italy). House R-R2. Phase 2 (MBA 3) - Set of two balance weights (cat. no. 340, 360). Associations: tin ingot, casting mould.
- Gaggio di Castelfranco [site no. 40, settlement] (Modena, Emilia Romagna, Italy). T. 507, Trench 3, VP 3, US 4373, fase 1.3. External productive area, next to a fireplace. Phase 2 (MBA-RBA) - Set of two weights (cat. no. 34, 52). Associations: traces of metallurgical activity.

Phase 3

- Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Sicily, Italy).
  - ▹ House beta IV, dromos, slab pavement. Phase 3 (RBA) - Set of two weights (cat. no. 22, 318). Associations: loom weight, high number of spindle whorls.
  - ▹ House alpha II, Wall, base layer. Phase 4 (FBA) - Set of two weights (cat. no. 136, 143). Associations: nuragic pottery, four loom weights, high number of spindle whorls, bronze chisel, scalpel, bronze fragments, mould, metal hoard (*c.* 75 kg).
- ZAC du Sansonnet, Metz [site no. 125, settlement] (Grand Est, dép. Moselle, France). Melting pit (surroundings). Phase 3 (Br D) - Set of two balance weights (cat. no. 96, 200). Associations: fire pits, crucibles, metal objects.

Phase 4

- Monte Croce-Guardia [site no. 27, settlement] (Arcevia, Marche, Italy). House 3, fase III, US 402. Phase 4 (FBA) - Set of two balance weights (cat. no. 38, 120). Associations: concentration of fragmented bronze objects and a casting mould, interpreted as workshop/hoard (sickle fragment, fibula fragment, bronze wire fragment, glass bead).
- Penha Verde [site no. 195, settlement] (Sintra, Sintra, Portugal). House 2. Phase 4 (Atlantic FBA III) - Set of four balance weights (cat. no. 185, 187, 212, 219). Associations: fragment of bronze ingot, fragment of bronze armring, gold pin, gold bead.

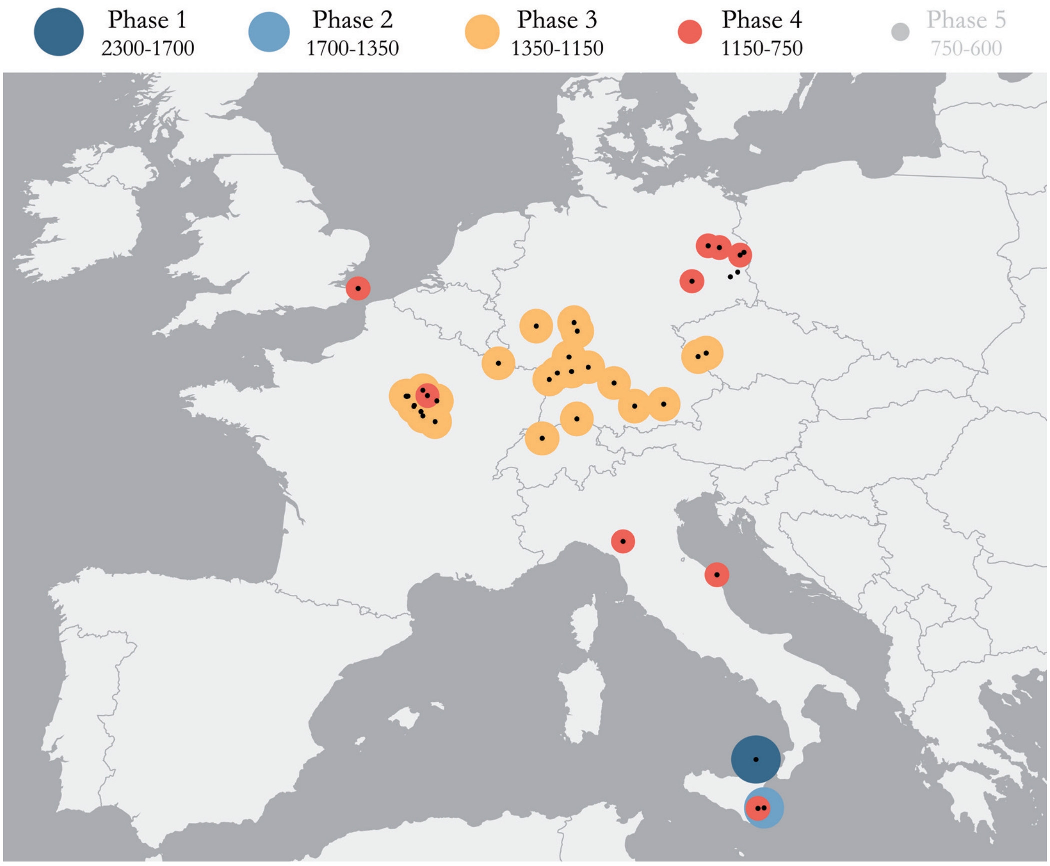
Phase 5

- Santu Brai [site no. 7, settlement] (Sardinia, Italy). Rectangular house. Phase 5 (EIA 2B-Early Orientalizing) - One incised line on one face; two crossed lines across two faces. Set of four balance weights (cat. no. 164, 307, 308, 316). Associations: small ceramic jug containing an awl, a small saw, a dagger, and a bronze fragment; Etruscan bucchero.

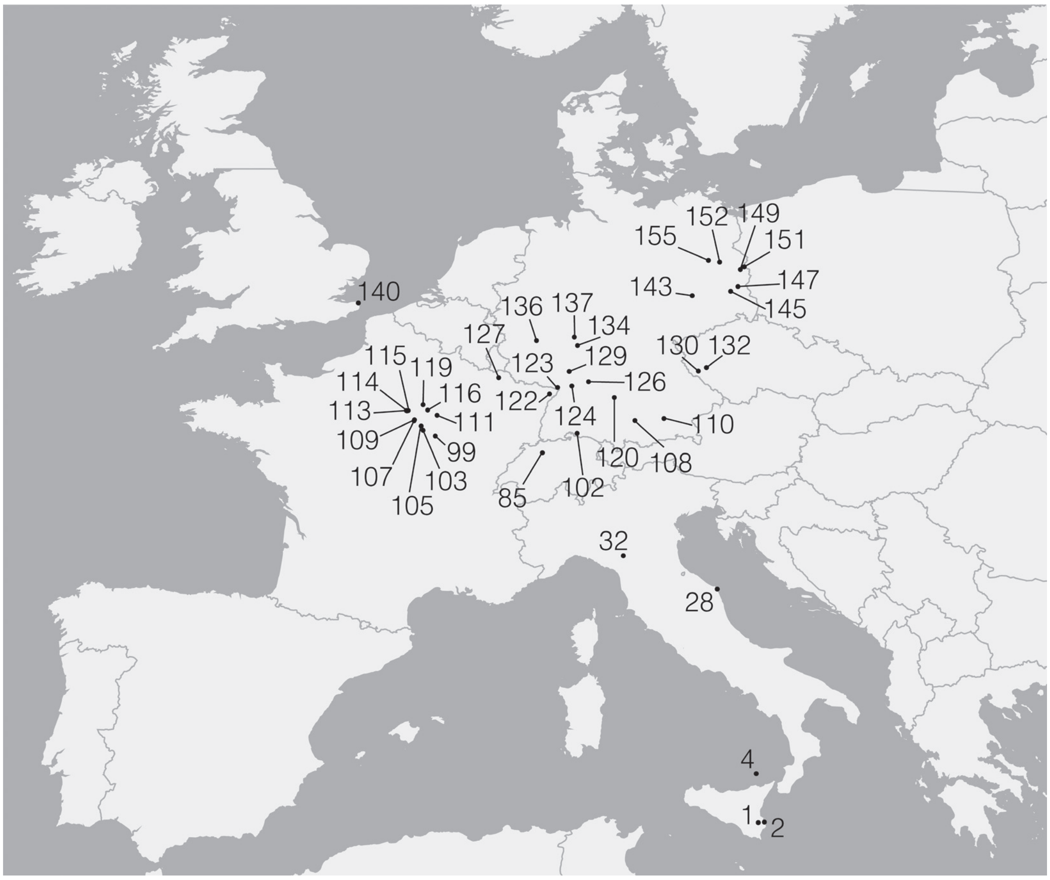
3.5. Burials (Fig. 3.12.-13.)

3.5.1. Association analysis

Examining the distribution of weighing equipment in burials offers the unique opportunity to attempt connecting weighing technology with their users. The distribution of weighing equipment in European burials has been addressed a few times in the past. C. Pare's (1999) study, published more than 20 years ago, is still the most exhaustive available to date. Pare was the first to confidently identify parallelepiped weights as the most recurring type in Central Europe starting *c.* 1350 BCE, often occurring in sets comprising up to twelve objects. Later research on French burials of the same period, albeit more limited in its geographical and chronological scope, could rely on high-quality first-hand documentation from accurate excavations (Roscio *et al.* 2011; 2018; Roscio 2018). These studies already provide excellent graphical and contextual documentation of most of the burial contexts included in this book, and while I could add a few entries to



▶ *Fig. 3.12. Burial sites: geographic and diachronic distribution.*



▶ *Fig. 3.13. ID numbers of the burial sites illustrated in fig. 3.12. 1 - Pantalica; 2 - Thapsos; 4 - Lipari, Contrada Diana; 10 - Monte Prama; 28 - Numana; 32 - Bismantova, Campo Pianelli; 85 - Galgenrain; 99 - Noyers; 102 - Singen, Widerholdstrasse; 103 - Monéteau, "Aux Bries"; 105 - Migennes, Le Petit Moulin; 107 - Passy-sur-Yonne, La Sablonière; 108 - Hurlach; 109 - Etigny, "Le Brassot" Ouest; 110 - Poing; 111 - Rosières-près-Troyes "Les Monts Hauts"; 113 - Marolles-sur-seine, la Croix-Saint-Jacques; 114 - Marolles-sur-Seine, La Croix de la Mission; 115 - Marolles-sur-Seine, Gours-aux-Lions; 116 - Marigny-le-Châtel - Le Pont de Riom; 118 - Barbuise-Courtavant, Les Grèves; 119 - Barbuise-Courtavant, Grèves de Frécul; 120 - Königsbronn; 122 - Haguenau-Oberfeld; 123 - Büchelberg; 124 - Gondelsheim-Mordäcker; 126 - Neckarsulm; 127 - Richemont-Pépinville; 129 - Waldspitz; 130 - Milavče; 132 - Horušany; 134 - Düne; 136 - Kobern; 137 - Steinfurth; 140 - Cliffs End Farm; 143 - Battaune; 145 - Pritzen; 147 - Cottbus-Schmellwitz; 149 - Müllrose; 151 - Frankfurt "Nussweg"; 152 - Berlin-Rahnsdorf; 155 - Wilmersdorf.*

site n.	Inhumation/Cremation	sex	balance weights	balance beam	sword/scabbard	bronze vessel	dagger	awl/chisel/hammer/moulds	spear head/butt	wagon/horse bits	knife/sickle/hook	tweezers/razor	pins	bronze fragments	gold fragments	organic container (?)	phase	shekel/mina
130	I	(M)	2		■	■				■	■	■	■				3	shekel
130	I	(M)	2		■				■		■		■	■			3	shekel
126	I	M	1		■						■		■	■		■	3	shekel
110	C	(M)	1		■	■				■	■	■	■	■			3	shekel
118	I	(M)	1		■						■		■			■	3	shekel
102	I	(M)	2		■				■		■						3	shekel
108	C	M+F	3		■						■		■		■		3	shekel
105	I	(M)	2	1	■								■				3	shekel
115	I	M	2		■							■			■	■	3	shekel
127	I	(M)	7		■						■	■	■	■		■	3	shekel
105	I	M	19	2			■	■				■		■	■	■	3	shekel
115	C	(M)	1	1			■	■				■		■	■	■	3	shekel
105	I			1			■									■	3	
120	C	(M)	1					■	■	■			■				3	shekel
116	C		1					■								■	3	shekel
109	I	(M)	13	1				■			■	■		■		■	3	shekel
132	C		4					■						■		■	3	shekel
136	C		1					■									3	shekel
123	I		9				■	■					■			■	3	shekel
129	I		2					■			■		■			■	3	shekel
107	I	(M)	5				■	■				■	■			■	3	shekel
143	C		1					■									4	shekel
28	C	(M)	1					■			■	■	■				4	shekel
32	C	(M)	1									■	■				4	shekel
2	I		18									■		■			3	shekel
99	C												■				3	
124	I		2										■			■		shekel
152	C		1										■				4	mina
110	C		2								■		■			■	3	shekel
137	I		12										■			■	3	shekel
119	I	(M)	3									■					3	shekel
118	I		4								■				■	■	3	shekel
103	I	(M)	2	1								■					3	shekel
2	I		1											■			3	shekel
105	C			1													3	
114	C			1								■		■	■	■	3	
134	C		1														3	shekel
147	C		1														4	mina
113	C			1													3	
122	C			1													3	
155	C		3														4	shekel+mina
1	I		1														4	shekel
4	I		1														1	shekel
149	C		1														4	mina
151	C																4	mina

▲ *Fig. 3.14. Synthetic table of the associations of grave goods and weighing devices in graves.*

the list, the limited amount of new data does not justify a detailed, case-by-case re-examination.

Here, I present the data in tabular form and attempt a comparative analysis. Any consideration on weighing equipment in Bronze Age burials must take into account the inherent limits of the available documentation, illustrated in the first part of this chapter. Fig. 3.14. shows a synthetic report of all the relevant traits of the 45 burials considered in this study that offer enough contextual information for a comparative analysis. The table records: 1) the site number; 2) the grave number, in case more than one burial from a same site is included in the list; 3) whether the burial is an inhumation or a cremation; 4) the determination of sex given in the original publication (in parenthesis if it is determined based on the grave goods); 5) type and quantity of weighing equipment (weight/balance beam); 6) grave goods (only presence/absence); 7) the chronological phase; 8) country of provenance.

Burial contexts were grouped based on the exclusive occurrence of different categories of grave goods. The first group is defined by the exclusive presence of a sword and/or a scabbard, with the occasional occurrence of bronze vessels. The exclusive presence of working tools defines the second group with the occasional occurrence of a dagger; the tools represented in this group can be generically correlated with the metallurgical sphere, being suitable for smelting (casting moulds) and for breaking down metal objects (awl, chisel, hammer). The third group is characterised by the absence of any kind of exclusive element, while showing variable associations of grave goods also occurring in the first two groups, with the notable exception of any kind of weaponry (in particular spearheads and arrowheads), miniature wagons, and horse bits. Finally, the fourth group is formed by graves that do not present any form of grave goods, with the exception of weighing equipment.

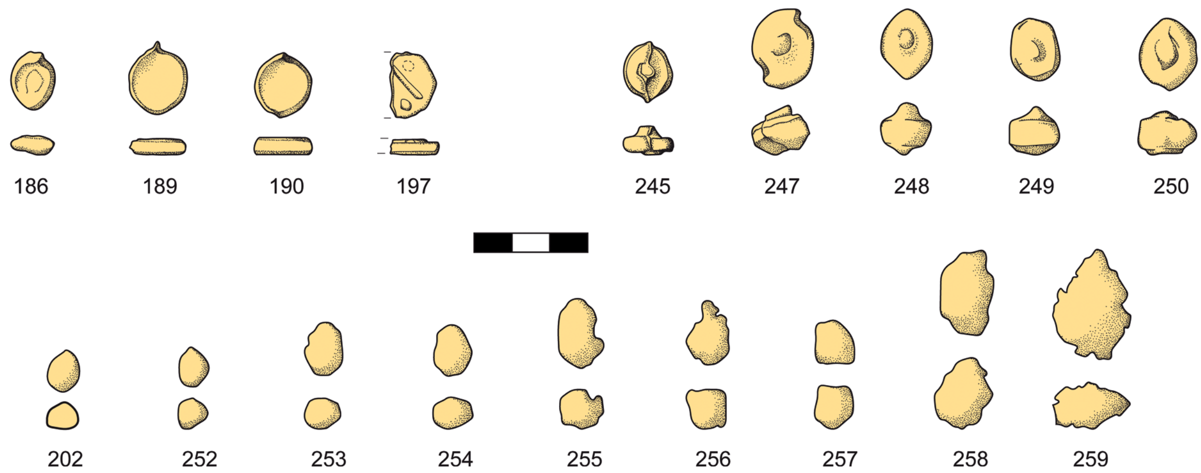
The associations table yields a rather sharp rendition of the tiered scheme in which archaeologists often classify Bronze Age burials, with individuals with swords usually placed at the top of an ideal hierarchy, graves with less prominent armament occupying a lower position, and individuals without distinctive traits – especially those without weapons – coming last (*e. g.*, Pacciarelli 2001; Harding 2007; Meller 2017). There is of course widespread awareness that such a scheme represents an oversimplification of the highly complex interplay between the organisation and structure of living societies and their ritual representation in the burial rite (Brück/Fontijn 2013; Frieman *et al.* 2017; Pape/Ialongo 2023), and this book is clearly not the appropriate space to discuss its many facets. For the scope of this study, I will simply rely on the widespread assumption that different groups of grave goods associations – being fairly regular and recurrent – must be at least loosely correlated to real-life perceptions of rank, status or function.

I will start by outlining the limits and apparent contradictions highlighted by the available evidence. The determination of the sex of buried individuals is the first obstacle to assessing the significance of the data. Determinations based on osteological analyses are only available for four burials in the sample, three of which contain individuals determined as male, and one the remains of two individuals, one female and one male (site no. 108). Fifteen more individuals lacking osteological determinations are associated with grave goods that are usually interpreted as typical of the male equipment. Prominently among these, swords are generally assumed to be masculine attributes in European burials, as are spearheads, tweezers, and razors (Treherne 1995). Daggers, on the other hand, tend to be associated with both biological males and females (Pape/Ialongo 2023). While the data show convincing evidence of associations with male individuals, the missing sex determinations are too many to exclude that weighing equipment was commonly associated to female burials as well. As a consequence, no preferential connection can be established, for the time being, with either biological sex.

A further limit of the classic tiered scheme is its ambiguity in the distinction of socially-constructed qualities such as rank, status or prestige as opposed to the more mundane aspect of wealth, the latter gaining quite some relevance when it comes to assess the significance of tools whose main purpose was to quantify economic value in transactions. While quantifying wealth in burials is objectively difficult and perhaps inevitably tied to subjective perceptions, one can easily observe that the 'expensive material' by definition – *i. e.*, gold – occurs indifferently in the first three groups. Moreover, gold always occurs in fragments, which would appear to stress its economic value rather than its symbolic meaning. Bronze fragments recur across the first three groups as well – sometimes associated with gold fragments – suggesting a possible connection with their hypothetical monetary use, which is in turn supported by their systematic compliance with weight systems (Ialongo/Lago 2021; 2024). Finally, it should be noted that the fourth group includes mostly cremations burials which notoriously lack grave goods, due to ritual norms, and that therefore it should not be necessarily regarded as a group of 'poor' graves. Nonetheless, it is worth noting that weighing devices are the only grave goods (other than pottery) represented in these graves.

A further unifying trait between the first three groups is the frequent occurrence of traces of small containers made of organic material, identified by small bronze-sheet cylinders that functioned as hinges or closing devices (Pare 1999). When detailed excavation reports are available, such cylinders are aften aligned on the edges of darker patches of soil collecting dense concentrations of small ob-

Thapsos
[2, burial] (Siracusa, Sicily, Italy). Northern necropolis, Grave 6, Inner chamber (Phase 2-3)



▲ *Fig. 3.15. Weighing sets from burials (Italy). Yellow filling: bronze.*

jects, including balance weights and scales (Roscio *et al.* 2011). One of these containers – containing metal scraps – has been recently identified among the remains of the Bronze Age battlefield of Tollense Valley, in northern Germany (Uhlig *et al.* 2019).

3.5.2. General observations on burial contexts

In synthesis, the tabular analysis singles out four groups of depositions that approximately correspond to the usual tiered scheme of Bronze Age burials, and weighing equipment is indifferently attested in each group, roughly in equal proportions. Based on the available data, it can be concluded that there is no evidence that status, rank, prestige and even wealth are determinant factors for the deposition of weighing equipment in European graves. Moreover, the randomness of the distribution of weighing equipment indirectly corroborates the statistical significance of the available sample, despite its small size: As weights and balances occur in equal quantities in each group, it is fair to expect that a moderate increase in the sample size will not result in a significantly different picture, at least not in the near future.

Overall, the picture rendered by burials is entirely consistent with the evidence from settlements, which shows that weights and balances indifferently occur in association with diverse productive activities – as well as with no activity at all – both in private and public spaces. In conclusion, the evidence from both burials and settlements reinforces the impression that weights and balances were rather unremarkable tools of everyday utility, that could be used in the most diverse occasions by the most diverse individuals.

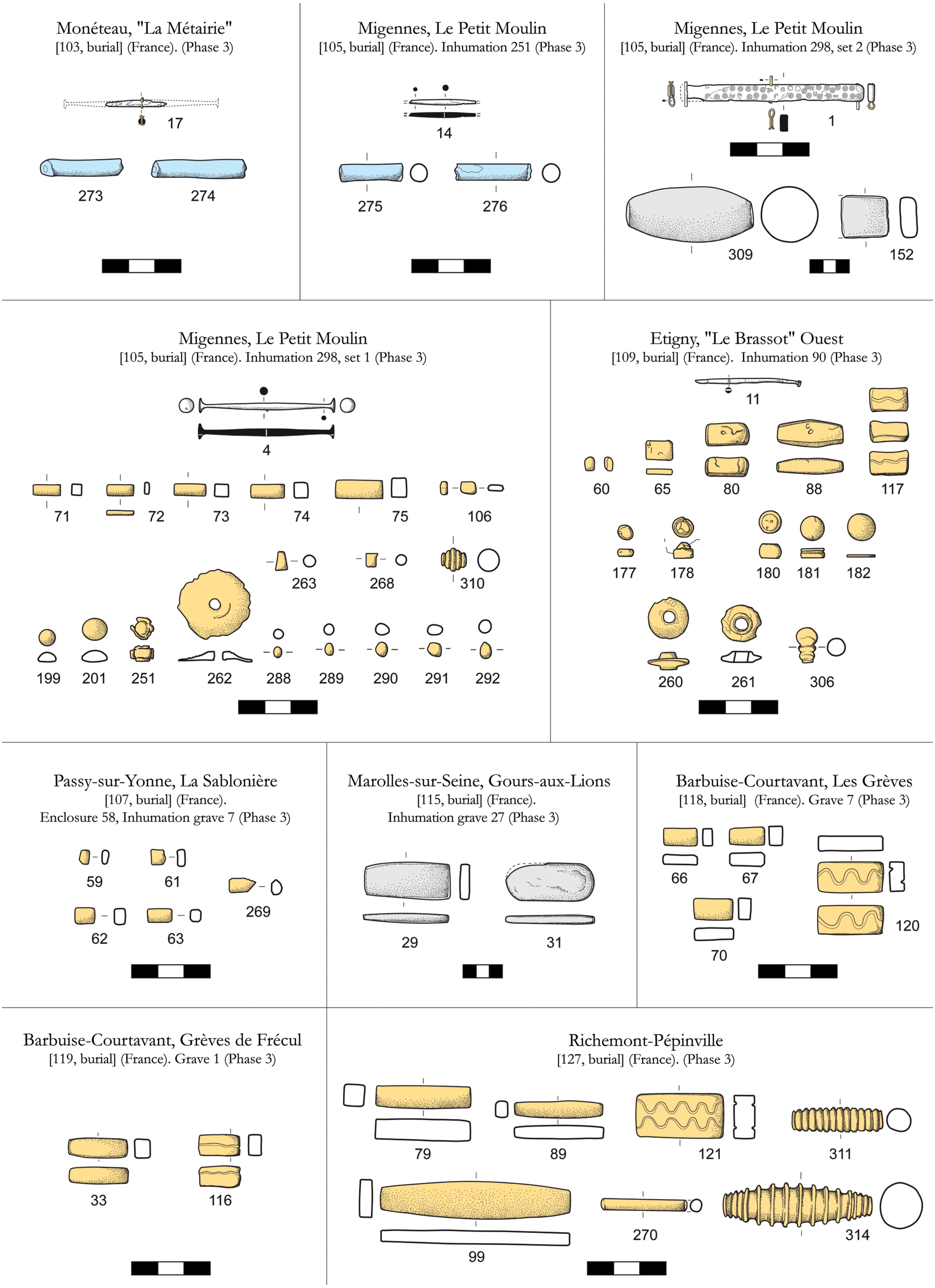
3.5.3. Weighing sets from burials

Italy (Fig. 3.15.)

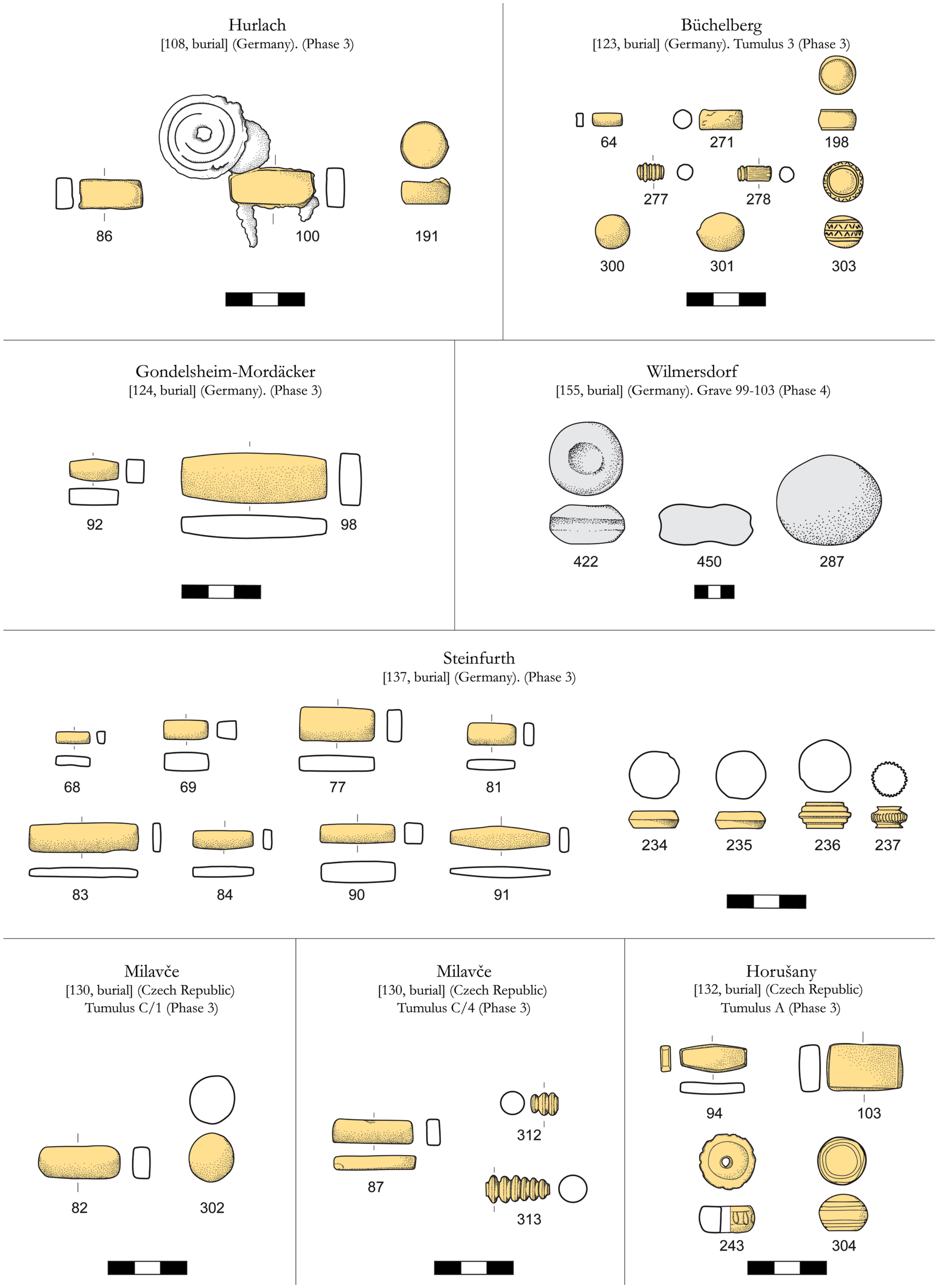
- Thapsos [site no. 2, burial] (Siracusa, Sicily, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, four bronze fragments - Complete. Copper/bronze.

France (Fig. 3.16.)

- Monéteau, "Aux Bries" [site no. 103, burial] (Yonne, Bourgogne-Franche-Comté, France). Phase 3 (Br D) - Set of two balance weights and one balance beam (cat. no. 17, 273, 274). Associations: two lead weights, balance beam, razor.
- Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France).
  - ▹ Inhumation 251. Phase 3 (Br D) - Set of two balance weights and one balance beam (cat. no. 14, 275, 276). Associations: two lead balance weights, fragment of a bone balance beam, sword, pin, scabbard, applique.
  - ▹ Inhumation 298. Phase 3 (Br D). Associations: six bronze hinges (organic container), dagger, hammer, awl, tweezers, three arrowheads, two rings, seven bronze fragments, twelve gold fragments, four amber beads. Two weighing sets.
    - › Set 1: two weights and one balance beam (cat. no. 1, 152, 309).
    - › Set 2: 18 weights and one balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310)
- Etigny, "Le Brassot" Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Set of 13 balance weights and one balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: three bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife.
- Passy-sur-Yonne, La Sablonière [site no. 107, burial] (Yonne, Bourgogne-Franche-Comté, France). Richebourg, Enclosure 58, Inhumation grave 7. Phase 3 (Br D) - Set of five



▲ *Fig. 3.16. Weighing sets from burials (France). Yellow filling: bronze; grey filling: stone; white filling: bone.*



▲ *Fig. 3.17. Weighing sets from burials (Germany and Czech Republic). Yellow filling: bronze; grey filling: stone.*

balance weights (cat. no. 59, 61, 62, 63, 269). Associations: three bronze hinges (organic container), dagger, awl, razor, pin, stud.

- Gours-aux-Lions [site no. 115, burial] (Marolles-sur-Seine, Seine-et-Marne, Île-de-France, France). Inhumation grave 27. Phase 3 (Br D) - Set of two balance weights and one balance beam (cat. no. 13, 29, 31). Associations: bronze hinge (organic container?), scabbard, razor, ring, gold fragment.
- Barbuise-Courtavant, Les Grèves [site no. 118, burial] (Aube, Grand Est, France). Grave 7. Phase 3 (Br D) - Set of five balance weights (cat. no. 66, 67, 70, 120, 272). Associations: bronze hinge (organic container?), two hooks, gold fragment.
- Pépinville [site no. 127, burial] (Richemont, Moselle, Grand Est, France). Phase 3 (Br D) - Set of seven balance weights (cat. no. 79, 89, 99, 121, 270, 311, 314). Associations: sword, tweezers, knife, pin, miniature duck, two bronze fragments, seven bronze cylinders filled with lead.

Germany (Fig. 3.17.)

- Hurlach [site no. 108, burial] (Landsberg a. Lech, Bayern, Germany). Phase 3 (Br C-Br D) - Set of three balance weights (cat. no. 86, 100, 191). Associations: cremated remains belonging to two individuals, a male and a female. Three knives, sword, belt hook, several bronze studs, bronze necklace with gold pendant and three amber beads, five pins, seven pin heads, gold fragment, pottery.
- Büchelberg [site no. 123, burial] (Germersheim, Rheinland-Pfalz, Germany). Tumulus 3. Phase 3 (Br D) - Set of eight balance weights (cat. no. 64, 198, 271, 277, 278, 300, 301, 303). Associations: three bronze hinges (organic container?), dagger, awl, pottery.
- Gondelsheim-Mordäcker [site no. 124, burial] (Karlsruhe, Baden-Württemberg, Germany). Phase 3 (Br D) - Set of two balance weights (cat. no. 92, 98). Associations: bronze hinge (organic container?), two pin fragments.
- Wilmersdorf [site no. 155, burial] (Dahme-Spreewald, Brandenburg, Germany). Grave 99-103 (one of five graves). Phase 4 (Period IV-V) - Set of three weights (cat. no. 287, 422, 450).
- Steinfurth [site no. 137, burial] (Bad Nauheim, Wetterauskreis, Hessen, Germany). Phase 3 (Br D) - Set of twelve balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: two bronze hinges (organic container?), pin.

Czech Republic (Fig. 3.17.)

- Milavče [site no. 130, burial] (Bohemia, Czech Republic).
  - ▹ Tumulus C/1. Phase 3 (Br D) - Set of two balance weights (cat. no. 82, 302). Associations: bronze vase on wheels, two bronze cups, sword, razor, knife, two phalerae, four rings, 23 bronze sheet fragments, four pin fragments, rod fragment.
  - ▹ Tumulus C/4. Phase 3 (Br D) - Set of three balance weights (cat. no. 87, 312, 313). Associations: sword, spearhead, knife, pin fragment, three bronze sheet fragments, bronze fragment.
- Horušany [site no. 132, burial] (Bohemia, Czech Republic). Tumulus A. Phase 3 (Br D) - Part of a set of four balance weights (cat. no. 94, 103, 243, 304). Associations: three bronze hinges (organic container?), awl, three phalerae, stud, bronze fragment, pottery.

3.6. Hoards, caves, votive depositions, and potential shipwreck (Fig. 3.18.-19.)

3.6.1. General observations

The contexts described in this section belong to the least attested site-types with weighing equipment in Europe. They are also united by their extremely elusive connection with identifiable activities and identities, unlike settlement and burial contexts.

In first instance, their classification is not always clear-cut. The majority of the contexts considered here are normally classified as 'hoards', a rather generic term widely used in Bronze Age studies to define assemblages of metal objects buried simultaneously. Some weights and balances come from caves, but it cannot be excluded that at least some of them originally belonged to metal hoards – such as the find from Heathery Burn Cave in England (cat. no. 36, site no. 187) (Britton/Longworth 1968) – or were dedicated as votive depositions – such as the balance weight found in a natural niche inside a cave at Su Benticheddu in Sardinia (cat. no. 104, site no. 13), together with two complete bronze vases and an iron clamp (Lo Schiavo 1978). Let alone that caves themselves are often interpreted as ritual spaces in the Bronze Age, and at least one balance weight is part of the votive assemblage of the Nuragic Sanctuary of Abini, in Sardinia (cat. no. 714, site no. 12), which, in turn is often referred to as 'hoard' in the literature. Finally, the assemblage from Salcombe, retrieved on the sea bed off the south-western coast of England (cat. no. 102, 123, site no. 102), represents yet a different case: Interpreted as the wreck of two different cargo-ships (Berger *et al.* 2022), its composition is not substantially different from many hoards located on both sides of the channel (Harding 2013a). If this does not necessarily rule out the shipwreck hypothesis, then one cannot even exclude that other similar contexts – that we generically classify as 'hoards' – are in fact the remains of trade-related enterprises.

In a broader perspective, the interpretive challenges of this heterogeneous group of finds are somehow encompassed by the old debate around

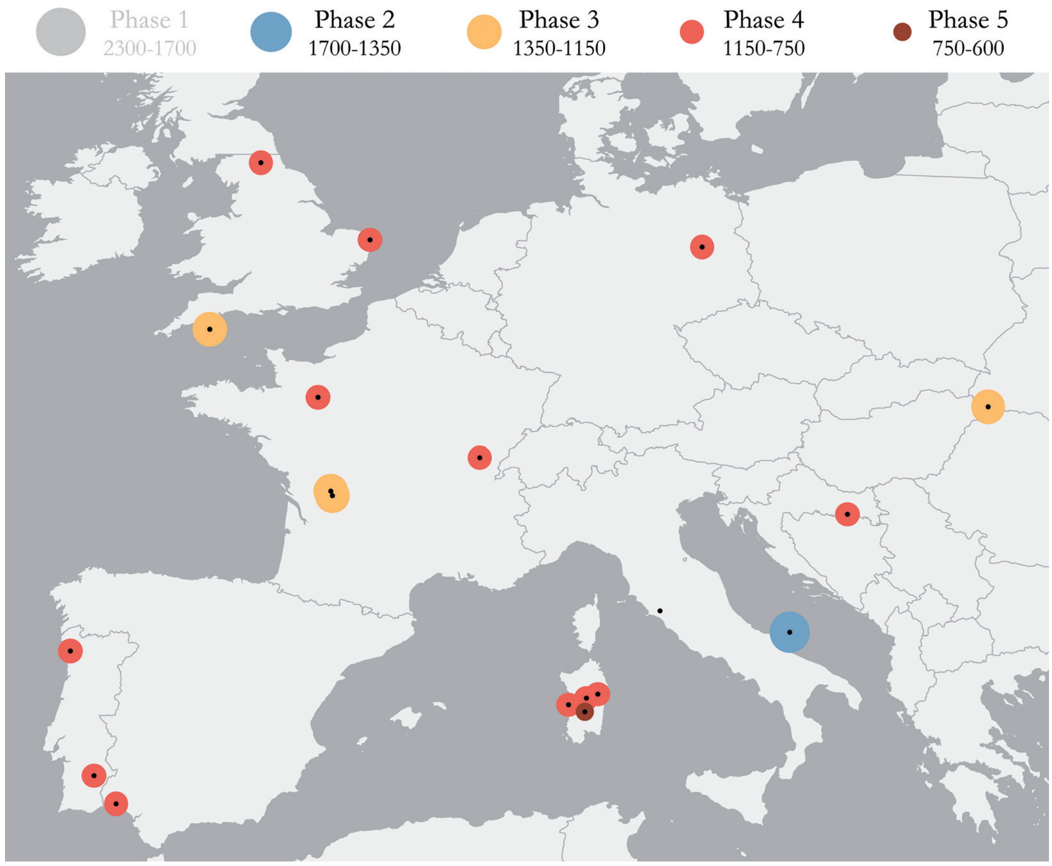


Fig. 3.18. Hoards, votive depositions, caves, and potential shipwreck: geographic and diachronic distribution.

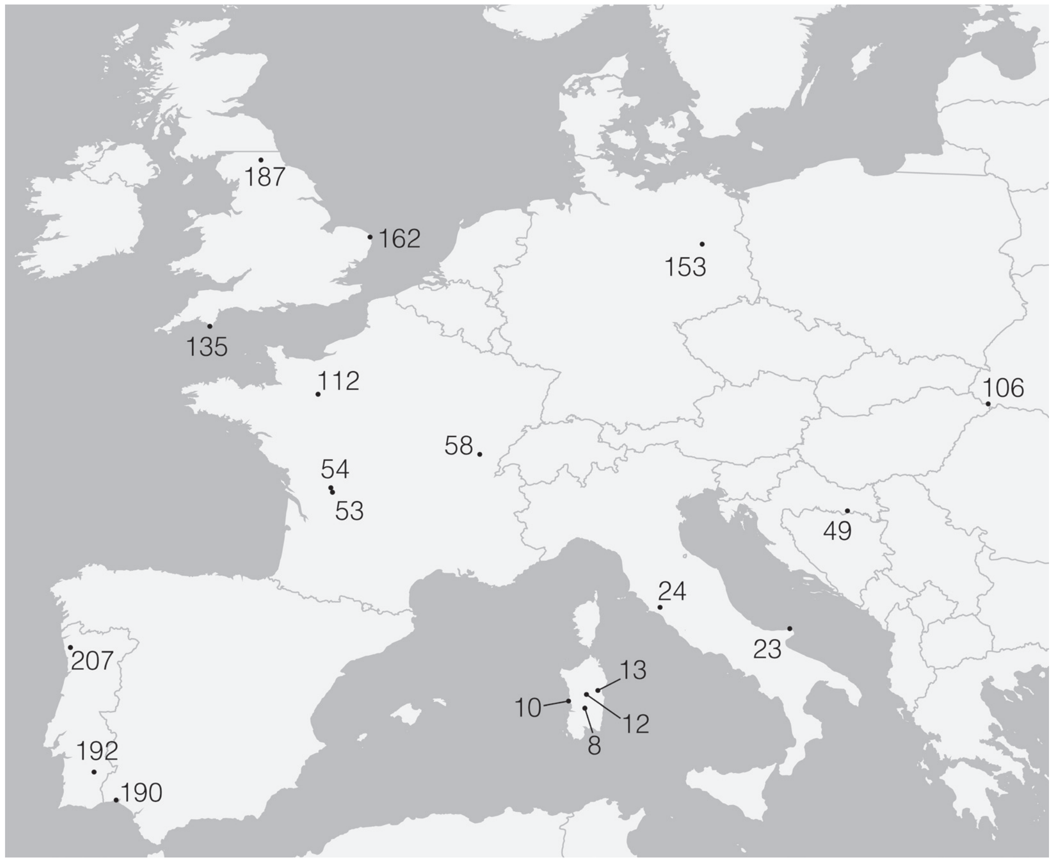
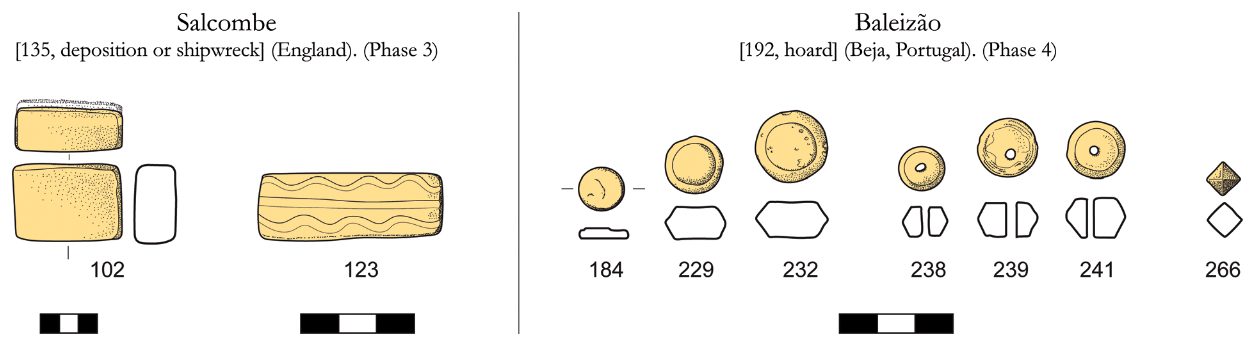


Fig. 3.19. ID numbers of the sites illustrated in fig. 3.18. 8 - Forraxi Nioi; 12 - Abini; 13 - Su Benticheddu; 23 - Grotta Manaccora; 24 - Grotta Nuova; 49 - Slavonski Brod; 53 - Vilhonneur, Grotte de la Cave Chaude; 54 - Agris, Grotte de Perrats; 58 - Les Genettes, Larnaud; 106 - Tiszabecs; 112 - Saint-Léonard-des-Bois; 135 - Salcombe; 153 - Krampnitz; 162 - West Caister; 187 - Heathery Burn Cave; 190 - Rìa de la Huelva; 192 - Baleizão; 207 - Bouça.

the interpretation of Bronze Age hoards writ large. To summarise, hoards are alternatively interpreted as votive depositions, metallurgists' stocks destined to be recycled, and temporary deposits of valuables which, for whatever reason, were never retrieved by their owners (Brandherm 2018; Lago 2020). While it is clearly not within the scope of this book to solve this riddle, one can nonetheless observe



▲ *Fig. 3.20. Weighing sets from a potential shipwreck (left) and from a hoard (right). Yellow filling: bronze.*

that, at least in theory, the presence of weighing equipment makes sense in either of these three scenarios, albeit in different ways. If one sees hoards as votive depositions, then weights and balances would have been selected by virtue of their symbolic significance. If the preferred hypothesis is either 'metallurgist's stock' or 'deposit of value', then the owner would have required weights to assess the value of the pieces of metal that were received or given out in payment. This is, however, nothing more than a dialectic exercise, and does not really add much to our understanding of weighing equipment in Bronze Age Europe. In conclusion, since the available evidence from hoards, in the term's broadest meaning, is scarce and scattered, it is unfortunately impossible for the time being to infer meaningful patterns.

3.6.2. Weighing sets from hoards/shipwrecks (Fig. 3.20.)

Salcombe [site no. 135, votive deposition or shipwreck] (Devon, England). Phase 3 (Penard, Ewart Park) - Set of two weights (cat. no. 102, 123).

Baleizão [site no. 192, hoard] (Beja, Portugal). Phase 4 (Atlantic FBA III) - Set of seven balance weights (cat. no. 184, 229, 232, 238, 239, 241, 266). Associations: three axes, seven bronze rings, six bronze fragments, three gold torques, seven gold fragments.

3.7. Concluding remarks

The associations between weighing devices and different types of archaeological contexts document a wide range of possible combinations. The most recurrent associations are connected to metalworking and metal hoarding, the latter intended as a generic accumulation of metal scraps. The frequent association with metals is in line with past research indicating that metal scraps in European hoards tend to comply with weight systems, and likely circulated as weighed money (Ialongo/Lago 2021; 2024). At the same time, it is very likely that the contextual evidence is affected by documentation bias in favour of metals. Metals and metalworking tools are, in fact, among the most durably preserved traces of economic activities in the Bronze Age. There are many other productive activities that may not leave as readable remains in the archaeological record, but this does not imply that they did not take place in connection with weighing equipment. The association with textile production, for example, is documented in a few cases by the association with spindle whorls and loom weights, but this association is significant only insofar as weighing devices were used to quantify the value of finished products in view of their selling. If there were, say, merchants dealing in textile trade but not in textile production, and we were to excavate their warehouses, we would probably find only balance weights and nothing else related to that same trade. Nonetheless, there is evidence of the use of weighing devices in connection with 'rare' economic activities such as dye production, which is also connected with textiles, and with simple domestic activities that do not even imply trade, such as cooking. Overall, the regular presence of weighing equipment in houses might simply mean that weights and balances were part of the standard equipment of Bronze Age households.

In burials, weighing equipment is associated with individuals that belong to all degrees of the standard tiered scheme in which archaeologists usually classify grave goods, encompassing alleged 'elite' and 'commoners' without distinction. Interestingly, gold fragments – the only proxy that can be loosely correlated with at least a vague notion of 'wealth' – occur indistinctly in high- as well as in low-rank burials, together with weighing equipment.

The comparative analysis shows that no exclusive pattern is visible in the distribution of weighing devices on a continental scale, neither in connection with their hypothetical use, nor in connection with particular social strata of the population. In other words, there is no evidence that weighing equipment was preferentially used in connection with particular economic activities, nor that it was significantly more associated with elites than with anyone else. The available data support a model of 'distributed use' of weighing devices, meaning that different economic activities and social strata had utility from the use of weighing equipment. This is in line with previous findings observing that monetary transactions carried out in weighed metal scraps tend to concentrate around low values, suggesting in turn that the bulk of monetary exchange was aimed to fulfil small-consumer demand in local markets (Ialongo/Lago 2024).

4 Bonze Age weight metrology and the making of a continental market

4.1. Introduction

Weight systems are the most direct, and to date only quantifiable proxy of economic interaction in prehistoric economies, as they emerge from the interaction between economic agents making use of weighing technology to quantify transaction values. Understanding weight systems, then, is a socio-economic problem. At the same time, their identification is a statistical problem. Understanding weight systems is vastly more complex and intriguing than just assigning arbitrary values in grams to ancient units. It requires departing from the classificatory exactitude that is so ingrained in the culture-historical tradition of the pre- and protohistoric archaeologies of the Old World, and embrace an unfamiliar framework grounded in indeterminacy. In practical terms, it requires giving up categorical variables in exchange for numeric ones. The trade-off is worth the price: We may lose the comfort of categories, but we gain the advantages of quantification. The purpose of prehistoric weight metrology is, then, to make sense of (some aspects of) prehistoric economies through quantitative means.

In the first part of this chapter, I will outline a model for Bronze Age weight units that will inform both the methodological and the interpretive frameworks. The model is largely grounded in empirical research I carried out during the last seven years in the framework of the WEIGHT AND VALUE Project, addressing the early manifestations of weighing technology and weight systems across Western Eurasia. The general views expressed in this chapter – especially those regarding the issue of accuracy – are in line with new approaches to Mesopotamian and Aegean Bronze Age metrology (Hafford 2012; Petruso 2019; *e. g.*, Chambon/Otto 2023).

The model's design is largely based on the evidence from Bronze Age Greater Mesopotamia, due to the unmatched quantity and quality of the available documentation, both archaeological and textual. The treatment of the Mesopotamian evidence pivots around the discussion of old but extremely influential models that are by some – although not by all – considered outdated. I would like to clarify that I do not discuss these models because I consider them to be representative of current research on Mesopotamian metrology, but because they are instrumental in making a point. After many conversations I had in the past few years with colleagues and friends who are not specialists in the field of ancient metrology, I have come to realise that such old models are, in fact, very accurate representations of how non-specialists conceptualise ancient weight units through the lenses of common-sense. The point I wish to make, then, is that common-sense is not adequate to understand pre-metric weight units, which instead requires a great deal of counterintuitive reasoning – and some basic statistics – as more and more Bronze Age metrologists are coming to acknowledge.

Some of the hypotheses that constitute the backbone of my model could be tested thanks to experimental research conducted by R. Hermann in collaboration with expert bone carvers and stone masons (Hermann *et al.* 2020; Ialongo *et al.* 2021). The model itself was tested based on a large database of Western Eurasian balance weights, fully published in Ialongo *et al.* 2021.

The chapter continues with the description of the analytical methodology and the illustration of its results. The last two parts are devoted to outlining a model for the origin of weight systems in Western Eurasia, and to explore the connection between weight systems, the origin of money, and the formation of an integrated market in pre-literate Bronze Age Europe.

4.2. The quest for the unit

4.2.1. A unit is not a number

The model outlined in this chapter is based on a simple, fundamental axiom: A unit is not a number. Any attempt to assign an exact value in grams to a pre-metric unit is an entirely arbitrary and largely futile endeavour, doing little more than pretending to 'translate' for a modern audience something that its original users always perceived as '1'. The fallacy of reducing ancient units to the metric system was impeccably introduced by W. Kula (1986, 98-99) in his seminal work on the systems of measurement of Medieval Europe:

[The goal of historical metrology] *will not be achieved if its aims are narrowly restricted in the traditional manner as being "to ascertain precisely the terminology of former measures, to reconstruct the system of measurement, and to calculate the values of the measures of yesteryear, as well as to translate them into the units in use today." For this conception of the scope of historical metrology has, on the one hand, deprived it of the opportunities of tackling problems of the greatest scientific interest and, on the other, has led on occasion to skepticism and cognitive pessimism among its students and, still more, among historians wishing to utilize the data from historical metrology. To convert old time measures into the units of the metric system is often, in fact, not a feasible task, and results of such attempts, however painstaking, are often of little practical use, because even the most meticulous determination of the dimensions of, say, the łan* [*i. e.*, a unit of field measurement in use in medieval Poland] *could not be extensively utilized when even neighboring villages in the same year, more often than not, would have łans of different sizes. The skepticism and the cognitive pessimism were therefore quite often by no means groundless.*

Yet, when the historian succeeds in uncovering the social import of a given measure, although this may not tell him much of what he wants to know then (such as the correct metric equivalent), it may offer him an opening leading to many other, possibly more important, matters.

The concerns expressed by W. Kula (1986) are slowly being incorporated in the scientific discourse on Bronze Age metrology, which has been otherwise dominated by the quest for exact units for roughly a century. As I show in this section, both theoretical modelling and the empirical evidence lead to reject the idea of Bronze Age weight units as exact values, while supporting a model of units as indeterminate intervals.

4.2.2. The many units of Bronze Age Mesopotamia

Bronze Age Mesopotamia is the ideal starting point for a reflection of Bronze Age weight units in Western Eurasia. There is no doubt that the Mesopotamian weight system is the best documented one in the Bronze Age world, thanks to the abundance of written and archaeological evidence. It is a well-known fact that the Mesopotamian weight system – as virtually any pre-metric system of measurement – had different names to identify different orders of magnitude of the same quantity, *i. e.*, mass. The most frequently used orders of magnitude – or 'units,' as they are always designated in common language – were the *shekel* and the *mina*, with the *grain* and the *talent* being somewhat less represented. To simplify an utterly complex problem to its core, the *shekel* – a word of Semitic origin literally meaning 'weight' – was a small unit whose value is conventionally fixed at 60 times the value of the *grain* and $^1/_{60}$ the value of the *mina*, the latter being in turn $^1/_{60}$ the value of the *talent* (Powell 1987).

Trying to determine the exact value in grams of the *shekel* and the *mina* has been a primary focus of research in ancient metrology spanning the last 100 years or so. While most researchers agree that the most frequent value of the *shekel* should be fixed at *c.* 8.3-8.5 g, there are hints that seem to suggest the coexistence of *shekels* of different values. Based on the analysis of a small sample of balance weights from the Bronze Age city of Ebla (Syria; objects dating mostly to *c.* 2000-1700 BCE), A. Archi (1987) proposed the coexistence of three different *shekels*: an 'Eblaite' or 'Syrian *shekel*' of 7.8 g, a 'Levantine *shekel*' of 9.4 g, and an 'Anatolian *shekel*' of 11.75 g. A. Archi's attempt to identify different *shekels* for the Early Bronze Age (*c.* 3000-2000 BCE) and Middle Bronze Age (*c.* 2000-1700 BCE) mirrors a slightly older study by N. Parise (1981), focussing on Mesopotamian weight metrology of the Late Bronze Age. N. Parise identifies exactly the same values and designates them with the names of the cities that would have allegedly adopted them as official: the *shekel* of Carchemish, the *shekel* of Khatti, and the *shekel* of Ugarit. Both A. Archi's and N. Parise's metrological reconstructions of the weight systems of the Ancient Near East have since established themselves as highly influential – equally among supporters and critics – and provided the benchmark for later research.

From a historical perspective, the hypothesis that Early Bronze Age units were created in the very same regions where they eventually became official centuries later is certainly appealing. This hypothesis, however, is based on a biased perception of the nature of ancient weight units, and is not ultimately supported by the evidence. State-of-the-art statistical analyses based on a sample of thousands of balance weights clearly show that there is no ground to assume the existence of any other unit than the so-called 'Mesopotamian *shekel*' of *c.* 8.3-8.5 g in the Early and Middle Bronze Age (Ialongo *et al.* 2021). If we conceptualise Bronze Age units as values expressed in grams, the empirical evidence might then give the impression that the 'right' value of the Mesopotamian *shekel* is 8.3 g, while any other suggested value is 'wrong'. This impression would be profoundly mistaken: All the proposed values – including the supposedly correct one – are, in fact, 'right' and 'wrong' at the same time.

4.2.3. The indeterminacy of Bronze Age units

From a purely mathematical perspective, the most fundamental flaw in traditional approaches to Bronze Age metrology is to conceptualise weight units as 'values' while they are, in fact, 'intervals' (Ialongo 2019; Petruso 2019; Chambon/Otto 2023). Before proceeding, it is crucial to keep in mind that all relative error estimates reported in this book are always intended in terms of Coefficient of Variation (CV) at one Standard Deviation (SD). Since it is a proven fact that the distribution of weight units follows a normal distribution, the CV offers a very accurate estimate of their relative error. This also means that the complete error range must be intended in terms of three standard deviations, as is good practice with normal distributions. For example, a distribution with mean 10 g and CV 5 % will have a total error range comprised between 8.5 g (*i. e.*, 10-0.5*3) and 11.5 g (10+0.5*3). In other words, the complete interval that defines Bronze Age units is always equal to the average value of the distribution plus or minus three times the CV.

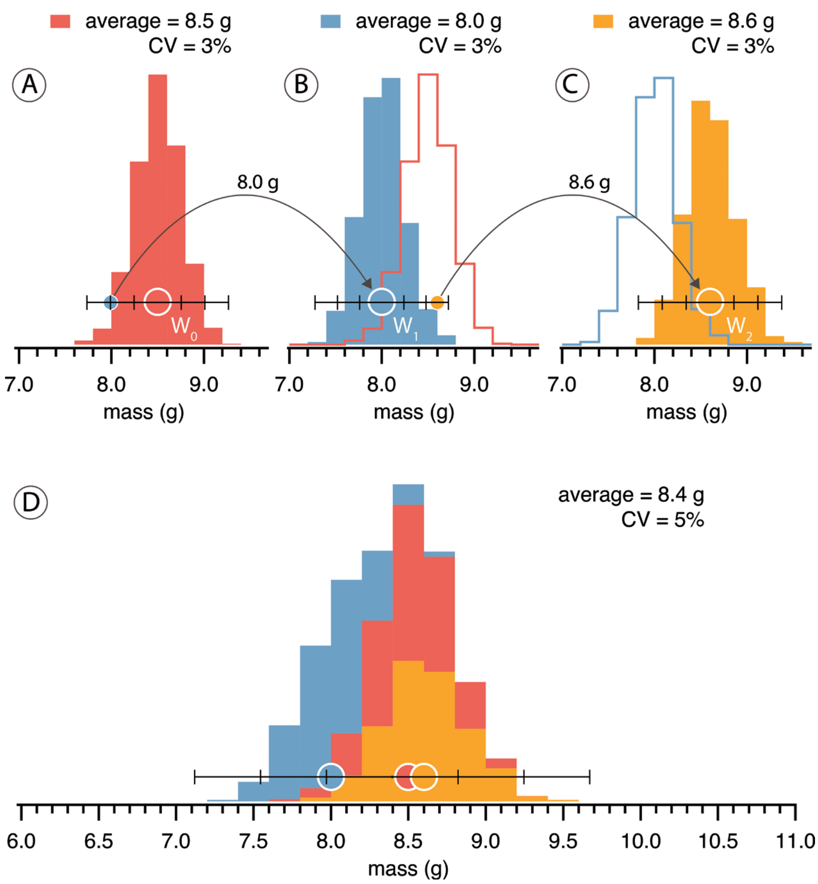
It has been a well-known fact since the dawn of Bronze Age metrology that ancient weight units are arrays of normally-distributed values (Weissbach 1907; 1916; Viedebantt 1917; *e. g.*, 1923). This can be easily demonstrated empirically, simply by plotting the binned distribution of balance weights, as shown in several publications (Parise 1970; *e. g.*, Hafford 2012; Ialongo *et al.* 2018a). More specifically, weight units are distributions of values that are symmetrical about their mean, and whose probability decreases progressively the farther away they get from the mean value, until becoming negligible. Units are ranges of values – *i. e.*, *intervals* – comprised between a minimum and a maximum value that are, in turn, equidistant from, and symmetrically positioned about their median point. Weight units are, in other words, indeterminate by definition.

The next step to frame the nature of Bronze Age units is then to quantify their inaccuracy and identify its causes. Inaccuracy has two prime determinants: instrumental error and propagation of uncertainty. Instrumental error (or systematic error) is an inherent component of any measurement instrument. No matter how technologically advanced, a measurement instrument will always produce a discrepancy between the observed value of a measurable quantity and its 'true' unknown value. Some measurement instruments have an absolute error, *i. e.*, the error remains constant independently from the size of the observed quantity, corresponding to the smallest value that the instrument is designed to measure; a standard ruler, for example, as a systematic error of 1 mm, as 1 mm is the smallest measurable value. Other instruments have, instead, a systematic error that is relative to the quantity being measured. Relative error is crucial to understand Bronze Age weight systems, as it is embedded in the only mass-measuring tool known at the time: the equal-arm balance. Equal-arm balances effectively provide what in hard sciences is called a 'null-measurement', a measurement technique that involves comparing an unknown quantity with a known quantity of the same type – in our case, mass. This comparison is repeated until the instrument registers zero (= null) response – *i. e.*, until the balance beam is in equilibrium – indicating equality between the two quantities. Notably, the systematic error of null-measurement techniques is always relative to the quantity being measured.

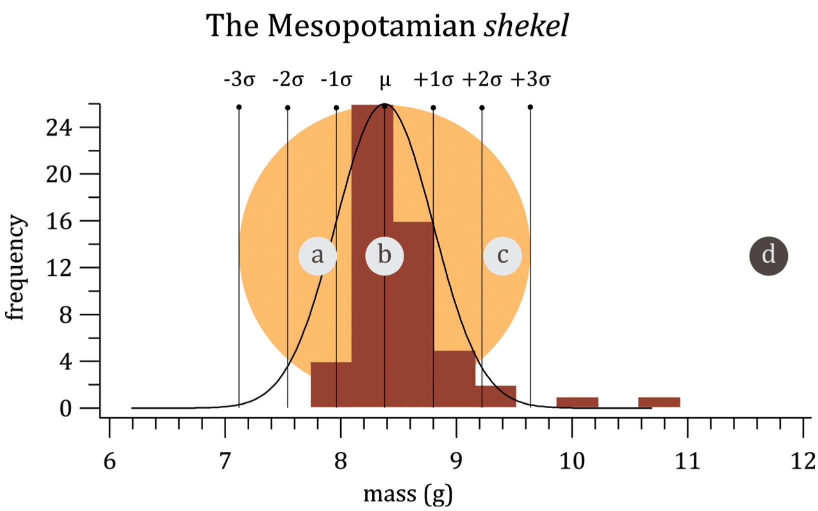
The next problem to solve is how to quantify this error. Ancient users were already well aware of the inaccuracy of their balance scales (Joannès 1989). Based on detailed reports provided by cuneiform texts, the instrumental error of Bronze Age balances can be estimated at *c.* 3 % (Powell 1979). Experiments based on accurate replicas of Bronze Age balance beams and weights confirm this estimation (Ialongo *et al.* 2021).

The inaccuracy of balance scales provides only a partial explanation for the overall statistical dispersion of Bronze Age units. The second determinant factor is the propagation of error caused by the repeated creation of new balance weights. A striking majority of all the Bronze Age balance weights known in Western Eurasia is made of stone. While the available evidence seems to indicate a preference for metal in some areas of Greece in the Late Bronze Age (Petruso 1992), 70 % of the balance weights of pre-literate Bronze Age Europe included in this book and nearly all the weights known between Mesopotamia and the Indus Valley are made of stone (Ascalone/Peyronel 2006; Kulakoğlu 2017; *e. g.*, Ascalone 2022; Rahmstorf 2022). Stone weights, then, make up for most of the statistical variability of the sample, and offer an ideal benchmark to address how the creation of new balance weights affects the overall statistical dispersion of Bronze Age units.

Null-measurements require a reference quantity. Imagine a prototype weight (which we will call W_0) weighing exactly 8.5 g, serving as a reference quantity – *i. e.*, a model – to make new ones. To make a new weight (W_1), we would take a stone of the appropriate material with mass greater than W_0, and carve it down to shape, repeatedly checking the mass of W_1 against the mass of W_0 on an equal-arm balance, until the beam is in equilibrium. Since Bronze Age balance beams have a systematic error of 3 %, the final mass of W_1 will have a normally-distributed probability of falling anywhere within an interval of ± 9 % from the value of W_0, *i. e.*, between 7.735 g and 9.265 g. If we repeat this process, say, 1,000 times, the result will be a normally-distributed sample with average 8.5 and CV 3 % (Fig. 4.1.A). This explains the instrumental error of 3 % affecting all the balance weights produced using exactly the same prototype. This is, however, an extremely unlikely scenario: It is impossible that all the balance weights of the Bronze Age were modelled after the same prototype. The only solution is to assume that potentially any weight modelled after W_0 was subsequently used as a prototype to make new weights, and so on for an indefinite number of prototypes and replicas. Each time a new prototype is picked from one of the 'tails' of the original distribution, the error will propagate,



▲ *Fig. 4.1. Propagation of uncertainty: a visual model of the formation of new weight systems.*
A: formation of a normally-distributed sample of 1,000 balance weights with CV = 3 %, starting from a prototype of 8.5 g (called W0 in the text);
B: formation of a normally-distributed sample of 1,000 balance weights with CV = 3 %, starting from a prototype of 8.0 g (W1, randomly picked from the previous distribution);
C: formation of a normally-distributed sample of 1,000 balance weights with CV = 3 %, starting from a prototype of 8.6 g (W2, randomly picked from the previous distribution);
D: final normally-distributed population, including all previously generated samples, with mean = 8.4 g and CV = 5 %.



▲ *Fig. 4.2. The indeterminacy of weight units. Binned frequency distribution of the unit-value of Mesopotamian inscribed weights of the Early and Middle Bronze Age, obtained by multiplying the mass of each weight by the fractional value indicated by the inscription (full dataset published in* Ialongo *et al. 2021). Mean= 8.4 g, CV= 5 %. Vertical lines indicate the Standard Deviations of the distribution. Exact values of alleged units frequently cited in the literature: A) 'Syrian unit' (7.8 g); B) 'Mesopotamian unit' (8.4 g); C) 'Levantine unit' (9.4 g); D) 'Anatolian unit' (11.75 g).*

consequently enlarging the interval of the unit. Fig. 4.1. illustrates this process. The second prototype is a weight with mass 8 g, picked from the left side of the original distribution. If we use this prototype to build another batch of 1,000 weights, we will have another normal distribution, with the same CV but with mean= 8 g (Fig. 4.1.B). We repeat the process one more time, this time picking a new prototype of 8.6 g from the right side of the distribution, and we obtain yet the same result (Fig. 4.1.C).

At the end of the experiment, we obtain three normally-distributed samples with slightly different means. We can tell that these distributions are in fact slightly different because we obtained them through a controlled experiment, each time using a different prototype and noting down each step carefully, so that we always know exactly which weight was made based on which protype. But what if the experiment was made by someone else, and we did not know which weight was made based on which prototype? Would we be able to make out the three different concentrations, and figure out not only that they were obtained using three different prototypes, but also the exact value in grams of each prototype? The answer is no. Fig. 4.1.D clearly shows that the three distributions seamlessly blend into one another, and that in doing so they create yet another normal distribution, but this time with mean 8.4 g and CV= 5 %.

What I have just illustrated is a simplified model derived from scientific data gathered in a real experiment conducted by R. Hermann in collaboration with an expert stone mason (Ialongo *et al.* 2021). The experiment confirms that the reiterated production of balance weights starting from randomly-picked prototypes propagates the initial instrumental error of 3 % until eventually settling around a CV of *c.* 5 %. This experiment provides the expectations to be tested against the archaeological data. The analysis of the complete dataset of inscribed balance weights in Bronze Age Western Eurasia confirms the expectations. If we divide the mass values of each inscribed weight by the fractional value indicated by their inscriptions, then we can easily quantify the statistical dispersion from the expected value – which, by definition, is always '1' – and the measured value. The results indicate a CV of 5.4 % for Bronze Age units (Fig. 4.1.D) and confirm the expectations derived from experimental replicas.

4.2.4. The 'right' unit

Experimental research and archaeological data demonstrate that Bronze Age units are not exact values, but rather indeterminate, normally-distributed intervals. But how does this help us in our quest for the unit? And how can we use this knowledge to decide which of the many units that have been proposed in the past is 'right,' and which one is 'wrong'?

These questions can now be answered empirically. The graph in fig. 4.2. shows the distribution of the mass values obtained by dividing the observed mass of Mesopotamian inscribed weights of the 3rd and early 2nd millennium by the fractional value indicated by the inscriptions. Inscribed weights undoubtedly represent the best way in which we can reliably identify how ancient users perceived their units of measurements. As expected, the graph shows a normally-distributed concentration with average 8.4 g and CV ≈ 5 %. If we take the exact values of the different units that have been proposed in the past and overlay them on the graph, we can finally answer our question. The 'Syrian' (7.8 g), 'Mesopotamian' (8.4 g), and 'Levantine' (9.4 g) units all comfortably fall within two Standard Deviations from the distribution mean (Fig. 4.2.). The 'Anatolian unit' of 11.75 g, on the other hand, not only falls well outside of the interval, but does not actually correspond to the fractional value of any known inscribed weight. In conclusion, the 'Syrian', 'Mesopotamian', and 'Levantine' units are all randomly-picked values that belong to a normally-distributed interval that its ancient users always perceived as one *shekel*. They are, in other words, *the same unit*. On the other hand, the 'Anatolian' unit of the Early and Middle Bronze Age is, based on the available evidence, a false positive. That the users of weighing technology did not normally differentiate between different competing systems is also indirectly confirmed by the fact that only *c.* 3 % of the Mesopotamian balance weights of the Early and Middle Bronze Age actually bear marks and inscriptions indicating their fractional values (Ialongo *et al.* 2021).

Far from reflecting a historical reality, the proliferation of different units in metrological research is rather an academic artefact, likely depending on the sampling strategy of previous studies. A sample of limited size, as well as a sample drawn from a single site or a single chronological phase, can have been randomly drawn from one of the extremes that compose the overall interval of the unit, and is therefore likely to give biased results. At the same time, this does not imply that these results are necessarily 'wrong'. As far as we know, almost all the values that have been proposed are equally good candidates to represent the 'original unit'. The model in fig. 4.1. shows that the final value of the unit does not precisely correspond to any of the initial values that were used to create it. Which means, in turn, that the 'original Mesopotamian unit' can be one among the ones that have been proposed in the past, as well as none. In more general terms, the Mesopotamian evidence provides the blueprint to frame the nature and the formation of weight units across Western Eurasia in the Bronze Age.

4.2.5. Units and power

Thinking of weight units as indeterminate intervals generated by chance raises a fundamental question: If weight units are the outcome of a random process, how is it possible that their overall dispersion never significantly exceeded a CV of 5 %? The answer, one might argue, is to be found in the regulatory action put in place by central authorities. Before proceeding with addressing the relationship between weight units and power in the Bronze Age, it is first necessary to clarify the cultural-evolutionary context of the appearance of weights and balances.

Weighing technology is one of the great original innovations of the Bronze Age. It was invented *c.* 3100 BCE between Mesopotamia and Egypt, and in the course of the next 2,000 years it spread to then Indus Valley, Anatolia and the Aegean (*c.* 2800 BCE), Italy (*c.* 2300 BCE), Central Europe and the British Isles (*c.* 1350 BCE), and Atlantic Europe (*c.* 1200 BCE). Each time it was adopted in a new region, weighing technology inevitably gave rise to the formation of a new weight system (Ialongo *et al.* 2021). Before weights and balances were invented, no objective frame of reference existed that could allow anyone engaging in an economic transaction to quantify and convert the value of a substance into that of any other substance on the marketplace (Renfrew 2012). This ignited a revolution in trade, whose long-lasting consequences are still very much evident today (Ialongo/Vanzetti 2016).

It is this character of disruptive originality that makes the formation of primary weight systems in Western Eurasia a unique case study in the long history of the relationship between units of measurement and power (Kula 1986), and hence not necessarily comparable with later developments. With the term *'primary weight system'* I designate a weight system that arises in a given region contextually with the first adoption of weighing technology. Hence, in a way, asking whether central authorities plaid a determinant role in the formation of primary weight systems touches on the more general question of the relationship between power and technological innovation.

Outside of Mesopotamia and Egypt, primary weight systems emerged in the Indus Valley, Anatolia, Greece, Italy, Central Europe, the British Isles and the Iberian Peninsula. Each of these regions was characterised by a different and peculiar socio-political setting, and yet in all cases the resulting units never exceeded a CV of *c.* 5 %. This has crucial implications: if the outcome was the same everywhere between the Atlantic and the Indus Valley regardless of cultural peculiarities, it follows that any interpretive model must be equally applicable to all socio-cultural contexts of Bronze Age Western Eurasia, and cannot admit particularisms. This means, in turn, that the agency of central authorities cannot have been the primary determinant factor in regulating the statistical dispersion of weight units, simply because central authorities did not exist in some of these regions during the Bronze Age.

Centralised regulatory action could have occurred in Egypt and Mesopotamia. A determinant role of central authorities is, however, much less likely for western Anatolia and Greece, where centralisation was only at an incipient stage during the Early Bronze Age (Frangipane 2012; Özdoğan 2023). Centralised regulation is ultimately not a viable option for pre-literate Bronze Age Europe – *i. e.*, west of Greece – where far-reaching central authorities simply never existed until the first half of the 1st millennium BCE (*e. g.*, Harding 2000; Kristiansen/Larsson 2005), and even then, only in circumscribed regions of the Mediterranean coast (Pacciarelli 2001; Cardarelli 2018; Stoddart 2020).

There are also reasons to think that, even in Mesopotamia, public authorities did not necessarily play a determinant role in the formation of primary weight systems for roughly a millennium. As both archaeological and textual evidence attest, weight systems appeared and were widespread already on the verge of the 3rd millennium BCE (Powell 1979; Ialongo *et al.* 2021; Rahmstorf 2022). And yet, despite the pervasiveness of weighing technology, there is no evidence of the existence of a 'royal standard' until 2112-2095 BCE, roughly 1,000 after the invention of weighing technology. And even then, the textual evidence does not imply the creation of a new unit, but simply the ratification of a pre-existing one (Frayne 1997; Wilcke 2002; Chambon 2011, 38-41). Evidence of top-down control is also absent for the Indus Valley in the Early Bronze Age, where most balance weights come from domestic contexts, and the very existence of strongly centralised power is questionable (Green *et al.* 2023, 105-147).

The evidence available for profoundly different socio-economic contexts across Western Eurasia suggests that primary weight systems did not require centralised power to flourish. Primary weight units are never created by central authorities, nor are they 'norms' in themselves, although they can be eventually sanctioned by official regulations. Actually, pre-metric units in general are never 'created' by political power, the metric system being as a matter of fact the first – and to date last – instance of a measurement system that was created from scratch under the initiative of a political authority (Kula 1986). Primary weight units, then, are not even necessarily attributes of power, to the extent that they are clearly widespread even where power is comparatively weak.

4.2.6. Units and networks

Since top-down control is insufficient to explain the evidence, bottom-up convergence could offer a viable alternative (Ialongo *et al.* 2018b). A vastly interconnected network of economic agents could effectively regulate the statistical dispersion of weight units by systematically excluding aberrations, and making sure that the overall dispersion did not exceed the customarily-accepted range.

The recent history of units of measurements offers a glimpse into how units can emerge out of custom. In 1866, American oil producers reached an agreement and established the standardized measurement for oil known as the 'oil barrel,' still used today in the US. Prior to this, during the early years of oil extraction in the US, there was no specific container for oil, so it was transported in reused wooden barrels originally used for various goods such as fish and whiskey. These barrels typically held around 42 gallons (approximately 160 l), and were intended to contain approximately 'as much as a man could reasonably wrestle.' The surge in oil production in the early 1860s eventually led to a shortage of wooden barrels, prompting the production of specialized containers for the oil market, which was finally standardized at 42 gallons (AOGHS 2013).

While merely an anecdote, the story of the oil barrel offers a compelling insight into how units of measurement can evolve from customary practices, even in the industrial age. Notably, the 'standard quantity' was already widely used before its official recognition as a unit of measurement, echoing the way ancient Near Eastern reforms solidified pre-existing standards. Organizational convenience drove the adoption of the 42-gallon barrel, as both sellers and buyers were accustomed to the average quantity in which the product was shipped. Therefore, formalizing an already customary measure as the 'official' one likely appeared as the most practical choice for all involved parties. In essence, the endorsement of the unit of measurement served to regulate a specific instance of market exchange already governed by customary norms and a well-established framework of habit and trust.

The notion that official units can emerge from customary standards is not novel in Bronze Age studies. M. Lenerz-de Wilde (1995), C. Pare (2013), R. Peroni (1998), M. Primas (1997), and C. Sommerfeld (1994), for example, all argued that the earliest European standards may have evolved from widely distributed ingot-like objects, such as torcs, axes and sickles, spanning the Early and the Late Bronze Age. As for the Ancient Near East, M. A. Powell (1987) suggests a shared etymology of the term '*shekel*' and the Sumerian word for 'axe', implying that the term initially referred to axes as approximate standards. Additionally, the Sumerian, Akkadian, and Greek words for '*talent*' all essentially mean 'burden/load', hinting that a talent represented 'as much as a man can carry', which in turn closely parallels the origins of the oil barrel, derived from recycled containers and purportedly chosen to hold 'as much as a man could reasonably wrestle'.

Whether the actual likelihood of these 'origin stories' may or may not be the point, the idea of a bottom-up, relationally-defined convergence offers a viable alternative to the top-down normative model. The bottom-up hypothesis is also in line with the increasingly influential idea that Bronze Age Western Eurasia was tied together by a vast, decentralised trade network largely driven by the need to procure tin and cooper (Earle *et al.* 2015; Vandkilde 2016; Kristiansen 2018b; Murray 2023). Finally, the bottom-up hypothesis does not imply that central authorities, where they existed, did not play any role in regulating the statistical spread of weight units. Actually, quite the opposite. Central authorities, to the extent that they themselves constituted economic subjects dealing in weight-based trade, contributed to the bottom-up regulation of weight units proportionately to their economic capacity and relative share of connections within the network. And since strong authorities tend to be outstanding in both aspects, they can be expected to individually contribute more than any other private subject to the overall bottom-up regulation mechanism, even without necessarily relying on normative enforcement.

4.2.7. A model for Bronze Age weight units: recap

The following scheme summarises all the considerations expressed so far, that ultimately constitute the salient traits of my working model of Bronze Age units.

<u>What a weight unit *is not*:</u>

- A weight unit is not a number, and even less an exact value expressed in grams. A weight unit is never 'precise', and its accuracy cannot be quantified in absolute numbers. A weight unit is never created by a political authority (at least, not until the French Revolution), it is not necessarily a norm, and it is not necessarily an attribute of power.

<u>What a weight unit *is*:</u>

- A weight unit is a normally-distributed interval (with conventional CV of *c.* 5 % in the Bronze Age), with all the values included in this interval being always perceived as '1' by their ancient users. Weight units emerge from networks of economic agents (including both private and public ones), and they are customarily regulated from the bottom-up.

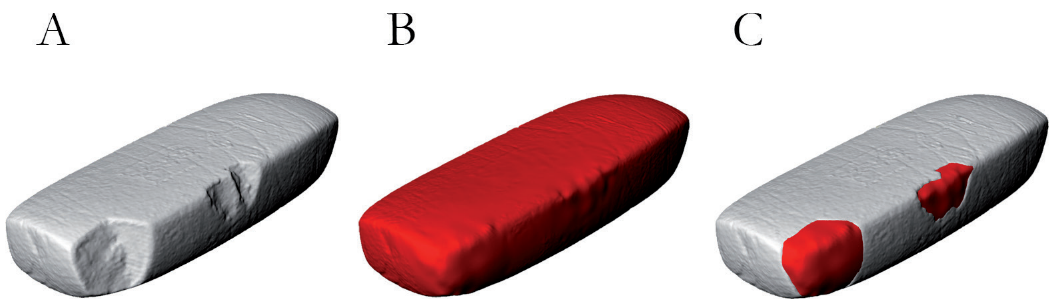


Fig. 4.3. Example of 3D reconstruction of a chipped weight.

This model constitutes the groundwork for the methodological and interpretive frameworks illustrated below.

4.3. Methods

4.3.1. Premise

I have addressed the identification of weight units in pre-literate Bronze Age Europe in several published works. Previous analyses have allowed me to confidently identify two relevant units: a *shekel* of *c.* 10 g (Ialongo 2019; Ialongo *et al.* 2021), and a *mina* of *c.* 450 g (Ialongo/Rahmstorf 2019; 2022). The analyses illustrated here do not add any significantly new result. This book, however, provides the opportunity for an extensive recap of the methodology, a reassessment of its strength and weaknesses, and most importantly an exhaustive discussion of its results.

My choice of using terms like *shekel* and *mina* to identify, respectively, a 'small' and a 'heavy' unit – as well as the choice to assign these units approximate values in grams – is entirely arbitrary and conventional. It is simply meant to aid the reader by reducing a continuous reality to a discrete, simplified framework, that takes its inspiration from a terminology in common use in a field of study – the archaeology of the Ancient Near East – where the values of the *shekel* and the *mina* can be approximately identified thanks to the rich textual record and the occasional occurrence of inscribed weights. Therefore, the use of this terminology should not in any way be taken to imply any direct connection of European units with the Mesopotamian units with the same names.

The sample of balance weights included in this study – its typology, chronology, geographical distribution, and find contexts – have already been described in detail in Chapters 2 and 3.

4.3.2. Reconstruction of chipped weights

The statistical analyses were conducted only on complete and reconstructed weights. For previously published weights, the mass values used for the analyses are the ones given in the original publications. For previously unpublished weights that I documented in museums and excavation storerooms, I used a 2-digit precision balance for objects weighing up to 500 g, and a 0-digit precision balance for weights above 500 g. Chipped weights were subject to 3D scanning, and were digitally reconstructed in order to reconstruct their original mass. This procedure was only applied in case of limited damage, and only when the original shape of the object could be easily reconstructed, such as in the example in fig. 4.3. I used an Artec Spider portable 3D scanner to acquire the 3D models of the objects. The 3D meshes of the scanned objects were modified with the free 3D sculpting software Sculptris. Finally, the volumes of both the original and reconstructed 3D mesh were measured with Rhinoceros 3D, and the hypothetical mass of the reconstructed weight was calculated based on density.

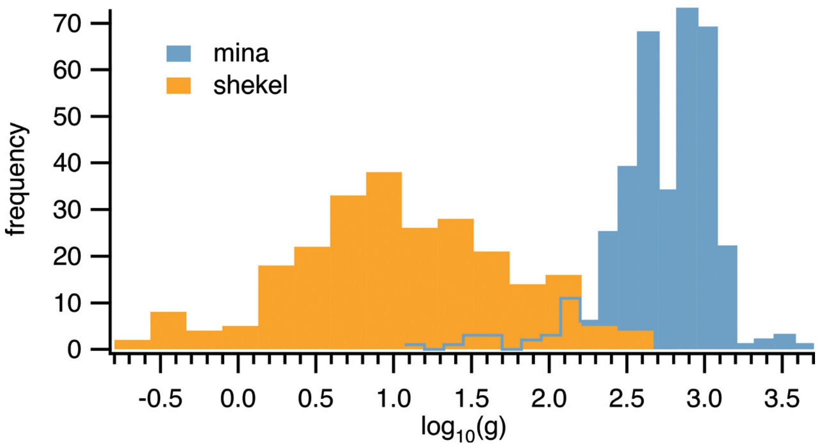
4.3.3. Cosine Quantogram Analysis

Cosine Quantogram Analysis (CQA) is the most reliable analytical technique in metrological studies of the Ancient World. CQA was initially devised in 1974 by the statistician D. G. Kendall (1974). It was employed in weight metrology for the first time in the 1990s (Petruso 1992), and has been further developed in subsequent years (Pare 1999; Rahmstorf 2010; Pakkanen 2011; *e. g.*, Hafford 2012; Ialongo *et al.* 2021; Poigt 2022).

CQA is a non-inductive method that allows to determine if a sample of metrical observations is the product of one or more basic units, by looking for *quanta* in a distribution of mass values. A *quantum* is a single value for which most of the mass values in a sample are divisible for a negligible remainder. If the sample is 'quantally configured' (*i. e.*, if most of the values are divisible by the same number), then most values will give a round rational number when divided for the best quantum. All values are divided by a series of quanta and the analysis gives positive results for those quanta that give a negligible remainder for most of the values in the distribution. CQA tests whether an observed measurement X is an integer multiple of a quantum q plus a small error component ε. X is divided for q and the remainder (ε) is tested. Positive results occur when ε is close to either to 0 or q, *i. e.*, when X is (close to) an integer multiple of q:

$$\phi(q) = \sqrt{2/N}\ \sum_{i=1}^{n}\ \cos\left(\frac{2\pi\varepsilon_i}{q}\right)$$

Where N is the sample size, and $\varphi(q)$ is the test-statistic. The resulting graph shows peaks where a quantum gives a high positive value for $\varphi(q)$, which indicates, in turn, that the correspond-



▲ *Fig. 4.4. Orders of magnitude of European balance weights. Binned frequency distribution of the logarithms of the mass values of the balance weights in the shekel- and mina-ranges.*

ing quantum is a 'good fit' (Ialongo 2019; the online version of the article contains a downloadable applet for the calculation of CQA).

4.3.4. Subsampling

CQA is characterised by several limitations, that can be overcome through a mindful sub-selection of the sample of balance weights. I will enumerate such limitations, and eventually establish the subsampling value-ranges.

4.3.4.1. *Shekel*-range *vs mina*-range

The presence of different orders of magnitude with dedicated units significantly impacts the analytical strategy. Fig. 4.4. illustrates a comparison between the logarithmic distributions of the mass values of the balance weights in the *shekel* and *mina*-ranges, showing that the two orders of magnitude have neatly distinct concentrations, only marginally overlapping. This data-configuration strongly suggests the existence of two distinct orders of magnitude, and warrants a separate analysis of the two datasets. Since CQA cannot simultaneously address datasets spanning several orders of magnitude, the *shekel* and *mina*-ranges will be analysed separately.

4.3.4.2. CQA can test multiples, but not fractions

One of the limits of CQA is that it can assess potential multiples of a target quantum, but not its fractions. The most direct consequence is that the analysed dataset must be composed of measurements that are approximately equal to or higher than the target quantum.

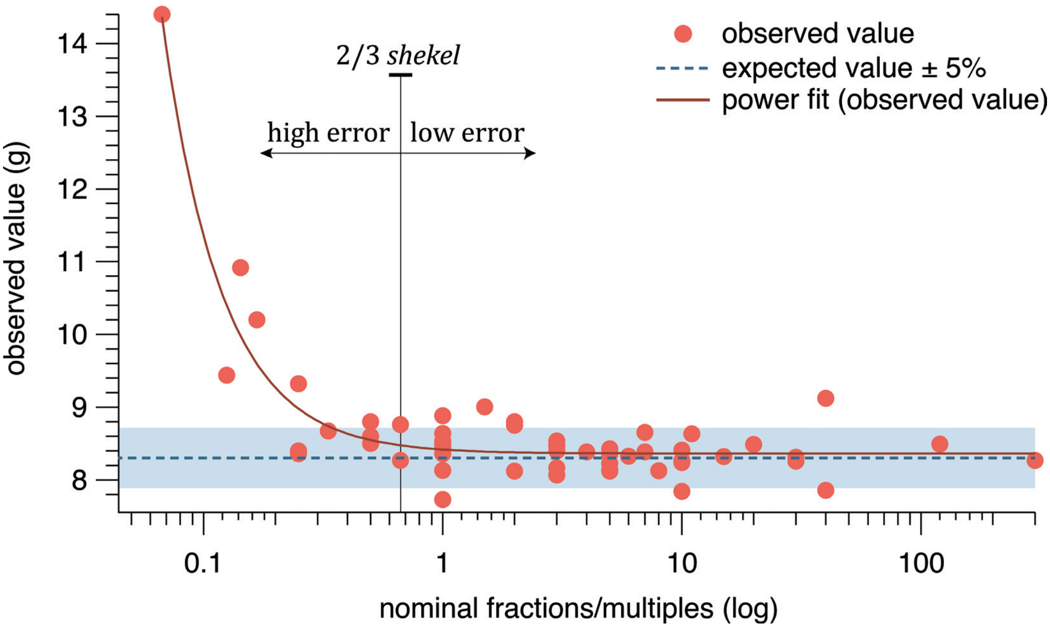
A closer examination of the formula elucidates why measurements smaller than the target quantum invariably yield erroneous results for the unit-range. The formula component determining the goodness of fit for a quantum within a range from 1 (perfect fit) to -1 (no fit) is expressed as

$$\cos\left(\frac{2\pi\varepsilon_i}{q}\right)$$

For instance, testing a 19 g measurement against a hypothetical 10 g unit yields a result of 0.81, indicating a very good fit due to the negligible remainder of 9 being close to the quantum of 10. However, a 5 g measurement results in -1 despite being exactly half of 10 g, highlighting a limitation of CQA where multiples of half the unit always yield negative results.

4.3.4.3. CQA is based for measurement that are many times bigger than the target quantum

Furthermore, the upper limit of the analysis range is governed by error propagation concerns. For instance, considering a theoretically exact value of 30 times the unit (*e. g.*, 300 g) with an accepted error of ± 5 %, the actual value could range from approximately 285 g to 315 g. Despite these values theoretically representing 30 times the unit, testing with a 10 g quantum would yield -1 for 285 g,



▶ *Fig. 4.5. Size vs accuracy. Y axis: unit-value of Mesopotamian inscribed weights of the Early and Middle Bronze Age, obtained by multiplying the mass of each weight by the fractional value indicated by the inscription (full dataset published in* Ialongo *et al. 2021). X axis: fractional value indicated by the inscription (logarithmic scale). The graph shows that the distribution of the error becomes asymmetrical at ⅔x the value of the shekel, and rises exponentially for lower values.*

Shekel	size after sub-sampling	best-fitting quantum	phi(q)	α=1%	α=5%
Total sample	140	9.6	4.70	3.85	3.31
Phase 1-2	28	9.6	2.77		
Phase 3	51	10.2	3.41		
Phase 4	45	9.6	3.35		
Phase 5	12	9.1			
Italy	62	10.2	2.49		
Central Europe	53	10.2	2.68		
Atlantic Europe	25	9.3	4.57		

Mina					
Total sample	297	445.0	10.09	3.85	3.39
Kannelurensteine (total)	248	447.0	9.94	3.84	3.28
Kannelurensteine (Italy)	84	436.0	6.47		
Kannelurensteine (Switzerland)	142	449.0	7.68		
Kannelurensteine (Germany)	41	112.8	3.21	3.71	3.20
Piriform (total)	40	429.0	3.37	3.40	2.98

▲*Tab. 4.1. Sub-sample sizes and summary of the results of CQA and Monte Carlo Simulations.*

295 g, 305 g, and 315 g, and negative results for many values in that same range, despite the fact that all those values can hypothetically represent the theoretically-exact value of 30 times the unit. As a rule of thumb, in order to obtain meaningful results, the standard error of the highest value of the analysis-range should be at most approximately as big as the target quantum.

4.3.4.4. Measurement error is inversely proportional to size

The graph in fig. 4.5. shows the correlation between the unit value of Mesopotamian inscribed weights (obtained by multiplying the mass of the weight by the fractional value indicated by the inscription) and the fractional value indicated by the inscription. The graph clearly shows that for fractional values higher than $^2/_3$ of the unit the distribution of the error remains stably symmetrical and mostly within one SD from the mean value (8.4 g), while for fractional values equal to or smaller than $^2/_3$ the error rises exponentially. This demonstrates that the smaller the measured quantity is, the higher the inaccuracy becomes. In absolute terms, the threshold can be fixed at *c.* 7 g for Bronze Age units. This outcome is entirely expected, as those sources of error that are irrelevant for bigger quantities – such as the mass of the pans and their chords, the non-perfectly centred fulcrum, the non-perfectly even thickness of the beam, and so on (Poigt *et al.* 2021) – become very much relevant for very small quantities.

4.3.4.5. Subsampling ranges

Considering the caveats illustrated above, the analysis range for the CQA has been set to 7-200 g for the *shekel*-range, and to 300-5,050 g for the *mina*-range, in line with previously published analyses. The final size of all analysed subsets after subsampling is given in tab. 4.1.

4.3.5. Monte Carlo test for statistical significance

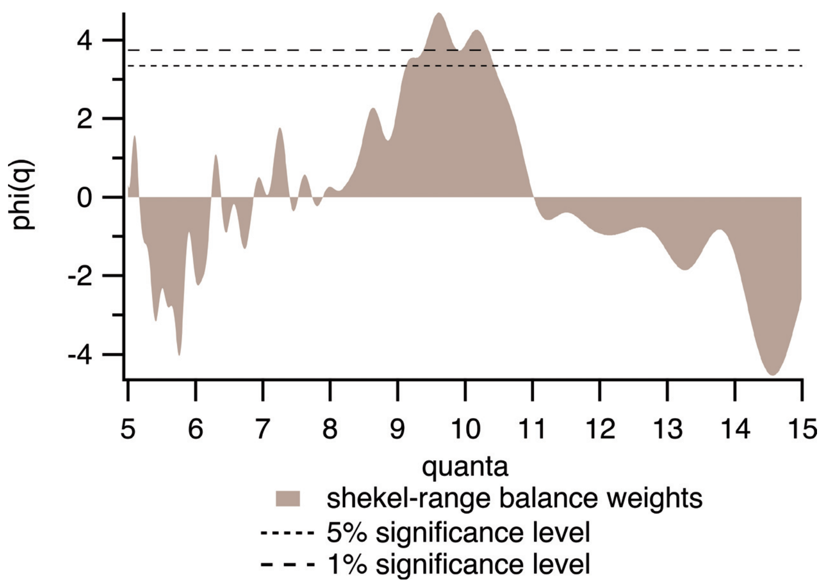
Monte Carlo tests can exclude the occurrence of false positives (Kendall 1974; Pakkanen 2011; Ialongo 2019). The test is based on the reiterated generation of random numbers, in order to check whether random datasets would give better results than the actual sample. The null-hypothesis is that the sample is randomly constituted, *i. e.*, that the observed quantal configuration is only due to chance. Following D. B. Kendall's method, we produced a simulation of 1,000 randomly generated datasets. The original sample was randomized, by adding a random fraction of ± 15 % to each measurement. Each generated dataset was analysed through CQA. If equal or better results occur more often than a predetermined threshold (typically 1 % or 5 % of iterations), it means that it cannot be excluded that the results obtained from the actual sample are simply due to chance, and therefore they should be rejected. For our experiment, we set the threshold (alpha level) to 1 %. In other words, if better results occur in less than 1 % of the iterations, then the null-hypothesis is rejected and the sample is very likely the result of an intentionally quantal portioning.

4.4. Results

The detailed breakdown of sample sizes, best-fitting quanta, φ(*q*) values, and alpha levels for each subsample is given in tab. 4.1.

4.4.1. The shekel

The analysis of the complete sample of balance weights in the *shekel*-range confirms previous results (Ialongo 2019; Ialongo *et al.* 2021). Results highlight a highly significant best-fitting quantum of 9.6 g with ϕ(q)= 4.7, while Monte Carlo simulations indicate ϕ(q) values for 1 % and 5 % significance thresholds of, respectively, 3.85 and 3.31 (Fig. 4.6.). The binned Frequency Distribution Analysis (FDA) offers further insights on the distribution of the sample. The mass values are clearly organized in a multimodal distribution, with a sequence of roughly bell-shaped concentra-



▲ *Fig. 4.6. Cosine Quantogram Analysis of European balance weights of the shekel-range. Complete sample.*

tions corresponding to approximate multiples and fractions of the best-fitting quantum highlighted by the CQA (Fig. 4.7.).

The outcomes of the CQA support the existence of a 'Pan-European *shekel*' of *c.* 9-10 g for the European Bronze Age. They also raise further questions: When and where did the Pan-European *shekel* emerge, and how widespread was it?

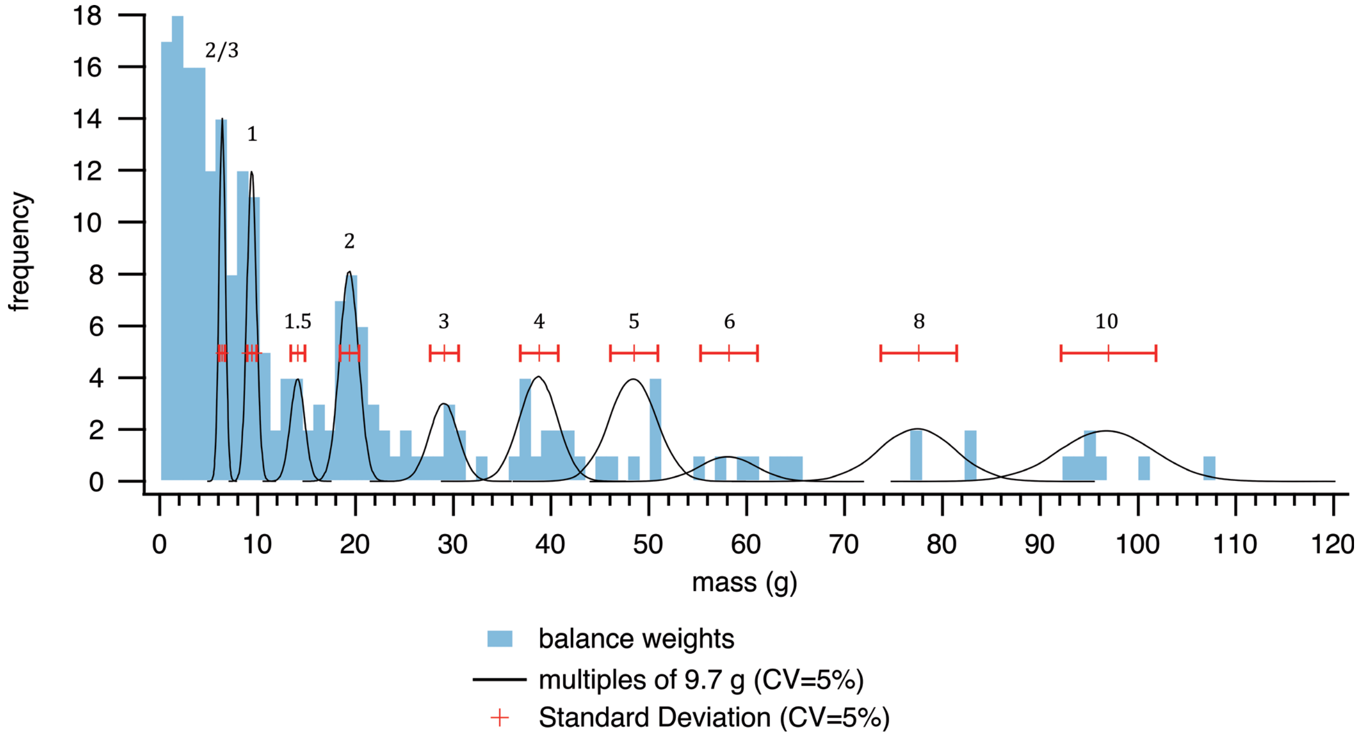
Addressing these questions in detail would require subdividing the sample into smaller subsets, and targeting different European regions in different periods. Unfortunately, the sample is not very big, and dividing it further into narrow geo-chronological subsets would not provide enough data for analyses.

Hence, in order to achieve a compromise between accuracy and sample size, the total sample was divided into two overlapping subsets, one addressing chronology (Fig. 4.8.) and the other addressing geographical distribution (Fig. 4.9.). The chronological phases represented in the graphs are the same used elsewhere in this book; Phases 1 and 2 are analysed together, to make up for the small amount of data. As for the geographical distribution, the sample was divided into three macro regions, roughly corresponding to the already observed diachronic diffusion of weighing technology in Europe: Italy, Central Europe (including Switzerland, Serbia, Czech Republic, Croatia, Hungary, Poland, Germany, and France), and Atlantic Europe (including the British Isles and the Iberian Peninsula).

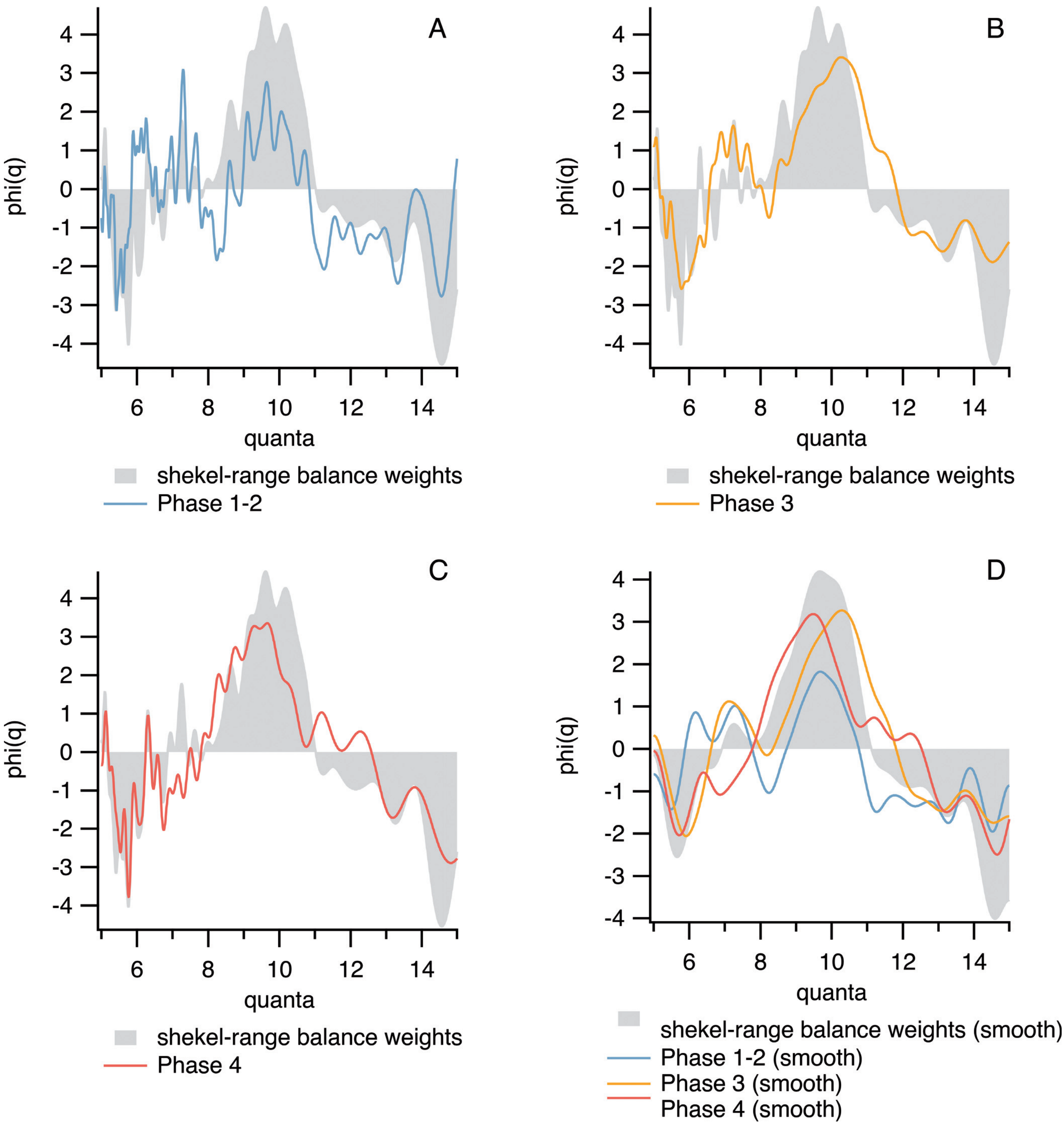
This solution partially makes up for the lack of a more detailed analysis, thanks to the peculiar diachronic and geographical distribution of the sample (see Chapter 2), for example: a) Phases 1 and 2 entirely correspond to Italy; b) Phase 3 is mostly represented in Central Europe (especially Germany and France); d) the Iberian Peninsula is only represented in Phases 4-5.

Results indicate three recurrent best-fitting quanta, all belonging to the statistical dispersion of the same theoretical unit:

- a best-fitting quantum of 9.3 g for Atlantic Europe in Phase 4 (Fig. 4.8.C; 4.9.C);



▲ *Fig. 4.7. Binned Frequency Distribution Analysis of the complete sample of European balance weights of the shekel-range (cut at 120 g). The black curves indicate multiples of the best-fitting quantum identified by CQA (9.6 g), represented as normally-distributed intervals with CV=5 %. The red lines indicate the Standard Deviation of each multiple.*



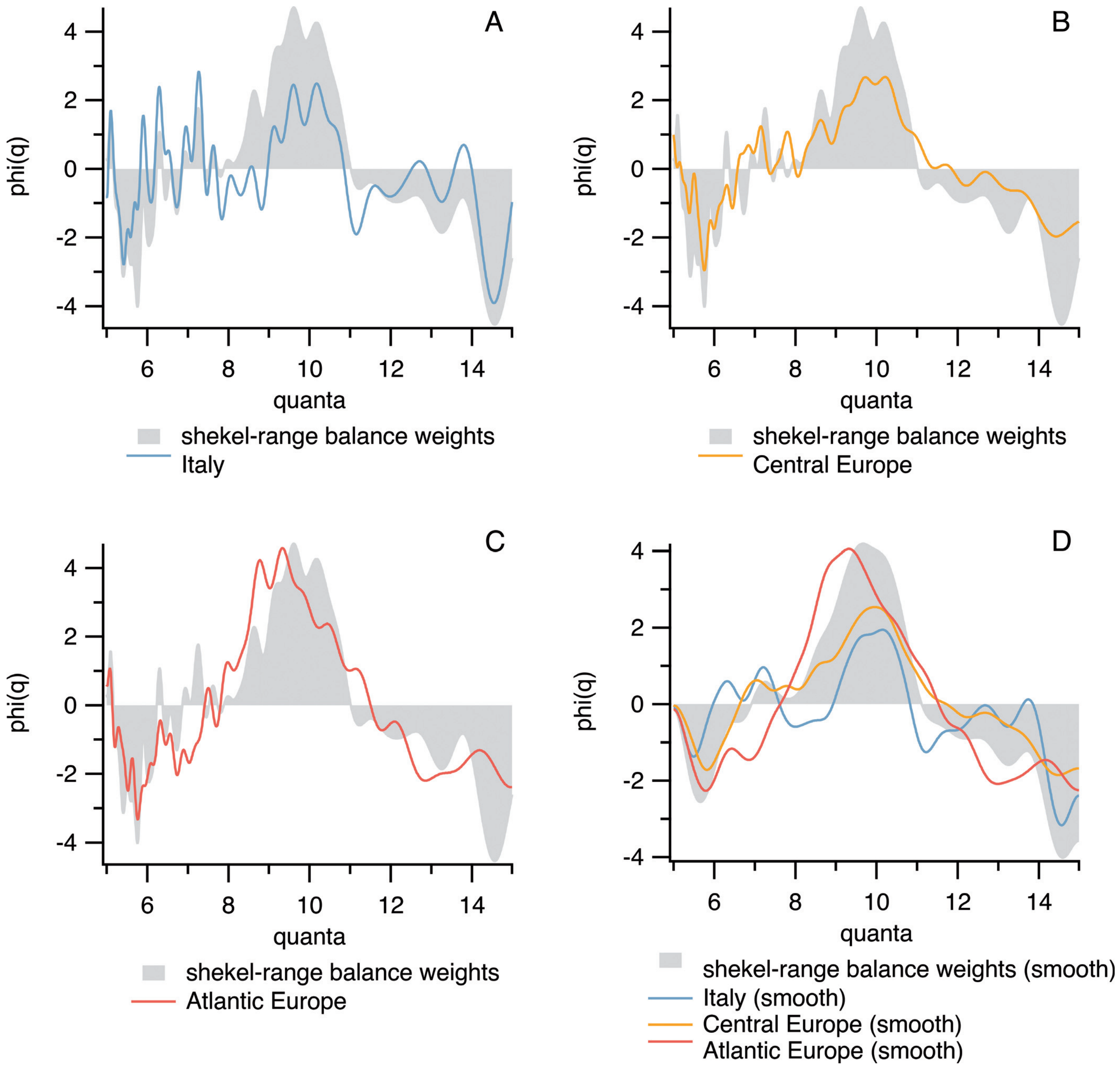
- a best-fitting quantum of 9.6 g for Phases 1-2 in Italy, and for Phase 4 across Europe (Fig. 4.8.A,C; 4.9.A);
- a best-fitting quantum of 10.2 for Phase 3 in Italy and Central Europe (Fig. 4.8.B; 4.9.B).

In conclusion, the results of the statistical analyses for both the diachronic and geographical subsets confirm that the Pan-European *shekel* of *c.* 9-10 g remains relatively stable in Europe throughout the Bronze Age, gradually spreading hand in hand with the diffusion of weighing technology (see Chapter 2). All subsets consistently show roughly bell-shaped concentrations corresponding to the same interval of significant quanta highlighted by the analysis of the total sample. Individual best-fitting quanta in this interval range between 9.3 g and 10.2 g – respectively recorded in in Phase 4 and 3 – with the Italian subset of Phases 1-2 remaining roughly in between.

4.4.2. The mina

The analysis of the complete sample of balance weights in the *mina*-range are in line with previously obtained results (Ialongo/Rahmstorf 2019; 2022). CQA highlights a highly significant best-fitting quantum of 445 g with $\phi(q)$= 9.88, while Monte Carlo simulations indicate $\phi(q)$ values for 1 % and 5 % significance thresholds of, respectively, 3.85 and 3.39 (Fig. 4.10.A).

▲ *Fig. 4.8. Cosine Quantogram Analysis, shekel-range: diachronic analysis. A: Phase 1-2 (c. 2300-1350 BCE); B: Phase 3 (c. 1350-1150 BCE); C: Phase 4 (c. 1150-800 BCE). D: comparative chart; the curves were smoothed out to enhance visibility.*

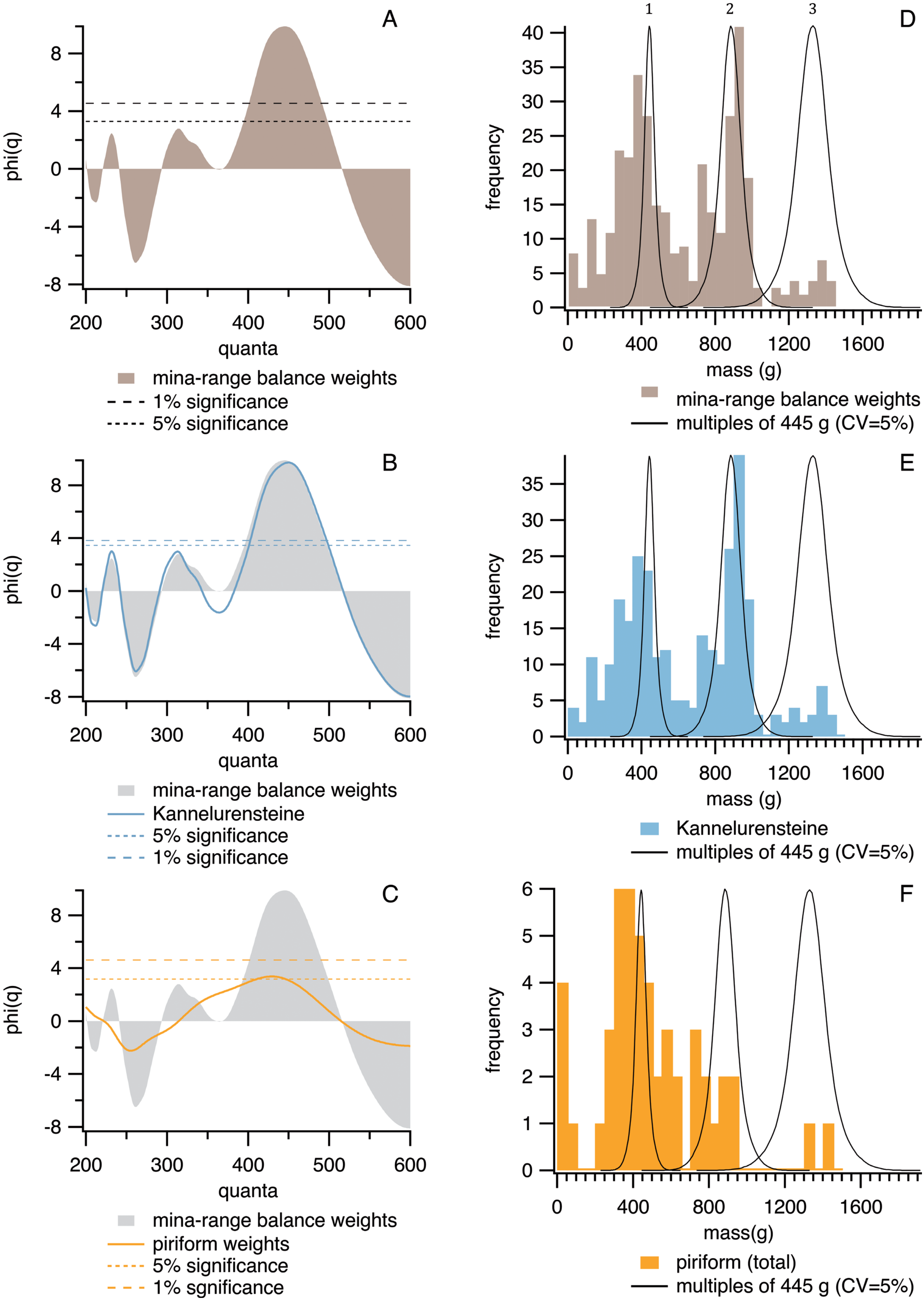


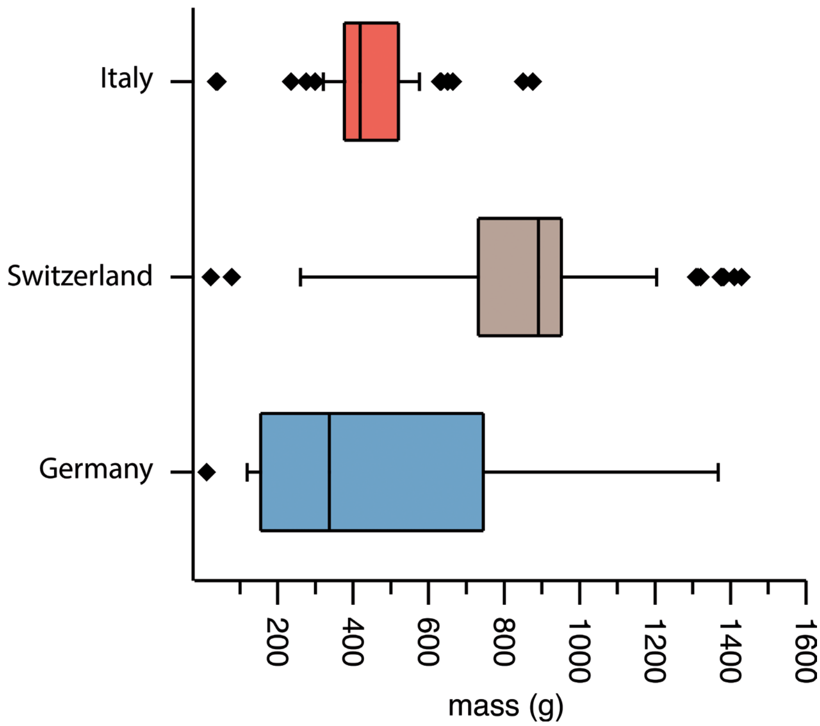
▲ *Fig. 4.9. Cosine Quantogram Analysis, shekel-range: geographic analysis. A: Italy; B: Central Europe; C: Atlantic Europe. D: comparative chart; the curves were smoothed out to enhance visibility.*

The separate analysis of *Kannelurensteine* (Fig. 4.10.B) and piriform weights (Fig. 4.10.C), representing respectively 82 % and 15 % of the total sample, gives comparable results. As *Kannelurensteine* represent the vast majority of the sample in the *mina*-range, it is no surprise that their quantogram very closely mirrors the results obtained for the total sample. The FDA shows two very well-clustered bell-shaped concentrations around 2x and 3x the value of the best-fitting quantum (Fig. 4.10.E). The concentration around the alleged unit value, however, is rather spread out: While the mode of the concentration corresponds to the best-fitting quantum of 445 g, the left part of the concentration stretches as far as to include the $^1/_2$ fraction. This fuzziness is easily solved by the separate analysis of regional samples, illustrated below.

The CQA for piriform weights shows somewhat less-sharp results, but still highlights a significant best-fitting quantum that is consistent with the overall results (432 g). The FDA shows similar concentrations to the ones observed for the *Kannelurensteine*: two concentrations corresponding to 2x and 3x the value of the best-fitting

▶ *Fig. 4.10. Mina-range: Cosine Quantogram Analysis (A-C) and Binned Frequency Distribution Analysis (D-F). CQA: A) complete sample; B) Kannelurensteine; C) piriform weights. FDA: D) complete sample; E) Kannelurensteine; F) piriform weights. The black curves overlayed on the FDA indicate multiples of the best-fitting quantum identified by CQA (445 g), represented as normally-distributed intervals with CV= 5 %.*


A
phi(q)
quanta
mina-range balance weights
1% significance
5% significance
D
1
2
3
frequency
mass (g)
mina-range balance weights
multiples of 445 g (CV=5%)
B
phi(q)
quanta
mina-range balance weights
Kannelurensteine
5% significance
1% significance
E
frequency
mass (g)
Kannelurensteine
multiples of 445 g (CV=5%)
C
phi(q)
quanta
mina-range balance weights
piriform weights
5% significance
1% sgnificance
F
frequency
mass(g)
piriform (total)
multiples of 445 g (CV=5%)



▲ *Fig. 4.11. Regional samples of Kannelurensteine: boxplot.*

quantum, and a fuzzier concentration around the alleged unit value (Fig. 4.10.F).

In line with the results of previous research (Ialongo/Rahmstorf 2019; 2022), the structure of the European *mina* appears characterised by a greater degree of variability than that of the *shekel*. While the unit value remains relatively stable, a closer analysis of the frequency distribution of the mass values of *Kannelurensteine* highlights observable shifts across time and space. Dividing the *Kannelurensteine* sample into three regional sub-samples (Italy, Switzerland, and Germany) offers a first look at these chronological and geographical differences.

The boxplot in fig. 4.11. shows that: a) the Italian sample is roughly symmetrically distributed about the alleged unit value, b) the Swiss sample is roughly symmetrically distributed about 2x the alleged unit value, and c) the German sample shows a right-skewed distribution, with the highest density below the alleged unit value. In short, most *Kannelurensteine* in Switzerland are rather heavy, most of those from Germany are rather light, while the Italian ones are approximately in between. Furthermore, if one considers that most *Kannelurensteine* from Italy are dated to Phase 2-3, and all those from Switzerland and Germany date to Phase 4, it appears that the geographical shift also reflects a chronological one.

The quantograms of Italian and Swiss *Kannelurensteine* reveals that both samples give best-fitting quanta that are consistent with the alleged unit of *c.* 445 g (Fig. 4.12.A-B). If the CQA shows comparable quantal structures, the FDA reveals a peculiar difference: While the near complete sample of *Kannelurensteine* from Italy clusters around the value of the best-fitting quantum (Fig. 4.12.D), the Swiss sample shows relevant concentrations around 2x, 3x, and $^1/_2$x that value, and almost no measurement in the interval that theoretically belongs to the alleged unit of *c.* 445 g (Fig. 4.12.E).

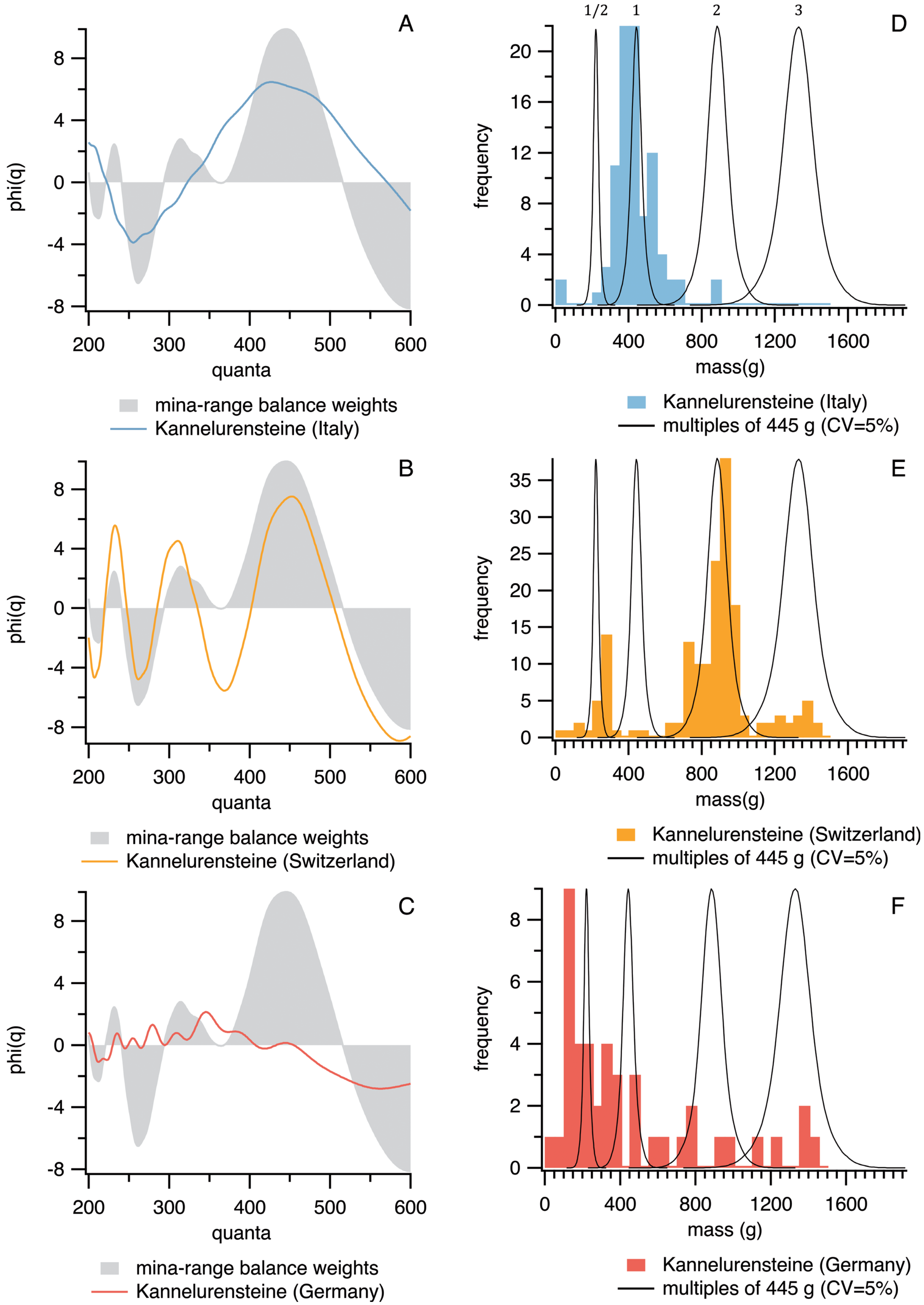
The analysis of the German sub-sample reveals yet a different pattern. CQA, for instance, does not indicate any relevant quantum in the analysis range (Fig. 4.12.C). The FDA, however, detects small and loose concentrations around 1x, 2x, and 3x the value of the alleged unit, but most measurements cluster below the unit value (Fig. 4.12.F). A more detailed analysis of the German sub-sample, however, reveals a pattern that is still consistent with the alleged unit. Repeating the CQA with a lower starting point for the analysis-range (*i. e.*, 100-1,500 g, instead of 300-5,050 g), identifies a significant best-fitting quantum of 112.8 g, *i. e.*, almost exactly $^1/_4$ of the best-fitting quantum of 445 g obtained for the total sample (Fig. 4.13.A). In line with this result, the FDA shows relevant concentrations around $^1/_2$x and $^1/_4$x the alleged unit value (Fig. 4.13.B).

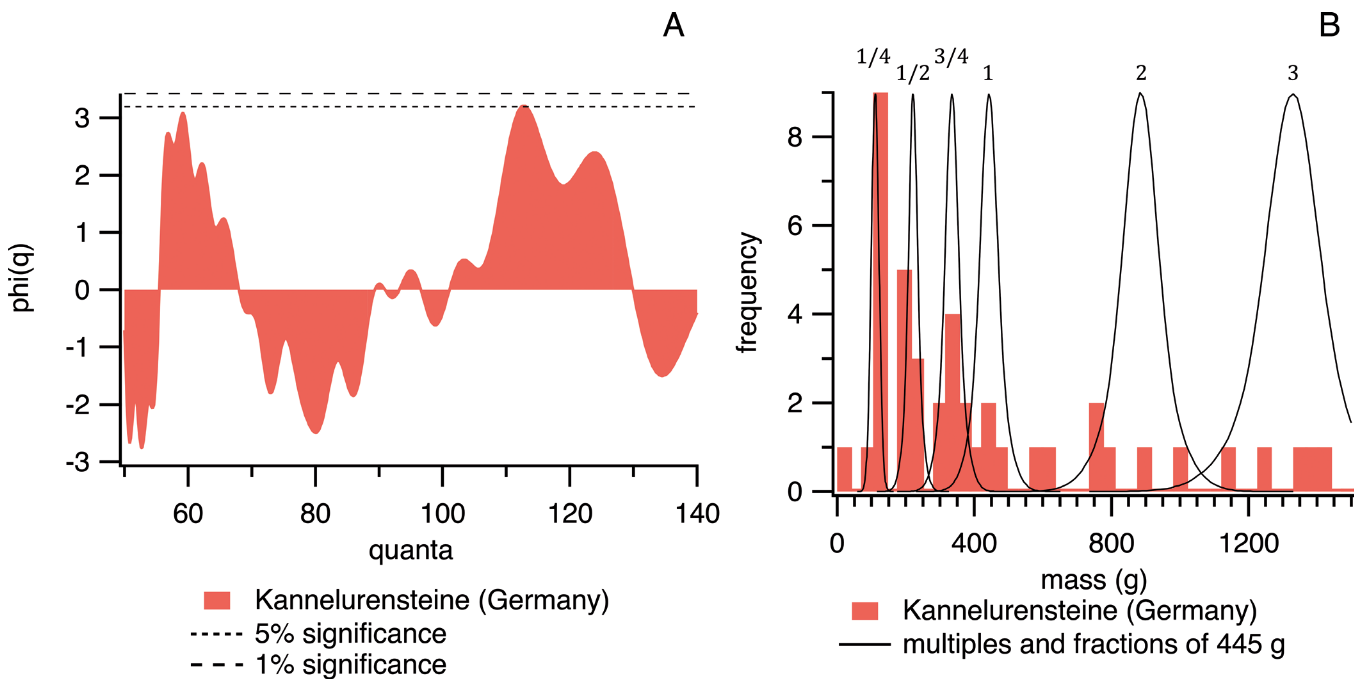
In conclusion, the comparative analysis of the different sub-samples of *Kannelurensteine* confirms the existence of a European *mina* whose theoretical value corresponds to *c.* 445 g or *to one of its multiples and fractions*, the difference being merely a matter of subjective perception. Based on available evidence, the distribution of the European *mina* is limited to Italy in Phase 2-3, and extends to Central Europe in Phase 4.

4.4.3. Towards the Iron Age: the balance weights of Phase 5 (c. 750-600 BCE)

A small sample of twelve balance weights, all belonging to the *shekel*-range, comes from find contexts datable to the 8th and 7th centuries BCE (Phase 5) (Fig. 4.14.). A much larger sample of Iron Age weights spanning the 1st millennium BCE was analysed in T. Poigt (2022). The Iron Age weights analysed here represent the 'residue' of the chronological screening of the complete sample collected during the research; they only come from Sardinia and the Iberian Peninsula, and they are in no way a significant sample of weighing devices for their period of reference. I decided to include them in this study because they are the only reliably datable weights coming from early Phoenician settlements in Europe, or from local settlements that entertained contacts with Phoenicians in the 8th and 7th centuries BCE.

▶ *Fig. 4.12. Kannelurensteine, regional samples: Cosine Quantogram Analysis (A-C) and Binned Frequency Distribution Analysis (D-E). CQA: A) Italy; B) Switzerland; C) Germany. FDA: D) Italy; E) Switzerland; F) Germany. The black curves overlayed on the FDA indicate multiples of the best-fitting quantum identified by CQA (445 g), represented as normally-distributed intervals with CV=5%.*


A
phi(q)
quanta
mina-range balance weights
Kannelurensteine (Italy)
B
phi(q)
quanta
mina-range balance weights
Kannelurensteine (Switzerland)
C
phi(q)
quanta
mina-range balance weights
Kannelurensteine (Germany)
D
1/2
1
2
3
frequency
mass(g)
Kannelurensteine (Italy)
multiples of 445 g (CV=5%)
E
frequency
mass(g)
Kannelurensteine (Switzerland)
multiples of 445 g (CV=5%)
F
frequency
mass (g)
Kannelurensteine (Germany)
multiples of 445 g (CV=5%)

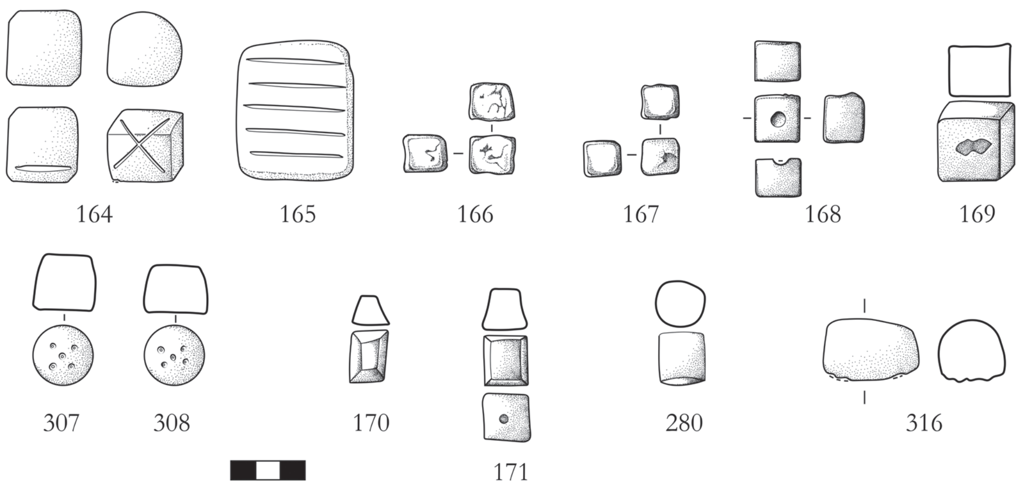


▲ *Fig. 4.13. Kannelurensteine from Germany. A: Cosine Quantogram Analysis; B: Binned Frequency Distribution Analysis. The black curves overlayed on the FDA indicate multiples of the best-fitting quantum identified by CQA (445 g), represented as normally-distributed intervals with CV= 5 %.*

All these weights except one (Fig. 4.14.316; sphendonoid with flat base) have peculiar formal types, that are never attested in Bronze Age contexts. Furthermore, six of them – five from Sardinia (Fig. 4.14.164-165,168,307-308), and one from Spain (Fig. 4.14.171) – bear incised signs that are often interpreted as quantity marks. Unfortunately, the analysis of quantity marks does not give clear results (Tab. 4.2.). Three Sardinian weights – one from the hoard of Forraxi Nioi (Fig. 4.14.165) and two form the settlement of Santu Brai (Fig. 4.14.307-308) – bear five incised signs, suggesting a unit value between *c.* 4.7 g and 5.4 g (Tab. 4.2.). Another weight from Santu Brai (Fig. 4.14.164) and one from Nuraghe Sant'Imbenia (Fig. 4.14.168), however, yield respectively 63.37 g and 45.52 g. Finally, a lead weight from Huelva in south-western Spain indicates a potential unit of 9.54 g (Fig. 4.14.171). Based on the marks, the only correspondence can be found between the three weights with five incised marks from Santu Brai and Forraxi Nioi, indicating a unit interval around 5 g. However, another weight from Santu Brai indicates a completely different unit (63.37 g), as well as the two remaining ones from Sant'Imbenia (45.52 g) and Huelva (63.37 g).

A unit of 11.75 g was proposed for the Sardinian weights (Zaccagnini 1991; Lo Schiavo 2006). If this value sounds familiar it is because it is directly derived from the so-called '*shekel* of Khatti', which I discussed in the first part of this chapter in connection with the 'Anatolian *shekel*' of the same value. This interpretation, however, is problematic: Let alone that none of the actual and reconstructed mass values comes even close to the alleged 'Microasiatic unit', any attempt to use exact values in metrological reconstructions is, as it should be clear by now, always bound to produce meaningless results.

Despite the small sample size, we have then no other choice than turning to statistics. CQA shows a best-fitting quantum of 9.1 g (Fig. 4.15.A), which is compatible with the results obtained from a larg-



▶ *Fig. 4.14. Balance weights of Phase 5 (c. 750-600 BCE). Stone: cat. no. 164-165, 307-308, 316. Lead: cat. no. 166-169, 170-171, 280.*

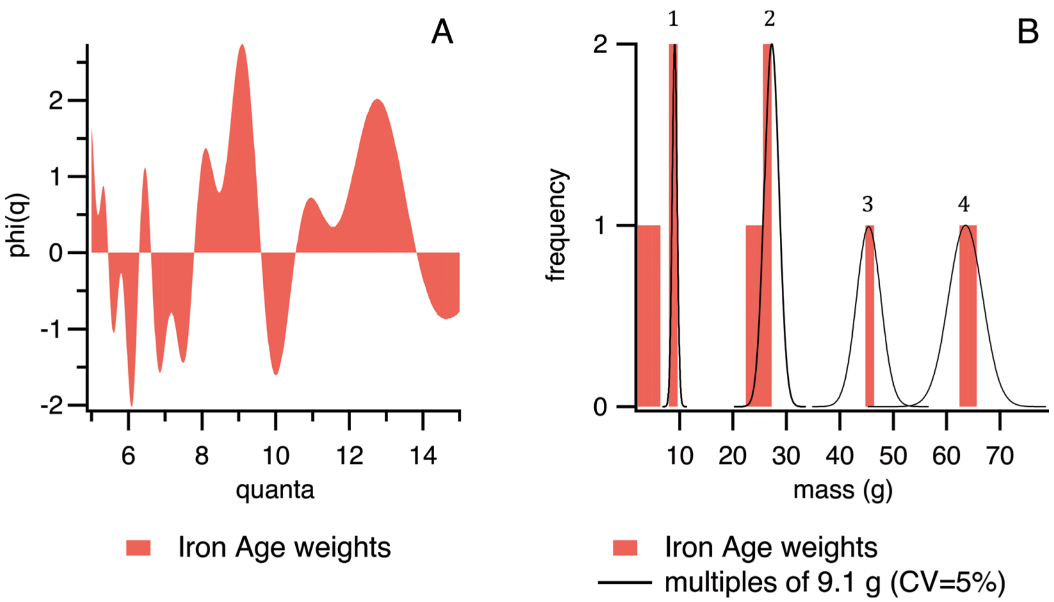
Cat.n.	Site	Region	Material	Mass (g)	Mark description	Inferred multiplier	Resulting unit
167	Quinta do Almaraz	Portugal	Lead	2.63			
170	Huelva - Plaza de las Monjas	Spain	Lead	4.45			
166	Quinta do Almaraz	Portugal	Lead	6.38			
171	Huelva - Plaza de las Monjas	Spain	Lead	9.54	Circular indentation on the base	1	9.54
280	Huelva - Plaza de las Monjas	Spain	Lead	9.59			
165	Forraxi Nioi	Italy (Sardinia)	Stone	23.87	Five incised lines on one face	5	4.77
308	Santu Brai	Italy (Sardinia)	Stone	25.17	Five incised dots on the flat face	5	5.03
169	Huelva - Plaza de las Monjas	Spain	Lead	26.62			
307	Santu Brai	Italy (Sardinia)	Stone	26.8	Five incised dots on the flat face	5	5.36
168	Nuraghe Sant'Imbenia	Italy (Sardinia)	Lead	45.52	Circular indentation on one face	1	45.52
164	Santu Brai	Italy (Sardinia)	Stone	63.7	Single incised line on one face; two crossed lines across two faces	1	63.70

▲ *Tab. 4.2. Balance weights of Phase 5 (c. 750-600 BCE).*

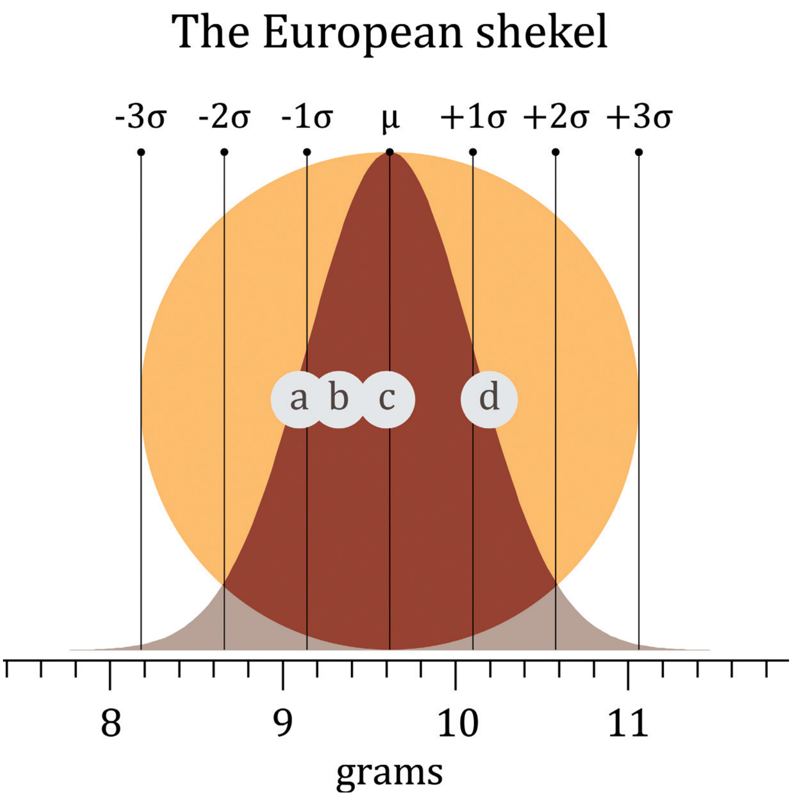
er sample of later Iron Age weights from the Iberian Peninsula (Poigt 2022, 253-258). This result is further clarified by the FDA, showing small but consistent concentrations around 9 g, 25-27 g, and 64-65 g – respectively *c.* 1x, 3x, and 7x the value of the best-fitting quantum – plus an isolated value at *c.* 45 g (5x) (Fig. 4.15.B). In conclusion, while the small sample size urges caution, the results of the statistical analyses suggest a best-fitting quantum that is still compatible with the interval of the Bronze Age *shekel*.

4.4.4. The weight units of pre-literate Bronze Age Europe

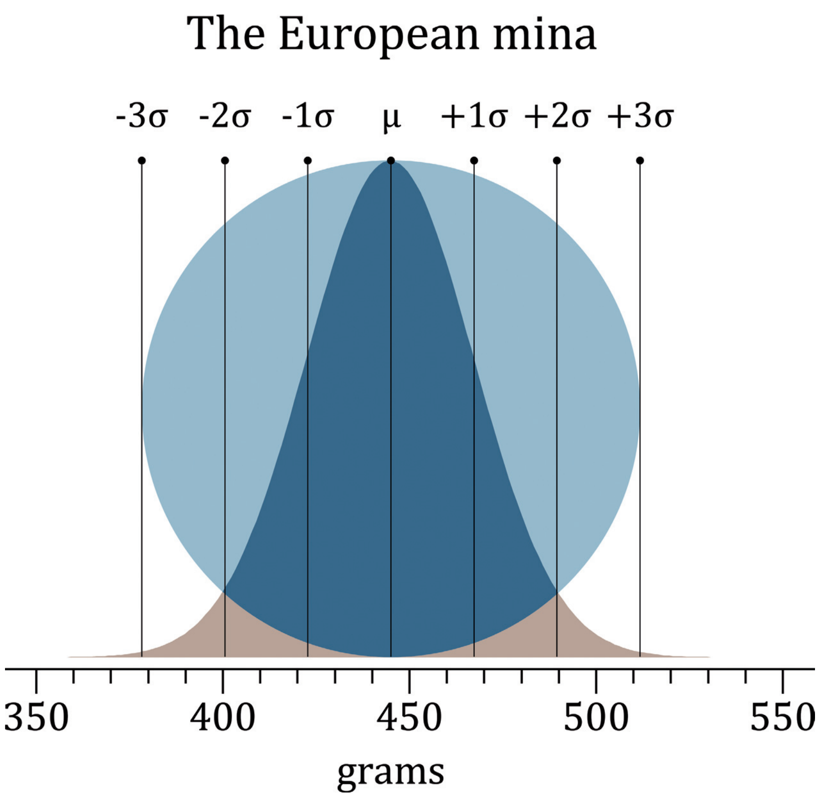
The results of the statistical analyses identify two weight units, widespread in Europe throughout the Bronze Age: a small unit of *c.* 9-10 g – the 'Pan-European *shekel*' – and a *mina* of *c.* 450 g (Tab. 4.1.). As already illustrated in the introduction to this chapter, the more or less exact values in grams that we use to designate ancient weight units are merely labels that may facilitate communication, but they actually bear little significance. Weight units – and units of measurement in general – are by definition intervals, whose statistical dispersion depends on many factors, chiefly among which the accuracy of measurement tools. For the Bronze Age world, the overall error margin of weighing technology was *c.* 5 % in terms of Coefficient of Variation which, considering the full range of three standard deviations that defines normal distributions, amounts to a total range of ± 15 %. Considering the full error range makes it possible to have a more accurate representation of European Bronze Age units, with



◀ *Fig. 4.15. Balance weights of Phase 5 (c. 750-600 BCE). A: Cosine Quantogram Analysis; B: Binned Frequency Distribution Analysis. The black curves overlayed on the FDA indicate multiples of the best-fitting quantum identified by CQA (9.6 g), represented as normally-distributed intervals with CV= 5 %.*



▲ *Fig. 4.16. The Pan-European shekel (mean= 9.6 g, CV= 5 %). Vertical lines indicate the Standard Deviations of the distribution. Best-fitting quanta identified by CQA: A) 9.1 g (Phase 5); B) 9.3 g (Atlantic Europe); C) 9.6 g (total, Phase 1-2, Phase 4); D) 10.2 g (Phase 3, Italy, Central Europe).*



▲ *Fig. 4.17. The European mina (mean= 445 g, CV= 5 %). Vertical lines indicate the Standard Deviations of the distribution.*

the *shekel* being equal to *c.* 8-11 g, and the *mina* to *c.* 360-520 g (Fig. 4.16.-17.). When addressing the significance of Bronze Age units, one must always bear in mind that any value within these ranges was potentially perceived as '1' by their users. It is also crucial to consider that the best-fitting quanta given by the CQA are only approximations that are dependent on the actual distribution of mass measurements, and that slightly different results for different datasets in no way mean slightly different units. A closer examination of the several, slightly different best-fitting quanta obtained from different subsets of the *shekel*-range, for example, clearly shows that each value is perfectly compatible with the overall interval of the Pan-European *shekel*, regardless of chronology and geographical distribution (Fig. 4.16.).

This way of conceptualising weight units fundamentally affects the way of conceptualising how primary weight systems emerged in Bronze Age Western Eurasia, contextually to the first adoption of weighing technology in a region where weights and balances were previously not used (Ialongo *et al.* 2021).

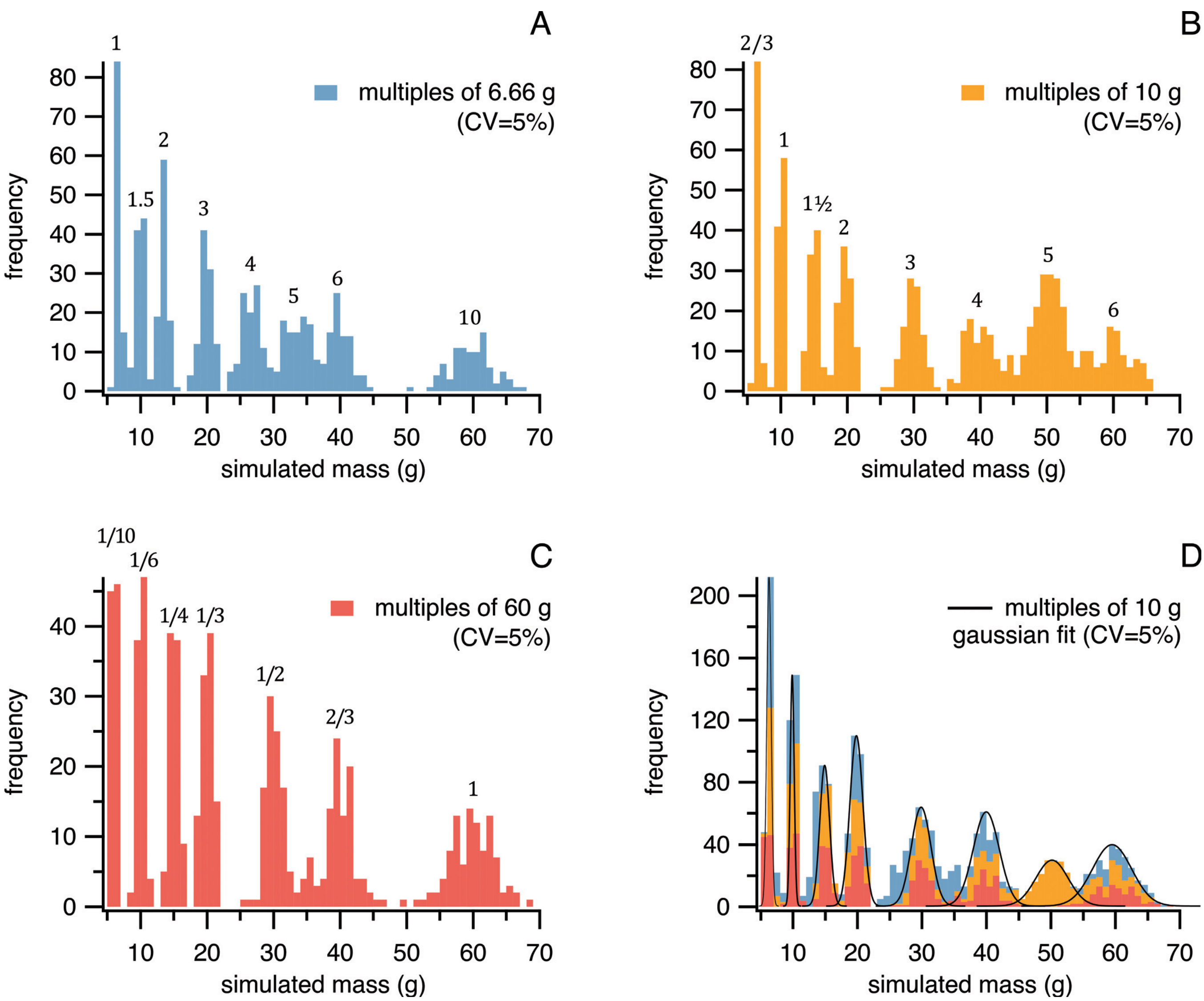
4.5. The origin of European weight systems

4.5.1. The myth of the 'imported unit'

The analysis of the European sample of balance weights indicates a best-fitting quantum of *c.* 10 g which – for the sake of simplification – I have been referring to as a 'unit'. Previous studies based on smaller samples have suggested an alternative unit of *c.* 6.1-6.7 g (Pare 1999; Cardarelli *et al.* 2001), representing, in turn, *c.* $^{1}/_{10}$ of the alleged 'Aegean unit' of *c.* 58-65 g (Petruso 1992). In early studies on the spread of weight systems it was generally assumed that weight units in pre-literate Bronze Age Europe were imported 'as-is' from the Aegean, together with weighing technology.

At this point, one may ask if we can really exclude that the Pan-European *shekel* was 'imported' from the Aegean. Which, again, boils down to the question of the 'true value' of pre-metric units. Here I will illustrate a thought experiment that demonstrates how ill-formulated this question is.

Imagine a hypothetical region of the Bronze Age world in which three different weight units were in use at the same time. Now, imagine that these units correspond to the three alleged units proposed by different authors: The 'Pan-European *shekel*' of 10 g, and the 'Aegean units' of 6.6 g and 60 g. I simulated a hypothetical scenario in which we possess a large sample of balance weights which we can aprioristically and precisely assign to each of these three different units. I randomly generated three subsets of *c.* 1,000 measurements. Each subset is a multimodal distribution, composed by a series of normally-distributed concentrations of randomly generated numbers, each concentration corresponding to multiples and fractions of the respective unit with a Coefficient of Variation of 5 %, *i. e.*, the inherent



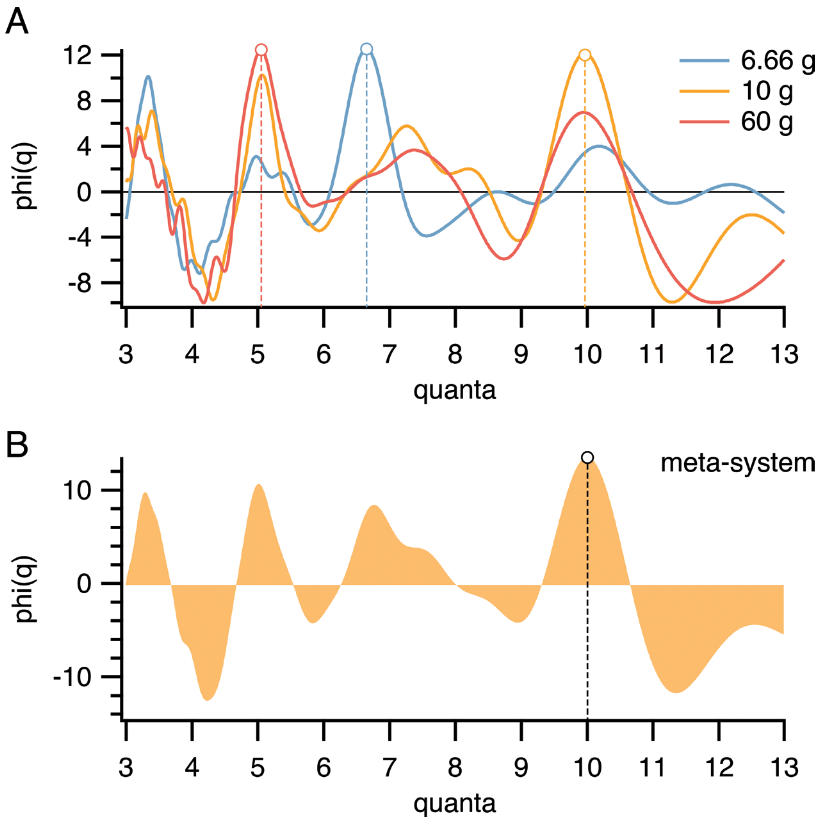
▲ *Fig. 4.18. Hypothetical meta-system (FDA). A) multiples of 6.66 g (CV=5%); B) multiples of 10 g (CV=5%); C) multiples 60 G (CV=5%). D) meta-system: complete distribution. The black curves overlayed on the FDA indicate multiples of 10 g, represented as normally-distributed intervals with CV= 5 %.*

error margin of Bronze Age units. The simulated subsets show very neatly-separated concentrations, each easily ascribable to their unit of reference (Fig. 4.18.A-C). As expected, the CQA correctly identifies the unit of each subset, showing best-fitting quanta at 6.66 g, 10 g, and 5 g (*i. e.*, $^{1}/_{12}$ of 60 g) (Fig. 4.19.A).

So far, the simulation suggests that, if we are able to attribute each balance weight to its respective unit *before* the statistical analysis, we will likely be able to identify different units as well. Unfortunately, this is never the case with real archaeological data. In Bronze Age Western Eurasia balance weights are almost never inscribed, and typology alone is not reliable to pre-emptively assign each balance weight to a particular unit. This is, after all, precisely the reason why we need statistical analyses: to identify the potential existence of weight systems in an apparently chaotic sample of measurements.

If we want to simulate a real research scenario, then, we need take all our simulated subsets, analyse them all together, and see if we can detect the existence of three different systems. Surprisingly, the Frequency Distribution Analysis of the complete datasets now identifies only concentrations that are multiples of 10 g (Fig. 4.18.D). In the same way, the CQA now univocally identifies 10 g as the best-fitting quantum (Fig. 4.19.B). Truth be told, this outcome is not surprising at all. The nominal values of the three units are all multiples and fractions of one another, therefore it is simply inevitable that their respective multiples and fractions will exactly correspond many times over, and even when they do not, the distance will be so small that the respective dispersions will overlap to the point where they are impossible to discern. The reason why the analysis of the complete dataset only highlights the unit of 10 g is simply because 10 g is the Greatest Common Divisor of the complete dataset.

Which one, then, is the 'true' value of the unit of Bronze Age Europe? All considered, the only possible answer is: *All of them, and possibly even more*. Elsewhere, I dubbed this way of conceptualising the seamless intersection between nominally different, but factually analogous units the 'meta-



▲ *Fig. 4.19. Hypothetical meta-system (CQA). A: separate analysis of the samples illustrated in fig. 4.18. B: comprehensive analyses of all samples at once.*

system model' (Ialongo *et al.* 2018a; 2018b). The meta-system model clarifies, at the same time, the limits of the analytical methods and the nature of Bronze Age weight units. CQA does not reveal 'the unit', but simply a common denominator. This means that, as far as pre-literate societies are concerned, we will never be able to positively identify 'the unit'. The good news is that 'the unit' is a purely theoretical concept, and a largely irrelevant factor in understanding the structure of prehistoric systems of measurement, their empirical application, and their impact on economic and social systems.

4.5.2. One, No One and One Hundred Thousand units

From both a theoretical and empirical point of view, once we identify a significant quantum in a distribution of metrically-configured objects we know that the mass values of those objects were seamlessly convertible into one another through a simple system of fractions and multiples, independently from the exact value of 'the unit', and even regardless of the coexistence of different units. It follows that, as long as at least a single quantum was shared, each region, settlement, and even each single individual could have theoretically used a different unit, and this would make no difference – neither to ancient users, nor to modern archaeologists.

Imagine, for example, a system with 100 agents, each using a nominally different weight unit: Common sense would tell us that this system would be too chaotic to function. Now imagine that each of these units was a round multiple of, say, 5 g, *i. e.*, 5-10-15-20-25-30…500 g. In this scenario, the existence of 100 nominally different units would make no difference whatsoever, as all these supposedly different units can be instantly and effortlessly reduced to the common denominator of 5 g. In an international trade network in which 'official units' could not exist because there was no far-reaching centralised authority that could sanction, let alone enforce them, a weight system with a similar structure would have provided virtually frictionless conversion factors, even with the simultaneous presence of a multitude of different units. This could also explain why inscriptions and quantity-marks are so rare in some regions (only 5 % of the balance weights from Mesopotamia has inscriptions or marks; Ialongo *et al.* 2021) and completely absent in others (such as Bronze Age Europe), and even why sometimes marked weights from the same period, region, and culture seem to be based on completely different units (such as in the Iberian Peninsula and Sardinia in the Iron Age; see above, also Poigt 2022): In a typical transaction-scenario it does not matter which fraction or multiple one's weight *objectively* represents, as long as each agent *subjectively* agrees on the value of the transaction.

The structure of the European *mina* represents an emblematic case study on the nature of customary weight units in pre-state societies, while also offering an instructive perspective on the biased perception that modern observers tend to have on ancient systems of measurement. If we look at the frequency distribution of the mass values of *Kannelurensteine*, we observe that the Italian sample has a main cluster around 450 g, the Swiss sample around 900 g, and the German sample around 112 g. Even if we assume that the unit is the most attested value, then we would have that the Italian unit is exactly 4x the German one, the Swiss unit is exactly 2x the Italian one, and the German unit is exactly ⅛x the Swiss one. Which is tantamount to having exactly the same unit in all three territories.

4.5.3. How did weight units 'move'?

A unit can 'move' only on very particular conditions. For a unit to 'exist' in the first place, it needs to be somehow fixed in time and space, with a conventional value (or range of values) that is, in turn, sanctioned by an institution – either private or public – with the authority to enforce it. To be simply embodied in balance weights, as we have seen, is not enough, since that would not necessarily mean that the unit was one and unique.

Once this requisite is met, there are basically two scenarios for an existing unit to be 'transferred' to a new region. The first scenario is *adoption*: The unit must be adopted by an institution with the same enforcing authority, that can sanction its value and make it 'official', also in the framework of a formal international agreement with the authority of the unit's region of origin. The second scenario is *imposition*: The institution sanctioning the unit in its region of origin must extend its authority to the new region, either peacefully or violently. These scenarios are more or less explicitly advocated in some studies attempting to draw historical considerations based on weight units, conceived as exactly-determined, inherently-normative entities (Massa/Palmisano 2018; Rosenswig 2024). None of these two scenarios, however, applies to Bronze Age Europe.

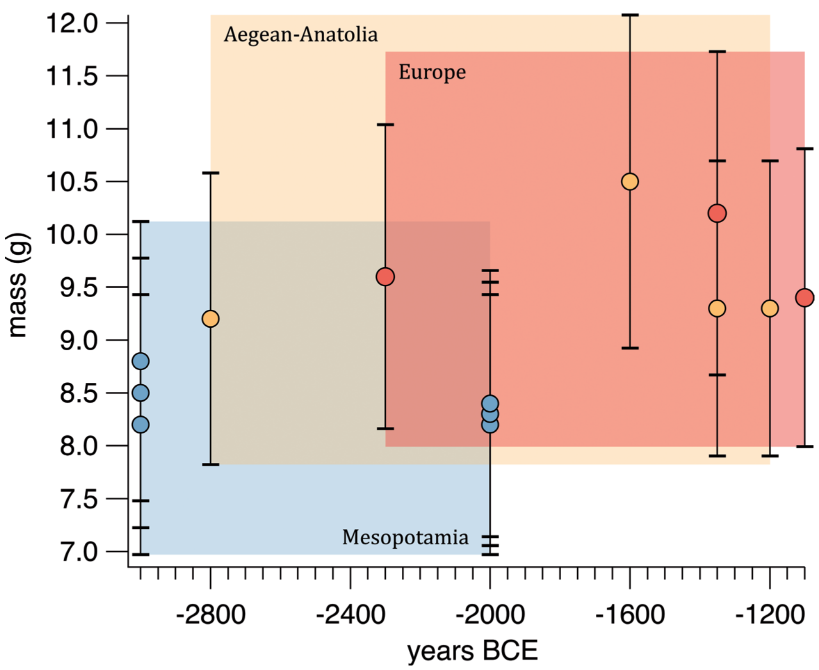
Eastern states never established any form of direct or indirect control over Europe. There is not even evidence of direct contacts between Europe (west of Greece) and the Levant, at least not until the end of the 2nd millennium BCE (Berger *et al.* 2022; Eshel *et al.* 2022), roughly 1,000 years after the first appearance of weighing technology in southern Italy, and even then the evidence is not conclusive. Perhaps even more importantly, there was no single authority in Europe that was in the condition to negotiate treaties with Eastern states, let alone imposing and enforcing them on a continental scale. It is even debatable whether or not, in the Near East, weight units were actually 'officially enforced' in the first place. Official overseeing was mainly enacted by public officers in instances of reallocation of goods that took place within the palace's precinct (Durand 1987; Joannès 1989, 127; Arkhipov 2012, 183), while private merchants usually worked out reciprocal controversies on their own (Stratford 2017).

A weight unit can be regulated by official norms, but is not a norm in itself. A weight unit is not a 'number' either, that can be copied as-is and transferred to another location. It is not even an object that can be moved, or 'imported'. If weight systems are not movable objects, they can however move *with* objects. Independently from whether a single unique unit exists or many interconnected ones, balance weights are the embodiment of the abstract concept of weight, and enclose within themselves all the necessary material properties to preserve, replicate, and even create weight systems. Simply put, weight units do not move; people do, and balance weights move with them.

When weighing technology appears in a new region it does not emerge spontaneously, but it is brought by people carrying along their tools – weights and balances – that are eventually 'copied' and used by other people. Since weights and balances are trading tools, the most likely scenario of the appearance of weighing technology in a new region is via trade. Merchants from a 'weighing region' (say, the Aegean) entertain trade relationships with a 'non-weighing region' (say, southern Italy). The weighing merchants quantify their incomes and expenditures according to the system they are best acquainted with – *i. e.*, weighing – but they find themselves struggling when it comes to negotiate prices with their non-weighing partners, who have different systems to account for value. Eventually, the non-weighing merchants will see the practical advantages of the new technology, and they will start using it for themselves. The next logical step would be to borrow one or two weights from their tech-savvy partners, and simply use them as models to make new ones (Petruso 2019). It is worth noting that there is nothing preventing this process from happening anywhere within a given trade network: Weighing technology does not need to be brought from one region to another by their original users, but it can be also learned by the eventual new users when travelling to the region where the technology is already in use.

The formation of new weight systems in the Bronze Age world can then be modelled as follows: Balance weights are borrowed and replicated, and since balance weights are physical manifestation of abstract units, the units move along with them. Replicas are, in turn, also replicated, and a new weight system eventually emerges in a new region.

As both empirical and textual evidence unequivocally demonstrate, however, balance weights are by definition never 'precise'. No matter how meticulously one strives for accuracy, a single balance weight will always have a normally distributed probability of falling anywhere within the unit's statistical dispersion-range (see above, Fig. 4.1.-2.). Far from being a merely theoretical exercise, the inherent indeterminacy of weight units bears fundamental consequences on how new units are born. If the initial array of 'borrowed' weights, constituting the model for the new weight system, is picked from one of the two 'tails' of the unit's normal distribution, the value-range of the new unit will be inevitably slightly different from the value-range of the unit from which it originated from. And since this process is repeated again and again each time



▲ *Fig. 4.20. Bronze Age weight systems between Mesopotamia and Europe. Each dot shows the best-fitting quantum of the relative regional sample and its chronology (the earliest date of the interval is indicated). The vertical lines indicate the three Standard Deviations range of each best-fitting quantum.*

the technology reaches a new region, the statistical error will spread, and the final result will be a normally-distributed value-range that randomly oscillates between slightly less and slightly more than the original value-range. This model of random propagation of Bronze Age units was successfully tested based on a dataset of thousands of balance weights spanning Mesopotamia Europe between the 3rd and the 2nd millennium BCE (Ialongo *et al.* 2021).

The graph in fig. 4.20. shows the observed values of all the weight units in the *shekel*-range that can be identified between Mesopotamia and Europe in the 3rd and 2nd millennium BCE. The graph clearly shows that the overall error-range of all the units largely overlaps throughout the whole time-span, and across a total distance of roughly 5,000 km. This means, in turn, that regardless of how different the theoretical values each unit might appear at first glance, all these systems were largely interoperable.

4.6. Weight systems and market integration

4.6.1. Premise: the relational nature of weight units and the problem of markets

The random-propagation model raises a fundamental question: If the formation of new units is governed by chance, and if there was no authority capable of regulating their statistical dispersion, then how come the weight systems of pre-literate Bronze Age Europe remained stable for over a millennium?

Common sense cannot explain the stability of primary weight systems, as the common-sense conceptualisation of primary weight units as 'numbers,' 'norms' and 'objects' is not supported by the evidence. The nature of Bronze Age units is neither objective nor normative. It is *relational*: Weight units can be defined as *relational constructs*, as they emerge from, and are consolidated by relationships between people, and hence they are more closely assimilable to the notions of 'habit' and 'custom' than to that of 'norm'. The regulation of weight systems was about people constantly engaging in transactions, haggling over price, working out controversies, and ultimately figuring out how much they could deviate from an implicitly understood custom before breaking one another's trust.

Bronze Age weight systems remain stable over wide territories for long periods of time because they are upheld by a formidably dense network of trading agents constantly negotiating prices, watching over potential frauds, discarding contentious weights, and ultimately assuring that the statistical dispersion of the unit does not exceed the socially-accepted threshold of the trade network *as a whole*, no matter how big it was. In other words, the spread of Bronze Age weight units is regulated by the market.

Talking about 'markets' in the Bronze Age is often met with scepticism, as their existence would be, allegedly, theoretically impossible in pre-modern economies (*e. g.*, Bruck 2016; Fontijn 2019; Jung 2021). Let alone that economic anthropology has abandoned the arbitrary distinction between 'primitive' and 'modern' economies long ago (Bourdieu 1977; Granovetter 1985; Appadurai 1986) – and that contemporary archaeological theory is finally acknowledging the compatibility of the market model with prehistoric societies (Baron/Millhauser 2021; Blanton/Feinman 2024) – the question is not whether or not markets are 'theoretically possible,' but rather whether or not the evidence supports the existence of markets. If it does, then the theory must be modified, and a role for markets needs to be created.

We sometimes tend to forget that 'the market' is not an 'external force' endowed with its own agency, but it is simply a model that describes what happens when a multitude of people in a vast territory creates connections in order to secure the supply of goods that they need or want to obtain. These connections can be direct or indirect, regular or occasional, high- or low-volume, but eventually they determine the emergence of an exchange system in which all agents are to some extent interdependent. This system is, as a matter of fact, indistinguishable from what is more or less universally referred to as the 'Bronze Age Western Eurasian trade network' (Earle *et al.* 2015; Vandkilde 2016; Kristiansen 2018b; Murray 2023). Imagine countless different agents spread out across Europe periodically engaging in economic transactions, each time with different partners in different places, for different quantities of different goods, every day all year long. Whether we call it a 'market' or a 'network' really makes very little difference. What matters for the subject at hand is that, once we eliminate the normative hypothesis, the market model is the only option left to explain why, in the absence of international authorities, the interval of Bronze Age weight systems remains approximately constant across roughly a millennium.

4.6.2. Weight-regulated money in Mesopotamia

Before concluding this chapter with the outline of a distributed-network model for market exchange in pre-literate Bronze Age Europe, I will introduce the problem of pre-coinage money in Bronze Age economies. The theoretical literature on the 'origin' of money is vast, stratified and complex. It traditionally involved many competing approaches from the fields of economics, anthropology, history and archaeology, which seldomly engage in interdisciplinary debate and among which there is no established consensus, not even among scholars in the same field (Bohannan 1959; Dalton 1965; Melitz 1970; Jones 1976; *e. g.*, Bloch/Parry 1989; Zelizer 1989; Haselgrove/Krmnicek 2012).

At the same time, it is perhaps puzzling to realise that, in the face of such an impressive corpus of theoretical literature on the subject, empirical re-

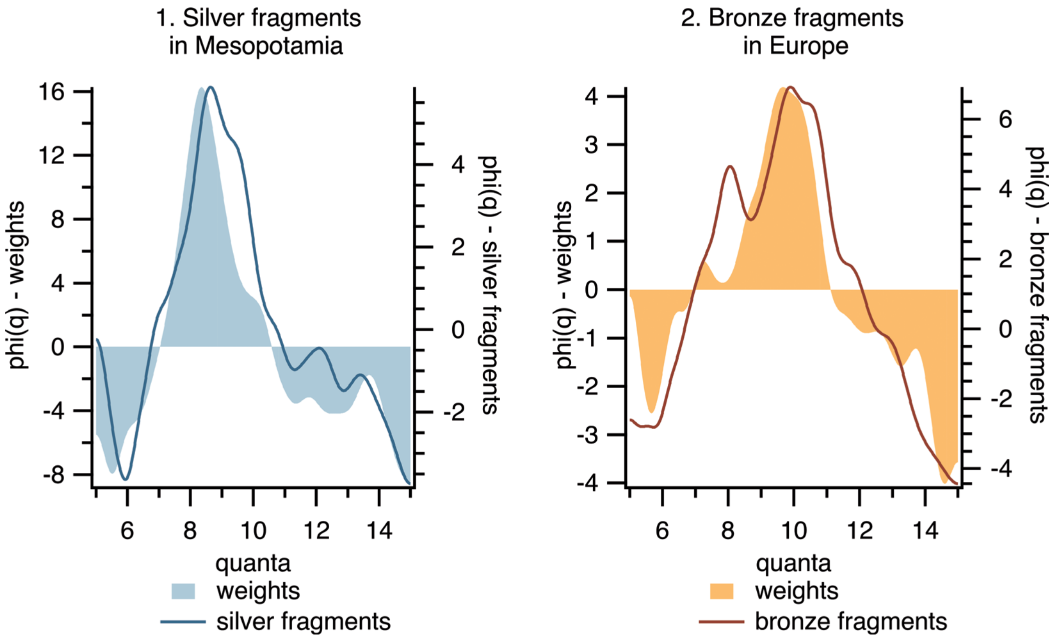


Fig. 4.21. Weight-regulated money in the Bronze Age. Cosine Quantogram Analysis of metal scraps compared with balance weights. 1) silver fragments in Mesopotamia (data for silver in Ialongo *et al. 2018); 2) bronze fragments in Europe (data for bronze in* Ialongo *et al. 2023).*

search on the pre-coinage currencies used by those very economies that eventually 'invented' coins – as opposed to ethnographically-documented ones – is traditionally rather scarce. This is to say that virtually all the competing theories on the 'origin of money,' intended as a hypothetical historical process, remain to date largely untested. Fortunately, a recent surge of interest in the archaeological problem of pre-coinage money in pre- and protohistoric economies raises hopes that the debate can finally move on from its merely theoretical dimension, and embrace a data-grounded perspective (Baron 2018; Baron/Millhauser 2021; Ialongo/Lago 2021; 2023; Kuijpers/Popa 2021; Rahmstorf *et al.* (eds.) 2021; Montalvo-Puente *et al.* 2023; Rosenswig 2024). Since the problem of money is only tangential to the aims of this book, I will limit the discussion to the empirical evidence, as it is closely related to the origin of weight systems.

Whether arguing over the nature of money may or may not be the point, there is substantial evidence that Bronze Age economies between Mesopotamia and Europe at least partly relied on lumps and fragments of weighed metal as means of payment in economic transactions. In Mesopotamia, such a function was largely fulfilled by silver scraps at least since the 3rd millennium BCE (Powell 1996), with evidence becoming clearer and clearer by the beginning of the 2nd millennium BCE, thanks to the precise documentation found in business letters and bookkeeping accounts of private merchants (Stratford 2017; Barjamovic *et al.* 2019; Dercksen 2021). According to many surviving documents, silver fulfilled the function of medium of exchange, standard of value, reserve of value, and means of deferred payment (Garfinkle 2004; Steinkeller 2004; Englund 2012; Dercksen 2021), even though it was never officially adopted, let alone 'issued' by any central authority (Peyronel 2010; Rahmstorf 2016a).

The value of silver was quantified through weighing, which in turn makes its monetary function very much recognisable empirically through the very same methodology employed to reconstruct weight systems based on balance weights. A recent study showed that the silver lumps and fragments contained in a hoard found in the Bronze Age city of Ebla, Syria (*c.* 2000-1700 BCE), have the same metrological structure as the balance weights of the same period (Ialongo *et al.* 2018a). More in detail, CQA shows that both balance weights and silver scraps comply with the 'Mesopotamian *shekel*' of *c.* 8.3-8.5 g (Fig. 4.21.1).

Since there was no enforced 'norm' that prescribed that silver scraps complied with weight systems, the fact that they do requires a different explanation. Just like for balance weights, the apparent weight-based regulation of silver scraps can be explained by a bottom-up, customary process mostly dictated by convenience. Simply put, since most transactions values were quantified in multiples of the *shekel*, silver would have been most conveniently broken down to match those values, hence minimising the potential friction caused by the high incidence of remainders, which in turn eventually produced quantally-configured datasets that CQA can very easily detect. Note that, just like for balance weights, the outcome needs to be neither regular nor precise in absolute terms, but only regular and precise *enough* to produce statistically-significant quantal variability.

As it is always the case in ancient as well as in modern economies (Dalton 1965; Melitz 1970; Pryor 1977; Bloch/Parry 1989; Haselgrove/Krmnicek 2012; Rosenswig 2024), there were many different currencies circulating at the same time in Bronze Age Mesopotamia. Silver is the most 'visible' one simply because it was the most used by those subjects – *i. e.*, public administrations and wealthy merchants – that produced the largest share of the textual and archaeological evidence that survived to be collected and studied by philologists and archaeologists. Grains, for example, were probably one of the most used everyday currencies in local markets, as well as non-precious metals such as copper, lead and tin (Powell 1996; Steinkeller 2004; Sallaberger/Pruss 2015). Just like bronze coins in the Roman Republic were used in local markets by agents that could not normally afford – or did not have much use for – silver mints (Kemmers 2016; Stannard 2021), one can imagine local currency-systems largely relying on less-than-noble metals. We may not see conspicuous traces of these local markets in Mesopotamia simply because their protagonists were average 'commoners' who, unlike wealthy private merchants engaging in long-distance trade, did not have the need to produce detailed written documents to keep track of their businesses. After all, nearly all we know about the private economy of Bronze Age Mesopotamia comes from the site of Kültepe/Kanesh, in Anatolia; if, by an unfortunate coincidence, this single site had gone unexcavated, we would probably doubt that a private economy even existed in the first place (Steinkeller 2004).

While the widespread monetary circulation of non-precious metals remains for now an untestable hypothesis for the Near East, substantial evidence suggests that bronze scraps fulfilled in pre-literate Bronze Age Europe the same monetary function that silver did in Mesopotamia.

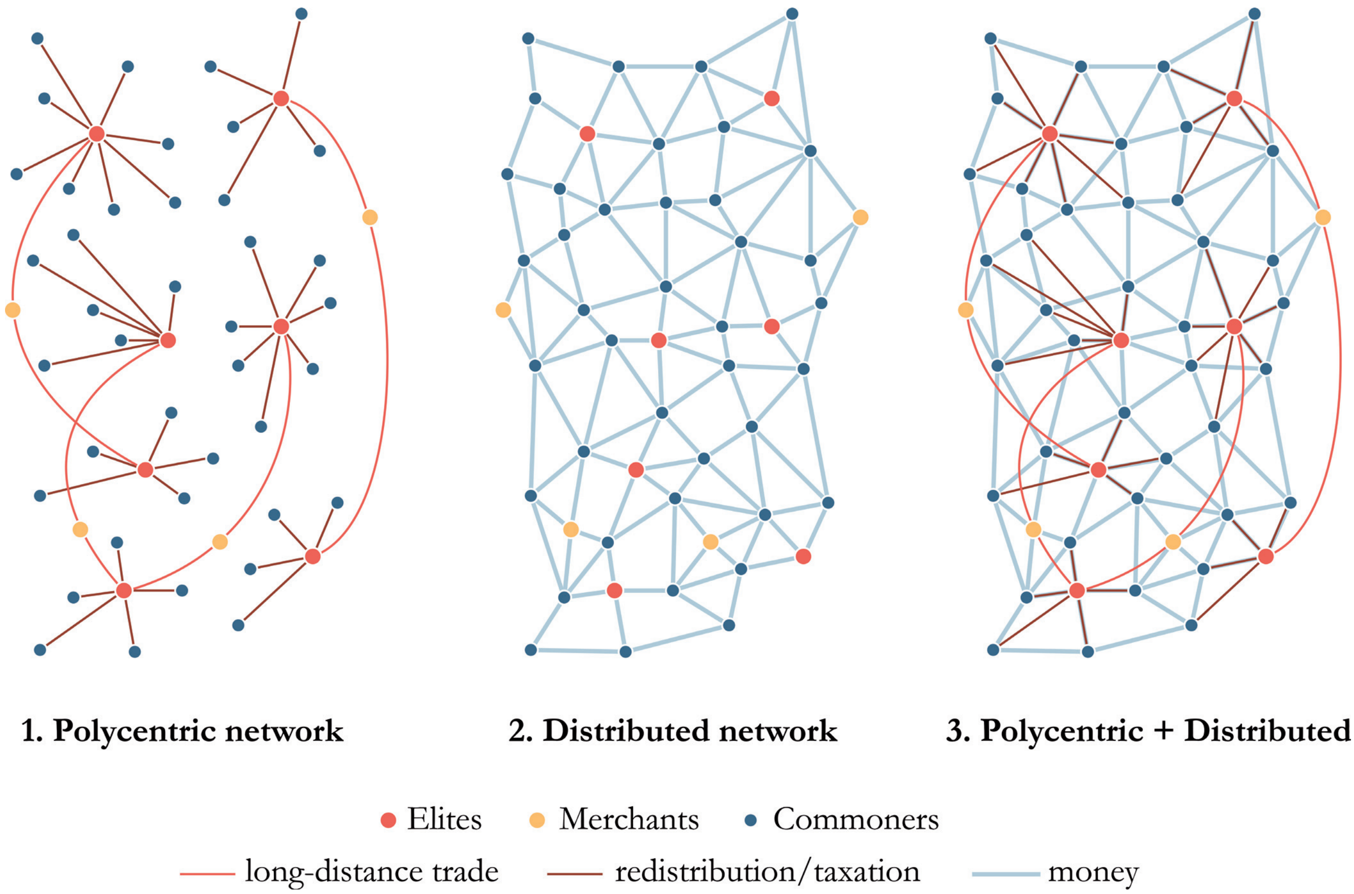
4.6.3. Weight-regulated money in Europe

The analysis of a very large sample of more than 20,000 bronze objects from more than 1,000 Bronze Age hoards distributed between Italy and Germany reveals that fragments start complying with the Pan-European *shekel* starting *c.* 1500-1350 BCE (Fig. 4.21.2). Before then, bronze fragments show no sign of weight-based regulation, while complete objects simply never do (Ialongo/Lago 2021; 2023).

This is not the appropriate space to discuss the fragmentation phenomenon of Bronze Age Europe, which has been widely addressed in archaeological literature in last 100 years or so (Primas 1986; Sommerfeld 1994; Bruck 2016; Hansen 2016; *e. g.*, Brandherm 2018; Vilaça/Bottaini 2019; Lago 2020). Suffice it to say that starting *c.* 1500-1350 BCE, the vast majority (*c.* 75 % of the total) of the metal objects we find in European hoards were intentionally fragmented. The results of the statistically analysis strongly imply that these objects were intentionally broken down to match multiples of a weight unit, and, based on the analogy with silver fragments in Mesopotamia, they circulated as weight-regulated money. The premises, results and implications of this research, as well as the sample on which it is based have been discussed at length in recent publications (Ialongo/Lago 2021; 2023). What is important to note for the subject at hand, is the remarkable chronological correlation between the emergence of the fragmentation phenomenon, the beginning of the weight-based regulation of bronze fragments, and the appearance of weighing technology in Central Europe. These three continental-scale phenomena are clearly interconnected, and bear strong implications for the monetary circulation of metal fragments, the emergence of primary weight systems, and the formation of a continental trade network in pre-literate Bronze Age Europe.

In the same way as silver in Mesopotamia, bronze objects were broken down to match transaction values. Contrary to silver, however, bronze was an extremely common and widely available material, and the fact that it circulated in a monetary fashion implies exchange patterns that did not necessarily involve affluent agents. The generalised compliance of metal fragments with weight systems – both in Europe and Mesopotamia – is a secondary consequence of the monetary circulation of metal, and it is precisely for this reason that the weight-based regulation of metal fragments is the single most important outcome of the spread of weighing technology in the Bronze Age world. Metal fragments do not comply with weight systems because it was 'mandatory,' but because it was convenient. Just like the regulation of weight systems, the weight-based regulation of media of exchange is the material consequence of emergent economic behaviour, consistently enacted on a continental scale through half a millennium, and it is therefore a quantifiable proxy of that same behaviour. In a typical scenario, two trading partners negotiate a transaction. If credit or payment 'in kind' are not feasible, for whatever reason, the partners will agree on a price to be paid in metal, as the seller knows that they will be available to exchange that piece of metal for something else that they want or need in a future transaction. The buyer then chips off a piece of metal from their stock, whose mass corresponds to the transaction value both agents agreed upon, and the transaction is concluded.

What is especially intriguing about transactions paid with bronze fragments in Europe is their extremely low average value. The mass values of bronze fragments in European hoards are log-normally distributed (meaning that low values are vastly more represented than high ones), with *c.* 50 % of them weighing between *c.* 0.5-20 g, and 75 % below *c.* 70 g (Ialongo/Lago 2021; 2023). If Mesopotamian prices are any indication for Bronze Age Europe, bronze was significantly less valuable than silver. An unsystematic review of price equivalences spanning the Early and the Late Bronze Age indicates that the value of bronze was approximately one order of magnitude smaller than the value of silver (Gelb *et al.* 1991; Englund 2012; Stratford 2017; Dercksen 2021). If we piece



▲ *Fig. 4.22. Network models compared. The distribution of nodes is identical in all three versions.*

together these bits of information with the price equivalences for different commodities, one can derive that a quantity of bronze in the same range as the most attested mass values of bronze fragments in European hoards (*c.* 1-100 g) could purchase goods that are compatible with the everyday needs of a modest household, for example: *c.* 1-10 g of tin, 10-100 g of wool or salt, or 1-10 kg of cheese, lentils, or garlic. While these figures are obviously not verifiable in any systematic way, it is nonetheless rather striking that the vast majority of metal objects that show signs of weight-based regulation in Bronze Age Europe clearly belongs to a mass-range that a large part of the population did not realistically struggle to come by. In other words, the systematic compliance of bronze fragments with weight systems seems to be a proxy of small-scale transactions in local markets.

The indirect weight-regulation of metal fragments is so systematic and widespread, that it hints at a widely diffused phenomenon. The fact that weight fragments circulated as weighed currency is simply a proxy of the frequency of small-scale transactions in local markets; whether all of these transactions were 'monetary' in nature or not makes little difference. In conclusion, metal fragments comply with weight systems. And just as in the case of balance weights, once the top-down hypothesis is eliminated, the market model is the only viable explanation left.

4.6.4. Weight systems, money, and the formation of an integrated market in Bronze Age Europe

What was the role of weight-regulated money in the formation of trade networks in Bronze Age Europe? In order to find a role for money in prehistoric economies, we must first ask who had a use for it. Today, the most influential models for Bronze Age Europe are mainly concerned with exploring how power controls the economy in a top-down fashion, whereas 'power' is identified with elites operating within different degrees of polycentric chiefdom-like societies (*e. g.*, Earle *et al.* 2015; Kristiansen 2018b; Ling *et al.* 2018).

Local and chronological peculiarities aside, the polycentric model rests on two fundamental assumptions: 1) Western Eurasia is globally entangled in a trade network fuelled by the need to procure raw materials, especially tin and copper, and 2) in Europe, regional elites control local production and long-distance exchange. As a corollary, long-distance trade happens between peer elite groups or individuals, through a system of alliances and reciprocal dependencies (Fig. 4.22.1). The main actors are usually ranked in a four-tier scheme: 1) The elites, controlling and organising production and trade, extracting resources through tributes and redistributing wealth, and funding long-distance expeditions, *e. g.* by building and maintaining ships (Ling *et al.* 2018); 2) merchants, usually acting on behalf of elites as vectors, although recently having been acknowledged a certain degree of entrepreneurial freedom (Vandkilde 2021); 3) commoners, working under the control of elites to fulfil their economic planning; and 4) slaves, at the same time part of the workforce and valuable commodity.

Let alone slaves, full economic agency is only acknowledged to elites and partially to merchants, while commoners appear as passive recipients of a redistribution mechanism, with no agency on their own. All the attention is directed towards long-distance directional trade, and local markets play barely any role, while money is sometimes mentioned, but its function never defined.

Theoretically speaking, one could argue that in a model that frames economic initiative almost exclusively as private negotiations between distant elites, money can safely have no role at all. Be it European elites (Earle *et al.* 2015; Kristiansen 2018b; Ling *et al.* 2018) or Near Eastern states and merchants (Barjamovic *et al.* 2019; Benati *et al.* 2021), the common consensus is that high-tier subjects in the Bronze Age engaged in long distance exchange of a wide variety of different commodities, shipped in diversified bulks. Affluent subjects may not have had much use for money simply because they had at the same time ready availability of, and high demand for a wide range of different goods. Hence, it would be relatively easier for them to find partners that have what they want, and want what they have. Such a *'Double Coincidence of Wants'* is the minimum requirement for any transaction to take place, and is in turn the key-concept on which functional approaches in monetary theory build their models for the bottom-up origin of money in local markets (Jevons 1875; Jones 1976; Graeber 2011).

The reliance on money, in fact, becomes increasingly pressing the more the range of demanded goods exceeds the range of available products to offer in exchange. On the opposite end of the social spectrum, small producers – such as farmers and shepherds – may have struggled finding potential partners in local markets that met the requirements for the 'Double Coincidence of Wants,' and hence could have enormously benefitted from the existence of a standard medium of exchange to mitigate friction and facilitate transactions. In this scenario, the circulation of 'small change' sustains a distributed network, where each agent can potentially interact with any other provided that they are close enough, regardless of their status (Fig. 4.22.2). Monetary exchange in local markets could then simply facilitate the satisfaction of basic needs and wants, such as diversifying diets and procuring clothing, tools and novelty items (Ialongo/Lago 2023).

While the polycentric and distributed models may appear radically different at first glance, they are in fact perfectly superimposable (Fig. 4.22.3). After all, the elites do not exist outside of the economic sphere, but they are part of it. In this perspective, weight-regulated money simply reveals a vast sector of the economy of Bronze Age Europe that has gone so far largely unnoticed to prehistoric research: small-scale, short-range transactions in local markets, a dimension of Bronze Age economies that is gaining more and more prominence in recent research (Knapp *et al.* 2022; Murray 2023; Powell *et al.* 2022).

In conclusion, whether or not the economy of Bronze Age Europe was a 'monetary economy' is not really relevant. What I have tried to argue in this conclusive chapter is rather that the diffusion of weighing technology and the formation of weight systems produced a wealth of quantifiable archaeological data, that offer a unique and so-far vastly unexplored perspective on prehistoric economies in Western Eurasia.

4.7. Chapter highlights

- Bronze Age weight units are not precise values, but indeterminate, normally-distributed intervals with Coefficient of Variation of *c.* 5 %.
- Weighing technology progressively spreads westward during the Bronze Age, and primary weight systems emerge contextually wherever the technology is adopted for the first time. By the end of the 2nd millennium BCE, weight systems exist everywhere between the Indus Valley and Atlantic Europe.
- Bronze Age weight systems are *relational constructs*. They are never 'created' by central authorities, but emerge in a bottom-up fashion from economic networks.
- Bronze Age weight units are neither fixed values nor physical entities, hence they cannot be 'imported'. The emergence of new weight systems is a process governed by statistical randomness, which in turn is the consequence of the physical replication of balance weights.
- The weight system of pre-literate Bronze Age Europe emerges around 2000 BCE, and remains stable throughout the 2nd and early 1st millennium BCE.
- The European weight system is organised around two basic units. These units can be conventionally defined as a *shekel* (*i. e.*, a small unit) of *c.* 9-10 g – attested in Italy, Central Europe, the British Isles and the Iberian Peninsula – and a *mina* (*i. e.*, a big unit) of *c.* 445 g (or alternatively, 2x or ½x of this value), attested in Italy and Central Europe.
- The statistical dispersion of Bronze Age weight systems is largely regulated by the market. Central authorities can play a role in regulating statistical dispersion, but only where central authorities existed in the first place. In pre-literate Bronze Age Europe, there is no evidence that such authorities ever existed.
- Metal fragments comply with weight systems, and circulated as weighed currencies: silver in Mesopotamia, bronze in Europe.
- The monetary circulation of bronze in Europe suggests frequent small-scale transactions in local markets.

5 TYPOLOGICAL CATALOGUE OF WEIGHING DEVICES

In this chapter, I provide a full catalogue of all the weighing devices that form the dataset on which all the analyses in this book were conducted. The sample collected in this book includes 696 balance weights and 18 balance beams, unevenly distributed between Italy, Eastern Europe, Central Europe, Western Europe and the British Isles, roughly encompassing the whole duration of the Bronze Age and the very beginning of the Early Orientalizing period, *c.* 2300-700 BCE.

Each morphological type is introduced by a detailed overview of their typology, chronology, geographical distribution, and functional features. Distribution maps and general quantification graphs are provided for each morphological type.

The numbering of the objects is incremental, starting with 1 and ending with 714. All objects provided with an illustration appear in the plates, and are identified with the same number given in the catalogue.

All objects are illustrated by a detailed description, based on the following template:

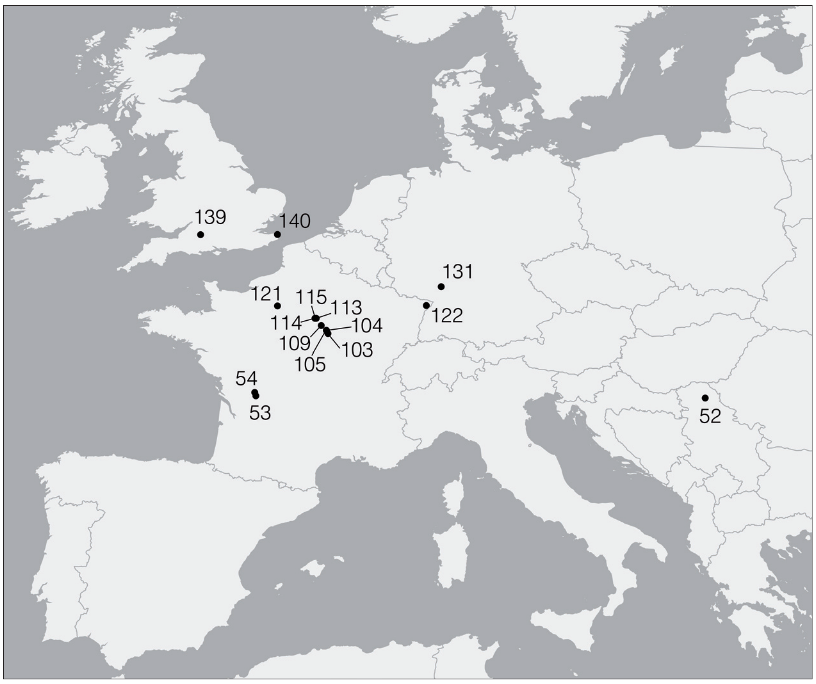
- object number (cat. no.);
- the site name, as known in the literature;
- site number (site no.), site type [in square brackets];
- levels of administrative denomination, from local to supralocal (in round brackets);
- archaeological context, *e. g.*, level, stratum, house, grave;
- chronological phase (in round brackets, relative chronological phase for the specific region);
- short description of typological features that are not encompassed by the general description of the type or variant;
- if the object is part of a weighing set, information about the composition of the set (in round brackets: object numbers of the items included in the set);
- if there are associations, description of the associated objects/features;
- state of preservation, *i. e.*, complete/fragmented;
- construction material;
- mass in grams, either complete or reconstructed (in round brackets: original mass if the weight was reconstructed);
- linear dimensions, in cm;
- physical location of the find (in round brackets: inventory number if available);
- if the object was previously published, bibliographic reference, if not, 'unpublished'.

The full database is freely available for download on ZENODO:
IALONGO, N. (2024): Ialongo_2024_book_supplement_Bronze_Age_Weights_Database. – (Zenodo). doi: 10.5281/ZENODO.13903718.

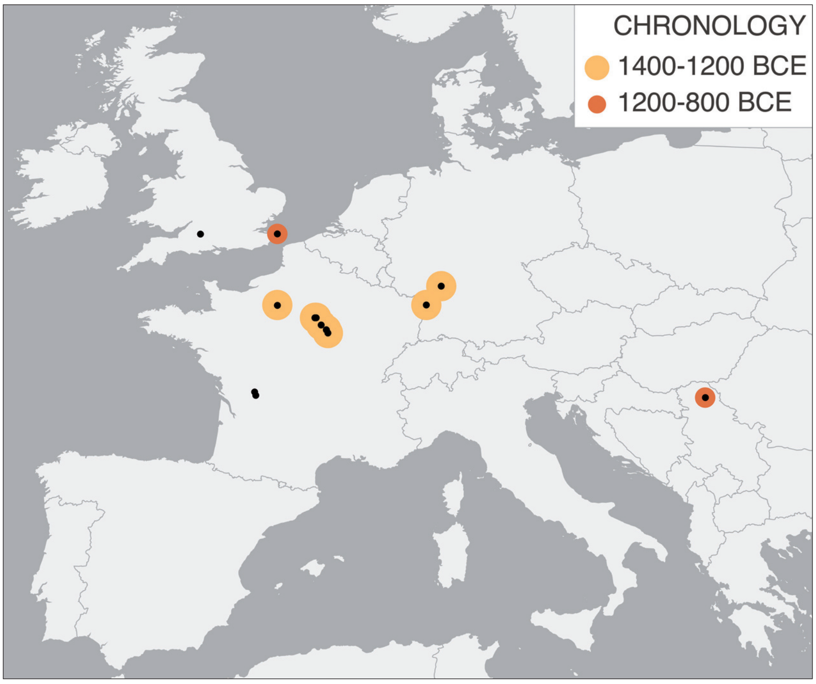
5.1. BALANCE BEAMS

- *number of objects*: 18
- *chronological range*: Phase 3-4 (*c.* 1400-800 BCE)
- *material:* bone + copper/bronze
- *14 sites:* site no. 52, 53, 54, 103, 105, 109, 113, 114, 115, 121, 122, 131, 139, 140
- *6 sets:* site no. 103, 105 (3 sets), 109, 115
- *length range (complete/reconstructed):* 9.5-21.3 cm

Distribution maps: fig. 5.1.-4.
Composition of the sample: fig. 5.5.-6.



▲ *Fig. 5.1. Balance beams. Geographical distribution: site ID.*



▲ *Fig. 5.2. Balance beams. Geographical distribution: chronology.*

Typology and comparisons

Equal-arm balance scales are the earliest type of balance, and the only one attested until the appearance of the steelyard in Roman times (Damerow *et al.* 2002). While in eastern Mediterranean and Levantine Bronze Age contexts most of the documentation is provided by balance pans (normally made of bronze), beams are the only preserved parts of balance scales in pre-literate Bronze Age Europe (*i. e.*, west of Greece). There are 18 known balance beams from European Bronze Age contexts, all made of bone. When fully preserved, beams always have perforations for the fulcrum and on both extremities in order to fix the strings from which pans or bags were hanging. Some objects have loops of bronze/copper wired secured inside perforations. When preserved, the loops always present an elongated 'omega' shape.

Balance beams can be subdivided into three typological variants, based on their overall shape and the position/orientation of their perforations. Variant 1 is characterised by a rectangular cross-section, with vertical perforations on the fulcrum and the extremities. The only object pertaining to V1 (1) is decorated with concentric circles on both faces, and has all its metal loops still secured inside the perforations.

Variant 2 has circular cross-section, the body is slightly tapered, and the extremities are plain and flat. Three small transversal perforations are present on the fulcrum and on the extremities. The only object classified in V2 (2) is the longest beam preserved so far (21.3 cm).

Variant 3 has a round cross-section and tapered body similar to V2, but the extremities are expanded in a trumpet-like shape. The fulcrum is obtained through a transversal perforation. In nine out of ten objects (cat. no. 3, 5-12), the perforations on the extremities have an oblique orientation, running from the centre of the round expansion to the base of the expansion itself. In one case (cat. no. 4) the perforations are parallel to the beam, and run from the lower side of the round expansion to the base of the expansion itself. Object cat. no. 6 has a metal loop still preserved in the fulcrum.

Six fragmented objects with round cross-section and missing extremities cannot be assigned to either V2 or V3 (cat. no. 13-18). Five of these beams have a metal loop preserved in the fulcrum (cat. no. 13, 15-18).

Bone balance beams appear between Greece and Mesopotamia in the 3rd millennium BCE (Rahmstorf 2022, 528-535). An object similar to V1 comes from the Early Bronze Age settlement of Tell Fadous-Kfarabida, in Lebanon (Genz 2011). A tapered beam with plain extremities analogous to V2 is attested at the western Anatolian site of Bözöyük, also dated to the EBA (Rahmstorf 2022, 531, fig. 168.4). Both objects are roughly 1,000 years earlier than their European counterparts. Between the Aegean and the Near East, no bone balance beams are known for the 2nd millennium BCE, whereas balance scales are mostly documented by frequent finds of bronze pans (Pare 1999). For the 1st millennium BCE, at least two bone beams with expanded extremities – similar to V3 – are attested in the Levant at Megiddo and Lachish (Peyronel 2011).

Chronology and geographical distribution

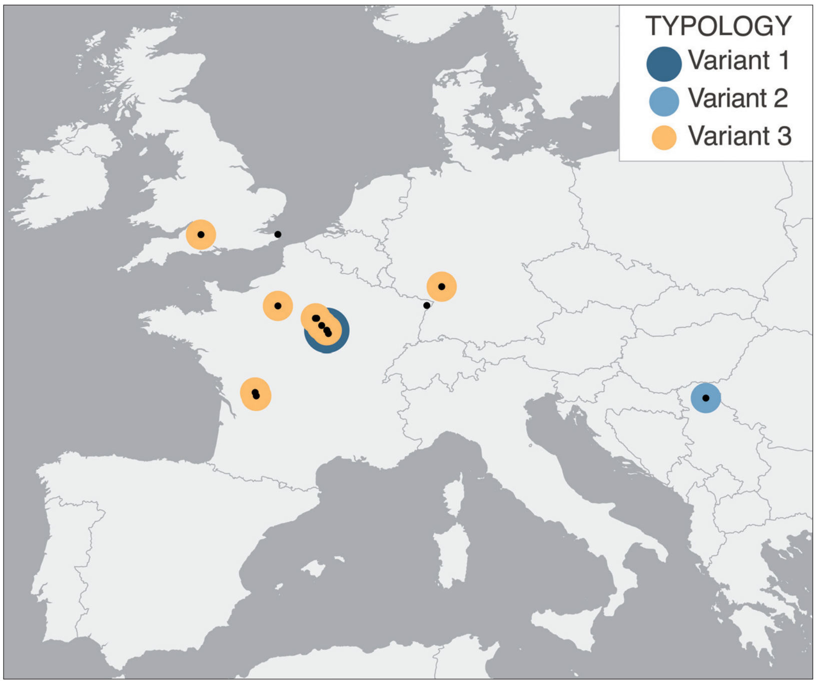
The earliest securely-dated balance beams are attested in Central Europe in the Br D phase (*c.* 1350-1200 BCE), between eastern France and western Germany (Fig. 5.2.). Twelve of the 13 beams dated to this chronological phase all come from burials, with a notable concentration in mixed-ritual burial sites of the Yonne basin in Bourgogne-Franche-Comté (Roscio *et al.* 2011). A fragmented beam (cat. no. 8) is documented at the fortified settlement of Fort Harrouard, in Centre-Val de Loire (site no. 121). Seven of the 13 beams dated to Phase 3 are classified into V3 (cat. no. 4, 7-12), one in V1 (1) and five are fragmented objects belonging to either V2 or V3 (cat. no. 13-15, 17-18). Two balance beams are dated to Phase 4 (*c.* 1200-800 BCE): a complete beam from the Serbian settlement of Bordjoš (cat. no. 2, site no. 52), and a fragmented one from the burial area of the midden site of Cliffs End Farm, in south-eastern England (cat. no. 16, site no. 140). Finally, there are three objects (cat. no. 3, 5-6) coming from mixed deposits, generically datable to the Bronze Age.

Contexts

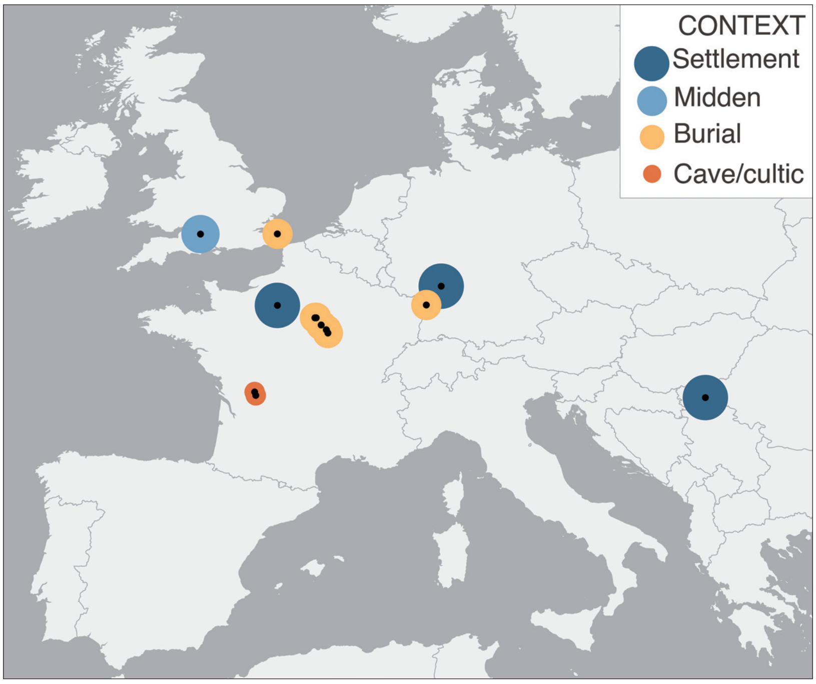
Most known balance beams come from Central European graves dating to the Br D phase (Fig. 5.2.; 5.4.; 5.6.), several of which are associated with sets of balance weights. The inhumation grave no. 298 at the site of Migennes – Le petite Moulin (site no. 105) represents an exceptional case, with two balance scales (cat. no. 1, 4) belonging to two separate weighing sets (Roscio *et al.* 2011). Approximately dating to the same chronological horizon, a fragmented balance beam (cat. no. 8) from the fortified settlement of Fort Harrouard in France (site no. 121) is associated with several fragments of clay tuyère (Mohen/Bailloud 1987, fig. 85.8). In the settlement of Bordjoš in Slovenia (site no. 52), a balance beam (cat. no. 2) was found in a small pit, together with eight natural pebbles (Medović 1995). It is theoretically possible that these pebbles were used as balance weights, but they are too few to be tested statistically (Rahmstorf 2014). Finally, three objects come from generically dated deposits, one from a midden site in England (cat. no. 3, site no. 139) and two from two different caves in France (cat. no. 5-6, site no. 53-54).

Accuracy and function

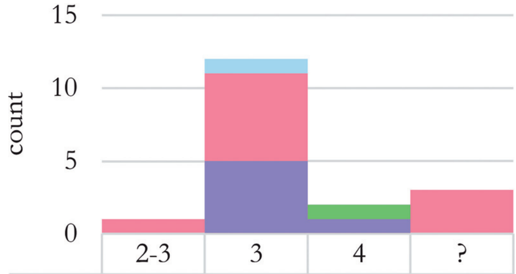
The only technical requirements for an equal-arm balance are a symmetrical shape about its middle point and a clearly marked fulcrum. Equal-arm balance scales are null instruments, *i. e.*, measuring devices that balance an unknown value against a known one in order to obtain a zero sum. Null instruments can be very precise. However, as they cannot directly quantify magnitude, their error is always relative to the quantity being measured, *i. e.*, is expressed in percentage rather than in absolute values. The accuracy of balance scales was a known issue since their inception: cuneiform texts of the 3rd millennium BCE report an average accuracy of *c.* 3 % of the quantity being measured, a value confirmed by a recent experiment (Ialongo *et al.* 2021). A simulation based on 3D models suggests



▲ *Fig. 5.3. Balance beams. Geographical distribution: typology.*

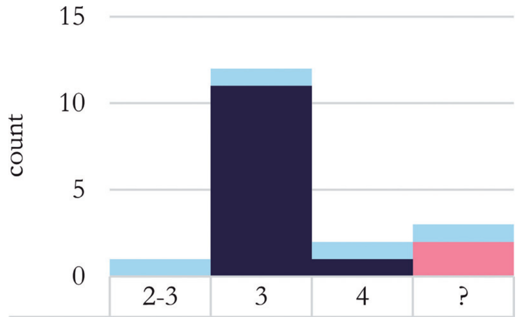


▲ *Fig. 5.4. Balance beams. Geographical distribution: site type.*



	2-3	3	4	?
V1		1		
V2			1	
V3	1	6		3
V2-3		5	1	

▶ *Fig. 5.5. Balance beams. Quantification: typology vs chronology.*



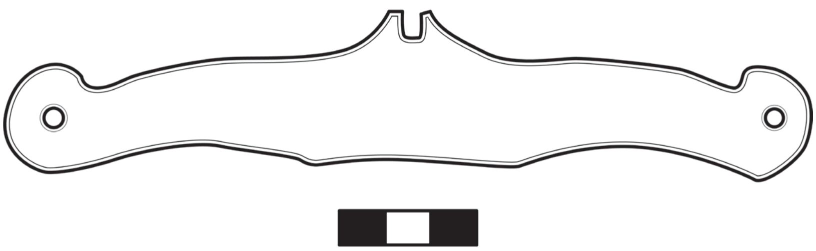
	2-3	3	4	?
sett.	1	1	1	1
burial		11	1	
cave				2

▶ *Fig. 5.6. Balance beams. Quantification: site type vs chronology.*

that the smallest quantity that could be measured on Bronze Age scales ranged between *c.* 0.1-0.5 g (Poigt *et al.* 2021). This figure is compatible with the mass of the smallest known balance weight in Bronze Age Europe, equal to 1.6 g (cat. no. 288).

A recent study produced accurate replicas of all the types of bone balance beams documented in BA Europe, and demonstrated that their overall loading capacity ranged between *c.* 7-30 kg (Hermann *et al.* 2020)macromolecular chemistry and material science. Although possible, it is unlikely that balance scales were regularly used at full capacity. Heavy loads were probably measured with bigger scales made of wood, of which there is for now no direct evidence in the archaeological record of Western Eurasia. Images of large wooden balance scales, however, are attested in Egypt already during the Old Kingdom (Rahmstorf 2022, 533-534), and described in cuneiform texts of the 3rd millennium BCE (Peyronel 2011).

▼ *Fig. 5.7. Bronze object from the Early/Middle Bronze Age tomb of Castelluccio (Sicily, Italy), sometimes interpreted as a balance beam.*



West of Greece, there is so far no archaeological evidence of balance pans. As equal arm balance scale – in most use-scenarios – require containers hanging from the extremities on which to lay balance weights and the quantity to be measured, one must conclude that these containers were made of perishable materials. R. Hermann *et al.* (2020), for example, equipped their experimental replicas with leather pans. However, pans can also be replaced with bags.

Weighing with equal-arm balance scales is in principle extremely easy: One lays the quantity to be measured on a pan hanging from one of the two extremities and balance weights on the opposite pan until the beam is horizontal. This basic technique can have several variants, for example:

A- *Additive weighing*. The quantity to be measured is put on a pan or inside a bag on one side, and balance weights are added to the opposite pan/bag until equilibrium is achieved.

B- *Counterweighing*. A known quantity of one or more balance weights is put on a pan or inside a bag, and an unknown quantity is added to the opposite pan/bag until equilibrium is achieved. The same operation can be executed with a balance weight directly hanging from one extremity; in this scenario, the weight requires a perforation or a means to fix a cord, *i. e.*, a metal loop or an annular groove. Several balance weights attested in BA Europe present these characteristics.

C- *Subtractive weighing*. The quantity to be measured is put on a pan or inside a bag on one side, and balance weights are added to the opposite pan/bag, or hang directly from the extremity as counterweights. If the mass of the balance weights is excessive, further balance weights can be added to the quantity being measured until equilibrium is achieved. The quantity to be measured is calculated by subtracting the mass of the balance weights lying together with the quantity to be measured from the mass of the balance weights on the opposite side.

Other potential balance beams

Over the years, a few objects of uncertain function have been singled out from Bronze Age contexts in Europe, and tentatively interpreted as potential balance beams (*e. g.*, Cardarelli *et al.* 2001; Rahmstorf 2014). As they never present a fulcrum, their identification as balance beams is highly dubious, and they were not included in this study.

A. Cardarelli *et al.* (2001) singled out five objects from Italian contexts dating to the Middle and Late Bronze Age, tentatively proposing to identify them as balance beams. The first of these objects – from the Early/Middle Bronze Age grave of Castelluccio, in Sicily – is made of bronze, and has a symmetrical shape with two perforations at the extremities (Fig. 5.7.). The central perforation that would have been used as fulcrum – if this object were actually a balance beam – is, however, open towards the top, not broken, and hence could not be used to fix a suspension cord. The remaining four objects (one made of wood and three of bronze) do not have any central perforation that could serve as fulcrum. L. Rahmstorf (2014) – in addition to some of the balance beams considered in this book – reconsiders the four doubtful objects identified by A. Cardarelli *et al.* and adds two further ones from Central European contexts: a fragment of an elongated bone object with a terminal perforation, and a long, slightly bent bronze bar with two hanging rings attached to its extremities. None of these two objects, however, has a fulcrum.

Variant 1: Rectangular cross-section (cat. no. 1)

1. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 2 weights and 1 balance beam (cat. no. 1, 152, 309). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Bone. Mass: n/a. Dimensions: 13.8 cm x 1.4 cm x 0.7 cm - Roscio *et al.* 2011, fig. 5.13.

Variant 2: Round cross-section, simple extremities (cat. no. 2)

2. Bordjoš [site no. 52, settlement] (Banat, Novi Bečej, Serbia). Pit. Phase 4 (Ha A1) - Associations: 8 pebbles - Complete. Bone. Mass: n/a. Dimensions: 21.3 cm x 1.1 cm - Medović 1995, fig. 4.

Variant 3: Round cross-section, expanded extremities (cat. no. 3-12)

- *number of objects:* 10
- *chronological range*: Phase 3-4 (*c.* 1350-800 BCE)
- *material*: bone and bronze
- *8 sites:* site no. 53, 54, 105, 109, 114, 121, 131, 139
- *2 sets:* site no. 105, 109

3. Potterne [site no. 139, midden] (County Wiltshire, England). Undetermined chronology (Bronze Age) - Complete. Bone. Mass: n/a. Dimensions: 12.3 cm x 0.8 cm - Lawson (ed.) 2000, 236.
4. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Bone. Mass: n/a. Dimensions: 10.3 cm x 0.8 cm - Roscio *et al.* 2011, fig. 2.35.
5. Agris, Grotte de Perrats [site no. 54, cave] (Charente, Nouvelle-Aquitaine, France). Undetermined chronology (Bronze Age) - Complete. Bone. Mass: n/a. Dimensions: 9.5 cm x 0.7 cm - Peake *et al.* 1999, fig. 1.2.
6. Vilhonneur, Grotte de la Cave Chaude [site no. 53, cave] (Charente, Nouvelle-Aquitaine, France). Undetermined chronology (Bronze Age) - Metal loop preserved. Complete. Bone. Mass: n/a. Dimensions: 17.8 cm x 0.9 cm - Peake *et al.* 1999, fig. 1.3.
7. La Croix de la Mission [site no. 114, burial] (Marolles-sur-Seine, Seine-et-Marne, Île-de-France, France). Cremation grave 13. Phase 3 (Br D) - Associations: 2 bronze hinges (organic container), gold and bronze fragments, tweezers, pebble weights (?) - Complete. Bone. Mass: n/a. Dimensions: 11.3 cm x 0.6 cm - Pare 1999, fig. 22.1.
8. Fort Harrouard [site no. 121, settlement] (d'Eure-et-Loir, Centre-Val de Loire, France). B. 543. Phase 2-3 (Bronze Moyen-Bronze Final I) - Associations: several tuyère fragments - Fragmented. Bone. Mass: n/a. Dimensions: 5.5 cm x 0.6 cm - Mohen/Bailloud 1987, pl. 85.8.
9. Mannheim-Wallstadt [site no. 131, settlement] (Baden-Württemberg, Germany). Fundstelle 17. Phase 3 (Br D) - Thin rib at the base of the expanded extremity. Fragmented. Bone. Mass: n/a. Dimensions: 6.2 cm x 0.7 cm - Görner 2003, fig. 21, 71.3.
10. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Incineration 284. Phase 3 (Br D) - Associations: fragments of bronze, destroyed by fire - Fragmented. Bone. Mass: n/a. Dimensions: 7.5 cm x 0.5 cm – Roscio/Marcigny 2022, fig. 3.284.6.
11. Etigny, “Le Brassot” Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Fragmented. Bone. Mass: n/a. Dimensions: 8.1 cm x 0.5 cm - Musées de Sens - Roscio 2018, pl. 85.28.
12. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 267. Phase 3 (Br D) - Associations: 3 bronze hinges (organic container), dagger, amber, flint, animal bone - Fragmented. Bone. Mass: n/a. Dimensions: 1.2 cm x 0.5 cm – Muller 2009, fig. 5b.5.

Variant 2 or 3: Fragmented beams (cat. no. 13-18)

- *number of objects:* 6
- *chronological range*: Phase 3-4 (*c.* 1350-800 BCE)
- *material*: bone and bronze
- *6 sites:* site no. 103, 105, 113, 115, 122, 140
- *3 sets:* site no. 103, 105, 115

13. Gours-aux-Lions [site no. 115, burial] (Marolles-sur-Seine, Seine-et-Marne, Île-de-France, France). Cremation grave 5. Phase 3 (Br D) - Associations: 3 bronze hinges (organic container), dagger, chisel, tweezers, 3 bronze fragments, 3 gold fragments,

stone axe - Metal loop preserved. Part of a set of 2 balance weights and 1 balance beam (cat. no. 13, 29, 31). Fragmented. Bone. Mass: n/a. Dimensions: 10.5 cm x 0.6 cm - Pare 1999, fig. 20.14.

14. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 251. Phase 3 (Br D) - Part of a set of 2 balance weights and 1 balance beam (cat. no. 14, 275, 276). Associations: 2 lead balance weights, fragment of a bone balance beam, sword, pin, scabbard, applique - Fragmented. Bone. Mass: n/a. Dimensions: 5.0 cm x 0.6 cm – Muller 2009, fig. 5a.5.
15. La Croix-Saint-Jacques [site no. 113, burial] (Marolles-sur-Seine, Seine-et-Marne, Île-de-France, France). Cremation grave 61. Phase 3 (Br D) - Metal loop preserved. Fragmented. Bone. Mass: n/a. Dimensions: 4.2 cm x 0.6 cm - Delattre/Peake 2015, fig. 18.1, pl. 60.
16. Cliffs End Farm [site no. 140, burial] (Kent, England). Phase 4 (Ewart Park) - Associations: balance weights from the same site - Metal loop preserved. Fragmented. Bone. Mass: n/a. Dimensions: 2.5 cm x 1.1 cm – Grimm/Schuster 2014, pl. 5.9.1.
17. Monéteau, "Aux Bries" [site no. 103, burial] (Yonne, Bourgogne-Franche-Comté, France). Phase 3 (Br D) - Metal loop preserved. Part of a set of 2 balance weights and 1 balance beam (cat. no. 17, 273, 274). Associations: 2 lead weights, balance beam, razor - Metal loop preserved. Fragmented. Bone. Mass: n/a. Dimensions: 4.6 cm x 0.7 cm - Roscio 2018, pl. 93.3.
18. Haguenau-Oberfeld [site no. 122, burial] (Bas-Rhin, Grand Est, France). Tumulus 57. Phase 3 (Br D) - Metal loop preserved. Fragmented. Bone. Mass: n/a. Dimensions: 3.6 cm x 0.5 cm - Roscio 2018, pl. 20.7.

5.2. PARALLELEPIPED

- *number of objects*: 145
- *objects with known mass (complete/reconstructed)*: 108 (74.5 %).
- *chronological range*: Phase 1-4 (*c.* 2300-800 BCE)
- *material:* stone (77), copper/bronze (64), lead (4)
- *66 sites:* site no. *3*, 5, 6, 9, 10, 11, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 27, 28, 32, 33, 34, 35, 37, 40, 58, 74, 82, 84, 85, 91, 98, 99, 100, 101, 105, 106, 107, 108, 109, 110, 111, 115, 116, 118, 119, 120, 123, 124, 125, 126, 127, 129, 130, 132, 133, 134, 135, 136, 137, 138, 141, 162, 187, 196, 207
- 17 sets: site no. 3 (2 sets), 105, 107, 108, 109, 115, 118, 119, 123, 124, 127, 130 (2 sets), 132, 137
- *mass range (complete/reconstructed):* 0.3-469.4 g (5th percentile= 1.41 g; 95th percentile= 182.55 g)

Distribution maps: fig. 5.8.-12.
Composition of the sample: fig. 5.13.-15.

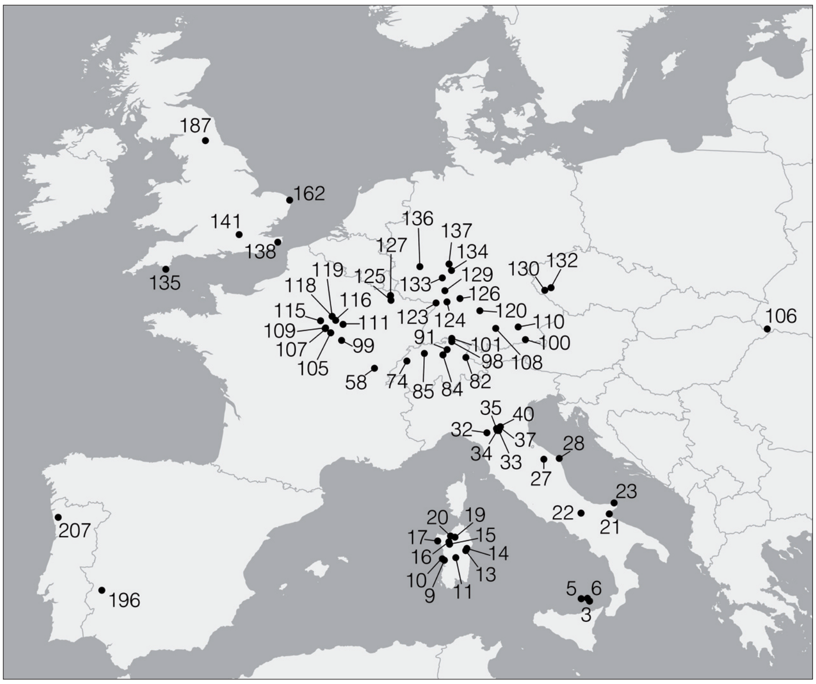
Typology, materials, comparisons, and function

Most parallelepiped weights have a regular, elongated shape with straight or slightly convex sides. The typological variability encompasses objects with a square surface (cat. no. 50-54, 101, 108-109), and with more irregular shapes (cat. no. 57-58, 104-105, 112-113, 140). With 145 objects, parallelepiped weights are the most numerous among the weight types in the *shekel*-range. Parallelepiped weights were first identified in the MBA-LBA of Central Europe by C. Pare (1999).

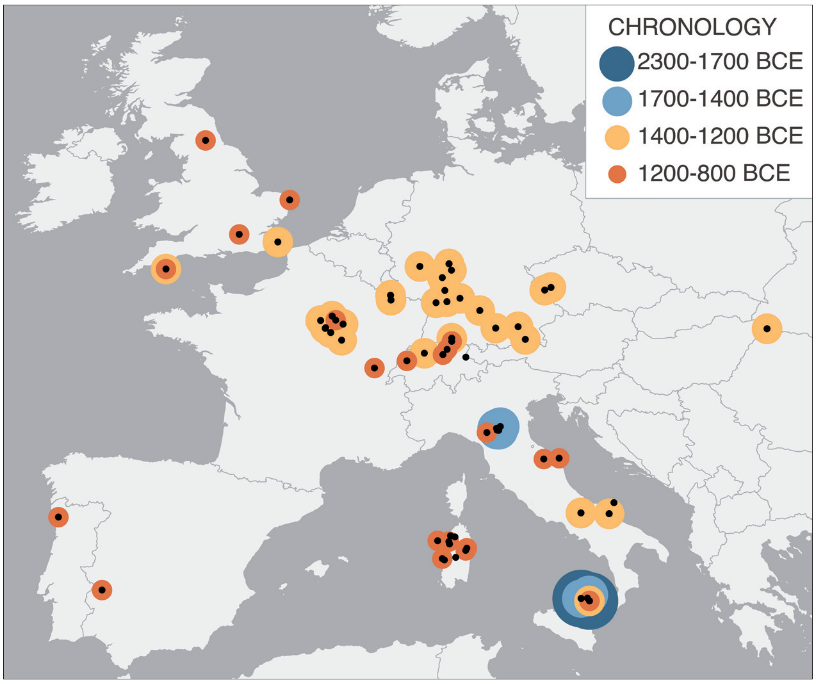
This type includes four variants. Variant 1 has plain rectangular surfaces, while Variant 2 presents a small circular indentation towards one of the extremities. The two variants present overall the same shape, and both include objects made of stone and metal. The mass values of the objects included in V2 are varied, hence it is unlikely that the circular indentations identify a weight unit. The parallelepiped shape is the most attested in Europe among the balance weights of the *shekel*-range. Having a simple shape, these weights were probably easy to produce and did not require any particular expertise. This shape is also attested in the LBA of the eastern Mediterranean (Pulak 1997, 337, 375), although it is not very common. Variant 3 is one of the most characteristic balance weight shapes in BA Europe. All made of bronze, the objects in this variant all have wavy grooves on two or more faces, some of which include inlaid copper wires. The morphological traits of Variant 4 are the same as V1 and V2, with the difference that they all have a circular perforation towards one of the extremities. While all other variants were simply put on a balance pan, the weights in V4 could also be attached directly to one of the balance arms through a cord. The sample includes fragmented objects that could not be reconstructed, and hence could not be attributed to one of the variants due to their lacking state. Finally, the list also includes four objects from the Bronze Age sites on Lipari, that are described in the publication but could not be found in the museum's storerooms.

Chronology and geographical distribution

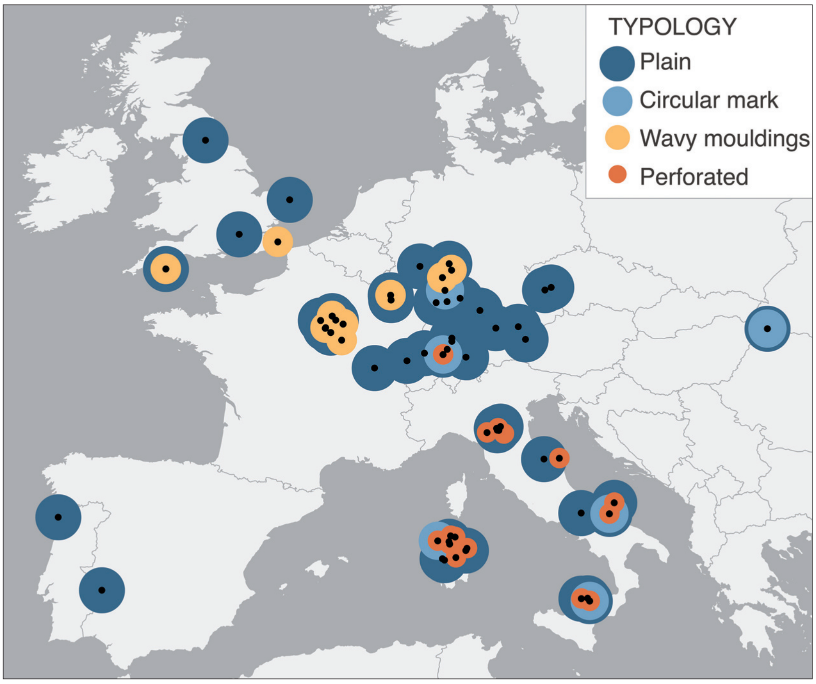
Parallelepiped weights cover a wide chronological interval, being attested in four phases (Fig. 5.9.). Their presence in Early Bronze Age settlements on the Aeolian Islands (site no. 3, 5) make them the earliest type of balance weights attested in Europe,



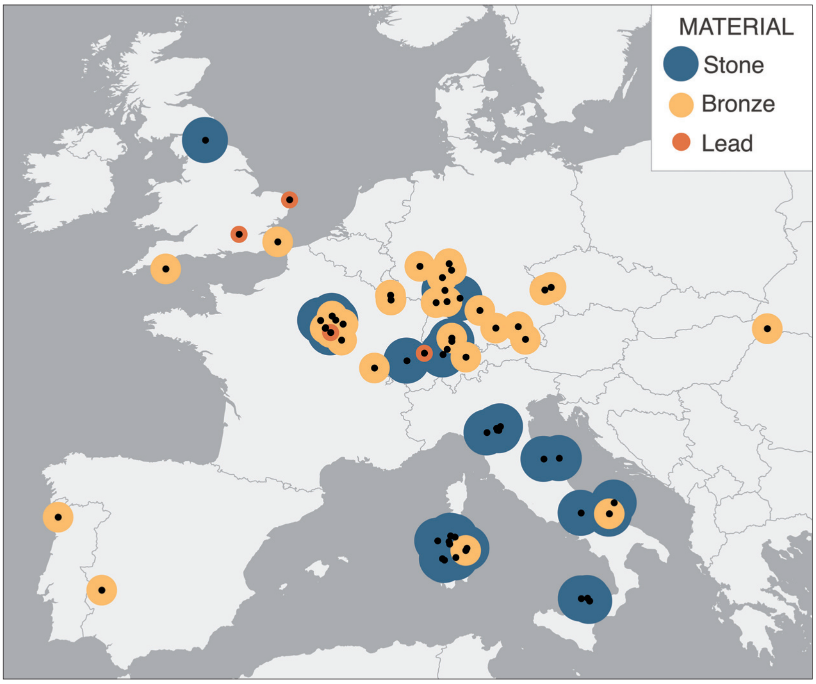
▲ *Fig. 5.8. Parallelepiped weights. Geographical distribution: site ID.*



▲ *Fig. 5.9. Parallelepiped weights. Geographical distribution: chronology.*



▲ *Fig. 5.10. Parallelepiped weights. Geographical distribution: typology.*



▲ *Fig. 5.11. Parallelepiped weights. Geographical distribution: materials.*

outside of Greece. The chronology of the Aeolian finds is bound to the chronology of the layers in which they were found, ranging *c.* 2300-1700 BCE. The stratigraphy does not allow for a more accurate date, but it cannot be excluded that parallelepiped weights were present along the whole sequence (Ialongo 2019; see chapter contexts). The EBA finds belong to V1, V2, and V4, hence showing that these three variants were already present at the onset of weighing technology in southern Italy. Parallelepiped weights are attested in Phase 2 in northern Italy, are widespread in Central Europe and England in Phase 3, and appear in the Atlantic façade in Phase 4 (Fig. 5.9.).

Variant 3 – unlike V1, V2, and V4, attested throughout the whole Bronze Age – is exclusive to Phase 3. Weights belonging to V3 occur significantly in burial contexts in Central Europe dating to the Bronze D phase (*c.* 1350-1200 BCE). A weight with wavy mouldings (cat. no. 123) is also present in the underwater assemblage of metal objects of Salcombe (site no. 135), off the south coast of England, in association with a plain bronze weight belonging to V1. This context was interpreted as a possible shipwreck (Needham *et al.* 2013). The assemblage of Salcombe spans two archaeological phases: Penard (*c.* 1300-1150 BCE) and Wilburton (*c.* 1150-1000 BCE) (Roberts *et al.* 2013). Based on its typical shape and well-dated contexts in Central Europe, this object was likely part of the earlier assemblage. The second parallelepiped weight lacks any datable feature. However, bronze parallelepipeds seem to be rather typical of Phase 3; hence, for the sake of simplification, the two weights are hypothetically assigned to the same chronological phase.

In Italy and Atlantic Europe, this type mostly occurs in settlements, with sporadic attestations in hoards, burials, caves, and cult places (Fig. 5.12.), such as Nuragic sanctuaries in Sardinia (cat. no. 51).

Contexts

Parallelepiped weights are commonly found in sets in Central European burials dating to the Bronze D phase (*c.* 1350-1200 BCE), and in eastern France they are frequently associated with balance beams (sites no. 8, 9, 12, 14) (see Chapter 3). Weighing sets that include parallelepiped weights can contain up to 18 balance weights of different types; notable cases include Steinfurth in Germany (site no. 137, with 12 weights), Etigny "Le Brassot" grave 90 (France, site no. 109, with 13 weights and a balance beam), and the exceptional grave 298 of Migennes "Le Petite Moulin" (France, site no. 105), containing two distinct weighing sets (18 and 2 weights respectively), each with their own balance beam.

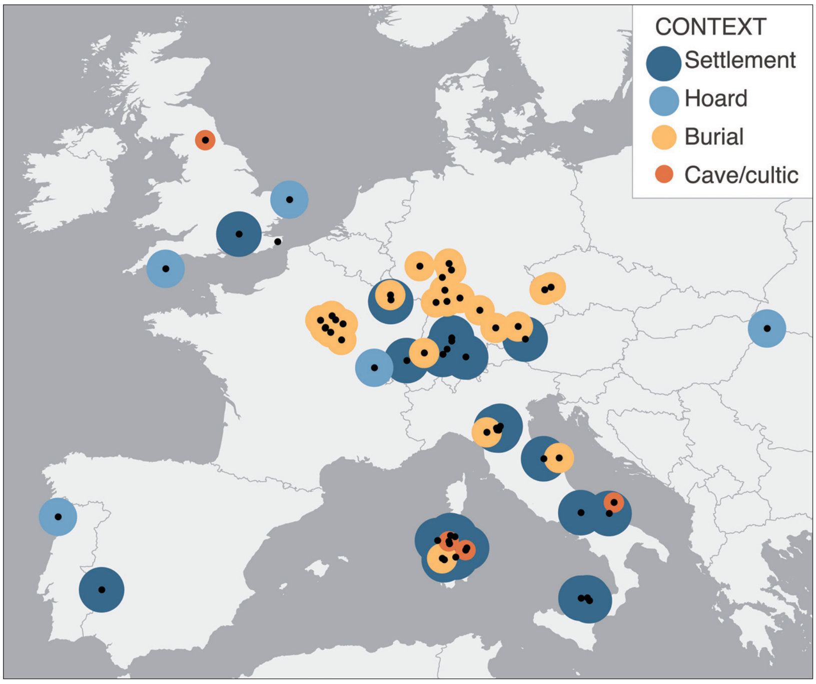
In settlements, parallelepiped weights sometimes occur in association with metallurgy-related facilities, such as smelting/melting pits, for example at ZAC du Sansonnet near Metz in France (cat. no. 96, site no. 125), and at the *terramara* of Gaggio, in northern Italy (cat. no. 52, site no. 40). In the settlement on the acropolis of Lipari, in the Aeolian Islands, parallelepiped weights occur inside houses in association with casting moulds in the Early Bronze Age (*c.* 2300-1700 BCE; cat. no. 43), and in the Final Bronze Age (*c.* 1100-950 BCE; cat. no. 161-162). Metallurgy is not the only trade-related productive activity associated with parallelepiped weights. The fortified settlement of Coppa Nevigata in Apulia, Italy (site no. 21) is renowned for the earliest attestation of purple dye production from sea molluscs in the Mediterranean (Minniti/Recchia 2018); a parallelepiped weight was found in a room in association with relevant amounts of sea shells, a by-product of purple dye extraction (*c.* 1600-1500 BCE; cat. no. 23).

Variant 1*:* Plain parallelepiped (cat. no. 19-109)

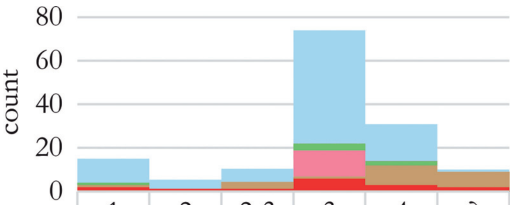
- *number of objects:* 91
- *objects with known mass (complete/reconstructed)*: 84 (92.3 %)
- *chronological range*: Phase 1-4 (*c.* 2300-800 BCE)
- *material*: stone (40), copper/bronze (47), lead (4)
- *46 sites (16 sets):* site no. (3, 2 sets), 5, 6, 9, 10, 13, 16, 21, 22, 27, 34, 35, 37, 40, 58, 74, 84, 85, 91, 98, 100, 101, (105, 2 sets), (107), (108), (109), 110, (115), 116, (118), (119), 120, (123), (124), 125, 126, (127), (130, 2 sets), (132), 135, (137), 141, 162, 187, 196, 207
- *mass range (complete/reconstructed):* 0.3-391.2 g (5th percentile= 1.2 g; 95th percentile= 157.46 g)

Stone

19. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). Trench N, Planum 5 (phase Capo Graziano). Phase 1 (EBA-MBA 1-2) - Complete. Stone (limestone?). Mass: 13.94 g. Dimensions: 4.1 cm x 2.9 cm x 0.9 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 8358) - Unpublished.
20. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House delta XIV, Area Bh, (phase Capo Graziano). Phase 1 (EBA-MBA 1-2) - Part of a set of 2 weights (cat. no. 20, 37). Associations: 2 bone spatulae - Complete. Stone (schist). Mass: 18.73 g. Dimensions: 5.0 cm x 2.3 cm x 0.8 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 5078) - Unpublished.
21. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). Trench N, Planum 2 (phase Capo Graziano). Phase 1 (EBA-MBA 1-2) - Fragmented (reconstructed in 3D). Stone (lime-

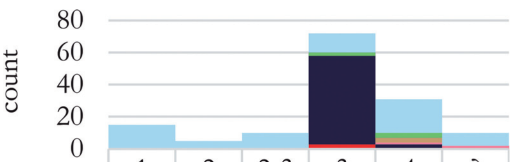


▲ *Fig. 5.12. Parallelepiped weights. Geographical distribution: site type.*



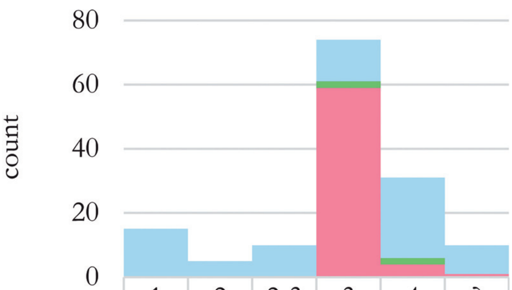
	1	2	2-3	3	4	?
V1	11	4	6	52	17	1
V2	1			3	2	
V3				12		
V4	1		3	1	9	7
?	2	1	1	6	3	2

▲ *Fig. 5.13. Parallelepiped weights. Quantification: typology vs chronology.*



	1	2	2-3	3	4	?
sett.	15	5	10	12	21	8
hoard				2	3	
cultic					3	
cave					1	2
burial				55	3	
?				3		

▲ *Fig. 5.14. Parallelepiped weights. Quantification: site type vs chronology.*



	1	2	2-3	3	4	?
stone	15	5	10	13	25	9
lead				2	2	
bronze				59	4	1

▲ *Fig. 5.15. Parallelepiped weights. Quantification: materials vs chronology.*

stone?). Mass: 37.95 g (37.52 g). Dimensions: 6.2 cm x 2.2 cm x 1.3 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 8357) - Unpublished.

22. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House beta IV, dromos, slab pavement. Phase 3 (RBA) - Part of a set of 2 weights (cat. no. 22, 318). Associations: loom weight, high number of spindle whorls - Complete. Stone (schist). Mass: 20.26 g. Dimensions: 5.4 cm x 2.1 cm x 0.9 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 8093) - Unpublished.
23. Coppa Nevigata [site no. 21, settlement] (Manfredonia, Puglia, Italy). CN 01, E2O, 3I. Inside a room in the fortification wall, with traces of activities of extraction of purple dye from molluscs. Phase 2-3 (MBA 3) - Associations: found in a small room inside the fortification wall, close to the main gate. Associated with relevant amounts of sea shells, a by-product of purple-dye extraction - Slightly chipped. Stone (greenstone?). Mass: 37 g. Dimensions: 5.7 cm x 2.6 cm x 1.4 cm - Unpublished.
24. Filicudi, Montagnola di Capo Graziano [site no. 5, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House VI, Plana 1-5, layer on top of the Milazzese soil. Phase 2 (MBA 3) - Fragmented (reconstructed in 3D). Stone. Mass: 19.69 g (19.21 g). Dimensions: 4.6 cm x 2.3 cm x 0.9 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 3976b) - Unpublished.
25. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House delta IV, Area O, Strata 3-4 (Capo Graziano). Phase 1 (EBA-MBA 1-2) - Part of a set of 2 weights (cat. no. 25, 28). Associations: bronze awl, 3 bronze fragments - Complete. Stone (limestone). Mass: 6.66 g. Dimensions: 4.9 cm x 1.2 cm x 0.6 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 7583) - Unpublished.
26. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House alpha I, Trench Z6, Fire layer, last phase, Ausonio II. Phase 4 (FBA) - Associations: spindle whorls - Complete. Stone. Mass: 22.83 g. Dimensions: 6 cm x 2.2 cm x 0.7 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 4650) - Unpublished.
27. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 30.05 g. Dimensions: 6.7 cm x 2.8 cm x 0.8 cm - Museo Archeologico Etnografico Modena (inv. no. 7823) - Unpublished.
28. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House delta IV, Area O, Phase Capo Graziano. Phase 1 (EBA-MBA 1-2) - Part of a set of 2 weights (cat. no. 25, 28). Associations: bronze awl, 3 bronze fragments - Fragmented (reconstructed in 3D). Stone (limestone?). Mass: 62.75 g (62.65 g). Dimensions: 7.5 cm x 3.0 cm x 1.6 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 7676) - Unpublished.
29. Gours-aux-Lions [site no. 115, burial] (Marolles-sur-Seine, Seine-et-Marne, Île-de-France, France). Inhumation grave 27. Phase 3 (Br D) - Part of a set of 2 balance weights and 1 balance beam (cat. no. 13, 29, 31). Associations: bronze hinge (organic container?), scabbard, razor, ring, gold fragment - Complete. Stone (sandstone). Mass: 23.28 g. Dimensions: 6.6 cm x 2.8 cm x 0.7 cm - Musée départemental de Préhistoire d'Île-de-France, Nemours (inv. no. 82.5.93) - Pare 1999, fig. 27.3.
30. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (slate). Mass: 16.7 g. Dimensions: 5.5 cm x 1.5 cm x 0.8 cm (inv. no. 2549) - Bolliger Schreyer *et al.* 2004, Taf. 228.2549.
31. Gours-aux-Lions [site no. 115, burial] (Marolles-sur-Seine, Seine-et-Marne, Île-de-France, France). Inhumation grave 27. Phase 3 (Br D) - Part of a set of 2 balance weights and 1 balance beam (cat. no. 13, 29, 31). Associations: bronze hinge (organic container?), scabbard, razor, ring, gold fragment - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 20.48 g (18.79 g). Dimensions: 6.8 cm x 2.9 cm x 0.7 cm - Musée départemental de Préhistoire d'Île-de-France, Nemours - Pare 1999, fig. 27.2.
32. Filicudi, Montagnola di Capo Graziano [site no. 5, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House XIV, Destruction (phase Capo Graziano). Phase 1 (EBA-MBA 1-2) - Complete. Stone (schist). Mass: 20.14 g. Dimensions: 7.9 cm x 2.0 cm x 0.6 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 15982) - Unpublished.
33. Barbuise-Courtavant, Grèves de Frécul [site no. 119, burial] (Aube, Grand Est, France). Grave 1. Phase 3 (Br D) - Part of a set of 2 balance weights (cat. no. 33, 116). Associations: razor, pottery - Complete. Stone. Mass: 16.29 g. Dimensions: 4.54 cm x 1.475 cm x 1.21 cm - Pare 1999, fig. 15.2.
34. Gaggio di Castelfranco [site no. 40, settlement] (Modena, Emilia-Romagna, Italy). T. 507, Trench 3, VP 3, US 4373, fase 1.3. External productive area, next to a fireplace. Phase 2 (MBA-RBA) - Part of a set of 2 weights (cat. no. 34, 52). Associations: traces of metallurgical activity - Complete. Stone. Mass: 36.02 g. Dimensions: 5.1 cm x 2.2 cm x 1.5 cm - Museo Archeologico Etnografico Modena (inv. no. 4162) - Unpublished.
35. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). "Capo Graziano Hut", Trench B (outside the acropolis), Plana 22-24 (phase Capo Graziano). Phase 1 (EBA-MBA 1-2) - Complete. Stone. Mass: 138.41 g. Dimensions: 6.4 cm x 3.4 cm x 3.4 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 4719) - Unpublished.
36. Heathery Burn Cave [site no. 187, cave] (Stanhope, County Durham, England). Phase 4 (LBA) - Complete. Stone. Mass: 96.1 g. Dimensions: 5.0 cm x 3.2 cm x 3.0 cm – Britton/Longworth 1968, no. 182.
37. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House delta XIV, Area

Bh (phase Capo Graziano). Phase 1 (EBA-MBA 1-2) - Part of a set of 2 weights (cat. no. 20, 37). Associations: 2 bone spatulae - Complete. Stone (steatite?). Mass: 122.56 g. Dimensions: 5.7 cm x 4.1 cm x 2.9 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 7705) - Unpublished.

38. Monte Croce-Guardia [site no. 27, settlement] (Arcevia, Ancona, Marche, Italy). House 3, fase III, US 402. Phase 4 (FBA) - Part of a set of 2 balance weights (cat. no. 38, 120). Associations: concentration of fragmented bronze objects and a casting mould, interpreted as workshop/hoard. Sickle fragment, fibula fragment, bronze wire fragment, glass bead - Complete. Stone (sandstone). Mass: 57.58 g. Dimensions: 4.5 cm x 3.3 cm x 2.2 cm - Unpublished.
39. Oratino [site no. 22, settlement] (Campobasso, Molise, Italy). RO 06, C4 H, Phase III 3a. US 164 E. Phase 3 (RBA) - Complete. Stone (limestone). Mass: 152.3 g. Dimensions: 8.8 cm x 3.4 cm x 2.4 cm - Unpublished.
40. Salina, Villaggio della Portella [site no. 6, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House I, Milazzese layers. Phase 2 (MBA 3) - Complete. Stone. Mass: 137.3 g. Dimensions: 5.9 cm x 4.5 cm x 2.7 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 2268) - Unpublished.
41. Marigny-le-Châtel - Le Pont de Riom [site no. 116, burial] (Aube, Grand Est, France). T. 134. Phase 4 (Ha A2) - Associations: 2 bronze hinges (organic container), fragment of a ribbed pin (balance weight?), awl/chisel, bronze ring, bronze brooch, 3 stone beads, 3 flint blades, 1 fossil (?) - Complete. Stone. Mass: n/a - Dohrmann/Riquier (eds.) 2018, 424-425.
42. Filicudi, Montagnola di Capo Graziano [site no. 5, settlement] (Aeolian Islands, Messina, Sicilia, Italy). Phase 1 (EBA-MBA 1-2) - Fragmented (reconstructed in 3D). Stone (schist). Mass: 151.48 g (145.62 g). Dimensions: 10.7 cm x 4.2 cm x 1.5 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 15987) - Unpublished.
43. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House delta XII, Area BA-BC (Capo Graziano). Phase 1 (EBA-MBA 1-2) - Associations: 1 mould, 2 stone axes, 2 bronze needles - Fragmented (reconstructed in 3D). Stone (limestone?). Mass: 154.45 g (150.51 g). Dimensions: 12.6 cm x 4.3 cm x 1.4 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 7675) - Unpublished.
44. Oratino [site no. 22, settlement] (Campobasso, Molise, Italy). RO 06, C4 H, Phase III 3a. US 164 E. Phase 3 (RBA) - Complete. Stone (sandstone). Mass: 391.2 g. Dimensions: 16.2 cm x 6.7 cm x 1.8 cm - Unpublished.
45. Neckarsulm [site no. 126, burial] (Heilbronn, Baden-Württemberg, Germany). Grab 18, Individual 1. Phase 3 (Br D) - Associations: 4 bronze hinges (organic container?), sword, scabbard, knife, pin, large stud, 10 rings, 11 bronze fragments - Complete. Stone. Mass: 28.22 g. Dimensions: 7.0 cm x 2.2 cm x 0.8 cm - Knöpke 2009, Taf. 38.3.
46. Gorzano [site no. 34, settlement] (Maranello, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: n/a. Dimensions: 9.9 cm x 2.6 cm x 1.0 cm - Museo Archeologico Etnografico Modena (inv. s.n. XV) - Unpublished.
47. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 183.14 g. Dimensions: 17.1 cm x 3.7 cm x 1.5 cm - Museo Archeologico Etnografico Modena (inv. s.n. 541) - Unpublished.
48. Gorzano [site no. 34, settlement] (Maranello, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 153.3 g. Dimensions: 9.9 cm x 3.7 cm x 2.2 cm - Museo Archeologico Etnografico Modena (inv. no. 1220) - Unpublished.
49. Gorzano [site no. 34, settlement] (Maranello, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 300.06 g. Dimensions: 25.2 cm x 6.04 cm x 7.04 cm - Museo Archeologico Etnografico Modena (inv. s.n. XVII) - Unpublished.
50. Oratino [site no. 22, settlement] (Campobasso, Molise, Italy). RO 06, C4 H, Phase III 3a. US 164 E. Phase 3 (RBA) - Complete. Stone (sandstone). Mass: 93.7 g. Dimensions: 6.9 cm x 6.3 cm x 1.1 cm - Unpublished.
51. Monte S. Antonio [site no. 16, nuragic sanctuary] (Siligo, Sassari, Sardegna, Italy). Monumental cluster, paved area, in front of the access to the nuraghe. Phase 4 (EIA) - Associations: bronze fragments, four crucibles - Fragmented. Stone. Mass: 107.6 g. Dimensions: 3.2 cm x 3.0 cm x 1.9 cm - Ialongo 2011, I, 113.
52. Gaggio di Castelfranco [site no. 40, settlement] (Modena, Emilia-Romagna, Italy). T. 507, Trench 2, Z I/4, US 3282, fase 1.3. Metallurgical area with smelting pit. Phase 2 (MBA-RBA) - Part of a set of 2 weights (cat. no. 34, 52). Associations: 2-3 casting moulds, crucible, metal slags and fragments - Fragmented (reconstructed in 3D). Stone. Mass: 181.45 g (180.37 g). Dimensions: 5.7 cm x 5.3 cm x 3.2 cm - Museo Archeologico Etnografico Modena (inv. no. 3941) - Unpublished.
53. Sa Osa [site no. 9, settlement] (Cabras, Oristano, Sardegna, Italy). B56, 23-11. Undetermined chronology (Bronze Age) - Complete. Stone (basalt). Mass: 39.31 g. Dimensions: 3.1 cm x 3.2 cm x 3.1 cm - Museo delle Origini, Roma - Unpublished.
54. Greifensee-Böschen [site no. 91, settlement] (Zürich, Switzerland). Feld T, Fundkomplex 3655. Phase 4 (Ha A-B) - Complete. Stone. Mass: 19 g. Dimensions: 2.7 cm x 2.5 cm x 1.7 cm (inv. no. 1026) - Eberschweiler *et al.* 2007, Taf. 108.1026.
55. Monte Prama [site no. 10, votive deposition in burial context] (Cabras, Oristano, Sardegna, Italy). US 034. Phase 4 (EIA) - Fragmented (reconstructed in 3D). Stone (schist). Mass: 82.34 g (77.95 g). Di-

mensions: 5.3 cm x 1.2 cm x 0.8 cm - Museo Civico Giovanni Marongiu, Cabras - Unpublished.

56. Insel Werd [site no. 98, settlement] (Eschenz, Thurgau, Switzerland). Feld X. Phase 4 (Ha A-B) - Complete. Stone. Mass: 100 g. Dimensions: 9.6 cm x 3.0 cm x 2.2 cm (inv. no. 6139) - Brem *et al.* 1987, Abb. 30.S8.
57. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 77.6 g. Dimensions: 4.9 cm x 3.8 cm x 2.7 cm (inv. no. 2927) - Leuvrey 1999, pl. 71.5.
58. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 48.5 g. Dimensions: 5.8 cm x 3.0 cm x 1.4 cm (inv. no. 1090) - Leuvrey 1999, pl. 71.6.

Bronze

59. Passy-sur-Yonne, La Sablonière [site no. 107, burial] (Yonne, Bourgogne-Franche-Comté, France). Richebourg, Enclosure 58, Inhumation grave 7. Phase 3 (Br D) - Part of a set of 5 balance weights (cat. no. 59, 61, 62, 63, 269). Associations: 3 bronze hinges (organic container), dagger, awl, razor, pin, stud - Complete. Copper/bronze. Mass: n/a. Dimensions: 0.6 cm x 0.4 cm x 0.3 cm - Musées de Sens - Pare 1999, fig. 28.C.4-5.
60. Etigny, "Le Brassot" Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 0.32 g. Dimensions: 0.6 cm x 0.3 cm x 0.2 cm - Musées de Sens - Roscio 2018, pl. 85.21.
61. Passy-sur-Yonne, La Sablonière [site no. 107, burial] (Yonne, Bourgogne-Franche-Comté, France). Richebourg, Enclosure 58, Inhumation grave 7. Phase 3 (Br D) - Part of a set of 5 balance weights (cat. no. 59, 61, 62, 63, 269). Associations: 3 bronze hinges (organic container), dagger, awl, razor, pin, stud - Complete. Copper/bronze. Mass: n/a. Dimensions: 0.6 cm x 0.6 cm x 0.3 cm - Musées de Sens - Pare 1999, fig. 28.C.4-5.
62. Passy-sur-Yonne, La Sablonière [site no. 107, burial] (Yonne, Bourgogne-Franche-Comté, France). Richebourg, Enclosure 58, Inhumation grave 7. Phase 3 (Br D) - Part of a set of 5 balance weights (cat. no. 59, 61, 62, 63, 269). Associations: 3 bronze hinges (organic container), dagger, awl, razor, pin, stud - Complete. Copper/bronze. Mass: 1.3 g. Dimensions: 0.7 cm x 0.6 cm x 0.5 cm - Musées de Sens - Pare 1999, fig. 28.C.4-5.
63. Passy-sur-Yonne, La Sablonière [site no. 107, burial] (Yonne, Bourgogne-Franche-Comté, France). Richebourg, Enclosure 58, Inhumation grave 7. Phase 3 (Br D) - Part of a set of 5 balance weights (cat. no. 59, 61, 62, 63, 269). Associations: 3 bronze hinges (organic container), dagger, awl, razor, pin, stud - Complete. Copper/bronze. Mass: 1.73 g. Dimensions: 0.9 cm x 0.6 cm x 0.5 cm - Musées de Sens - Pare 1999, fig. 28.C.4-5.
64. Büchelberg [site no. 123, burial] (Germersheim, Rheinland-Pfalz, Germany). Tumulus 3. Phase 3 (Br D) - Part of a set of 8 balance weights (cat. no. 64, 198, 271, 277, 278, 300, 301, 303). Associations: 3 bronze hinges (organic container?), dagger, awl, pottery - Complete. Copper/bronze. Mass: n/a. Dimensions: 1.2 cm x 0.5 cm x 0.25 cm - Historisches Museum der Pfalz, Speyer - Pare 1999, fig. 24.15.
65. Etigny, "Le Brassot" Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 1.18 g. Dimensions: 1.0 cm x 0.7 cm x 0.2 cm - Musées de Sens - Roscio 2018, pl. 85.4.
66. Barbuise-Courtavant, Les Grèves [site no. 118, burial] (Aube, Grand Est, France). Grave 7. Phase 3 (Br D) - Part of a set of 5 balance weights (cat. no. 66, 67, 70, 120, 272). Associations: bronze hinge (organic container?), 2 hooks, gold fragment - Complete. Copper/bronze. Mass: 2.91 g (2.42 g). Dimensions: 1.305 cm x 0.65 cm x 0.39 cm - Pare 1999, fig. 16.4; Rottier *et al.* (eds.) 2012, fig. 270.4.
67. Barbuise-Courtavant, Les Grèves [site no. 118, burial] (Aube, Grand Est, France). Grave 7. Phase 3 (Br D) - Part of a set of 5 balance weights (cat. no. 66, 67, 70, 120, 272). Associations: bronze hinge (organic container?), 2 hooks, gold fragment - Complete. Copper/bronze. Mass: 5.25 g (4.74 g). Dimensions: 1.49 cm x 0.82 cm x 0.49 cm - Pare 1999, fig. 16.2; Rottier *et al.* (eds.) 2012, fig. 270.6.
68. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 1.89 g. Dimensions: 1.34 cm x 0.52 cm x 0.41 cm - Pare 1999, fig. 14.9.
69. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 7.6 g. Dimensions: 1.7 cm x 0.75 cm x 0.8 cm - Pare 1999, fig. 14.7.
70. Barbuise-Courtavant, Les Grèves [site no. 118, burial] (Aube, Grand Est, France). Grave 7. Phase 3 (Br D) - Part of a set of 5 balance weights (cat. no. 66, 67, 70, 120, 272). Associations: bronze hinge (organic container?), 2 hooks, gold fragment - Complete. Copper/bronze. Mass: 3.74 g (3.51 g). Dimensions: 1.34 cm x 0.69 cm x 0.52 cm - Pare 1999, fig. 16.3; Rottier *et al.* (eds.) 2012, fig. 270.5.
71. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhu-

mation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 1.06 g. Dimensions: 1.0 cm x 0.4 cm x 0.35 cm - Roscio *et al.* 2011, fig. 2.65.

72. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 0.39 g. Dimensions: 1.0 cm x 0.4 cm x 0.15 cm - Roscio *et al.* 2011, fig. 2.64.

73. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 1.63 g. Dimensions: 1.2 cm x 0.5 cm x 0.5 cm - Roscio *et al.* 2011, fig. 2.53.

74. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 3.16 g. Dimensions: 1.3 cm x 0.6 cm x 0.5 cm - Roscio *et al.* 2011, fig. 2.30.

75. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 4.32 g. Dimensions: 1.8 cm x 0.7 cm x 0.5 cm - Roscio *et al.* 2011, fig. 2.49.

76. Los Concejiles [site no. 196, settlement] (Lobòn, Badajoz, Extremadura, Spain). Unprovenanced. Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 6.37 g. Dimensions: 0.7 cm x 1.16 cm x 0.7 cm - Vilaça *et al.* 2012, fig. 20.3.

77. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 14.55 g. Dimensions: 2.94 cm x 0.83 cm x 0.82 cm - Pare 1999, fig. 14.5.

78. Les Genettes, Larnaud [site no. 58, hoard] (Jura, Bourgogne-Franche-Comté, France). Phase 4 (Ha B1) - Associations: *c.* 1600 objects, dating between Br D and Ha B1, with one EBA pin - Complete. Copper/bronze. Mass: 9.58 g (9.15 g). Dimensions: 2.5 cm x 1.0 cm x 0.3 cm - Pare 1999, fig. 19.3.

79. Pépinville [site no. 127, burial] (Richemont, Moselle, Grand Est, France). Phase 3 (Br D) - Part of a set of 7 balance weights (cat. no. 79, 89, 99, 121, 270, 311, 314). Associations: sword, tweezers, knife, pin, miniature duck, 2 bronze fragments, 7 bronze cylinders filled with lead - Complete. Copper/bronze. Mass: 19.89 g. Dimensions: 3.62 cm x 0.84 cm x 0.82 cm - Pare 1999, fig. 17.3.

80. Etigny, "Le Brassot" Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 6.47 g. Dimensions: 1.7 cm x 0.8 cm x 0.7 cm - Musées de Sens - Roscio 2018, pl. 85.8.

81. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 4.86 g. Dimensions: 1.83 cm x 0.9 cm x 0.45 cm - Pare 1999, fig. 14.8.

82. Milavče [site no. 130, burial] (Bohemia, Czech Republic). Tumulus C/1. Phase 3 (Br D) - Part of a set of 2 balance weights (cat. no. 82, 302). Associations: bronze vase on wheels, 2 bronze cups, sword, razor, knife, 2 phalerae, 4 rings, 23 bronze sheet fragments, 4 pin fragments, rod fragment - Complete. Copper/bronze. Mass: 15.01 g. Dimensions: 3.1 cm x 1.2 cm x 0.65 cm - Pare 1999, fig. 5.11.

83. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 13.72 g. Dimensions: 4.23 cm x 1.13 cm x 0.41 cm - Pare 1999, fig. 14.2.

84. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 4.84 g. Dimensions: 2.32 cm x 0.77 cm x 0.42 cm - Pare 1999, fig. 14.6.

85. Poing [site no. 110, burial] (Ebersberg, Bayern, Germany). Grave 4. Phase 3 (Br D) - Associations: 2 bronze hinges (organic container?), pin, knife, pin-head, 2 rings - Complete. Copper/bronze. Mass: 6.5 g. Di-

mensions: 2.1 cm x 0.7 cm x 0.55 cm - Pare 1999, fig. 19.2.

86. Hurlach [site no. 108, burial] (Landsberg a. Lech, Bayern, Germany). Phase 3 (Br C-D) - Part of a set of 3 balance weights (cat. no. 86, 100, 191). Associations: cremated remains belonging to 2 individuals, a male and a female, 3 knives, sword, belt hook, several bronze studs, bronze necklace with gold pendant and 3 amber beads, 5 pins, 7 pin heads, gold fragment, pottery - Complete. Copper/bronze. Mass: 8.8 g. Dimensions: 3.3 cm x 1.1 cm x 0.7 cm - Pare 1999, fig. 12.2.
87. Milavče [site no. 130, burial] (Bohemia, Czech Republic). Tumulus C/4. Phase 3 (Br D) - Part of a set of 3 balance weights (cat. no. 87, 312, 313). Associations: sword, spearhead, knife, pin fragment, 3 bronze sheet fragments, bronze fragment - Complete. Copper/bronze. Mass: 8.56 g. Dimensions: 2.85 cm x 0.85 cm x 0.5 cm - Pare 1999, fig. 9.11.
88. Etigny, "Le Brassot" Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 8.62 g. Dimensions: 2.6 cm x 1.1 cm x 0.6 cm - Musées de Sens - Roscio 2018, pl. 85.13.
89. Pépinville [site no. 127, burial] (Richemont, Moselle, Grand Est, France). Phase 3 (Br D) - Part of a set of 7 balance weights (cat. no. 79, 89, 99, 121, 270, 311, 314). Associations: sword, tweezers, knife, pin, miniature duck, 2 bronze fragments, 7 bronze cylinders filled with lead - Complete. Copper/bronze. Mass: 7.86 g. Dimensions: 3.37 cm x 0.64 cm x 0.5 cm - Pare 1999, fig. 17.4.
90. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 18.13 g. Dimensions: 2.8 cm x 1.28 cm x 0.67 cm - Pare 1999, fig. 14.4.
91. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 8.2 g. Dimensions: 3.78 cm x 0.96 cm x 0.45 cm - Pare 1999, fig. 14.3.
92. Gondelsheim-Mordäcker [site no. 124, burial] (Karlsruhe, Baden-Württemberg, Germany). Phase 3 (Br D) - Part of a set of 2 balance weights (cat. no. 92, 98). Associations: bronze hinge (organic container?), 2 pin fragments - Complete. Copper/bronze. Mass: 7.45 g. Dimensions: 1.87 cm x 0.86 cm x 0.65 cm - Pare 1999, fig. 11.2.
93. Singen, Mühlenzelgle [site no. 101, settlement] (Konstanz, Baden-Württemberg, Germany). Fundstelle 5. Phase 3 (Br C-D) - Associations: metal-working area inside settlement - Complete. Copper/bronze. Mass: 3.19 g. Dimensions: 1.6 cm x 0.7 cm x 0.4 cm - Pare 1999, fig. 19.10.
94. Horušany [site no. 132, burial] (Bohemia, Czech Republic). Tumulus A. Phase 3 (Br D) - Part of a set of 4 balance weights (cat. no. 94, 103, 243, 304). Associations: 3 bronze hinges (organic container?), awl, 3 phalerae, stud, bronze fragment, pottery - Complete. Copper/bronze. Mass: 6.7 g. Dimensions: 2.45 cm x 0.95 cm x 0.45 cm - Pare 1999, fig. 10.1.
95. Rachelburg [site no. 100, settlement] (Flintsbach, Rosenheim, Bayern, Germany). Phase 3 (Br D-Ha A - uncertain) - Complete. Copper/bronze. Mass: 10 g. Dimensions: 2.8 cm x 1.1 cm x 0.5 cm - Pare 1999, fig. 19.10.
96. ZAC du Sansonnet [site no. 125, settlement] (Metz, Moselle, Grand Est, France). Melting pit (surroundings). Phase 3 (Br D) - Part of a set of 2 balance weights (cat. no. 96, 200). Associations: fire pits, crucibles, metal objects - Complete. Copper/bronze. Mass: 6.94 g. Dimensions: 2.75 cm x 0.91 cm x 0.4 cm - Klag/Wiethold 2020, fig. 11.10.
97. Königsbronn [site no. 120, burial] (Heidenheim, Baden-Württemberg, Germany). Phase 3 (Br D) - Associations: 2 horse bits, 2 side-pieces, 5 rein-knobs, 4 decorative nails, 9 rivets, pin, 3 ornithomorphic ornaments, spearhead, ferrule, wagon-pole cap with ornithomorphic decoration, 2 arm spirals, 2 chisels, pottery - Complete. Copper/bronze. Mass: 43 g. Dimensions: 6.2 cm x 1.5 cm x 0.7 cm - Pare 1999, fig. 19.6.
98. Gondelsheim-Mordäcker [site no. 124, burial] (Karlsruhe, Baden-Württemberg, Germany). Phase 3 (Br D) - Part of a set of 2 balance weights (cat. no. 92, 98). Associations: bronze hinge (organic container?), 2 pin fragments - Complete. Copper/bronze. Mass: 60.65 g. Dimensions: 5.47 cm x 1.97 cm x 0.87 cm - Pare 1999, fig. 11.1.
99. Pépinville [site no. 127, burial] (Richemont, Moselle, Grand Est, France). Phase 3 (Br D) - Part of a set of 7 balance weights (cat. no. 79, 89, 99, 121, 270, 311, 314). Associations: sword, tweezers, knife, pin, miniature duck, 2 bronze fragments, 7 bronze cylinders filled with lead - Complete. Copper/bronze. Mass: 39.27 g. Dimensions: 7.17 cm x 1.44 cm x 0.53 cm - Pare 1999, fig. 17.5.
100. Hurlach [site no. 108, burial] (Landsberg a. Lech, Bayern, Germany). Phase 3 (Br C-D) - The object is fused together with a spherical object and a spiral by corrosion. Part of a set of 3 balance weights (cat. no. 86, 100, 191). Associations: cremated remains belonging to 2 individuals, a male and a female, 3 knives, sword, belt hook, several bronze studs, bronze necklace with gold pendant and 3 amber beads, 5 pins, 7 pin heads, gold fragment, pottery - Complete. Copper/bronze. Mass: n/a. Dimensions: 3.2 cm x 1.6 cm x 0.8 cm - Gäubodenmuseum Straubing - Pare 1999, fig. 12.3.
101. Bouça [site no. 207, hoard] (Meixedo, Viana do Castelo, Minho-Lima, Portugal). Phase 4 (Atlantic FBA III) - Associations: socketed axe and spearhead

- Complete. Copper/bronze. Mass: n/a. Dimensions: 3.2 cm x 3.4 cm x 2.2 cm - Coffyn 1985, pl. XXXVI.8.

102. Salcombe [site no. 135, votive deposition or shipwreck] (Devon, England). Phase 3 (Penard, Ewart Park) - Part of a set of 2 weights (cat. no. 102, 123). Complete. Copper/bronze. Mass: 44.7 g. Dimensions: 2.9 cm x 2.0 cm x 1.1 cm - Needham 2017, fig. 4.4, 1.
103. Horušany [site no. 132, burial] (Bohemia, Czech Republic). Tumulus A. Phase 3 (Br D) - Part of a set of 4 balance weights (cat. no. 94, 103, 243, 304). Associations: 3 bronze hinges (organic container?), awl, 3 phalerae, stud, bronze fragment, pottery - Complete. Copper/bronze. Mass: 21.4 g. Dimensions: 2.6 cm x 1.7 cm x 0.7 cm - Pare 1999, fig. 10.2.
104. Su Benticheddu [site no. 13, votive deposition] (Oliena, Nuoro, Sardegna, Italy). Phase 4 (EIA 1B) - Associations: 2 bronze vases, 2 daggers, 2 pins, iron rod - Complete. Copper/bronze. Mass: 20 g. Dimensions: 3.3 cm x 2.7 cm x 0.8 cm - Lo Schiavo 1978, tav. 29.3.
105. Singen, Mühlenzelgle [site no. 101, settlement] (Konstanz, Baden-Württemberg, Germany). Fundstelle 5. Phase 3 (Br C-D) - Associations: many bronze scraps. A loop that might belong to a balance - Triangular cross-section. Complete. Copper/bronze. Mass: 3.66 g. Dimensions: 1.7 cm x 0.75 cm - Hopert 1995, fig. 14.132.

Lead

106. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Lead. Mass: 0.3 g. Dimensions: 0.6 cm x 0.5 cm x 0.2 cm - Roscio *et al.* 2011, fig. 2.67.
107. Galgenrain [site no. 85, burial] (Wangen an der Aare, Bern, Switzerland). Mixed materials from several graves. Phase 3 (Br D) - Complete. Lead. Mass: 13.06 g. Dimensions: 3 cm x 1 cm x 1 cm - Pare 1999, fig. 19.13.
108. West Caister [site no. 162, hoard] (Norfolk, England). Phase 4 (Ewart Park) - Associations: axe, bead, brooch, ring - Complete. Lead. Mass: 158 g. Dimensions: 4.6 cm x 4.8 cm x 1.6 cm - Lawson 1979, fig. 9.2.E.
109. Runnymede Bridge [site no. 141, settlement] (Berkshire, England). Phase 4 (Ewart Park) - Associations: settlement with evidence of metalworking - Complete. Lead. Mass: 112.3 g. Dimensions: 3.0 cm x 3.0 cm x 1.3 cm - Needham/Hook 1988, fig. 2.1.

Variant 2: Small circular indentation on one extremity (cat. no. 110-115)

- *number of objects:* 6
- *objects with known mass (complete/reconstructed)*: 4 (67 %)
- *chronological range*: Phase 1-4 (*c.* 2300-800 BCE)
- *material*: stone (5), copper/bronze (1)
- *6 sites:* site no. 3, 17, 21, 84, 106, 129
- *mass range (complete/reconstructed):* 21.0-469.4 g

Stone

110. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 51 g. Dimensions: 10.4 cm x 1.6 cm x 1.3 cm (inv. no. 2546) - Bolliger Schreyer *et al.* 2004, Taf. 228.2546.
111. Waldspitz [site no. 129, burial] (Mannheim, Baden-Württemberg, Germany). Tumulus of 1934. Phase 3 (Br D) - Associations: 3 bronze hinges (organic container?), awl, stone chisel-shaped object, 3 pins, knife, ring, shark tooth, pottery - Complete. Stone. Mass: n/a. Dimensions: 6.7 cm x 2.0 cm x 1.4 cm - Reiss Museum, Mannheim - Pare 1999, fig. 25.13.
112. Nuraghe Palmavera [site no. 17, settlement] (Tula, Sassari, Sardegna, Italy). Hut 42, US 109. Phase 4 (EIA) - Fragmented (reconstructed in 3D). Stone (steatite). Mass: 41.13 g (36.98 g). Dimensions: 6.5 cm x 3.1 cm x 1.1 cm - University of Sassari, storerooms - Unpublished.
113. Coppa Nevigata [site no. 21, settlement] (Manfredonia, Puglia, Italy). CN 11, H3F, 1 Va. Phase 3 (RBA) - Associations: filling layer of a pit (residual) - Drop-shaped. Complete. Stone. Mass: 21 g. Dimensions: 6.6 cm x 2.5 cm x 0.8 cm - Unpublished.
114. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). Trench AP, Stratum 3 (Capo Graziano). Phase 1 (EBA-MBA 1-2) - Fragmented (reconstructed in 3D). Stone. Mass: 469.41 g (456.34 g). Dimensions: 15.8 cm x 7.9 cm x 1.8 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no 2997) - Unpublished.

Bronze

115. Tiszabecs [site no. 106, hoard] (Szabolcs-Szatmár, Hungary). Phase 3 (Br D) - Fragmented. Copper/bronze. Mass: n/a (67.7 g). Dimensions: 4.9 cm x 2.3 cm x 0.7 cm - Pare 1999, fig. 19.8.

Variant 3: Wavy mouldings (cat. no. 116-127)

- *number of objects:* 12
- *complete/reconstructed:* 8 (67 %).
- *chronological range*: Phase 3 (*c.* 1350-1200 BCE)
- *material*: copper/bronze (12)
- *10 sites (**4 sets**):* site no. 99, (***109***), 111, (***118***), (***119***), (***127***), 133, 134, 135, 138
- *mass range (complete/reconstructed):* 3.86-41.0 g

116. Barbuise-Courtavant, Grèves de Frécul [site no. 119, burial] (Aube, Grand Est, France). Grave 1. Phase 3 (Br D) - Part of a set of 2 balance weights

(cat. no. 33, 116). Associations: razor, pottery - Complete. Copper/bronze. Mass: 3.86 g (3.53 g). Dimensions: 1.55 cm x 0.845 cm x 0.448 cm - Pare 1999, fig. 15.1.

117. Etigny, "Le Brassot" Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 4.29 g. Dimensions: 1.5 cm x 0.9 cm x 0.6 cm - Musées de Sens - Roscio 2018, pl. 85.16.
118. Düne [site no. 134, burial] (Maintal-Wachenbuchen, Main-Kinzig-Kreis, Hessen, Germany). Grave 6. Phase 3 (Br C-D) - Associations: pottery - Complete. Copper/bronze. Mass: 5.83 g. Dimensions: 1.6 cm x 1.03 cm x 0.49 cm - Pare 1999, fig. 13.1.
119. Auf dem Weidich [site no. 133, unknown context] (Wallerstädten, Groß-Gerau, Hessen, Germany). Phase 3 (Br D) - Fragmented. Copper/bronze. Mass: 6.44 g (5.53 g). Dimensions: 1.6 cm x 1.0 cm x 0.7 cm - Pare 1999, fig. 19.4.
120. Barbuise-Courtavant, Les Grèves [site no. 118, burial] (Aube, Grand Est, France). Grave 7. Phase 3 (Br D) - Part of a set of 5 balance weights (cat. no. 66, 67, 70, 120, 272). Associations: bronze hinge (organic container?), 2 hooks, gold fragment - Complete. Copper/bronze. Mass: 13.42 g (13.31 g). Dimensions: 2.5 cm x 1.16 cm x 0.99 cm - Pare 1999, fig. 16.1.
121. Pépinville [site no. 127, burial] (Richemont, Moselle, Grand Est, France). Phase 3 (Br D) - Part of a set of 7 balance weights (cat. no. 79, 89, 99, 121, 270, 311, 314). Associations: sword, tweezers, knife, pin, miniature duck, 2 bronze fragments, 7 bronze cylinders filled with lead - Complete. Copper/bronze. Mass: 41 g. Dimensions: 3.3 cm x 1.7 cm x 0.8 cm - Pare 1999, fig. 17.2.
122. Denton with Wootton [site no. 138, unknown context] (Kent, England). Phase 3 (Wilburton-Ewart Park) - Complete. Copper/bronze. Mass: 32.66 g. Dimensions: 2.7 cm x 1.8 cm x 0.9 cm - Ahmet 2017.
123. Salcombe [site no. 135, votive deposition or shipwreck] (Devon, England). Phase 3 (Penard, Ewart Park) - Part of a set of 2 weights (cat. no. 102, 123). - Complete. Copper/bronze. Mass: 29.8 g. Dimensions: 2.4 cm x 0.9 cm - Needham *et al.* 2013, fig. 3.21-S27.
124. Sologne Region [n/a, unknown context] (Centre-Val de Loire, France). Phase 3 (Br D) - Fragmented. Copper/bronze. Mass: n/a (62.78 g). Dimensions: 5.8 cm x 2.0 cm x 0.8 cm - Pare 1999, fig. 19.5.
125. Noyers [site no. 99, burial] (Yonne, Bourgogne-Franche-Comté, France). Phase 3 (Br D) - Associations: bracelet, ribbed pin - Complete. Copper/bronze. Mass: n/a. Dimensions: 5.2 cm x 1.9 cm - Cordier 1996, fig. 94.3.
126. Rosières-près-Troyes "Les Monts Hauts" [site no. 111, burial] (Aube, Grand Est, France). Phase 3 (Br D-Ha A) - Complete. Copper/bronze. Mass: n/a. Dimensions: 3.9 cm x 2.1 cm x 1.0 cm - Roscio *et al.* 2018, fig. 2.4.
127. Rosières-près-Troyes "Les Monts Hauts" [site no. 111, burial] (Aube, Grand Est, France). Phase 3 (Br D-Ha A) - Complete. Copper/bronze. Mass: n/a. Dimensions: 2.3 cm x 2.1 cm x 1.6 cm - Roscio *et al.* 2018, fig. 2.4.

Variant 4: Perforated (cat. no. 128-148)

- *number of objects:* 21
- *objects with known mass (complete/reconstructed)*: 12 (80 %)
- *chronological range*: Phase 1-4 (*c.* 2300-800 BCE)
- *material*: stone
- *15 sites: site no.* 3, 5, 11, 14, 15, 17, 19, 20, 21, 23, 28, 32, 33, 37, 84
- *mass range (complete/reconstructed):* 9.8-334.0 g

128. Coppa Nevigata [site no. 21, settlement] (Manfredonia, Puglia, Italy). CN 06, G2G, 1b. Phase 3 (RBA) - Associations: filling layer of the access ramp to the the main gate (residual) - Complete. Stone. Mass: 9.8 g. Dimensions: 5.3 cm x 1.9 cm x 0.7 cm - Unpublished.
129. Serra Orrios [site no. 14, settlement] (Dorgali, Nuoro, Sardegna, Italy). Phase 4 (LBA) - Complete. Stone (schist). Mass: 36.86 g. Dimensions: 7.0 cm x 2.3 cm x 1.3 cm - Museo Archeologico di Dorgali (inv. no. 94656) - Unpublished.
130. Monte Barello [site no. 33, settlement] (Castelvetro, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone. Mass: 59.32 g (58.35 g). Dimensions: 7.1 cm x 2.0 cm x 2.2 cm - Museo Archeologico Etnografico Modena (inv. no. 1909) - Unpublished.
131. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: n/a (32.86 g). Dimensions: 7.4 cm x 1.6 cm x 1.4 cm - Museo Archeologico Etnografico Modena (inv. no. 7817) - Unpublished.
132. Nuraghe Santu Antine [site no. 15, settlement] (Torralba, Sassari, Sardegna, Italy). Undetermined chronology (LBA) - Fragmented (reconstructed in 3D). Stone (steatite). Mass: 17.77 g (17.44 g). Dimensions: 8.6 cm x 2.2 cm x 0.6 cm - Museo Nazionale G.A. Sanna, Sassari (inv. no. 11521) - Unpublished.
133. Sa Mandra Manna [site no. 19, settlement] (Tula, Sassari, Sardegna, Italy). Surface. Undetermined chronology (Bronze Age) - Complete. Stone (steatite). Mass: 50.73 g. Dimensions: 7.7 cm x 3.1 cm x 1.1 cm - University of Sassari, storerooms - Unpublished.
134. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete.

Stone. Mass: 117.93 g. Dimensions: 6.1 cm x 4.5 cm x 1.9 cm - Museo Archeologico Etnografico Modena (inv. no. 7818) - Unpublished.

135. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (slate). Mass: 25.1 g. Dimensions: 9.9 cm x 1.4 cm x 1.0 cm (inv. no. 2542) - Bolliger Schreyer *et al.* 2004, Taf. 228.2542.
136. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House alpha II, Wall, base layer. Phase 4 (FBA) - Part of a set of 2 weights (cat. no. 136, 143). Associations: nuragic pottery, 4 loom weights, high number of spindle whorls, bronze chisel, scalpel, bronze fragments, mould, metal hoard (*c.* 75 kg) - Fragmented (reconstructed in 3D). Stone (limestone?). Mass: 216.67 g (216.05 g). Dimensions: 15.2 cm x 2.8 cm x 2.4 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 5277) - Unpublished.
137. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Fragmented. Stone (sandstone). Mass: n/a (52.7 g). Dimensions: 6.8 cm x 2.1 cm x 1.6 cm (inv. no. 2548) - Bolliger Schreyer *et al.* 2004, Taf. 228.2548.
138. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Fragmented. Stone (sandstone). Mass: n/a (52.6 g). Dimensions: 9.1 cm x 2.2 cm x 2.0 cm (inv. no. 2547) - Bolliger Schreyer *et al.* 2004, Taf. 228.2547.
139. Numana [site no. 28, burial] (Arcevia, Ancona, Marche, Italy). Grave 52 (area Quagliotti). Phase 4 (EIA 1) - Associations: awl, knife, razor, pin - Horizontal incision across the perforation. Complete. Stone. Mass: 334 g - Museo Archeologico Nazionale delle Marche, Ancona - Lollini 1976, fig. 1.
140. Nuraghe Talei [site no. 11, settlement] (Sorgono, Nuoro, Sardegna, Italy). Trench C. Stratum VII. Undetermined chronology (Bronze Age) - Drop-shaped. Complete. Stone. Mass: 77.33 g. Dimensions: 11.0 cm x 3.8 cm x 1.3 cm - Unpublished.
141. Bismantova, Campo Pianelli [site no. 32, burial] (Reggio Emilia, Emilia-Romagna, Italy). Grave 43. Phase 4 (FBA) - Associations: razor, pin, tweezers, ornaments - Upper hook separated by incised decoration. Complete. Stone (steatite). Mass: 12.88 g. Dimensions: 5.9 cm x 2.0 cm – Catarsi/Dall'Aglio 1978, tav. 25.8.
142. Sa Tanca 'e sa Idda [site no. 20, settlement] (Martis, Sassari, Sardegna, Italy). N 2000, Nz 167, 5ag 2-1, 2-110 120. Undetermined chronology (Bronze Age) - Upper hook separated by incised decoration. Fragmented (reconstructed in 3D). Stone (granite). Mass: 50.59 g (48.66 g) - Museo Archeologico e Paleobotanico di Perfugas (inv. ND) - Unpublished.
143. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House alpha II, Wall, base layer. Phase 4 (FBA) - Part of a set of 2 weights (cat. no. 136, 143). Associations: nuragic pottery, 4 loom weights, high number of spindle whorls, bronze chisel, scalpel, bronze fragments, mould, metal hoard (*c.* 75 kg). - Fragmented. Stone (schist). Mass: n/a (52.72 g). Dimensions: 8.4 cm x 3.7 cm x 1.0 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 4636) - Unpublished.
144. Nuraghe Santu Antine [site no. 15, settlement] (Torralba, Sassari, Sardegna, Italy). Undetermined chronology (LBA) - Fragmented. Stone (steatite). Mass: n/a (15 g). Dimensions: 5.5 cm x 2.8 cm x 0.6 cm - Museo Nazionale G.A. Sanna, Sassari (inv. no. 11581) - Unpublished.
145. Nuraghe Palmavera [site no. 17, settlement] (Alghero, Sassari, Sardegna, Italy). House 8. Phase 4 (EIA) - Fragmented. Stone (limestone). Mass: n/a (53.47 g). Dimensions: 3.0 cm x 2.0 cm x 0.7 cm - University of Sassari, storerooms (inv. no. 67) - Unpublished.
146. Nuraghe Santu Antine [site no. 15, settlement] (Torralba, Sassari, Sardegna, Italy). Undetermined chronology (LBA) - Fragmented. Stone (steatite). Mass: n/a (18.82 g). Dimensions: 5.0 cm x 2.5 cm x 1.0 cm - Museo Nazionale G.A. Sanna, Sassari (inv. no. 11582) - Unpublished.
147. Filicudi, Montagnola di Capo Graziano [site no. 5, settlement] (Aeolian Islands, Messina, Sicilia, Italy). Capo Graziano layers. Phase 1 (EBA-MBA 1-2) - Fragmented. Stone. Mass: n/a (10.81 g). Dimensions: 3.0 cm x 2.4 cm x 1.2 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. SN) - Unpublished.
148. Grotta Manaccora [site no. 23, cave] (Peschici, Puglia, Italy). Big cave, GM 33, A III (66). Undetermined chronology (Bronze Age) - Fragmented. Stone (limestone). Mass: n/a (211.8 g). Dimensions: 8.2 cm x 6.2 cm x 2.3 cm - Museo delle Origini, Roma (inv. no. 4652 bis) - Unpublished.

Undetermined variant: Fragmented
(cat. no. 149-159)

- *number of objects:* 11
- *chronological range:* Phase 1-3 (*c.* 2300-1200 BCE)
- *material*: stone (7), copper/bronze (4)
- *9 sites (__1 set__):* site no. 3, 5, 21, 23, 40, 82, (***__105__***), 106, 136

__Stone__

149. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House delta XIV, Area BH (phase Capo Graziano). Phase 1 (EBA-MBA 1-2) - Associations: 2 bone spatulae - Fragmented. Stone (schist). Mass: n/a (9.53 g). Dimensions: 3.0 cm x 2.3 cm x 0.7 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 7706) - Unpublished.
150. Filicudi, Montagnola di Capo Graziano [site no. 5, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House XXIV, Capo Graziano layers. Phase 1 (EBA-MBA 1-2) - Fragmented. Stone. Mass: n/a (25.65 g). Dimensions: 5.3 cm x 2.3 cm x 1.3 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 15981) - Unpublished.
151. Gaggio di Castelfranco [site no. 40, settlement] (Modena, Emilia-Romagna, Italy). T. 507, Trench

4, UA 4, US 13101, fase 1.2.B, T. 507. Dwelling area. Phase 2 (MBA-RBA) - Fragmented. Stone. Mass: n/a (79.33 g). Dimensions: 5.2 cm x 2.8 cm x 2.3 cm - Museo Archeologico Etnografico Modena (inv. no. 4879) - Unpublished.

152. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 2 weights and 1 balance beam (cat. no. 1, 152, 309). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Fragmented. Stone. Mass: n/a (29.5 g). Dimensions: 1.9 cm x 1.6 cm x 0.6 cm - Roscio *et al.* 2011, fig. 5.8; Rahmstorf 2014, fig. 3.8.
153. Grotta Manaccora [site no. 23, cave] (Peschici, Puglia, Italy). Big cave, GM 33, TG III. Undetermined chronology (Bronze Age) - Fragmented. Stone (limestone). Mass: n/a (78.6 g). Dimensions: 7.0 cm x 3.7 cm x 2.1 cm - Museo delle Origini, Roma (inv. no. 6179) - Unpublished.
154. Coppa Nevigata [site no. 21, settlement] (Manfredonia, Puglia, Italy). CN 05, E3H, 2Ia (44). Open area. Phase 2-3 (MBA 3) - Associations: domestic structure with cooking facilities - Fragmented. Stone (sandstone). Mass: n/a (41.1 g) - Unpublished.
155. Coppa Nevigata [site no. 21, settlement] (Manfredonia, Puglia, Italy). CN 11, G2 P, 12. Open area, close to the main gate. Phase 3 (RBA) - Associations: found on a pebble-floor, in an open area close to the main gate. Possibly part of a set of 3 weights (cat. no. 155, 281, 657) - Fragmented. Stone. Mass: n/a (136.5 g). Dimensions: 8.6 cm x 4.6 cm x 2.3 cm - Unpublished.

Bronze

156. Wartau-Herrenfeld [site no. 82, settlement] (St. Gallen, Switzerland). Undetermined chronology (Bronze Age) - Fragmented. Copper/bronze. Mass: n/a (19.2 g). Dimensions: 2.8 cm x 1.5 cm x 0.7 cm - Pare 1999, fig. 19.7.
157. Coppa Nevigata [site no. 21, settlement] (Manfredonia, Puglia, Italy). CN 14, H3 N, 2a I (4). Phase 3 (RBA) - Fragmented. Copper/bronze. Mass: n/a (15.77 g). Dimensions: 2.4 cm x 2.7 cm x 1.1 cm - Unpublished.
158. Tiszabecs [site no. 106, hoard] (Szabolcs-Szatmár, Hungary). Phase 3 (Br D) - Fragmented. Copper/bronze. Mass: n/a (29.7 g). Dimensions: 2.1 cm x 2.0 cm x 1.1 cm - Pare 1999, fig. 19.9.
159. Kobern [site no. 136, burial] (Kobern-Gondorf, Mayen-Koblenz, Rheinland-Pfalz, Germany). Phase 3 (Br D-Ha A1) - Associations: tweezers, 2 studs, pottery - Fragmented. Copper/bronze. Mass: n/a. Dimensions: 4.0 cm x 1.4 cm x 0.2 cm - Rheinisches Landesmuseum, Bonn - Pare 1999, fig. 18.5.

Undetermined variant: Mentioned in literature, without image (cat. no. 160-163)

- *number of objects:* 4
- *chronological range:* Phase 1-3 (*c.* 2300-1200 BCE)
- *material*: stone
- *1 site:* site no. 3

160. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). Insula IV, Stray find, Planum 3-4 (phase Capo Graziano). Phase 3 (RBA) - Integrity cannot be determined. Stone (schist). Mass: n/a - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 6068) - Unpublished.
161. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). Between huts alpha IV and alpha IX, Area C1, Planum 1, fire layers, Ausonio II. Taglio 1, strati incendio Ausonio II (Ausonio II). Phase 4 (FBA) - Integrity cannot be determined. Stone. Mass: n/a - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 5629a) - Unpublished.
162. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). Trench I, Insula IV, Planum 6, destruction, destruction layer and immediately underneath (phase Ausonio II). Phase 4 (FBA) - Integrity cannot be determined. Stone (schist). Mass: n/a - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 5629b) - Unpublished.
163. Lipari, outside the acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). Trench AH'. Phase 4 (FBA) - Integrity cannot be determined. Stone. Mass: n/a - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 4798) - Unpublished.

5.3. CUBE

- *number of objects*: 8
- *objects with known mass (complete/reconstructed)*: 8 (100 %).
- *chronological range*: Phase 4-5 (*c.* 900-675 BCE)
- *material:* stone (2), lead (6)
- *5 sites:* site no. 7, 8, 18, 189, 194
- *1 set:* site no. 7
- *mass range (complete/reconstructed):* 2.63-63.7 g

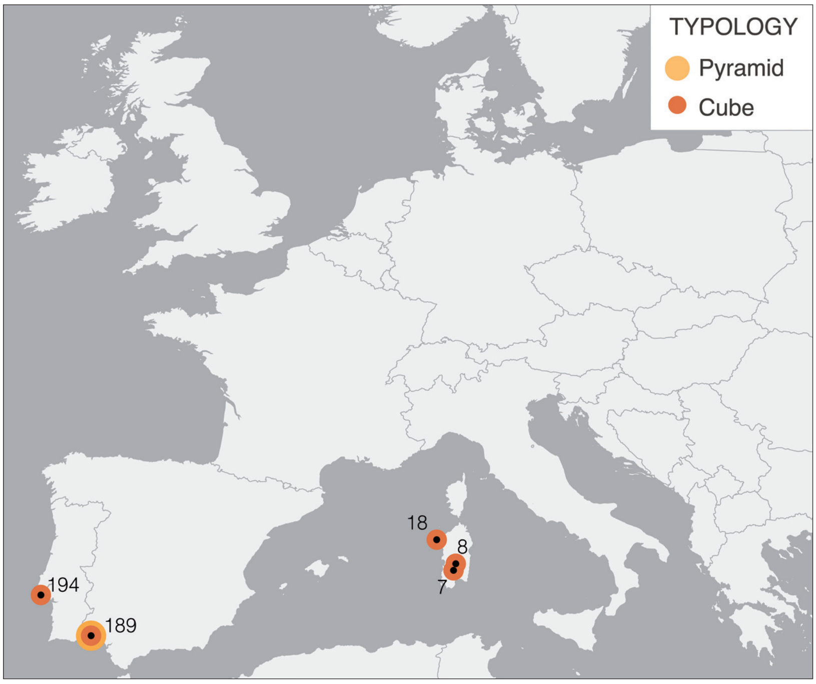
Distribution map: fig. 5.16.

Typology, materials, comparisons, and function

Cubic weights seem to appear very late in the European record, no earlier than *c.* 850 BCE (Fig. 5.16.), with two objects made of stone and six made of lead. All cubic weights in this catalogue come from sites and regions with frequent relationships with western Phoenicians, namely Sardinia and south-western Iberia. The chronology of all the finds is compatible with the early horizon of Phoenician settlements in the western Mediterranean and the Atlantic coast (González de Canales Cerisola *et al.* 2004; Torres Ortiz 2008; Ialongo 2017).

The earliest lead cube weight is attested at the site of Nuraghe Sant'Imbenia in Sardinia (cat. no. 168, site no. 18), in a layer dated to the Italian Early Iron Age 2 (*c.* 850-725 BCE). At Santu Brai (site no. 7) – a small settlement in Sardinia, dated to the Early Orientalizing period (*c.* 725-675 BCE) – a stone cube weight (cat. no. 164) is part of a weighing set together with two troncoconical weights (cat. no. 307, 308); all weights included in the set bear incised quantity marks. The lead cube weights from the hoard of Forraxi Nioi (Sardinia, Italy; cat. no. 165, site no. 8), the settlement of Quinta do Almaraz (Portugal; cat. no. 166-167, site no. 194), and the site of Huelva – Plaza de las Monjas (Spain; cat. no. 169-171, site no. 189) belong to mixed deposits datable between the 10th and early 7th centuries BCE.

Three cubic weights bear signs that might be interpreted as quantity marks. The stone weight from Forraxi Nioi (cat. no. 165) has a mass of 23.87 g, and has five horizontal incised lines on one face. If one assumes that these lines indicate a denominator, the resulting unit would be 4.8 g. The lead weight from Nuraghe Sant'Imbenia (cat. no. 168) has a mass of 45.52 g, and a single circular indentation on one of its faces. Finally, the stone weight from Santu Brai has an "X" sign across two faces, and a single straight line on another face. The weight has a mass of 63.7 g, but the sign cannot be easily reconnected to any number. Based on the scarce available evidence, the identification of these signs with quantity marks cannot be ascertained.



▲ *Fig. 5.16. Pyramid and cubic weights. Geographical distribution: typology and site ID.*

164. Santu Brai [site no. 7, settlement] (Sud Sardegna, Sardegna, Italy). Rectangular house. Phase 5 (EIA 2B-EO) - One incised line on one face; two crossed lines across two faces. Part of a set of 4 balance weights (cat. no. 164, 307, 308, 316). Associations: small ceramic jug containing an awl, a small saw, a dagger, and a bronze fragment; Etruscan bucchero - Complete. Stone. Mass: 63.7 g. Dimensions: 3 cm x 3 cm x 3 cm - Ugas 1986, tav. XVI.5.
165. Forraxi Nioi [site no. 8, hoard] (Nuragus, Sud Sardegna, Sardegna, Italy). Phase 5 (EIA 2B-EO) - Five incised lines on one face. Complete. Stone. Mass: 23.87 g. Dimensions: 5.5 cm x 4.8 cm - Ugas 1986, tav. XVII.5.
166. Quinta do Almaraz [site no. 194, settlement] (Cacilhas, Almada, Oeste, Portugal). Phase 4-5 (Atlantic FBA III-Orientalizing) - Complete. Lead. Mass: 6.38 g. Dimensions: 1.7 cm x 1.5 cm x 1.8 cm - Vilaça 2011, fig. 6.2.
167. Quinta do Almaraz [site no. 194, settlement] (Cacilhas, Almada, Oeste, Portugal). Phase 4-5 (Atlantic FBA III-Orientalizing) - Complete. Lead. Mass: 2.63 g. Dimensions: 1.4 cm x 1.6 cm x 1.5 cm - Vilaça 2011, fig. 6.1.
168. Nuraghe Sant'Imbenia [site no. 18, settlement] (Alghero, Sassari, Sardegna, Italy). House 48, 19-07-2012, US 396. Phase 4 (EIA) - Circular indentation on one face. - Complete. Lead. Mass: 45.52 g. Dimensions: 1.9 cm x 1.8 cm x 1.7 cm - Storerooms of the archaeological excavations at Sant'Imbenia, Alghero (inv. ND) - Unpublished.
169. Huelva - Plaza de las Monjas [site no. 189, settlement] (Andalucìa, Spain). Phase 4-5 (Atlantic FBA III) - Complete. Lead. Mass: 26.62 g. Dimensions: 2.5 cm x 2.6 cm x 2.0 cm - González de Canales Cerisola *et al.* 2004, 154-155, fig. 38.13.

5.4. TRUNCATED PYRAMID

- *number of objects*: 2
- *objects with known mass (complete/reconstructed)*: 2 (100 %).
- *chronological range*: Phase 5 (*c.* 900-675 BCE)
- *material:* lead
- *1 site:* site no. 189
- *mass range (complete/reconstructed):* 4.45-9.54 g

Distribution map: fig. 5.16.

Two pyramid-shaped made of lead are attested among the mixed materials of the site of Huelva - Plaza de las Monjas (Spain; site no. 189), which include Greek and Phoenician imports. Object cat. no. 171 has a small circular indentation on the base, probably a quantity mark indicating the unit value; the weight's mass is 9.54 g.

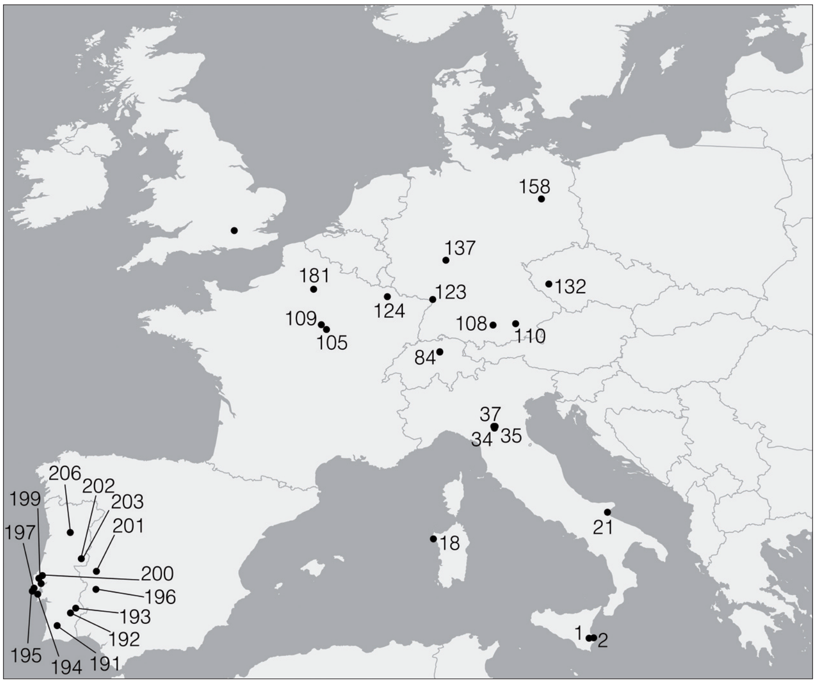
170. Huelva - Plaza de las Monjas [site no. 189, settlement] (Andalucìa, Spain). Undetermined chronology (Atlantic FBA III) - Complete. Lead. Mass: 4.45 g. Dimensions: 1.2 cm x 2.2 cm x 1.5 cm - González de Canales Cerisola *et al.* 2004, 154-155, fig. 38.10.

171. Huelva - Plaza de las Monjas [site no. 189, settlement] (Andalucìa, Spain). Undetermined chronology (Atlantic FBA III) - Circular indentation on the base. Complete. Lead. Mass: 9.54 g. Dimensions: 1.7 cm x 2 cm x 1.8 cm - González de Canales Cerisola *et al.* 2004, 154-155, fig. 38.11.

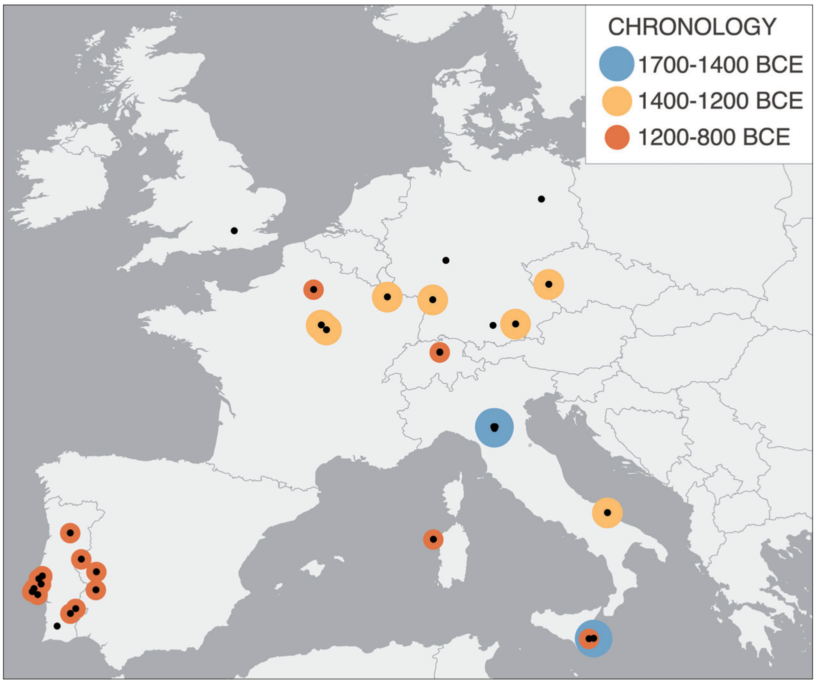
5.5. DISC

- *number of objects*: 91
- *objects with known mass (complete/reconstructed)*: 78 (86 %)
- *chronological range*: Phase 2-4 (*c.* 1600-800 BCE)
- *material:* stone (9), copper/bronze (73), lead (3)
- *33 sites:* site no. 1, 2, 18, 21, 34, 35, 37, 84, 105, 108, 109, 123, 125, 128, 132, 137, 141, 158, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 206
- *9 sets:* site no. 2, 105, 108, 109, 123, 132, 137, 192, 195
- *mass range (complete/reconstructed):* 0.36-164.7 g

Distribution maps: fig. 5.17.-21.
Composition of the sample: fig. 5.22.-24.



▲ *Fig. 5.17. Disc weights. Geographical distribution: site ID.*



▲ *Fig. 5.18. Disc weights. Geographical distribution: chronology.*

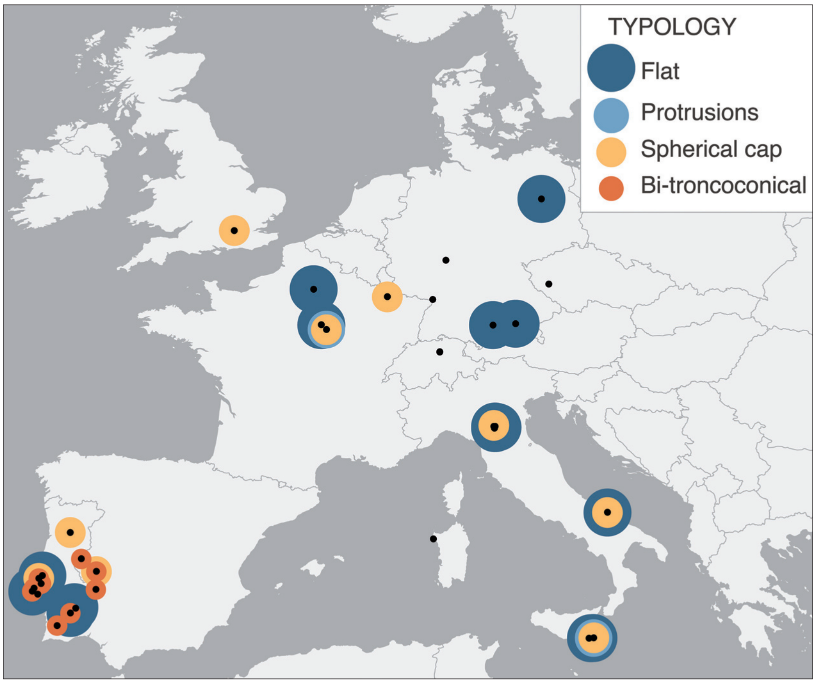
Typology, materials, comparisons, and function

Disc weights are a formally heterogeneous type, grouping small objects with a round upper profile, and most of them have at least one flat base. All objects included in this type could be easily placed on a balance pan; only the weights classified in V3.C and V5 present a perforation (cat. no. 238-243), which suggests that they could also be hanged directly on one of the extremities of a balance scale. This type includes five variants. Objects belonging to Variant 1 are plain discs with two flat bases, most of which (16 objects) are made of bronze, one of lead and five of stone. Five objects with unique characteristics are also included in V1 (cat. no. 194-198): a stone disc with an annular incision (cat. no. 194), a stone disc with a small circular indentation (cat. no. 195), a discoid object made of bronze with slightly irregular shape (cat. no. 196), a fragmentary bronze disc with a relief decoration consisting of two small circular bumps separated by a straight line (cat. no. 197), and a pin-head whose shaft was intentionally removed and any residue grinded away (cat. no. 198). There is no evidence that the decoration of cat. no. 197 (which unfortunately could not be reconstructed) represents a quantity mark. However, one can note that the preserved part of the weight is *c.* ½, and the current mass is 2.38 g, which would correspond to *c.* ½ of the theoretical Pan-European unit of *c.* 9.8 g.

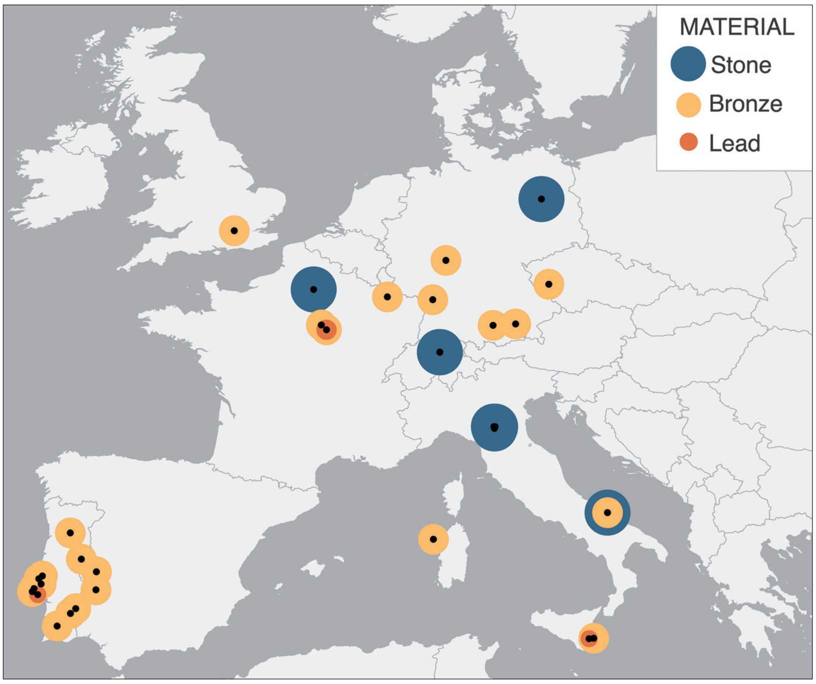
Variant 2 groups nine objects with plano-convex shape, all of which are made of bronze. Two further stone objects with unique features are also included in V2: one with crossing incisions on the upper face (cat. no. 208), and one with hollow base (cat. no. 209).

Variant 3 is the most typologically homogeneous. It includes 35 objects with bi-tronco-conical profile, all made of metal (34 bronze, 1 lead), and is articulated into two sub-variants. Objects classified in V3.A have a plain biconical profile. Object cat. no. 228 from Monte do Trigo (site no. 202), a LBA settlement in Portugal, is fused together to a much smaller weight by corrosion. Object cat. no. 227 comes from the same site, but no indication about the context is unfortunately available (Vilaça 2003). Four objects included in V3.A are pin-heads, whose shaft was intentionally removed and any residue grinded away. Objects cat. no. 234-235 belong to a common type widespread in Central Europe in the Bronze D phase (*c.* 1350-1200 BCE), and their shape is undistinguishable from the weights classified in V3.A (Pare 1999). Objects cat. no. 236 and 237 have decorations. V3.B groups six objects with biconical profile and a longitudinal perforation. Object cat. no. 243 is decorated with small grooves.

Objects classified in Variant 4 are all very small, ranging between 0.8-7.66 g. V4 has a characteristic 'spinning-top shape', with one or two tubular



▲ *Fig. 5.19. Disc weights. Geographical distribution: typology.*



▲ *Fig. 5.20. Disc weights. Geographical distribution: materials.*

protrusions. Fourteen of 15 objects are made of bronze, all coming from the MBA/RBA necropolis of Thapsos in Sicily (site no. 2, *c.* 1500-1200 BCE). Object cat. no. 251, made of lead, is part of the weighing set of grave 298 in Migennes - Le Petit Moulin, France (site no. 105, *c.* 1350-1200 BCE). Objects cat. no. 252-259 all come from the same chamber tomb as cat. no. 245, 247-250. They are heavily corroded, and the drawing could not render their details. However, direct observation suggests that these objects are analogous to those coming from the same tomb.

Finally, Variant 5 includes three discoid elements with longitudinal perforation belonging to the shaft decoration of a well-known type of pin ('jagged pin') widespread in Central Europe in the Bronze D phase (*c.* 1350-1200 BCE). They all come from accurately-excavated graves in France, and the absence of the shaft is likely intentional (*e. g.*, Roscio *et al.* 2011).

Plain disc weights similar to V1 are rather common in Mediterranean Bronze Age contexts, especially in the Aegean. Several disc weights of the plain variant come, for example, from the Late Minoan/Helladic I-II settlement of Ayia Irini on the island of Keos, in Greece (Petruso 1992). In the Aegean, however, the vast majority of disc weights is made of lead, and only a small minority is made of stone or bronze. Several of the Ayia Irini weights closely resemble the lead weight cat. no. 193, from the necropolis of Pantalica (Sicily, Italy). This weight, however, dates to the Italian Early Iron Age (*c.* 950-800 BCE), and is much later than the weights from Keos. Disc weights – albeit only a few – are also documented in the Uluburun shipwreck, off the southern coast of Turkey (*c.* 1350-1300 BCE) (Pulak 1997, 361, 395, 432-434, 437, 463). Plano-convex weights analogous to V2 are well-attested at Uluburun, and are contemporary to weights with the same shape coming from Phase 3 contexts in Italy and France (cat. no. 199-202, 207). Two lead disc weights from Uluburun have a longitudinal perforation (Pulak 1997, no. 108-109), similarly to V3.B from the Iberian Peninsula. It must be considered, however, that the Mediterranean parallels are much earlier than the Iberian objects, which all date to the Bronce Final III (*c.* 1200-800 BCE, Phase 4).

Chronology and geographical distribution

Disc weights are first attested in southern Italy in Phase 2 (*c.* 1600-1350 BCE) (Fig. 5.18.). In the chamber tomb 6 of the necropolis of Thapsos (Sicily, site no. 2), 18 disc-weights (all made of bronze) are part of a set, including objects pertaining to Variants 1, 2 and 4. Stone disc weights are also attested in northern Italy, from *Terramare* settlements dating between *c.* 1600-1200 BCE (Phase 2-3). Disc weights are present in several graves in Central Europe dating to Bronze D, corresponding to Phase 3 (*c.* 1350-1200 BCE). All of them are made of bronze except cat. no. 251, which is made of lead, and cover the whole typological variability, including at least one object from each variant. A small plano-convex weight made of bronze (cat. no. 200) is attested in the site of ZAC du Sansonnet near Metz (France), interpreted as an open-air metallurgical area (site no. 125). A 14C sample associated with the context provides a 1σ date of 1268-1147 BCE (Poz-72783: 2985 ± 35 BP (Klag/Wiethold 2020), which would be compatible with a late Br D or an early Ha A. A bronze parallelepiped weight comes from the same site (cat. no. 96). Object cat. no. 207 (bronze) from Coppa Nevigata (Italy, site no. 21) comes from a layer dated the RBA, contemporary to Br D.

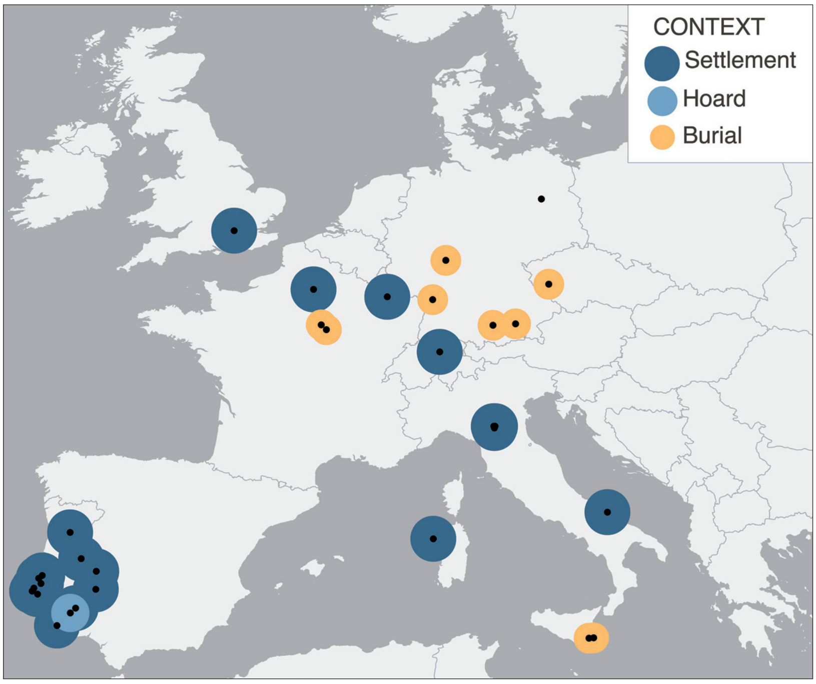
The first attestation of disc weights in the Iberian Peninsula dates to the Atlantic Final Bronze Age III, a rather wide chronological phase spanning *c.* 1200-800 BCE, corresponding to Phase 4 (Fig. 5.18.). Disc weights from the Iberian Peninsula belong to Variants 1, 2 and 3, and come from contexts that cannot be precisely assigned to a specific moment within this time span.

Contexts

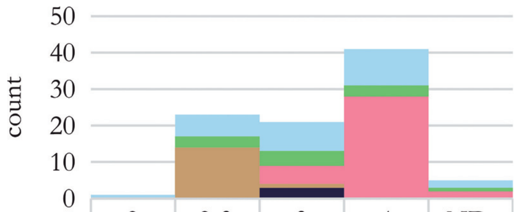
Disc weights are distributed almost equally between settlements (44 objects) and burials (39), with only six objects coming from hoards (Fig. 5.21.; 5.23.). Objects cat. no. 200 and 206 – respectively from the settlements of ZAC du Sansonnet (France, site no. 125) and Runnymede Bridge (England, site no. 141) – are associated with metallurgical facilities. Four disc weights from the LBA settlement of Penha Verde (Portugal, site no. 195, objects cat. no. 185, 187, 212, 219) were found together in the same house, and constitute one of the rare weighing sets attested in dwelling areas. Almost all disc weights from burials (37 objects) belong to weighing sets, twelve of which are associated with a balance beam. The five disc-weights from the hoard of Baleizão (Portugal, site no. 192, objects cat. no. 184, 229, 232, 238, 239, 241) are part of a set of seven balance weights, including an octahedral one (cat. no. 266). Other than the weights, the hoard contained bronze axes, gold torques and several bronze scraps.

Variant 1: Plain disc (cat. no. 172-198).

- *number of objects:* 27
- *objects with known mass (complete/reconstructed):* 9 (82 %)
- *chronological range*: Phase 2-4 (*c.* 1600-800 BCE)
- *material*: stone (7), copper/bronze (19), lead (1)
- *17 sites:* site no. 1, 2, 18, 21, 34, 37, 84, 108, 109, 123, 128, 158, 192, 193, 195, 197, 200
- *6 sets:* site no. 2, 108, 109, 123, 192, 195
- *mass range (complete/reconstructed):* 0.36-164.7 g

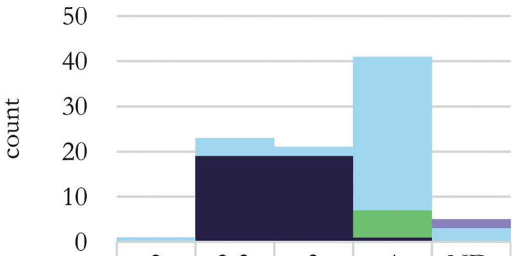


▲ *Fig. 5.21. Disc weights. Geographical distribution: site type.*



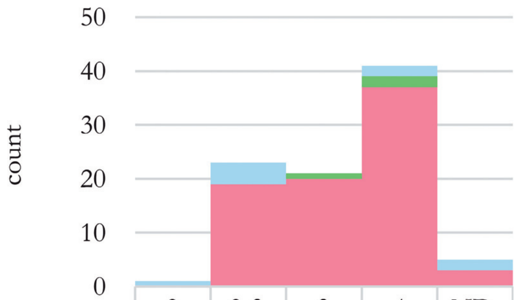
	2	2-3	3	4	ND
V1	1	6	8	10	2
V2		3	4	3	1
V3			5	28	2
V4		14	1		
V5			3		

▲ *Fig. 5.22. Disc weights. Quantification: typology vs chronology.*



	2	2-3	3	4	ND
ND					2
sett.	1	4	2	34	3
hoard				6	
burial		19	19	1	

▲ *Fig. 5.23. Disc weights. Quantification: site type vs chronology.*



	2	2-3	3	4	ND
stone	1	4		2	2
lead			1	2	
bronze		19	20	37	3

▲ *Fig. 5.24. Disc weights. Quantification: materials vs chronology.*

172. Gorzano [site no. 34, settlement] (Maranello, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 7.86 g (7.68 g). Dimensions: 3.01 cm x 3.08 cm x 0.86 cm - Museo Archeologico Etnografico Modena (inv. s.n. 99) - Unpublished.
173. Coppa Nevigata [site no. 21, settlement] (Manfredonia, Puglia, Italy). CN 97, D4L, A-L, S III. Close to the internal side of the fortification wall. Phase 2 (MBA 2) - Associations: disturbed layer - Slightly chipped. Stone (quartzite). Mass: 21.7 g. Dimensions: 3.5 cm x 3.7 cm x 0.9 cm - Unpublished.
174. Saint-Pierre-en-Chastre, Vieux-Moulin [site no. 128, settlement] (Oise, Hauts-de-France, France). Phase 4 (Atlantic FBA III) - Complete. Stone. Mass: n/a - Blanchet 1984, fig. 147.11.
175. Wustermark [site no. 158, unknown context] (Havelland, Brandenburg, Germany). Undetermined chronology (Bronze Age) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 93 g (56.24 g). Dimensions: 4.7 cm x 4.7 cm x 3.0 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 1998-822/782/3) - Unpublished.
176. Wustermark [site no. 158, unknown context] (Havelland, Brandenburg, Germany). Undetermined chronology (Bronze Age) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 94.84 g (86.46 g). Dimensions: 4.1 cm x 4.8 cm x 2.7 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 1998-822/920/2) - Unpublished.
177. Etigny, “Le Brassot” Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 0.36 g. Dimensions: 0.6 cm x 0.6 cm x 0.3 cm - Musées de Sens - Roscio 2018, pl. 85.7.
178. Etigny, “Le Brassot” Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Fused together with a smaller metal object by corrosion. Part of a set of 13 balance weights and 1 balance beam. Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Overweight. Copper/bronze. Mass: n/a (0.93 g). Dimensions: 0.6 cm x 0.7 cm x 0.3 cm - Musées de Sens - Roscio 2018, pl. 85.6, 29.
179. Penedo do Lexim [site no. 197, settlement] (Mafra, Lisbon, Portugal). Locus 3b, Intrusion in Chalcolithic context. S.U. 07. Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 1.4 g. Dimensions: 0.9 cm x 0.9 cm x 0.4 cm (inv. no. IGN.017.12993) - Sousa/Sousa 2018, fig. 10, top.
180. Etigny, “Le Brassot” Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 2.25 g. Dimensions: 0.8 cm x 0.8 cm x 0.6 cm - Musées de Sens - Roscio 2018, pl. 85.5.
181. Etigny, “Le Brassot” Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 1.68 g. Dimensions: 1.0 cm x 1.0 cm x 0.3 cm - Musées de Sens - Roscio 2018, pl. 85.18.
182. Etigny, “Le Brassot” Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 0.49 g. Dimensions: 1.1 cm x 1.1 cm x 0.1 cm - Musées de Sens - Roscio 2018, pl. 85.10.
183. Abrigo Grande das Bocas [site no. 200, settlement] (Rio Maior, Santarém, Portugal). Phase 4 (Bronze Age - uncertain) - Complete. Copper/bronze. Mass: 4.92 g. Dimensions: 1.3 cm x 0.5 cm - Vilaça 2003, fig. 1.3.
184. Baleizão [site no. 192, hoard] (Beja, Portugal). Phase 4 (Atlantic FBA III) - Part of a set of 7 balance weights (cat. no. 184, 229, 232, 238, 239, 241, 266). Associations: 3 axes, 7 bronze rings, 6 bronze fragments, 3 gold torques, 7 gold fragments - Complete. Copper/bronze. Mass: 2.32 g. Dimensions: 1.1 cm x 1.1 cm x 0.3 cm - Vilaça 2013, fig. 12.7.
185. Penha Verde [site no. 195, settlement] (Sintra, Lisbon, Portugal). House 2. Phase 4 (Atlantic FBA III) - Part of a set of 4 balance weights (cat. no. 185, 187, 212, 219). Associations: fragment of bronze ingot, fragment of bronze armring, gold pin, gold bead - Complete. Copper/bronze. Mass: 2.2 g. Dimensions: 1.0 cm x 0.9 cm x 0.6 cm - Cardoso 2011, fig. 3.8.
186. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Complete. Copper/bronze. Mass: 3.17 g. Dimensions: 1.5 cm x 1.2 cm x 0.5 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.4) - Unpublished.
187. Penha Verde [site no. 195, settlement] (Sintra, Lisbon, Portugal). House 2. Phase 4 (Atlantic FBA III) - Part of a set of 4 balance weights (cat. no. 185, 187,

212, 219). Associations: fragment of bronze ingot, fragment of bronze armring, gold pin, gold bead - Complete. Copper/bronze. Mass: 8.5 g. Dimensions: 1.6 cm x 1.7 cm x 0.8 cm - Cardoso 2011, fig. 3.5.

188. Castro dos Ratinhos [site no. 193, settlement] (Barragem do Alqueva, Moura, Portugal). C1/Sup/001, From the heap of phase 1a. Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: n/a (4.5 g). Dimensions: 1.7 cm x 1.7 cm x 0.6 cm - Berrocal-Rangel/Silva 2010, fig. 143.15.
189. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Two small, diametrically-opposite ribs on the diameter, probably due to the casting technique. Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Complete. Copper/bronze. Mass: 6.31 g. Dimensions: 1.8 cm x 1.0 cm x 0.5 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.1) - Unpublished.
190. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Two small, diametrically-opposite ribs on the diameter, probably due to the casting technique. Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Complete. Copper/bronze. Mass: 4.25 g. Dimensions: 1.65 cm x 1.5 cm x 0.45 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.3) - Unpublished.
191. Hurlach [site no. 108, burial] (Landsberg a. Lech, Bayern, Germany). Phase 3 (Br C-D) - Part of a set of 3 balance weights (cat. no. 86, 100, 191). Associations: cremated remains belonging to 2 individuals, a male and a female. 3 knives, sword, belt hook, several bronze studs, bronze necklace with gold pendant and 3 amber beads, 5 pins, 7 pin heads, gold fragment, pottery - Complete. Copper/bronze. Mass: 11.7 g. Dimensions: 1.8 cm x 1.8 cm x 0.9 cm - Pare 1999, fig. 12.1.
192. Poing [site no. 110, burial] (Ebersberg, Bayern, Germany). Grave 1. Phase 3 (Br D) - Associations: bronze strainer, several bronze fragments, 2 pins, several wagon fittings, several arrowheads, 2 sickles, several fragments of ingots, fra, ring - Complete. Copper/bronze. Mass: 20.8 g. Dimensions: 1.9 cm x 1.9 cm x 1.3 cm - Pare 1999, fig. 19.11.
193. Pantalica [site no. 1, burial] (Siracusa, Sicilia, Italy). North-western necropolis, Grave 9. Phase 4 (FBA-EIA) - Complete. Lead. Mass: 124.85 g. Dimensions: 6.2 cm x 5.3 cm x 0.4 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 15772) - Unpublished.
194. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Annular incision. Complete. Stone. Mass: 30.05 g. Dimensions: 3.5 cm x 2.8 cm x 1.8 cm - Museo Archeologico Etnografico Modena (inv. no. 7822) - Unpublished.
195. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Circular indentation on one face. Complete. Stone (sandstone). Mass: 164.7 g. Dimensions: 7.9 cm x 8.3 cm x 1.6 cm (inv. no. 2550) - Bolliger Schreyer *et al.* 2004, Taf. 228.2550.
196. Nuraghe Sant'Imbenia [site no. 18, settlement] (Alghero, Sassari, Sardegna, Italy). House 48, Sector IV, 07-07-2010. US 50. Phase 4 (EIA) - Irregular shape. Complete. Copper/bronze. Mass: 13.88 g. Dimensions: 2.6 cm x 2.8 cm x 0.5 cm - Storerooms of the archaeological excavations at Sant'Imbenia, Alghero (inv. ND) - Unpublished.
197. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Transversal rib on one face. Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Fragmented. Copper/bronze. Mass: n/a (2.38 g). Dimensions: 1.65 cm x 1.1 cm x 0.4 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.5) - Unpublished.
198. Büchelberg [site no. 123, burial] (Germersheim, Rheinland-Pfalz, Germany). Tumulus 3. Phase 3 (Br D) - Part of a set of 8 balance weights (cat. no. 64, 198, 271, 277, 278, 300, 301, 303). Associations: 3 bronze hinges (organic container?), dagger, awl, pottery - Complete. Copper/bronze. Mass: 8.1 g. Dimensions: 1.3 cm x 1.3 cm - Pare 1999, fig. 24.2.

Variant 2: Plano-convex (cat. no. 199-209).

- *number of objects:* 11
- *objects with known mass (complete/reconstructed)*: 23 (85 %)
- *chronological range*: Phase 2-4 (*c.* 1600-800 BCE)
- *material*: stone (2), copper/bronze (9)
- *9 sites:* site no. 2, 21, 35, 105, 125, 141, 199, 201, 206
- *2 sets:* site no. 2, 105
- *mass range (complete/reconstructed):* 0.4-69.89 g

199. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 0.48 g. Dimensions: 0.6 cm x 0.6 cm x 0.3 cm - Roscio *et al.* 2011, fig. 2.48.
200. ZAC du Sansonnet [site no. 125, settlement] (Metz, Moselle, Grand Est, France). Melting pit (surroundings). Phase 3 (Br D) - Part of a set of 2 balance weights (cat. no. 96, 200). Associations: fire pits, crucibles, metal objects - Complete. Copper/bronze. Mass: 0.4 g. Dimensions: 6.4 cm x 6.4 cm x 0.4 cm - Klag/Wiethold 2019, fig. 11.10.

201. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 1.59 g. Dimensions: 0.9 cm x 0.8 cm x 0.4 cm - Roscio *et al.* 2011, fig. 2.61.
202. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Shapeless. Copper/bronze. Mass: 0.89 g. Dimensions: 1.0 cm x 0.8 cm x 0.7 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.13) - Unpublished.
203. Canedotes [site no. 206, settlement] (Vila Nova de Paiva, Viseu, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 3.8 g. Dimensions: 1.0 cm x 0.8 cm - Vilaça 2003, fig. 1.7.
204. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 4.34 g. Dimensions: 1.7 cm x 0.5 cm - Vilaça 2003, fig. 3.16.
205. Cabezo de Araya [site no. 201, settlement] (Arroyo de la Luz, Càceres, Extremadura, Spain). Stray find. Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: n/a. Dimensions: 1.3 cm x 1.0 cm - Almagro 1961, fig. 4.24.
206. Runnymede Bridge [site no. 141, settlement] (Berkshire, England). Layer 5a. Undetermined chronology (Bronze Age) - Associations: settlement with evidence of metalworking - Complete. Copper/bronze. Mass: n/a. Dimensions: 2.1 cm x 2.0 cm x 0.64 cm - Needham 1980, fig. 13.29.
207. Coppa Nevigata [site no. 21, settlement] (Manfredonia, Puglia, Italy). CN 14, H3 M, S. Phase 3 (RBA) - Complete. Copper/bronze. Mass: 10.26 g. Dimensions: 2.3 cm x 2.0 cm x 1.2 cm - Unpublished.
208. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Two crossing incised lines on the top. Complete. Stone. Mass: 29.43 g. Dimensions: 3.9 cm x 3.9 cm x 1.4 cm - Museo Archeologico Etnografico Modena (inv. no. 457) - Unpublished.
209. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Excavation '800, LXV, 98. Phase 2-3 (MBA-RBA) - Concave base. Complete. Stone. Mass: 18.7 g. Dimensions: 4.32 cm x 3.39 cm x 1.34 cm - Museo Archeologico Etnografico Modena (inv. no. 528) - Unpublished.

Variant 3: Biconical (cat. no. 210-244).

- *number of objects:* 35
- *objects with known mass (complete/reconstructed)*: 29 (83 %)
- *chronological range*: Phase 3-4 (*c.* 1350-800 BCE)
- *material*: copper/bronze
- *13 sites:* site no. 132, 137, 191, 192, 194, 195, 196, 197, 198, 199, 201, 202, 203
- *4 sets:* site no. 132, 137, 192, 195
- *mass range (complete/reconstructed):* 1.82-268.7 g

Sub-variant 3.A: Plain (cat. no. 210-237)

210. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 1.82 g. Dimensions: 0.8 cm x 0.6 cm - Vilaça 2003, fig. 3.1.
211. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 2.86 g. Dimensions: 0.9 cm x 0.5 cm - Vilaça 2003, fig. 3.2.
212. Penha Verde [site no. 195, settlement] (Sintra, Lisbon, Portugal). House 2. Phase 4 (Atlantic FBA III) - Part of a set of 4 balance weights (cat. no. 185, 187, 212, 219). Associations: fragment of bronze ingot, fragment of bronze armring, gold pin, gold bead - Complete. Copper/bronze. Mass: 2.2 g. Dimensions: 1.0 cm x 1.0 cm x 0.5 cm - Cardoso 2011, fig. 3.7.
213. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 3.87 g. Dimensions: 1.0 cm x 0.7 cm - Vilaça 2003, fig. 3.10.
214. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 4.21 g. Dimensions: 1.1 cm x 0.6 cm - Vilaça 2003, fig. 3.5.
215. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 4.1 g. Dimensions: 1.1 cm x 0.7 cm - Vilaça 2003, fig. 3.3.
216. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 4.08 g. Dimensions: 1.2 cm x 0.6 cm - Vilaça 2003, fig. 3.6.
217. Penedo do Lexim [site no. 197, settlement] (Mafra, Lisbon, Portugal). Locus 1, Small pit, S.U. 017. Phase 4 (Atlantic FBA III) - Associations: found in a pit in a paved area. On the paved area: chisel, spear head, ring - Complete. Copper/bronze. Mass: 3.69 g. Dimensions: 1.2 cm x 1.2 cm x 0.6 cm (inv. no. IGN.017.05576) - Sousa/Sousa 2018, fig. 10, middle.
218. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 4.79 g. Dimensions: 1.1 cm x 0.8 cm - Vilaça 2003, fig. 3.4.
219. Penha Verde [site no. 195, settlement] (Sintra, Lisbon, Portugal). House 2. Phase 4 (Atlantic FBA III) - Part of a set of 4 balance weights (cat. no. 185, 187, 212, 219). Associations: fragment of bronze ingot, fragment of bronze armring, gold pin, gold

bead - Complete. Copper/bronze. Mass: 4.54 g. Dimensions: 1.2 cm x 0.6 cm - Vilaça 2003, fig. 1.2; Cardoso 2011, fig. 3.6.

220. Castro da Cola [site no. 191, settlement] (Ourique, Beja, Portugal). Undetermined chronology (LBA) - Complete. Copper/bronze. Mass: n/a. Dimensions: 1.2 cm x 1.3 cm - Vilaça 2011, fig. 8.1.
221. Castro da Cola [site no. 191, settlement] (Ourique, Beja, Portugal). Undetermined chronology (LBA) - Complete. Copper/bronze. Mass: n/a. Dimensions: 1.6 cm x 1.5 cm - Vilaça 2011, fig. 8.2.
222. Moreirinha [site no. 203, settlement] (Idanha-a-Nova, Castelo Branco, Portugal). Phase 4 (Atlantic FBA) - Complete. Copper/bronze. Mass: 3.98 g. Dimensions: 1.3 cm x 0.4 cm - Vilaça 2003, fig. 1.4.
223. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 9.32 g. Dimensions: 1.6 cm x 0.7 cm - Vilaça 2003, fig. 3.8.
224. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 8.7 g. Dimensions: 1.5 cm x 0.8 cm - Vilaça 2003, fig. 3.7.
225. Castro da Ota [site no. 198, settlement] (Alenquer, Lisbon, Oeste, Portugal). Phase 4 (Bronze Age - uncertain) - Complete. Copper/bronze. Mass: 8 g. Dimensions: 1.6 cm x 0.7 cm - Vilaça 2003, fig. 1.1.
226. Penedo do Lexim [site no. 197, settlement] (Mafra, Lisbon, Portugal). Locus 2, Intrusion in Chalcolithic context. S.U. 04. Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 8.7 g. Dimensions: 1.5 cm x 1.5 cm x 0.8 cm (inv. no. IGN.017.03946) - Sousa/Sousa 2018, fig. 10, bottom.
227. Monte do Trigo [site no. 202, settlement] (Idanha-a-Nova, Castelo Branco, Portugal). Phase 4 (Atlantic FBA) - Complete. Copper/bronze. Mass: 9.54 g. Dimensions: 1.5 cm x 1.5 cm x 0.9 cm - Vilaça 2003, fig. 2.1.
228. Monte do Trigo [site no. 202, settlement] (Idanha-a-Nova, Castelo Branco, Portugal). Phase 4 (Atlantic FBA) - Fused together with a smaller weight by corrosion. Complete. Copper/bronze. Mass: 19.48 g. Dimensions: 1.6 cm x 1.6 cm x 1.1 cm - Vilaça 2003, fig. 2.2.
229. Baleizão [site no. 192, hoard] (Beja, Portugal). Phase 4 (Atlantic FBA III) - Part of a set of 7 balance weights (cat. no. 184, 229, 232, 238, 239, 241, 266). Associations: 3 axes, 7 bronze rings, 6 bronze fragments, 3 gold torques, 7 gold fragments - Complete. Copper/bronze. Mass: 9.67 g. Dimensions: 1.5 cm x 1.5 cm x 0.9 cm - Vilaça 2013, fig. 12.4.
230. Cabezo de Araya [site no. 201, settlement] (Arroyo de la Luz, Càceres, Extremadura, Spain). Stray find. Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: n/a. Dimensions: 1.5 cm x 0.8 cm - Almagro 1961, fig. 4.32.
231. Los Concejiles [site no. 196, settlement] (Lobòn, Badajoz, Extremadura, Spain). Unprovenanced. Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 19.01 g. Dimensions: 1.77 cm x 1.81 cm x 1.16 cm - Vilaça *et al.* 2012, fig. 20.1.
232. Baleizão [site no. 192, hoard] (Beja, Portugal). Phase 4 (Atlantic FBA III) - Part of a set of 7 balance weights (cat. no. 184, 229, 232, 238, 239, 241, 266). Associations: 3 axes, 7 bronze rings, 6 bronze fragments, 3 gold torques, 7 gold fragments - Complete. Copper/bronze. Mass: 18.64 g. Dimensions: 1.85 cm x 1.85 cm x 0.9 cm - Vilaça 2013, fig. 12.1.
233. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 18.72 g. Dimensions: 1.9 cm x 1.1 cm - Vilaça 2003, fig. 3.9.
234. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Pin-head. Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 11.26 g. Dimensions: 1.55 cm x 1.55 cm - Pare 1999, fig. 14.14.
235. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Pin-head. Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 13.32 g. Dimensions: 1.87 cm x 1.8 cm - Pare 1999, fig. 14.13.
236. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Pin-head, with three horizontal ribs. Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 19.82 g. Dimensions: 2.1 cm x 2.1 cm - Pare 1999, fig. 14.12.
237. Steinfurth [site no. 137, burial] (Bad Nauheim, Wetteraukreis, Hessen, Germany). Phase 3 (Br D) - Pin-head, with vertical grooves. Part of a set of 12 balance weights (cat. no. 68, 69, 77, 81, 83, 84, 90, 91, 234, 235, 236, 237). Associations: 2 bronze hinges (organic container?), pin - Complete. Copper/bronze. Mass: 6.38 g. Dimensions: 1.33 cm x 1.33 cm - Pare 1999, fig. 14.15.

Sub-variant 3.B: Longitudinal perforation (cat. no. 238-244)

238. Baleizão [site no. 192, hoard] (Beja, Portugal). Phase 4 (Atlantic FBA III) - Part of a set of 7 balance weights (cat. no. 184, 229, 232, 238, 239, 241, 266). Associations: 3 axes, 7 bronze rings, 6 bronze fragments, 3 gold torques, 7 gold fragments - Complete. Copper/bronze. Mass: 6.37 g. Dimensions: 1.2 cm x 1.1 cm x 0.8 cm - Vilaça 2013, fig. 12.5.
239. Baleizão [site no. 192, hoard] (Beja, Portugal). Phase 4 (Atlantic FBA III) - Part of a set of 7 balance weights (cat. no. 184, 229, 232, 238, 239, 241, 266). Associations: 3 axes, 7 bronze rings, 6 bronze fragments, 3 gold torques, 7 gold fragments - Complete. Copper/bronze. Mass: 12.78 g. Dimensions: 1.5 cm x 1.5 cm x 0.9 cm - Vilaça 2013, fig. 12.2.
240. Cabezo de Araya [site no. 201, settlement] (Arroyo de la Luz, Càceres, Extremadura, Spain). Stray find. Phase 4 (Atlantic FBA III) - Complete. Copper/

bronze. Mass: n/a. Dimensions: 2.0 cm x 1.1. cm - Almagro 1961, fig. 4.23.

241. Baleizão [site no. 192, hoard] (Beja, Portugal). Phase 4 (Atlantic FBA III) - Part of a set of 7 balance weights (cat. no. 184, 229, 232, 238, 239, 241, 266). Associations: 3 axes, 7 bronze rings, 6 bronze fragments, 3 gold torques, 7 gold fragments - Complete. Copper/bronze. Mass: 9.75 g. Dimensions: 1.5 cm x 1.5 cm x 1.0 cm - Vilaça 2013, fig. 12.3.
242. Los Concejiles [site no. 196, settlement] (Lobòn, Badajoz, Extremadura, Spain). Unprovenanced. Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: n/a (14.18 g). Dimensions: 1.94 cm x 1.96 cm x 0.96 cm - Vilaça *et al.* 2012, fig. 20.2.
243. Horušany [site no. 132, burial] (Bohemia, Czech Republic). Tumulus A. Phase 3 (Br D) - Vertical ribs. Part of a set of 4 balance weights (cat. no. 94, 103, 243, 304). Associations: 3 bronze hinges (organic container?), awl, 3 phalerae, stud, bronze fragment, pottery - Complete. Copper/bronze. Mass: 19.1 g. Dimensions: 2.0 cm x 0.9 cm - Pare 1999, fig. 10.4.
244. Quinta do Almaraz [site no. 194, settlement] (Cacilhas, Almada, Oeste, Portugal). Phase 4 (Atlantic FBA III-Orientalizing) - Mentioned in the original publication, no image. Complete. Lead. Mass: n/a - Valério *et al.* 2003 (mentioned).

Variant 4: Plano-convex (cat. no. 245-259).

- *number of objects:* 15
- *objects with known mass (complete/reconstructed)*: 23 (85 %)
- *chronological range*: Phase 2-3 (*c.* 1600-1200 BCE)
- *material*: copper/bronze (14), lead (1)
- *2 sites:* site no. 2, 105
- *2 sets:* site no. 2, 105
- *mass range (complete/reconstructed):* 0.8-7.66 g

245. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Complete. Copper/bronze. Mass: 4.65 g. Dimensions: 1.6 cm x 1.3 cm x 0.8 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.2) - Unpublished.
246. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 14, chamber. Phase 2-3 (MBA3-RBA) - Associations: 4 bronze fragments - Complete. Copper/bronze. Mass: 5.85 g. Dimensions: 1.6 cm x 1.4 cm x 0.7 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 5.1) - Unpublished.
247. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Complete. Copper/bronze. Mass: 6.92 g. Dimensions: 2.0 cm x 1.55 cm x 1.2 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.21) - Unpublished.
248. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Complete. Copper/bronze. Mass: 7.66 g. Dimensions: 1.8 cm x 1.4 cm x 1.4 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.26) - Unpublished.
249. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Complete. Copper/bronze. Mass: 5.93 g. Dimensions: 1.6 cm x 1.3 cm x 1.3 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.22) - Unpublished.
250. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Complete. Copper/bronze. Mass: 6.7 g. Dimensions: 1.9 cm x 1.6 cm x 1.2 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.23) - Unpublished.
251. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Lead. Mass: 2 g. Dimensions: 0.9 cm x 0.9 cm x 0.6 cm - Roscio *et al.* 2011, fig. 2.62.
252. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Shapeless. Copper/bronze. Mass: 0.8 g. Dimensions: 1.1 cm x 0.8 cm x 0.8 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.12) - Unpublished.
253. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Shapeless. Copper/bronze. Mass: 1.8 g. Dimensions: 1.5 cm x 1.1 cm x 0.7 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.18) - Unpublished.
254. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat.

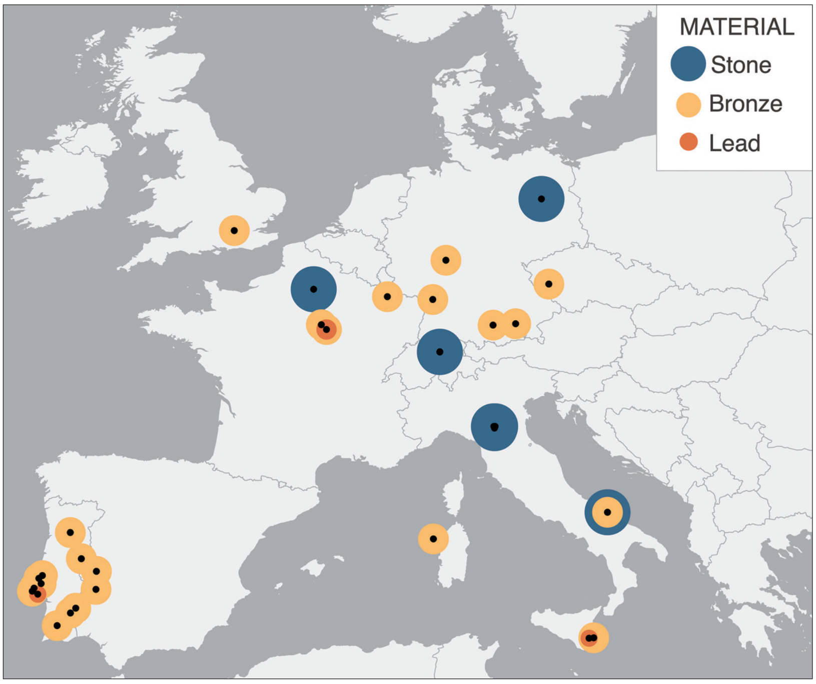
no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Shapeless. Copper/bronze. Mass: 1.63 g. Dimensions: 1.35 cm x 1.1 cm x 0.8 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.19) - Unpublished.

255. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Shapeless. Copper/bronze. Mass: 3.06 g. Dimensions: 1.8 cm x 1.2 cm x 0.9 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.15) - Unpublished.
256. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Shapeless. Copper/bronze. Mass: 2.28 g. Dimensions: 1.7 cm x 1.1 cm x 1.1 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.16) - Unpublished.
257. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Shapeless. Copper/bronze. Mass: 3.2 g. Dimensions: 1.2 cm x 1.1 cm x 1.1 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.17) - Unpublished.
258. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Fragmented. Copper/bronze. Mass: n/a (6.1 g). Dimensions: 2.2 cm x 1.5 cm x 1.8 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.25) - Unpublished.
259. Thapsos [site no. 2, burial] (Siracusa, Sicilia, Italy). Northern necropolis, Grave 6, Inner chamber. Phase 2-3 (MBA3-RBA) - Part of a set of 18 weights (cat. no. 186, 189, 190, 197, 202, 245, 247, 248, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259). Associations: tweezers, 4 bronze fragments - Shapeless. Copper/bronze. Mass: 4.92 g. Dimensions: 2.8 cm x 2.0 cm x 1.0 cm - Museo Archeologico Regionale Paolo Orsi, Siracusa (inv. no. 16.24) - Unpublished.

Variant 5: Pin-jags (cat. no. 260-262).

- *number of objects:* 3
- *objects with known mass (complete/reconstructed)*: 3 (100 %)
- *chronological range*: Phase 3 (*c.* 1350-1200 BCE)
- *material*: copper/bronze
- *2 sites:* site no. 105, 109
- *2 sets:* site no. 105, 109
- *mass range (complete/reconstructed):* 1.89-3.8 g

260. Etigny, "Le Brassot" Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 3.15 g. Dimensions: 1.6 cm x 1.6 cm x 0.7 cm - Musées de Sens - Roscio 2018, pl. 85.15.
261. Etigny, "Le Brassot" Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 1.89 g. Dimensions: 1.4 cm x 1.4 cm x 0.5 cm - Musées de Sens - Roscio 2018, pl. 85.12.
262. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 3.8 g. Dimensions: 2.7 cm x 2.7 cm x 0.4 cm - Roscio *et al.* 2011, fig. 2.19.



▲ *Fig. 5.25. Octahedral, biconical and conical weights. Geographical distribution: typology and site ID.*

5.6. CONE

- *number of objects*: 1
- *objects with known mass (complete/reconstructed)*: 1 (100 %).
- *chronological range*: Phase 3 (*c.* 1400-1200 BCE)
- *material:* bronze
- *1 site:* site no. 105
- *1 set:* site no. 105
- *mass:* 0.62 g

Distribution map: fig. 5.25.

The only conical weight included in this catalogue is a very small object from grave 298 of the Bronze D burial site of Migennes – Le Petit Moulin, in France (site no. 105) (Fig. 5.25.). The object is part of a set of 18 balance weights and a balance beam.

263. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 0.62 g. Dimensions: 0.75 cm x 0.5 cm x 0.5 cm - Roscio *et al.* 2011, fig. 2.54.

5.7. DOUBLE CONE

- *number of objects*: 2
- *objects with known mass (complete/reconstructed)*: 2 (100 %).
- *chronological range*: Phase 4 (*c.* 1200-800 BCE)
- *material:* bronze
- *2 sites:* site no. 190, 205
- *mass range (complete/reconstructed):* 9.1-16.45 g

Distribution map: fig. 5.25.

Two very similar weights with biconical shape are documented in the south-eastern Iberian Peninsula, in the settlement of Nossa Senhora da Guia de Baiões (Portugal, site no. 205) and in the hoard of Rìa de la Huelva (Spain, site no. 190) (Fig. 5.25.).

264. Nossa Senhora da Guia de Baiões [site no. 205, settlement] (S. Pedro do Sul, Viseu, Portugal). Phase 4 (Atlantic FBA) - Complete. Copper/bronze. Mass: 9.1 g. Dimensions: 1.4 cm x 1.1 cm - Vilaça 2003, fig. 1.5.
265. Rìa de la Huelva [site no. 190, hoard] (Andalucìa, Spain). Phase 4 (Atlantic FBA III-Orientalizing) - Complete. Copper/bronze. Mass: 16.45 g. Dimensions: 1.85 cm x 1.78 cm x 1.78 cm - Almagro Gorbea 1958, fig. 18.20.

5.8. OCTAHEDRON

- *number of objects*: 2
- *objects with known mass (complete/reconstructed)*: 2 (100 %).
- *chronological range*: Phase 4 (*c.* 1200-800 BCE)
- *material:* bronze
- *2 sites:* site no. 192, 202
- *1 set:* site no. 192
- *mass range (complete/reconstructed):* 4.56-37.0 g

Distribution map: fig. 5.25.

Two octahedral weights are documented in Portugal, in the hoard of Baleizão (site no. 192) and at the settlement of Monte do Trigo (site no. 202) (Fig. 5.25.). The object from Baleizão (cat. no. 266) is part of a weighing set of seven balance weights.

266. Baleizão [site no. 192, hoard] (Beja, Portugal). Phase 4 (Atlantic FBA III) - Part of a set of 7 balance weights (cat. no. 184, 229, 232, 238, 239, 241, 266). Associations: 3 axes, 7 bronze rings, 6 bronze fragments, 3 gold torques, 7 gold fragments - Complete. Copper/bronze. Mass: 4.56 g. Dimensions: 1.4 cm x 1.0 cm x 1.0 cm - Vilaça 2013, fig. 12.6.
267. Monte do Trigo [site no. 202, settlement] (Idanha-a-Nova, Castelo Branco, Portugal). Phase 4 (Atlantic FBA) - Complete. Copper/bronze. Mass: 37 g. Dimensions: 2.7 cm x 2.1 cm x 2.1 cm - Vilaça 2003, fig. 2.3.

5.9. CYLINDER

- *number of objects*: 13
- *objects with known mass (complete/reconstructed)*: 8 (61 %).
- *chronological range*: Phase 3-5 (*c.* 1400-675 BCE)
- *material:* copper/bronze (6), lead (7)
- *8 sites:* site no. 49, 103, 105, 107, 118, 123, 127, 189
- *6 sets:* site no. 6, 7, 9, 10, 17, 19
- *mass range (complete/reconstructed):* 0.49-37.6 g

Distribution map: fig. 5.26.
Composition of the sample: fig. 5.27.-28.

Typology, materials, comparisons, and function

Cylindrical weights have been classified into four variants. Objects in Variant 1 are either made of bronze (cat. no. 268-270) or lead (cat. no. 271-276); they have a thin cross-section, and most of them have an elongated shape (cat. no. 270-276). Based on published drawings, objects cat. no. 273 and 274 seem to have a longitudinal perforation; however, due to the lack of a description it was not possible to verify this. Variant 2 includes intentionally broken fragments of pins with an overall cylindrical shape (cat. no. 277-278). Variant 3 includes a single bronze object with squat cylindrical body and a small loop fixed on its side (cat. no. 279). Finally, Variant 4 is represented by a single lead object with squat body (cat. no. 280).

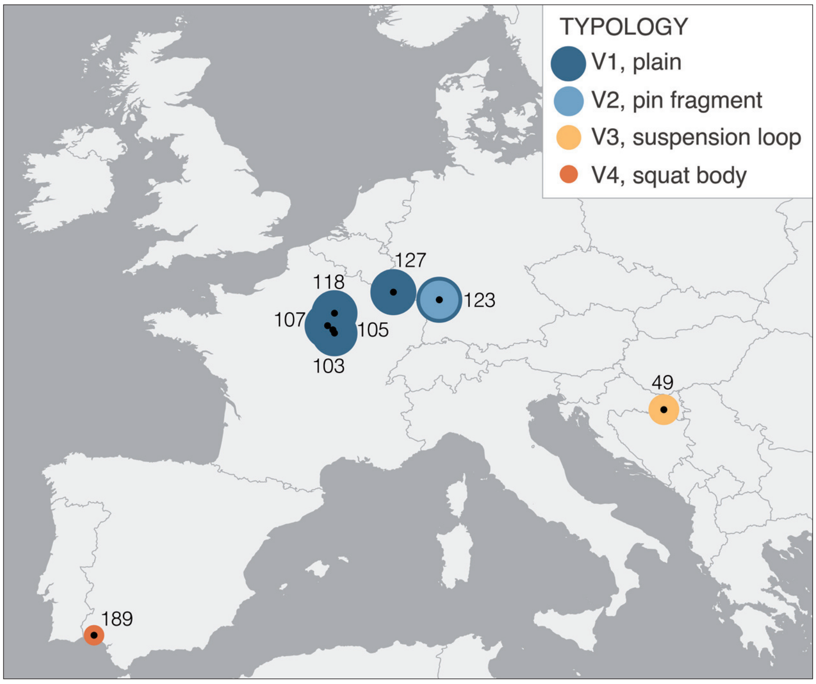
Of all cylindrical weights, the weight classified in Variant 3 is the only one that could be directly fixed to a cord hanging from a balance's arm; all remaining objects could be laid on a pan or in a bag.

All cylindrical weights classified in V1 come from Central European graves dating to the phase Bronze D (*c.* 1350-1200 BCE), where they are frequently part of weighing sets (Fig. 5.26.). The object with the loop comes from a Croatian hoard dated to Ha A1 (site no. 49), while the squat lead weight is part of the mixed deposit of Huelva – Plaza de las Monjas (site no. 189), dated between the 10th and the early 7th century BCE and associated with Greek and Phoenician imports (González de Canales Cerisola *et al.* 2004).

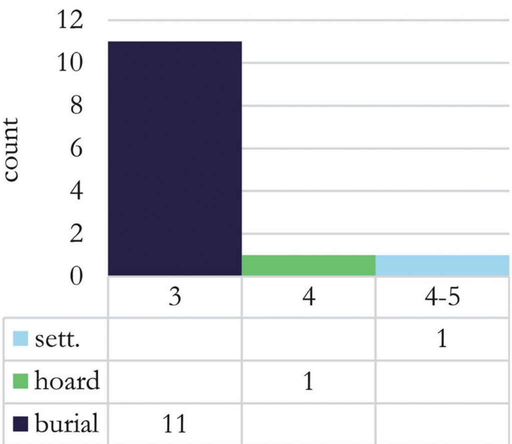
Variant 1: Thin plain cylinder (cat. no. 268-276)

- *number of objects: 9*
- *objects with known mass (complete/reconstructed)*: 4 (44.44 %)
- *chronological range*: Phase 3 (*c.* 1350-1200 BCE)
- *material*: copper/bronze (3), lead (6)
- *6 sites*: site no. 103, 105, 107, 118, 123, 127
- *6 sets*: site no. 103, 105 (2 sets), 107, 123, 127
- *mass range (complete/reconstructed):* 0.49-6.9 g

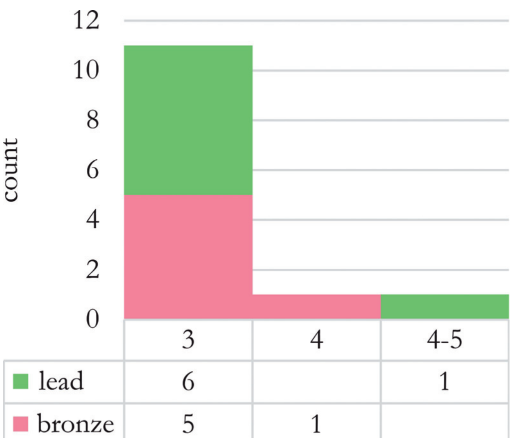
268. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges



▲ *Fig. 5.26. Cylindrical weights. Geographical distribution: typology and site ID.*



▲ *Fig. 5.27. Cylindrical weights. Quantification: site type vs chronology.*



▲ *Fig. 5.28. Cylindrical weights. Quantification: materials vs chronology.*

(organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 0.49 g. Dimensions: 0.6 cm x 0.4 cm x 0.4 cm - Roscio *et al.* 2011, fig. 2.37.

269. Passy-sur-Yonne, La Sablonière [site no. 107, burial] (Yonne, Bourgogne-Franche-Comté, France). Richebourg, Enclosure 58, Inhumation grave 7. Phase 3 (Br D) - Part of a set of 5 balance weights (cat. no. 59, 61, 62, 63, 269). Associations: 3 bronze hinges (organic container), dagger, awl, razor, pin, stud - Complete. Copper/bronze. Mass: n/a. Dimensions: 1.0 cm x 0.5 cm x 0.4 cm - Musées de Sens - Pare 1999, fig. 28.C.4-5.
270. Pépinville [site no. 127, burial] (Richemont, Moselle, Grand Est, France). Phase 3 (Br D) - Part of a set of 7 balance weights (cat. no. 79, 89, 99, 121, 270, 311, 314). Associations: sword, tweezers, knife, pin, miniature duck, 2 bronze fragments, 7 bronze cylinders filled with lead - Complete. Copper/bronze. Mass: 3.83 g. Dimensions: 3.3 cm x 0.42 cm x 0.42 cm - Pare 1999, fig. 17.8.
271. Büchelberg [site no. 123, burial] (Germersheim, Rheinland-Pfalz, Germany). Tumulus 3. Phase 3 (Br D) - Part of a set of 8 balance weights (cat. no. 64, 198, 271, 277, 278, 300, 301, 303). Associations: 3 bronze hinges (organic container?), dagger, awl, pottery - Complete. Lead. Mass: 5.5 g. Dimensions: 1.6 cm x 0.7 cm - Pare 1999, fig. 24.10.
272. Barbuise-Courtavant, Les Grèves [site no. 118, burial] (Aube, Grand Est, France). Grave of 1874. Phase 3 (Br D) - Part of a set of 5 balance weights (cat. no. 66, 67, 70, 120, 272). Associations: 2 bronze hinges (organic container?), sword, scabbard, knife, pin, ring, potteri - Complete. Lead. Mass: 6.9 g. Dimensions: 2.2 cm x 0.9 cm x 0.8 cm - Pare 1999, fig. 26.3; Rottier *et al.* (eds.) 2012, fig. 270.7.
273. Monéteau, "Aux Bries" [site no. 103, burial] (Yonne, Bourgogne-Franche-Comté, France). Phase 3 (Br D) - Part of a set of 2 balance weights and 1 balance beam (cat. no. 17, 273, 274). Associations: two lead weights, balance beam, razor - Complete. Lead. Mass: n/a. Dimensions: 3.1 cm x 0.7 cm - Roscio 2018, pl. 93.4.
274. Monéteau, "Aux Bries" [site no. 103, burial] (Yonne, Bourgogne-Franche-Comté, France). Phase 3 (Br D) - Part of a set of 2 balance weights and 1 balance beam (cat. no. 17, 273, 274). Associations: two lead weights, balance beam, razor - Complete. Lead. Mass: n/a. Dimensions: 3.6 cm x 0.8 cm - Roscio 2018, pl. 93.5.
275. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 251. Phase 3 (Br D) - Part of a set of 2 balance weights and 1 balance beam (cat. no. 14, 275, 276). Associations: 2 lead balance weights, fragment of a bone balance beam, sword, pin, scabbard, applique - Complete. Lead. Mass: n/a. Dimensions: 2.5 cm x 0.6 cm x 0.6 cm – Muller 2009, fig. 5a.7.
276. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 251. Phase 3 (Br D) - Part of a set of 2 balance weights and 1 balance beam (cat. no. 14, 275, 276). Associations: 2 lead balance weights, fragment of a bone balance beam, sword, pin, scabbard, applique - Fragmented. Lead. Mass: n/a. Dimensions: 2.9 cm x 0.7 cm x 0.7 cm - Muller 2009, fig. 5a.6.

Variant 2: Pin fragments (cat. no. 277-278)

- *number of objects:* 2
- *objects with known mass (complete/reconstructed)*: 2 (100 %)
- *chronological range*: Phase 3 (*c.* 1350-1200 BCE)
- *material*: copper/bronze
- *1 site*: site no. 123
- *1 set*: site no. 123
- *mass range (complete/reconstructed):* 2.0-2.1 g

277. Büchelberg [site no. 123, burial] (Germersheim, Rheinland-Pfalz, Germany). Tumulus 3. Phase 3 (Br D) - Part of a set of 8 balance weights (cat. no. 64, 198, 271, 277, 278, 300, 301, 303). Associations: 3 bronze hinges (organic container?), dagger, awl, pottery - Fragmented. Copper/bronze. Mass: 2 g. Dimensions: 1.0 cm x 0.6 cm x 0.6 cm - Pare 1999, fig. 24.8.
278. Büchelberg [site no. 123, burial] (Germersheim, Rheinland-Pfalz, Germany). Tumulus 3. Phase 3 (Br D) - Part of a set of 8 balance weights (cat. no. 64, 198, 271, 277, 278, 300, 301, 303). Associations: 3 bronze hinges (organic container?), dagger, awl, pottery - Fragmented. Copper/bronze. Mass: 2.1 g. Dimensions: 1.3 cm x 0.6 cm x 0.6 cm - Pare 1999, fig. 24.9.

Variant 3: Squat body with suspension loop (cat. no. 279)

279. Slavonski Brod [site no. 49, hoard] (Croatia). Phase 4 (Ha A1) - Slightly chipped. Copper/bronze. Mass: 37.6 g (37.35 g). Dimensions: 2.3 cm x 1.8 cm x 1.8 cm - Pare 1999, fig. 19.12.

Variant 4: Plain squat body (cat. no. 280)

280. Huelva - Plaza de las Monjas [site no. 189, settlement] (Andalucìa, Spain). Phase 4-5 (Atlantic FBA III) - Complete. Lead. Mass: 9.59 g. Dimensions: 2.2 cm x 1.9 cm x 1.8 cm - González de Canales Cerisola *et al.* 2004, 154-155, fig. 38.12.

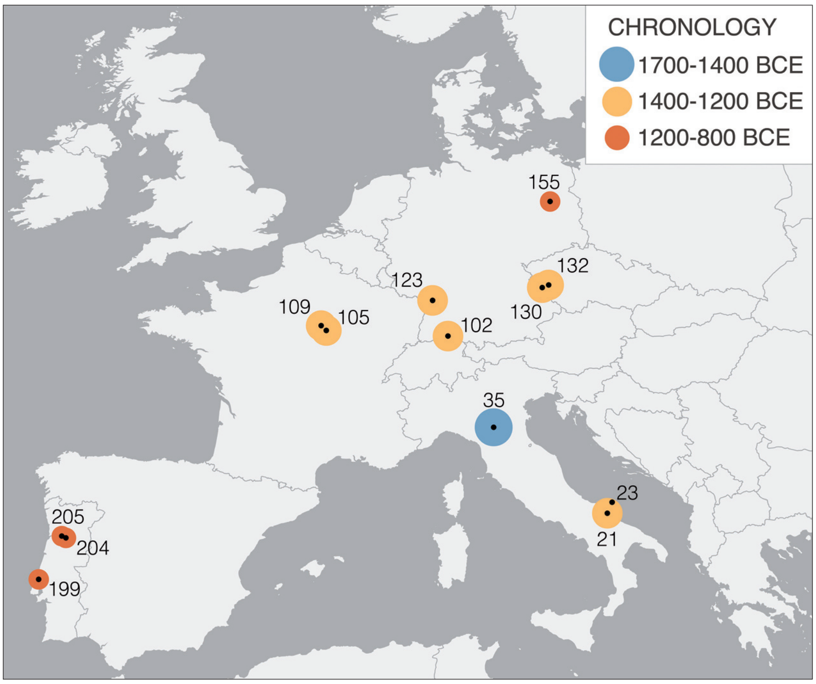
5.10. SPHERE

- *number of objects*: 26
- *objects with known mass (complete/reconstructed)*: 24 (92 %).
- *chronological range*: Phase 2-4 (*c.* 1600-800 BCE)
- *material:* stone (9), copper/bronze (17)
- *13 sites:* site no. 1 21, 35, 23, 155, 105, 199, 205, 204, 123, 130, 132, 102, 109
- *6 sets:* site no. 155, 105, 123, 130, 132, 109
- *mass range (complete/reconstructed):* 0.16-82.4 g

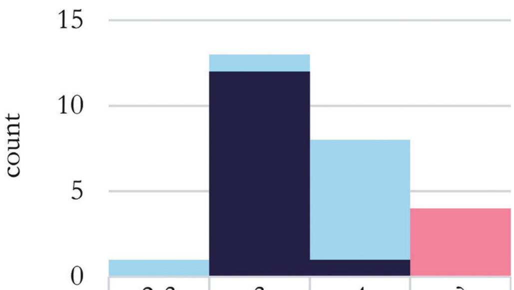
Distribution maps: fig. 5.29.-30.
Composition of the sample: fig. 5.31.-32.

Typology, materials, comparisons, and function

Spherical weights have a simple and homogeneous shape. Most objects are made of bronze (cat. no. 288-302); two of them – both coming from the settlement of Castro de Pragança, Portugal (site no. 199) – present small casting flaws in the shape of short protrusions (cat. no. 294, 297). Objects cat. no. 288-292 from the weighing set of t. 298 of Migennes, Le Petit Moulin (France, site no. 105) have irregular shape, which likely depends on their very small size (0.16-0.45 g). The seven stone objects classified as weights (cat. no. 281-287) all present a regularly spherical surface that would lead to think that they were intentionally shaped. Object cat. no. 281 has a single incised point. The object's mass is 8 g, slightly below the error margin of the shekel of *c.* 9.8 g; however, there is no evidence that the incision represents a quantity mark. The grooves on cat. no. 284 were caused by natural erosion, before the object was modelled into a sphere. The type also includes four pin-heads, whose shaft was intentionally removed (cat. no. 303-306), all coming from burials in Central Europe dated to Br D

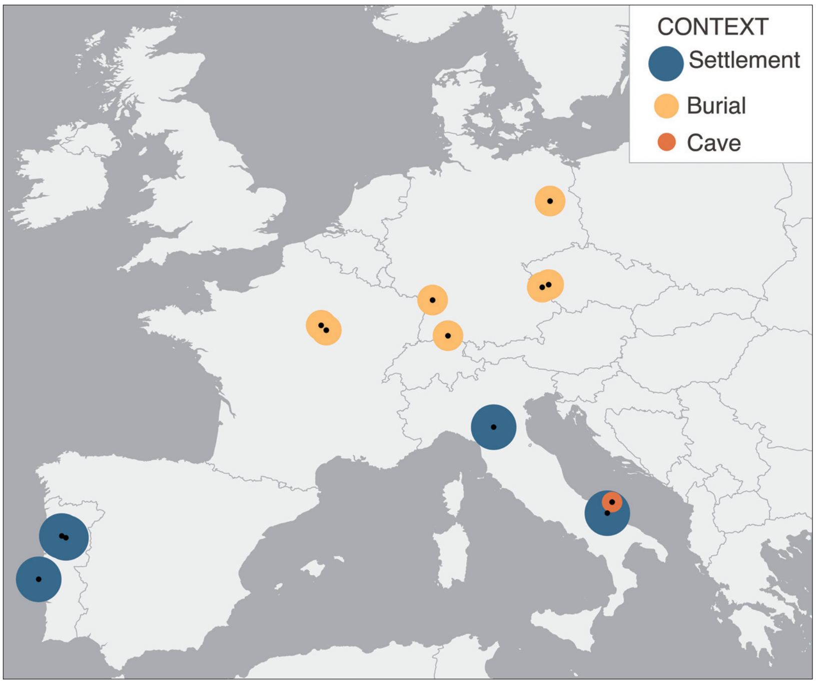


▲ *Fig. 5.29. Spherical weights. Geographical distribution: Chronology and site ID.*

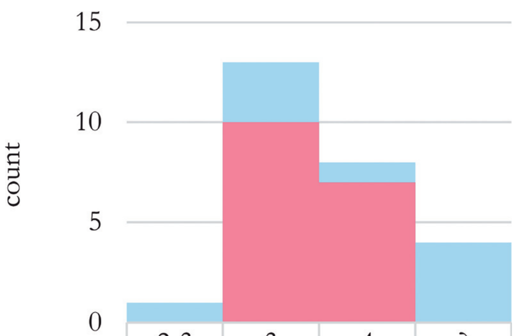


	2-3	3	4	?
sett.	1	1	7	
burial		12	1	
cave				4

▲ *Fig. 5.31. Spherical weights. Quantification: Site type vs chronology.*



▲ *Fig. 5.30. Spherical weights. Geographical distribution: Site type.*



	2-3	3	4	?
stone	1	3	1	4
bronze		10	7	

▲ *Fig. 5.32. Spherical weights. Quantification: Materials vs chronology.*

(Phase 3, *c.* 1350-1200 BCE). All spherical weights are small enough to be comfortably used with small balances, laid on pans.

Spherical weights are not at all common in the eastern Mediterranean and in the Levant. K. M. Petruso (1992, 4), for example, preliminarily excluded any spherical objects from his analysis of bronze Age weights in the Aegean.

Chronology, geographical distribution and contexts

Spherical weights are not attested in well-dated contexts before Phase 3 (*c.* 1400-1200 BCE) (Fig. 5.29.). The earliest objects (all made of bronze), come from several burials in Central Europe dated to Br D (cat. no. 288-292, 300-306) – where they are always part of weight sets – and from a settlement in Italy dated to the RBA (cat. no. 281). In Phase 4 (*c.* 1200-800 BCE), bronze spherical weights are well-attested in the Iberian Peninsula (cat. no. 293-299), and a stone object is present in a cremation burial in Germany (cat. no. 287, site no. 155), and constitutes a set together with two *Kannelurensteine* (cat. no. 422, 450).

Spherical weights (281-306).

281. Coppa Nevigata [site no. 21, settlement] (Manfredonia, Puglia, Italy). CN 11, G2 P, 12. Phase 3 (RBA) - Associations: found on a pebble-floor, in an open area close to the main gate. Possibly part of a set of 3 weights (cat. no. 155, 281, 657) - Complete. Stone. Mass: 8 g. Dimensions: 1.9 cm x 1.9 cm x 1.9 cm - Unpublished.
282. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 18 g. Dimensions: 2.7 cm x 2.6 cm - Museo Archeologico Etnografico Modena (inv. Cas. 216) - Unpublished.
283. Grotta Manaccora [site no. 23, cave] (Peschici, Italy). Big cave. Undetermined chronology (Bronze Age) - Complete. Stone. Mass: 41 g. Dimensions: 2.9 cm x 3.0 cm x 2.7 cm - Museo delle Origini, Roma (inv. no. 4033) - Unpublished.
284. Grotta Manaccora [site no. 23, cave] (Peschici, Italy). Big cave. Undetermined chronology (Bronze Age) - Complete. Stone. Mass: 50.5 g. Dimensions: 3.6 cm x 3.4 cm x 3.4 cm - Museo delle Origini, Roma (inv. no. 4033) - Unpublished.
285. Grotta Manaccora [site no. 23, cave] (Peschici, Italy). Big cave. Undetermined chronology (Bronze Age) - Natural grooves. Complete. Stone. Mass: 29.3 g. Dimensions: 3.2 cm x 2.9 cm x 3.1 cm - Museo delle Origini, Roma (inv. no. 4033) - Unpublished.
286. Grotta Manaccora [site no. 23, cave] (Peschici, Italy). Big cave. Undetermined chronology (Bronze Age) - Complete. Stone. Mass: 82.4 g. Dimensions: 3.7 cm x 3.8 cm x 3.8 cm - Museo delle Origini, Roma (inv. no. 4033) - Unpublished.
287. Wilmersdorf [site no. 155, burial] (Dahme-Spreewald, Brandenburg, Germany). Grave 99-103 (one of five graves). Phase 4 (Period IV-V) - Part of a set of 3 weights (cat. no. 287, 422, 450). Complete. Stone. Mass: n/a. Dimensions: 2.9 cm x 2.6 cm - Museum für Vor- und Frühgeschichte Berlin - Busse 1900, 55.
288. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 0.16 g. Dimensions: 0.4 cm x 0.3 cm x 0.3 cm - Roscio *et al.* 2011, fig. 2.32.
289. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 0.2 g. Dimensions: 0.5 cm x 0.4 cm x 0.4 cm - Roscio *et al.* 2011, fig. 2.36.
290. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 0.44 g. Dimensions: 0.6 cm x 0.5 cm x 0.4 cm - Roscio *et al.* 2011, fig. 2.38.
291. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 0.39 g. Dimensions: 0.6 cm x 0.6 cm x 0.4 cm - Roscio *et al.* 2011, fig. 2.51.
292. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 0.45 g. Dimensions: 0.7 cm x 0.5 cm x 0.5 cm - Roscio *et al.* 2011, fig. 2.68.

293. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 3.29 g. Dimensions: 1 cm x 1 cm - Vilaça 2003, fig. 3.12.
294. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 3.17 g. Dimensions: 1.1 cm x 0.9 cm - Vilaça 2003, fig. 3.14.
295. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 3.2 g. Dimensions: 1 cm x 1 cm - Vilaça 2003, fig. 3.13.
296. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 4.65 g. Dimensions: 1.1 cm x 1.1 cm - Vilaça 2003, fig. 3.11.
297. Castro de Pragança [site no. 199, settlement] (Cadaval, Oeste, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: 6.28 g. Dimensions: 1.1 cm x 1.1 cm - Vilaça 2003, fig. 3.15.
298. Nossa Senhora da Guia de Baiões [site no. 205, settlement] (S. Pedro do Sul, Viseu, Portugal). Phase 4 (Atlantic FBA) - Complete. Copper/bronze. Mass: 6.2 g. Dimensions: 1.2 cm x 1.2 cm - Vilaça 2003, fig. 1.6.
299. Santa Luzia [site no. 204, settlement] (Viseu, Portugal). Phase 4 (Atlantic FBA III) - Complete. Copper/bronze. Mass: n/a. Dimensions: 1.1 cm x 1.1 cm x 1.0 cm - Vilaça 2011, fig. 1.4.
300. Büchelberg [site no. 123, burial] (Germersheim, Rheinland-Pfalz, Germany). Tumulus 3. Phase 3 (Br D) - Part of a set of 8 balance weights (cat. no. 64, 198, 271, 277, 278, 300, 301, 303). Associations: 3 bronze hinges (organic container?), dagger, awl, pottery - Complete. Stone (hematite). Mass: 9.9 g. Dimensions: 1.5 cm x 1.5 cm - Pare 1999, fig. 24.4.
301. Büchelberg [site no. 123, burial] (Germersheim, Rheinland-Pfalz, Germany). Tumulus 3. Phase 3 (Br D) - Part of a set of 8 balance weights (cat. no. 64, 198, 271, 277, 278, 300, 301, 303). Associations: 3 bronze hinges (organic container?), dagger, awl, pottery - Complete. Stone (hematite). Mass: 10.8 g. Dimensions: 1.5 cm x 1.5 cm - Pare 1999, fig. 24.5.
302. Milavče [site no. 130, burial] (Bohemia, Czech Republic). Tumulus C/1. Phase 3 (Br D) - Part of a set of 2 balance weights (cat. no. 82, 302). Associations: bronze vase on wheels, 2 bronze cups, sword, razor, knife, 2 phalerae, 4 rings, 23 bronze sheet fragments, 4 pin fragments, rod fragment - Complete. Copper/bronze. Mass: 21.45 g. Dimensions: 1.8 cm x 1.7 cm - Pare 1999, fig. 5.10.
303. Büchelberg [site no. 123, burial] (Germersheim, Rheinland-Pfalz, Germany). Tumulus 3. Phase 3 (Br D) - Part of a set of 8 balance weights (cat. no. 64, 198, 271, 277, 278, 300, 301, 303). Associations: 3 bronze hinges (organic container?), dagger, awl, pottery - Complete. Copper/bronze. Mass: 10.7 g. Dimensions: 1.5 cm x 1.5 cm - Pare 1999, fig. 24.3.
304. Horušany [site no. 132, burial] (Bohemia, Czech Republic). Tumulus A. Phase 3 (Br D) - Part of a set of 4 balance weights (cat. no. 94, 103, 243, 304). Associations: 3 bronze hinges (organic container?), awl, 3 phalerae, stud, bronze fragment, pottery - Fragmented. Copper/bronze. Mass: 16.8 g. Dimensions: 1.7 cm x 1.7 cm x 1.7 cm - Pare 1999, fig. 10.3.
305. Singen, Widerholdstraße [site no. 102, burial] (Konstanz, Baden-Württemberg, Germany). Phase 3 (Br D) - Associations: sword, spearhead - Fragmented. Copper/bronze. Mass: 10.59 g. Dimensions: 1.6 cm x 1.4 cm - Pare 1999, fig. 30.2.
306. Etigny, "Le Brassot" Ouest [site no. 109, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 90. Phase 3 (Br D) - Part of a set of 13 balance weights and 1 balance beam (cat. no. 11, 60, 65, 80, 88, 117, 177, 180, 181, 182, 260, 261, 306). Associations: 3 bronze hinges (organic container), razor, pin, tweezers, ornaments, awl, knife, balance weights - Complete. Copper/bronze. Mass: 3.18 g. Dimensions: 1.4 cm x 0.8 cm - Musées de Sens - Roscio 2018, pl. 85.9.

5.11. TRUNCATED CONE

- *number of objects*: 2
- *objects with known mass (complete/reconstructed)*: 2 (100 %).
- *chronological range*: Phase 5 (*c.* 750-600 BCE)
- *material:* stone
- *1 site:* site no. 7
- *1 set:* site no. 7
- *mass range (complete/reconstructed):* 25.17-26.8 g

This type includes only two stone objects, both from the Iron Age settlement of Santu Brai in Sardinia (*c.* 725-675 BCE). The weights have a truncated-conical shape, and both have five incised dots on the flat base. Assuming that these dots can be interpreted as quantity marks, the resulting unit would range between 5.03-5.36 g. These objects are part of a set of four balance weights (cat. no. 164, 307-308, 316).

307. Santu Brai [site no. 7, settlement] (Nuragus, Sud Sardegna, Sardegna, Italy). Rectangular house. Phase 5 (EIA 2B-EO) - Part of a set of 4 balance weights (cat. no. 164, 307, 308, 316). Associations: small ceramic jug containing an awl, a small saw, a dagger, and a bronze fragment; Etruscan bucchero - Five incised dots on the flat face. Complete. Stone. Mass: 26.8 g. Dimensions: 2.4 cm x 2.4 cm x 2.2 cm - Ugas 1986, tav. XVI.4.
308. Santu Brai [site no. 7, settlement] (Nuragus, Sud Sardegna, Sardegna, Italy). Rectangular house. Phase 5 (EIA 2B-EO) - Part of a set of 4 balance weights (cat. no. 164, 307, 308, 316). Associations: small ceramic jug containing an awl, a small saw, a dagger, and a bronze fragment; Etruscan bucchero - Five incised dots on the flat face. Complete. Stone. Mass: 25.17 g. Dimensions: 2.5 cm x 2.5 cm x 1.9 cm - Ugas 1986, tav. XVI.3.

5.12. SPHENDONOID

- *number of objects*: 12
- *objects with known mass (complete/reconstructed)*: 11 (92 %).
- *chronological range*: Phase 1-5 (*c.* 2300-675 BCE)
- *material:* stone (6), copper/bronze (6)
- *10 sites:* site no. 3, 4, 7, 27, 34, 102, 105, 127, 130, 130
- *5 sets:* site no. 7, 105 (2 sets), 127, 130
- *mass range (complete/reconstructed):* 2.12-269.72 g
- *Distribution maps:* fig. 5.33.-34.

Typology, materials, comparisons, and function

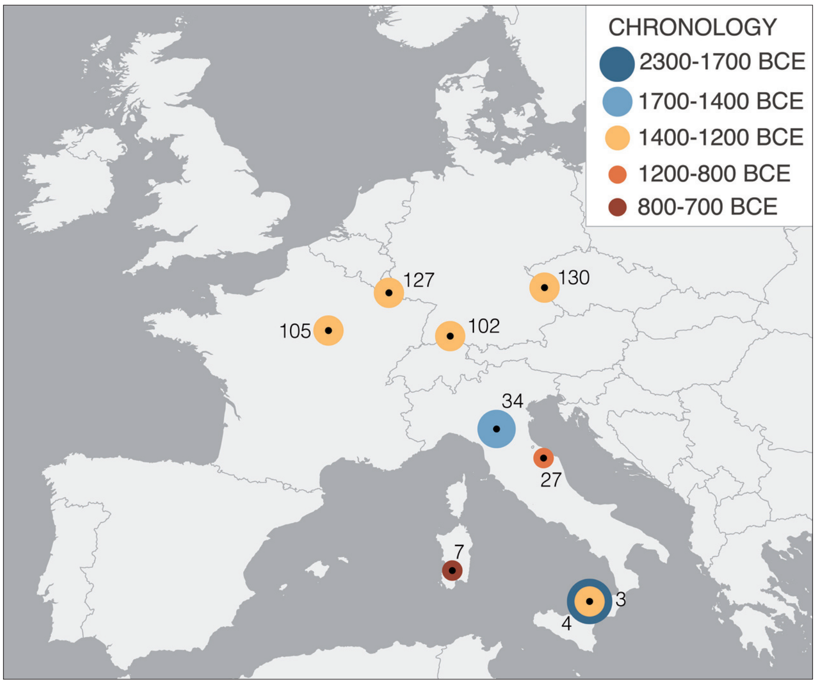
The term 'sphendonoid' – from the Greek *sphendonos* ('slingshot') – is widely used in Bronze Age metrology, and recalls the elongated ovoid shape of slingshot bullets. The weights here classified as sphendonoid are subdivided into three variants. Variant 1 includes only one stone object with round cross-section and truncated extremities (cat. no. 309). Objects classified in Variant 2 are all made of bronze, and present a dense series of annular ribs. V2 also includes an intentionally fragmented pin shaft with the same characteristics (cat. no. 315). C. Pare (1999) was the first to suggest that these objects could be interpreted as balance weights. A flattened base is the defining trait of Variant 3, which only includes stone objects. Object cat. no. 320 has a transversal perforation.

All sphendonoid weights could be easily laid inside a weighing bag, while V3 was best-suited to be put on a flat surface. Object cat. no. 320 could be hung directly on the balance scale through a cord.

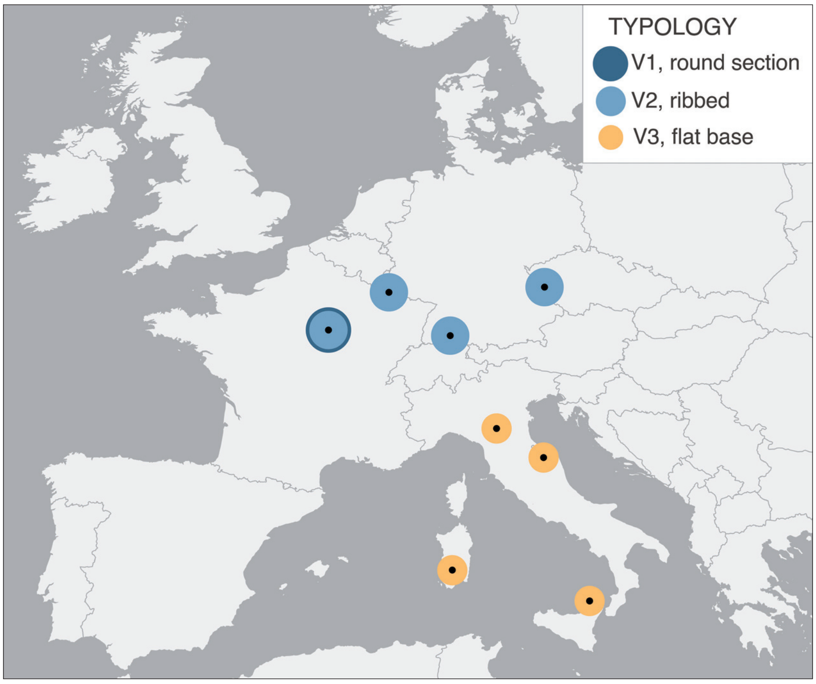
While spehndonoid weights are somewhat rare in Europe, are one of the most widespread types of balance weights in Mesopotamia and the Levant in the 2nd millennium BCE, where they are always made of stone (Rahmstorf 2022, 2-6). Sphendonoid weights with truncated ends – similar to V1 – are extremely common, for example, in the Assyrian *karum* of Kültepe-Kanesh, in central Anatolia (*c.* 2000-1700 BCE) (Kulakoğlu 2017). Some of these weights bear perforations similar to the one present on object cat. no. 320, often used to host a metal ring (Kulakoğlu 2017, fig. 21.1.7, 21.8.110). Perforated sphendonoid weights with suspension rings are also present in the Uluburun shipwreck (Pulak 1997, no. 46, 430). Finally, sphenonoid weights with flattened base seem to become more common in the Late Bronze Age, as attested by the Uluburun shipwrek (Pulak 1997). Bronze sphendonoid weights with annular ribs are not attested outside of Central Europe.

Chronology, geographical distribution, and contexts

While rare, sphendonoid weights have the longest time-span of all balance weight types analysed in this study, being attested from the beginning of the Bronze Age since at least the beginning of the 2nd Iron Age (Fig. 5.33.). The earliest sphendonoid weight (cat. no. 319) is attested in the Aeolian Islands (Italy), in cremation grave of the cemetery of Contrada Diana (site no. 4), dated to the Early Bronze Age (*c.* 2300-1700 BCE). The object is somewhat atypical, as it presents a flattened shape that is not recorded elsewhere. A sphendonoid weight with flattened base comes from the 19th century excavation of the settlement of Gorzano, a *Terramara* in the Po Plain (Italy, site no. 34). The mixed materials from the excavation can be dated between the Middle and the Recent Bronze Age (*c.* 1600-1200 BCE). Sphendonoid weights are first attested in Central Europe in the Bronze D Phase (*c.* 1350-1200 BCE), where they only



▲ *Fig. 5.33. Sphendonoid weights. Geographical distribution: chronology and site ID.*



▲ *Fig. 5.34. Sphendonoid weights. Geographical distribution: typology.*

occur in burials and are often part of weighing sets. Object cat. no. 320, from the hilltop settlement of Monte Croce-Guardia in Central Italy (site no. 27) (*c.* 1200-1000 BCE) comes from a house in association with several bronze fragments (Cardarelli *et al.* 2017, fig. 29.5), interpreted as workshop or a hoard. The latest object (cat. no. 316) is attested at the settlement of Santu Brai in Sardinia (site no. 7), where is part of a set of four balance weights.

Variant 1: Circular cross-section, plain surface (cat. no. 309)

- *number of objects:* 1
- *objects with known mass (complete/reconstructed)*: 1
- *chronological range*: Phase 3 (*c.* 1350-1200 BCE)
- *material*: stone
- *1 site:* site no. 105
- *1 set:* site no. 105
- *mass range (complete/reconstructed):* 269,72 g

309. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 2 weights and 1 balance beam (cat. no. 1, 152, 309). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Stone. Mass: 269.72 g. Dimensions: 4.7 cm x 2.2 cm x 2.2 cm - Roscio *et al.* 2011, fig. 5.6; Rahmstorf 2014, fig. 3.13.

Variant 2: Circular cross-section, annular ribs (cat. no. 310-314)

- *number of objects:* 6
- *objects with known mass (complete/reconstructed)*: 4 (67 %)
- *chronological range*: Phase 3 (*c.* 1350-1200 BCE)
- *material*: copper/bronze
- *4 sites:* site no. 102, 105, 127, 130
- *3 sets:* site no. 105, 127, 130
- *mass range (complete/reconstructed):* 2.12-55.02 g

310. Migennes, Le Petit Moulin [site no. 105, burial] (Yonne, Bourgogne-Franche-Comté, France). Inhumation 298. Phase 3 (Br D) - Part of a set of 18 weights and 1 balance beam (cat. no. 4, 71, 72, 73, 74, 75, 106, 199, 201, 251, 262, 263, 268, 288, 289, 290, 291, 292, 310). Associations: 6 bronze hinges (organic container), dagger, hammer, awl, tweezers, 3 arrowheads, 2 rings, 7 bronze fragments, 12 gold fragments, 4 amber beads - Complete. Copper/bronze. Mass: 2.12 g. Dimensions: 1.0 cm x 0.8 cm x 0.8 cm - Roscio *et al.* 2011, fig. 2.33.
311. Pépinville [site no. 127, burial] (Richemont, Moselle, Grand Est, France). Phase 3 (Br D) - Part of a set of 7 balance weights (cat. no. 79, 89, 99, 121, 270, 311, 314). Associations: sword, tweezers, knife, pin, miniature duck, 2 bronze fragments, 7 bronze cylinders filled with lead - Complete. Copper/bronze. Mass: 15.55 g. Dimensions: 3.45 cm x 0.9 cm x 0.9 cm - Pare 1999, fig. 17.7.
312. Milavče [site no. 130, burial] (Bohemia, Czech Republic). Tumulus C/4. Phase 3 (Br D) - Part of a set of 3 balance weights (cat. no. 87, 312, 313). Associations: sword, spearhead, knife, pin fragment, 3 bronze sheet fragments, bronze fragment - Fragmented. Copper/bronze. Mass: n/a (2.24 g). Dimensions: 1.0 cm x 0.9 cm x 0.9 cm - Pare 1999, fig. 9.10.
313. Milavče [site no. 130, burial] (Bohemia, Czech Republic). Tumulus C/4. Phase 3 (Br D) - Part of a set of 3 balance weights (cat. no. 87, 312, 313). Associations: sword, spearhead, knife, pin fragment, 3 bronze sheet fragments, bronze fragment - Fragmented. Copper/bronze. Mass: 8.94 g (6.7 g). Dimensions: 2.4 cm x 1.1 cm x 1.1 cm - Pare 1999, fig. 9.10.
314. Pépinville [site no. 127, burial] (Richemont, Moselle, Grand Est, France). Phase 3 (Br D) - Part of a set of 7 balance weights (cat. no. 79, 89, 99, 121, 270, 311, 314). Associations: sword, tweezers, knife, pin, miniature duck, 2 bronze fragments, 7 bronze cylinders filled with lead - Complete. Copper/bronze. Mass: 55.02 g. Dimensions: 5.63 cm x 1.66 cm x 0.8 cm - Pare 1999, fig. 17.6.
315. Singen, Widerholdstraße [site no. 102, burial] (Konstanz, Baden-Württemberg, Germany). Phase 3 (Br D) - Associations: sword, spearhead - Intentionally fragmented pin. Fragmented. Copper/bronze. Mass: 19.69 g. Dimensions: 5.5 cm x 0.9 cm x 0.9 cm - Pare 1999, fig. 30.3.

Variant 3: Flat base (cat. no. 316-320)

- *number of objects:* 5
- *objects with known mass (complete/reconstructed)*: 5 (100 %)
- *chronological range*: Phase 1-5 (*c.* 2300-675 BCE)
- *material*: stone, copper/bronze
- *5 sites:* site no. 3, 4, 7, 27, 34
- *1 set:* site no. 7
- *mass range (complete/reconstructed):* 41.72-137.46 g

316. Santu Brai [site no. 7, settlement] (Nuragus, Sud Sardegna, Sardegna, Italy). Rectangular house. Phase 5 (EIA 2B-EO) - Part of a set of 4 balance weights (cat. no. 164, 307, 308, 316). Associations: small ceramic jug containing an awl, a small saw, a dagger, and a bronze fragment; Etruscan bucchero - Fragmented. Stone. Mass: 64.87 g. Dimensions: 3.5 cm x 2.5 cm x 2.7 cm - Ugas 1986, tav. XVI.6.
317. Gorzano [site no. 34, settlement] (Maranello, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 41.72 g. Dimensions: 4.39 cm x 2.68 cm x 2.62 cm - Museo Archeologico Etnografico Modena (inv. V) - Unpublished.
318. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House beta IV, Planum 14 (phase Ausonio I). Phase 3 (RBA) - Part of a set of 2 weights (cat. no. 22, 318). Associations: loom weight, high number of spindle whorls - Fragmented (reconstructed in 3D). Stone (steatite?). Mass:

137.46 g (136.4 g). Dimensions: 7.1 cm x 3.7 cm x 3.0 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 5129) - Unpublished.

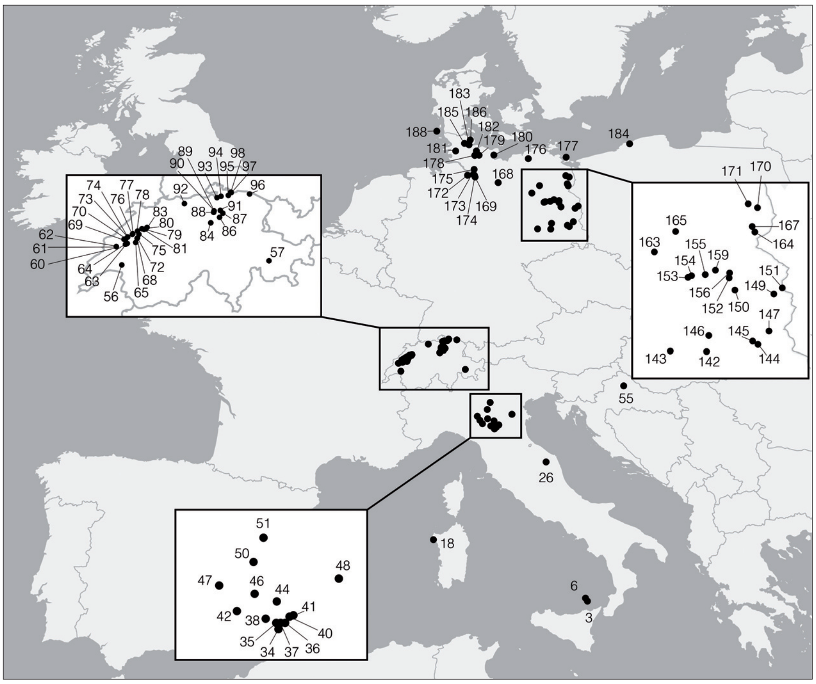
319. Lipari, Contrada Diana [site no. 4, burial] (Aeolian Islands, Messina, Sicilia, Italy). Contrada Diana, Capo Graziano necropolis, Grave 2. Phase 1 (EBA-MBA 1-2) - Complete. Stone (steatite?). Mass: 94.9 g. Dimensions: 7.4 cm x 4.7 cm x 1.6 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 8964) - Unpublished.

320. Monte Croce-Guardia [site no. 27, settlement] (Arcevia, Ancona, Marche, Italy). House 3, fase III, US 403 IIt. Phase 4 (FBA 3) - Transversal perforation. Part of a set of 2 balance weights (cat. no. 38, 120). Associations: concentration of fragmented bronze objects and a casting mould, interpreted as workshop/hoard. Sickle fragment, fibula fragment, bronze wire fragment, glass bead - Transversal perforation. Complete. Stone (limestone). Mass: 112.29 g. Dimensions: 7.6 cm x 3.1 cm x 3.5 cm - Cardarelli *et al.* 2017, fig. 29.5.

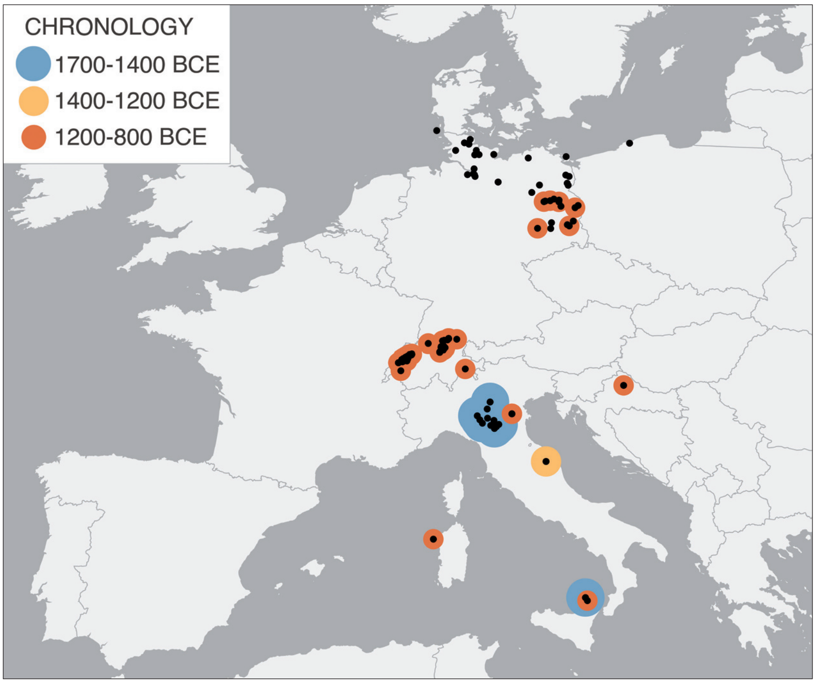
5.13. *KANNELURENSTEINE*

- *number of objects*: 322
- *objects with known mass (complete/reconstructed)*: 305 (95 %)
- *chronological range*: Phase 2-4 (*c.* 1600-800 BCE)
- *material:* stone
- *92 sites* (**2 sets**): site no. 3, (**6**), 18, 26, 34, 35, 36, 37, 38, 40, 41, 42, 44, 45, 46, 47, 48, 50, 51, 55, 56, 57, 60, 63, 64, 65, 69, 70, 71, 72, 74, 75, 76, 77, 78, 79, 80, 81, 83, 84, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 142, 143, 144, 145, 146, 147, 149, 150, 151, 152, 153, 154, (**155**), 156, 159, 163, 164, 165, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 188
- *mass range (complete/reconstructed):* 11.8-5,050.0 g (5th percentile= 133.71 g; 95th percentile= 1,344.2 g)

Distribution maps: fig. 5.35.-38.
Composition of the sample: fig. 5.39.-40.



▲ *Fig. 5.35. Kannelurensteine. Geographical distribution: site ID.*



▲ *Fig. 5.36. Kannelurensteine. Geographical distribution: chronology.*

Sample selection

The term *Kannelurenstein* (English: 'grooved stone'; sometimes *Rillenstein*, with the same meaning) is commonly used in German-speaking literature to identify roughly globular/lenticular stone objects with a characteristic annular groove, widespread between northern Italy and Central Europe in the Middle and Late Bronze Age. The first systematic study of *Kannelurensteine* was published by F. Horst (1981), who collected nearly 1,000 objects but did not propose an interpretation for their function. A. Cardarelli *et al.* (2001; 2004) were the first to propose the identification of *Kannelurensteine* with balance weights, based on a sample from MBA and LBA settlements in northern Italy.

F. Horst reports nearly 1,000 *Kannelurensteine* between Switzerland and Denmark, with more than half of the finds concentrated in eastern Germany. The mass values of the objects are never indicated. Only for *c.* 100 objects an image is provided, and nearly half of them do not correspond to the formal criteria of *Kannelurensteine* adopted in the present study. The lack of graphic documentation and the approximate selection criteria make it impossible to validate F. Horst's identification and distribution maps, and hence his catalogue was not included in the database. A. Cardarelli *et al.* (2001; 2004) published 39 objects from northern Italy, with mass values. M. Trachsel kindly provided his database, containing the mass values of 122 complete *Kannelurensteine* from Bronze Age sites in Switzerland. During research for the preparation of this book, I documented 98 unpublished objects from museums in Italy and Germany, and collected 63 more from publications.

Typology, geographical distribution and chronology

Kannelurensteine are the most characteristic type of balance weight of Bronze Age Europe, and the most numerous in the *mina*-range with 322 objects. They do not have typological parallels in the eastern Mediterranean. All *Kannelurensteine* are made of stone. Most variants have a squat body, with the characteristic annular groove on the diameter. Instead of a marked groove, some variants present a flattened surface. In northern Italy, these objects are often referred to as 'lenticular weights', after the most recurrent body shape in Italian contexts.

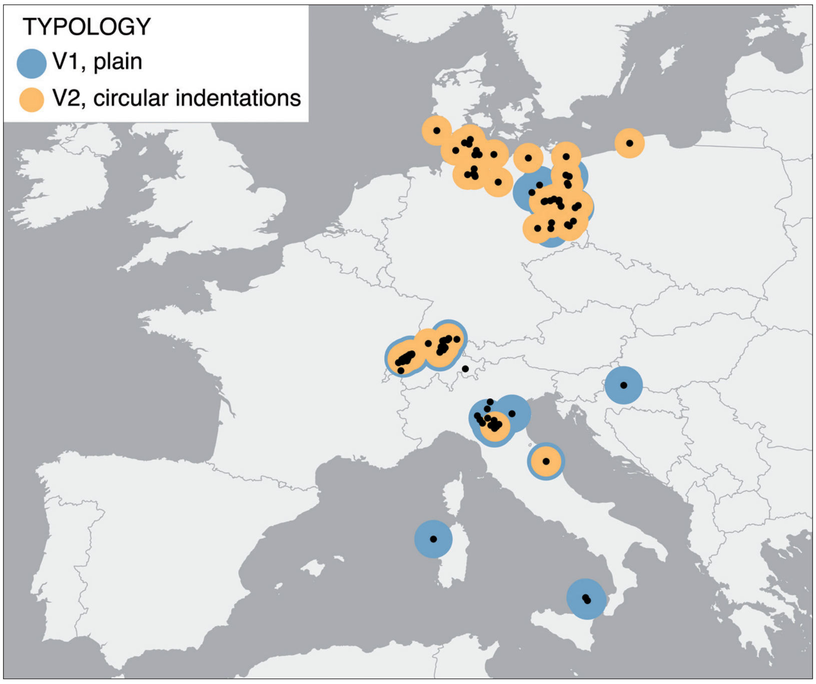
Their most significant typological trait is the presence/absence of two circular indentations, on the upper and lower faces. This trait allows separating *Kannelurensteine* into two main variants, each with peculiar chronological range and geographical distribution (Fig. 5.36.-37.). The variant with plain surfaces (V1) is the earliest. Eight objects pertaining to V1 are attested in at least two short-lived MBA contexts (Phase 2, *c.* 1600-1350 BCE): three at Salina – Villaggio della Portella in the Aeolian Islands (site no. 6; cat. no. 336, 340, 360), and five at Gaggio di Castelfranco in northern Italy (site no. 40; cat. no. 337, 347, 372, 414, 509). The chronology of V1 is not limited to Phase 2, but extends to Phase 4 throughout the entire distribution area. Variant 2 with circular indentations is overall later. Only two objects come from a Phase 3 settlement in central Italy (Moscosi – Piano di Fonte Marcosa, site no. 26; cat. no. 329, 427), while all remaining ones are attested in Phase 4 contexts in Italy, Switzerland, Germany, and Croatia.

The two main variants are further divided into subgroups based on the overall shape of their body. In general, body shape does not seem to indicate relevant chronological and distribution patterns, except in two cases. Italian contexts show prominently lenticular *Kannelurensteine*, but the same shape is also attested in Central Europe. Ovoid shapes, on the other hand, seem to be exclusive to northern Italy.

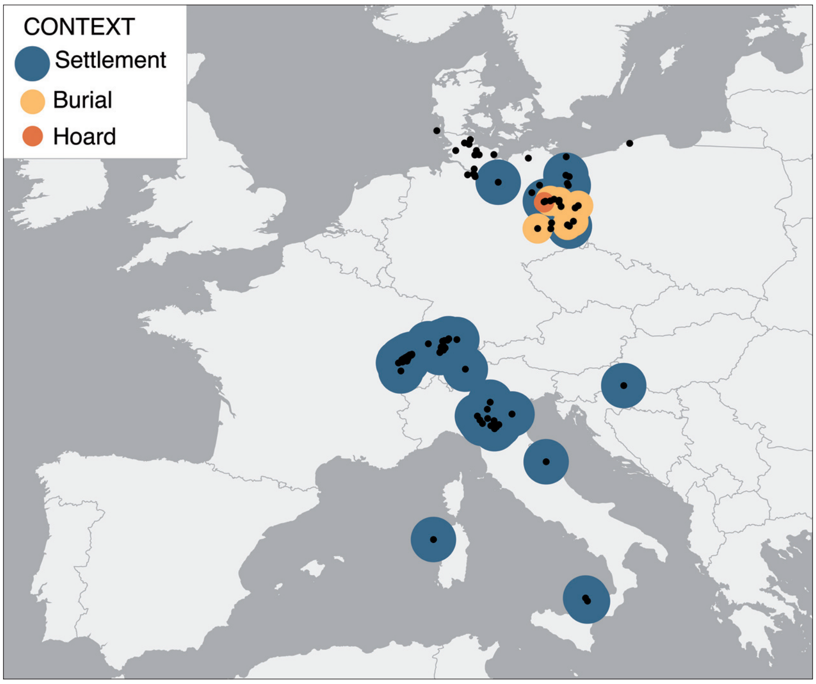
150 objects were mentioned in reliable, previously published detailed lists, which indicated the objects' mass values but did not provide an image. These objects were included in the catalogue, but were not typologically classified.

Function

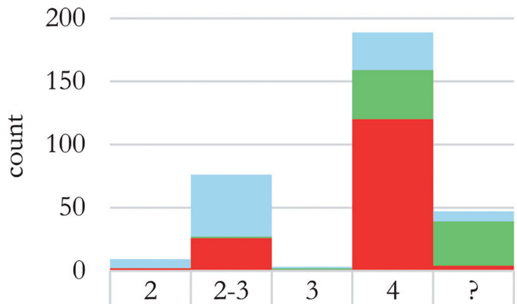
It has been proposed that *Kannelurensteine* were used as fixed pulleys (Leuvrey 1999, 79-81), based on the relatively frequent occurrence in Swiss sites of the type with opposed circular indentations. According to J. M. Leuvrey, the indentations would have been used as pivots for wooden poles. This interpretation, however, is extremely unlikely, because it would require the objects to be completely perforated. Moreover, only a limited number of *Kannelurensteine* present the circular indentations, and Italian ones almost never do. These objects are sometimes interpreted generically as "working tools", without further specification. However, the low occurrence of use wear makes it unlikely that they were systematically used for working activities. Moreover, the generic working-tool hypothesis does not explain the grooves and the indentations. Similar objects are documented at the Celtic site of Manching, and were interpreted as 'door-holders', hanging from a cord (Jacobi 1974, 243-244). There is no chronological continuity between the Bronze Age *Kannelurensteine* and the objects from Manching, therefore their respective functions can be completely different. However, a similar interpretation does not seem plausible for the Bronze Age objects. First of all, not all *Kannelurensteine* have a groove; second, the weight range is too wide, including objects that are either too light or too heavy for the purpose; and third, they are documented in open air smelting facilities and burials, where doors were probably of little use. For the eastern German sample, F. Horst (1981) emphasized that even though the majority of the known *Kannelurensteine* are single finds, there are indications of a connection to craftsmanship and especially metalworking.



▲ *Fig. 5.37. Kannelurensteine. Geographical distribution: typology.*

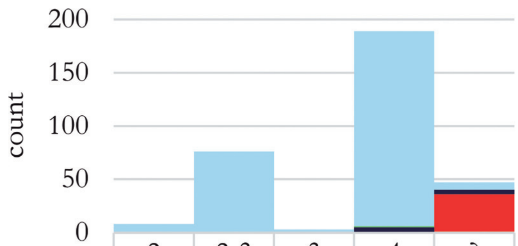


▲ *Fig. 5.38. Kannelurensteine. Geographical distribution: site type.*



	2	2-3	3	4	?
V1	7	49	1	30	8
V2		1	1	39	35
?	1	26		120	4

Fig. 5.39. Kannelurensteine. Quantification: typology vs chronology.



	2	2-3	3	4	?
sett.	8	76	2	183	7
hoard				1	
burial				5	4
?					36

Fig. 5.40. Kannelurensteine. Quantification: site type vs chronology.

The balance weight hypothesis – supported by the statistical analyses – provides plausible explanations for all those specific traits of *Kannelurensteine* that were used in previous studies to support different interpretations. The use wear that is sometimes observed in the groove – which, it is safe to remind, is not always present – can be explained with the frequent use of a cord to keep the weight hanging from one extremity of an equal-arm balance. If the much later objects from Manching were also used as balance weights, the function of the cord may have been taken over by the metal clamp. While it is likely that in the Bronze Age most balance beams were made of wood (Peyronel 2011; Ialongo 2019), it has been recently demonstrated that even the tiniest and most fragile bone beams (frequently contained in LBA burials) could support a weight of at least 5 kg (Hermann *et al.* 2020) macromolecular chemistry and material science, and thus they were perfectly capable of handling *Kannelurensteine*, either hanging directly from one of the arms or lying on one of the pans. The groove and the occasional presence of circular indentations – used to propose the unlikely interpretation as fixed pulleys – can be easily explained by the manufacture process of balance weights. The only way to construct a stone weight is to progressively remove material, until the desired mass is obtained. As balance weights, *Kannelurensteine* were meant to possess an approximately specific form, *i. e.*, a finely shaped, approximately lenticular object. The groove and the indentations may have been required to further carve the object in order to obtain the desired mass, once the crafter had already achieved the desired proportions. This also explains why the groove and the indentations are not present in all exemplars. Finally, the occasional occurrence of use wear can be explained with a possible reuse as a tool (as it is documented in the Bronze Age Aegean: Rahmstorf 2016c), and even with the practice related to the use of balance weights. Weights are, after all, still tools: They are often picked up and dropped on different surfaces during their use-lives, and rough movements can produce chipping and permanent traces. Finally, the significant spread of the size of *Kannelurensteine* (11.8-5,050 g) further supports the interpretation as balance weights, and is not compatible with other interpretations.

Contexts

Unfortunately, most *Kannelurensteine* are stray finds, or come from old excavations lacking documentation. Only in a few cases do contexts provide clues for their interpretation. In the Middle Bronze Age settlement of Salina, in the Aeolian Islands (site no. 6), two *Kannelurensteine* are associated with a casting mould and a clamp made of pure tin, probably imported as an ingot (Bettelli/Cardarelli 2005). In the site of Kalnik-Igrišče, in Croatia (site no. 55), *Kannelurensteine* are associated with smelting facilities (Vrdoljak/Forenbaher 1995).

Kannelurensteine are documented in burials only in eastern Germany and western Poland in the Lusatian culture (Ha A-B) (Fig. 5.38.). In the cemetery of Battaune, Kr. Delitzsch in Saxony (site no. 143), such an object was found together with two casting moulds in a cremation grave (Schmalfuss 2008). This burial from Saxony provides a clear reference to metallurgy. Also, in western Poland *Kannelurensteine* were placed in cremation graves like in the cemetery of Wartosław, ca. 60 km northwest of Poznań, which is not included in this study. While some of the *Kannelurensteine* (Krzyszowski (ed.) 2019, pl. 36) were found in excavations in the 19th century, recently excavated burials at the same site confirmed the fact that they were placed with the cremation urns and other vessels, like in the case of grave no. 200 (Krzyszowski (ed.) 2019, 55, 229 no. 227, pl. 95,5). The large grave no. 198 from the excavation in 2009 contained the cremated bodies of at least eight individuals, 70 pottery vessels, two metal objects, a stone axe, a stone mould and 33 stone objects – pebbles but also shaped stones. Some of them, if not all, seem to be balance weights as one bears a clear marking in the shape of a cross (Krzyszowski (ed.) 2019, pl. 27,7, 95,4, photo 60). Finally, the hoard of Krampnitz, Potsdam (site no. 153), in Brandenburg in eastern Germany is the only documented hoard containing a *Kannelurenstein*. It includes a spearhead, ornaments, scrap metal and an awl with a preserved wooden handle (Reinbacher 1956).

Variant 1: Plain surfaces (cat. no. 321-415)

- *number of objects*: 95
- *objects with known mass (complete/reconstructed)*: 91 (96 %)
- *chronological range*: Phase 2-4 (*c.* 1600-800 BCE)
- *material:* stone
- *24 sites (**1 set**):* site no. 3, (**6**), 18, 26, 34, 35, 36, 37, 38, 40, 46, 48, 55, 74, 76, 79, 84, 91, 98, 150, 154, 163, 165, 170
- *mass range (complete/reconstructed):* 11.8-2,928 g

Sub-variant 1.A: Spool-shaped (cat. no. 321-327)

321. Gorzano [site no. 34, settlement] (Maranello, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 235.67 g (226.17 g). Dimensions: 4.0 cm x 6.2 cm x 5.8 cm - Museo Archeologico Etnografico Modena (inv. no. 1251) - Unpublished.
322. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Fragmented. Stone. Mass: n/a (751.8 g). Dimensions: 9.2 cm x 9.2 cm x 5.6 cm - Leuvrey 1999, pl. 81.1.
323. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 337.4 g. Dimensions: 6.3 cm x 6.2 cm x 6.0 cm - Museo Archeologico Etnografico Modena (inv. no. Cas. 234) - Unpublished.
324. Friedersdorf [site no. 150, settlement] (Dahme-Spreewald, Brandenburg, Germany). Undetermined chronology (Bronze Age) - Complete. Stone (sandstone). Mass: 361.07 g. Dimensions: 6.1 cm x 6.0 cm x 5.8 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 2009-2002/74) - Unpublished.
325. Germany (unknown provenance) [n/a, unknown context] (Germany). Undetermined chronology (Ha A-B) - Fragmented (reconstructed in 3D). Stone. Mass: 360.4 g (335.97 g). Dimensions: 6.4 cm x 5.0 cm x 7.0 cm - Museum für Vor- und Frühgeschichte Berlin (inv. aus BB 122) - Unpublished.
326. Germany (unknown provenance) [n/a, unknown context] (Germany). Undetermined chronology (Ha A-B) - Fragmented (reconstructed in 3D). Stone (limestone). Mass: 453.35 g (446.57 g). Dimensions: 7.4 cm x 6.8 cm x 6.1 cm - Museum für Vor- und Frühgeschichte Berlin (inv. aus BB 122) - Unpublished.
327. Germany (unknown provenance) [n/a, unknown context] (Germany). Undetermined chronology (Br C-Ha B) - Fragmented (reconstructed in 3D). Stone. Mass: 737.06 g (730 g). Dimensions: 9.1 cm x 7.3 cm x 7.6 cm - Museum für Vor- und Frühgeschichte Berlin (inv. aus BB 122) - Unpublished.

Sub-variant 1.B: Biconical (cat. no. 328-329)

328. Frattesina [site no. 48, settlement] (Fratta Polesine, Rovigo, Veneto, Italy). Phase 4 (RBA-FBA) - Fragmented. Stone. Mass: 361 g. Dimensions: 9.0 cm x 9.0 cm x 4.8 cm (inv. B) - Cardarelli *et al.* 2001, fig. 16.6.
329. Frattesina [site no. 48, settlement] (Fratta Polesine, Rovigo, Veneto, Italy). Phase 4 (RBA-FBA) - Fragmented. Stone. Mass: 440 g. Dimensions: 10.1 cm x 7.8 cm x 6.0 cm (inv. C) - Cardarelli *et al.* 2001, fig. 16.8.

Sub-variant 1.C: Bi-troncoconical (cat. no. 330)

330. Kalnik-Igrišče [site no. 55, settlement] (Croatia). Phase 4 (Ha B3) - Associations: casting moulds and metalworking facilities - Fragmented. Stone. Mass: n/a. Dimensions: 12.9 cm x 13.4 cm x 8.6 cm - Vrdoljak/Forenbaher 1995, fig. 4.

Sub-variant 1.D: Lenticular (cat. no. 331-371)

331. Hauterive-Champréveyres [site no. 76, settlement] (Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 600.2 g. Dimensions: 9.3 cm x 4.5 cm x 4.8 cm - Leuvrey 1999, pl. 79.2.
332. Hauterive-Champréveyres [site no. 76, settlement] (Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 780 g. Dimensions: 9.8 cm x 10.4 cm x 5.0 cm - Leuvrey 1999, pl. 80.1.
333. Hauterive-Champréveyres [site no. 76, settlement] (Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 707.6 g. Dimensions: 10.0 cm x 9.6 cm x 5.3 cm - Leuvrey 1999, pl. 79.4.
334. Frattesina [site no. 48, settlement] (Fratta Polesine, Rovigo, Veneto, Italy). Phase 4 (RBA-FBA) - Fragmented. Stone. Mass: 440 g. Dimensions: 9.6 cm x 9.5 cm x 3.8 cm (inv. no. 89897) - Cardarelli *et al.* 2001, fig. 16.4.
335. Michaelisbruch [site no. 163, unknown context] (Ostprignitz-Ruppin, Brandenburg, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 339.6 g. Dimensions: 7.4 cm x 7.2 cm x 4.1 cm - Museum für Vor- und Frühgeschichte Berlin (inv. no. If 22107) - Unpublished.
336. Salina, Villaggio della Portella [site no. 6, settlement] (Aeolian Islands, Messina, Sicilia, Italy). Phase 2 (MBA 3) - Complete. Stone (sandstone). Mass: 275.43 g. Dimensions: 8.4 cm x 7.0 cm x 3.3 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 24885) - Unpublished.
337. Gaggio di Castelfranco [site no. 40, settlement] (Modena, Emilia-Romagna, Italy). T. 505, Trench 11. US 20013, fase 2. Phase 2 (MBA-RBA) - Complete. Stone. Mass: 489.63 g. Dimensions: 7.7 cm x 8.2 cm x 5.2 cm - Museo Archeologico Etnografico Modena (inv. no. 2848) - Unpublished.
338. Nuraghe Sant'Imbenia [site no. 18, settlement] (Alghero, Sassari, Sardegna, Italy). A6, 04-07-2011. US 51. Phase 4 (EIA) - Complete. Stone. Mass: 398.49 g. Dimensions: 8.6 cm x 8.4 cm x 4.0 cm - Storerooms of the archaeological excavations at Sant'Imbenia, Alghero (inv. ND) - Unpublished.
339. Moscosi Piano Fonte Marcosa [site no. 26, settlement] (Cingoli, Macerata, Marche, Italy). PFM 92, BB 16a. US 172, pit filling. Phase 3 (MBA-RBA) - Fragmented. Stone (limestone). Mass: n/a (200.19 g). Dimensions: 8.6 cm x 4.6 cm x 3.9 cm - Biblioteca Comunale di Cingoli (MC) - Unpublished.

340. Salina, Villaggio della Portella [site no. 6, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House R2, US 49 III. Phase 2 (MBA 3) - Part of a set of 2 balance weights (cat. no. 340, 360). Associations: tin ingot, casting mould - Fragmented. Stone (limestone?). Mass: n/a (1,260 g). Dimensions: 12.7 cm x 10.1 cm x 7.2 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. ND) - Unpublished.
341. Scandiano [site no. 38, settlement] (Reggio Emilia, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone (porphyry). Mass: 436 g. Dimensions: 7.9 cm x 7.7 cm x 5.1 cm (inv. no. 3176) - Cardarelli *et al.* 2001, fig. 13.3.
342. Frattesina [site no. 48, settlement] (Fratta Polesine, Rovigo, Veneto, Italy). Phase 4 (RBA-FBA) - Fragmented. Stone. Mass: 362 g. Dimensions: 8.4 cm x 6.9 cm x 4.1 cm (inv. no. 32981) - Cardarelli *et al.* 2001, fig. 16.3.
343. Santa Rosa di Poviglio [site no. 46, settlement] (Reggio Emilia, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 545 g. Dimensions: 9.4 cm x 9.2 cm x 4.3 cm - Cardarelli *et al.* 2001, fig. 13.4.
344. Hauterive-Champréveyres [site no. 76, settlement] (Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 654.3 g. Dimensions: 9.1 cm x 9.7 cm x 5.2 cm - Leuvrey 1999, pl. 79.1.
345. Frattesina [site no. 48, settlement] (Fratta Polesine, Rovigo, Veneto, Italy). Phase 4 (RBA-FBA) - Fragmented. Stone. Mass: 490 g. Dimensions: 7.8 cm x 7.6 cm x 5.0 cm (inv. I.G. 17309) - Cardarelli *et al.* 2001, fig. 16.5.
346. Lipari, acropolis [site no. 3, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House beta IV, Trench BR, Plana 10-11, 4th floor (Ausonio II). Phase 4 (FBA) - Complete. Stone. Mass: 341.3 g. Dimensions: 7.8 cm x 6.7 cm x 5.3 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 5922) - Unpublished.
347. Gaggio di Castelfranco [site no. 40, settlement] (Modena, Emilia-Romagna, Italy). T. 507, Trench 9, UB 16. US 9010, fase 2. Phase 2 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone. Mass: 466.2 g (450.99 g). Dimensions: 7.8 cm x 8.2 cm x 4.7 cm - Museo Archeologico Etnografico Modena (inv. no. 1775) - Unpublished.
348. Schwanow [site no. 165, unknown context] (Ruppin, Brandenburg, Germany). Undetermined chronology (Ha A-B) - Fragmented (reconstructed in 3D). Stone. Mass: 291.86 g (290.46 g). Dimensions: 7.1 cm x 7.0 cm x 3.9 cm - Museum für Vor- und Frühgeschichte Berlin (inv. Slg. Schulze no. 1956:80) - Unpublished.
349. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 715.3 g. Dimensions: 8.6 cm x 9.6 cm x 6.7 cm (inv. no. 2512) - Bolliger Schreyer *et al.* 2004, Taf. 223.2512.
350. Groß-Glienicke [site no. 154, settlement] (either Berlin or Potsdam, either Berlin or Brandenburg, Germany). Undetermined chronology (Bronze Age) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 336.97 g (317.73 g). Dimensions: 8.1 cm x 7.9 cm x 3.9 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 2009-1737/07) - Hensel 2009.
351. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 521.7 g. Dimensions: 5.9 cm x 7.9 cm x 7.1 cm - Museo Archeologico Etnografico Modena (inv. no. 7751) - Unpublished.
352. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 521.73 g. Dimensions: 5.9 cm x 8.0 cm x 7.2 cm - Museo Archeologico Etnografico Modena (inv. no. 7731) - Unpublished.
353. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 389.01 g. Dimensions: 5.5 cm x 7.8 cm x 6.0 cm - Museo Archeologico Etnografico Modena (inv. no. 7722) - Unpublished.
354. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 250.9 g. Dimensions: 6.2 cm x 6.4 cm x 4.6 cm (inv. no. 2511) - Bolliger Schreyer *et al.* 2004, Taf. 223.2511.
355. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone (marble). Mass: 429 g. Dimensions: 8.1 cm x 8.1 cm x 4.1 cm (inv. no. 7705) - Cardarelli *et al.* 2001, fig. 13.1.
356. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 241.9 g. Dimensions: 7.3 cm x 7.1 cm x 4.0 cm (inv. no. 2510) - Bolliger Schreyer *et al.* 2004, Taf. 223.2510.
357. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,375.3 g. Dimensions: 11.05 cm x 10.35 cm x 7.9 cm - Bern, Bernisches Historisches Museum (inv. no. BHM 7882) - Bernatzky-Goetze 1987, 208, Taf. 167.4.
358. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 1,257.9 g. Dimensions: 12.2 cm x 10.6 cm x 8.1 cm (inv. no. 2509) - Bolliger Schreyer *et al.* 2004, Taf. 223.2509.
359. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 984.9 g. Dimensions: 10.55 cm x 8.5 cm x 7.25 cm - Bern, Bernisches Historisches Museum (inv. no. BHM 7883) - Bernatzky-Goetze 1987, 208, Taf. 167.5.
360. Salina, Villaggio della Portella [site no. 6, settlement] (Aeolian Islands, Messina, Sicilia, Italy). House R. Phase 2 (MBA 3) - Part of a set of 2 balance weights (cat. no. 340, 360). Associations: tin

ingot, casting mould (adjacent structure R2) - Complete. Stone. Mass: 2,928 g. Dimensions: 15.5 cm x 12.0 cm x 8.7 cm - Museo Archeologico Regionale Eoliano Luigi Bernabò Brea (inv. no. 24943) - Unpublished.

361. Greifensee-Böschen [site no. 91, settlement] (Zürich, Switzerland). Feld P, Halde, Fundkomplex 5918. Phase 4 (Ha A-B) - Complete. Stone (quarzite). Mass: 266 g. Dimensions: 6.3 cm x 5.8 cm (inv. no. 1021) - Eberschweiler *et al.* 2007, Taf. 107.1021.
362. Hauterive-Champréveyres [site no. 76, settlement] (Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 332.2 g. Dimensions: 6.5 cm x 7.0 cm x 4.9 cm - Leuvrey 1999, pl. 79.3.
363. Greifensee-Böschen [site no. 91, settlement] (Zürich, Switzerland). Feld N, Fundkomplex 4126. Phase 4 (Ha A-B) - Complete. Stone (quarzitic sandstone). Mass: 270 g. Dimensions: 6.8 cm x 7.3 cm x 4.2 cm (inv. no. 1020) - Eberschweiler *et al.* 2007, Taf. 107.1020.
364. Greifensee-Böschen [site no. 91, settlement] (Zürich, Switzerland). Feld A, Halde, Fundkomplex 1315. Phase 4 (Ha A-B) - Complete. Stone (amphibiolite). Mass: 722 g. Dimensions: 9.0 cm x 9.3 cm x 5.1 cm (inv. no. 1015) - Eberschweiler *et al.* 2007, Taf. 107.1015.
365. Greifensee-Böschen [site no. 91, settlement] (Zürich, Switzerland). Feld N, Fundkomplex 4096. Phase 4 (Ha A-B) - Complete. Stone (quarzite). Mass: 807 g. Dimensions: 9.1 cm x 10.5 cm x 5.5 cm (inv. no. 1016) - Eberschweiler *et al.* 2007, Taf. 107.1016.
366. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 1,273 g. Dimensions: 12.0 cm x 10.3 cm x 7.8 cm (inv. no. 2525) - Bolliger Schreyer *et al.* 2004, Taf. 225.2525.
367. Greifensee-Böschen [site no. 91, settlement] (Zürich, Switzerland). Feld F, Halde, Fundkomplex 4296. Phase 4 (Ha A-B) - Associations: axe, two awls - Complete. Stone (quarzitic sandstone). Mass: 1,309 g. Dimensions: 12 cm x 9 cm (inv. no. 1014) - Eberschweiler *et al.* 2007, Taf. 107.1014.
368. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 428 g (inv. no. 7786) - Cardarelli *et al.* 2001, fig. 14.4.
369. Gazzade [site no. 36, settlement] (Varese, Lombardia, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 533 g (inv. no. 192) - Cardarelli *et al.* 2001, fig. 13.2.
370. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone (sandstone). Mass: 41 g (36.5 g) - Cardarelli *et al.* 2004, fig. 1.5.
371. Battin [site no. 170, unknown context] (Prenzlau, Brandenburg, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 11.8 g. Dimensions: 2.3 cm x 2.3 cm x 1.5 cm - Museum für Vor- und Frühgeschichte Berlin (inv. no. If 265777) - Unpublished.

Sub-variant 1.E: Ovoid (cat. no. 372-409)

372. Gaggio di Castelfranco [site no. 40, settlement] (Modena, Emilia-Romagna, Italy). T. 507, Trench 5, TM 5. US 10122, fase 1.2, ditch. Phase 2 (MBA-RBA) - Complete. Stone. Mass: 416.64 g. Dimensions: 7.3 cm x 6.0 cm x 6.6 cm - Museo Archeologico Etnografico Modena (inv. no. 3572) - Unpublished.
373. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Worn (reconstructed in 3D). Stone (sandstone). Mass: 414.64 g (402.03 g). Dimensions: 6.8 cm x 6.8 cm x 6.0 cm - Museo Archeologico Etnografico Modena (inv. no. 238) - Unpublished.
374. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 375.74 g (373.37 g). Dimensions: 7.8 cm x 6.7 cm x 5.8 cm - Museo Archeologico Etnografico Modena (inv. no. 7731) - Unpublished.
375. Gorzano [site no. 34, settlement] (Maranello, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 588.04 g. Dimensions: 9.62 cm x 6.1 cm x 7.08 cm - Museo Archeologico Etnografico Modena (inv. no. 1234) - Unpublished.
376. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 299.06 g (274.74 g). Dimensions: 7.5 cm x 6.4 cm x 5.1 cm - Museo Archeologico Etnografico Modena (inv. s.n. 210) - Unpublished.
377. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 341.86 g (341.05 g). Dimensions: 7.6 cm x 6.7 cm x 5.3 cm - Museo Archeologico Etnografico Modena (inv. no. 7726) - Unpublished.
378. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 383.39 g (360.55 g). Dimensions: 8.0 cm x 6.3 cm x 5.8 cm - Museo Archeologico Etnografico Modena (inv. no. 460) - Unpublished.
379. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 319.91 g. Dimensions: 8.0 cm x 6.7 cm x 5.0 cm - Museo Archeologico Etnografico Modena (inv. no. 7763) - Unpublished.
380. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 317.95 g. Dimensions: 8.9 cm x 5.7 cm x 3.8 cm - Museo Archeologico Etnografico Modena (inv. no. 7758) - Unpublished.
381. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excava-

tion '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 409.02 g. Dimensions: 8.8 cm x 6.9 cm x 4.6 cm - Museo Archeologico Etnografico Modena (inv. no. 7727) - Unpublished.

382. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 381.39 g. Dimensions: 7.2 cm x 6.1 cm x 5.3 cm - Museo Archeologico Etnografico Modena (inv. s.n. 206) - Unpublished.
383. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 407.57 g. Dimensions: 8.3 cm x 7.0 cm x 4.2 cm - Museo Archeologico Etnografico Modena (inv. no. 7759) - Unpublished.
384. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 345.02 g. Dimensions: 7.5 cm x 5.5 cm x 5.2 cm - Museo Archeologico Etnografico Modena (inv. no. 7767) - Unpublished.
385. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 327.19 g (324.76 g). Dimensions: 7.5 cm x 5.6 cm x 5.1 cm - Museo Archeologico Etnografico Modena (inv. no. 7784) - Unpublished.
386. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 387.38 g. Dimensions: 9.0 cm x 6.3 cm x 4.8 cm - Museo Archeologico Etnografico Modena (inv. no. 7732) - Unpublished.
387. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 558.36 g. Dimensions: 7.9 cm x 7.2 cm x 6.8 cm - Museo Archeologico Etnografico Modena (inv. no. 7728) - Unpublished.
388. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 397.71 g. Dimensions: 6.5 cm x 6.5 cm x 6.2 cm - Museo Archeologico Etnografico Modena (inv. no. 7740) - Unpublished.
389. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 477.08 g (475.62 g). Dimensions: 6.4 cm x 6.9 cm x 6.4 cm - Museo Archeologico Etnografico Modena (inv. no. 7741) - Unpublished.
390. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 375.27 g (369.48 g). Dimensions: 7.3 cm x 6.9 cm x 5.0 cm - Museo Archeologico Etnografico Modena (inv. no. 7773) - Unpublished.
391. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 377.64 g (373.08 g). Dimensions: 7.3 cm x 6.7 cm x 5.9 cm - Museo Archeologico Etnografico Modena (inv. no. 7750) - Unpublished.
392. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 427.46 g. Dimensions: 5.6 cm x 7.6 cm x 7.2 cm - Museo Archeologico Etnografico Modena (inv. no. 7786) - Unpublished.
393. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 446.58 g. Dimensions: 8.0 cm x 7.18 cm x 8.12 cm - Museo Archeologico Etnografico Modena (inv. no. Cas. 158) - Unpublished.
394. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 332.52 g (328.75 g). Dimensions: 6.9 cm x 6.6 cm x 5.6 cm - Museo Archeologico Etnografico Modena (inv. no. 7781) - Unpublished.
395. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 453.02 g (447.21 g). Dimensions: 7.0 cm x 6.8 cm x 6.4 cm - Museo Archeologico Etnografico Modena (inv. no. 7739) - Unpublished.
396. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 365.46 g (360.66 g). Dimensions: 7.0 cm x 7.2 cm x 6.2 cm - Museo Archeologico Etnografico Modena (inv. no. 7712) - Unpublished.
397. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 381.03 g (355.28 g). Dimensions: 7.5 cm x 6.6 cm x 7.2 cm - Museo Archeologico Etnografico Modena (inv. no. 7742) - Unpublished.
398. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 390.06 g. Dimensions: 7.5 cm x 6.2 cm x 5.5 cm - Museo Archeologico Etnografico Modena (inv. no. 7729) - Unpublished.
399. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 397.09 g (390.02 g). Dimensions: 7.0 cm x 7.1 cm x 5.5 cm - Museo Archeologico Etnografico Modena (inv. no. 7708) - Unpublished.

400. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 388.83 g (385.56 g). Dimensions: 8.4 cm x 7.6 cm x 5.0 cm - Museo Archeologico Etnografico Modena (inv. no. 7759) - Unpublished.
401. Greifensee-Böschen [site no. 91, settlement] (Zürich, Switzerland). Feld M, Fundkomplex 3339. Phase 4 (Ha A-B) - Associations: axe, hammer, five awls, two knives - Complete. Stone (sandstone). Mass: 255 g. Dimensions: 5.6 cm x 5.7 cm (inv. no. 1022) - Eberschweiler *et al.* 2007, Taf. 107.1022.
402. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Worn (reconstructed in 3D). Stone (sandstone). Mass: 431.06 g (402.06 g). Dimensions: 7.0 cm x 6.7 cm x 6.0 cm - Museo Archeologico Etnografico Modena (inv. no. 451) - Unpublished.
403. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Worn (reconstructed in 3D). Stone (sandstone). Mass: 420.8 g (403.94 g). Dimensions: 7.9 cm x 6.3 cm x 6.4 cm - Museo Archeologico Etnografico Modena (inv. no. 7713) - Unpublished.
404. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Worn (reconstructed in 3D). Stone (sandstone). Mass: 382.91 g (374.9 g). Dimensions: 7.3 cm x 6.6 cm x 5.4 cm - Museo Archeologico Etnografico Modena (inv. no. 7720) - Unpublished.
405. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Worn (reconstructed in 3D). Stone (sandstone). Mass: 334.44 g (329.22 g). Dimensions: 8.6 cm x 6.6 cm x 4.9 cm - Museo Archeologico Etnografico Modena (inv. no. 7757) - Unpublished.
406. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Worn (reconstructed in 3D). Stone (sandstone). Mass: 380.7 g (358.92 g). Dimensions: 7.4 cm x 6.4 cm x 5.8 cm - Museo Archeologico Etnografico Modena (inv. no. sn209) - Unpublished.
407. Gorzano [site no. 34, settlement] (Maranello, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 387.82 g. Dimensions: 6.5 cm x 7.02 cm x 6.26 cm - Museo Archeologico Etnografico Modena (inv. no. 1261) - Unpublished.
408. Gorzano [site no. 34, settlement] (Maranello, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 36.8 g. Dimensions: 3.18 cm x 3.47 cm x 2.34 cm - Museo Archeologico Etnografico Modena (inv. no. Gor. 1248) - Unpublished.
409. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 338.81 g. Dimensions: 6.7 cm x 6.4 cm x 5.7 cm - Museo Archeologico Etnografico Modena (inv. no. 340) - Unpublished.

Sub-variant 1.F: Transversal groove (cat. no. 410-412)

410. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 399.68 g. Dimensions: 7.6 cm x 7.7 cm x 5.2 cm - Museo Archeologico Etnografico Modena (inv. no. 7777) - Unpublished.
411. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (granite). Mass: 1,200.4 g. Dimensions: 13.4 cm x 11.1 cm x 6.4 cm (inv. no. 2521) - Bolliger Schreyer *et al.* 2004, Taf. 224.2521.
412. Hauterive-Champréveyres [site no. 76, settlement] (Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,133.4 g. Dimensions: 6.1 cm x 4.9 cm x 3.3 cm - Leuvrey 1999, pl. 88.3.

Sub-variant 1.G: Criss-crossing grooves (cat. no. 413-415)

413. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 432.46 g. Dimensions: 7.8 cm x 6.6 cm x 5.4 cm - Museo Archeologico Etnografico Modena (inv. no. 7699) - Unpublished.
414. Gaggio di Castelfranco [site no. 40, settlement] (Modena, Emilia-Romagna, Italy). T. 505, Trench 11, US 20013, fase 2. Phase 2 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone. Mass: 427.87 g (372.68 g). Dimensions: 8.7 cm x 6.9 cm x 4.8 cm - Museo Archeologico Etnografico Modena (inv. no. 2850) - Unpublished.
415. Insel Werd [site no. 98, settlement] (Eschenz, Thurgau, Switzerland). Feld XII. Phase 4 (Ha A-B) - Complete. Stone. Mass: 862 g. Dimensions: 9.5 cm x 9.5 cm x 6.0 cm (inv. no. 6322) - Brem *et al.* 1987, Abb. 29.S5.

Variant 2: Circular indentations (cat. no. 416-491)

- *number of objects*: 76
- *objects with known mass (complete/reconstructed)*: 64 (84 %)
- *chronological range*: Phase 3-4 (*c.* 1350-800 BCE)
- *material:* stone
- *43 sites (__1 set__):* site no. 26, 37, 70, 74, 76, 79, 84, 91, 92, 98, 142, 143, 144, 145, 146, 147, 149, 151, 152, 153, (__155__), 156, 159, 164, 167, 168, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 188
- *mass range (complete/reconstructed):* 87.78-3,073.02 g

Sub-variant 2.A: Spool-shaped (cat. no. 416-420)

416. Kr. Sorau (former) [site no. 142, unknown context] (Brandenburg, Germany). Undetermined chronology (Ha A-B) - Fragmented (reconstructed in 3D). Stone. Mass: 120 g (119.7 g). Dimensions: 5.0 cm x 5.1 cm x 2.6 cm - Museum für Vor- und Frühgeschichte Berlin (inv. no. II 8968) - Unpublished.
417. Müllrose [site no. 149, burial] (Oder-Spree, Brandenburg, Germany). Phase 4 (Period IV-V) - Associations: 6 small pebbles, pottery - Complete. Stone (sandstone). Mass: 125.08 g. Dimensions: 5.2 cm x 4.9 cm x 2.9 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 2003-74) - Unpublished.
418. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 1,195.3 g. Dimensions: 12.6 cm x 11.0 cm x 5.6 cm (inv. no. 2518) - Bolliger Schreyer *et al.* 2004, Taf. 224.2518.
419. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 604.2 g. Dimensions: 7.8 cm x 8.3 cm x 7.5 cm (inv. no. 2517) - Bolliger Schreyer *et al.* 2004, Taf. 224.2517.
420. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 1,005.1 g. Dimensions: 11.0 cm x 8.0 cm x 8.3 cm (inv. no. 2516) - Bolliger Schreyer *et al.* 2004, Taf. 224.2516.

Sub-variant 2.B: Bi-troncoconical (cat. no. 421-438)

421. Frankfurt "Nussweg" [site no. 151, burial] (Frankfurt (Oder), Brandenburg, Germany). Undetermined chronology (Bronze Age) - Complete. Stone (sandstone). Mass: 132.59 g. Dimensions: 5.0 cm x 5.0 cm x 3.6 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 1992-626/21) - Unpublished.
422. Wilmersdorf [site no. 155, burial] (Dahme-Spreewald, Brandenburg, Germany). Grave 99-103 (one of five graves). Phase 4 (Period IV-V) - Part of a set of 3 weights (cat. no. 287, 422, 450). - Complete. Stone. Mass: 123.4 g. Dimensions: 5.4 cm x 5.4 cm x 2.7 cm - Museum für Vor- und Frühgeschichte Berlin (inv. no. If 6651) - Busse 1900, 55.
423. Starkowo [site no. 184, unknown context] (formerly in Bomst, Brandenburg, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 120.2 g. Dimensions: 5.4 cm x 5.4 cm x 2.6 cm - Museum für Vor- und Frühgeschichte Berlin (inv. no. Id 473a) - Unpublished.
424. Germany (unknown provenance) [n/a, unknown context] (Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 127 g. Dimensions: 5.6 cm x 5.5 cm x 2.6 cm - Museum für Vor- und Frühgeschichte Berlin (inv. no. Id 684a) - Unpublished.
425. Schönermark [site no. 167, unknown context] (Angermünde, Uckermark, Brandenburg, Germany). Undetermined chronology (Bronze Age) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 87.78 g (82.98 g). Dimensions: 5.1 cm x 5.5 cm x 2.9 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 1965:23/75/2) - Unpublished.
426. Linden [site no. 181, unknown context] (Dithmarschen, Schleswig-Holstein, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 202.4 g. Dimensions: 6.2 cm x 5.9 cm x 3.6 cm - Museumsinsel Schloss Gottorf, Schleswig (inv. no. SH1920-5.1) - Unpublished.
427. Moscosi Piano Fonte Marcosa [site no. 26, settlement] (Cingoli, Macerata, Marche, Italy). PFM 92, AA 16, US 193b. Phase 3 (MBA-RBA) - Fragmented. Stone (limestone). Mass: n/a (340.78 g). Dimensions: 8.2 cm x 7.5 cm x 3.9 cm - Biblioteca Comunale di Cingoli (MC) - Unpublished.
428. Krampnitz [site no. 153, hoard] (Potsdam, Brandenburg, Germany). Found together with pottery sherds and "wood coal" (possibly a burial?). Phase 4 (Period IV) - Associations: spearhead, awl, fibula, 2 bracelets, 3 rings, hook, 3 bronze spirals, 4 sickle fragments, 3 rod fragments - Complete. Stone (sandstone). Mass: 112.23 g. Dimensions: 5.4 cm x 5.1 cm x 3.1 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 1001:3864) - Reinbacher 1956, Taf. 29.g.
429. Germany (unknown provenance) [n/a, unknown context] (Germany). Undetermined chronology (Bronze Age) - Complete. Stone (sandstone). Mass: 297.84 g. Dimensions: 6.9 cm x 6.9 cm x 4.5 cm - Brandenburgisches Landesamt für Denkmalpflege und archäologisches Landesmuseum (inv. no. ON 229) - Unpublished.
430. Insel Werd [site no. 98, settlement] (Eschenz, Thurgau, Switzerland). Feld VIII. Phase 4 (Ha A-B) - Complete. Stone. Mass: 939.8 g. Dimensions: 7.0 cm x 10.1 cm (inv. no. 1234) - Brem *et al.* 1987, Abb. 22.B12.
431. Kochendorf [site no. 183, unknown context] (Windeby, Rendsburg-Eckenförde, Schleswig-Holstein, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 453.9 g. Dimensions: 7.8 cm x 8.2 cm x 4.7 cm - Museumsinsel Schloss Gottorf, Schleswig (inv. no. SH1837-5.1) - Unpublished.

432. Tungendorf [site no. 178, unknown context] (Neumünster, Schleswig-Holstein, Germany). Undetermined chronology (LBA) - Complete. Stone. Mass: 475.2 g. Dimensions: 7 cm x 7 cm x 6 cm - Museumsinsel Schloss Gottorf, Schleswig (inv. no. SH1936-31.1) - Unpublished.
433. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 885.1 g. Dimensions: 10.3 cm x 10.5 cm x 5.9 cm - Leuvrey 1999, pl. 83.1.
434. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 858.7 g. Dimensions: 9.7 cm x 9.9 cm x 5.2 cm - Leuvrey 1999, pl. 83.3.
435. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 969.5 g. Dimensions: 10.1 cm x 10.3 cm x 7.5 cm (inv. no. 2514) - Bolliger Schreyer *et al.* 2004, Taf. 223.2514.
436. Borstel [site no. 175, unknown context] (Sülfeld, Segeberg, Schleswig-Holstein, Germany). Fundplatz R8. Undetermined chronology (MBA-LBA) - Fragmented (reconstructed in 3D). Stone (quartzite). Mass: 998.36 g (982 g). Dimensions: 9.7 cm x 10.3 cm x 7.4 cm - Archäologisches Museum Hamburg (inv. no. HM 63552) - Unpublished.
437. Dollrottfeld [site no. 186, unknown context] (Süderbraup, Schleswig-Flensburg, Schleswig-Holstein, Germany). Undetermined chronology (LBA) - Complete. Stone. Mass: 1,131.8 g. Dimensions: 9.3 cm x 9.0 cm x 8.9 cm - Museumsinsel Schloss Gottorf, Schleswig (inv. no. SH1959-24.1) - Unpublished.
438. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 876.9 g. Dimensions: 10.8 cm x 9.25 cm x 5.9 cm - Bern, Bernisches Historisches Museum (inv. no. BHM 7876) - Bernatzky-Goetze 1987, 208, Taf. 166.2.

Sub-variant 2.C: Lenticular (cat. no. 439-482)

439. Germany (unknown provenance) [n/a, unknown context] (Germany). Undetermined chronology (Bronze Age) - Fragmented. Stone (granite?). Mass: n/a (358.59 g). Dimensions: 6.7 cm x 6.9 cm x 5.5 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. ON240) - Unpublished.
440. Germany (unknown provenance) [n/a, unknown context] (Germany). Undetermined chronology (Bronze Age) - Complete. Stone (sandstone). Mass: 236.27 g. Dimensions: 6.0 cm x 6.1 cm x 4.2 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. ON 223) - Unpublished.
441. Felchow [site no. 164, settlement] (Uckermark, Brandenburg, Germany). Undetermined chronology (Bronze Age) - Complete. Stone (sandstone). Mass: 179.95 g. Dimensions: 5.4 cm x 5.7 cm x 3.9 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 2006-1023/2) - Unpublished.
442. Kleinflintbeck [site no. 182, unknown context] (Flintbeck, Rendsburg-Eckernförde, Schleswig-Holstein, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 347.2 g. Dimensions: 7.0 cm x 6.9 cm x 4.8 cm - Museumsinsel Schloss Gottorf, Schleswig (inv. no. SH1483-1.1) - Unpublished.
443. Hamburg-Marmstorf [site no. 174, unknown context] (Hamburg, Germany). Undetermined chronology (MBA-LBA) - Complete. Stone (quartzite). Mass: 330.18 g. Dimensions: 7.3 cm x 7.5 cm x 4.1 cm - Archäologisches Museum Hamburg (inv. no. V54:375) - Unpublished.
444. Greifensee-Böschen [site no. 91, settlement] (Zürich, Switzerland). Feld H, Fundkomplex 2438. Phase 4 (Ha A-B) - Complete. Stone. Mass: 256 g. Dimensions: 6.5 cm x 6.0 cm x 4.4 cm (inv. no. 1017) - Eberschweiler *et al.* 2007, Taf. 107.1017.
445. Hitzacker [site no. 168, settlement] (Lüchow-Dannenberg, Niedersachsen, Germany). Fundstelle 10. Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 235.2 g. Dimensions: 6.8 cm x 6.6 cm x 3.2 cm - Niedersächsisches Landesamt für Denkmalpflege (inv. no. 6903) - Unpublished.
446. Klein Görigk [site no. 144, settlement] (Neupetershain, Oberspreewald-Lausitz, Brandenburg, Germany). Pit 265, Bottom. Phase 4 (Period IV-V) - Complete. Stone (sandstone). Mass: 194.28 g. Dimensions: 5.7 cm x 5.9 cm x 3.4 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 2006-760) - Uhl/Bönisch 2007, fig. 171.
447. Klockow [site no. 171, settlement] (Uckermark, Brandenburg, Germany). Undetermined chronology (Bronze Age) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 119.05 g (66.6 g). Dimensions: 3.7 cm x 6.2 cm x 3.1 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 2008-700) - Unpublished.
448. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 125.2 g. Dimensions: 6.05 cm x 5.4 cm x 3.5 cm - Bern, Bernisches Historisches Museum (inv. no. BHM 7503) - Bernatzky-Goetze 1987, 208, Taf. 167.6.
449. Berlin-Rahnsdorf [site no. 152, burial] (Berlin, Germany). Grave 79. Phase 4 (Period IV-V) - Associations: pin with biconical head - Complete. Stone. Mass: n/a. Dimensions: 2.0 cm x 5.4 cm x 5.6 cm - Seyer 1967, fig. 1.c.
450. Wilmersdorf [site no. 155, burial] (Dahme-Spreewald, Brandenburg, Germany). Grave 99-103 (one of five graves). Phase 4 (Period IV-V) - Part of a set of 3 weights (cat. no. 287, 422, 450). Complete. Stone. Mass: n/a - Museum für Vor- und Frühgeschichte Berlin - Busse 1900, 55.
451. Hauterive-Champréveyres [site no. 76, settlement] (Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 786.5 g. Dimensions: 8.5 cm x 8.4 cm x 5.9 cm - Leuvrey 1999, pl. 80.3.

452. Wankendorf [site no. 179, unknown context] (Plön, Schleswig-Holstein, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 616.9 g. Dimensions: 7.6 cm x 7.6 cm x 7.2 cm - Museumsinsel Schloss Gottorf, Schleswig (inv. no. SH1875-3.1) - Unpublished.
453. Moisburg [site no. 172, unknown context] (Harburg, Hamburg, Germany). Undetermined chronology (MBA-LBA) - Complete. Stone (granite). Mass: 579.34 g. Dimensions: 8.2 cm x 8.8 cm x 5.8 cm - Archäologisches Museum Hamburg (inv. no. 60885) - Unpublished.
454. Greifensee-Böschen [site no. 91, settlement] (Zürich, Switzerland). Feld R, Fundkomplex 2860. Phase 4 (Ha A-B) - Fragmented. Stone (quarzite). Mass: n/a (764 g). Dimensions: 9.1 cm x 9.1 cm x 5.8 cm (inv. 1019) - Eberschweiler *et al.* 2007, taf. 107.1019.
455. Greifensee-Böschen [site no. 91, settlement] (Zürich, Switzerland). Feld T, Fundkomplex 3580. Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 714 g. Dimensions: 9.2 cm x 8.7 cm x 6.1 cm (inv. no. 1018) - Eberschweiler *et al.* 2007, Taf. 107.1018.
456. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 1,204.1 g. Dimensions: 11.8 cm x 10.3 cm x 6.7 cm (inv. no. 2513) - Bolliger Schreyer *et al.* 2004, Taf. 223.2513.
457. Hauterive-Champréveyres [site no. 76, settlement] (Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Fragmented. Stone. Mass: n/a (847.4 g). Dimensions: 10.0 cm x 10.4 cm x 5.8 cm - Leuvrey 1999, pl. 80.4.
458. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 982.9 g. Dimensions: 10.5 cm x 8.4 cm x 7.7 cm - Leuvrey 1999, pl. 81.2.
459. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Fragmented. Stone. Mass: n/a (914.2 g). Dimensions: 11.0 cm x 10.0 cm x 5.6 cm - Leuvrey 1999, pl. 82.1.
460. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 854.8 g. Dimensions: 9.7 cm x 9.9 cm x 6.7 cm - Leuvrey 1999, pl. 82.2.
461. Stepnitzer Moor [site no. 176, unknown context] (Kammin, Vorpommern-Greifswald, Mecklenburg-Vorpommern, Germany). Undetermined chronology (Ha A-B) - Fragmented (reconstructed in 3D). Stone (sandstone?). Mass: 1,394.77 g (1,355 g). Dimensions: 12.5 cm x 12.5 cm x 7.0 cm - Museum für Vor- und Frühgeschichte Berlin (inv. no. MM II 7362) - Unpublished.
462. Hauterive-Champréveyres [site no. 76, settlement] (Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 923.2 g. Dimensions: 11.6 cm x 10.8 cm x 5.2 cm - Leuvrey 1999, pl. 80.2.
463. Hitzacker [site no. 168, settlement] (Lüchow-Dannenberg, Niedersachsen, Germany). Fundstelle 10. Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 905.6 g. Dimensions: 9.4 cm x 9.6 cm x 6.1 cm - Niedersächsisches Landesamt für Denkmalpflege (inv. no. 663-7) - Unpublished.
464. Unknown [n/a, unknown context] (north-western Germany, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 752.9 g. Dimensions: 9.1 cm x 9.5 cm x 5.5 cm - Museum für Vor- und Frühgeschichte Berlin (inv. no. Ug. 20294) - Unpublished.
465. Fleestedt [site no. 173, unknown context] (Harburg, Hamburg, Germany). Fundplatz 3/1. Undetermined chronology (MBA-LBA) - Complete. Stone (granite). Mass: 779 g. Dimensions: 9.3 cm x 9.7 cm x 5.4 cm - Archäologisches Museum Hamburg (inv. no. V61:35) - Unpublished.
466. Insel Werd [site no. 98, settlement] (Eschenz, Thurgau, Switzerland). Feld X. Phase 4 (Ha A-B) - Complete. Stone. Mass: 918 g. Dimensions: 6 cm x 10 cm x 10 cm (inv. no. 6203) - Brem *et al.* 1987, Abb. 22.B13.
467. Cortaillod-Est [site no. 70, settlement] (Station Est, Neuchâtel, Switzerland). Phase 4 (Ha B2) - Complete. Stone. Mass: 810 g. Dimensions: 10.1 cm x 10.1 cm x 5.8 cm - Latènium, Hauterive (inv. no. Cort. 1593) - Ribaux 1986, 95, Taf. 16.25.
468. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 909 g. Dimensions: 10.5 cm x 9.8 cm x 5.8 cm - Bern, Bernisches Historisches Museum (inv. no. BHM 7875) - Bernatzky-Goetze 1987, 208, Taf. 166.1.
469. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 917.5 g. Dimensions: 10.1 cm x 10.0 cm x 5.8 cm - Bern, Bernisches Historisches Museum (inv. no. BHM 7881) - Bernatzky-Goetze 1987, 208, Taf. 166.6.
470. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 900.9 g. Dimensions: 9.1 cm x 9.0 cm x 5.9 cm - Bern, Bernisches Historisches Museum (inv. no. BHM 7880) - Bernatzky-Goetze 1987, 208, Taf. 167.1.
471. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 945.8 g. Dimensions: 10.05 cm x 9.65 cm x 5.8 cm - Bern, Bernisches Historisches Museum (inv. no. BHM 7884) - Bernatzky-Goetze 1987, 208, Taf. 167.2.
472. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,313.1 g. Dimensions: 11.85 cm x 11.6 cm x 5.75 cm - Bern, Bernisches Historisches Museum (inv. no. BHM 7879) - Bernatzky-Goetze 1987, 208, Taf. 166.5.
473. Hitzacker [site no. 168, settlement] (Lüchow-Dannenberg, Niedersachsen, Germany). Fundstelle 10. Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 1,245 g. Dimensions: 12.2 cm x 13.3 cm x 4.9 cm - Niedersächsisches Landesamt für Denkmalpflege (inv. no. 7062) - Unpublished.

474. Kampen [site no. 188, unknown context] (Sylt, Nordfriesland, Schleswig-Holstein, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 1,432.2 g. Dimensions: 13.2 cm x 13.2 cm x 6.1 cm - Museumsinsel Schloss Gottorf, Schleswig (inv. no. SH9999-195.1) - Unpublished.
475. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,428.6 g. Dimensions: 10.75 cm x 10.4 cm x 8.7 cm - Bern, Bernisches Historisches Museum (inv. no. BHM 7878) - Bernatzky-Goetze 1987, 208, Taf. 166.4.
476. Unknown [n/a, unknown context] (Brandenburg, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 2,788.2 g. Dimensions: 15.2 cm x 14.9 cm x 9.4 cm - Museum für Vor- und Frühgeschichte Berlin (inv. no. SM 2017-01964) - Unpublished.
477. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Complete. Stone (sandstone). Mass: 934.1 g. Dimensions: 10.4 cm x 9.4 cm x 8.1 cm (inv. no. 2508) - Bolliger Schreyer *et al.* 2004, Taf. 223.2508.
478. Wittnau [site no. 92, settlement] (Wittnauer Horn, Aargau, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: n/a - Rheinfelden, Museum - Bersu 1945, Taf. 35.3.
479. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 886.6 g. Dimensions: 9.1 cm x 8.8 cm x 7.6 cm - Leuvrey 1999, pl. 83.2.
480. Schleswig [site no. 185, unknown context] (Schleswig-Flensburg, Schleswig-Holstein, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 177.5 g. Dimensions: 5.8 cm x 5.7 cm x 3.9 cm - Museumsinsel Schloss Gottorf, Schleswig (inv. no. SH1877-2.1) - Unpublished.
481. Kölpinsee [site no. 177, unknown context] (Mecklenburgische Seenplatte, Mecklenburg-Vorpommern, Germany). Undetermined chronology (LBA) - Complete. Stone (sandstone). Mass: 121.8 g. Dimensions: 5.6 cm x 5.9 cm x 2.2 cm - Museum für Vor- und Frühgeschichte Berlin - Unpublished.
482. Schlieben [site no. 146, unknown context] (Elbe-Elster, Brandenburg, Germany). Undetermined chronology (Ha A-B) - Complete. Stone. Mass: 235.92 g. Dimensions: 6.4 cm x 6.4 cm x 4.1 cm - Museum für Vor- und Frühgeschichte Berlin (inv. no. II 106) - Unpublished.

Sub-variant 2.D: Multiple horizontal grooves (cat. no. 483-490)

483. Battaune [site no. 143, burial] (Doberschütz, Nordsachsen, Sachsen, Germany). Grab 1. Phase 4 (Ha A-B) - Associations: 3 casting moulds - Complete. Stone (sandstone). Mass: n/a. Dimensions: 6 cm x 6 cm x 3 cm - Schmalfuss 2008, Taf. 2.7.
484. Bollensdorf [site no. 156, unknown context] (Neuenhagen bei Berlin, Märkisch-Oderland, Brandenburg, Germany). Undetermined chronology (Bronze Age) - Complete. Stone (sandstone). Mass: 185.1 g. Dimensions: 6.1 cm x 5.4 cm x 3.8 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 1975-1) - Unpublished.
485. Pritzen [site no. 145, burial] (Altdöbern, Oberspreewald-Lausitz, Brandenburg, Germany). Undetermined chronology (Bronze Age) - Complete. Stone (sandstone). Mass: 385.82 g. Dimensions: 8.2 cm x 7.9 cm x 3.9 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 1985-2/1/6/10) - Unpublished.
486. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,321 g. Dimensions: 11.65 cm x 10.7 cm x 6.9 cm - Bern, Bernisches Historisches Museum (inv. no. BHM 7877) - Bernatzky-Goetze 1987, 208, Taf. 166.3.
487. Zug-Sumpf [site no. 84, settlement] (Zug, Switzerland). Phase 4 (Ha A-B) - Fragmented. Stone (sandstone). Mass: n/a (974.3 g). Dimensions: 12.9 cm x 11.1 cm x 6.0 cm (inv. no. 2515) - Bolliger Schreyer *et al.* 2004, Taf. 223.2515.
488. Berlin, Weissensee, Hohenschoenhausen [site no. 159, unknown context] (Berlin, Germany). Undetermined chronology (Ha A-B) - Fragmented (reconstructed in 3D). Stone (granite?). Mass: 3,073.02 g (2,950 g). Dimensions: 16.4 cm x 16.4 cm x 8.6 cm - Museum für Vor- und Frühgeschichte Berlin (inv. no. Bez. 18) - Unpublished.
489. Cottbus-Schmellwitz [site no. 147, burial] (Brandenburg, Germany). Undetermined chronology (Br D-Ha A) - Associations: vases and 3 fragments of bronze sheet, burned with the human bones - Complete. Stone (sandstone). Mass: n/a. Dimensions: 5.3 cm x 8.5 cm x 8.9 cm - Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum (inv. no. 1996-58/6/1) - Meerheim 1998, fig. 3.5.
490. Merkendorf [site no. 180, unknown context] (Schashagen, Ostholstein, Schleswig-Holstein, Germany). Undetermined chronology (LBA) - Fragmented. Stone (sandstone). Mass: n/a (147.8 g). Dimensions: 6.5 cm x 6.9 cm x 3.1 cm - Museumsinsel Schloss Gottorf, Schleswig (inv. no. SH1919-3.1) - Unpublished.

Sub-variant 2.E: Transversal groove (cat. no. 491)

491. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 438.72 g. Dimensions: 9.0 cm x 6.6 cm x 4.0 cm - Museo Archeologico Etnografico Modena (inv. no. 7756) - Unpublished.

Unclassified objects (cat. no. 492-642)

- *number of objects*: 151
- *objects with known mass (complete/reconstructed)*: 151 (100 %)
- *chronological range*: Phase 2-4 (*c.* 1600-800 BCE)
- *material:* stone
- *39 sites:* site no. 35, 36, 37, 40, 41, 42, 44, 45, 47, 48, 50, 51, 56, 57, 60, 63, 64, 65, 69, 71, 72, 75, 77, 78, 79, 80, 81, 83, 86, 87, 88, 89, 90, 93, 94, 95, 96, 97, 169
- *mass range (complete/reconstructed):* 22.54-5,050,0 g

492. Basilicanova [site no. 42, settlement] (Parma, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 299 g - Cardarelli *et al.* 2001.
493. Peschiera del Garda [site no. 51, settlement] (Verona, Veneto, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 304 g (inv. L) - Cardarelli *et al.* 2001.
494. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 388 g (inv. no. 7722) - Cardarelli *et al.* 2001.
495. Peschiera del Garda [site no. 51, settlement] (Verona, Veneto, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 415 g (inv. H) - Cardarelli *et al.* 2001.
496. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 417 g (inv. no. 7715) - Cardarelli *et al.* 2001.
497. Casaroldo [site no. 47, settlement] (Mantova, Lombardia, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 419 g - Cardarelli *et al.* 2001.
498. Bellanda [site no. 50, settlement] (Gazoldo degli Ippoliti, Mantova, Lombardia, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 424 g (inv. no. 242/37) - Cardarelli *et al.* 2001.
499. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 442 g (inv. no. 7721) - Cardarelli *et al.* 2001.
500. Peschiera del Garda [site no. 51, settlement] (Verona, Veneto, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 443 g (inv. F) - Cardarelli *et al.* 2001.
501. Redù [site no. 41, settlement] (Nonantola, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 492 g (inv. no. R75554) - Cardarelli *et al.* 2001.
502. Cornocchio [site no. 45, settlement] (Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 494 g (inv. no. B 130) - Cardarelli *et al.* 2001.
503. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 520 g (inv. no. 7731) - Cardarelli *et al.* 2001.
504. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 520 g (inv. no. 7714) - Cardarelli *et al.* 2001.
505. Reggiano [n/a, settlement] (unknown provenance, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 525 g (inv. no. 1872) - Cardarelli *et al.* 2001.
506. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 539 g (inv. no. 7724) - Cardarelli *et al.* 2001.
507. Redù [site no. 41, settlement] (Nonantola, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 542 g (inv. no. 811) - Cardarelli *et al.* 2001, fig. 14.3.
508. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 546 g (inv. no. 217) - Cardarelli *et al.* 2001.
509. Gaggio di Castelfranco [site no. 40, settlement] (Modena, Emilia-Romagna, Italy). Phase 2 (MBA-RBA) - Complete. Stone. Mass: 548 g (inv. no. 22a) - Cardarelli *et al.* 2001.
510. Redù [site no. 41, settlement] (Nonantola, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 549 g (inv. no. 73865) - Cardarelli *et al.* 2001.
511. Gazzade [site no. 36, settlement] (Varese, Lombardia, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 559 g (inv. no. 190) - Cardarelli *et al.* 2001.
512. Savana di Cibeno [site no. 44, settlement] (Carpi, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 580 g - Cardarelli *et al.* 2001.
513. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 630 g (inv. no. 7772) - Cardarelli *et al.* 2001.
514. Gazzade [site no. 36, settlement] (Varese, Lombardia, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 633 g (inv. no. 193) - Cardarelli *et al.* 2001.
515. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 650 g (inv. no. 7752) - Cardarelli *et al.* 2001.
516. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 664 g (inv. no. 453) - Cardarelli *et al.* 2001.
517. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 850 g (inv. no. 7770) - Cardarelli *et al.* 2001.
518. Gazzade [site no. 36, settlement] (Varese, Lombardia, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 876 g (inv. no. 191) - Cardarelli *et al.* 2001.
519. Frattesina [site no. 48, settlement] (Fratta Polesine, Rovigo, Veneto, Italy). Phase 4 (RBA-FBA) - Fragmented. Stone. Mass: 385 g (inv. no. I.G. 328656) - Cardarelli *et al.* 2001.

520. Ramelsloh [site no. 169, unknown context] (Harburg, Hamburg, Germany). Undetermined chronology (MBA-LBA) - Complete. Stone. Mass: 1,350 g - Archäologisches Museum Hamburg - Unpublished.
521. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 729.1 g. Dimensions: 9.5 cm x 9.1 cm x 5.1 cm - Biel, Musée Schwab (inv. no. E 11378) - M. Trachsel database (unpublished).
522. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 260.1 g. Dimensions: 6.65 cm x 6.45 cm x 3.5 cm - Biel, Musée Schwab (inv. no. E 11370) - M. Trachsel database (unpublished).
523. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 259 g. Dimensions: 6.8 cm x 6.5 cm x 3.45 cm - Biel, Musée Schwab (inv. no. E 11368) - M. Trachsel database (unpublished).
524. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 471.4 g. Dimensions: 6.8 cm x 6.0 cm x 7.9 cm - Biel, Musée Schwab (inv. no. E 11473 (alte Nr. 2348)) - M. Trachsel database (unpublished).
525. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 759.6 g. Dimensions: 8.2 cm x 7.7 cm x 6.5 cm - Basel, Museum der Kulturen (inv. no. I 1326) - M. Trachsel database (unpublished).
526. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,119.7 g. Dimensions: 9.8 cm x 9.7 cm x 6.85 cm - Basel, Museum der Kulturen (inv. no. I 1325) - M. Trachsel database (unpublished).
527. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 908.3 g. Dimensions: 9.0 cm x 8.0 cm x 8.4 cm - Bern, Bernisches Historisches Museum (inv. no. 9096) - M. Trachsel database (unpublished).
528. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 276.4 g. Dimensions: 6.25 cm x 6.0 cm x 4.1 cm - Bern, Bernisches Historisches Museum (inv. no. 9098) - M. Trachsel database (unpublished).
529. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 872.4 g. Dimensions: 9.9 cm x 9.25 cm x 6.5 cm - Bern, Bernisches Historisches Museum (inv. no. 9097 (altes Etikett: B 245)) - M. Trachsel database (unpublished).
530. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 240.3 g. Dimensions: 5.4 cm x 4.85 cm x 5.45 cm - Bern, Bernisches Historisches Museum (inv. no. 9101) - M. Trachsel database (unpublished).
531. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 779.1 g. Dimensions: 7.85 cm x 7.25 cm x 8.65 cm - Bern, Bernisches Historisches Museum (inv. no. 9099) - M. Trachsel database (unpublished).
532. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 254.3 g. Dimensions: 5.95 cm x 5.0 cm x 5.55 cm - Bern, Bernisches Historisches Museum (inv. no. 9100) - M. Trachsel database (unpublished).
533. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 937.1 g. Dimensions: 9.35 cm x 8.3 cm x 8.0 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 6929) - M. Trachsel database (unpublished).
534. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 3,756.2 g. Dimensions: 21.7 cm x 14.8 cm x 8.0 cm - Lausanne, Musée d'Archéologie (inv. no. 13199) - M. Trachsel database (unpublished).
535. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 789.1 g. Dimensions: 10.15 cm x 9.0 cm x 5.7 cm - Lausanne, Musée d'Archéologie (inv. no. 12005) - M. Trachsel database (unpublished).
536. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 799.9 g. Dimensions: 11.0 cm x 11.0 cm x 4.1 cm - Lausanne, Musée d'Archéologie (inv. no. 13259) - M. Trachsel database (unpublished).
537. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 942.2 g. Dimensions: 10.35 cm x 10.05 cm x 6.4 cm - Lausanne, Musée d'Archéologie (inv. no. 10203) - M. Trachsel database (unpublished).
538. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 931.2 g. Dimensions: 10.1 cm x 10.1 cm x 7.7 cm - Lausanne, Musée d'Archéologie (inv. no. 10202.IV) - M. Trachsel database (unpublished).
539. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 834.4 g. Dimensions: 9.45 cm x 8.0 cm x 7.35 cm - Lausanne, Musée d'Archéologie (inv. no. 11904) - M. Trachsel database (unpublished).
540. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 870.6 g. Dimensions: 8.2 cm x 7.6 cm x 8.1 cm - Bern, Bernisches Historisches Museum (inv. no. 25872) - M. Trachsel database (unpublished).
541. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 852.1 g. Dimensions: 10.7 cm x 9.4 cm x 6.15 cm - Bern, Bernisches Historisches Museum (inv. no. 9764) - M. Trachsel database (unpublished).
542. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 791.2 g. Dimensions: 9.8 cm x 9.7 cm x 5.1 cm - Lausanne, Musée d'Archéologie (inv. no. 13273) - M. Trachsel database (unpublished).
543. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 829.3 g. Dimensions: 9.7 cm x 9.2 cm x 5.6 cm - Lausanne, Musée d'Archéologie (inv. no. 10093.IV) - M. Trachsel database (unpublished).

544. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 684 g. Dimensions: 9.9 cm x 9.7 cm x 4.5 cm - Lausanne, Musée d'Archéologie (inv. no. 10839 IV) - M. Trachsel database (unpublished).
545. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 889.2 g. Dimensions: 9.6 cm x 9.1 cm x 6.0 cm - Lausanne, Musée d'Archéologie (inv. no. 10204) - M. Trachsel database (unpublished).
546. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 266.1 g. Dimensions: 6.2 cm x 4.4 cm x 5.8 cm - Lausanne, Musée d'Archéologie (inv. no. 13504) - M. Trachsel database (unpublished).
547. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 836.3 g. Dimensions: 10.4 cm x 10.3 cm x 7.0 cm - Lausanne, Musée d'Archéologie (inv. no. 12582 IV.) - M. Trachsel database (unpublished).
548. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 914.3 g. Dimensions: 10.65 cm x 9.7 cm x 6.0 cm - Lausanne, Musée d'Archéologie (inv. no. 12760.IV) - M. Trachsel database (unpublished).
549. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 910.6 g. Dimensions: 10.5 cm x 9.9 cm x 6.9 cm - Lausanne, Musée d'Archéologie (inv. no. 10096.IV) - M. Trachsel database (unpublished).
550. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 864.7 g. Dimensions: 10.1 cm x 9.4 cm x 5.6 cm - Lausanne, Musée d'Archéologie (inv. no. 22682.IV) - M. Trachsel database (unpublished).
551. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 761.4 g. Dimensions: 10.0 cm x 9.6 cm x 6.35 cm - Lausanne, Musée d'Archéologie (inv. no. 20225.IV) - M. Trachsel database (unpublished).
552. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 978.9 g. Dimensions: 10.6 cm x 10.2 cm x 5.9 cm - Lausanne, Musée d'Archéologie (inv. no. 13749) - M. Trachsel database (unpublished).
553. Grandson-Corcelettes [site no. 60, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,179 g. Dimensions: 11.2 cm x 9.9 cm x 6.7 cm - Lausanne, Musée d'Archéologie (inv. no. 10095 IV) - M. Trachsel database (unpublished).
554. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 22.54 g. Dimensions: 3.1 cm x 3.0 cm x 1.6 cm - Bern, Bernisches Historisches Museum (inv. no. 7860) - M. Trachsel database (unpublished).
555. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 948.5 g. Dimensions: 9.5 cm x 9.35 cm x 5.8 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26093) - M. Trachsel database (unpublished).
556. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 922.8 g. Dimensions: 9.6 cm x 9.2 cm x 6.8 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26091) - M. Trachsel database (unpublished).
557. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 962.8 g. Dimensions: 9.4 cm x 9.3 cm x 7.7 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26092) - M. Trachsel database (unpublished).
558. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 729 g. Dimensions: 10.0 cm x 5.9 cm x 7.6 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26095) - M. Trachsel database (unpublished).
559. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 937.4 g. Dimensions: 9.7 cm x 9.4 cm x 6.0 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26101.X) - M. Trachsel database (unpublished).
560. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 953.9 g. Dimensions: 9.8 cm x 9.4 cm x 6.2 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26100) - M. Trachsel database (unpublished).
561. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 939 g. Dimensions: 9.55 cm x 8.9 cm x 6.75 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26099) - M. Trachsel database (unpublished).
562. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 927.9 g. Dimensions: 11.2 cm x 8.4 cm x 6.5 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26106) - M. Trachsel database (unpublished).
563. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 909.4 g. Dimensions: 10.3 cm x 9.8 cm x 6.65 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26105) - M. Trachsel database (unpublished).
564. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 953.7 g. Dimensions: 9.45 cm x 9.3 cm x 6.4 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26103) - M. Trachsel database (unpublished).
565. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 942.2 g. Dimensions: 8.95 cm x 8.35 cm x 7.7 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26102) - M. Trachsel database (unpublished).
566. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 944.1 g. Dimensions: 10.0 cm x 9.6 cm x 5.9 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26107.1 X (neu: 26104)) - M. Trachsel database (unpublished).
567. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 931.9 g. Dimensions: 9.4 cm x 9.2 cm x 7.2 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26107) - M. Trachsel database (unpublished).

568. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 955.9 g. Dimensions: 9.6 cm x 9.4 cm x 6.9 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26109) - M. Trachsel database (unpublished).
569. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 978.1 g. Dimensions: 9.7 cm x 9.5 cm x 6.7 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26114) - M. Trachsel database (unpublished).
570. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 900 g. Dimensions: 9.4 cm x 8.6 cm x 7.1 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26111) - M. Trachsel database (unpublished).
571. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 950.1 g. Dimensions: 9.4 cm x 9.3 cm x 8.3 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM A 26117) - M. Trachsel database (unpublished).
572. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 958.7 g. Dimensions: 10.5 cm x 10.3 cm x 7.3 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM A 26116) - M. Trachsel database (unpublished).
573. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 908.7 g. Dimensions: 10.7 cm x 9.5 cm x 6.45 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM A 26108) - M. Trachsel database (unpublished).
574. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 947.6 g. Dimensions: 9.45 cm x 9.4 cm x 7.2 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM A 26791) - M. Trachsel database (unpublished).
575. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 928 g. Dimensions: 9.4 cm x 9.3 cm x 6.05 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM A 26886.1 (neu: 26787)) - M. Trachsel database (unpublished).
576. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 911.5 g. Dimensions: 10.0 cm x 9.7 cm x 6.95 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM A 26794) - M. Trachsel database (unpublished).
577. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 981 g. Dimensions: 10.8 cm x 10.6 cm x 5.4 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM A 26835) - M. Trachsel database (unpublished).
578. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 891.1 g. Dimensions: 10.2 cm x 10.2 cm x 5.3 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM A 26795) - M. Trachsel database (unpublished).
579. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 876.9 g. Dimensions: 11.0 cm x 10.55 cm x 4.35 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM A 46575) - M. Trachsel database (unpublished).
580. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 719.5 g. Dimensions: 9.3 cm x 9.0 cm x 6.0 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26788) - M. Trachsel database (unpublished).
581. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,014.4 g. Dimensions: 11.2 cm x 8.8 cm x 6.2 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 26789) - M. Trachsel database (unpublished).
582. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha B1/2) - Complete. Stone. Mass: 861 g - Zürich, Kantonsarchäologie (inv. no. FK Q217) - M. Trachsel database (unpublished).
583. Zürich-Grosser Hafner [site no. 89, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 881.7 g. Dimensions: 8.85 cm x 8.5 cm x 6.5 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 47437) - M. Trachsel database (unpublished).
584. Zürich-Grosser Hafner [site no. 89, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 914.7 g. Dimensions: 10.4 cm x 9.4 cm x 6.7 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 11497) - M. Trachsel database (unpublished).
585. Zürich-Grosser Hafner [site no. 89, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 941.8 g. Dimensions: 10.3 cm x 9.9 cm x 5.0 cm - Zürich, Unterwasserarchäologie (inv. no. Zürich/Rb-Grosser Hafner 2000/R173) - M. Trachsel database (unpublished).
586. Zürich-Grosser Hafner [site no. 89, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 943.3 g. Dimensions: 9.8 cm x 9.5 cm x 6.6 cm - Zürich, Unterwasserarchäologie (inv. no. Zürich/Rb-Grosser Hafner 1998/R104) - M. Trachsel database (unpublished).
587. Zürich-Grosser Hafner [site no. 89, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 708.7 g. Dimensions: 9.6 cm x 6.5 cm x 8.7 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM A 74184 ("103" in rot)) - M. Trachsel database (unpublished).
588. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 933.9 g. Dimensions: 10.1 cm x 9.0 cm x 6.5 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1141) - M. Trachsel database (unpublished).
589. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 873.4 g. Dimensions: 10.0 cm x 9.9 cm x 7.2 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1139) - M. Trachsel database (unpublished).
590. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 966.6 g. Dimensions: 9.1 cm x 8.9 cm x 6.8 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1143) - M. Trachsel database (unpublished).
591. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 912.7 g. Dimensions: 10.85 cm x 9.0 cm x 7.35 cm

- Zürich, Schweizerisches Landesmuseum (inv. no. 1140) - M. Trachsel database (unpublished).
592. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 868.5 g. Dimensions: 10.1 cm x 9.9 cm x 5.6 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1146) - M. Trachsel database (unpublished).
593. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 958.9 g. Dimensions: 9.35 cm x 9.15 cm x 7.1 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1144) - M. Trachsel database (unpublished).
594. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 949.3 g. Dimensions: 10.6 cm x 9.9 cm x 5.3 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1147) - M. Trachsel database (unpublished).
595. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 960 g. Dimensions: 10.4 cm x 9.5 cm x 6.3 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1148) - M. Trachsel database (unpublished).
596. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 955.4 g. Dimensions: 9.55 cm x 9.3 cm x 7.7 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1142) - M. Trachsel database (unpublished).
597. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,382 g. Dimensions: 11.8 cm x 10.05 cm x 5.7 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1145) - M. Trachsel database (unpublished).
598. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 245.5 g. Dimensions: 6.8 cm x 6.8 cm x 3.15 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1151) - M. Trachsel database (unpublished).
599. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 260 g. Dimensions: 6.5 cm x 5.4 cm x 4.8 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1149) - M. Trachsel database (unpublished).
600. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 228.5 g. Dimensions: 6.3 cm x 5.75 cm x 4.1 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 1150) - M. Trachsel database (unpublished).
601. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 748.5 g. Dimensions: 8.4 cm x 8.2 cm x 7.2 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 30473) - M. Trachsel database (unpublished).
602. Andelfingen [site no. 94, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 898.8 g. Dimensions: 9.9 cm x 5.7 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 2308) - M. Trachsel database (unpublished).
603. Autavaux [site no. 64, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 863.8 g. Dimensions: 10.1 cm x 9.8 cm x 5.0 cm - Fribourg, SACF (inv. no. MAHF 2883) - M. Trachsel database (unpublished).
604. Avenches [site no. 65, settlement] (Eau Noir, Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 853.5 g. Dimensions: 10.0 cm x 9.7 cm x 5.5 cm - Lausanne, Musée d'Archéologie (inv. no. 33387 VII) - M. Trachsel database (unpublished).
605. Berg am Irchel [site no. 93, settlement] (Ebersberg, Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 890.6 g. Dimensions: 9.7 cm x 9.5 cm x 5.6 cm - Zürich, Schweizerisches Landesmuseum (inv. no. SLM 2303.8) - M. Trachsel database (unpublished).
606. Bevaix [site no. 69, settlement] (Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 801.1 g. Dimensions: 9.2 cm x 8.8 cm x 5.95 cm - Biel, Musée Schwab (inv. no. BX 8127 (alte Nr. 2555)) - M. Trachsel database (unpublished).
607. Eschenz [site no. 97, settlement] (Thurgau, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: n/a - M. Trachsel database (unpublished).
608. Forel [site no. 56, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 782.1 g. Dimensions: 9.6 cm x 8.9 cm x 5.4 cm - Biel, Musée Schwab (inv. without no.) - M. Trachsel database (unpublished).
609. Guévaux [site no. 71, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 831.3 g. Dimensions: 8.45 cm x 8.2 cm x 8.1 cm - Lausanne, Musée d'Archéologie (inv. no. 10742.VI) - M. Trachsel database (unpublished).
610. Haut-Vully [site no. 72, settlement] (Guévaux, Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 821.6 g. Dimensions: 8.1 cm x 7.8 cm x 7.2 cm - Biel, Musée Schwab (inv. no. GX 21091) - M. Trachsel database (unpublished).
611. Haut-Vully [site no. 72, settlement] (Guévaux, Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 876.9 g. Dimensions: 9.1 cm x 6.75 cm x 8.8 cm - Biel, Musée Schwab (inv. no. GX 21090) - M. Trachsel database (unpublished).
612. Ins [site no. 75, settlement] (Witzwil, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 277 g - Witzwil, Strafanstalt - M. Trachsel database (unpublished).
613. Le Landeron [site no. 78, settlement] (Grand Marais, Neuchâtel, Switzerland). Phase 4 (Ha B2) - Complete. Stone. Mass: 810 g - Fribourg, Musée d'Art et d'Histoire (inv. no. Le La 1968, 440, H 12) - M. Trachsel database (unpublished).
614. Meilen [site no. 86, settlement] (Rohrenhaab, Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 949.1 g. Dimensions: 9.5 cm x 9.3 cm x 6.0 cm - Zürich, Unterwasserarchäologie (inv. no. Meilen-Rohrenhaab 1999/D78) - M. Trachsel database (unpublished).
615. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,374.2 g. Dimensions: 10.0 cm x 7.6 cm x 11.6 cm - Zürich, Schweizerisches Landesmuseum (inv. no. 87443 (alt: 69; 183 (Tabula ansata) und A 779)) - M. Trachsel database (unpublished).

616. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 728.5 g. Dimensions: 7.85 cm x 7.85 cm x 6.65 cm - Biel, Musée Schwab (inv. no. N 13816) - M. Trachsel database (unpublished).
617. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 969.1 g. Dimensions: 10.4 cm x 10.1 cm x 6.0 cm - Biel, Musée Schwab (inv. no. N 6257) - M. Trachsel database (unpublished).
618. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 272 g. Dimensions: 5.9 cm x 5.8 cm x 4.7 cm - Biel, Musée Schwab (inv. no. N 13120) - M. Trachsel database (unpublished).
619. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 733.9 g. Dimensions: 9.65 cm x 9.5 cm x 4.55 cm - Biel, Musée Schwab (inv. no. N 13580) - M. Trachsel database (unpublished).
620. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 907.5 g. Dimensions: 10.0 cm x 9.75 cm x 6.25 cm - Biel, Musée Schwab (inv. no. N 13114) - M. Trachsel database (unpublished).
621. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 924.9 g. Dimensions: 9 cm x 9 cm x 7 cm - Biel, Musée Schwab (inv. no. N 6258) - M. Trachsel database (unpublished).
622. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 953.2 g. Dimensions: 9.1 cm x 9.0 cm x 6.8 cm - Basel, Museum der Kulturen (inv. no. I 5635) - M. Trachsel database (unpublished).
623. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 941.9 g. Dimensions: 9.8 cm x 9.5 cm x 6.1 cm - Basel, Museum der Kulturen (inv. no. I 5636) - M. Trachsel database (unpublished).
624. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 78.6 g. Dimensions: 5.2 cm x 4.95 cm x 2.1 cm - Basel, Museum der Kulturen (inv. no. I 6670) - M. Trachsel database (unpublished).
625. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 138.2 g. Dimensions: 5.5 cm x 5.4 cm x 3.6 cm - Basel, Museum der Kulturen (inv. no. I 6671) - M. Trachsel database (unpublished).
626. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,222.2 g. Dimensions: 12.0 cm x 11.6 cm x 5.8 cm - Basel, Museum der Kulturen (inv. no. I 6677) - M. Trachsel database (unpublished).
627. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 878.9 g. Dimensions: 9.9 cm x 8.9 cm x 6.2 cm - Biel, Musée Schwab (inv. no. 9743 (alte Nr. 82)) - M. Trachsel database (unpublished).
628. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,374.2 g. Dimensions: 11.1 cm x 10.9 cm x 7.1 cm - Biel, Musée Schwab (inv. no. 9744 (alte Nr. 83)) - M. Trachsel database (unpublished).
629. Nidau [site no. 80, settlement] (Steinberg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 848 g. Dimensions: 10.4 cm x 9.9 cm x 6.5 cm - Biel, Musée Schwab (inv. no. 9745 (alte Nr. 84)) - M. Trachsel database (unpublished).
630. Port [site no. 83, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 2,105.4 g. Dimensions: 18.5 cm x 10.8 cm x 7.1 cm - Biel, Musée Schwab (inv. no. Port 1936) - M. Trachsel database (unpublished).
631. Saint-Blaise [site no. 77, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 252 g. Dimensions: 6.85 cm x 6.5 cm x 3.55 cm - Basel, Museum der Kulturen (inv. no. I 6235) - M. Trachsel database (unpublished).
632. Savognin [site no. 57, settlement] (Padnal, Graubünden, Switzerland). Phase 4 (Ha B) - Complete. Stone. Mass: 433.5 g. Dimensions: 6.4 cm x 6.3 cm x 6.4 cm - Haldenstein, ADG (inv. no. Sp 72/50) - M. Trachsel database (unpublished).
633. Scherzingen [site no. 96, settlement] (westl. des Klosters Münsterlingen (735240/277080), Thurgau, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,410 g. Dimensions: 13.1 cm x 10.0 cm x 7.0 cm - Private collection - M. Trachsel database (unpublished).
634. Twann [site no. 81, settlement] (St. Petersinsel, Heidenweg, Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 243.8 g. Dimensions: 6.5 cm x 6.3 cm x 3.7 cm - Bern, Bernisches Historisches Museum (inv. no. 8993) - M. Trachsel database (unpublished).
635. Ürschhausen [site no. 95, settlement] (Horn, Thurgau, Switzerland). Phase 4 (Ha B3) - Complete. Stone. Mass: 718.3 g. Dimensions: 10.4 cm x 9.1 cm x 6.3 cm - Frauenfeld, Kantonsarchäologie (inv. no. ÜH-70-27) - M. Trachsel database (unpublished).
636. Ürschhausen [site no. 95, settlement] (Horn, Thurgau, Switzerland). Phase 4 (Ha B3) - Complete. Stone. Mass: 773 g - Frauenfeld, Kantonsarchäologie (inv. no. ÜH-85-134.1) - M. Trachsel database (unpublished).
637. Ürschhausen [site no. 95, settlement] (Horn, Thurgau, Switzerland). Phase 4 (Ha B3) - Complete. Stone. Mass: 899 g. Dimensions: 9.85 cm x 9.45 cm x 5.55 cm - Frauenfeld, Kantonsarchäologie (inv. no. ÜH-86-1221.4) - M. Trachsel database (unpublished).
638. Ürschhausen [site no. 95, settlement] (Horn, Thurgau, Switzerland). Phase 4 (Ha B3) - Complete. Stone. Mass: 187 g - Frauenfeld, Kantonsarchäologie (inv. no. ÜH-85-646.2) - M. Trachsel database (unpublished).
639. Uster-Riedikon [site no. 87, settlement] (zwischen Uster und Riedikon, Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 5,050 g. Dimensions: 21.7 cm x 12.4 cm x 11.3 cm - Zürich, Schwei-

zerisches Landesmuseum (inv. no. 2375 (“12” in rot)) - M. Trachsel database (unpublished).

640. Switzerland (unknown provenance) [n/a, unknown context] (unknown provenance, Switzerland). Undetermined chronology (Ha A-B) - Complete. Stone. Mass: 1,378.5 g. Dimensions: 12.2 cm x 10.9 cm x 6.8 cm - Lausanne, Musée d’Archéologie (inv. without no.) - M. Trachsel database (unpublished).

641. Switzerland (unknown provenance) [n/a, unknown context] (unknown provenance, Switzerland). Undetermined chronology (Ha A-B) - Complete. Stone. Mass: 715.2 g. Dimensions: 9.5 cm x 8.65 cm x 5.6 cm - Lausanne, Musée d’Archéologie (inv. without no.) - M. Trachsel database (unpublished).

642. Switzerland (unknown provenance) [n/a, unknown context] (unknown provenance, Switzerland). Undetermined chronology (Ha A-B) - Complete. Stone. Mass: 1,005.1 g. Dimensions: 9.3 cm x 8.6 cm x 8.0 cm - Murten, Museum (inv. no. Fu 2827) - M. Trachsel database (unpublished).

5.14. PIRIFORM

- *number of objects*: 58
- *objects with known mass (complete/reconstructed)*: 49 (84.5 %).
- *chronological range*: Phase 2-4 (*c.* 1600-800 BCE)
- *material:* stone (55), copper/bronze (1), lead (2)
- *26 sites:* site no. 21, 24, 25, 26, 29, 30, 31, 33, 34, 35, 37, 39, 40, 41, 43, 51, 59, 60, 66, 67, 70, 74, 79, 90, 112, 117
- *mass range (complete/reconstructed):* 36.5-1,413.2 g

Distribution maps: fig. 5.41.-43.
Composition of the sample: fig. 5.44.-46.

Typology, materials, comparisons, and function

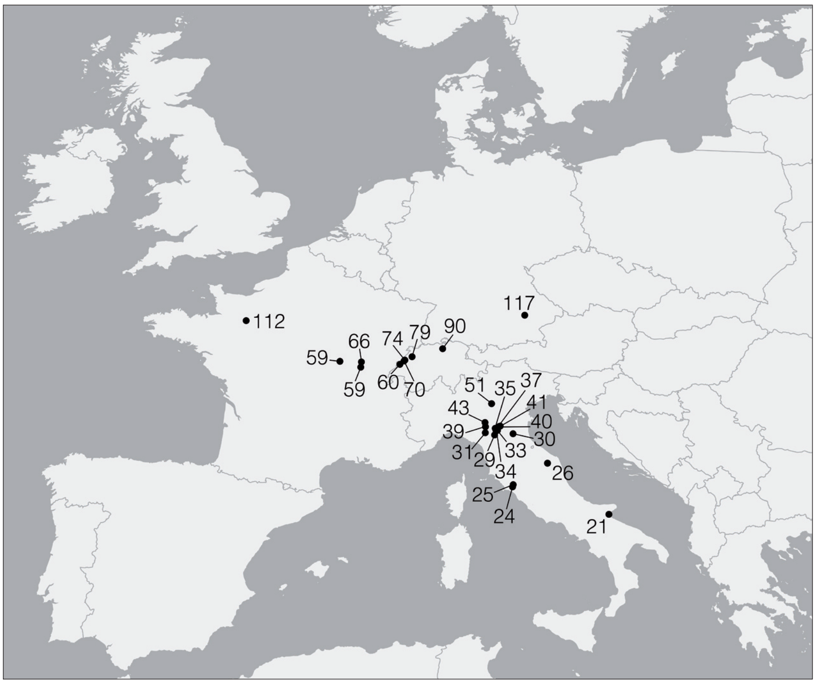
Piriform weights were first identified as a formal type by A. Cardarelli *et al.* (2001) in northern Italy. A roughly globular body (ranging from elongated/ovoid to squatted) and an upper protrusion (with or without perforation) give them their characteristic pear-shaped profile. Piriform weights are articulated into two main variants, based on the presence (Variant 1) or absence (Variant 2) of a perforation on the upper protrusion. The presence/absence of a perforation determines a partial difference in terms of functionality between the two variants. While both could be easily laid on balance pans, Variant 1 could also be hanged directly on one extremity of a balance beam.

Variant 1 is further subdivided into seven sub-variants, based on different decoration techniques. A further sub-variant groups smaller weights with upper perforation that vaguely resemble the general shape of bigger piriform weights (cat. no. 675-677). Object cat. no. 673 from the *Terramara* of Montale (Italy) has a small V-shaped sign incised on the body. However, there is no basis to interpret this sign as a quantity mark. Object cat. no. 674 from the *Terramara* of Gaggio di Castelfranco (Italy) provides an example of a possible restoration of a balance weight after fracture. Originally, the object had a perforated protrusion on top. After the protrusion was lost (either intentionally or accidentally), the fracture was polished and rendered smooth. In addition, an annular groove was carved across the vertical diameter, making the object very similar to a *Kannelurenstein*, and hence suggesting that piriform weights and *Kannelurensteine* were somehow interchangeable.

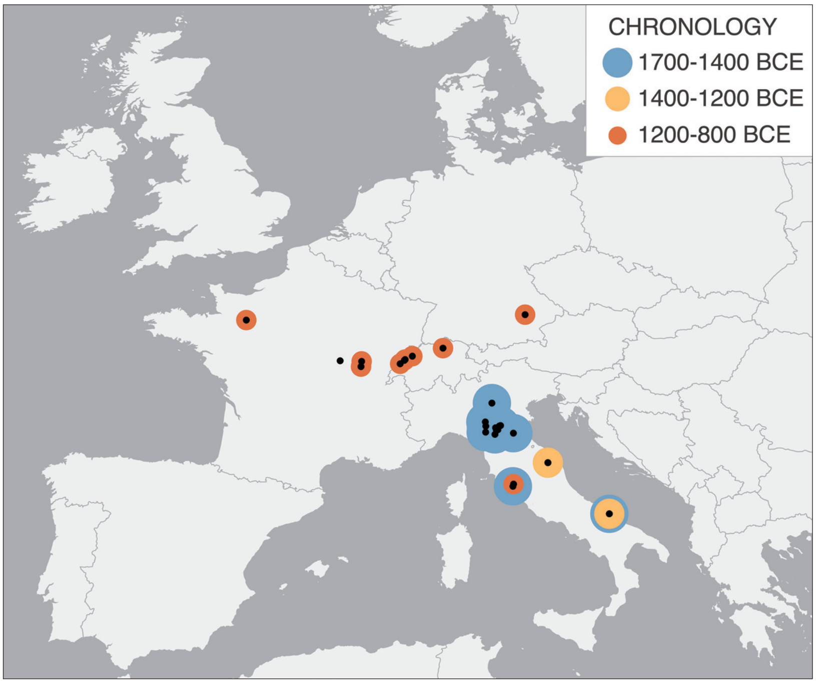
Variant 2 includes six stone objects with remarkably similar features, all presenting a globular body, no decoration, and a chiselled circular knob on the upper part (cat. no. 678-683). Object cat. no. 681 from the settlement of Moscosi - Piano Fonte Marcosa (Italy) provides a unique case of a likely unfinished weight. The object was only roughly modelled, with the final shaped only hinted at by the rudimentary upper protrusion. In total, seven piriform weights are recorded from the same site – three with perforation (cat. no. 646, 655, 661) and four without (cat. no. 678, 679, 680, 681) – all made of the same material, probably travertine.

There are finally 17 objects form Italian contexts mentioned in A. Cardarelli *et al.* (2001), for which images are not available and hence could not be classified.

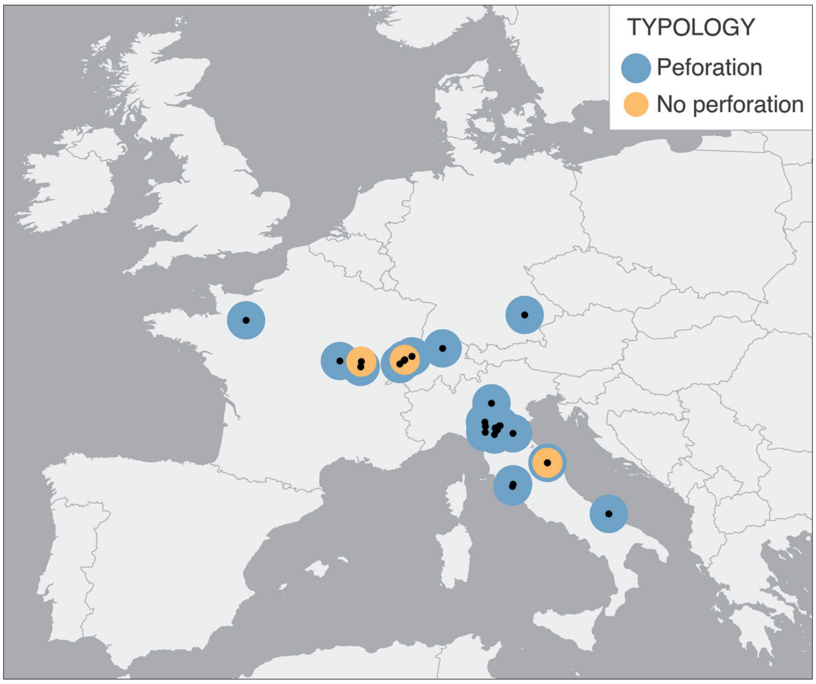
Most objects (55 out of 58) are made of stone (Fig. 5.45.). Two of them (652 from an unknown context in Ouroux-sur-Saône in France, and 653 from the pile-dwelling settlement of Grandson-Corcelettes, in Switzerland), have a metal loop attached on the top of the upper protrusion, in place of the more frequent perforation. Three objects are made of metal: cat. no. 658 (hoard of



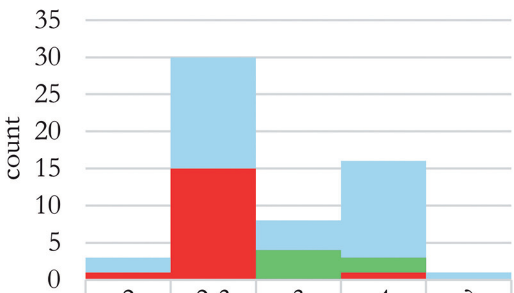
▲ *Fig. 5.41. Piriform weights. Geographical distribution: site ID.*



▲ *Fig. 5.42. Piriform weights. Geographical distribution: chronology.*



▲ *Fig. 5.43. Piriform weights. Geographical distribution: typology.*



	2	2-3	3	4	?
V1	2	15	4	13	1
V2			4	2	
?	1	15		1	

▲ *Fig. 5.44. Piriform weights. Quantification: typology vs chronology.*

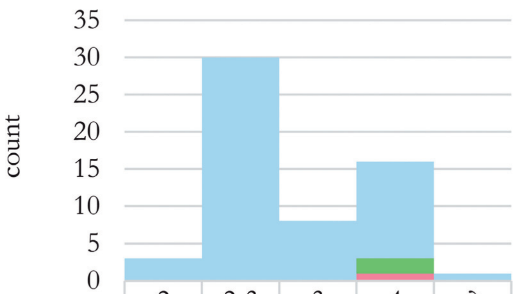
Saint-Léonard-des-Bois, eastern France) and cat. no. 684 (pile-dwelling settlement of Auvernier, Switzerland) are made of lead, while cat. no. 663 (pile-dwelling settlement of Cortaillod-Est, Switzerland) is made of bronze.

Piriform weights are not very common in the eastern Mediterranean and the Near East. Two lead piriform weights with upper knob without perforation are present in the Late Minoan I settlement at Tylissos (*c.* 1700-1400 BCE), in Crete (Petruso 1992, fig. 15.163-164), and are roughly contemporaneous with the earliest piriform weights from secure contexts in northern Italy (objects cat. no. 648, 674, 700). In Mesopotamia, the piriform shape is documented since the 3rd millennium BCE (Rahmstorf 2022, 285).

Chronology and geographical distribution

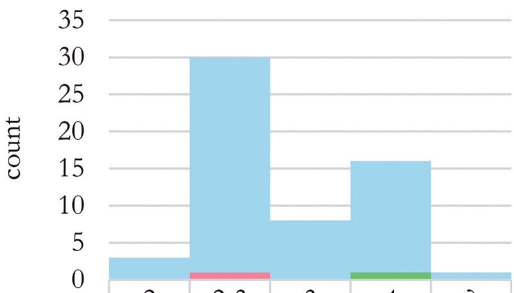
The earliest piriform weights are documented in the Terramara of Gaggio di Castelfranco (site no. 40), in northern Italy, in the MBA. Objects cat. no. 648 and 674 (both belonging to Variant 1) come from well-dated layers of the second occupation phase of the settlement (Balista *et al.* 2008), dating to the Italian MBA 2 (*c.* 1600-1500 BCE). In Phases 2-3 (*c.* 1600-1200 BCE), piriform weights are only documented in the Italian Peninsula (Fig. 5.42.). Several objects come from contexts dating between Phase 2 and 3 (MBA and RBA in Italian chronology), while well-dated contexts belonging to Phase 3 (*c.* 1350-1200 BCE) are located in central and southern Italy (sites no. 21, 26). North of the Alps, piriform weights are only documented in contexts dating to Phase 4 (Ha A-B, *c.* 1200-800 BCE), with a distribution area reaching northern France to the west, and southern Germany to the east. Most objects come from pile-dwelling settlements in Switzerland.

Based on available data, the earliest objects belonging to Variant 2 are documented in the Phase 3 site of Moscosi – Piano di Fonte Marcosa, in central Italy (site no. 21). However, since Variant 2 includes only six objects, it cannot be excluded that earlier ones are simply not documented yet.



	2	2-3	3	4	?
stone	3	30	8	13	1
lead				2	
bronze				1	

▲ *Fig. 5.45. Piriform weights. Quantification: materials vs chronology.*



	2	2-3	3	4	?
sett.	3	29	8	15	1
hoard				1	
cave		1			

▲ *Fig. 5.46. Piriform weights. Quantification: site type vs chronology.*

Contexts

Piriform weights are mostly documented in settlements, only once in a hoard, in one case in a cave, and never in burials (Fig. 5.46.). They never occur in sets. Most piriform weights come from old excavations, and lack specific indication of provenance. Only two objects are documented in closed settlement contexts with meaningful associations. In Gaggio di Casterlfranco (site no. 40, northern Italy), a piriform weight (cat. no. 674) comes from a sector of the settlement interpreted as an area devoted to metallurgy (dated to the MBA, *c.* 1600-1500 BCE), and is associated with two casting moulds (Balista *et al.* 2008). In the fortified settlement of Coppa Nevigata (site no. 21, southern Italy), a piriform weight (cat. no. 657) belonged to a tight concentration of finds located near the settlement's main gate. This concentration (dated to the RBA, *c.* 1350-1200 BCE), included a piriform weight, a bronze knife, 33 bronze studs, 5 bronze spirals, a decorated bone element, and perforated crystal sphere. The context was interpreted as a workshop (Cazzella/Recchia 2017).

Variant 1: With perforation (cat. no. 643-677)

- *number of objects:* 35
- *objects with known mass (complete/reconstructed)*: 29 (83 %)
- *chronological range*: Phase 2-4 (*c.* 1600-800 BCE)
- *material*: stone (33), copper/bronze (1), lead (1)
- *21 sites:* site no. 21, 25, 26, 29, 30, 31, 34, 35, 37, 40, 41, 43, 59, 60, 67, 70, 74, 79, 90, 112, 117
- *mass range (complete/reconstructed):* 36.5-1,413.2 g

Sub-variant 1.A: Plain (cat. no. 643-664)

643. Bismantova, settlement [site no. 31, settlement] (Castelnovo ne' Monti, Reggio Emilia, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone (sandstone). Mass: 391 g. Dimensions: 6.2 cm x 7.2 cm - Cardarelli *et al.* 2001, fig. 10.7.
644. Sorgenti della Nova [site no. 25, settlement] (Farnese, Viterbo, Lazio, Italy). Settore IV, cave, niche. Stratum 1B. Phase 4 (FBA 3) - Complete. Stone. Mass: n/a - Cremonesi 2006, tav. 2.6.
645. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Worn (reconstructed in 3D). Stone (sandstone). Mass: 296.54 g (294.24 g). Dimensions: 8.5 cm x 6.7 cm x 6.6 cm - Museo Archeologico Etnografico Modena (inv. no. 7743) - Unpublished.
646. Moscosi Piano Fonte Marcosa [site no. 26, settlement] (Cingoli, Macerata, Marche, Italy). PFM 86, Alpha, 91. 2. Phase 3 (MBA-RBA) - Fragmented. Stone (travertino). Mass: n/a (264.72 g). Dimensions: 6.0 cm x 6.3 cm x 6.1 cm - Museo Archeologico di Cingoli (inv. no. 52090) - Unpublished.
647. Landshut [site no. 117, settlement] (Bayern, Germany). Phase 4 (Ha A-B) - Complete. Stone. Mass: 777 g. Dimensions: 10.0 cm x 7.8 cm - Feth 2014, fig. 2.5.
648. Gaggio di Castelfranco [site no. 40, settlement] (Modena, Emilia-Romagna, Italy). Phase 2. Phase 2 (MBA) - Complete. Stone. Mass: 450 g - Balista *et al.* 2008, fig. 22.5; Cardarelli *et al.* 2004, fig. 1.7.
649. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,320 g. Dimensions: 11.6 cm x 9.6 cm x 9.6 cm - Feth 2014, fig. 2.6.
650. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 1,413.2 g. Dimensions: 5.9 cm x 5.0 cm x 4.6 cm (inv. no. 1804) - Leuvrey 1999, pl. 78.2.
651. San Giuliano in Toscanella [site no. 30, settlement] (Bologna, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone (limestone). Mass: 420 g. Dimensions: 6.9 cm x 6.7 cm x 6.7 cm (inv. no. 32759) - Cardarelli *et al.* 2001, fig. 10.6.
652. Ouroux-sur-Saône [site no. 59, settlement] (Saône-et-Loire, Bourgogne-Franche-Comté, France). Phase 4 (Ha A-B) - Attached metal hook. Complete. Stone. Mass: 741 g. Dimensions: 11.6 cm x 9.0 cm - Feth 2014, fig. 2.7.
653. Corcelettes [site no. 60, settlement] (Grandson, Vaud, Switzerland). Phase 4 (Ha A-B) - Attached metal hook. Complete. Stone. Mass: 922 g. Dimensions: 9.3 cm x 8.9 cm x 8.9 cm - Feth 2014, fig. 2.10.
654. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented. Stone (sandstone). Mass: n/a (453.62 g). Dimensions: 8.0 cm x 8.8 cm x 8.4 cm - Museo Archeologico Etnografico Modena (inv. no. 7724) - Unpublished.
655. Moscosi Piano Fonte Marcosa [site no. 26, settlement] (Cingoli, Macerata, Marche, Italy). PFM, Surface, Stray find. Phase 3 (MBA-RBA) - Complete. Stone (travertino). Mass: 446.82 g. Dimensions: 8.3 cm x 7.4 cm x 7.5 cm - Museo Archeologico di Cingoli (inv. no. 52153) - Unpublished.
656. Zürich-Alpenquai [site no. 90, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Fragmented. Stone. Mass: n/a (810 g). Dimensions: 8.7 cm x 9.0 cm - Feth 2014, fig. 2.3.
657. Coppa Nevigata [site no. 21, settlement] (Manfredonia, Puglia, Italy). CN 11, G3D, 5.1. Before the gate. Phase 3 (RBA) - Associations: context described as "workshop". Bronze knife, 33 bronze studs, 5 bronze spirals, decorated bone element, perforated crystal sphere. Possibly part of a set of 3 weights (cat. no. 155, 281, 657) - Complete. Stone (sandstone). Mass: 450 g. Dimensions: 6.9 cm x 8.3 cm - Cazzella/Recchia 2017, fig. 2.3.
658. Saint-Léonard-des-Bois [site no. 112, hoard] (Sarthe, Pays de la Loire, France). Phase 4 (Ha A-B) - Lead weight with bronze loop. Complete. Lead. Mass: 700 g. Dimensions: 4.4 cm x 5.9 cm - Feth 2014, fig. 3.6; Charnier *et al.* 1999, fig. 5.35.
659. Ouroux-sur-Saône [site no. 59, settlement] (Saône-et-Loire, Bourgogne-Franche-Comté, France). Phase 4 (Ha A-B) - Complete. Stone. Mass: 592 g. Dimensions: 7.8 cm x 7.9 cm - Feth 2014, fig. 2.8.

660. Redù [site no. 41, settlement] (Nonantola, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone (marble). Mass: 385 g (inv. no. 813) - Cardarelli *et al.* 2001, fig. 14.1.
661. Moscosi Piano Fonte Marcosa [site no. 26, settlement] (Cingoli, Macerata, Marche, Italy). PFM 91, Z 16d, US 159. Phase 3 (MBA-RBA) - Fragmented. Stone (travertino). Mass: n/a (550.48 g). Dimensions: 8.4 cm x 9.0 cm x 7.0 cm - Museo Archeologico di Cingoli (inv. no. 52091) - Unpublished.
662. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Thick hook. Complete. Stone (sandstone). Mass: 425.01 g. Dimensions: 10.1 cm x 7.6 cm x 7.2 cm - Museo Archeologico Etnografico Modena (inv. no. 7746) - Unpublished.
663. Cortaillod-Est [site no. 70, settlement] (Station Est, Neuchâtel, Switzerland). Phase 4 (Ha B2) - Complete. Copper/bronze. Mass: 212 g. Dimensions: 3.8 cm x 4.3 cm - Feth 2014, fig. 3.12.
664. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone (alabaster). Mass: 36.6 g. Dimensions: 3.6 cm x 3.1 cm x 2.7 cm (inv. no. 455) - Cardarelli *et al.* 2001, fig. 10.2.

Sub-variant 1.B: Incised decoration (cat. no. 665)

665. Mont Beuvray-Bibracte [site no. 67, settlement] (Saône-et-Loire, Bourgogne-Franche-Comté, France). Stray find. Undetermined chronology (Bronze Final) - Thick hook, incised decoration. Complete. Stone. Mass: n/a. Dimensions: 5.6 cm x 3.9 cm x 4.2 cm - Gabillot *et al.* 2016, fig. 3.B.

Sub-variant 1.C: Horizontal grooves at the base of the upper protrusion (cat. no. 666-668)

666. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Incised decoration. Fragmented. Stone (rosa ammonitico). Mass: 392 g. Dimensions: 6.8 cm x 6.7 cm x 6.6 cm (inv. no. 7811) - Cardarelli *et al.* 2001, fig. 10.4.
667. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 98.5 g. Dimensions: 4.5 cm x 4.9 cm - Feth 2014, fig. 2.2.
668. Mörigen [site no. 79, settlement] (Bern, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 850 g. Dimensions: 9.0 cm x 8.7 cm - Feth 2014, fig. 2.9.

Sub-variant 1.D: Horizontal grooves on the body (cat. no. 669)

669. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 941 g. Dimensions: 9.9 cm x 9.2 cm x 9.2 cm - Feth 2014, fig. 2.4.

Sub-variant 1.E: Horizontal ribs on the body (cat. no. 670-672)

670. Quingento [site no. 43, settlement] (San Prospero, Parma, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone (limestone). Mass: 340 g. Dimensions: 9.1 cm x 7.2 cm - Cardarelli *et al.* 2001, fig. 10.5.
671. Gorzano [site no. 34, settlement] (Maranello, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone. Mass: 394.8 g (391.9 g) (inv. no. SN 98) - Cardarelli *et al.* 2001.
672. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (sandstone). Mass: 294.38 g (280.84 g). Dimensions: 7.8 cm x 8.4 cm x 8.0 cm - Museo Archeologico Etnografico Modena (inv. no. 7812) - Unpublished.

Sub-variant 1.F: Vertical ribs and incised mark (cat. no. 673)

673. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Vertical ribs on the body, incised v-shape sign. Fragmented. Stone (barite). Mass: 43.2 g. Dimensions: 2.8 cm x 3.2 cm x 3.1 cm (inv. no. 7802) - Cardarelli *et al.* 2001, fig. 10.3.

Sub-variant 1.G: Vertical annular groove (cat. no. 674)

674. Gaggio di Castelfranco [site no. 40, settlement] (Modena, Emilia-Romagna, Italy). Phase 2. Phase 2 (MBA) - Associations: 2 casting moulds, crucible, bronze dagger, bronze pins - Fragmented (reconstructed in 3D). Stone. Mass: 348.91 g (343.69 g). Dimensions: 6.4 cm x 6.3 cm x 6.1 cm - Museo Archeologico Etnografico Modena (inv. no. 256910 (433)) - Balista *et al.* 2008, fig. 22.4.

Sub-variant 1.H: Other small weights with perforation (cat. no. 675-677)

675. Gorzano [site no. 34, settlement] (Maranello, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Biconical body. Complete. Stone (sandstone). Mass: 38.23 g. Dimensions: 3.57 cm x 3.51 cm x 3.34 cm - Museo Archeologico Etnografico Modena (inv. no. 1249) - Unpublished.
676. Gaiato [site no. 29, settlement] (Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone (marble). Mass: 36.5 g. Dimensions: 3.4 cm x 2.6 cm x 2.7 cm - Cardarelli *et al.* 2001, fig. 10.1.
677. Casinalbo [site no. 35, settlement] (Formigine, Modena, Emilia-Romagna, Italy). Excavation '800. Phase 2-3 (MBA-RBA) - Fragmented. Stone (sandstone). Mass: n/a (25.86 g). Dimensions: 4.2 cm x 3.2 cm x 2.9 cm - Museo Archeologico Etnografico Modena (inv. no. s.n. 545) - Unpublished.

Variant 2: Without perforation (cat. no. 678-683)

- *number of objects:* 6
- *objects with known mass (complete/reconstructed)*: 4 (67 %)
- *chronological range*: Phase 3-4 (*c.* 1350-800 BCE)
- *material*: stone (6)
- *3 sites:* site no. 26, 66, 74
- *mass range (complete/reconstructed):* 350.06-877.5 g

678. Moscosi Piano Fonte Marcosa [site no. 26, settlement] (Cingoli, Macerata, Marche, Italy). PFM 91, BB 16d, US 155. Phase 3 (MBA-RBA) - Fragmented (reconstructed in 3D). Stone (travertino). Mass: 556.41 g (435.19 g). Dimensions: 7.8 cm x 6.2 cm x 8.7 cm - Museo Archeologico di Cingoli (inv. no. 52092) - Unpublished.
679. Moscosi Piano Fonte Marcosa [site no. 26, settlement] (Cingoli, Macerata, Marche, Italy). PFM 91, AA 1bc, US 155. Phase 3 (MBA-RBA) - Complete. Stone (travertino). Mass: 350.06 g. Dimensions: 7.8 cm x 6.5 cm x 6.6 cm - Museo Archeologico di Cingoli (inv. no. 52089) - Unpublished.
680. Moscosi Piano Fonte Marcosa [site no. 26, settlement] (Cingoli, Macerata, Marche, Italy). PFM, Surface, Stray find. Phase 3 (MBA-RBA) - Fragmented. Stone (travertino). Mass: n/a (194.18 g). Dimensions: 4.9 cm x 6.8 cm x 7.9 cm - Museo Archeologico di Cingoli (inv. no. 52154) - Unpublished.
681. Moscosi Piano Fonte Marcosa [site no. 26, settlement] (Cingoli, Macerata, Marche, Italy). PFM 91, BB 16a, US 155. Phase 3 (MBA-RBA) - Unfinished object. Fragmented. Stone (travertino). Mass: n/a (401.19 g). Dimensions: 8.9 cm x 6.5 cm x 7.5 cm - Museo Archeologico di Cingoli (inv. no. 52088) - Unpublished.
682. Allerey-sur-Saône [site no. 66, settlement] (Saône-et-Loire, Bourgogne-Franche-Comté, France). Phase 4 (Ha A-B) - Complete. Stone. Mass: 770 g. Dimensions: 8.0 cm x 8.6 cm x 8.6 cm - Feth 2014, fig. 2.11.
683. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 877.5 g. Dimensions: 8.9 cm x 9.0 cm x 9.0 cm - Feth 2014, fig. 2.12.

Undetermined variant: Mentioned in literature, without image (cat. no. 684-700)

- *number of objects:* 17
- *chronological range:* Phase 2-4 (*c.* 1600-800 BCE)
- *material*: stone
- *1 site:* site no. 21, 24, 33, 37, 39, 40, 51, 74
- *mass range (complete/reconstructed):* 295-842 g

684. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Lead. Mass: 730 g - Feth 2014.
685. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 295 g (inv. no. 7748) - Cardarelli *et al.* 2001.
686. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 309 g (inv. no. 7812) - Cardarelli *et al.* 2001.
687. Servirola San Polo [site no. 39, settlement] (Reggio Emilia, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 343 g (inv. no. 92) - Cardarelli *et al.* 2001.
688. Servirola San Polo [site no. 39, settlement] (Reggio Emilia, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 347 g (inv. no. 91) - Cardarelli *et al.* 2001.
689. Monte Barello [site no. 33, settlement] (Cuneo, Piemonte, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 348 g (inv. no. 2028) - Cardarelli *et al.* 2001.
690. Peschiera del Garda [site no. 51, settlement] (Verona, Veneto, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 376 g (inv. B) - Cardarelli *et al.* 2001.
691. Peschiera del Garda [site no. 51, settlement] (Verona, Veneto, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 417 g (inv. I) - Cardarelli *et al.* 2001.
692. Grotta Nuova [site no. 24, cave] (Viterbo, Lazio, Italy). Phase 2-3 (MBA-RBA) - Complete. Stone. Mass: 453 g - Cardarelli *et al.* 2001.
693. Montale [site no. 37, settlement] (Castelnuovo Rangone, Modena, Emilia-Romagna, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 461 g (inv. no. 7704) - Cardarelli *et al.* 2001.
694. Reggiano [n/a, settlement] (unknown provenance, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 524 g (inv. no. 96 (p9110)) - Cardarelli *et al.* 2001.
695. Coppa Nevigata [site no. 21, settlement] (Manfredonia, Puglia, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 539 g - Cardarelli *et al.* 2001.
696. Monte Barello [site no. 33, settlement] (Cuneo, Piemonte, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 590 g (inv. no. 1) - Cardarelli *et al.* 2001.
697. Reggiano [n/a, settlement] (unknown provenance, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 636 g (inv. no. 1181/65 (p7326)) - Cardarelli *et al.* 2001.
698. Reggiano [n/a, settlement] (unknown provenance, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 641 g (inv. no. 1180-63) - Cardarelli *et al.* 2001.
699. Reggiano [n/a, settlement] (unknown provenance, Italy). Phase 2-3 (MBA-RBA) - Fragmented. Stone. Mass: 842 g (inv. no. 76) - Cardarelli *et al.* 2001.
700. Gaggio di Castelfranco [site no. 40, settlement] (Emilia-Romagna, Modena, Italy). Phase 2 (MBA) - Complete. Stone. Mass: 448.25 g. Dimensions: 6.8 cm x 6.4 cm x 8.2 cm - Museo Archeologico Etnografico Modena (inv. no. 256911 (698)) - Cardarelli *et al.* 2004, fig. 1.7.

5.15. OTHER HANGING WEIGHTS

- *number of objects*: 14
- *objects with known mass (complete/reconstructed)*: 13 (93 %).
- *chronological range*: Phase 3-4 (*c.* 1350-800 BCE)
- *material:* stone (2), copper/bronze (1), lead (11)
- *12 sites:* site no. 12, 25, 60, 61, 62, 63, 68, 73, 74, 88, 121, 140
- *mass range (complete/reconstructed):* 102.3-2,128.0 g

This section groups balance weights in the *mina*-range with heterogeneous shapes, but all provided with features that can be used to fix a suspension cord. Weights classified in Variant 1 (cat. no. 701-705) are round with a bi-concave cross-section. They are all made of lead except cat. no. 702, which is made of stone, and have a bronze wire loop fixed on the upper side. They all come from Late Bronze Age pile-dwelling settlements in Switzerland. Variant 2 includes two roughly made lead objects with hemispherical shape (cat. no. 706-707), both of which have a thin indentation on the upper side, suitable to host a loop of metal wire. V2 is attested in northern France at the settlement of Fort Harrouard (site no. 121, *c.* 1500-1200 BCE) and in southern England from a burial in the midden site of Cliffs End Farm (site no. 140, *c.* 950-725 BCE). Variant 3 includes a single object with spherical-cap shape and a metal loop fixed on the upper side (cat. no. 708), from the Swiss pile-dwelling settlement of Zürich-Wollishofen (site no. 88). The weights classified in Variant 4 are spherical (cat. no. 709-712). Object cat. no. 709 – from the Late Bronze Age settlement of Sorgenti della Nova (Italy, site no. 25) – is made of stone, with a U-shaped perforation on the upper side. The lead objects cat. no. 710-712 come from pile-dwelling settlements in Switzerland, and all have a metal loop fixed on the upper side. The bell-shaped lead weight with metal loop from the pile-dwelling settlement of Estavayer-le-Lac (site no. 12) is classified in Variant 5. Finally, Variant 6 has a parallelepiped shape with an upper protrusion, around which a bronze ring is fixed through a bronze wire. The only weight classified in V6 comes from the Nuragic Sanctuary of Abini, in Sardinia (site no. 12), dated *c.* 950-800 BCE.

Variant 1: Bi-concave cross-section (cat. no. 701-705)

- *number of objects:* 5
- *objects with known mass (complete/reconstructed)*: 5 (100 %)
- *chronological range*: Phase 4 (*c.* 1150-800 BCE)
- *material*: stone (1), lead (4)
- *4 sites:* site no. 61, 62, 74, 88
- *mass range (complete/reconstructed):* 102.3-735.0 g

701. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Lead. Mass: 731.7 g. Dimensions: 5.7 cm x 5.5 cm x 3.7 cm - Rychner 1979, pl. 130.11.
702. Concise [site no. 62, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Stone. Mass: 102.3 g. Dimensions: 4.25 cm x 4.25 cm x 2.6 cm - Feth 2014, fig. 2.1.
703. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Lead. Mass: 735 g. Dimensions: 5.8 cm x 5.8 cm - Feth 2014, fig. 3.11.
704. Auvernier [site no. 74, settlement] (Boudry, Neuchâtel, Switzerland). Phase 4 (Ha A-B) - Complete. Lead. Mass: 734 g. Dimensions: 5.4 cm x 5.4 cm - Feth 2014, fig. 3.10.
705. Onnens [site no. 61, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Lead. Mass: 615.5 g. Dimensions: 5.5 cm x 5.7 cm - Feth 2014, fig. 3.9.

Variant 2: Hemispherical (cat. no. 706-707)

- *number of objects:* 2
- *objects with known mass (complete/reconstructed)*: 2 (100 %)
- *chronological range*: Phase 3-4 (*c.* 1350-800 BCE)
- *material*: lead (2)
- *2 sites:* site no. 121, 140
- *mass range (complete/reconstructed):* 144-284 g

706. Fort Harrouard [site no. 121, settlement] (d'Eure-et-Loir, Centre-Val de Loire, France). B. 558 bis. Phase 2-3 (Bronze Moyen-Bronze Final I) - Complete. Lead. Mass: 284 g. Dimensions: 4.7 cm x 4.6 cm x 2.6 cm - Mohen/Bailloud 1987, pl. 89.25.
707. Cliffs End Farm [site no. 140, burial] (Kent, England). Phase 4 (Ewart Park) - Associations: balance beam from the same site - Complete. Lead. Mass: 144 g. Dimensions: 3.0 cm x 3.3 cm x 3.2 cm - Grimm/Schuster 2014, fig. 5.9.11.

Variant 3: Spherical cap (cat. no. 708)

708. Zürich-Wollishofen [site no. 88, settlement] (Zürich, Switzerland). Phase 4 (Ha A-B) - Complete. Lead. Mass: 728 g. Dimensions: 3.1 cm x 6.5 cm - Feth 2014, fig. 3.8.

Variant 4: Spherical (cat. no. 709-712)

- *Number of objects:* 4
- *objects with known mass (complete/reconstructed)*: 3 (75 %)
- *chronological range*: Phase 4 (*c.* 1150-800 BCE)
- *material*: stone (1), lead (3)
- *4 sites:* site no. 25, 60, 68, 73
- *mass range (complete/reconstructed):* 387-389 g

709. Sorgenti della Nova [site no. 25, settlement] (Farnese, Viterbo, Lazio, Italy). Settore IV, cave, niche. Stratum 1B. Phase 4 (FBA 3) - Complete. Stone. Mass: n/a - Cremonesi 2006, tav. 2.5.
710. Colombier [site no. 73, settlement] (Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Lead. Mass: 387 g. Dimensions: 4.3 cm x 4.3 cm x 4.3 cm - Feth 2014, fig. 3.2.

711. Corcelettes [site no. 60, settlement] (Grandson, Vaud, Switzerland). Phase 4 (Ha A-B) - Fragmented. Lead. Mass: 388 g (387 g). Dimensions: 4.6 cm x 4.3 cm x 4.3 cm - Feth 2014, fig. 3.3.
712. Vallamand [site no. 68, settlement] (Vully-les-lacs, Vaud, Switzerland). Phase 4 (Ha A-B) - Complete. Lead. Mass: 389 g. Dimensions: 5.6 cm x 5.1 cm - Feth 2014, fig. 3.4.

Variant 5: Bell-shaped (cat. no. 713)

713. Estavayer-le-Lac [site no. 63, settlement] (Fribourg, Switzerland). Phase 4 (Ha A-B) - Fragmented. Lead. Mass: 615 g (552 g). Dimensions: 5.3 cm x 5.0 cm - Feth 2014, fig. 3.5.

Variant 6: Parallelepiped with upper protrusion (cat. no. 714)

714. Abini [site no. 12, nuragic sanctuary] (Teti, Nuoro, Sardegna, Italy). Phase 4 (EIA) - Complete. Copper/bronze. Mass: 2,128 g. Dimensions: 13.9 cm x 11.6 cm x 3.6 cm - Lo Schiavo 2006, fig. 5.

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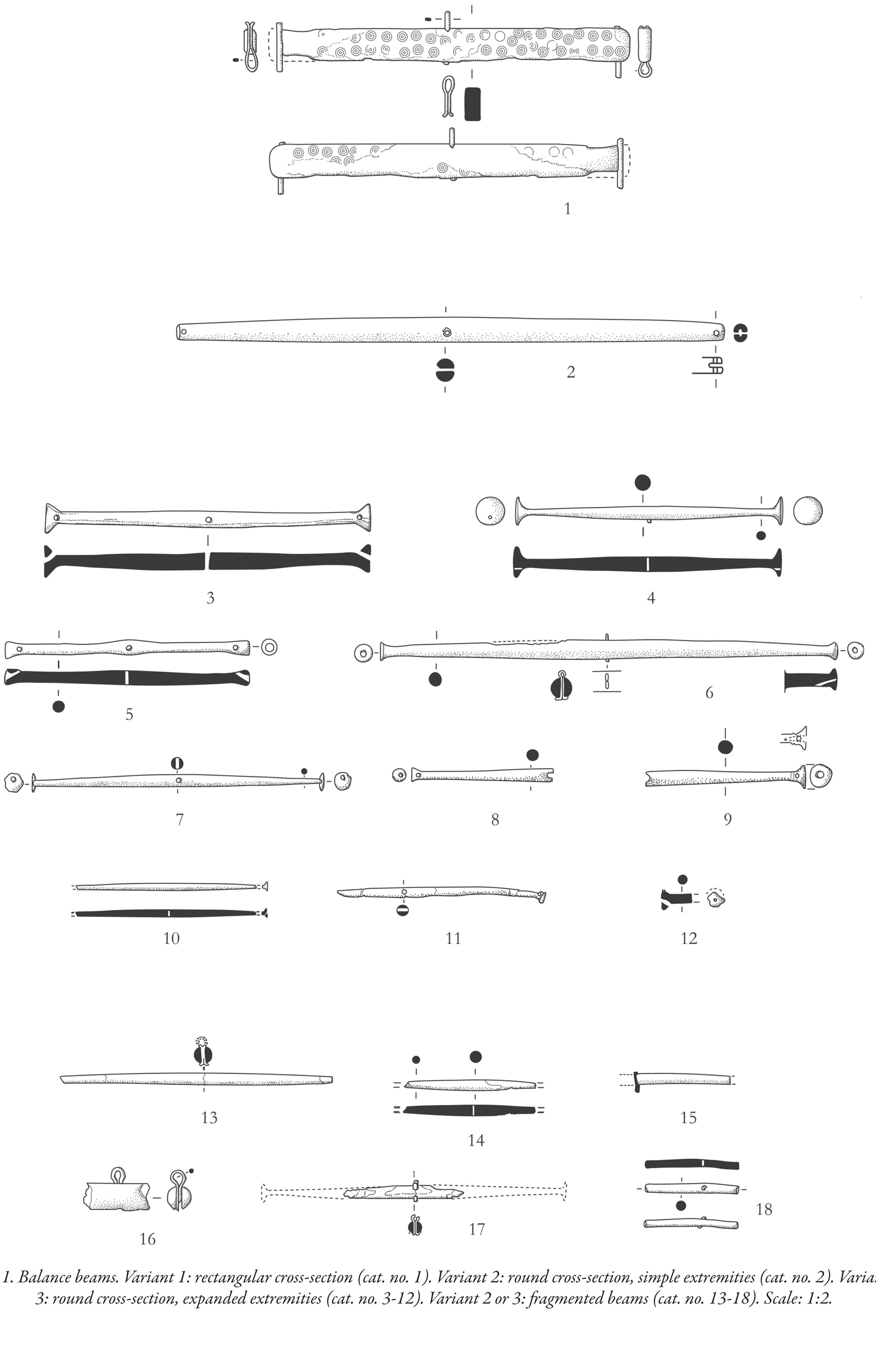
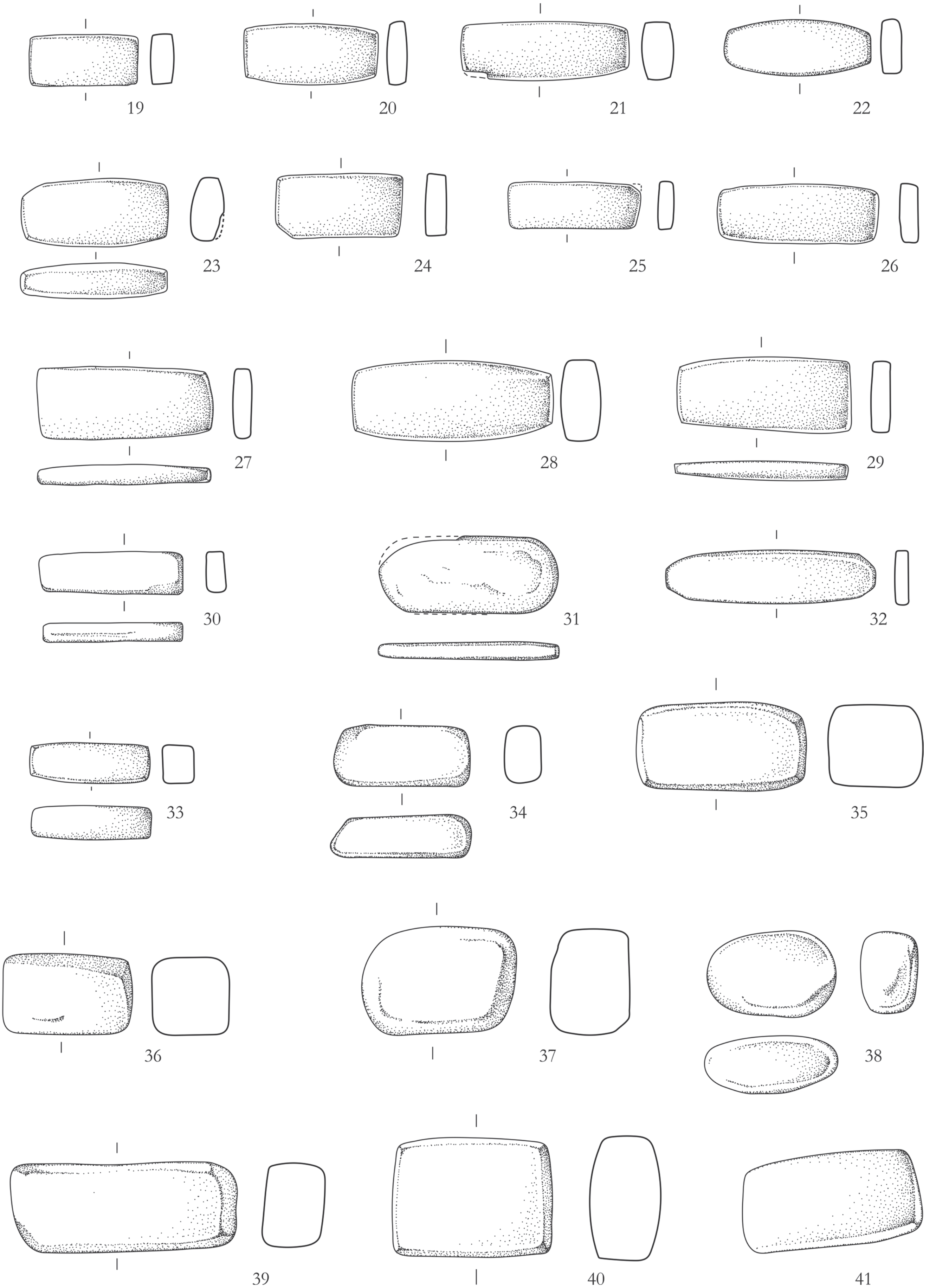
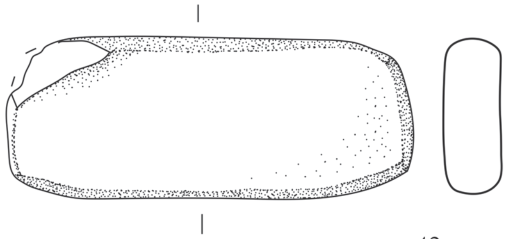
Plates



Pl. 1. Balance beams. Variant 1: rectangular cross-section (cat. no. 1). Variant 2: round cross-section, simple extremities (cat. no. 2). Variant 3: round cross-section, expanded extremities (cat. no. 3-12). Variant 2 or 3: fragmented beams (cat. no. 13-18). Scale: 1:2.



Pl. 2. Parallelepiped. Variant 1: plain parallelepiped. Stone. Scale: 1:2.



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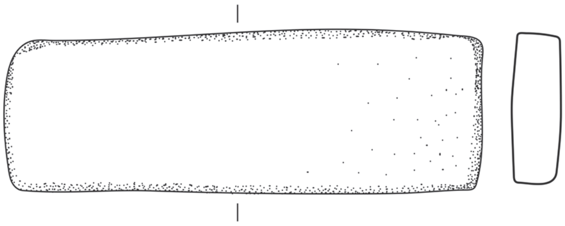

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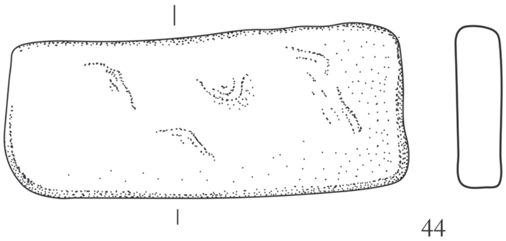

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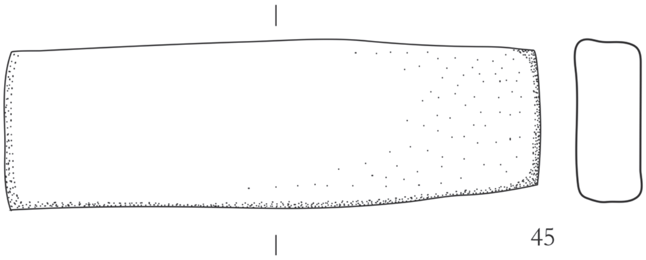

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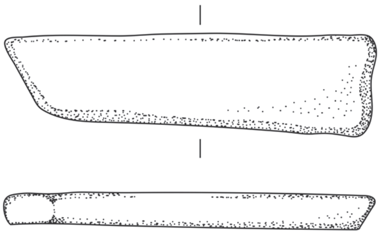

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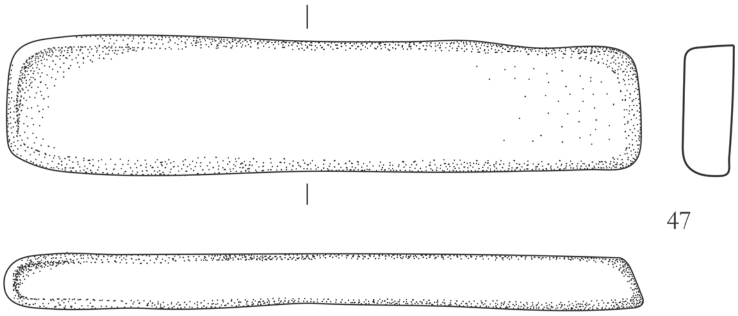

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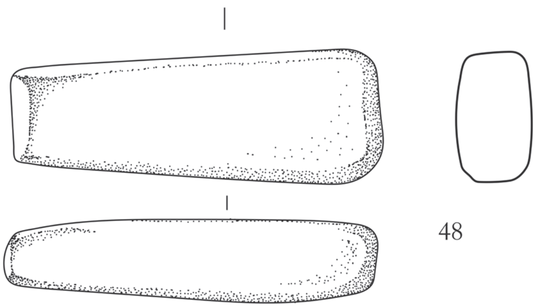

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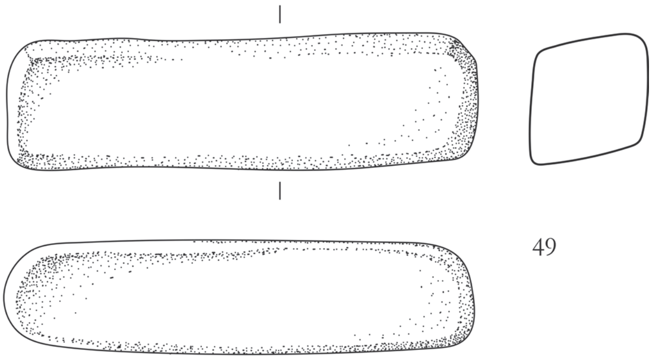

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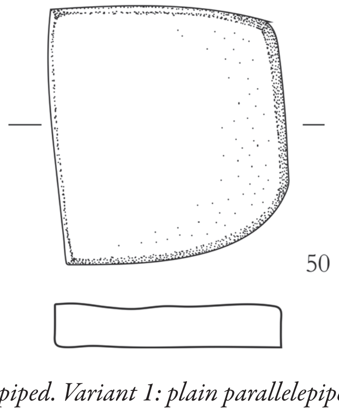

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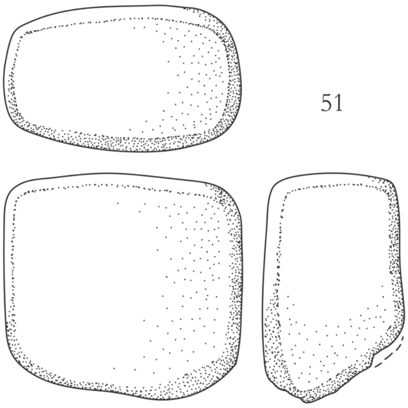
Pl. 3. Parallelepiped. Variant 1: plain parallelepiped. Stone. Scale: 1:2.



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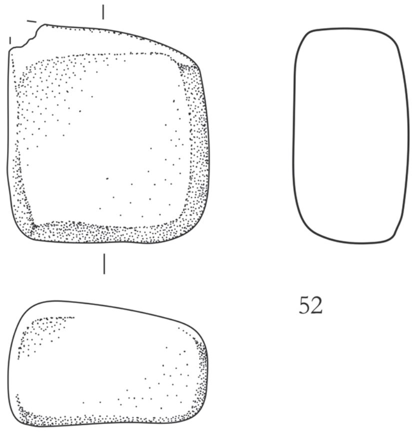

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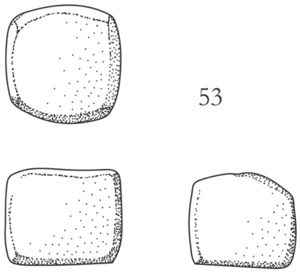

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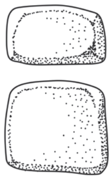

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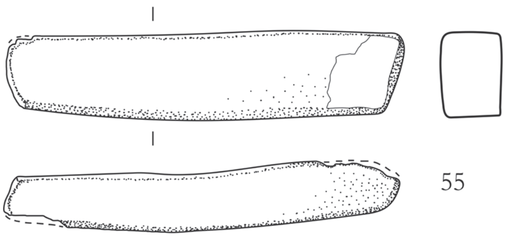

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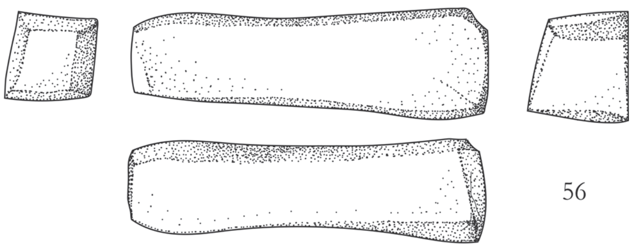

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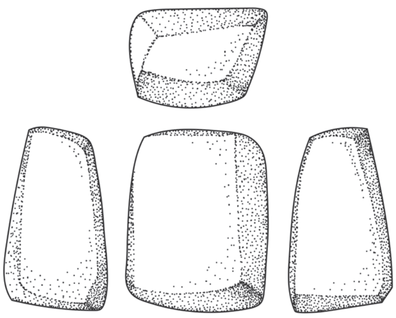

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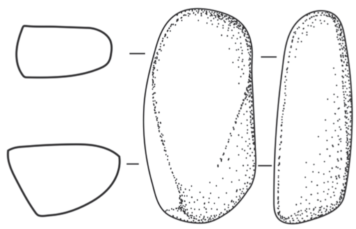

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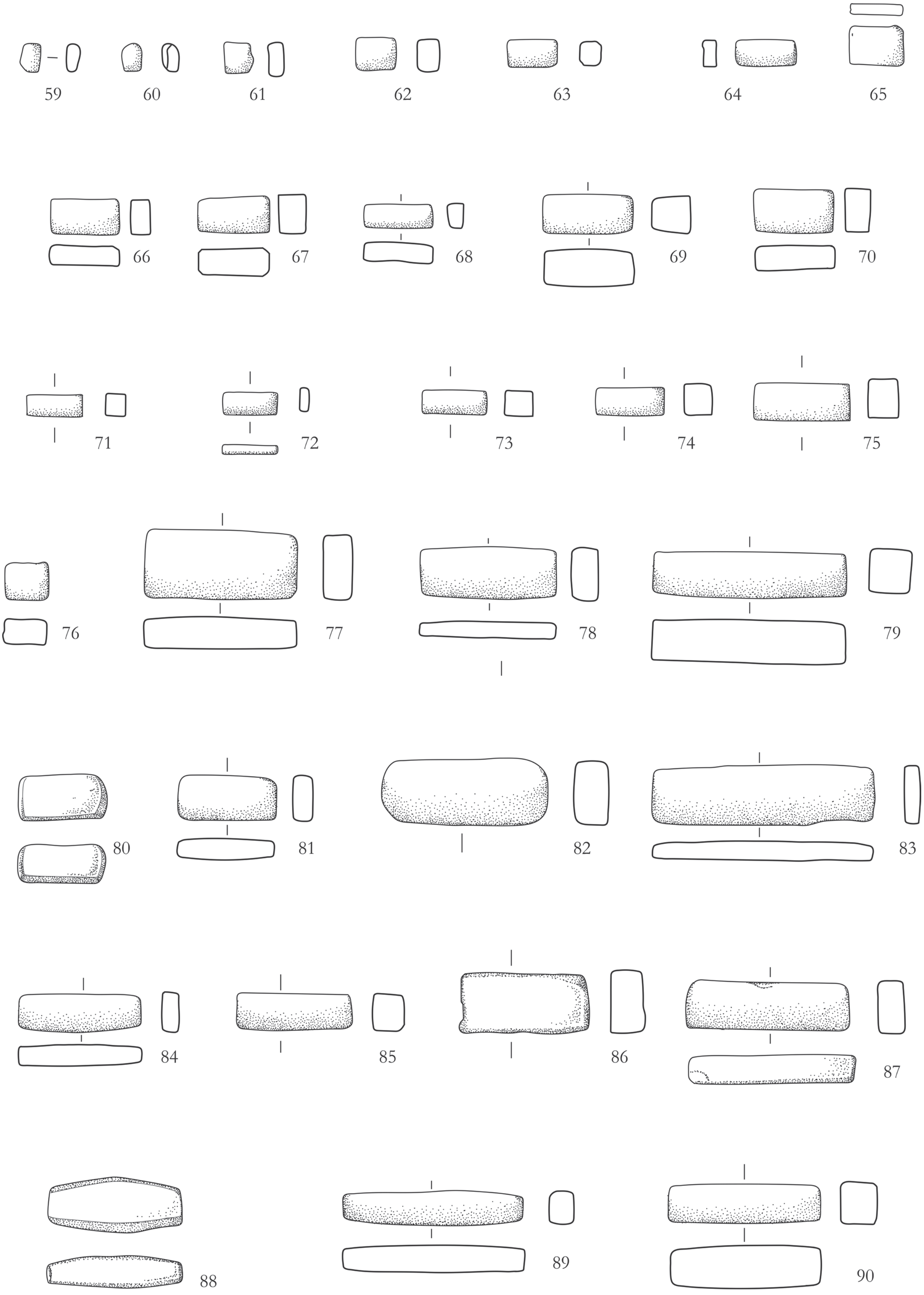
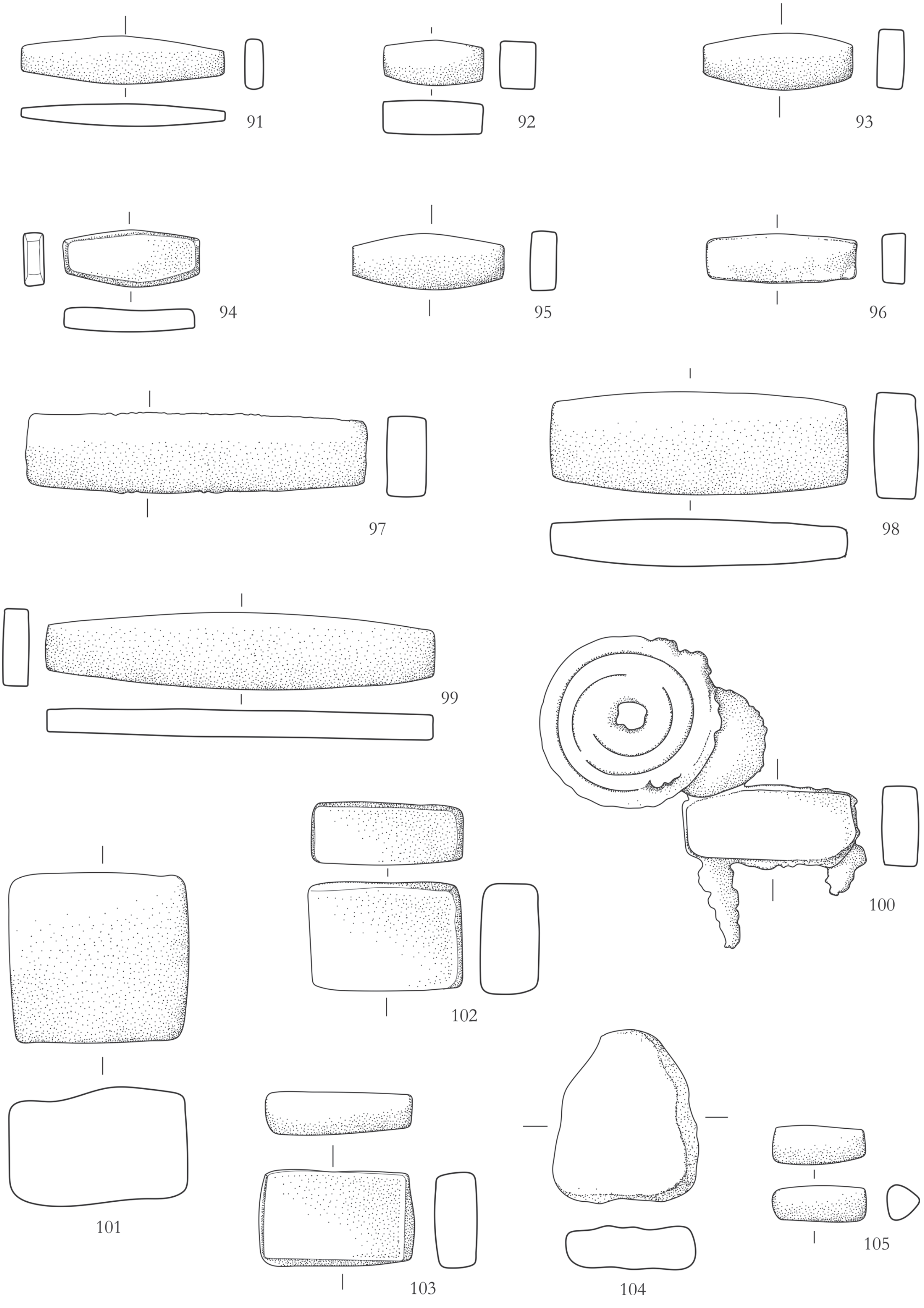
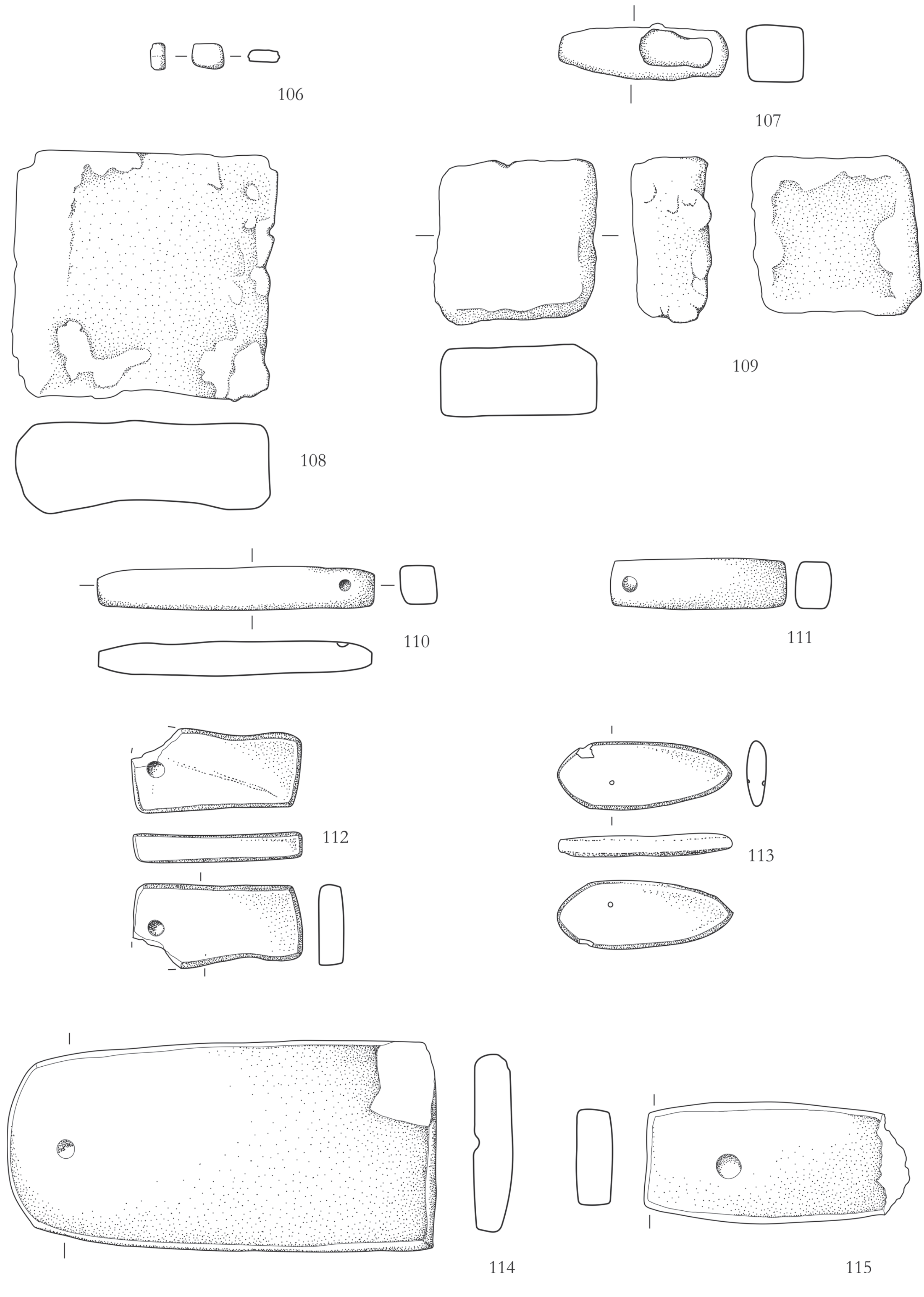
Pl. 4. Parallelepiped. Variant 1: plain parallelepiped. Stone. Scale: 1:2.



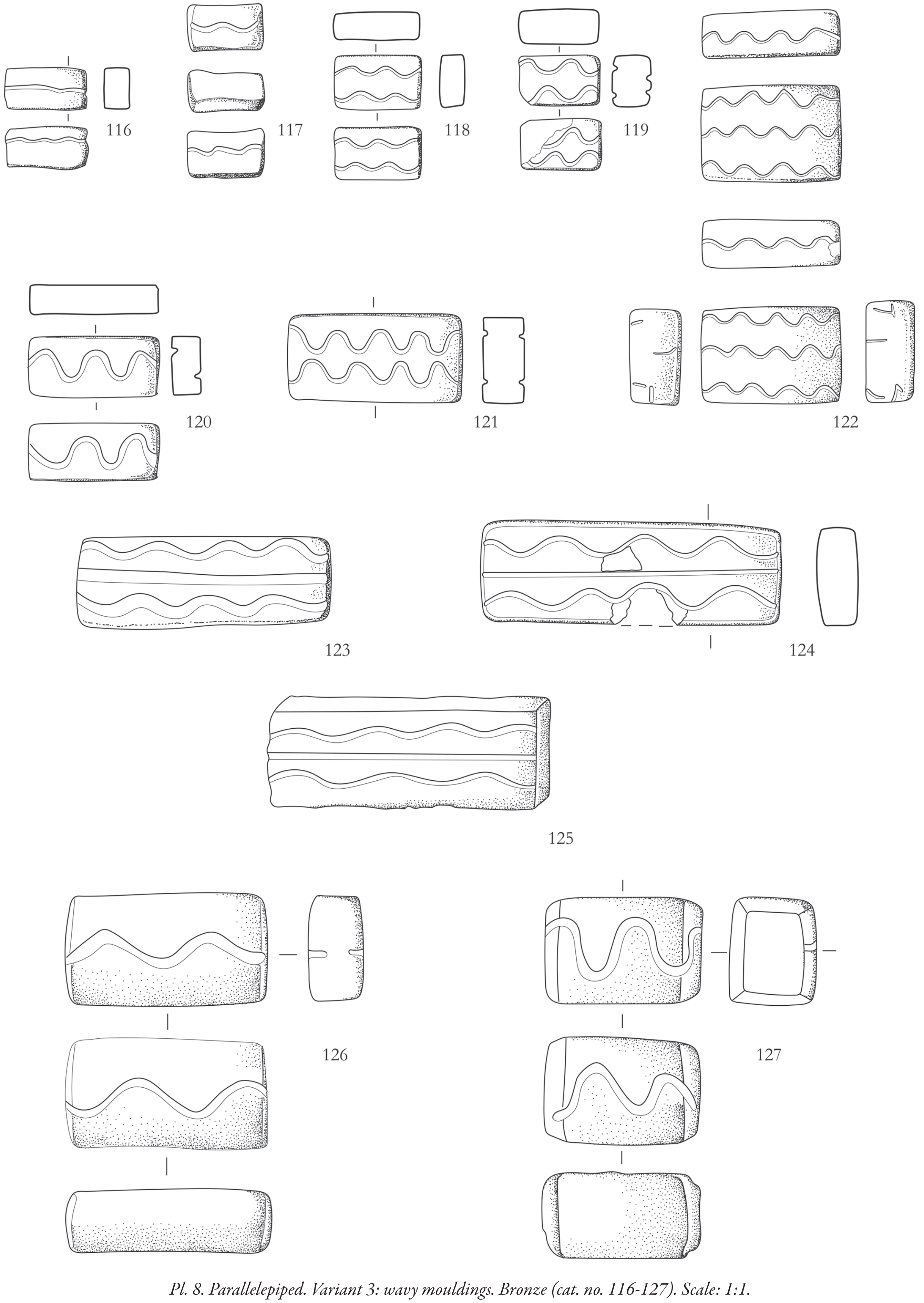
Pl. 5. Parallelepiped. Variant 1: plain parallelepiped. Bronze. Scale: 1:1.



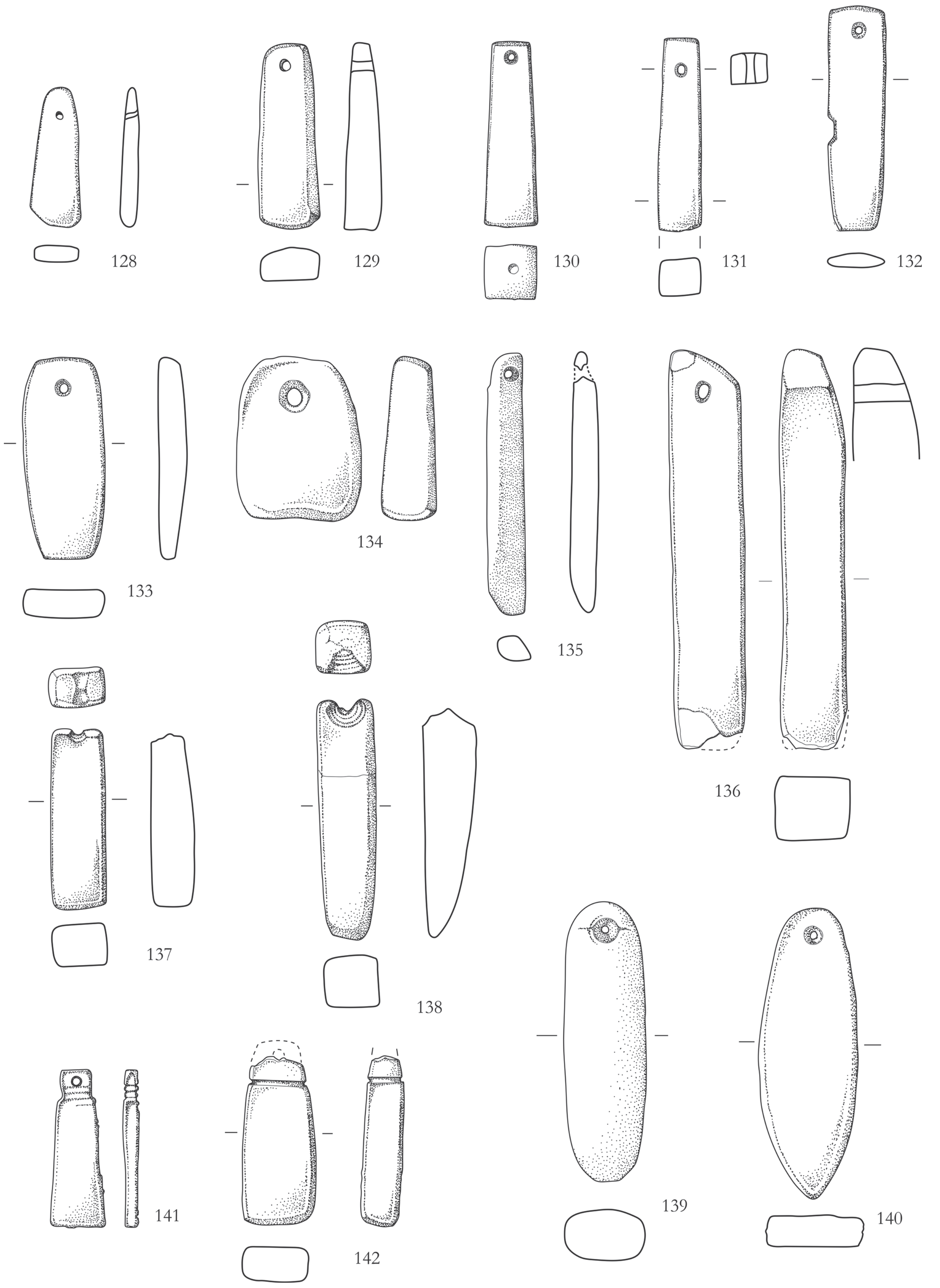
Pl. 6. Parallelepiped. Variant 1: plain parallelepiped. Bronze. Scale: 1:1.



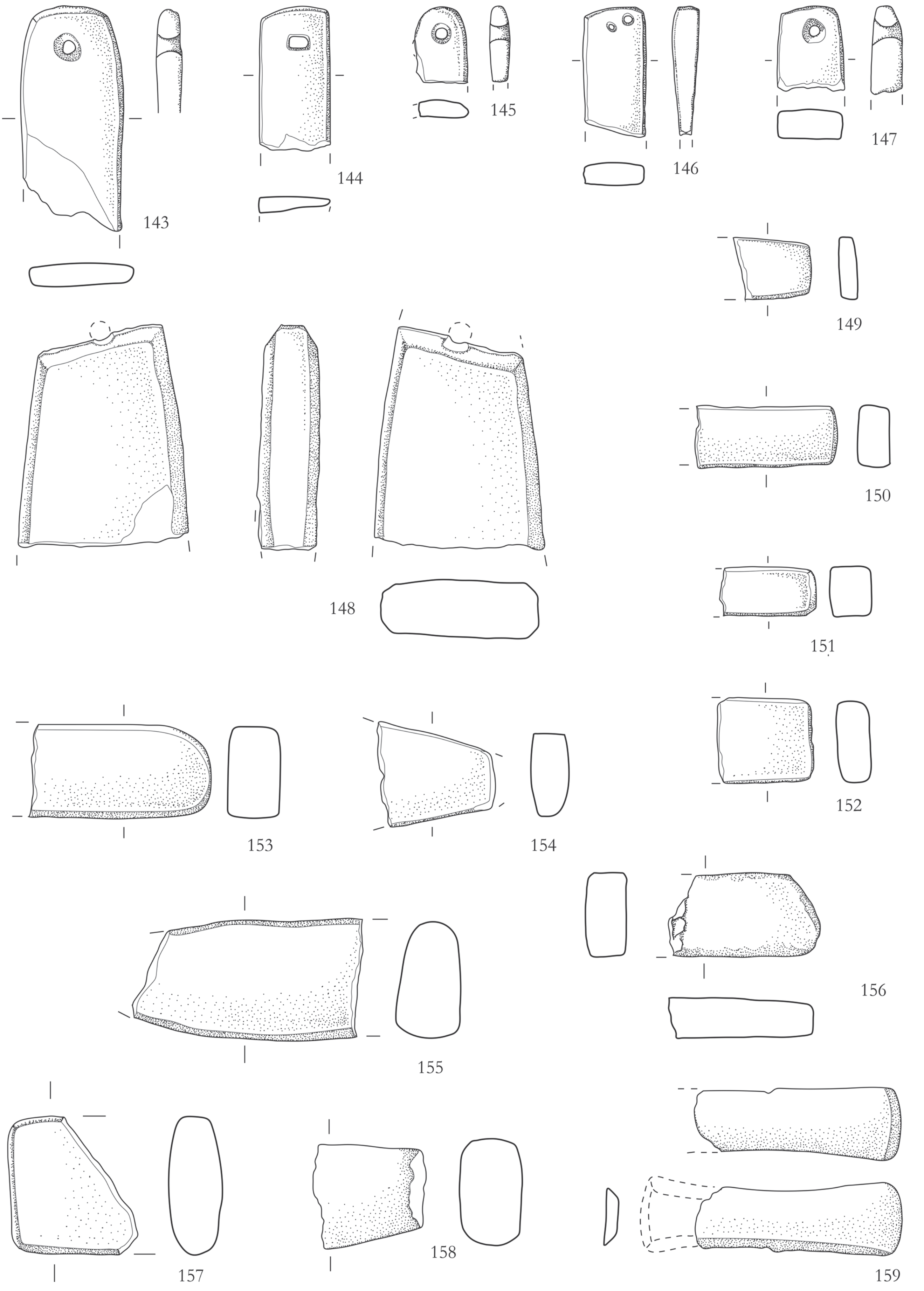
Pl. 7. Parallelepiped. Variant 1: plain parallelepiped. Lead (cat. no. 106-109). Scale: 1:1.
Variant 2: small circular indentation on one extremity. Stone (cat. no. 110-114). Scale: 1:2. Bronze (cat. no. 115). Scale: 1:1.



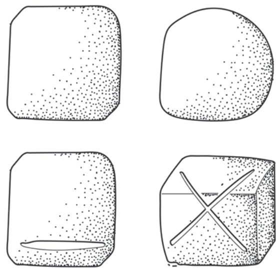
Pl. 8. Parallelepiped. Variant 3: wavy mouldings. Bronze (cat. no. 116-127). Scale: 1:1.



Pl. 9. Parallelepiped. Variant 4: perforated. Stone. Scale: 1:2.



Pl. 10. Parallelepiped. Variant 4: perforated. Stone (cat. no. 143-148). Scale: 1:2. Undetermined variant. Stone (cat. no. 149-155). Scale: 1:2. Bronze (cat. no. 156-159). Scale: 1:1.



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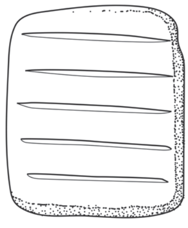

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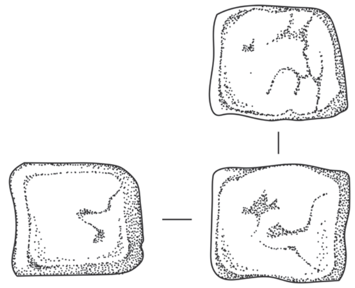

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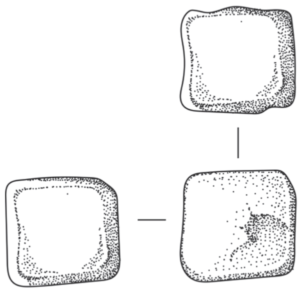

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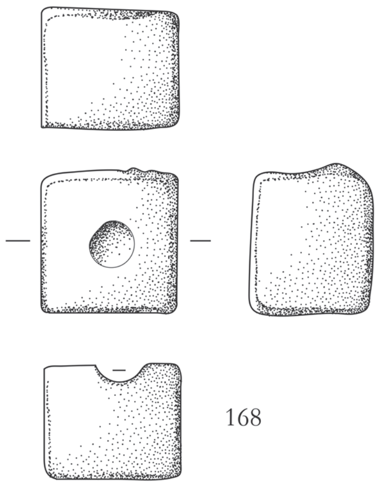

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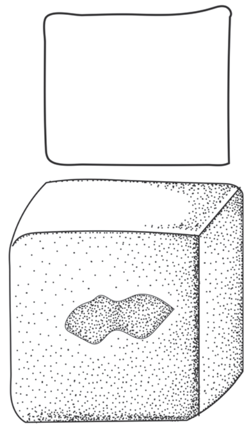

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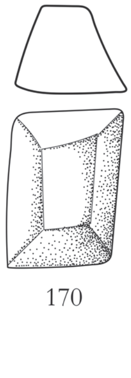

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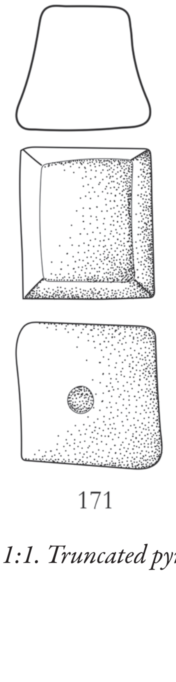

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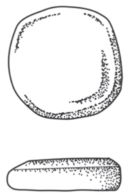
Pl. 11. Cube. Stone (cat. no. 164-165). Scale: 1:2. Lead (cat. no. 166-169). Scale: 1:1. Truncated pyramid. Lead (cat. no. 170-171). Scale: 1:1.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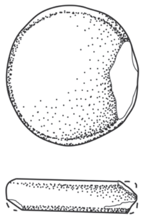
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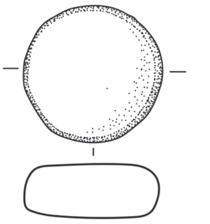
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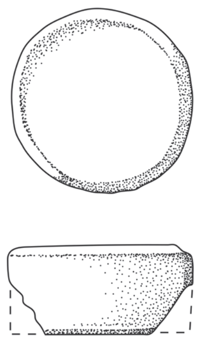
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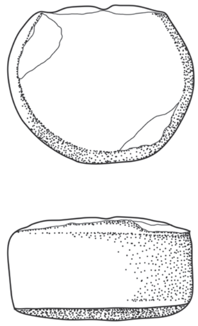
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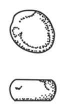
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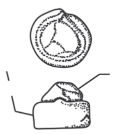
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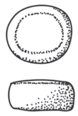
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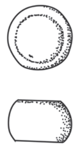
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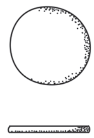
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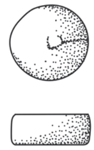
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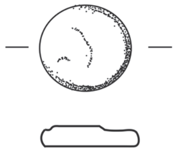
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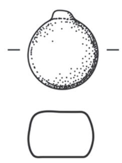
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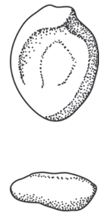
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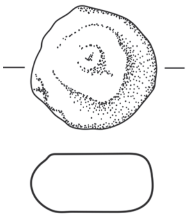
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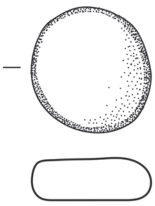
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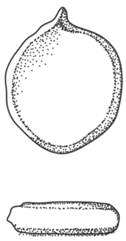
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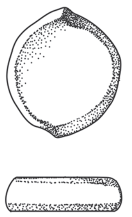
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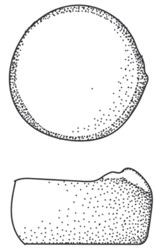
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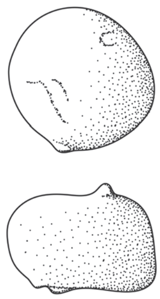
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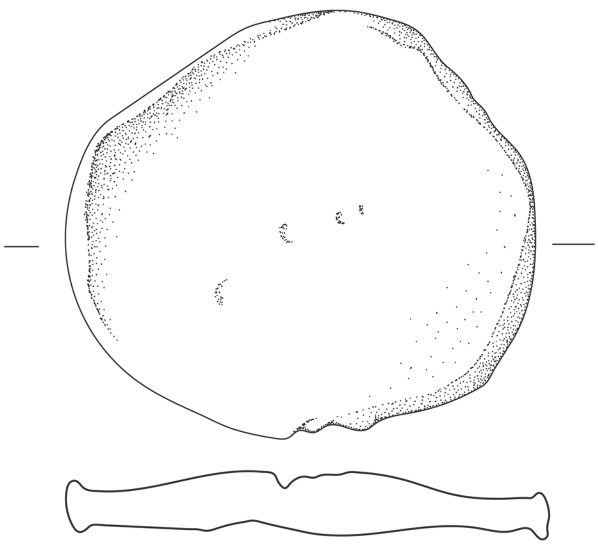
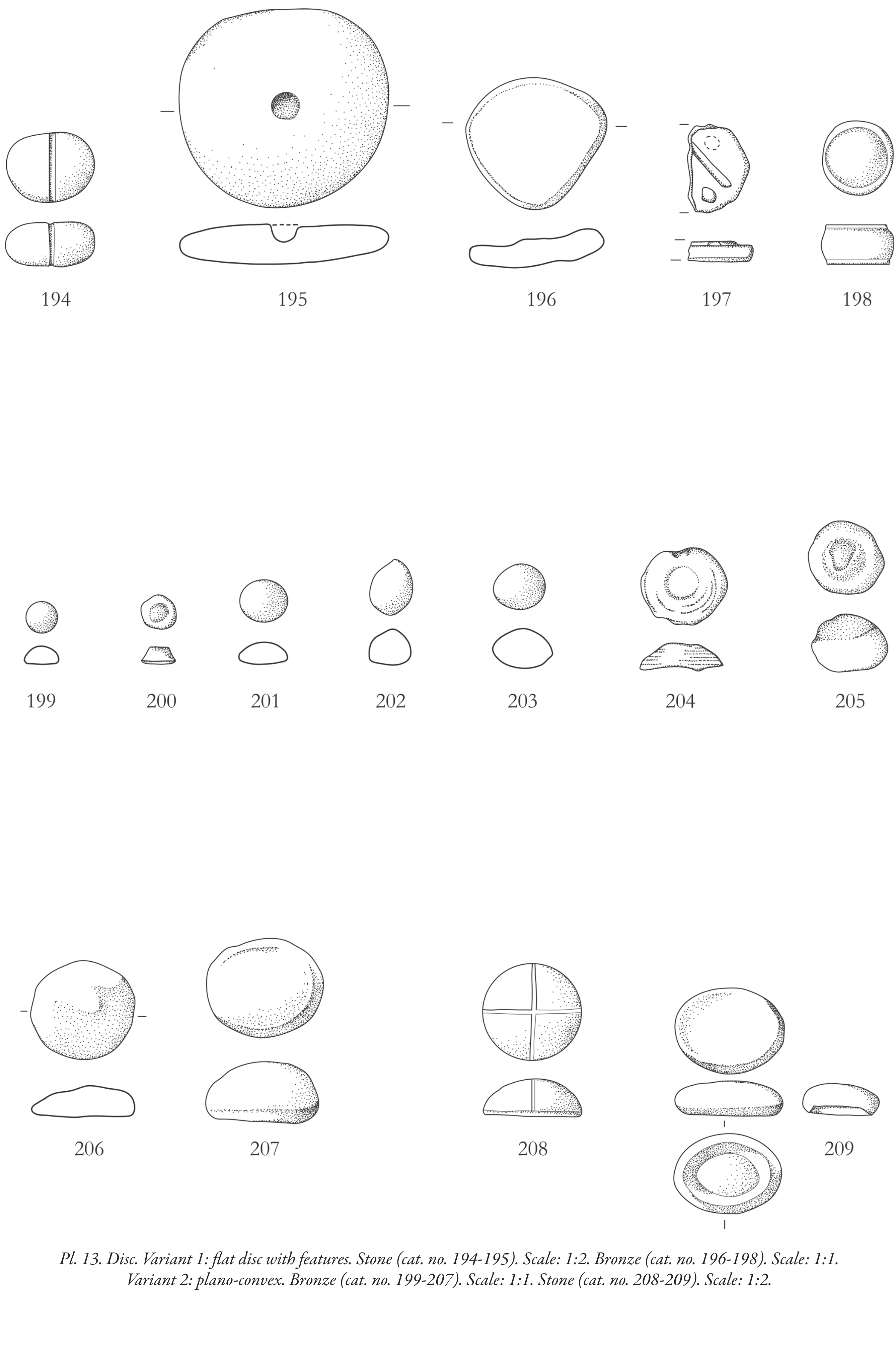
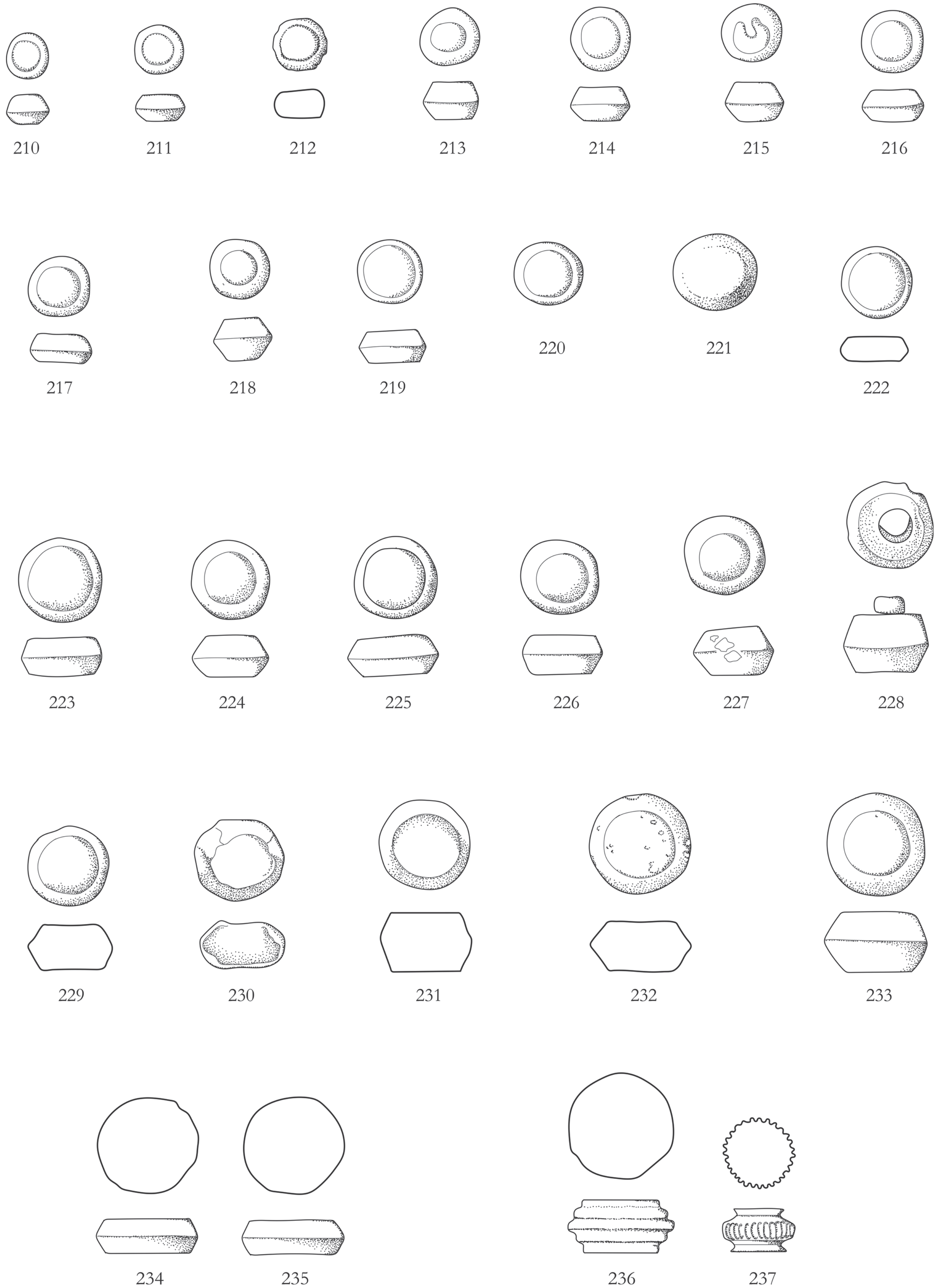

193

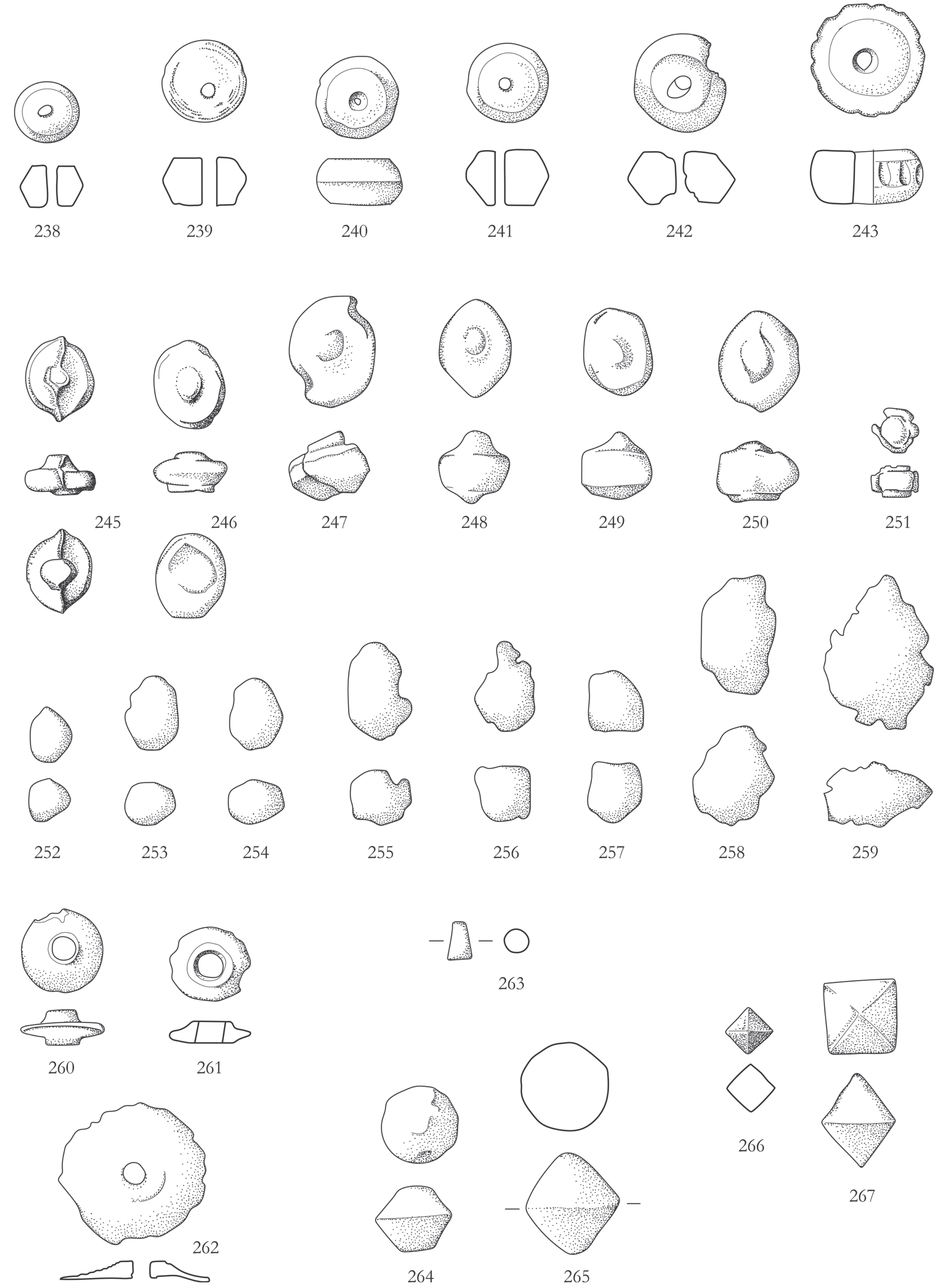
Pl. 12. Disc. Variant 1: plain disc. Stone (cat. no. 172-176). Scale: 1:2. Bronze (cat. no. 177-192). Scale: 1:1. Lead (cat. no. 193). Scale: 1:1.



Pl. 13. Disc. Variant 1: flat disc with features. Stone (cat. no. 194-195). Scale: 1:2. Bronze (cat. no. 196-198). Scale: 1:1. Variant 2: plano-convex. Bronze (cat. no. 199-207). Scale: 1:1. Stone (cat. no. 208-209). Scale: 1:2.



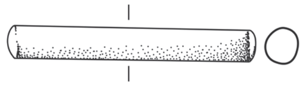
Pl. 14. Disc. Variant 3: biconical. Sub-variant 3.A: plain. Bronze. Scale: 1:1.



Pl. 15. Disc. Variant 3: biconical. Sub-variant 3.B: longitudinal perforation. Bronze (cat. no. 238-243). Scale: 1:1. Variant 4: plano-convex. Bronze (cat. no. 238-250, 252-259). Scale: 1:1. Lead (cat. no. 251). Scale: 1:1. Variant 5: pin-jags. Bronze (cat. no. 260-262). Scale: 1:1. Cone. Bronze (cat. no. 263). Scale: 1:1. Double cone. Bronze (cat. no. 264-265). Scale: 1:1. Octahedron. Bronze (cat. no. 266-267). Scale: 1:1.


268


269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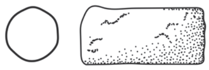
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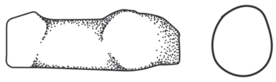
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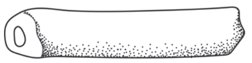
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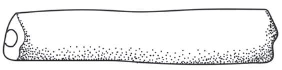
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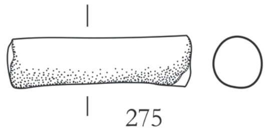
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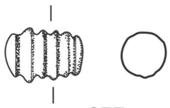
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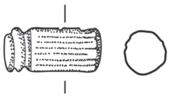
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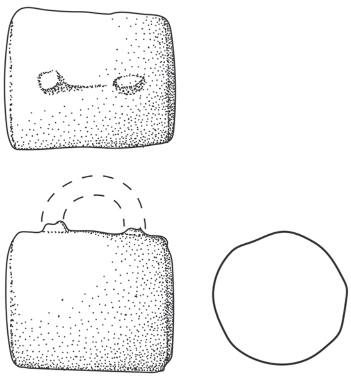
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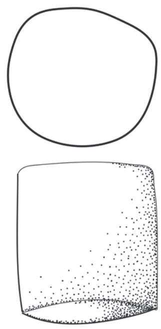
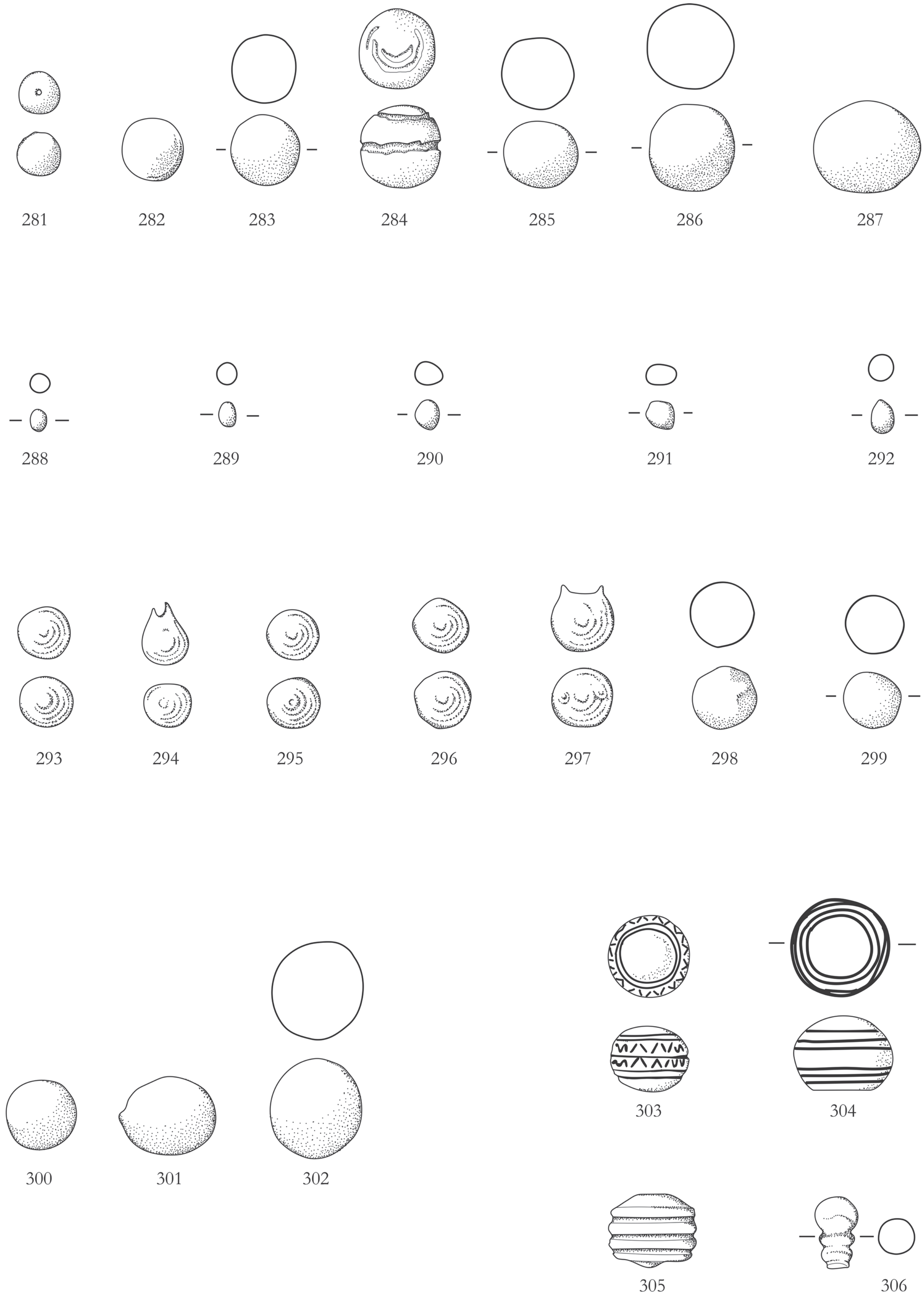
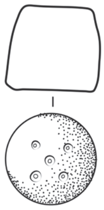

280

Pl. 16. Cylinder. Variant 1: thin plain cylinder. Bronze (cat. no. 268-270). Scale: 1:1. Lead (cat. no. 271-276). Scale: 1:1. Variant 2: pin fragments. Bronze (cat. no. 277-278). Scale: 1:1. Variant 3: squat body with suspension loop. Bronze (cat. no. 279). Scale: 1:1. Variant 4: plain squat body. Lead (cat. no. 280). Scale: 1:1.



Pl. 17. Sphere. Stone (cat. no. 281-287). Scale: 1:2. Bronze (cat. no. 288-306). Scale: 1:1.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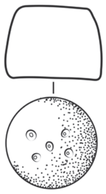
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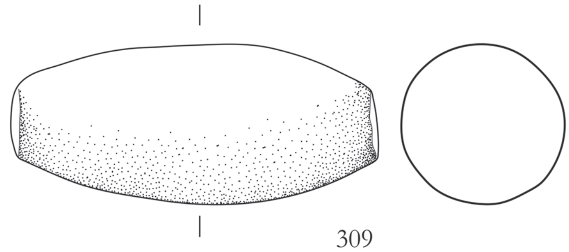
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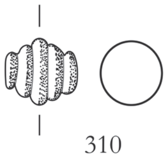
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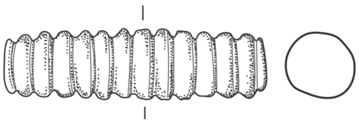
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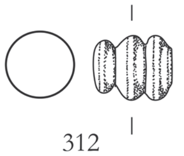
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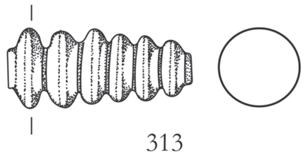
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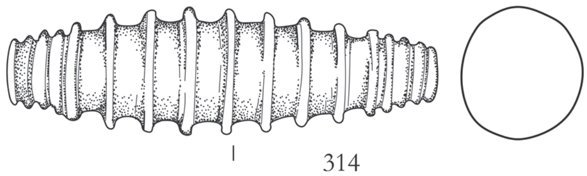
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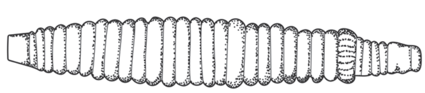
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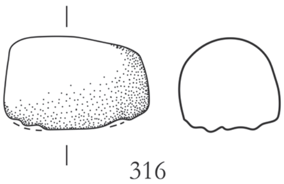
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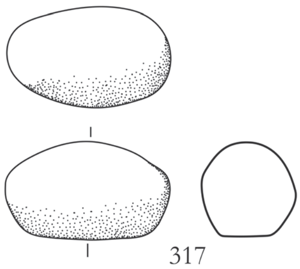
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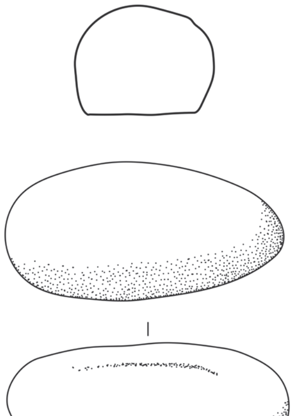
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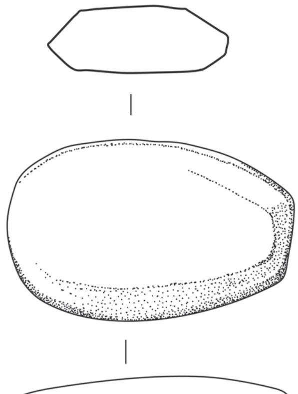
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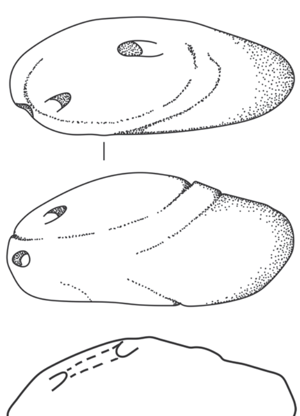
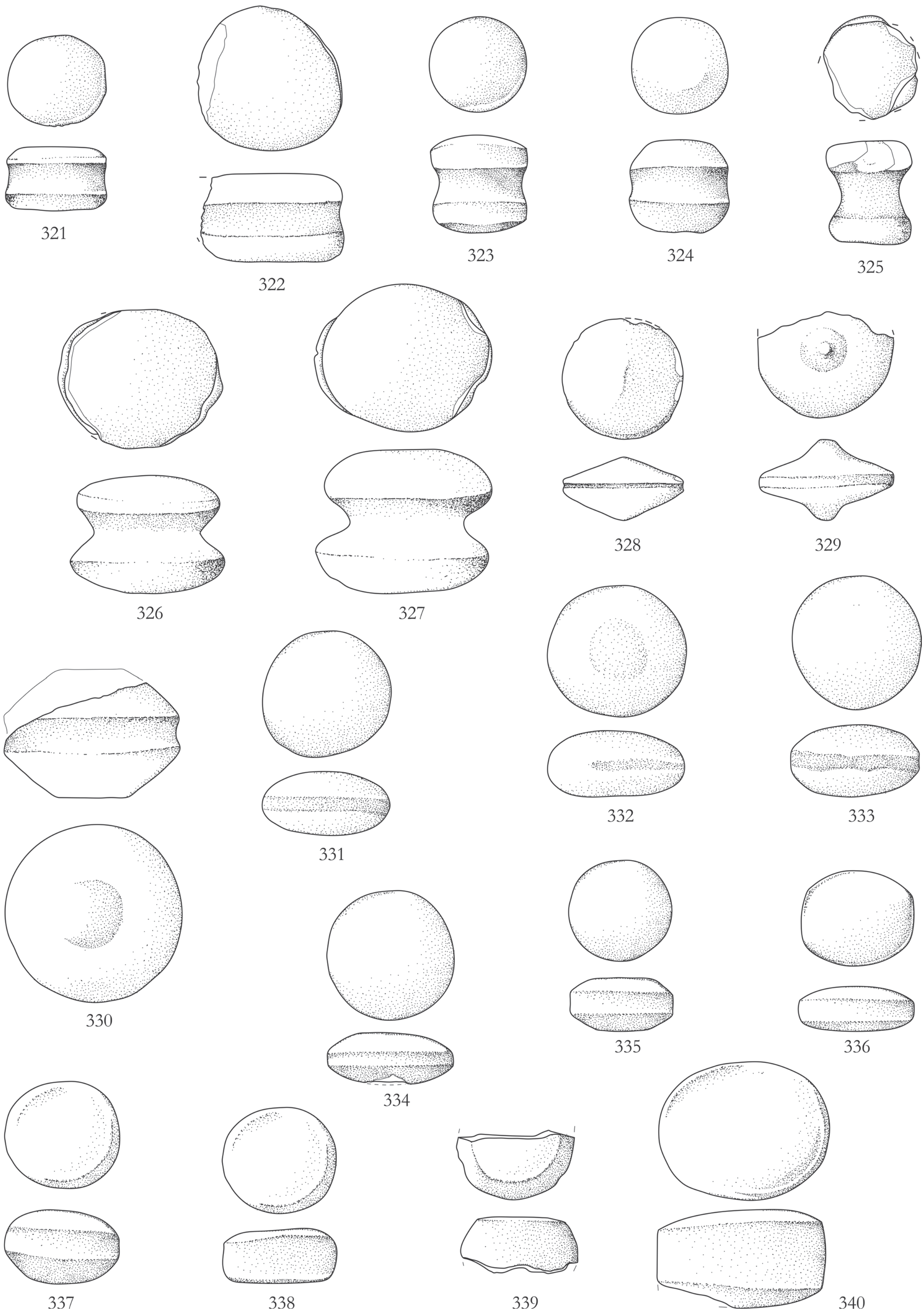
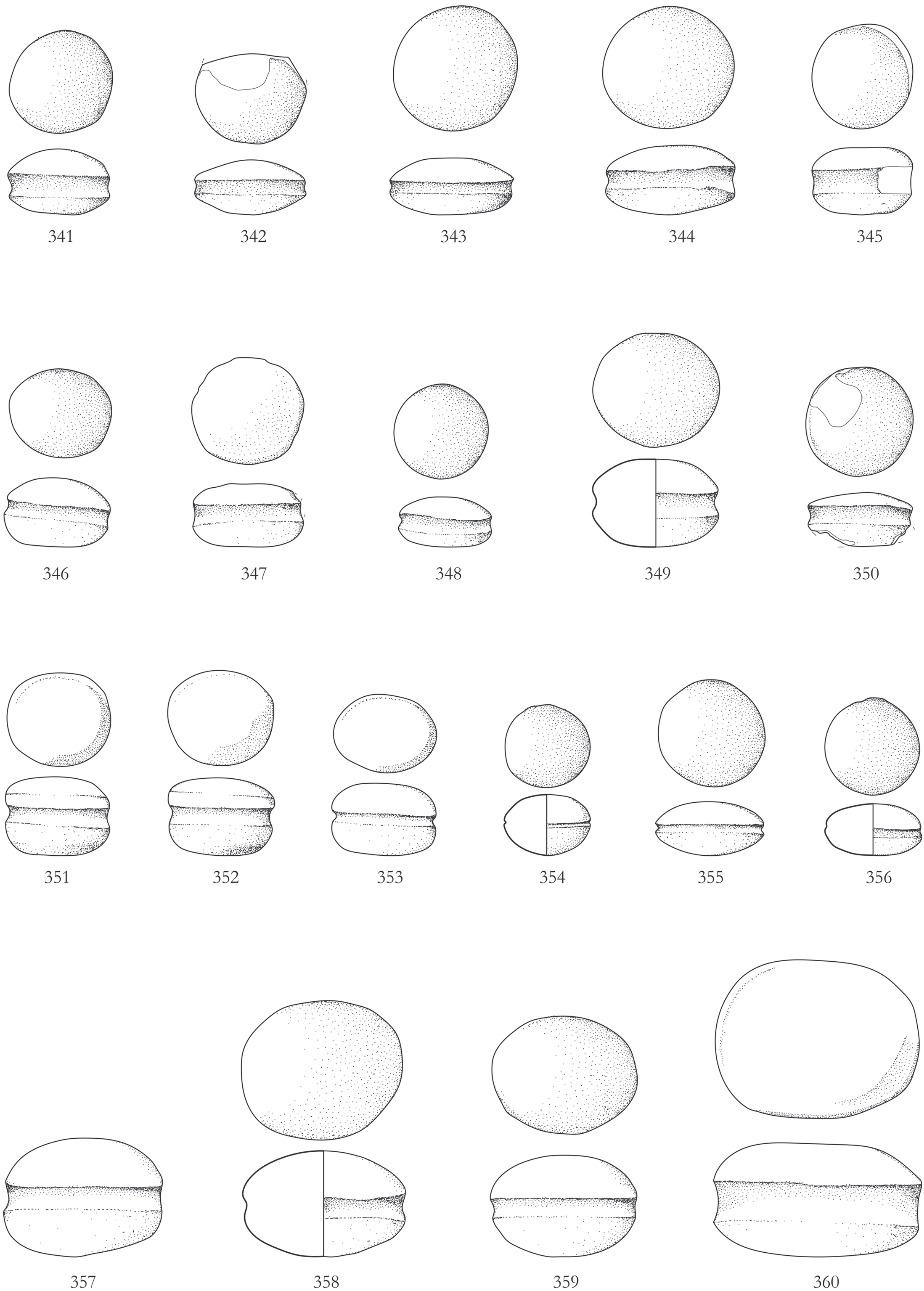

320

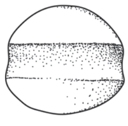
Pl. 18. Truncated cone. Stone (cat. no. 307-308). Scale: 1:2. Sphendonoid. Variant 1: circular cross-section, plain surface. Stone (cat. no. 309). Scale: 1:2. Variant 2: circular cross-section, annular ribs. Bronze (cat. no. 310-314). Scale: 1:1. Variant 3: flat base. Stone (cat. no. 316-320). Scale: 1:2.



Pl. 19. Kannelurensteine. Variant 1: plain surfaces. Sub-variant 1.A: spool-shaped (cat. no. 321-327). Sub-variant 1.B: biconical (cat. no. 328-329). Sub-variant 1.C: bi-troncoconical (cat. no. 330). Sub-variant 1.D: lenticular (cat. no. 331-340). Scale: 1:4.



Pl. 20. Kannelurensteine. Variant 1: plain surfaces. Sub-variant 1.D: lenticular. Scale: 1:4.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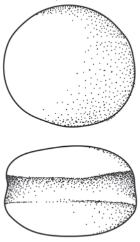
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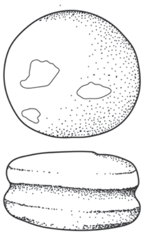
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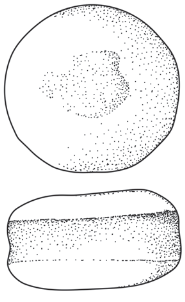
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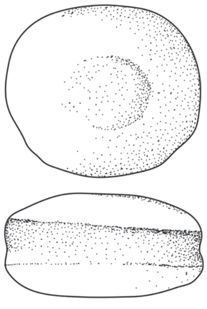
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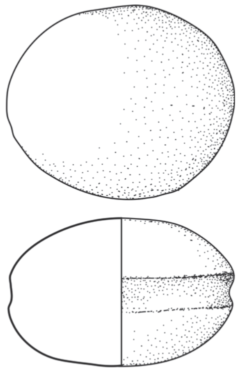
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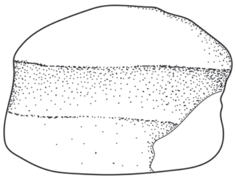
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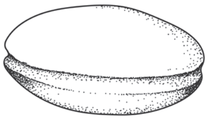
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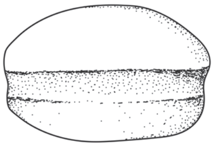
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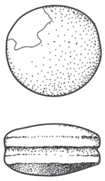
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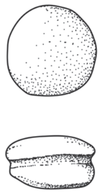
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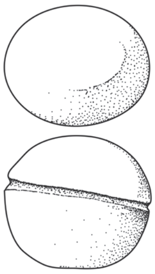
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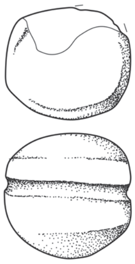
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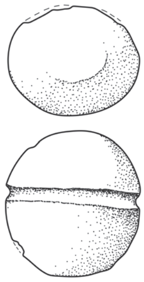
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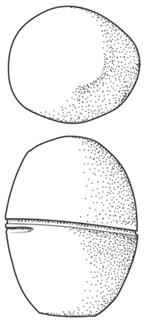
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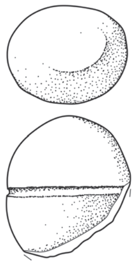
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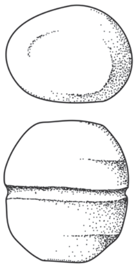
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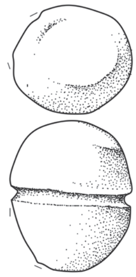
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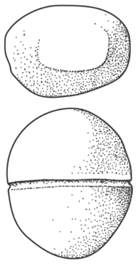
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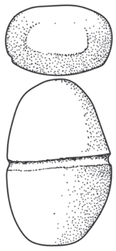
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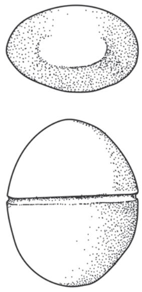
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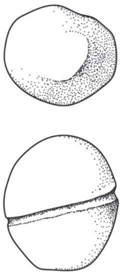
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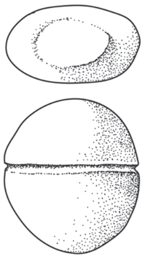
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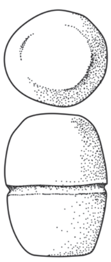
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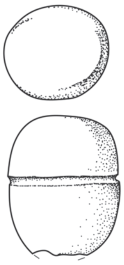
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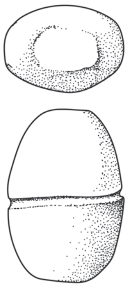
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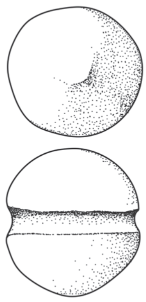
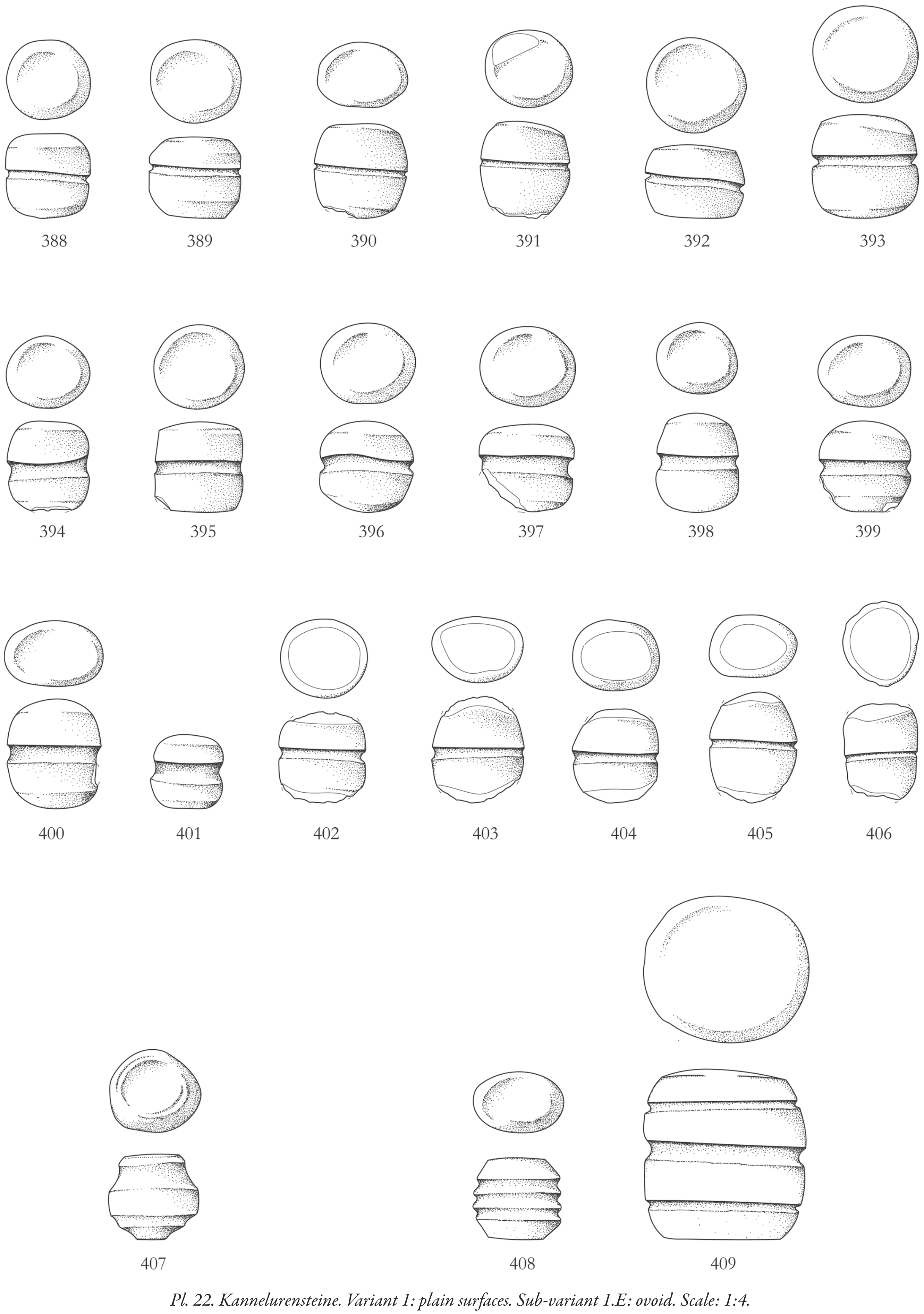
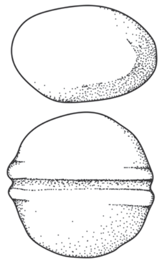

387

Pl. 21. Kannelurensteine. Variant 1: plain surfaces. Sub-variant 1.D: lenticular (cat. no. 361-371). Sub-variant 1.E: ovoid (cat. no. 372-387). Scale: 1:4.



Pl. 22. Kannelurensteine. Variant 1: plain surfaces. Sub-variant 1.E: ovoid. Scale: 1:4.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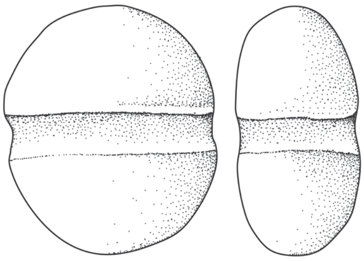
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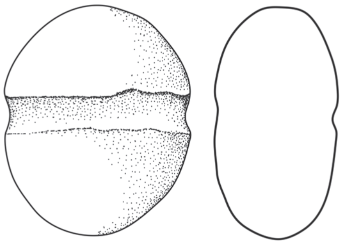
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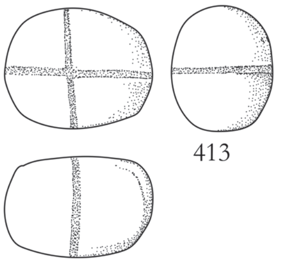
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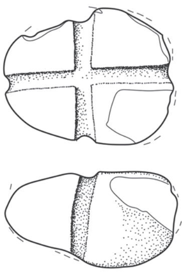
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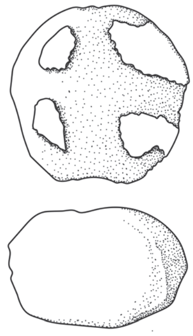
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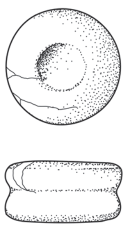
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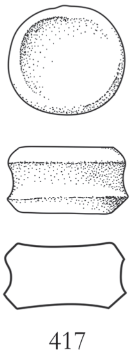
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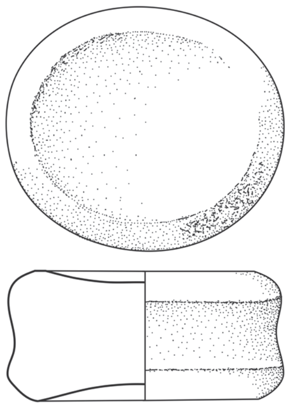
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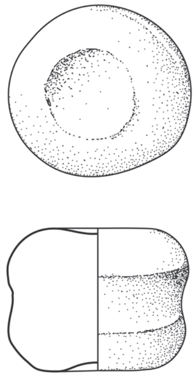
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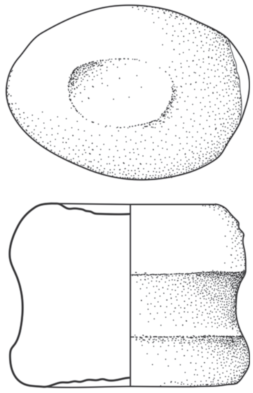
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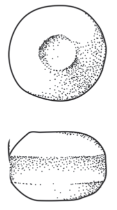
Pl. 23. Kannelurensteine. Variant 1: plain surfaces. Sub-variant 1.F: transversal groove (cat. no. 410-412). Sub-variant 1.G: criss-crossing grooves (cat. no. 413-415). Variant 2: circular indentations. Sub-variant 2.A: spool-shaped (cat. no. 416-420). Scale: 1:4.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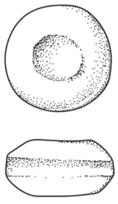
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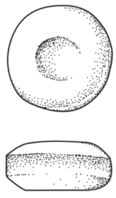
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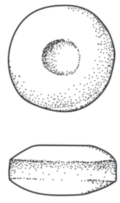
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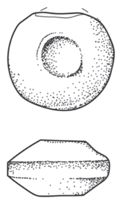
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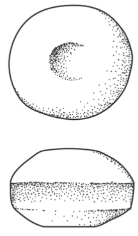
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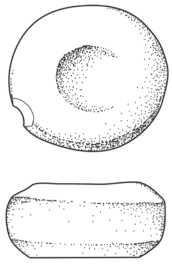
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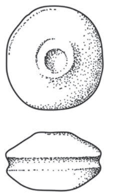
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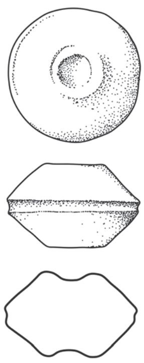
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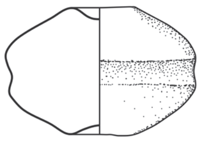
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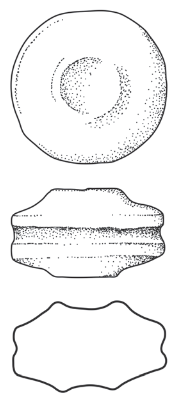
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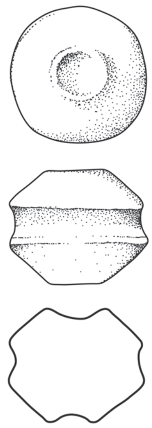
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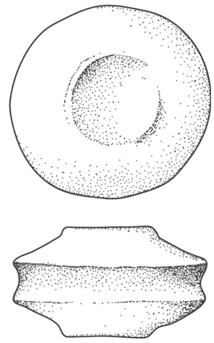
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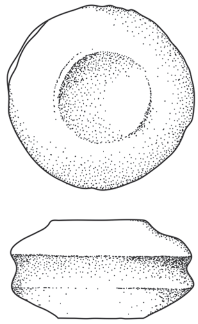
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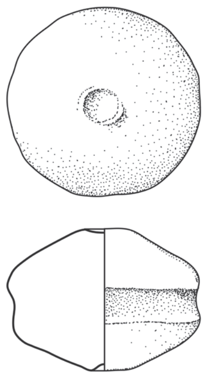
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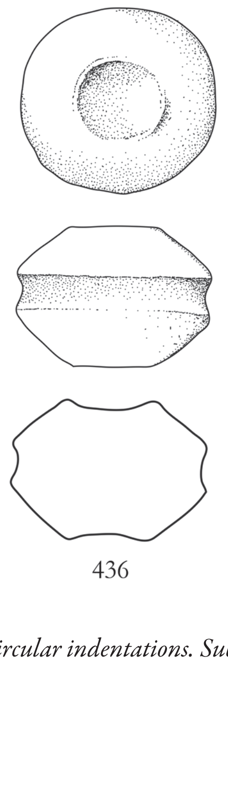
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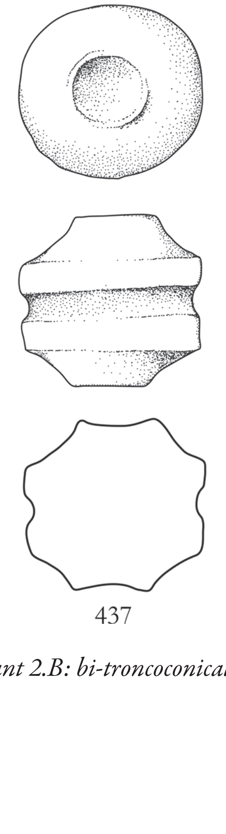
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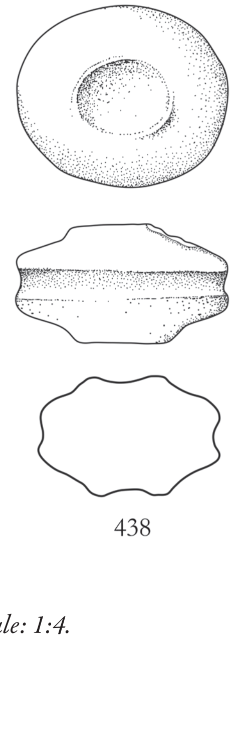
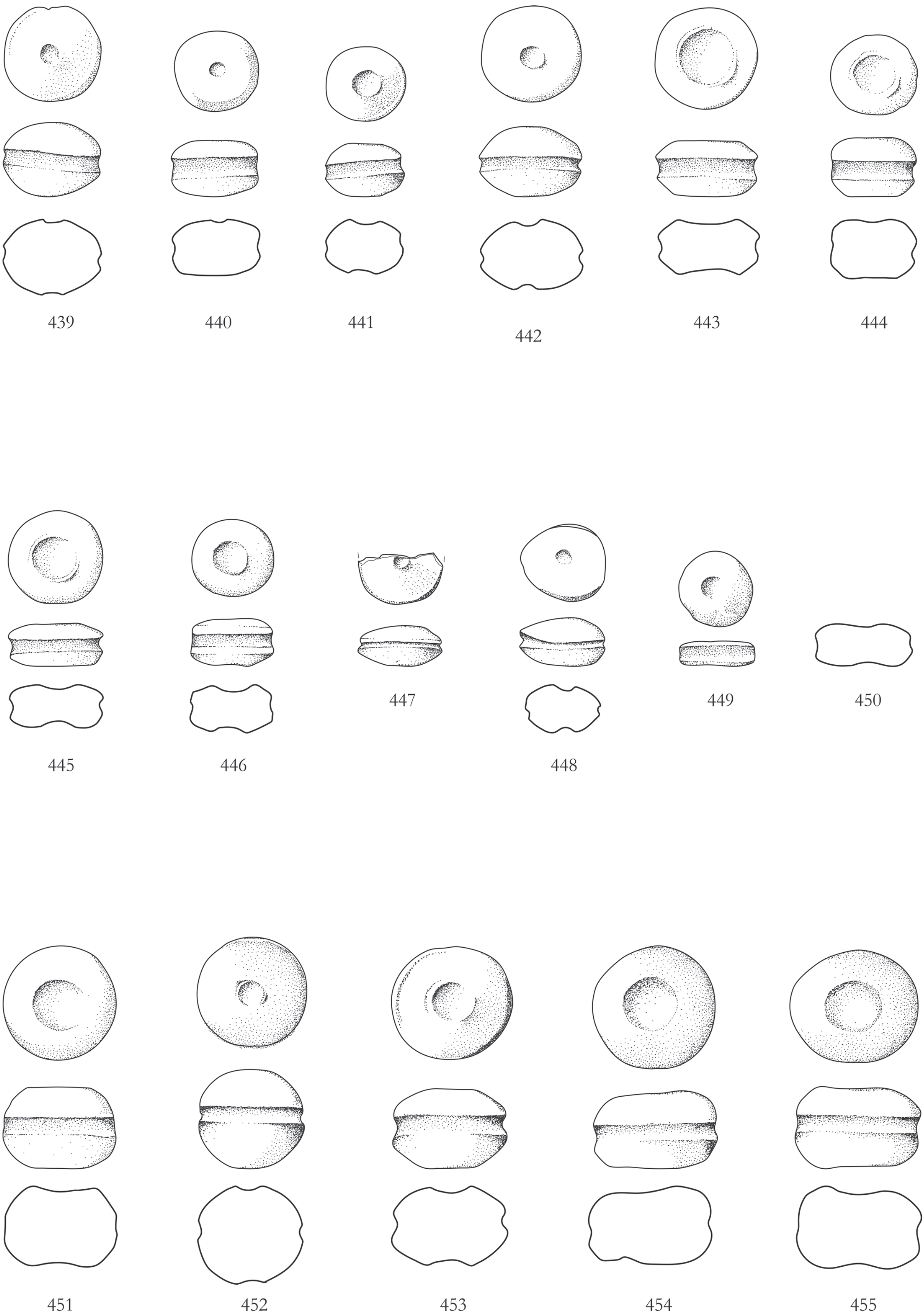
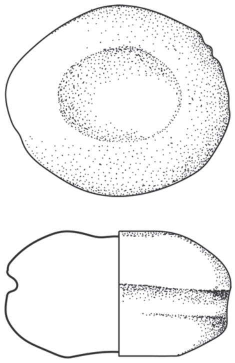

438

Pl. 24. Kannelurensteine. Variant 2: circular indentations. Sub-variant 2.B: bi-troncoconical. Scale: 1:4.



Pl. 25. Kannelurensteine. Variant 2: circular indentations. Sub-variant 2.C: lenticular. Scale: 1:4.



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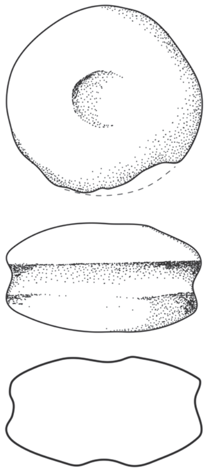

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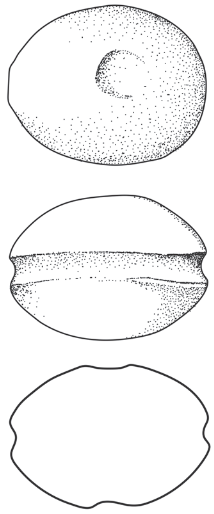

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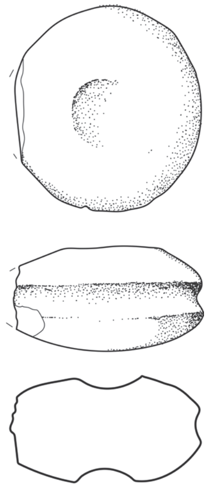

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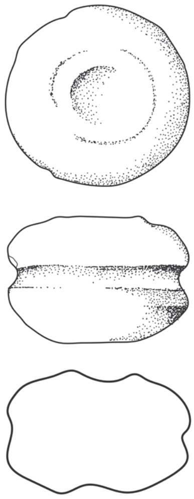

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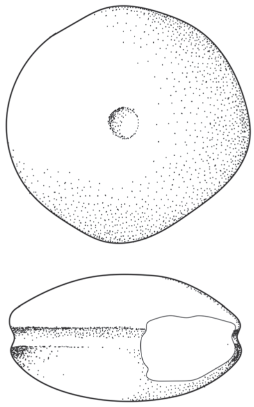

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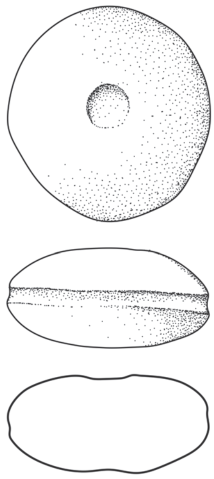

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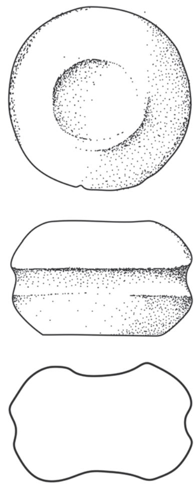

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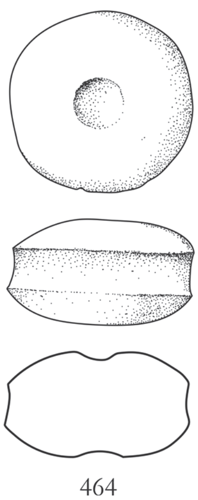

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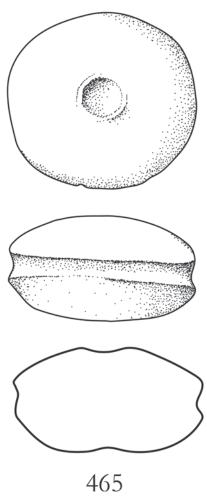

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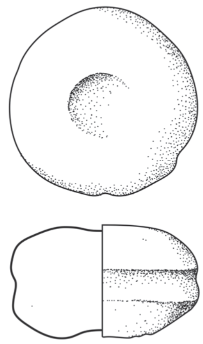
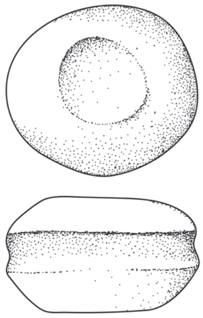


466

Pl. 26. Kannelurensteine. Variant 2: circular indentations. Sub-variant 2.C: lenticular. Scale: 1:4.



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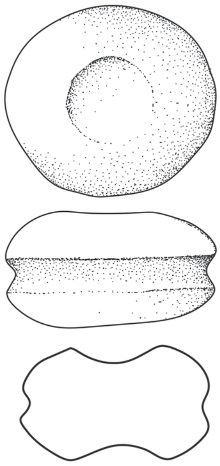

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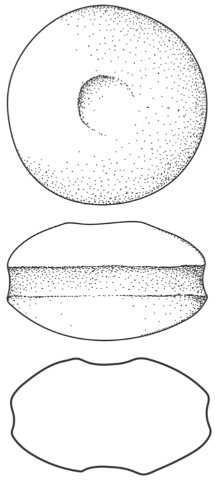

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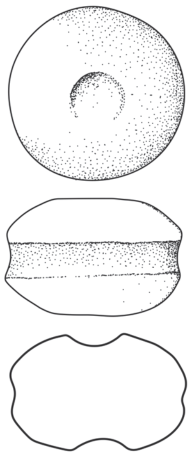

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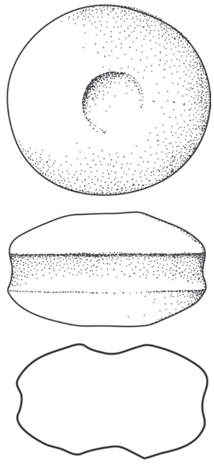

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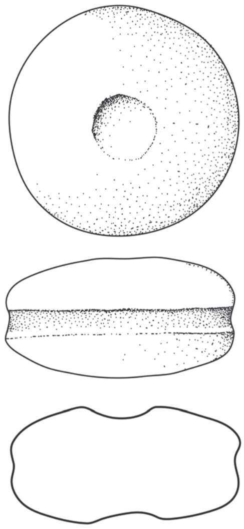

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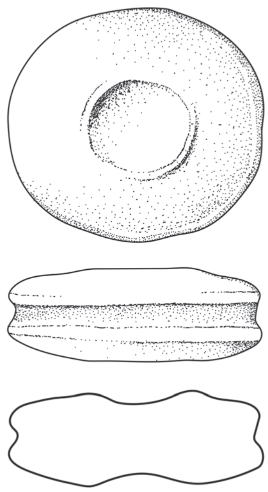

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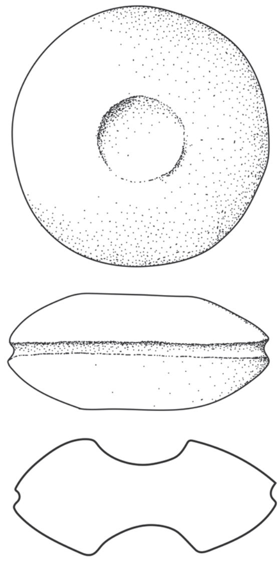

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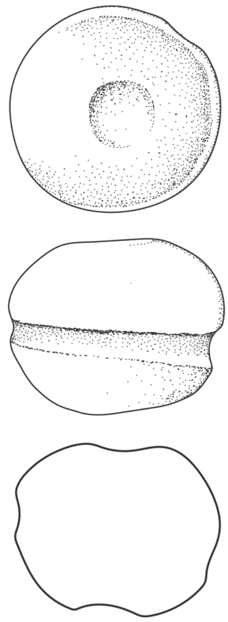

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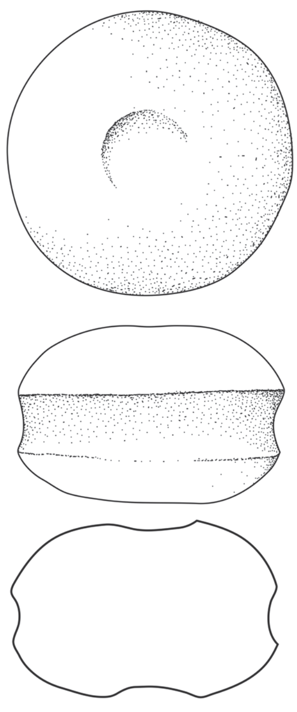

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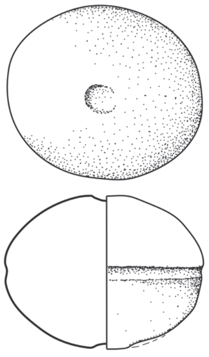

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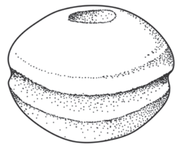

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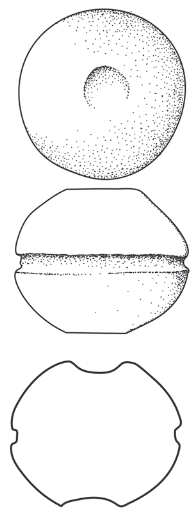
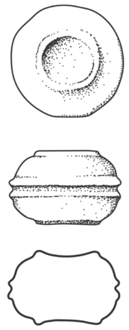


479

Pl. 27. Kannelurensteine. Variant 2: circular indentations. Sub-variant 2.C: lenticular. Scale: 1:4.



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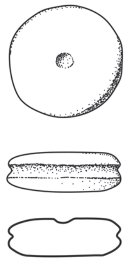

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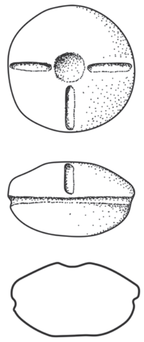

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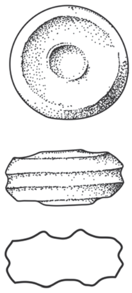

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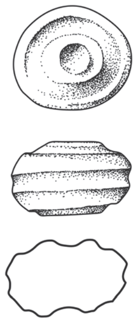

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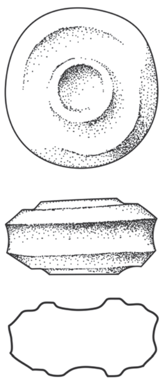

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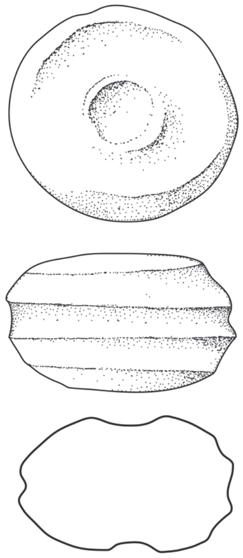

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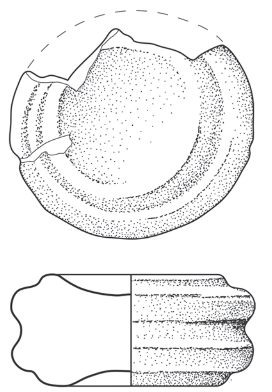

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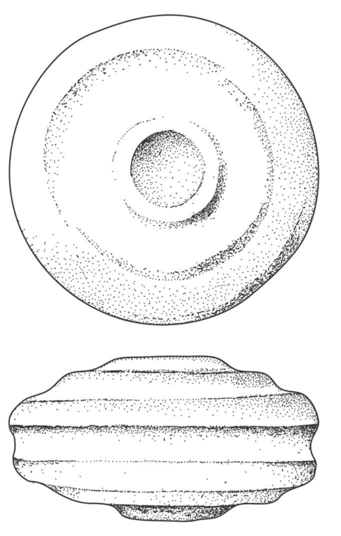

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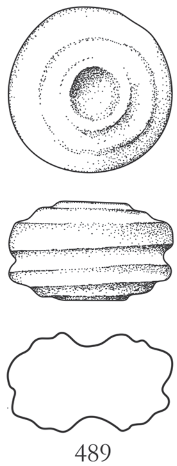

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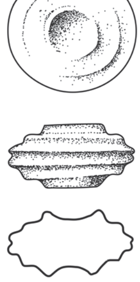

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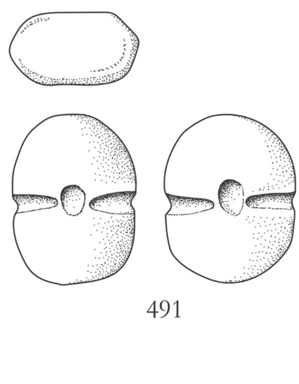
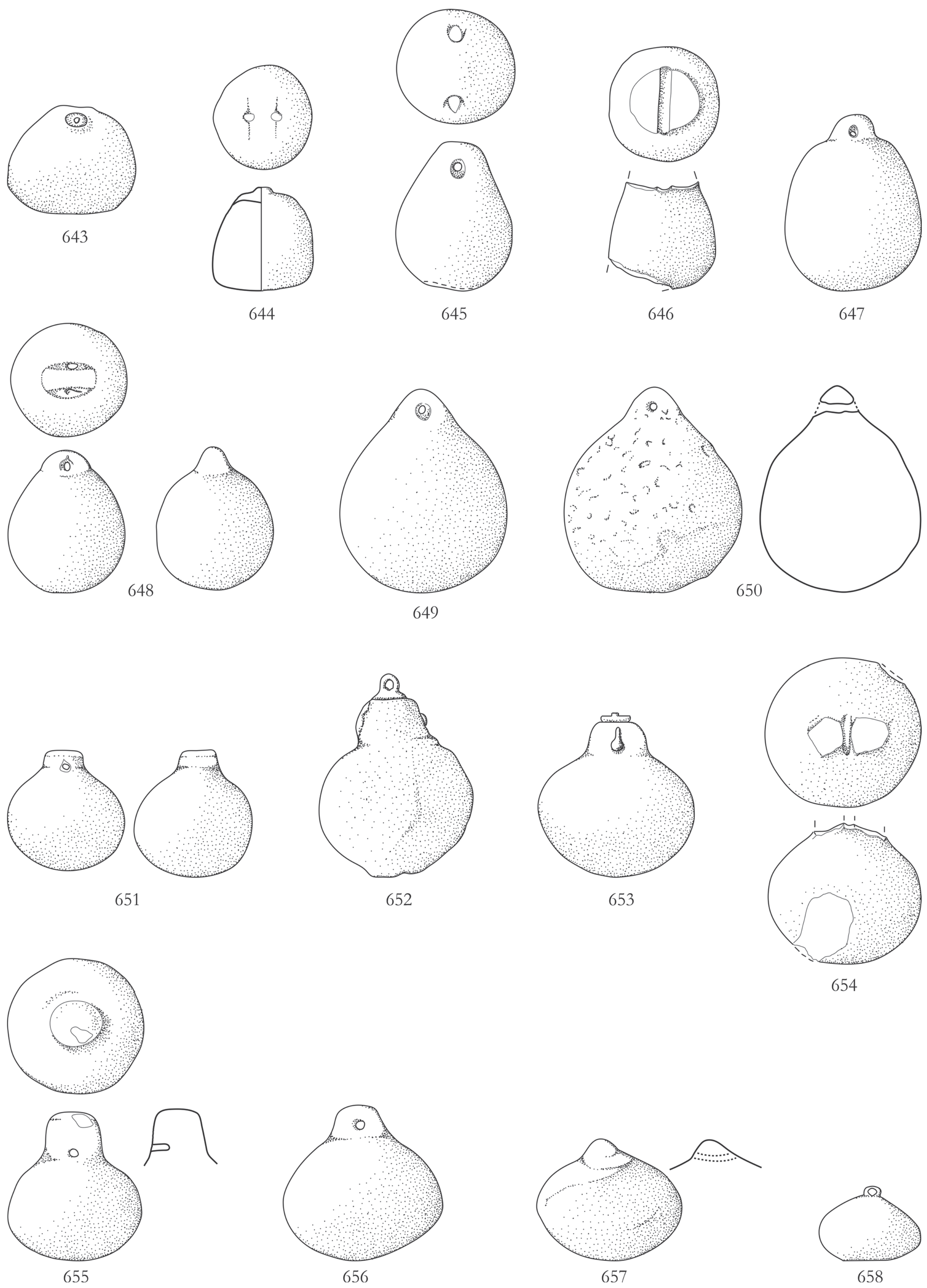
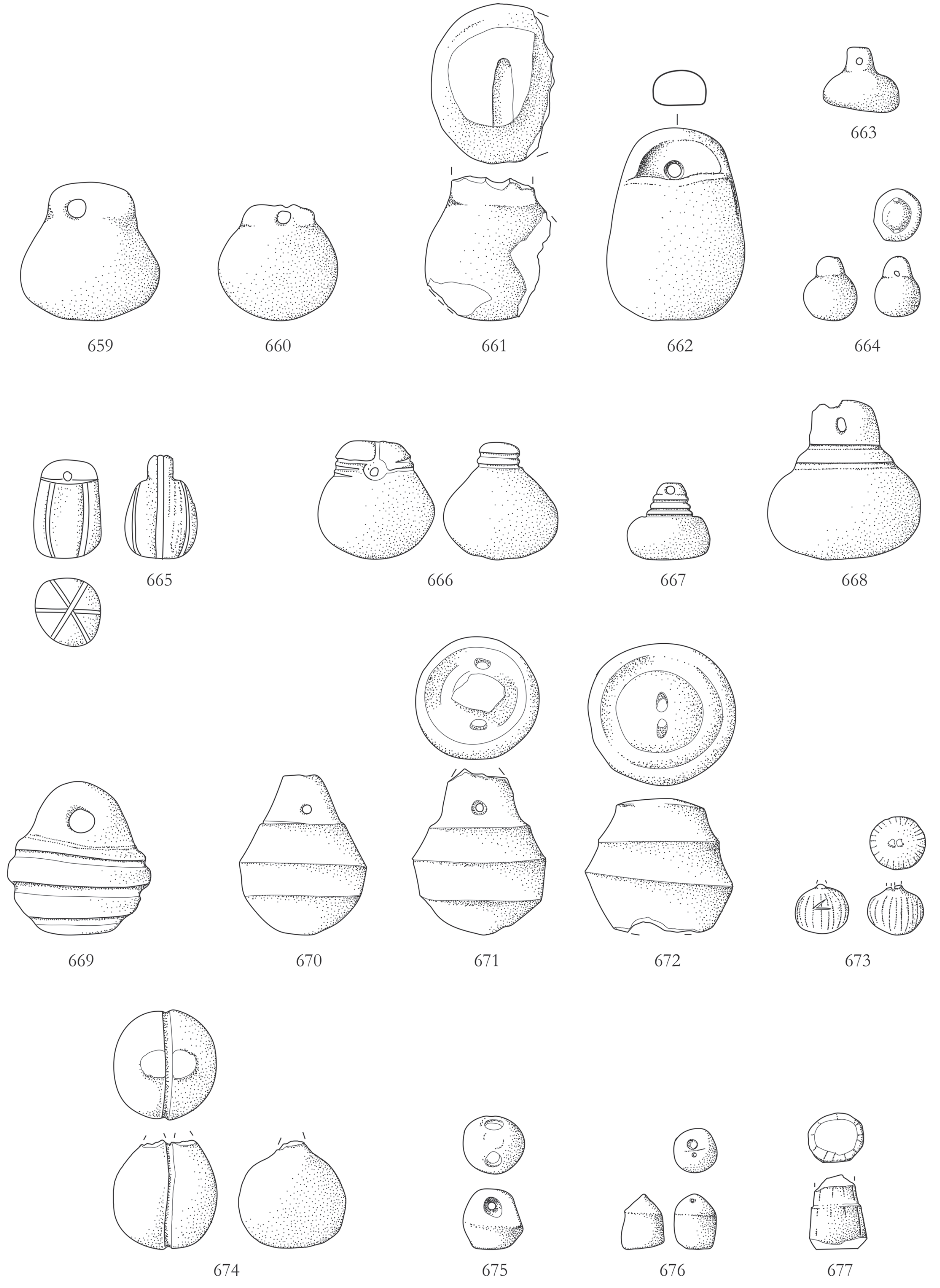


491

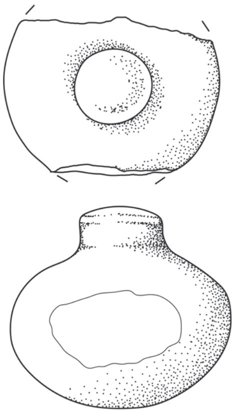
Pl. 28. Kannelurensteine. Variant 2: circular indentations. Sub-variant 2.C: lenticular (cat. no. 480-482). Sub-variant 2.D: multiple horizontal grooves (cat. no. 483-490). Sub-variant 2.E: transversal groove (cat. no. 491). Scale: 1:4.



Pl. 29. Piriform. Variant 1: with perforation. Sub-variant 1.A: plain. Stone (cat. no. 643-657). Scale: 1:3. Lead (cat. no. 658). Scale: 1:3.



Pl. 30. Piriform. Variant 1: with perforation. Sub-variant 1.A: plain. Stone (cat. no. 659-664). Sub-variant 1.B: incised decoration. Stone (cat. no. 665). Sub-variant 1.C: horizontal grooves at the base of the upper protrusion. Stone (cat. no. 666-668). Sub-variant 1.D: horizontal grooves on the body (cat. no. 669). Sub-variant 1.E: horizontal ribs on the body (cat. no. 670-672). Sub-variant 1.F: vertical ribs and incised mark (cat. no. 673). Sub-variant 1.G: vertical annular groove (cat. no. 674). Sub-variant 1.H: other small weights with perforation (cat. no. 675-677). Scale: 1:3.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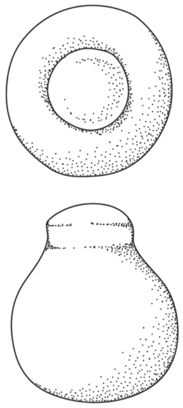
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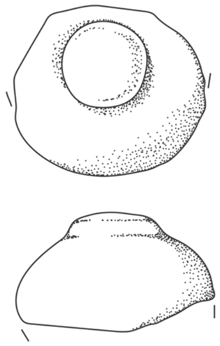
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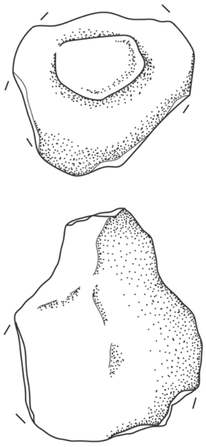
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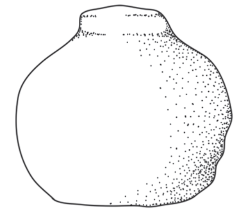
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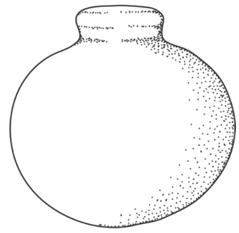
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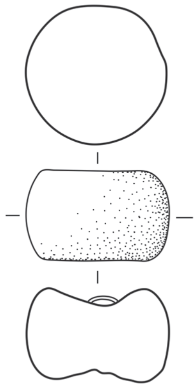
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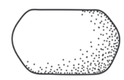
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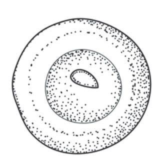
703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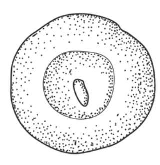
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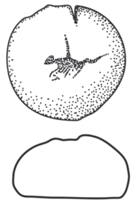
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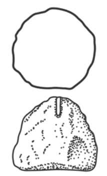
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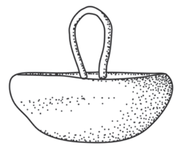
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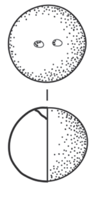
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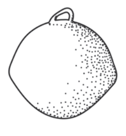
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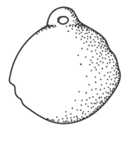
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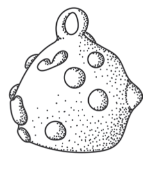
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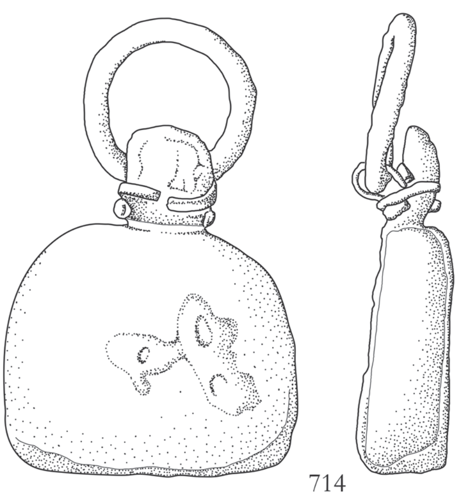
713


714

Pl. 31. Piriform. Variant 2: without perforation. Stone (cat. no. 678-683). Scale: 1:3. Other hanging weights. Variant 1: bi-concave cross-section. Lead (cat. no. 701, 703-705). Stone (cat. no. 702). Variant 2: hemispherical. Lead (cat. no. 706-707). Variant 3: spherical cap. Lead (cat. no. 708). Variant 4: spherical. Stone (cat. no. 709). Lead (cat. no. 710-712). Variant 5: bell-shaped. Lead (cat. no. 713). Variant 6: parallelepiped with upper protrusion. Bronze (cat. no. 714). Scale: 1:4.